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Trois Essais sur la répartition mondiale des fortunes

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Three Essays on the World Distribution of Wealth

Thesis Advisor: Thomas Piketty

Jury

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Summary

This PhD dissertation gathers three essays on the world distribution of wealth. The first chapter, "The Missing Wealth of Nations: Are Europe and the U.S. net Debtors or net Creditors?" attempts to measure the wealth held by rich individuals in offshore tax havens, using unique Swiss statistics and systematic anomalies in the international investment data of countries. The main finding is that about 8% of the world's financial wealth of households is held offshore, of which at least three-quarters go unrecorded in the official data. Accounting for this missing wealth can turn the world's second largest net debtor, the eurozone, into a net creditor, and significantly improves the net position of the world's largest net debtor, the U.S.

The second chapter, "The End of Bank Secrecy? An Evaluation of the G20 Tax Haven Crackdown", written with Niels Johannesen, investigates whether recent policy initiatives aimed at curbing tax evasion has been effective. In the aftermath of the financial crisis, G20 countries compelled tax havens to sign bilateral tax treaties providing for the exchange of bank information upon request. Based on a rich dataset from the Bank for International Settlements, the chapter shows that the signature of treaties has not provoked any substantial repatriation of wealth onshore but so far has led to a relocation of offshore fortunes to the benefit of the least compliant tax havens.

The last chapter, "Capital is Back: Wealth-Income Ratios in Rich Countries, 1700-2010", written with Thomas Piketty, attempts to document and explain the long run evolution of aggregate wealth to income ratios. It establishes two sets of striking facts: first, wealth-income ratios have been rising in all rich countries since the 1970s; second, today's ratios appear to be returning to the high levels observed in Europe in the 18th and 19th centuries (600%-700%). The bulk of the 1970-2010 dynamics can be explained by the slowdown of income growth (largely due to the slowdown of population growth) and by a long-run asset price recovery, itself driven by changes in capital policies since the World Wars. These results, supported by a new, extensive database on wealth and income, shed new light on the changing shape of the production function and the global rise of capital shares.

Contents

Chapter 1

The Missing Wealth of Nations: Are Europe and the U.S. net Debtors or net Creditors?

Abstract: This chapter shows that official statistics substantially underestimate the net foreign asset positions of rich countries because they fail to capture most of the assets held by households in offshore tax havens. Drawing on a unique Swiss dataset and exploiting systematic anomalies in countries' portfolio investment positions, I find that around 8% of the global financial wealth of households is held in tax havens, three-quarters of which goes unrecorded. On the basis of plausible assumptions, accounting for unrecorded assets turns the eurozone, officially the world's second largest net debtor, into a net creditor. It also reduces the U.S. net debt significantly. The results shed new light on global imbalances and challenge the widespread view that, after a decade of poor-to-rich capital flows, external assets are now in poor countries and debts in rich countries. I provide concrete proposals to improve international statistics.

1 Introduction

There are two puzzles in international investment statistics. The first is a set of statistical anomalies. At the global level, liabilities tend to exceed assets: the world as a whole is a net debtor (Lane and Milesi-Ferretti, 2007). Similarly, the global balance of payments shows that more investment income is paid than received each year. Since the problem was identified in the 1970s, the International Monetary Fund has commissioned a number of reports to investigate its causes, and national statistical agencies have put considerable resources into improving their data. Yet despite a great deal of progress, large anomalies remain; many European securities, in particular, have no identifiable owner (Milesi-Ferretti et al., 2010).

The second puzzle is a theoretical challenge. Since the latter half of the 1990s, capital has been flowing from poor to rich countries. As a result, the rich world now appears to be a sizeable net debtor in the official data, dragged down by the U.S. and Europe. While the literature has put forward possible explanations for the U.S. net debt and the rise in China's assets,[1] the negative net positions of Europe and the overall rich world remain largely unexplained. Despite this, many observers have grown accustomed to the view that external assets are now in poor countries and debts in rich countries. In the public debate, the view that "China owns the world" has become particularly popular. Should it be correct, the implications for policymaking and open-economy modeling would be far-reaching.

My paper challenges this view. The negative net foreign asset position of the rich world, I argue, is an illusion caused by tax havens. International statistics fail to capture most of the assets held by households through tax havens: they overlook the portfolios of equities, bonds, and mutual fund shares that households own via banks in Switzerland and other countries with strict bank secrecy rules. This coverage gap explains many of the long-standing anomalies in global data. My

[1]See Dooley et al. (2003), Bernanke (2005), Dollar and Kraay (2006), Engel and Rogers (2006), Caballero et al. (2008), Mendoza et al. (2009), Carroll and Jeanne (2009), Ma and Haiwen (2009), Obstfeld et al. (2010), Aguiar and Amador (2011), Song et al. (2011), and Alfaro et al. (2011) among others.

computations find that around 8% of households' financial wealth is held through tax havens, three-quarters of which goes unrecorded. This stock of unrecorded assets is double the recorded net debt of the rich world (Figure I). Since a body of evidence suggests that most of the wealth in tax havens belongs to residents of rich countries, accounting for it turns the rich world into a net creditor. Despite a decade of global imbalances, therefore, external wealth is still probably in rich countries overall: China does not own the world yet. Back in the 1980s-1990s the rich world had a large positive net position; over the last decade it has eaten some of its claims away; but today poor countries are still repaying their debts to advanced economies.

These findings have direct implications for core issues in international macroeconomics. On the basis of plausible assumptions, accounting for the wealth in tax havens turns the eurozone, officially the world's second largest net debtor, into a net creditor. It also improves the U.S. net position. Now, the net foreign asset position is a key state variable in dynamic macroeconomic models. Accurate net positions are essential to assess the merits of the different views put forward on the causes of global imbalances and they are important to monitor financial stability. A large body of literature has questioned the sustainability of global imbalances.[2] If indeed the net positions of Europe and the U.S. are higher than in the official statistics, the required international adjustment is smaller than commonly thought. Domestic imbalances and public finance issues may be more serious today for rich countries than global imbalances: rich countries taken as a whole are richer than we think, but some of their wealthiest residents hide part of their assets in tax havens, which contributes to making governments poor. So far, tax havens have been ignored by the literature that studies the evolution of top income shares around the world (Atkinson et al., 2011).[3] My findings, therefore, also have implications for

[2] See Obstfeld and Rogoff (2005), Blanchard et al. (2005), Gourinchas and Rey (2007b), the papers in Clarida (2007), Hausmann and Sturzenegger (2007), Curcuru et al. (2008), and Blanchard and Milesi-Ferretti (2009) among others.

[3] The two exceptions are Roine and Waldenström (2009) who use anomalies in Sweden's balance of payments to approximate capital flight, and Dell et al. (2007) who use Swiss tax data to put an

this strand of research: my macro-based estimate of the funds held through tax havens could be used as a first step to include these funds into micro-based studies of income and wealth distributions.

The paper proceeds as follows. Section II begins with a brief primer on the activities that take place in tax havens and the statistical issues involved. Section III analyses a previously unused official dataset from the Swiss National Bank. A considerable amount of wealth is held unrecorded in Swiss accounts, and contrary to popular belief, this wealth mostly belongs to residents of rich countries. Section IV then presents a novel method to estimate the personal wealth in all the world's tax havens, using anomalies in the aggregate portfolio stock data of countries (the key source here is Lane and Milesi-Ferretti, 2007). My method is indirect and relies on data with known imperfections, so it is subject to some margin of error. Section V presents consistency and robustness checks, based on bilateral and flow data from the IMF, suggesting that the order of magnitude I find is reliable. The many datasets used in this paper all paint the same picture: households own a large amount of mutual fund shares through unrecorded accounts in tax havens. In Section VI, I propose scenarios as to how including the unrecorded assets in the statistics would affect published international investment positions. I discuss the implications for global imbalances and the uncertainties that remain. The conclusion provides concrete proposals to improve the official data. There are numerous intricacies in the financial activities of tax havens and the international statistics. The most important ones are discussed in the paper; others are detailed in a comprehensive Online Appendix.

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upper bound on the amount of capital income earned in Switzerland by non-resident taxpayers. Tax data, however, are not an appropriate source in this case, because the bulk of income earned by foreigners in Switzerland does not have to be declared to Swiss tax authorities.

2 Tax Havens and Their Implications for International Statistics

First, let's look at the basic concepts that will be used throughout the paper. A country's foreign assets and liabilities are recorded in its international investment position (IIP). The IIP is the stock equivalent of the financial account of the balance of payments: the IIP shows the stock of existing cross-border investments at the end of each year, while the balance of payments shows the yearly flow of new investments. There are three broad categories of cross-border claims: direct investments (holdings of over 10%), portfolio securities (equities and bonds that do not qualify as direct investment), and other assets (mainly loans and deposits).[4] At the end of 2008, as shown by Table I, securities were the largest category: they accounted for $40tr out of $90tr.

Tax havens host numerous financial activities. About 40% of the world's foreign direct investments are routed through tax havens such as the British Virgin Islands.[5] Many investment funds and financial vehicles are incorporated offshore. Luxembourg is the second largest mutual fund center in the world after the U.S; a great deal of the world's money market funds are incorporated in Ireland; and most hedge funds are in the Cayman Islands. Multinational corporations routinely use tax havens for treasury operations and group insurance. Some of these activities have legitimate roles and are satisfactorily covered in the statistics.[6] My paper focuses on one specific tax haven activity: personal wealth management or "private banking". This activity is present in many but not all tax havens. Leaders include countries with strict bank secrecy rules such as Switzerland, the Cayman Islands, the Bahamas, Hong Kong, Singapore, and Jersey. Banks incorporated in

[4] On the asset side of official IIPs, statisticians isolate a fourth category, reserve assets, which includes the portfolio securities and other assets held by central banks. In this paper, "securities" will always include the fraction of reserve assets invested in securities.

[5] See data gathered by the IMF for its Coordinated Direct Investment Survey. In 2011 for instance, 30% of India's inward direct investments came from Mauritius; 25% of Brazils' came from the Netherlands; 60% of China's came from Hong Kong and the British Virgin Islands.

[6] See for instance IMF (2000).

these countries – which are often subsidiaries of large global banks – attract foreign individuals and provide them with investment advice and services. In the IIPs of countries, the personal wealth management activities of tax havens do not affect direct investment data, slightly affect "other assets", but cause large, systematic errors for portfolio securities.

A How Cross-Border Securities Should be Recorded in Principle

To see what errors occur in portfolio data, denote A_{ij} the amount of securities issued by country j, owned by residents of country $i \neq j$. To measure A_{ij}, the data collection system of each country i covers some agents directly and others indirectly (IMF, 2002). Financial corporations such as banks, investment funds, and insurance companies, are direct reporters. They provide data on their own holdings (the securities that are on their balance sheets) and on their clients' holdings (the securities that are off their balance sheets, but that they can observe). Governments and nonfinancial corporations above a certain size threshold are also direct reporters. By contrast, households are indirectly covered, for practical reasons. Their holdings are reported by financial companies. Trusts, personal wealth-holding companies, and other small nonfinancial corporations are indirectly covered as well, and I include them in the household sector. We can therefore write A_{ij} as the sum of the foreign securities owned by directly covered agents (a_{ij}) and households ($\tilde{a}_{ij}$).

All types of investors entrust their securities to domestic or to foreign banks for custody. Through to the 1960s, all securities existed in the form of paper certificates that were deposited in safe places such as bank vaults. Keeping their clients' certificates safe was the custodians' job. Today, paper has been replaced by electronic records, but investors still use custodian banks as book-keepers and for other services. Let's denote the custodian's country of residence with a superscript letter:

$$A_{ij} = \sum_k A^k_{ij} = \sum_k (a^k_{ij} + \tilde{a}^k_{ij}) = \underbrace{[a^i_{ij} + \tilde{a}^i_{ij}]}_{\text{onshore}} + \underbrace{\sum_{k \neq i} (a^k_{ij} + \tilde{a}^k_{ij})}_{\text{offshore}}$$

To fix ideas, consider a portfolio of U.S. (j) equities held by a household living in France (i). This portfolio can either be entrusted to a French bank – in which case we will say that it is held onshore – or to an offshore bank, say in Switzerland (k).

Offshore banks provide investment advice and services just like onshore banks do. But they also provide opportunities to evade personal income taxes. In most non-haven countries, onshore banks automatically report the investment income earned by their clients to tax authorities. Such third-party reporting makes tax evasion impossible. By contrast, in tax havens with strict bank secrecy rules, banks do not generally report information. Taxes can be collected only if taxpayers self-declare their income.

International investment statistics work on the basis of the residence principle (IMF, 1993). The residence principle states that a security issued by the U.S. and held by a French resident through a Swiss bank must be recorded as an asset for France on the U.S. and a liability for the U.S. vis-à-vis France. The location of the custodian is irrelevant.

B Offshore Portfolios: A Blind Spot in Securities Statistics

In practice, offshore custodian banks cause a blind spot in portfolio assets data. When French households entrust U.S. securities to Swiss banks, these assets $\tilde{a}^k_{ij}$ cannot be captured by surveying French custodians. They go completely unrecorded in the French IIP.[7] This blind spot is well known among statisticians: Bertaut et al. (2006, p. A67) discuss it in the context of the U.S. data reporting system, the ECB

[7] As Section IV.A will show, transfers of funds to tax havens are not well recorded, so that it is not possible to capture offshore portfolios by cumulating banking flows. That is why errors in portfolio positions translate into errors for the full IIP.

(2002, p. 8) in the context of the eurozone's.

Household offshore portfolios do not appear on the IIPs of tax havens either. To compile Switzerland's external accounts, the Swiss National Bank asks domestic banks to report on the securities that they hold in custody. Swiss bankers observe that they hold U.S. securities belonging to French residents. These securities are neither assets nor liabilities for Switzerland, so in keeping with the residence principle, they are excluded from Switzerland's position.

Household offshore portfolios, however, do appear in the liabilities of countries' IIPs. U.S. securities held by French savers are duly recorded as liabilities for the U.S. whether they are held in France or in Switzerland. Most of the securities issued by the U.S. are ultimately kept by the U.S. central securities depository, the final bookkeeper where settlements take place. This centralization makes it relatively easy to estimate the amount of U.S. equities and bonds held by foreigners. (The country allocation of liabilities, however, are distorted: U.S. securities held by French savers through Switzerland are wrongly attributed to Switzerland, because seeing through the Swiss banks is not possible.)

The failure to record the offshore portfolios of households plagues countries' international data. An obvious solution would be to ask each tax haven k to provide information about the portfolios held by foreign individuals through their banks, the $\tilde{a}_{ij}^{k}$ $(k \neq i)$. No haven, however, discloses this information. No haven, except Switzerland.

3 Offshore Wealth in Switzerland

Since 1998, the Swiss National Bank has published the value of the offshore portfolios in Swiss banks. A monthly survey of Swiss-domiciled custodians covers 95% of these holdings. The SNB conducts a full survey yearly. Portfolios are broken down by asset class and currency. The SNB also provides evidence as to who owns Swiss accounts. I am not aware of any other paper that uses this unique set of data to investigate the wealth held offshore. The outsized role that Switzerland plays in the offshore wealth management industry means that this one data source can do a lot to fill in the gaps in countries' portfolio assets data. This Section analyzes what we learn from the Swiss case, before attempting to compute the amount of wealth held in tax havens globally.

A The Level and Composition of the Offshore Fortunes in Switzerland

The first striking result, reported in the first column of Table II, is the huge amount of offshore wealth in Swiss banks. At the end of 2008 – when global stock markets were low – foreigners held through Switzerland portfolios of foreign (i.e., non Swiss) securities worth $\Omega^s = \$1.5$tr.[8] Once you add bank deposits (more on these below), the total offshore wealth in Swiss banks comes to more than \$2tr – as much as China's foreign exchange reserves.

For comparison, the second column of Table II shows the value of the assets belonging to Swiss residents in Swiss banks. They are much smaller. In 2008, only one-third of all the foreign securities in the Swiss banks vaults belonged to Swiss savers – two-thirds belonged to foreigners. This pattern epitomizes what offshore financial centers do: Swiss banks essentially help foreigners invest out of Switzerland, the banks acting only as conduits.[9] In 2004 there was a survey of the custodial holdings in French banks. In sharp contrast to the Swiss case, almost all the foreign securities in French banks belong to French investors (Gest and Dajean, 2005).

[8] In the above accounting framework, Ω^s (where Ω stands for offshore, and s for Switzerland) is equal to $\sum_{i \neq s} \sum_{j \neq s} (a^s_{ij} + \tilde{a}^s_{ij})$. Ideally we would like to exclude from the offshore portfolios Ω^s the portfolios of foreign securities that belong to foreign direct reporters ($\sum_{i \neq s} \sum_{j \neq s} a^s_{ij}$), and we would like to include the portfolios of Swiss securities that belong to foreign households ($\sum_{i \neq s} \tilde{a}^s_{is}$). As discussed below, in all likelihood both are relatively small, so that Ω^s is a good proxy for the amount of wealth held in Switzerland that goes completely unrecorded in other countries' positions, $\sum_{i \neq s} \sum_j \tilde{a}^s_{ij}$.

[9] One common misconception is that having a Swiss account means having Swiss francs or Swiss assets. In general, this is not the case.

The second interesting result relates to the composition of the offshore portfolios in Swiss banks. Mutual fund shares account for one half, bonds for one-third, and equities for the rest. The SNB does not provide statistics on the type of mutual funds that foreigners own (do they invest in bond funds? equity funds?). But we do know that out of the 8,000 funds registered for distribution in Switzerland, about 4,600 are incorporated in Luxembourg and 1,200 in Ireland.[10] The data, therefore, reveal a clear pattern, summarized by Figure II. On their Swiss accounts, foreigners do own some U.S. equities, but they mostly own Luxembourg and Irish fund shares (the funds, in turn, invest all around the world).

Investing in a Luxembourg fund through a Swiss account makes perfect sense for a French tax evader: Luxembourg does not withhold taxes on cross-border payments, so the tax evader receives the full dividend paid by the fund on his or her account, and French personal income tax can be evaded, since there is no automatic exchange of information between Swiss banks and the French tax authority. Conversely, a French person has to go through each step of the France-Switzerland-Luxembourg circuit to evade taxes. Investing in a Luxembourg fund through a French bank does not save on taxes. Investing in a Swiss mutual fund through a Swiss bank is also useless, because capital income paid by Swiss corporations is subject to a 35% advance tax withheld at source by Switzerland. The advance tax can only be refunded when taxpayers self-declare income in their home country. The tax does not apply to income credited to Swiss accounts but paid by foreign corporations, such as Luxembourg funds. This fact explains why the vast majority of the mutual funds distributed in Switzerland are incorporated abroad.

In all likelihood, the foreign securities held in Switzerland by foreigners belong to households. It makes little sense for foreign banks, insurance companies, or investment funds to entrust their non-Swiss holdings to Swiss custodians: doing so does not secure any tax or regulatory advantage. There is no evidence that

[10] See http://www.swissfunddata.ch. Most hedge funds are not registered, hence not covered by these statistics. Section V.A. will specifically address the important case of hedge funds.

Swiss banks provide significant custody services for foreign corporations. There is, by contrast, considerable evidence from newspaper investigations, industry reports, and high-profile tax scandals that they offer extensive wealth management services to foreign individuals. Ω^s is thus a good proxy for household offshore portfolios in Swiss banks.[11]

The foregoing discussion has centered on portfolio wealth. In tax havens, however, households can hold not only securities, but also bank deposits. Swiss banks provide a unique kind of deposit owned by households only, in the form of what are known as fiduciary deposits. Fiduciary deposits cannot be used as a medium of exchange: they are useless for corporations. Swiss banks invest the funds placed in fiduciary deposits in foreign money markets on behalf of their clients. Legally speaking, all interest is considered to be paid by foreigners to the depositors, with the Swiss banks acting merely as "fiduciaries." Thus, fiduciary deposits are not subject to the 35% Swiss advance tax. As shown by Table II, in 2008 fiduciary deposits accounted for one-quarter of the total amount of offshore wealth in Swiss banks.

B Who Owns Swiss Bank Accounts?

The last contribution made by the Swiss data is to provide unique evidence as to the likely owners of unrecorded fortunes in tax havens. Since 1976, the SNB has published a full country breakdown of the owners of fiduciary deposits.

Country breakdowns are puzzling at first glance. As Figure III shows, the SNB records a large and growing fraction of Swiss fiduciary deposits as belonging to tax havens, most notably Panama, Liechtenstein, and the British Virgin Islands. What

[11] Note that the SNB provides a breakdown of Ω^s by owner sector (private customers, commercial customers, and institutional investors). But this breakdown is misleading: the SNB does not see through intermediate wealth-holding structures used by individuals with a Swiss account. The SNB counts the securities of a French individual who uses a sham Panamanian holding company as belonging to the foreign "institutional investors" sector. This is a first-order issue: few individuals have an account in Switzerland with their own personal address; most Swiss bank clients use intermediate wealth-holding structures (see Section III.B. below).

happens? The SNB records such holdings because it does not see through sham corporations used by households. If a French saver opens an account in the name of a shell company incorporated in Panama, the SNB assigns the funds to Panama. Using sham corporations as nominal owners of Swiss accounts has a long tradition, dating back to at least the end of the Second World War (Schaufelbuehl, 2009). Once you understand the purposes that sham corporations serve, it becomes clear that most fiduciary deposits assigned to tax havens by the SNB belong to residents of rich countries, in particular to Europeans.

A sham corporation adds a layer of secrecy between the owner of a Swiss account and his holdings, making it harder for tax authorities to investigate cases of tax evasion. When tax evaders combine numerous sham corporations in multiple tax havens, foreign authorities have practically no way to find out who is the beneficial owner of a Swiss account. Sham corporations are less useful to residents of countries where there is no income tax or where tax administrations have no resources to investigate offshore tax evasion. Sham corporations also help Europeans evade taxes. The European Union has adopted the Savings Directive in a move to curb tax evasion: since 2005, Swiss and other offshore banks must withhold a tax on interest earned by European Union residents.[12] But the Directive only applies to accounts opened by European households in their own name; sham corporations are a straightforward way of eschewing it.

Figure III shows that there is a clear negative correlation between the share of fiduciary deposits held by Europeans and the share of fiduciary deposits assigned to tax havens. European depositors have shifted their deposits to sham corporations over time. They reacted particularly strongly to the introduction of the EU Savings Directive in July 2005: between December 2004 and December 2005, Europe's share of Swiss fiduciary deposits declined by 10 percentage points while tax havens gained

[12] In July 2011, the tax rate was set at 35%. Tax havens keep one-quarter of the tax revenue and transfer the remaining three-quarters to the European country where the account owner is resident. This withholding tax allows tax havens to avoid automatic exchange of bank information, the EU standard.

8 percentage points.[13] Zaki (2010, p. 54) documents how Swiss bankers created sham corporations on a large scale during the summer of 2005 to help their European clients circumvent the Directive.

The U.S. Internal Revenue Service (IRS) provides additional evidence that rich countries' residents use sham corporations extensively. In 2009, the IRS released case studies of tax evasion by U.S. residents in a big Swiss bank.[14] In almost all cases, U.S. tax evaders owned their accounts through sham entities incorporated in Panama, the British Virgin Islands, and Hong Kong. Many of them had transferred their accounts to shell companies in the 1990s or 2000s. In many IRS cases, the sums involved are huge, attaining $100 million for a single family in a single bank.

Let's assume that in 2004, before the EU Savings Directive, if a country owned 10% of the fiduciary deposits not assigned to tax havens, it also owned 10% of the deposits assigned to tax havens. Let's also assume that Gulf countries do not use sham corporations, which is plausible since they have no capital income tax. Then the rich world owned 62% of Swiss fiduciary deposits in 2004.[15] Contrary to popular belief, there is no indication that African dictators or rich Asian investors own the bulk of Swiss accounts.

4 An Estimate of the Global Offshore Wealth

Switzerland is not the only tax haven that offers wealth management services to foreign individuals. Just like in Switzerland, banks incorporated in the Bahamas, Singapore, and other havens with strict bank secrecy rules attract foreign individuals and provide them with similar private banking services – securities custody and investment advice.[16] The goal of this Section is to present a novel method to esti-

[13]See Johannesen (2010) for an analysis of the reaction of Swiss bank deposits to the Directive.

[14]http://www.irs.gov/uac/Offshore-Tax-Avoidance-and-IRS-Compliance-Efforts.

[15]See Appendix, Table A26.

[16]The testimony of a former Cayman banker can be read in U.S. Senate (2001). Many of the large global banks have subsidiaries with private wealth management activities in Hong Kong, the Cayman Islands, and so on. Based on interviews with offshore wealth managers, the Boston Consulting Group (2009) estimates that about a third of the global offshore wealth is in Switzerland;

mate the amount of wealth held by individuals through all the world's tax havens. The method is independent from the official Swiss statistics, which will enable us to check its results against the Swiss data.

A Using Anomalies in Countries' Portfolio Securities Data

The method exploits the anomalies that the personal wealth management activities of tax havens cause in the portfolio data of countries. Take the typical investment revealed by the Swiss data: French residents who own Luxembourg fund shares through their Swiss accounts. (In turn, the Luxembourg funds invest in U.S. bonds, German equities, and so on, but forget about the investments made by the funds: they are irrelevant for the argument). These fund shares should be recorded as portfolio assets for France and liabilities for Luxembourg.[17] In practice, France has no way to record assets. Luxembourg statisticians duly record portfolio liabilities – they are aware that foreigners own shares of domestic funds.[18] And Switzerland rightly records nothing on its balance sheet. Portfolio liabilities are bound to exceed assets globally.

The same argument applies when you replace France by any country i whose households use tax havens (say the U.S.), Switzerland by any tax haven k that hosts personal wealth management activities (say the Bahamas), and Luxembourg by any country j that attracts investments or where a lot of mutual funds are incorporated (say the U.K.). Denote L_j the portfolio liabilities of country j, A_{ij} the true assets

20% in Jersey, Guernsey, and Ireland; 20% in the Caribbean and the U.S.; 15% in Luxembourg; 10% in Singapore and Hong Kong.

[17] In international investment statistics, mutual funds are treated as regular corporations, they are never made transparent. All mutual fund shares are classified as a type of portfolio equities (even the shares issued by mutual funds that only invest in bonds). This statistical convention can be seen as bizarre, but it is uniformly applied across the world. To clarify matters, I keep the word "equity" for regular portfolio equities and distinguish equities from fund shares.

[18] Note that the investments made by Luxembourg funds are also duly recorded: U.S. equities purchased by the funds will be recorded as portfolio assets for Luxembourg and liabilities for the U.S. Further, imagine that the funds in Luxembourg are in fact affiliates of German financial companies. In top of everything else, Luxembourg will record a direct investment liability and Germany an asset. The value of the direct investment will be the residual net worth of the funds (e.g., the value of the funds' offices), which is very small compared to the funds' gross portfolio assets and liabilities. Any error here does not affect the argument.

of country i on country j, and $\hat{A}_{ij}$ statisticians' estimates. Because of the personal wealth management activities of tax havens, there will be a fundamental anomaly in the portfolio stock data of countries:

Anomaly 1: *More cross-border portfolio liabilities* $\sum_j L_j$ *than assets* $\sum_j \sum_i \hat{A}_{ij}$ *will be recorded at the global level.*

Corollary of Anomaly 1: *For the countries* j *in which holders of offshore accounts invest, debtor-reported portfolio liabilities* L_j *will be greater than creditor-derived liabilities* $\sum_i \hat{A}_{ij}$.

Tax havens also cause anomalies in flow data. First, statisticians usually compute dividends and interest income by applying representative yields to stock positions, because observed positions are considered more reliable than flows.[19] If some securities are missing from the stocks, then Anomaly 2 follows:

Anomaly 2: *More cross-border dividends and interest will be paid than received globally.*

In addition, offshore banks do not only provide custody but also brokerage services: they buy and sell securities on behalf of their clients. Take a U.S. individual who purchases U.K. equities from her account in the Bahamas. In principle, Bahamian statisticians will notice that the buyer is not a resident of the Bahamas, so in keeping with the residence principle they will not record any equity purchase.[20] The U.K., by contrast, will duly record a sale.

Anomaly 3: *When offshore account holders are net purchasers of securities, more securities are sold than purchased globally. (And more securities are purchased than sold when offshore account holders are net sellers).*

Transfers of funds to tax havens can also cause anomalies. Take a U.S. saver who wires funds to the Bahamas. Following the double-entry bookkeeping system used in balance of payments accounting, such a transfer must be recorded twice

[19] See for instance BEA (2011, p. 42) in the case of the U.S.

[20] A practical reason why they will indeed not record a purchase is that transaction data are increasingly inferred from variations in observed positions – and statisticians do establish positions in keeping with the residence principle, as the Swiss data exemplify.

in the U.S.: both as an other investment credit (funds flow from a U.S. bank to a Bahamian bank) and an other investment debit (a U.S. person purchases a foreign asset, namely a Bahamian bank deposit).[21] In practice, a credit will be recorded but a debit will not, thus causing negative net errors and omissions in the U.S.[22]

U.S. savers can also purchase securities from their onshore accounts and then entrust them to offshore banks for custody. In this case, U.S. portfolio investment flow data will be accurate but the positions will not: there will be negative other changes in the statistics that reconcile flows and stocks as per the identity $\Delta Stocks = Flows + Valuation + OtherChange$.

Anomaly 4: *In individual countries' statistics, some transfers of funds to tax havens cause net errors and omissions and flow-stock discrepancies.*

But tax evaders can also carry banknotes, gold, and diamonds overseas. Such transfers will go fully unrecorded in U.S. international accounts, and thus will not cause any anomalies. Funds legally earned are unlikely to be massively transferred this way but funds illegally earned may well be.

We can use Anomaly 1 to compute the value of the assets globally held unrecorded by households in all the world's havens provided we make two assumptions. On the asset side, we need to assume that the securities held by direct reporters (such as financial corporations and governments) and those held onshore by households are well measured globally (H1). Second, the global amount of recorded portfolio liabilities must be accurate (H2). Under these assumptions, the global gap between identifiable portfolio liabilities and assets captures the value of the portfolios held by households through all tax havens. In this paper, my estimate of the unrecorded wealth in all tax havens is equal to the difference between globally identifiable portfolio liabilities and assets.

At first glance, this estimation method might seem trivial and crude. It is neither. It requires quite a lot of data, some of which have become available only

[21] In the financial account of the balance of payments, credits denote a reduction in assets or an increase in liabilities, while debits denote an increase in assets or a reduction in liabilities.

[22] See Appendix D.4.2 for a detailed analysis.

recently and are assembled here for the first time. More importantly, although assumptions (H1) and (H2) are not fully verified in practice, they are reasonable starting points and the results are robust to relaxing them.

Leaving aside household offshore wealth, portfolio positions are indeed considered quite reliable. Securities markets are highly centralized. Most countries have a long-standing tradition of monitoring custodians, and custodians observe all the securities held onshore. There is usually no valuation issue: traded stocks and bonds have readily available market prices. That is why, in a reference article, Bertaut et al. (2006, p. A67) write that: "In general, the data on U.S. liabilities are considered to be reasonably comprehensive [my assumption H2 in the U.S. case], as debt instruments tend to be issued by and bought or sold through large institutions that can be fairly readily identified and included in the data reporting network. U.S. foreign assets held by or through large U.S. institutions should also be well recorded [H1]."[23]

The relatively good quality of portfolio stock data extends to other leading countries. In response to a number of reports (IMF, 1987, 1992), the IMF launched in the 1990s a program to harmonize collection methods and spread best practices across the world (IMF, 2002). Since 2008, in all leading economies portfolio asset data have been based on security-by-security surveys. These surveys collect information at the level of individual securities, allowing for extensive cross-checking and error spotting.

Some issues do remain. But as we will see, they are minor for the paper's results. What they simply mean is that my method to compute the wealth in all the world's havens can only give an order of magnitude – not an exact figure as in the Swiss case.

[23]The authors then go on by describing the problem in which we are precisely interested in this paper: "However, for smaller U.S. investors, directly purchasing foreign securities abroad without using the services of a large, U.S.-resident institution is increasingly easy. Such acquisitions will not be captured in the U.S. recording system but will most likely be recorded as liabilities by the counterparty country's measurement system. Because all countries face this problem, cross-border assets are probably undercounted worldwide."

B Data on Countries' Aggregate Portfolio Securities

To compute the value of the global offshore portfolio using Anomaly 1, we need aggregate portfolio securities asset and liability figures for all countries. The key source is the August 2009 updated and extended version of the External Wealth of Nations dataset constructed by Lane and Milesi-Ferretti (2007), which covers 178 economies. In the database, portfolio position data come from published IIPs or in minor cases are derived by cumulating flows and adjusting for valuation effects.[24]

There are three data challenges here: the External Wealth of Nations does not include data for all the world's territories; I want to include the securities held by central banks (which are classified as "reserves") in my portfolio assets total; and there are uncertainties on the holdings of Middle Eastern oil exporters. To address these challenges, many studies exist to rely on, drawing on independent sources. By construction, my figures are in line with these studies, which makes me confident in their accuracy. When uncertainties remain, they can be quantified and they are small compared to my estimate of the global offshore wealth.

First, filling in the coverage gaps in the External Wealth of Nations database does not pose major difficulties. The only significant country not covered is the Cayman Islands, a large financial center where about 10,000 hedge funds are incorporated.[25] But the Cayman Islands' Monetary Authority has been publishing data on the holdings of Cayman hedge funds since 2006. Based on this information, I reckon that the Cayman Islands had about \$1.25tr in portfolio assets at the end of 2008, of which about \$700bn were U.S. equities and bonds.[26]

Second, most countries disclose to the IMF what fractions of their reserves are

[24]Starting in 2001, the portfolio data for almost all the largest economies and financial centers come from published IIPs. That is why I only use post-2001 data in this research.

[25]For the other countries not covered, see Appendix Sections B.3 and B.4.

[26]Although there remains some uncertainty on the holdings of Cayman hedge funds, this does not affect my estimate of household offshore wealth, because I use the same method to compute the Cayman Islands' assets as to compute its liabilities. If my assets estimate is \$200bn too small, then my liabilities estimate is also \$200bn too small, leaving the global assets-liabilities gap unchanged. See Sections A.2 and B.3.1 of the Appendix for more details on the Cayman Islands.

held in the form of bank deposits versus bonds and other securities.[27] Notable exceptions include China and Taiwan. On average, central banks invest 75% of their assets in securities and 25% in bank deposits; I assume that the same holds true for those countries that do not provide data. However, Wooldridge (2006) suggests that the share of securities is probably higher in China, so I assume a 85% securities share for China. There is a $100-200bn uncertainty on China's portfolio and a 30$bn uncertainty on Taiwan's.[28] This is negligible compared to my estimate of the global offshore wealth ($4,500bn in 2008).

Lastly, little public information exists about oil exporters' holdings. In principle, one could use counterpart country data – such as the Treasury survey of U.S. portfolio liabilities – to capture oil exporters' assets. But oil exporters sometimes invest abroad through offshore banks; the U.S. securities that they hold through Swiss banks will wrongly be attributed by the U.S. to Switzerland.

To estimate oil exporters' onshore assets, I start with their holdings of U.S. securities as recorded in the Treasury liabilities survey. I then make assumptions regarding the share of U.S. securities in their portfolio. The many studies recently published on the subject share two conclusions: the U.S. share is high and it has declined in the 2000s. The assumption for 2001 of a 70% share of U.S. assets and a regular decline of two percentage points per year fits the available estimates best. To simplify matters, I do not try to specifically estimate the value of oil exporters' offshore assets; I include these in my globally unrecorded offshore wealth total. Although some uncertainties remain, available studies, official sources, and Swiss statistics suggest that oil exporters account for about 10% of my estimated total offshore wealth Ω.[29]

[27]The two key sources here are the IMF Special Data Dissemination Standard and an IMF survey of securities held as reserve assets, called SEFER.

[28]See Appendix Sections A.4 (China) and A.6.2 (Taiwan and other non-SEFER reporters).

[29]Section A.5 of the Appendix provides a thorough discussion of oil exporters.

C The Global Portfolio Assets-Liabilities Gap

Exploiting the global database, Figure IV reveals a first striking result: each year, less securities assets than liabilities are identifiable worldwide. In 2008, liabilities $\sum_i L_i$ equal \$40tr, while assets $\sum_i \hat{A}_i$ reach \$35.5tr only. There is a \$4.5tr gap $\Omega = \sum_i L_i - \sum_i \hat{A}_i$. (Note that selecting 2008 as the benchmark year tends to understate the absolute size of unrecorded claims given the collapse in world equity prices after the Lehman Brothers bankruptcy). Each year, more than 10% of all cross-border equities and bonds have unknown owners. Figures V and VI plot the discrepancy for equities (including fund shares) and bonds separately. 20% of all cross-border equities and fund shares have no identifiable owners; bonds are less affected.

Table III compares the portfolios that have no readily identifiable owners globally (Ω) with the offshore portfolios in Swiss banks (Ω^s), as of the end of 2008. Both look strikingly the same, although they rely on fully independent data. In each case, equities including fund shares account for two thirds, bonds for one third. (And as we will see below, most of the globally missing equities are actually mutual fund shares, just like most of the equities held through Swiss offshore accounts). This fact suggests that the global portfolio assets-liabilities gap does reflect the assets held by households through tax havens. One third of the global missing wealth (Ω =\$4,490bn) can be traced back to Switzerland (Ω^s =\$1,545bn), a finding consistent with industry reports estimating that about a third of the world's offshore wealth is in Switzerland (e.g., Boston Consulting Group, 2009).

At end 2008, the global net financial wealth of households – households' bank deposits, equities, bonds, and insurance contracts, net of debts – was about \$74tr.[30] By my estimate, individuals held unrecorded portfolios worth Ω=\$4.5tr in tax

[30]This figure comes from the work of Davies et al. (2011) who provide the first comprehensive estimate of the level and distribution of world wealth in 2000 based on an exhaustive exploitation of available national balance sheets. A report by Credit Suisse (2010) builds on the methodology developed by Davies et al. (2011) to provide yearly estimates for the 2000-2010 period, and finds \$74tr for 2008.

havens – that is, about 6% of their net financial wealth.

In tax havens households not only own portfolio securities but also bank deposits. Contrary to what happens for portfolios, offshore deposits do not go completely unrecorded in the international statistics. The major financial centers tell the Bank for International Settlements (BIS) how much deposits foreigners have placed in their banks. In principle, French statisticians can use the BIS data to estimate the value of French residents' offshore bank deposits, which will then be recorded in France's IIP as "other assets." The IMF has been advocating the use of the BIS data by national agencies since the 1990s. Not all countries do so, however, and the BIS does not separate out corporate from household deposits.

In order to give a rough estimate of the global amount of household offshore wealth, I assume in the first column of Table III that 25% of it takes the form of deposits and 75% of securities, as is the case in Switzerland. In 2008, global offshore wealth then amounts to \$4.5tr (securities) plus \$1.4tr (deposits). The resulting \$5.9tr total represents 8% of household financial wealth. Of this 8%, at most 2% (deposits) are recorded as assets in countries' IIPs.[31]

While this paper is the first in the academic literature to estimate the personal wealth held in tax havens, a number of studies have provided estimates before. The most detailed industry report puts the amount of household offshore wealth at \$6.7tr in 2008 (Boston Consulting Group, 2009, p. 31). Cap Gemini and Merrill Lynch (2002, p. 11) put it at \$8.5tr in 2002. The Tax Justice Network (2005) has a \$11.5tr figure for 2005 and Palan et al. (2010, p. 5) write that "the global rich held in 2007 approximately \$12 trillion of their wealth in tax havens." My estimate, \$5.9tr in 2008, is therefore at the low-end of the scale. Note that I focus on financial wealth only, whereas households can also use tax havens for works of art and real

[31] Deposits are only partially recorded, because not all statisticians use the BIS data as inputs to their IIPs. And more importantly, the BIS data under-estimate the offshore deposits of rich countries' households, because they do not see through the intermediate wealth-holding structures that the owners of offshore accounts use. The Swiss bank deposits held by French savers through sham Panamanian corporations are assigned to Panama in the BIS data. This is a first-order concern (see Section III.B).

estate.[32]

5 Consistency and Robustness Checks

My method to estimate the personal wealth globally held offshore is indirect, and as such subject to a margin of error. Future statistical improvements will make it possible to refine my estimate. In the meantime, this Section provides evidence that the order of magnitude I find is correct, robust to relaxing the key estimation assumptions, and consistent with independent flow data.

A Using Bilateral Assets Data to Decompose the Assets-Liabilities Gap

A basic objection to my estimation procedure is that the global portfolio assets-liabilities gap may reflect data deficiencies unrelated to tax havens. How can we be reasonably sure that it mostly reflects household offshore portfolios? Because of one key reason: the wealth does not vanish randomly, but following a specific pattern that closely mirrors what the independent Swiss data show.

To make this point, I use bilateral portfolio assets data to decompose the global portfolio assets-liabilities gap Ω and investigate its source. The main data source is the Coordinated Portfolio Investment Survey (CPIS), conducted under the auspices of the IMF on a yearly basis since 2001. I use the 2008 wave of the survey, which presents the bilateral portfolio holdings $\hat{A}_{ij}$ of 74 countries on 238 debtors. The CPIS is rounded out by a survey of securities held as reserve assets and by international organizations.

In its early years, the CPIS had important shortcomings. Initially, only 7 of the countries surveyed by the IMF conducted the security-by-security surveys required to accurately measure bilateral portfolio holdings. The majority of the entries in

[32] Whether these elements can explain the difference between my estimate and previous studies is a question that I leave for future research. Cross-border real estate, in particular, is an important asset class for households. I also disregard the wealth of individuals who live in tax havens.

the CPIS were estimated by participating countries on the basis of ad hoc methods. Over the years, progress was made. In 2008, most leading economies conducted security-by-security surveys, including the U.S., the entire eurozone, and Japan. For these countries, the geographical allocation of assets is likely to be very accurate.[33] Some problems still remain. The U.S., for instance, does not currently count short positions as negative assets, so reported figures are slightly too high. There are some valuation issues: when partial repayment of a debt security is possible, as is the case for asset-backed securities, some custodians keep track of the original principal, others only of what is remaining. But as Section V.B. will show, these shortcomings cannot affect the main conclusions I draw from the analysis of the CPIS data.

To analyze the source of the global gap Ω we need bilateral portfolio assets data for all countries. I have therefore filled in the coverage gaps in the CPIS. This is not problematic, because the CPIS has a very good coverage rate: it captures 86% of all cross-border securities in 2008.[34] All the leading industrial countries and the large financial centers participate – although the Cayman Islands only reports on its banks' portfolio holdings, disregarding its large hedge fund industry. To reach a 98-99% coverage rate, we only need to add data on four non-reporters: China, Middle Eastern oil exporters, Taiwan, and the Cayman Islands' hedge funds. We have reasonably good information about the investments these non-reporters make: we know that they invest in the U.S. a lot. To allocate some of the non-U.S. investments of CPIS non-reporters, I employ a gravity model of portfolio holdings.[35] The online Appendix extensively discusses the raw sources and methods used to fill in the gaps in the CPIS.

Figure VII decomposes the 2008 global portfolio assets-liabilities gap Ω using the extended CPIS data. Each dot is equal to the difference between the portfolio

[33] See for instance Bertaut et al. (2006, p. A63) in the case of the U.S.

[34] See Appendix Table A1.

[35] As shown by Portes and Rey (2005) and Lane and Milesi-Ferretti (2008), the gravity model fits cross-border portfolio flow and stock data well. Because I apply the gravity model to less than 5% of global assets, any error introduced by the model has negligible consequences.

liabilities reported by a country j (L_j) and the sum of the assets on j identifiable worldwide ($\sum_i \hat{A}_{ij}$). By construction, the dots sum to \$4,490bn, the global portfolio gap Ω. For 90% of the world's countries, debtor-reported and creditor-derived liabilities match ($L_j = \sum_i \hat{A}_{ij}$). But for the three financial centers that host large mutual fund industries – Luxembourg, the Cayman Islands, and Ireland – there is a huge discrepancy.[36] For instance, Luxembourg had around L_j=\$2tr in equity liabilities at end 2008. Yet only $\sum_i \hat{A}_{ij}$=\$1.1tr in equity assets on Luxembourg were identifiable worldwide: about \$900bn of Luxembourg mutual fund shares had no known owner.[37] Overall, claims on funds incorporated in Luxembourg, Ireland, and the Cayman, account for 48% of the globally missing wealth Ω.

The missing wealth thus follows a clear pattern that mirrors what the Swiss data showed. We learned in Section III that foreigners own a great deal of Luxembourg and Irish fund shares through their Swiss accounts (Figure II). We now observe that many of such fund shares have no identifiable owners globally (Figure VII). Banks all over the world, and not only in Switzerland, sell Luxembourg and Irish fund shares to their customers – simply because a considerable fraction of the world's mutual funds are incorporated in these two countries that do not withhold taxes on cross-border payments.[38] The specific pattern of anomalies in Figure VII can thus readily be explained by the fact that households own fund shares through unrecorded accounts in Switzerland, Singapore, and the Bahamas. It cannot satisfactorily be explained by other known issues with the data – including with the 2008 CPIS –, nor by my imputations for non-CPIS participating countries. There is

[36]These discrepancies have previously been documented by Lane and Milesi-Ferretti (2007) and the ECB (2009) in the case of Luxembourg and Ireland, and suggested by Lane and Milesi-Ferretti (2011) in the case of the Cayman Islands, but my paper is the first to provide a consistent explanation for them. Section D.4.6 of the Appendix discusses the preliminary steps taken by the ECB to address the issue. Statistical agencies cannot do much until all tax havens disclose who owns the offshore portfolios in their banks (see Section VII).

[37]Almost 100% of the equity liabilities of Luxembourg, Ireland, and the Cayman are fund shares.

[38]One exception is that not many foreign funds are sold on the U.S. territory, because of restrictions put by the Investment Company Act of 1940. Statistics gathered by the European Fund and Asset Management Association (EFAMA) show that Luxembourg and Ireland are the two leaders for the incorporation of mutual funds in Europe. At the global level, Luxembourg comes second to the U.S. But the U.S. withholds taxes on payments made by domestic funds to foreigners, which explains why in tax havens individuals own Luxembourg rather than U.S. fund shares.

admittedly some uncertainty on the holdings of China, oil exporters, and Taiwan, but no indication that these countries massively invest in Luxembourg and Irish funds.[39]

The large amount of missing claims on the Cayman can also be explained by the use of tax havens by individuals, although the mechanism is slightly different. Most of the funds incorporated in the Cayman are hedge and private equity funds. Shares of such funds are usually directly purchased by investors rather than distributed by Swiss and other banks. Because shares of hedge funds are not entrusted to custodian banks, it is hard for U.S. statisticians to measure U.S. claims on Cayman funds. At the end of 2008, the U.S. recorded less than $100bn in equity assets on the Cayman while funds incorporated there had more than $1tr in foreign equity liabilities.[40] In all likelihood a large amount of U.S. claims went unrecorded. For U.S. savers, directly investing in Cayman hedge funds offers roughly the same potential tax evasion opportunities as holding Luxembourg fund shares through Swiss accounts. When filling tax returns, taxpayers can choose to report income or not, since there is no automatic exchange of information between Cayman funds and the IRS.[41]

Why should we care that a considerable amount of Luxembourg, Irish, and Cayman fund shares have no identifiable owners? Because the funds in turn invest in U.S. equities and other securities. Since we do not know who owns a large fraction of the world's mutual funds, we cannot know who ultimately owns a large fraction of U.S. equities.[42]

The missing claims on France, Japan, and other rich countries in Figure VII can

[39] It makes little sense for central banks or sovereign funds to invest in mutual funds (except in hedge funds and private equity funds) since they already pay wealth managers to design suitable investment strategies. The largest sovereign wealth fund, Norway's, discloses its portfolio on a security-by-security basis: it has virtually no assets on Luxembourg, Ireland, and the Cayman Islands.

[40] See Department of the Treasury et al. (2009, Table 30 p. 68)

[41] A Foreign Account Tax Compliance Act passed in 2010 seeks to strengthen information reporting. For more information on the taxation of hedge fund investors, see Sheppard (2008). I have no data on what fraction of offshore income goes undeclared in tax returns globally. In the U.S., the IRS estimates that personal income tax evasion through offshore accounts and hedge funds might cost up to $70bn annually (Gravelle, 2009).

[42] Along these lines, Section C.2. of the Appendix reckons that at least 15% of U.S. cross-border portfolio equity liabilities have no identifiable ultimate owner.

be attributed to the fact that through their offshore accounts savers directly invest in French equities, Japanese bonds, and other securities issued by rich countries.[43] Again this would be congruent with the Swiss data, which showed that households directly own equities and bonds in addition to their Irish and Luxembourg fund shares.

B How Known Issues with Available Data Affect My Estimate

My estimate that about 6% of household financial wealth is held unrecorded in all the world's tax havens relies on two assumptions. First, portfolio asset figures must accurately reflect the securities held by corporations and governments and those held onshore by households (H1); second, portfolio liabilities must be accurate (H2). Here I briefly review the main known issues with countries' portfolio data and discuss how relaxing the two assumptions affects the results.

On the asset side, asset-backed securities and short positions are sometimes imperfectly recorded – this, however, cannot explain the considerable amount of globally missing mutual fund shares. The assets surveys of a number of economies also have idiosyncratic weaknesses: in the U.S., some hedge and private equity funds have for a long time been unaware of their reporting duties; in Singapore, official statistics have traditionally excluded important semi-official holders of portfolio claims.[44] Yet it is unlikely that these shortcomings play an important role for the 2008 pattern of anomalies identified in Figure VII. Between 2009 et 2011, both the U.S. and Singapore significantly strengthened their assets data,[45] but this did

[43] In principle, these anomalies could also be attributed to problems in the 2008 CPIS and in my imputations. However, there is no particular reason why these problems should specifically cause anomalies for France, Japan, Netherlands, and the U.S., as in Figure VII. Note that France is also one of the leading mutual fund centers in Europe along with Luxembourg and Ireland, and that many multinational corporations are headquartered in the Netherlands.

[44] See Appendix Section A.1.2. In Europe, Germany and Italy traditionally measured portfolio positions by cumulating flows and adjusting for valuation, but security-by-security surveys were introduced respectively in 2006 and 2008. See Appendix Sections A.1.1 (Germany) and B.2.3 (Italy).

[45] At the end of 2011, in the frame of the introduction of a new reporting form, the TIC SLT,

not affect much the pattern of debtor-reported/creditor-derived anomalies. In 2011, for instance, Luxembourg reported close to \$2.6tr in portfolio equity liabilities, and this was still considerably larger than the \$1.4tr of equity claims on Luxembourg reported in the CPIS; similarly, Ireland had close to \$1.5tr in equity liabilities and yet CPIS creditors only \$0.5tr in assets.[46] And despite notable statistical improvements in the U.S., identifiable equity claims on the Cayman remained smaller than the size of the Cayman fund industry.

A second potential issue has to do with liability figures, which might be overestimated. Take a French person who owns French equities via a Swiss bank. From the viewpoint of international statistics, these equities are not cross-border claims, but they will likely be recorded by French statisticians as liabilities for France. In this case, the use of offshore banks by households does not bias asset data downwards but liability data upwards. However, such round-tripping does not affect the paper's argument. Too much liabilities are recorded globally, and the observed assets-liabilities gap still directly reflects household offshore portfolios.

Liability figures, on the contrary, may be under-estimated. Take a French saver who owns U.S. equities via a Swiss bank. U.S. statisticians will not always be able to record these equities as U.S. liabilities. But these equities will not be recorded on the asset side of the French IIP either. So accounting for them would both deteriorate the U.S.'s net foreign asset position and improve France's by the same amount. The wealth held in tax havens would be even greater than I have found.

In sum, available aggregate portfolio data do not always verify my two identification assumptions. In light of what we know today, however, nothing indicates that my methodology substantially over- or under-estimates the wealth offshore. While future improvements in portfolio statistics will make it possible to refine my estimate, there is no particular reason to expect they could radically affect the order

the Federal Reserve Board significantly expanded its coverage of U.S. hedge and private equity funds (see Section VI.B below). Singapore integrated semi-official investors in its IIP and CPIS data.

[46]Note that here I do not attempt to estimate the holdings of non-CPIS reporters, including those of Cayman-based hedge funds.

of magnitude I find.

C Consistency Between Flow and Stock Anomalies

A last consistency check comes from the flow data. The global assets-liabilities gap Ω has its counterpart in the world balance of payments computed by the IMF independently from the present study. The IMF world balance of payments includes all countries' reports plus undisclosed IMF estimates for all non-reporters. It displays two inconsistencies. First, more investment income is paid than received each year (Anomaly 2). In 2008, the discrepancy amounted to D=\$156bn.[47] To see how this flow anomaly fits in with my estimated stock anomaly, denote r_Ω the yield on the missing portfolios Ω – that is, the flow of missing dividends and interest divided by the stock of missing securities. A missing flow of \$156bn implies a yield of r_Ω=3.5%, consistent with the average yield on recorded cross-border securities.[48]

Second, barring one exception in 1998, there are more securities sold than purchased globally (Anomaly 3). Again, this anomaly fits in well with the portfolio assets-liabilities gap Ω. To see why, denote I_t the net unrecorded purchases of securities, and VAL_t the net capital gains on existing unrecorded portfolios. We can write the change in the stock of unrecorded portfolios Ω between $t-1$ and t as $\Omega_t - \Omega_{t-1} = I_t + VAL_t$. Table IV breaks Ω down as per this equation. A reasonable pattern emerges: steady inflows, negative valuation effects during equity bear markets, positive valuation effects during bull markets, and reasonable yields r_Ω throughout the period.

One anomaly that is not systematic in the data is "net errors and omissions" in individual countries' balances of payments (Anomaly 4). Over the 1970-2004 period, some countries have exhibited large net errors, such as Italy, Norway, or Russia (Lane and Milesi-Ferretti, 2007, Table 3 p. 243). But some EU countries and the U.S. have not. Does that invalidate my results? Not at all, for two reasons.

[47] See Appendix Table A21.
[48] See Appendix Table A22.

First, transfers of funds offshore need not systematically cause net errors – carrying banknotes overseas, granting a loan to a shell offshore company, and receiving wage on an offshore account will not.[49] And conversely, "net errors" reflect many issues unrelated to tax havens – such as differences in the timing of trade and financial transactions – that make them a poor indicator of the magnitude of capital flight.

6 Implications of Tax Havens for International Imbalances

In 2008, globally identifiable portfolio liabilities exceeded assets by about \$4.5tr. The missing assets must belong to some countries. This Section proposes scenarios as to how accounting for them affects international imbalances – both stock and flow imbalances, commonly referred to as "global imbalances." The scenarios are thought experiments such as: "What is the true U.S. net foreign asset position if the U.S. owns 20% of the unrecorded wealth?"; as such, they are speculative. However, a number of qualitative findings emerge.

A The Eurozone and the Rich World are Probably Net Creditors

As we have seen, about one-third of the missing assets can readily be attributed to households with Swiss accounts, and the remaining two-thirds probably belong to households with accounts in other tax havens. The SNB's statistics suggest that more than half the offshore wealth in Switzerland belongs to Europeans. Although we do not know who owns the offshore wealth in the Cayman Islands and Singapore, surveys of wealth managers give some direction. For instance, the Boston Consulting Group (2009) estimates that 42% of all offshore wealth belongs to Europeans and 60% to residents of rich countries.

[49] Section D.4 of the Appendix discusses five concrete case studies of transfers and how they should be recorded.

Table V presents scenarios as to how unrecorded assets affect the net position of the eurozone, officially the world's second largest net debtor. Accounting for the offshore wealth in Switzerland alone considerably improves the eurozone's position. If in addition the eurozone owns 25% of the offshore portfolios in the world's other tax havens, then it is balanced. If it owns 50% of all the unrecorded portfolios, it is in actual facts a sizeable net creditor. In all plausible scenarios, the eurozone shifts into the black.

Table VI presents similar computations for the U.S. Accounting for unrecorded assets improves the U.S. net position, albeit by a smaller amount. If U.S. residents own 20% of all unrecorded wealth – say, 15% of the offshore wealth in Swiss banks and 25% of the other missing assets – then the net position of the U.S. is significantly better than in the official data: -12% of GDP on average over 2001-2008 as opposed to -18% in the data.

My benchmark scenario where the eurozone owns about half the unrecorded wealth and the U.S. 20% turns the overall rich world into a net creditor. This result is robust to alternative assumptions. The rich world shifts into the black as long as it owns more than half the globally unrecorded assets. Available Swiss data suggest that it is a lower bound, which is hardly surprising since residents of rich countries own 80% of recorded world wealth (Davies et al., 2011). Remember also that most of the unrecorded assets are Luxembourg, Irish, and Cayman fund shares. We have reason to believe that these fund shares belong in the main to Europeans (especially Luxembourg fund shares) and Americans (especially Cayman fund shares).[50] Developing countries have offshore accounts too, but plausibly not more than 30% of all offshore wealth: about 10% for oil exporters and 20% for non-oil developing countries is a reasonable take in light of available evidence.[51] Lastly,

[50]Felettigh and Monti (2008) document that about half the foreign equity holdings recorded by Italy are in Luxembourg funds. The ECB (2009) considers that most of the missing assets on Luxembourg and Ireland probably belong to eurozone residents. Lane and Milesi-Ferretti (2007) document that Irish statisticians recorded five times more U.S. investments in Irish equities than U.S. statisticians did in 2004, so U.S. residents may own a significant fraction of the missing claims on Ireland.

[51]The hypothesis that Middle Eastern oil exporters own 10% of the globally unrecorded portfo-

among rich countries, Japanese residents do not seem to use tax havens extensively – they own less than 1% of Swiss bank deposits – plausibly because capital income is much less taxed in Japan than in other developed economies.[52]

B Implications for Current Account Dynamics

Accounting for tax havens sheds light on the true size of debtor and creditor positions: the eurozone is likely to be a net creditor and the U.S. less indebted than in the official statistics. Although my methodology focuses on positions rather than transactions, the results have two implications for the analysis of current accounts dynamics.

First, we know that capturing household offshore portfolios has always been impossible. Although available data do not enable me to estimate the wealth held unrecorded before 2001, accounting for the missing assets must improve the pre-2001 net positions of Europe and the U.S. The rich world was therefore probably a sizeable net creditor in the 1980s and 1990s (Figure I). Now, if the rich world starts from a positive position in the mid-1990s, then poor-to-rich flows are a factor of convergence rather than divergence in the external positions of countries: developing countries are simply repaying their debts to advanced economies, as if output convergence was accompanied by net external wealth convergence. Although this is not necessarily what theory predicts – many open-economy models do not have clear-cut predictions on steady-state net foreign asset positions, and in standard models one can have persistent inequalities in net wealth even if output converges –, it seems important to keep this possibility in mind when analyzing the determinants of current account imbalances and the risks involved.

A second implication of my findings is that some of the most egregious incon-

lios Ω implies total portfolio holdings for Middle Eastern countries well in line with the literature, see Appendix Table A8. Middle Eastern countries own 10% of Swiss bank deposits and non-oil developing countries 25%, see Appendix Table A26.

[52] In 2005, the OECD reports that the net personal tax rate on dividends was 22% in Germany, 32% in France, as opposed to 10% in Japan, and 18% in the United States.

sistencies between financial flow and stock data, both in Europe and the U.S., may be related to tax havens.

Consider households moving portfolio securities to offshore accounts. The securities leave the radar of domestic statistical systems. This tends to make recorded portfolio positions smaller than cumulated past financial flows adjusted for valuation changes. Such capital flight probably explains in part why the eurozone's net international position has deteriorated from about zero in 1985 to -14% of GDP in 2011, despite zero current account deficit. A case in point is the dramatic evolution of Ireland's net international position during the crisis, from about -20% of GDP in 2007 to -100% in 2010. This development cannot satisfactorily be explained by financial flows and valuation losses (Lane, 2011). Capital flight in the midst of the eurozone crisis has probably played a significant role.

Conversely, statisticians sometimes improve their coverage of the wealth held in tax havens. The U.S., in particular, keeps discovering new portfolio assets from year to year (Curcuru et al., 2008; Lane and Milesi-Ferretti, 2009). These discoveries partly reflect an improvement in the coverage of U.S. corporations' offshore assets. One prominent example is the 2011 U.S. portfolio asset survey which significantly improved the coverage of the Cayman hedge fund shares held by U.S. companies: the 2011 survey found close to $500bn in Cayman equity assets, three times the 2010 level. Such improvements partly explain why the deterioration of the U.S. position has been much smaller than U.S. borrowing and valuation effects would suggest, a puzzle that has attracted considerable attention since the work of Gourinchas and Rey (2007a). The results of the 2011 U.S. survey may be pointing to a gradual reduction in the total amount of unrecorded wealth, as it identified some $500bn in previously unreported holdings.[53] But a lot of wealth clearly remains to be discovered globally: the U.S. still does not attempt to capture households' offshore portfolios, and in other countries such as Ireland, new waves of capital flight seem to vastly exceed discoveries of previously unreported assets.

[53] See Department of the Treasury et al. (2012, Table 4 p. 7).

C Remaining Anomalies in International Statistics

The failure to record the personal wealth in tax havens is certainly not the only issue in the investment statistics of countries. Could other errors in the data offset the improvement in rich countries' IIP resulting from accounting for households' offshore wealth? There is one necessary (though not sufficient) condition for countries' IIP to be accurate: globally, recorded claims should match liabilities. Here I briefly discuss scenarios where this condition is verified.

Accounting for tax havens can entirely solve the global assets-liabilities discrepancy for one category of claims: portfolio investments. It can also explain why more investment income is paid than received, which is the key driver of the current account deficit that the world has tended to run up (Motala, 1997). Two anomalies remain, however. First, contrary to the phenomenon found for portfolio securities, for foreign direct investments, slightly more assets can be identified than liabilities (Lane and Milesi-Ferretti, 2007, Figure 2 p. 232). Second, in a spectacular reversal of past trends, the world started running up a current account surplus in 2004. The surplus has been driven by the trade balance: since 2004, recorded exports have exceeded imports significantly (Figure VIII). Although there is no reason why the FDI and trade anomalies should be linked with household offshore assets, a brief discussion of their likely sources is in order.

FDI data raise huge challenges. Direct investments are decentralized, unlike portfolio holdings. Statisticians have only recently started spreading best practices and harmonizing data across countries by means of a Coordinated Direct Investment Survey conducted for the first time in 2009. Most importantly, direct investments have no observable market value, because they do not usually take the form of traded securities. Developing countries compile FDI statistics on a book value basis, while most rich countries try to infer market values based on the market prices of portfolio investments. Because asset prices rose more in developing than in rich countries in the 2000s, much of the direct investment discrepancy may come from the fact that the book values recorded by the developing countries for their direct investment liabilities are too low. The developing world may be more indebted than we think.

The trade discrepancy also likely comes from errors in developing countries' statistics. There is no particular reason to believe that exports are overestimated in rich countries. In fact, the U.S. Census Bureau (1998) has argued that U.S. goods exports have tended to be systematically underestimated, by as much as 10%. In contrast, there is substantial evidence that the developing world underestimates its imports: Fisman and Wei (2004) show that China's imports from Hong Kong are systematically under-reported for tax reasons. Now, developing countries' IIPs are still mostly compiled by cumulating current account flows (in particular for the "other assets" category). If developing countries' current account balances are overestimated, then their net foreign assets are also overestimated. Once again, the developing world may be more indebted than we think.

If the FDI and trade discrepancies are due purely to errors in developing countries' statistics, then they do not affect the results of this paper: when the world IIP is purged of all its errors, the rich world and the eurozone are net creditors, and the developing world a net debtor. If each country contributes to the FDI and trade discrepancies in proportion to the size of its international balance sheet – a worst case scenario given the available evidence – the central conclusions of this paper still hold. The eurozone remains a net creditor – albeit smaller – and the rich world is roughly balanced.[54]

As a final word of caution, it is worth remembering that in top of the FDI and trade issues, there are substantial uncertainties on cross-border holdings of real estate, which in many countries are insufficiently captured or even not at all. Curcuru et al. (2009) estimate that on net real estate increased U.S. liabilities of $565bn in 2007. Emerging economies might own a substantial fraction of foreign-owned U.S. and European real estate and miss these holdings in their statistics.

[54] See Appendix Tables A31-A32. Appendix Table A30 provides a line-by-line reconciliation of Ω with the world net foreign asset discrepancy (the world's puzzling net debt).

Further studies are called for on this important issue to improve estimates of the debtor and creditor positions of leading economies.

7 Conclusion: Two Proposals to Improve Official Statistics

This paper takes a serious look at the enormous challenges that the personal wealth management activities of tax havens pose for international data. The main finding is that around 8% of the global financial wealth of households is held in tax havens, three-quarters of which goes unrecorded. Available evidence suggests that offshore assets belong in the main to residents of rich countries, in particular to Europeans. On the basis of plausible assumptions, accounting for the wealth in tax havens turns the eurozone into a net international creditor and significantly improves the U.S. net position. Contrary to conventional wisdom that views Europe and the U.S. as severely indebted economies, the rich world is still overall likely to be a net creditor. Much of the literature on global imbalances has been preoccupied with major divergence trends in current accounts and net positions that could ultimately cause a sharp drop in the dollar and recessions in rich countries. My results suggest that poor-to-rich capital flows may be a factor of convergence rather than divergence in the net foreign asset positions of countries.

Accurate foreign asset data are crucial to many research and policy issues. They form a key input for the analysis of patterns in capital flows. Countries with high recorded net foreign debt are labelled high risk, which has direct consequences on their borrowing terms and increases the chances of disorderedly adjustments. Better investment data would improve our ability to track fundamental aspects of globalization and to monitor financial stability. All of this calls for changes to be made to the way data are compiled.

Two simple reforms would make for substantial improvements. First, statistics showing that 60% of Swiss deposits are owned by a small set of unpopulated tax havens are unhelpful. Cross-border banking data on the household sector should be compiled on a beneficial ownership basis. A bank deposit owned in Switzerland by a French individual through a sham Panamanian corporation should not be recorded as a Panamanian but as a French deposit. The key principle of anti-money laundering regulations is that bankers need to know at all times who are the beneficial owners of the funds they manage, even if they are held via a long chain of intermediate entities. Banks should be asked to use this information to compile cross-border banking data on the household sector. It would not require much extra work, since the information already exists within the banks.

Second, countries should exchange data on portfolio securities held offshore by households. All international financial centers should report to the Bank for International Settlements on the value of the securities held in custody by foreign residents in their banks – just as they do today for bank deposits. Custodial surveys have a long history and they do not raise any great practical problems. The reform would not violate any bank secrecy provisions. But it would only work if custodial holding data were also established on a beneficial ownership basis.

The combination of both reforms would enable statisticians to fill in long-standing gaps in portfolio investment data. As this paper has argued, this would radically change the international investment positions of rich countries.

A third source can be used as input to the statistics on the external positions of countries: tax data. These data would be reliable if offshore financial institutions exchanged information with foreign tax authorities on an automatic basis. Since the beginning of the financial crisis, and under G20 pressure, a number of tax havens have started exchanging bank information with foreign countries. But they only provide information "upon request:" in practice, the amount of information exchanged remains negligible (Johannesen and Zucman, 2013). Absent automatic information exchange, tax data may well remain an unreliable source to capture the offshore wealth of households.

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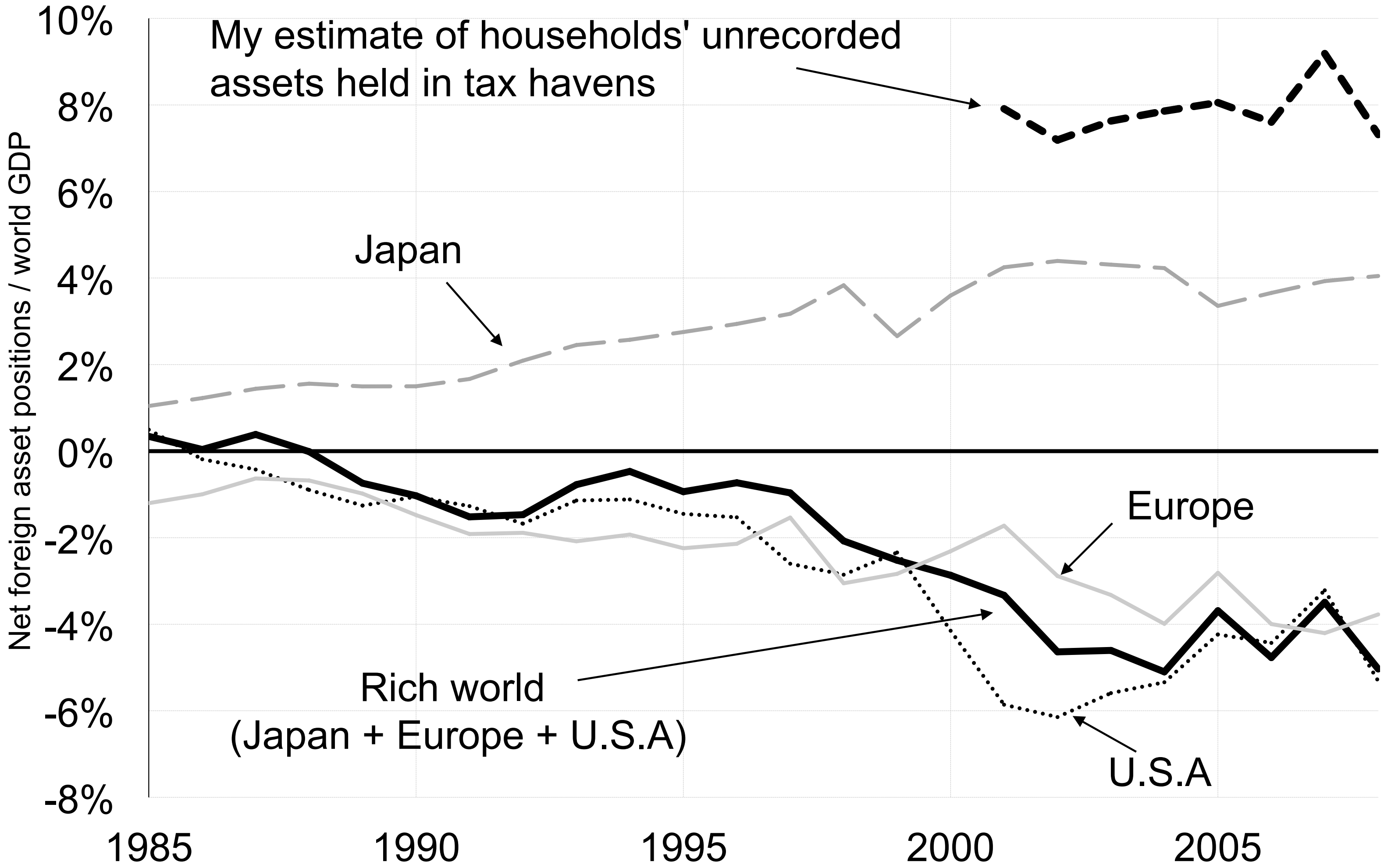
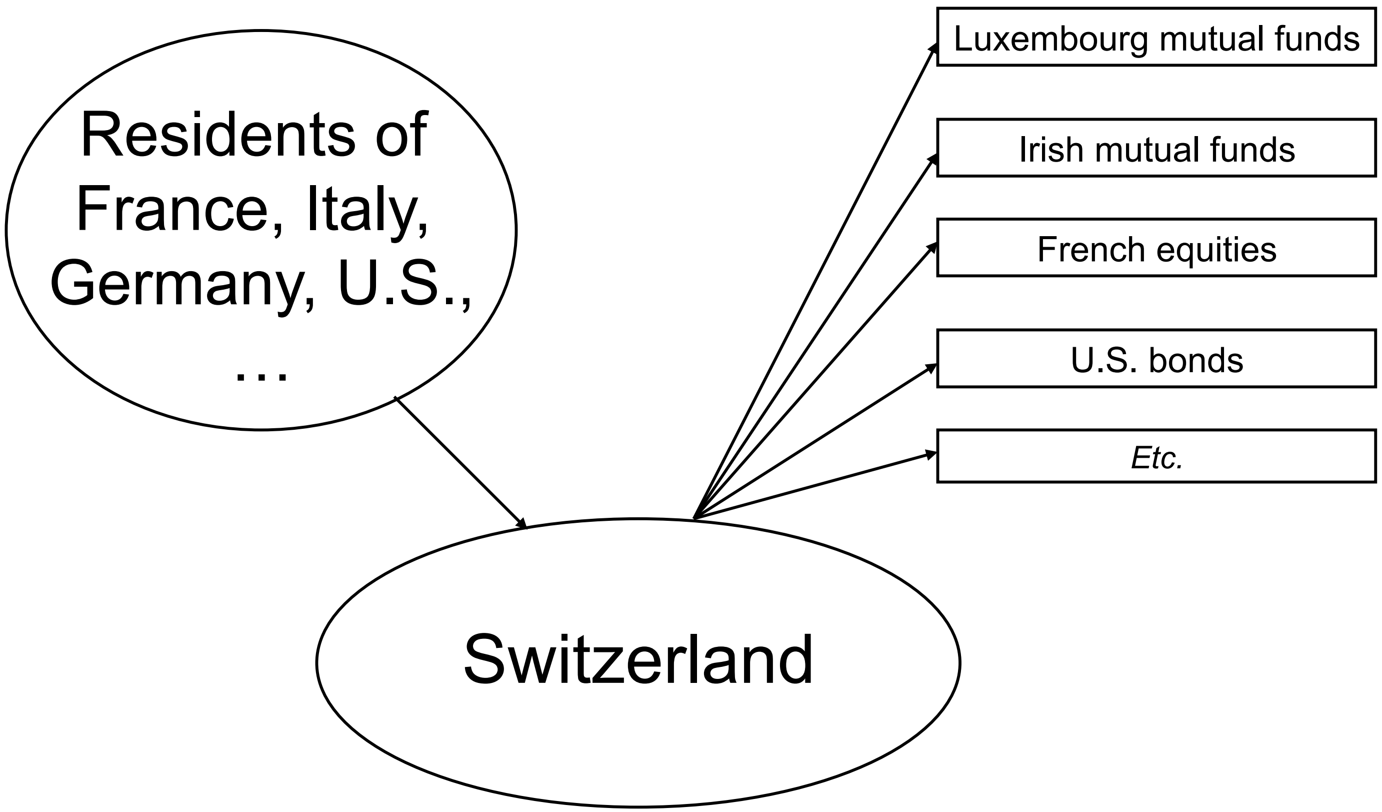
Figure 1.1: Recorded Net Assets of the Rich World and Estimated Unrecorded Assets in Havens



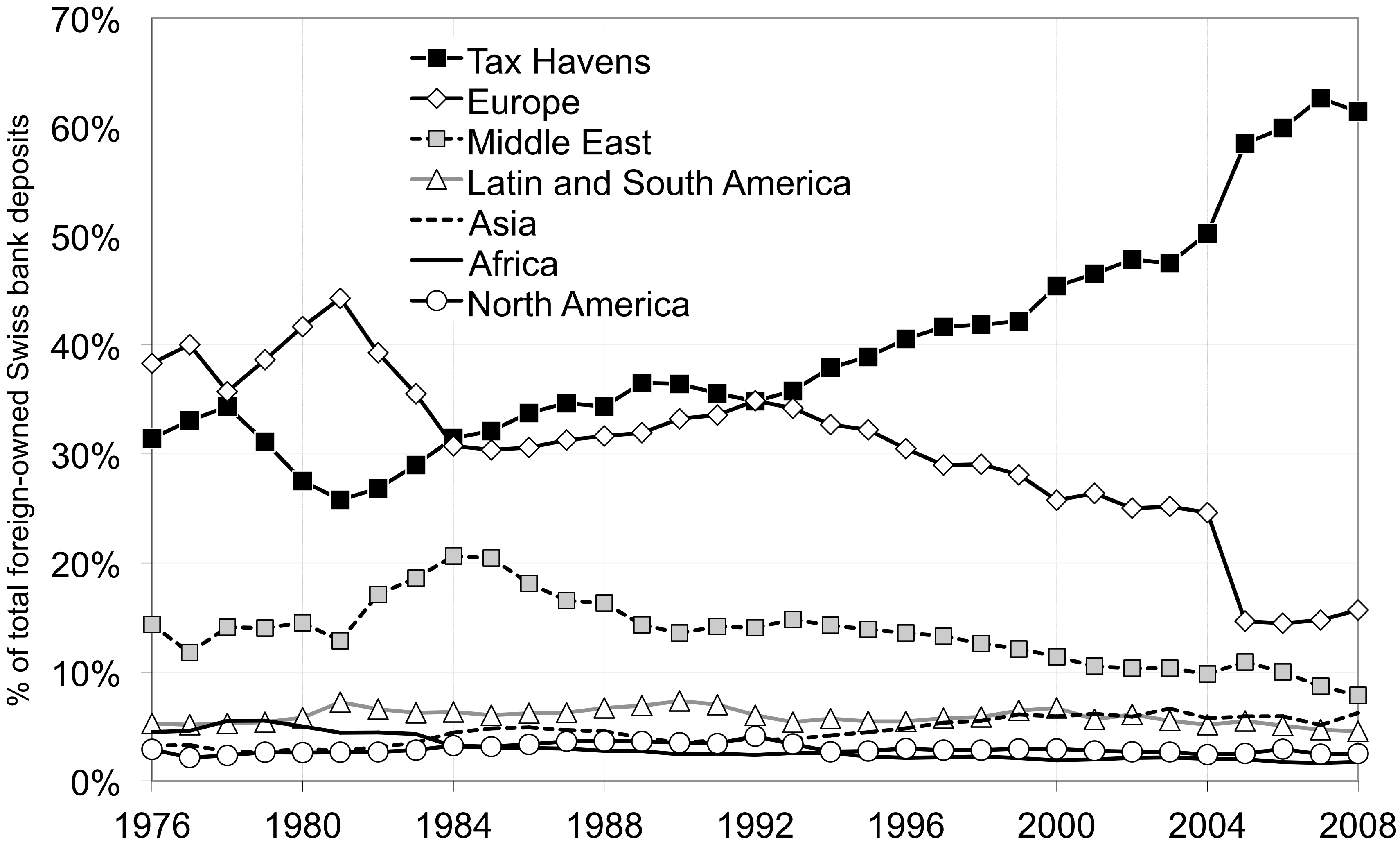
Note: The figure charts the value of unrecorded household assets in tax havens along with the officially recorded net foreign asset positions of Japan, the U.S., and Europe. All series are scaled by world GDP. In 2008, by my estimate, unrecorded household assets amounted to 7.3% of world GDP. Total household financial assets stood at 120% of world GDP (Davies et al., 2011) so unrecorded household assets amounted to 6% of total household financial assets. Europe includes the 16 members of the eurozone as at the end of 2010, five additional European countries (the UK, Norway, Sweden, Denmark and Switzerland), and three non-European countries (Australia, New Zealand, and Canada).
Source: Appendix Tables A3 and A27.

Figure 1.2: Through Their Swiss Accounts, Foreigners Mostly Invest in Mutual Funds



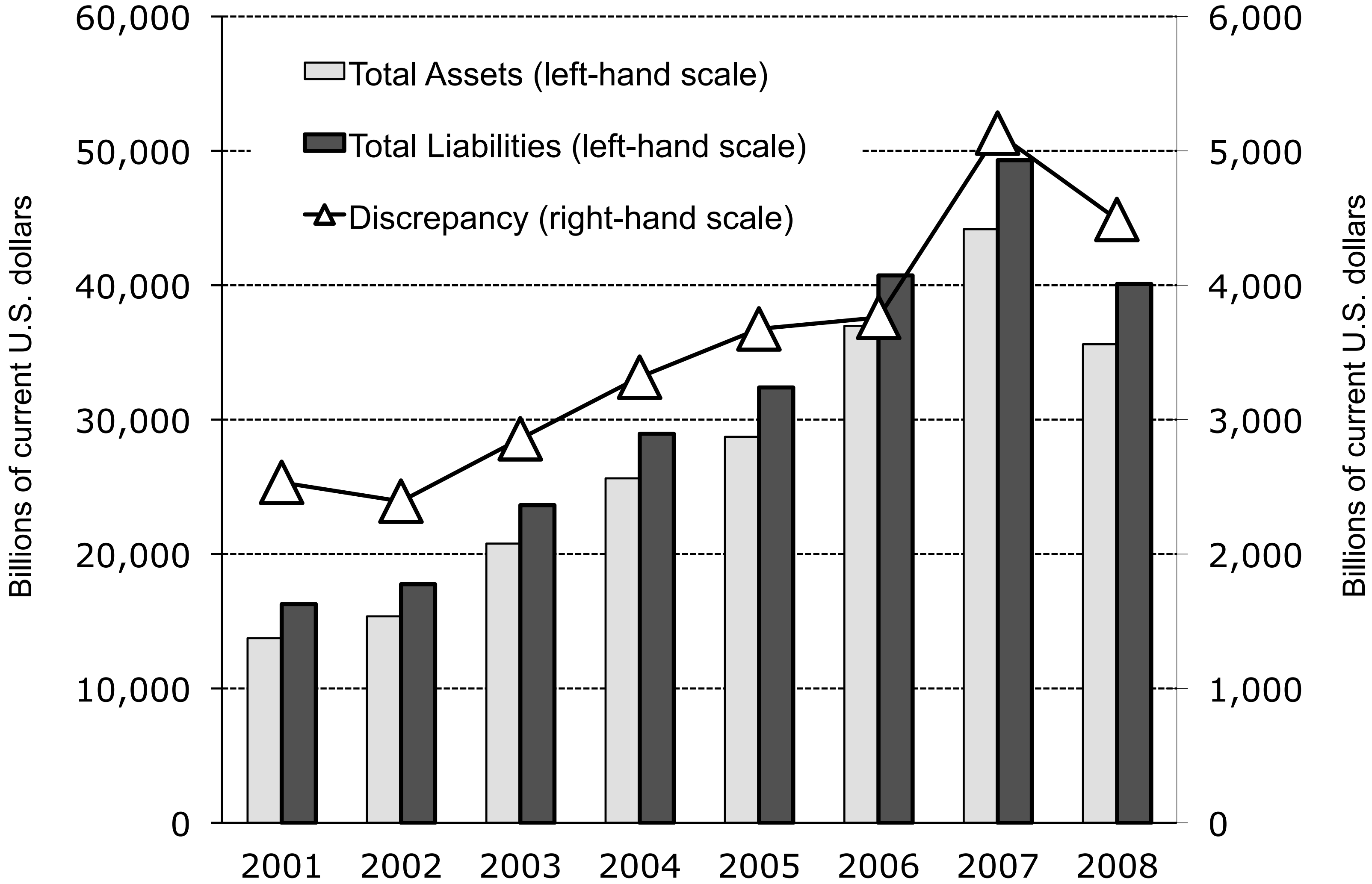
Note: This Figure presents the typical pattern of investments revealed by the Swiss National Bank's statistics studied in this paper. These statistics show that at the end of 2008, foreigners owned about US$ 2tr in Swiss banks in the form of bank deposits and portfolio investments. A large fraction of these assets were invested in mutual funds. Most of the mutual funds sold by Swiss banks to their clients are incorporated in Luxembourg and Ireland.

Figure 1.3: Most Swiss Accounts Probably Belong to Europeans



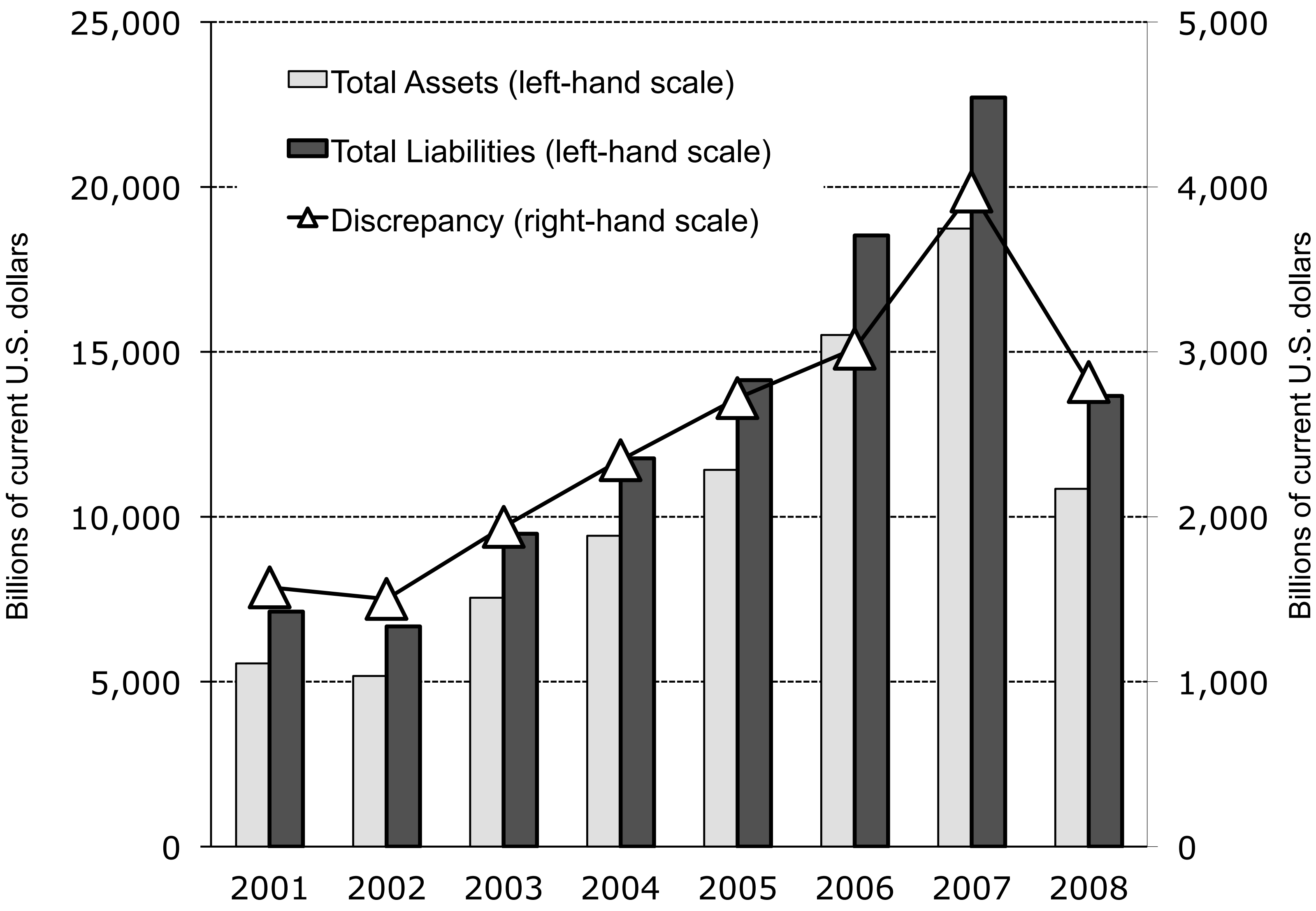
Note: This figure shows which countries' residents own Swiss fiduciary bank deposits, as reported by the Swiss National Bank (SNB). The SNB does not see through the sham corporations with addresses in such places as Panama or the British Virgin Islands used by European, U.S., and other rich countries' households as nominal owners of their accounts. This explains the high share of deposits assigned to tax havens.
Source: Appendix Table A25.

Figure 1.4: Each Year, Less Securities Assets Are Recorded Than Liabilities



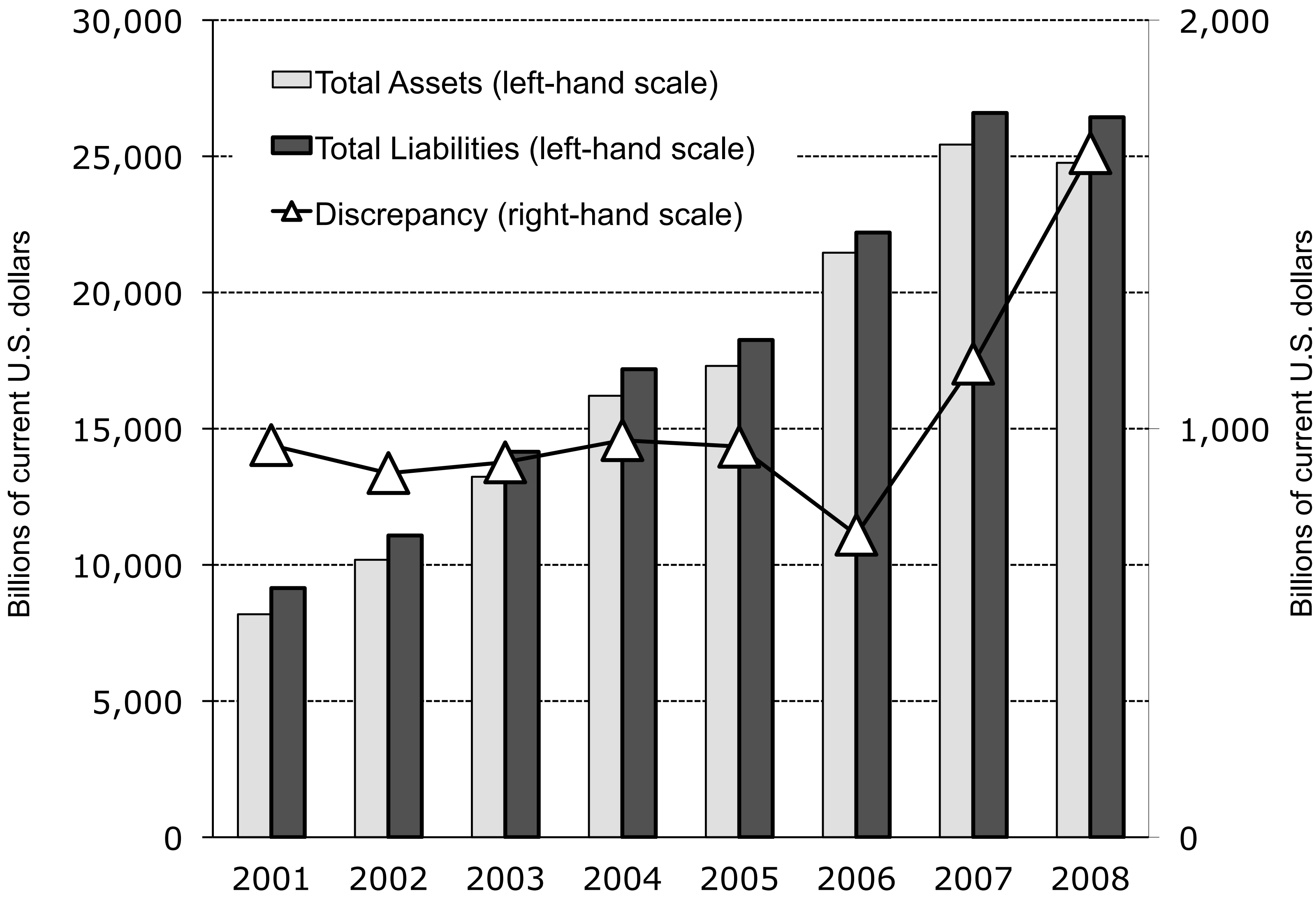
Note: This figure charts the securities assets and liabilities identifiable worldwide. Securities include all equities and bonds classified as portfolio investments or reserves. The totals cover 237 countries and territories along with international organizations.
Source: Appendix Table A3.

Figure 1.5: Each Year, Less Equity Assets Are Recorded Than Liabilities



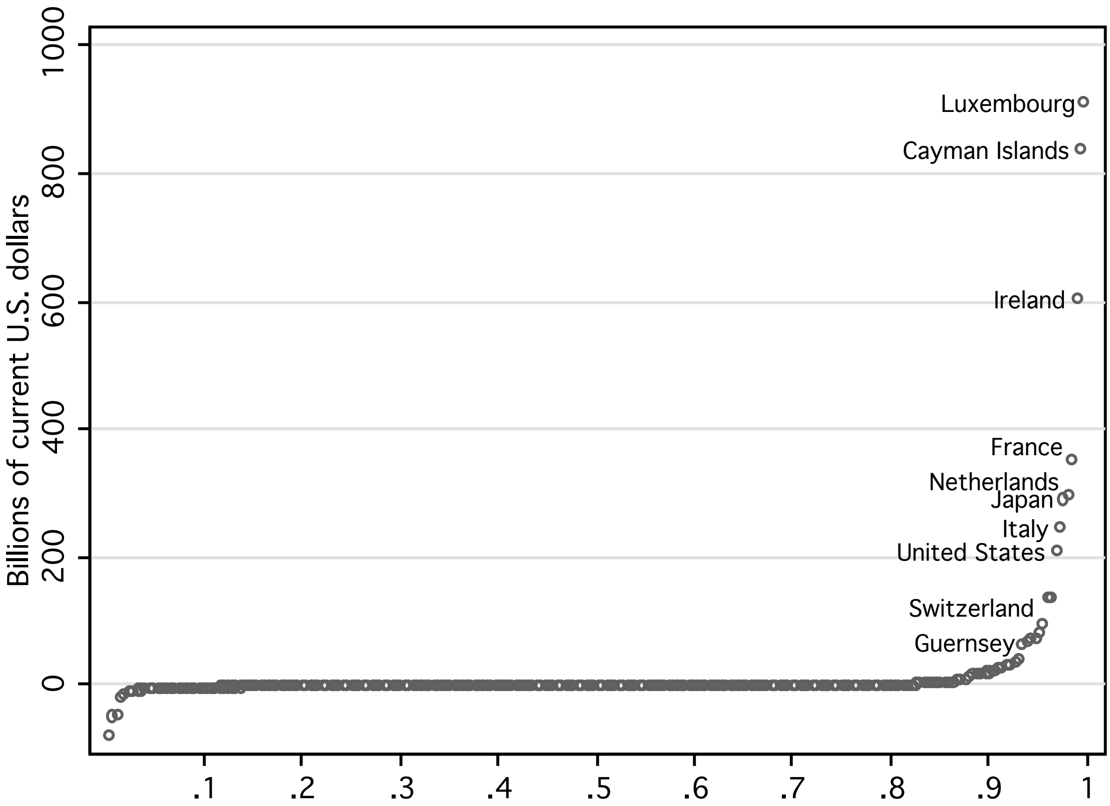
Note: This figure charts the equity assets and liabilities identifiable worldwide. Equities include all equities classified as portfolio investments or reserves. The totals cover 237 countries and territories along with international organizations.
Source: Appendix Table A3.

Figure 1.6: Each Year, Less Bond Assets Are Recorded Than Liabilities



Note: This figure charts the bond assets and liabilities identifiable worldwide. Bonds include all debt securities classified as portfolio investments or reserves. The totals cover 237 countries and territories along with international organizations.
Source: Appendix Table A3.

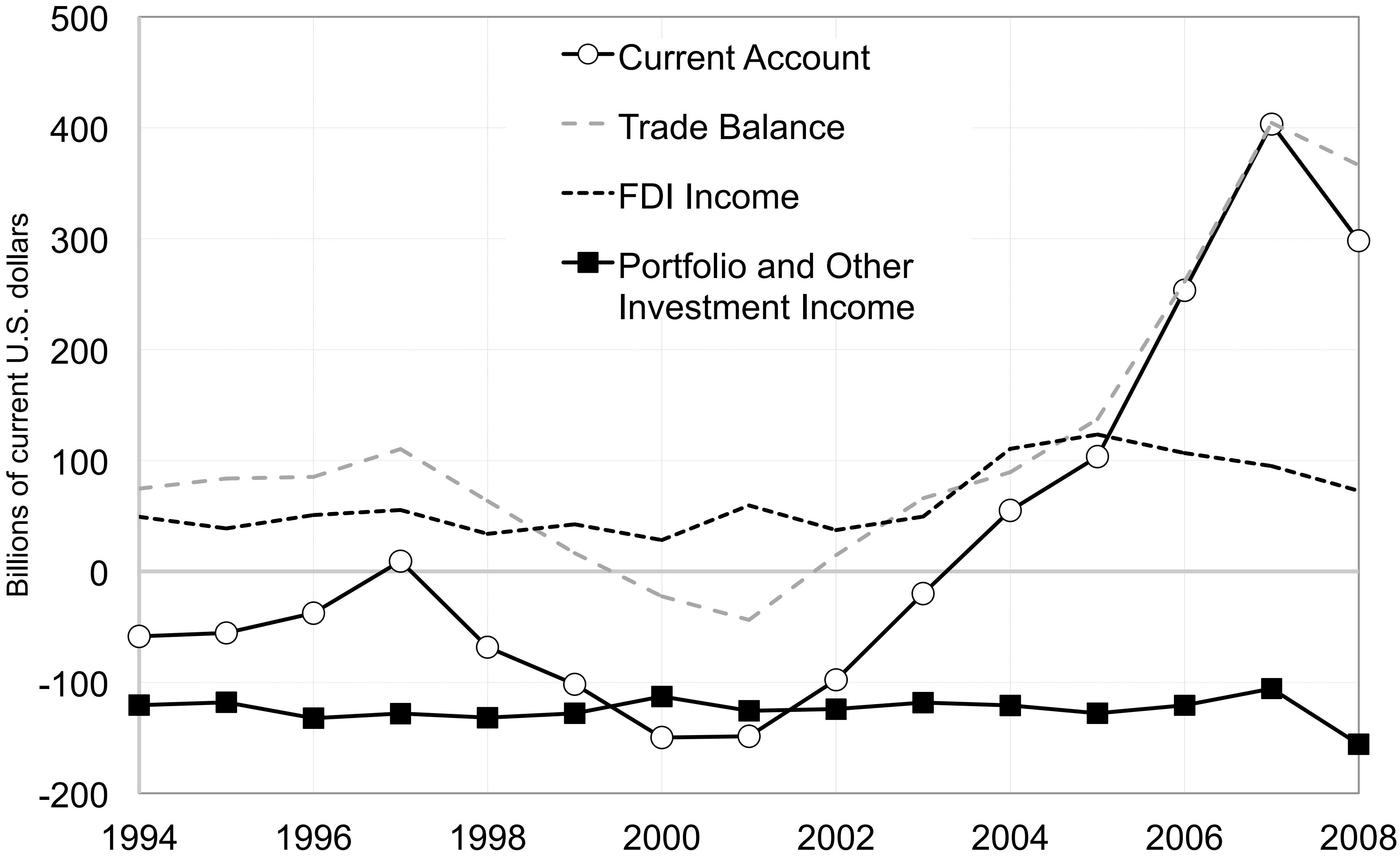
Figure 1.7: Many Mutual Fund Shares Have no Readily Identifiable Owners in the Official Statistics



Note: Each dot represents a country j and is equal to the difference between the securities liabilities reported in 2008 by j (L_j) and the sum of the securities assets on j held by 236 countries i and international organizations ($\sum_i \hat{A}_{ij}$). The securities issued by Luxembourg, the Cayman Islands, and Ireland, are mostly mutual fund shares.

Source: Appendix Tables A13 and A14.

Figure 1.8: The World Now Runs a Large Trade Surplus



Note: This figure charts the statistical anomalies in the world's balance of payments, which includes data for all countries and territories. Each year, more portfolio and other investment income is paid than received, the flow counterpart of missing assets in international investment positions. Since 2004, the world has been running a large trade surplus, driving a large current account surplus.
Source: Appendix Table A21.

Table 1.1: Securities Form the Bulk of Cross-Border Wealth

(End of 2008 values)	Trillions of current US$	% of world GDP
Securities	40.1	65%
Bonds	*26.4*	*43%*
Equities (including mutual fund shares)	*13.7*	*22%*
FDI	17.7	29%
Other (loans, deposits...)	32.0	52%
Total cross-border wealth	89.9	146%
Memo: World GDP (2008) = US$ 61.4tr		

Note: Securities include all "portfolio investments" and the fraction of "reserve assets" invested in equities and bonds. In international investment statistics, all mutual fund shares are classified as equities (irrespective of whether the funds invest in equities or bonds). FDI stands for foreign direct investment. Derivatives are excluded because they are not measured yet in all leading economies.
Source: IMF Balance of Payments Statistics and the updated and extended version of the External Wealth of Nations database constructed by Lane and Milesi-Ferretti (2007).

Table 1.2: Large Portfolios of Securities Are Held in Swiss Banks by Foreigners

(End of 2008 values in billions of current US$)	Belonging to foreigners	Belonging to Swiss residents
Foreign securities	1,545	810
Bonds	*540*	*484*
Equities	*1,005*	*326*
(Of which: mutual fund shares)	*767*	*196*
Fiduciary bank deposits	478	45
Total	2,022	855

Source: Securities: Swiss National Bank's *Monthly Statistical Bulletin* (http://www.snb.ch/en/iabout/stat/statpub/statmon/stats/statmon), series $D5_1$, $D5_{1a}$, $D5_1$, $D5_{1b}$, $D5_2$ and $D5_{2b}$ and *Banks in Switzerland* (http://www.snb.ch/en/iabout/stat/statpub/bchpub/stats/bankench), series 38a, 38b, 38c. Fiduciary deposits: *Monthly Statistical Bulletin*, series $D4$, $D4_{1a}$, $D4_{2a}$, and *Banks in Switzerland* series 36, 37, 38.

Table 1.3: Estimated Offshore Wealth, World and Switzerland

(End of 2008 values in billions of current US$)	World	Switzerland
Offshore securities	4,490	1,545
Bonds	*37%*	*35%*
Equities	*63%*	*65%*
(Of which: mutual fund shares)	*48%*	*50%*
Offshore bank deposits	1,388	478
Total offshore financial wealth	5,878	2,022
Memo: Global household financial wealth = 73,625		

Note: Global household financial wealth includes bank deposits, portfolios of securities, insurance contracts of households net of households' debt. Offshore financial wealth includes the bank deposits and portfolios of securities held by households in tax havens. It excludes real estate and other real assets held in tax havens.
Source: Offshore financial wealth: Appendix Tables A3, A23, and A24. Global household financial wealth: Credit Suisse (2010).

Table 1.4: The Anomalies Caused by Unrecorded Assets Are Internally Consistent

		2001	2002	2003	2004	2005	2006	2007	2008
[1]	Stock (Ω), bn$	2,532	2,392	2,858	3,316	3,676	3,760	5,131	4,490
[2]	Inflows (*I*), bn$	*38*	*164*	*153*	*240*	*230*	*116*	*189*	*364*
[3]	Valuation (*VAL*), bn$	*n.a.*	*-304*	*313*	*218*	*130*	*-31*	*1,182*	*-1,006*
[4]	Interest and dividends (*D*), bn$	126	124	118	121	128	121	106	156
[5]	Yield ($r_\Omega = D/\Omega$)	*5.0%*	*5.2%*	*4.1%*	*3.6%*	*3.5%*	*3.2%*	*2.1%*	*3.5%*

Note: This table reports on the estimated stocks and flows of unrecorded portfolios. Inflows are the net purchases of securities from unrecorded accounts. Valuation denotes the net capital gains/losses on unrecorded portfolios. Interest and dividends are the income earned by the owners of unrecorded portfolios.
Source: Appendix Tables A3 and A21; IMF *Balance of Payments Statistics* 2010, Table C-1: "Global discrepancies in balance of payments statistics."

Table 1.5: Accounting for the Wealth in Tax Havens Can Turn the Eurozone Into a Net Creditor

		Share of offshore portfolios in Switzerland belonging to eurozone residents			
		0%	**40%**	**50%**	**60%**
Share of offshore portfolios in other havens belonging to eurozone residents	**0%**	-11%	-6%	-5%	-3%
	25%	-6%	0%	1%	2%
	50%	0%	5%	7%	8%
	75%	6%	11%	12%	13%

Note: The Table reads as follows. The official eurozone's net foreign asset position/GDP ratio averaged -11% over the 2001-2008 period. If eurozone residents owned 40% of the unrecorded assets held through Switzerland and 50% of those held through the other tax havens, the true net foreign asset position/GDP ratio of the eurozone averaged +5%.
Source: Appendix Table A28.

Table 1.6: Accounting for the Wealth in Tax Havens Improves the U.S. Net Foreign Asset Position

		Share of offshore portfolios in Switzerland belonging to U.S. residents		
		0%	**5%**	**15%**
Share of offshore portfolios in other havens belonging to U.S. residents	**0%**	-18%	-17%	-16%
	25%	-13%	-13%	-12%
	50%	-9%	-8%	-7%
	75%	-5%	-4%	-3%

Note: The table reads as follows. The official U.S. net foreign asset position/GDP ratio averaged -18% over the 2001-2008 period. If U.S. residents owned 15% of the unrecorded assets held through Switzerland and 25% of those held through the other tax havens, the true net foreign asset position/GDP ratio of the U.S. averaged -12%.
Source: Appendix Table A29.

Chapter 2

The End of Bank Secrecy? An Evaluation of the G20 Tax Haven Crackdown

Abstract: During the financial crisis, G20 countries compelled tax havens to sign bilateral treaties providing for exchange of bank information. Policymakers have celebrated this global initiative as the end of bank secrecy. Exploiting a unique panel dataset, our study is the first attempt to assess how the treaties affected bank deposits in tax havens. Rather than repatriating funds, our results suggest that tax evaders shifted deposits to havens not covered by a treaty with their home country. The crackdown thus caused a relocation of deposits at the benefit of the least compliant havens. We discuss the policy implications of these findings.

1 Introduction

In August 2009, France and Switzerland amended their tax treaty.[1] The two countries agreed to exchange upon request all information necessary for tax enforcement, including bank information otherwise protected by Swiss bank secrecy laws. Over the following months, one of France's richest persons and her wealth manager were taped discussing what to do with two undeclared Swiss bank accounts, worth $160 million. After a visit to Switzerland, the wealth manager concluded that keeping the funds in Swiss banks or bringing them back to France would be too risky. He suggested that the funds be transferred to Hong Kong, Singapore, or Uruguay, three tax havens which had not committed to exchanging information with France. After the tapes were made public, they received extensive newspaper coverage and eventually the funds were repatriated to France.[2]

The amendment to the French-Swiss tax treaty was part of a major initiative to combat tax evasion at the global level. Since the end of the 1990s, the OECD has encouraged tax havens to exchange information with other countries on the basis of bilateral tax treaties, but until 2008 most tax havens declined to sign such treaties. During the financial crisis, the fight against tax evasion became a political priority in rich countries and the pressure on tax havens mounted. At the summit held in April 2009, G20 countries urged each tax haven to sign at least 12 information exchange treaties under the threat of economic sanctions. Between the summit and the end of 2009, the world's tax havens signed a total of more than 300 treaties.

The effectiveness of this crackdown on offshore tax evasion is highly contested. A positive view asserts that treaties significantly raise the probability of detecting tax evasion and greatly improve tax collection (OECD, 2011). According to policy makers, "the era of bank secrecy is over" (G20, 2009). A negative view, on the contrary, asserts that the G20 initiative leaves considerable scope for bank secrecy and

[1] This chapter was written with Niels Johannesen.

[2] For a summary of this evasion case, see "Affaire Bettencourt: ce que disent les enregistrements," *Le Monde*, 30 June 2010.

brings negligible benefits (Shaxson and Christensen, 2011). Whether the positive or the negative view is closer to reality is the question we attempt to address in this paper.

This is an important question for two reasons. First, the fight against offshore tax evasion is a key policy issue. Globalization and the information technology revolution have made it easier for tax evaders to move funds offshore. Absent information exchange between countries, personal capital income taxes cannot be properly enforced, giving rise to substantial revenue losses and constraining the design of tax systems. Against the backdrop of the large public deficits faced by most countries since the financial crisis, curbing tax evasion is high on the policy agenda.

Second, although treaties have prevailed as the main policy instrument in the fight against international tax evasion, surprisingly little is known about their effectiveness. The G20 crackdown has generated a lot of discussion in policy circles but there is little fact-based evidence of its efficacy and no academic evaluation. The OECD has launched a peer-review evaluation to assess whether treaties are properly drafted and enforced, but while this legal work is necessary, it is not sufficient: if the information exchange mechanism advocated by the OECD has fundamental shortcomings, then even properly drafted and enforced treaties may be ineffective. Our study is the first attempt to assess from a quantitative perspective the impact of the many treaties signed by tax havens since G20 countries have made tax evasion a priority.

Providing compelling evidence on tax evasion is notoriously difficult, and even harder in the complex area of international tax evasion. We break new ground in this field by drawing on a particularly rich dataset on cross-border bank deposits. For the purpose of our study, the Bank for International Settlements (BIS) has given us access to bilateral bank deposit data for 13 major tax havens, including Switzerland, Luxembourg, and the Cayman Islands. We thus observe the value of the deposits held by French residents in Switzerland, by German residents in

Luxembourg, by U.S. residents in the Cayman Islands and so forth, on a quarterly basis from the end of 2003 to the middle of 2011. Using specific country names for the sake of concreteness, we ask: Did French holders of Swiss deposits respond to the 2009 French-Swiss treaty by repatriating funds to France? Did they relocate their funds to other tax havens? Or did they simply leave them in Switzerland? To address these questions, after providing more details on offshore tax evasion and the data we use in Section 2, we employ graphical analysis in Section 3 and panel regression analysis in Section 4.

We obtain two main results. First, treaties have had a statistically significant but quite modest impact on bank deposits in tax havens: a treaty between say France and Switzerland causes an approximately 11% decline in the Swiss deposits held by French residents. Second, and more importantly, the treaties signed by tax havens have not triggered significant repatriations of funds, but rather a relocation of deposits between tax havens. We observe this pattern in the aggregate data: the global value of deposits in havens remains the same two years after the start of the crackdown, but the havens that have signed many treaties have lost deposits at the expense of those that have signed few. We also observe this pattern in the bilateral panel regressions: after say France and Switzerland sign a treaty, French deposits increase in havens that have no treaty with France.

The finding that tax evaders shift deposits in response to treaties, our key result, illustrates an important pitfall of the current approach to the fight against tax evasion. Tax havens are whitelisted after signing 12 treaties, leaving considerable scope for tax evaders to ensure that their assets are not covered by a treaty. Our analysis shows that tax evaders exploit this possibility, which ultimately provides incentives for tax havens to keep their treaty networks at the minimum. From a normative viewpoint, our paper thus lends support to the idea developed theoretically by Elsayyad and Konrad (2011) that a "big bang" multilateral agreement should be preferred to the current sequential approach.

The finding that treaties have had a modestly sized impact on bank deposits has several possible interpretations between which we cannot discriminate conclusively with the data at our disposal. First, most tax evaders may have chosen not to move deposits because they considered that treaties did not substantially increase the probability they be detected. This interpretation is consistent with the fact that treaties only rarely lead to actual exchange of information in practice. Yet another possible interpretation is that the modest size of our estimates is due to limitations of our deposit dataset. For instance, some tax evaders use sham corporations with addresses in Panama and the British Virgin Islands as nominal holders of their bank accounts in Switzerland and other havens, which obscures who ultimately owns part of the funds offshore. We tackle this issue in Section 5, for the first time in this literature, and we show that the funds held through sham corporations might have responded strongly to the treaties. Lastly, tax evaders might have declared some of their assets to tax authorities while keeping them offshore. In Section 6 we analyze a novel dataset with direct information on income that European owners of Swiss accounts voluntarily declare. We find no signs that treaties induced Swiss account holders to comply more with tax laws, but we cannot rule out an increase in compliance in other tax havens.

Our paper adds to the literature on tax treaties, where a recurring finding is that treaties have little real economic effects (e.g., Blonigen and Davies, 2005; di Giovanni, 2005; Louie and Rousslang, 2008). Relative to this literature, our contribution is to focus on the information sharing provisions included in tax treaties rather than on those aimed at promoting cross-border investments and limiting double taxation. The effectiveness of information sharing mechanisms is rarely assessed and our paper contributes to filling this gap.[3]

We also contribute to the literature on how tax policies affect international investments (e.g., Chan et al., 2005; Desai and Dharmapala, 2011). A branch of this literature initiated by Alworth and Andresen (1992) focuses on the determinants of

[3] A complementary contribution is Blonigen et al. (2011) who study whether information exchange agreements affect foreign direct investments (while we look at bank deposits and tax evasion).

cross-border deposits such as taxes, interest rate differentials and distance. Huizinga and Nicodème (2004) find that information exchange agreements have no significant effect on cross-border deposits in OECD countries. We focus, by contrast, on how tax treaties affect deposits in tax havens. This evaluation was not possible before 2009, the year when most tax havens started signing information exchange treaties.[4]

Lastly, our paper sheds new light on the activities taking place in tax havens, a topic which is attracting increasing interest (Desai et al., 2006; Dharmapala, 2008; Dharmapala and Hines, 2009; Palan et al., 2010). Tax havens provide corporations and individuals with opportunities to avoid or evade taxes. The bulk of the literature focuses on the use of tax havens by corporations, following Hines and Rice (1994). By contrast, we focus on their use by households, which is still little studied.

2 Offshore Tax Evasion By Households: Context and Data

A Policies to Prevent Offshore Tax Evasion

Tax havens such as Switzerland, Singapore, and the Cayman Islands host an important wealth management industry which provides foreigners with an opportunity to evade taxes. If a French household entrusts assets to a French bank, there is automatic reporting of capital income to the French tax authorities: evasion of the personal income tax is impossible. But if it entrusts assets to a Swiss bank, there is no automatic reporting: French authorities have to rely on self-reporting and tax evasion is possible.[5] Using official Swiss statistics and anomalies in the international investment data of countries, Zucman (2013) estimates that around 8% of households' global financial wealth is held in tax havens. This figure implies substantial

[4]Two related papers are Hemmelgarn and Nicodème (2009) and Johannesen (2010), who study the effects of the Savings Directive, a European policy initiative that imposes a tax on interest income earned by European Union residents in a number of tax havens. We discuss in the conclusion the relative merits of withholding taxes and treaties in light of our results.

[5]Kleven et al. (2011) document the importance of third-party reporting to prevent tax evasion.

tax revenue losses due to outright fraud.

Missing information on income earned through bank accounts in tax havens is the key problem for enforcing personal capital income taxes. Exchange of information between countries is the obvious solution. There are two main ways countries can exchange information: automatically or upon request (Keen and Ligthart, 2006). Automatic exchange of information is widely acknowledged to be the most effective solution because it allows tax authorities to obtain comprehensive data about income earned by domestic residents in foreign banks. But information exchange upon request is more common. It is the standard promoted by the OECD and embedded in the treaties signed by tax havens. Under the amended French-Swiss treaty, French authorities can request information from Switzerland to enforce tax laws. Requests must concern specific taxpayers. France cannot ask for a list of all its residents with funds in Switzerland. Moreover, the requested information must be "foreseeably relevant" (OECD, 2008, p. 38): information can be obtained by French authorities only if they have a well documented suspicion that a resident is evading taxes. All the treaties signed by tax havens have identical wording: they follow the OECD model tax convention.

The usefulness of the OECD standard of information exchange is the object of much controversy. Critics argue that since placing a request for information requires prior knowledge, which is extremely hard to come about, little can be obtained through treaties (Sheppard, 2009). And indeed, the U.S. Government Accountability Office (2011) revealed that during the 2006-2010 period, the U.S. placed only 894 requests under its more than 80 tax treaties. Since a single Swiss bank admitted in 2008 to have more than 19,000 U.S. clients with undeclared bank accounts (U.S. Senate, 2008), information exchange upon request is clearly associated with a small probability of detecting tax evasion. Advocates of the OECD standard, on the other hand, stress that even a small probability of detection may be sufficient to deter tax evasion and that information exchange upon request is a major step forward from no exchange at all.

Since the end of the 1990s, the OECD has tried to convince tax havens to sign information exchange treaties. But, as shown by Figure 1, most havens declined to sign treaties until the financial crisis.[6] The turning point occurred in April 2009. The OECD specified that each tax haven should conclude at least 12 treaties to be in compliance and drew up a list of 42 non-compliant havens. The G20 threatened to impose economic sanctions on non-compliant havens. In just five days, all havens committed to signing 12 treaties and the G20 declared the era of bank secrecy over (G20, 2009).

As a result of G20 pressure, treaty signature effectively boomed in 2009 and 2010. But the pace slowed down considerably after 2010. Moreover, tax havens signed many treaties with each other: in 2009, almost one-third of the treaties signed by tax havens were with other havens. Such haven-haven treaties do not help non-haven countries curb tax evasion in any way. In all likelihood they only reflect the desire of some tax havens to reach the 12 treaties threshold without giving substantial concessions.

B Data on Tax Treaties

To study the effects of the G20 tax haven crackdown, we have compiled a complete dataset on the treaties concluded by tax havens. The dataset covers 52 tax havens (see the Online Appendix), more than 220 potential partner countries, and includes information until the end of 2011q2.

Tax havens can start exchanging information with partner countries on the basis of two types of legal events: new treaties or amendments to existing treaties on the one hand (for instance, the amendment to the French-Swiss tax treaty in August 2009), and changes in domestic laws allowing for information exchange with existing treaty partners on the other (Cyprus passed such a law in July 2008). The two types of events are legally equivalent, but new treaties may be more salient than subtle

[6] All the data on tax treaties and aggregate bank deposits used for this research are available online on the authors' websites.

changes in the banking laws of tax havens. Distinguishing between the two kinds of legal events allows us to investigate whether depositors respond differently to more salient events.[7]

The main data source is the Exchange of Tax Information Portal, which represents the best effort of the OECD to gather accurate information on tax treaties.[8] In some cases, we have added information from official government websites. The Online Appendix describes step-by-step how we compiled the treaty dataset from readily available sources. The final dataset includes 1,025 events: 861 new treaties or amendments to existing treaties, and 164 instances when changes in domestic laws rendered information exchange possible under existing treaties. Note that since there are 52 tax havens and around 220 countries and territories in the world, a full network of treaties would include around 11,000 treaties. Through a peer-review evaluation, the OECD assesses whether the treaties signed by tax havens are properly drafted and enforced. Out of the 861 new treaties signed from 2004 to mid-2011, 68% were deemed compliant, 13% were deemed not compliant, and 19% were still unreviewed in November 2011.

C Data on Deposits in Tax Havens

Our second data source is the BIS locational banking statistics, which contain information on foreign bank deposits in 41 countries. The BIS publishes quarterly data aggregated at the country level, for instance total deposits held by French residents in foreign banks and total deposits held by foreign residents in Swiss banks. For our study and on the condition that we do not disclose bilateral information, the BIS has given us access to deposit data at the bilateral level, for instance deposits held by French residents in Swiss banks. There are 18 tax havens reporting to the BIS. We have access to bilateral deposit data for 13 of them: Austria, Belgium,

[7] Chetty et al. (2009) provide evidence of the importance of salience for the response to taxes.

[8] See http://eoi-tax.org/. We have also benefited from discussions with Jeremy Maddison and Sanjeev Sharma from the OECD.

the Cayman Islands, Chile, Cyprus, Guernsey, the Isle of Man, Jersey, Luxembourg, Macao, Malaysia, Panama, and Switzerland. We also have bilateral data for the aggregate of the remaining 5 havens: Bahamas, Bahrain, Hong Kong, the Netherlands Antilles, and Singapore.[9] The 13 havens for which we have bilateral data host about 75% of the deposits of all BIS-reporting havens, which allows us to make reasonable inference from this sample of countries.

The BIS locational banking statistics are widely used in international economics and are a key input to statistics on balance of payments. The most important financial centers (havens and non-havens) report to the BIS. New financial centers are systematically included in the BIS statistics once they reach a significant size, so that the havens not covered are by construction very small. Further, within each covered center there is almost full coverage of deposits, because all the banks with cross-border positions in excess of a modest threshold (e.g., $10 million in the Bahamas) are required to report. The BIS (2006) indicates that coverage rates systematically exceed 90%. The reporting requirements of the BIS do not violate any bank secrecy provisions, because banks do not report data on individual customers but only aggregate figures.

The BIS data, however, have three limitations. First, it is not possible to know what fraction of the deposits in tax havens belong to households evading taxes. The BIS provides a sectoral decomposition between deposits owned by banks and by "non-banks." Since interbank deposits do not play a role in personal income tax evasion, we focus on the deposits of "non-banks." Part of these deposits, however, belong to multinational corporations that stash cash offshore and that are not affected by bank information sharing. Ideally we would like to observe the deposits that belong to households only. Since this is not possible, we cannot directly estimate the behavioral response of tax evaders: all we can do is making inference from

[9] The secession of the Netherlands Antilles in October 2010 resulted in two new countries, Curaçao and Sint Maarten. Curaçao took over the reporting obligation to the BIS. Note also that we do not include Bermuda in our list of tax havens, because there are no private wealth management activities there (only 4 banks are registered in Bermuda).

the evolution of the deposits owned by "non-banks."

To do so, we need an idea of what fraction of "non-bank" deposits belong to households. Data made available by a number of BIS-participating central banks enable us to shed light on this issue. In Switzerland, the second largest offshore center in terms of "non-bank" deposits, 80-90% of the deposits seem to belong to households.[10] The Bank of England reports that in 2007 households owned about 70-75% of the deposits in the Channel Islands and the Isle of Man, collectively the third largest offshore center. And a previous study (Zucman, 2013), using different data, found that at least 50% of haven deposits likely belong to households.[11] On the basis of these elements, our baseline assumption when we interpret the results will be that tax evaders own about 50% of the deposits in tax havens.

The second limitation of the BIS data is that they are based on immediate rather than beneficial ownership. If a French individual owns a Swiss deposit through a sham corporation with an address in Panama, the BIS assigns the funds to Panama. Almost 25% of all deposits in tax havens are registered as belonging to other havens reflecting the widespread use of sham corporations by clients of offshore banks. Our analysis in Section 5 will explicitly address the existence of deposits held through sham corporations.

Lastly, the BIS data relate to only one form of wealth held by households in tax havens: bank deposits. They do not provide information on the equity and bond portfolios that savers entrust to tax haven banks. There is little public information on households' offshore portfolios, except in Switzerland. The Swiss National Bank

[10] There are two types of Swiss bank deposits covered by the BIS data: regular deposits (10-20% of the total) and "fiduciary deposits" (80-90%). In all likelihood, fiduciary deposits entirely belong to individuals: these are investments made by Swiss banks in foreign money markets on behalf of foreign individuals, an arrangement that enables clients of Swiss banks to avoid the 35% tax imposed by Switzerland on Swiss-source capital income. Multinational corporations do not use fiduciary deposits because they can directly invest in foreign money markets without having to pay the handsome fees charged by Swiss banks for these operations. For more details on fiduciary deposits, see e.g. Brown et al. (2011).

[11] The figure was obtained as follows. On the basis of official Swiss National Bank statistics and of large anomalies in the international investment data of countries, Zucman (2013) estimates that individuals owned at least \$6tr in financial assets through bank accounts in tax havens in end 2008, of which \$1.4 tr took the form of bank deposits. These \$1.4 tr account for 50% of the total deposits in tax havens as per the BIS.

reports that about 25% of the funds held by foreigners in Switzerland take the form of bank deposits, while 75% are equities and bonds (Zucman, 2013). With the data at our disposal, we cannot say anything about the response of tax evaders' portfolio wealth to treaties: we can only analyze the evolution of deposits. It is safe, however, to assume that the response of bank deposits is a good proxy for the response of the overall stock of offshore wealth, because the information exchange provisions of treaties affect all assets similarly.

3 Graphical Evidence

A The Effects of the G20 Initiative on Aggregate Deposits

As a starting point for the empirical analysis, Figure 2 shows the evolution of the bank deposits held on aggregate in the 18 tax havens reporting to the BIS. Despite the wave of treaties signed in 2009-2010, deposits in tax havens remained stable over the 2007-2011 period at around $2,700 billion. For comparison, the figure shows the evolution of the deposits held on aggregate in the non-haven countries reporting to the BIS. This group includes financial centers that have a large treaty network and have not been affected by the G20 initiative, such as the U.S. or Germany. Deposits in havens and non-havens have followed a similar trend over the 2004-2011 period. The evolution of deposits in non-havens might be an imperfect counterfactual for the evolution of deposits in tax havens, but we can at least exclude that the G20 crackdown was followed by a significant drop in aggregate deposits in tax havens.

Next, we compare the deposits that have become covered by a treaty to the deposits that have not. We consider all country-haven combinations (e.g., France-Switzerland) among the 13 havens for which we have bilateral deposit data and the more than 200 countries holding deposits in these havens. From this universe, we construct two groups: a "treaty" group including all country-haven pairs that signed a compliant treaty between 1 January 2008 and 30 June 2011, and a "no-treaty" group including all other pairs. Figure 3 shows that deposits decreased moderately in the "treaty" group but remained roughly stable in the "no-treaty" group. Should all deposits have followed the same trend, the deposits in the "treaty" group would have been around 15% larger in 2011. Figure 3 suggests that at least some tax evaders responded to treaty signatures, although it does not reveal the nature of this response.

B The Effects of the G20 Initiative on the Deposits in Each Tax Haven

To investigate how tax evaders responded to treaties, we examine the evolution of deposits in each tax haven between 2007 and 2011. Figure 4 reveals that the globally stable level of deposits in tax havens conceals significant differences across havens. Banks in Jersey lost the equivalent of 4% of the 2007 total amount of haven deposits (i.e., about 8% of tax evaders' deposits, if tax evaders own about 50% of haven deposits), while banks in Hong Kong gained around 2.5% (about 5% of tax evaders' deposits).

Crucially, the deposit gains and losses correlate strongly with the number of treaties signed by each haven. Figure 5 plots the percentage change of each haven's deposits between 2007 and 2011 against the number of compliant treaties signed over the same period. Cyprus signed only 2 compliant treaties and experienced a 60% increase in its deposits, whereas Guernsey signed 19 compliant treaties and experienced a 15% decrease. A simple bivariate regression suggests that an additional treaty signed by a haven is associated with a decrease of 3.8% of the deposits in its banks (with a standard error of 1.4%).[12]

Overall, the graphical evidence suggests that a number of tax evaders responded to treaties and that their response was mostly to transfer deposits to other tax

[12] This correlation remains when we consider cumulated exchange rate adjusted net flows in each haven as a percentage of end-2007 stocks rather than the simple growth rate of deposits, or when we consider all treaties signed, whether complying with the OECD standard, unreviewed, or not complying.

havens, leaving roughly unchanged the funds globally held in tax havens. Figure 6 lends additional support to this conjecture. It shows that there is no correlation between the number of treaties signed by OECD countries with tax havens between 2007 and 2011 and the growth of the deposits held by OECD countries' residents in tax havens. Signing more treaties does not seem to help OECD countries repatriate funds.

While the graphical evidence suggests a consistent scenario, it aggregates treaties signed at different dates and does not fully exploit the bilateral nature of our data. To deal with this, we now turn to panel regression analysis.

4 Regression-Based Evidence

A The Impact of Treaties on Bilateral Deposits

The first question we want to address is whether treaties have had a statistically significant impact on deposits in tax havens at the bilateral level. We run regressions of the form:

$$log(Deposits_{ijq}) = \alpha + \beta Signed_{ijq} + \gamma_{ij} + \theta_q + \epsilon_{ijq} \tag{4.1}$$

where $Deposits_{ijq}$ denotes the deposits held by residents of country i with banks of haven j at the end of quarter q, $Signed_{ijq}$ is a dummy equal to 1 if a treaty allowing for information exchange between i and j exists in quarter q, γ_{ij} denotes country-pair fixed effects, and θ_q time fixed effects. The coefficient of interest is β: should treaties have any effect at all, β should be statistically different from zero. The country-pair fixed effects γ_{ij} control for all time invariant characteristics of country-haven pairs, such as distance or common language. The time fixed effects θ_q control for all common time trends affecting the deposits in tax havens, such as the financial crisis. Thus, β only captures the deposit changes in the "treaty" country-haven pairs that come in addition to the deposit changes in the "no-treaty" pairs. All the regressions use the sample period 2003q4-2011q2 and have robust standard errors clustered at the country-pair level.

The first column of Table 1 estimates equation 1 using the complete universe of country-haven pairs for which we have bilateral deposit data. We find that the deposits of the "treaty" pairs are smaller after treaty signature than before relative to the deposits of the "no treaty" pairs. But the coefficient is only borderline significant.

We then in col. (2) restrict the sample to the universe of pairs that include one haven and one non-haven country, in order for our coefficient β to exclude the effect of the treaties signed by havens with each other on haven-haven deposits. Treaties now have a larger effect; β is different from zero at the 5% level. Col. (3) investigates the effect of haven-haven treaties on haven-haven deposits. We find that a treaty between say the British Virgin Islands (BVI) and Jersey does not affect the deposits "held by" the BVI in Jersey, consistent with our notion that treaties between two havens have no economic meaning. We continue the analysis with the sample that excludes haven-haven pairs. We refer the reader to Section 5 for a detailed analysis of how haven-haven deposits have responded to treaties between haven and *non-haven* countries.

In col. (4), we investigate whether depositors respond differently to new treaties and to changes in the domestic laws of tax havens. Since new treaties are more salient to tax evaders, we conjecture that evaders should respond more to new treaties. We interact the dummy variable *Signed* with dummy variables indicating whether the legal event establishing information exchange is a new treaty or a change in domestic law. The results show that new treaties affect deposits but equivalent changes in domestic laws do not.

The timing of the response to treaty signature is analyzed in col. (5). We include a dummy equal to one in the quarter q of the legal event establishing information exchange (*Contemp*), three dummies equal to one in $q+1$, $q+2$, and $q+3$ respectively, and a dummy equal to one in all quarters after $q+3$. We find that the bulk of the response occurs two quarters and more after treaty signature. A plausible explanation is that treaties do not enter into force immediately after they are signed. For instance, the amendment to the French-Swiss treaty signed in August 2009 entered into force in November 2010. Typically, there is a time lag of 3-5 quarters between treaty signature and entry into force.

Table 1 confirms that there is a correlation between treaties and deposits in tax havens: on average, the deposits in the "treaty" pairs decrease after treaty signature relative to the deposits in the "no treaty" pairs. The difference is statistically significant. But it is quite modest – about 11% according to col. (2).[13] How should we interpret this result?

Because the BIS data include deposits owned by corporations that are not concerned by information sharing agreements, our estimated β only provides a lower bound for the response of tax evaders. If tax evaders own a fraction s of deposits, one can show that their response to treaties is approximately β/s.[14] To interpret what a 11% drop in deposits means, we need to take a stance on how large s is. If, as available evidence suggests, s is around 50%, then treaties are associated with a roughly 22% average drop in tax evaders' deposits. This is probably much more than expected by those who considered treaties worthless: upon request information exchange seems enough to substantially affect behavior. But it does not seem strong enough to affect the deposit behavior of the majority of individuals: as long as s is larger than 20-25%, our results imply that only a minority of tax evaders (weighted by assets) have moved funds in response to treaties.

Another issue in the interpretation of the magnitude of β is that if tax evaders respond to treaties by shifting deposits, then our comparison group of "no treaty" country-pairs is also affected by treaty signature. We now augment the model to

[13] $exp(-0.1156) - 1 = 0.109$

[14] In a simple difference-in-differences setting in which deposits in the treaty group grow at rate g^t and deposits in the no-treaty group grow at rate g^c, the estimator of the response of bank deposits to treaty signature (in a log specification) is $log[(1 + g^t)/(1 + g^c)]$. If a fraction s of deposits initially belong to tax evaders, then the diff-in-diff estimator for the response of tax evaders is: $log[(s + g^t)/(s + g^c)]$. At a first order approximation this is $1/s$ times larger than $log[(1 + g^t)/(1 + g^c)]$.

tackle this issue.

B Deposit Shifting

Table 2 explicitly models shifting behavior. To fix ideas, consider the France-Cayman Islands pair. To explain the amount of French deposits held in the Cayman Islands, we introduce in col. (1)-(3) a treaty coverage variable that simply counts the number of treaties signed by France with the world's 51 tax havens other than the Cayman Islands. Col. (1) shows that an additional treaty signed by France, say with Switzerland, increases the deposits held by French residents in the Cayman Islands by 0.6%. More generally, it increases French deposits by an average of 0.6% in each of the 12 havens other than Switzerland for which we have bilateral data. It is natural to assume that deposits are also shifted to the havens for which we have no bilateral data, which host around 25% of offshore deposits. If each haven attracts funds in proportion to its initial deposit stock, a treaty signed by France with Switzerland increases French deposits in each of the world's havens other than Switzerland by 0.6%.[15]

As col. (2) shows, this shifting only occurs to the benefit of the havens that do not have a treaty with France (i.e., when $Signed = 0$). In such havens, an additional treaty signed by France is associated with 1.2% more French-owned deposits. By contrast, the havens that have a treaty with France (i.e., when $Signed = 1$) do not attract deposits. Note also that when we account for shifting, the signature of a treaty between say France and Switzerland still significantly decreases French deposits in Switzerland, just as we found previously.[16]

Since 2005, 18 tax havens have cooperated with EU countries in combatting tax

[15] The fact we do not have bilateral data for all the world's tax havens does not bias our estimate of the magnitude of shifting. Having more bilateral data would simply make our estimate more precise.

[16] In col. (2) of Table 2, *Signed* appears in three places, all of which need to be accounted for when computing the total effect of an additional treaty on bilateral deposit. Assuming that treaty coverage=6 (which is the mean number of compliant treaties signed by OECD countries with tax havens in the 2008-2011 period), the total coefficient on Signed is $-0.0498+6\times(0.0001-0.0120) = -0.12$. This coefficient is comparable to the coefficient found in col. (2) of Table 1.

evasion under the Savings Directive. When a bank in Jersey, for instance, pays interest to a French resident, it withholds 35% of the interest payment as a tax and remits 75% of the proceeds to France without disclosing the identity of the taxpayer. A number of havens, however, do not participate in the Directive, most notably Singapore, Hong Kong, the Bahamas, and Bahrain. Strikingly, we find that deposit shifting in response to treaties only occurs to the benefit of the havens that do not participate in the EU Savings Directive. As shown in col. (3), an additional treaty signed by France does not affect the deposits in havens that apply the Directive (i.e., when STD=1), but it increases deposits by 1.8% in havens that do not apply it and do not have a treaty with France. To put it simply, deposits go to the least compliant havens. Table 2 also confirms the finding of existing studies that the Directive itself significantly affected the bank deposits of EU residents in participating havens (Johannesen, 2010).

The number of treaties signed is a crude measure of treaty coverage. Treaties with Switzerland and Luxembourg are much more important for France in fighting tax evasion than treaties with Vanuatu and Saint Lucia. We therefore construct a second measure of treaty coverage that weighs treaties according to their importance.

For each country i and haven j for which we have bilateral deposit data, we compute the share of i's deposits in tax havens which were placed in j during the first year of our sample. In 2004, the location of deposits was unaffected by the European Savings Directive which was not yet implemented, and largely unaffected by treaties which were still few in numbers. The shares, therefore, measure the relative importance of haven j to tax evaders of country i and are exogenous to recent policy developments. For each country-haven pair (i, j), we use the shares to weigh each treaty concluded by i with havens other than j. The resulting measure of treaty coverage takes values between zero (no treaty) and one (full coverage). By construction, this measure only takes into account treaty coverage over the 13 havens for which we have bilateral deposit data.

As col. (4) to (6) show, with this measure of treaty coverage the results are similar to those obtained with the measure that merely counts the number of treaties signed. Consider a treaty between France and a haven which, in 2004, attracted 10% of the deposits owned by French residents in tax havens. According to col. (4), such a treaty causes a 1.2% average increase in French deposits in each other BIS-reporting tax haven. As col. (5) and (6) suggest, only the havens that have no treaty with France and that are not covered by the EU Savings Directive attract deposits.

The results in Tables 1 and 2 show that there is a strong correlation between treaty signature and subsequent deposit growth in tax havens. To conclude that the changes in deposits we observe are caused by treaties, we need to assume that in a counterfactual world without treaties, the deposits in the "treaty" and "no treaty" pairs would have grown similarly. This key identifying assumption deserves a careful examination.

C Tests of Identification Strategy

We have conducted two tests of our identification strategy. A first test examines the possibility that tax havens might have systematically signed treaties with countries that were placing less and less deposits in their banks relative to the global trend, which would introduce a spurious relationship between treaty signature and deposit growth. We investigate this possibility by running probit models of the form:

$$Treaty_{ijq} = \alpha + \beta_2 Growth_{ijq} + \delta X_{ijq} + \gamma Distance_{ij} + \zeta_i + \theta_q + \epsilon_{ijq} \tag{4.2}$$

where $Treaty_{ijq}$ is a dummy equal to 1 if i and j sign an information exchange treaty in quarter q, $Growth_{ijq}$ captures the growth rate of the deposits held by savers of country i in haven j before quarter q, X_{ijq} includes other bilateral factors, ζ_i denotes saver-country fixed effects and θ_q time fixed effects.

We want to know whether the probability to sign a treaty is affected by past deposit growth rates, i.e. whether β_2 is different from zero.[17] We consider two measures of deposit growth: the percentage growth over the 4 quarters before q, and the percentage growth from 8 quarters to 4 quarters before q. The results are in Table 3. As col. (1) shows, the probability to sign a treaty is not affected by the growth rate of deposits during the year preceding treaty signature. It is marginally affected by deposit growth from 8 quarters to 4 quarters before treaty signature, but this barely significant correlation disappears when we control for time fixed effects (col. 2): it reflects the fact that most treaties were signed during the financial crisis, when deposits were falling worldwide.

Col. (3) and (4) show that the *level* of deposits, distance, and GDP are significant determinants of the probability to sign a treaty. But when we control for those factors, the probability to sign a treaty remains unaffected by past growth rates of deposits. On average, treaties were not concluded by country-haven pairs where deposits were growing more slowly than the global trend.

Our second test examines whether the country-haven pairs that signed a treaty and those that did not experienced an otherwise similar evolution over the period of study. The goal of this test is to make sure that the correlation we observe between treaty signature and subsequent deposit growth is not driven by an unobserved third factor such as a slowdown in the financial activity of relatively compliant havens.

The idea of the test is simple: if a confounding trend were driving our results, then treaty signature should be associated with a subsequent lower growth of the haven activities that are unrelated to treaties. So we study how those unrelated activities evolve in the "treaty" and "no treaty" groups. We focus on the inter-bank activities of tax havens. Haven-based banks receive large amounts of deposits from foreign banks, which they use in turn to grant loans. Interbank deposits received by tax havens are unrelated to personal tax evasion, so they should not be affected

[17] The determinants of treaty signature have been studied theoretically by Bacchetta and Espinosa (2000), Eggert and Kolmar (2002), and Huizinga and Nielsen (2003), and empirically by Ligthart et al. (2011), Bilicka and Fuest (2012), and Elsayyad (2012).

by information exchange agreements. But they are sensitive to the international business cycle, to domestic conditions in the havens, and more generally to any trend that could potentially confound our analysis of treaties. In col. (1)-(2) of Table 4, we run the same regression for interbank deposits as we did for the deposits owned by "non-banks" in col. (2) of Table 1 and col. (2) of Table 2, our core specifications. The results show that treaties have zero effect on interbank deposits. In other words, interbank deposits have evolved similarly in the "treaty" and "no-treaty" pairs. The statistically significant effect of treaties on "non-bank" deposits is thus unlikely to be driven by an omitted differential time trend.

Our two tests establish that we have a reasonably valid natural experiment: the country-haven pairs in our sample have similar *ex ante* and *ex post* observable characteristics, the sole relevant difference being that some pairs signed an information exchange agreements while others did not. The correlations we document between treaty signature and subsequent deposit growth can thus be considered causal. We present below further robustness checks.

D Robustness Tests

OECD countries have concluded many more treaties than developing countries. Our results, one could fear, might be driven by asymmetric shocks reducing the deposits of developed countries relative to those of developing countries, such as the 2008-2009 financial crisis. To address this concern, we restrict the sample to OECD countries only. Col. (3)-(4) of Table 4 show that the response to treaties is slightly larger in the OECD sample than in the full sample, though qualitatively similar.

Second, we run the regressions with exchange rate adjusted deposit stocks. So far, we have used data that convert deposits in pounds, euros or Swiss francs into U.S. dollars using end of quarter exchange rates. If a large share of bank deposits in Switzerland are denominated in Swiss francs and if Switzerland signed most of its treaties during a period when the Swiss franc depreciated, there is a risk that we capture a spurious effect of treaties on deposits. To address this issue, we construct an exchange rate adjusted measure of deposit stocks. For each country-pair, we know what fraction of deposits are denominated in U.S. dollars, euros, British pounds, Swiss francs, and yen. We use this currency decomposition to hold exchange rates fixed at their end-of-2003 level. The results are reported in col. (5)-(6) of Table 4. The estimated effects of treaties are slightly smaller but qualitatively identical to the core specifications.

This result may come as a surprise given the large exchange rate movements that have occurred during the financial crisis. But it can easily be explained. The Online Appendix shows that the currency composition of deposits is strikingly similar in the group of "treaty" and "no treaty" country-pairs: it is not correlated with treaty signature. For this reason, exchange rate changes are absorbed by our time fixed-effects and do not interfere with the identification of the impact of treaties.

In a final robustness check, we sequentially add country-year dummies and haven-year dummies to the core specifications. Country-year dummies control for all time-varying factors at the country level, such as changes in compliance efforts, capital tax rates or the incomes of top earners who are most likely to hold assets in tax havens. Haven-year dummies control for all time-varying factors at the haven level, such as bank crises or changes in political environment. The results are reported in col. (7)-(10) of Table 4. The estimated effects are robust to the inclusion of country-year dummies. When we include both country-year dummies and haven-year dummies, we still find a modest effect of treaties on deposits but are unable to identify a deposit shifting effect.

5 Deposits Held Through Sham Corporations

There is a great deal of anecdotal evidence suggesting that clients of offshore banks routinely use sham corporations with addresses in tax havens such as Panama as nominal owners of their bank accounts in Switzerland and other havens. The IRS, for instance, provides case studies of tax evasion by U.S. individuals through a big Swiss bank revealing a quasi-systematic use of shell companies.[18] This section focuses on how deposits held through sham corporations have responded to the wave of tax treaties.

Remember that when a French saver holds assets in Switzerland through a sham Panamanian company, the BIS assigns the funds to Panama. This convention explains why haven-haven deposits are so important in the BIS statistics: in the first half of 2011, they accounted for around $550 billion, almost 25% of all the deposits in tax havens. Deposits from the British Virgin Islands and Panama were particularly important. Both jurisdictions have flexible corporate laws that make it simple to create companies in a few minutes.

Using a sham corporation as nominal account holder adds a layer of secrecy between an account and its beneficial owner: essentially, accounts held through sham corporations are equivalent to numbered accounts, which are today prohibited by anti-money laundering regulations. Sham corporations also help avoiding taxes: the EU Savings Directive does not apply to the deposits held by European residents through sham companies. But they do not protect from information exchange treaties. If France and Switzerland have a treaty and French authorities suspect a taxpayer of hiding funds in Switzerland, they can ask Switzerland to provide the relevant information, even if the funds are held through a shell company. Banks are required by anti-money laundering regulations to know at all times who are the ultimate owner of the assets they manage. They must provide this information to foreign authorities that file information requests under a treaty.

The implication is that if tax evaders respond to treaty signature, then treaties concluded between havens like Switzerland and countries like France should affect

[18] See http://www.irs.gov/uac/Offshore-Tax-Avoidance-and-IRS-Compliance-Efforts. See also Zaki (2010) for anecdotal evidence on the use of sham corporations by Europeans, and Hanlon et al. (2011) for evidence on the use of sham offshore corporations by U.S. tax evaders for their U.S. investments.

the Swiss deposits held by French residents through sham corporations, i.e. the Swiss deposits that the BIS assigns to the British Virgin Islands, Panama, and other havens.

Table 5 investigates whether this is the case by analyzing the evolution of haven-haven deposits. In col. (1), we regress haven-haven deposits (e.g., Swiss deposits assigned to Panama) on the number of treaties concluded by banking havens (e.g., Switzerland) with non-haven countries (e.g., France). A treaty between France and Switzerland reduces the Swiss deposits registered as belonging to each tax haven by 0.7% on average.

In col. (2), we investigate whether haven-haven treaties matter for the pattern of haven-haven deposits. Neither a treaty between Switzerland and Panama ($Signed = 1$) nor treaties between Switzerland and havens other than Panama affect the value of the Swiss deposits assigned to Panama in the BIS statistics, which is fully consistent with our interpretation of what haven-haven deposits represent. Indeed, there is no reason why information exchange between Panama and Switzerland should affect the French residents who use sham corporations in Panama as nominal owners of their Swiss accounts.

In col. (3) and (4), we run the same regressions as in col. (1) and (2) but with the measure of treaty coverage that weighs treaties by the importance of the deposits covered. The estimated effects are statistically and economically significant. Consider a treaty between France and Switzerland. Assume that French residents hold 10% of all Swiss deposits belonging to non-haven countries. Col. (3) suggests that such a treaty reduces the bank deposits in Switzerland registered as belonging to tax havens (e.g., Panama) by 4.5%.[19] Now assume that French residents are also the ultimate owners of 10% of the Swiss deposits registered as belonging to tax havens. Under this assumption, a treaty between France and Switzerland causes a 45% reduction of the deposits held in Switzerland by French savers through sham corporations. Under plausible assumptions, the tax evaders who use sham corpo-

[19] $(exp(-0.59) - 1) \times 10 = 4.5\%$.

rations may have responded strongly to the G20 crackdown.

There is one caveat, however: since we cannot identify the ultimate owners of the deposits held through sham corporations, the results in Table 5 rely on variation at the haven level rather than variation at the country-haven-pair level. It is an unfortunate feature of cross-border bank deposits statistics that they are based on immediate rather than beneficial ownership. If deposit data were established on a beneficial ownership basis, almost no deposits would be assigned to the British Virgin Islands or Panama; more deposits would be assigned to the U.S., Italy, or France; and it would be easier to track the progress made in the fight against tax evasion.

6 The Compliance Effect of Treaties

Our results so far indicate that the G20 initiative has caused a relocation of deposits between tax havens leaving the funds globally held offshore roughly unchanged. But depositors may have responded to the crackdown by complying more with tax laws while keeping their funds in tax havens. In this section we analyze the available evidence on the compliance effect of treaties.

There are two types of data at hand. First, we have direct information on tax compliance in Switzerland, probably the most important tax haven as far as personal wealth management is concerned.[20] Since mid-2005, in the context of the EU Savings Directive, Swiss banks must withhold a tax on interest income paid to European households who own Swiss accounts. Savers can escape the withholding tax if they voluntarily declare their income to their home country tax authority. Swiss authorities have published on a yearly basis the amount of interest earned by residents of each EU country, as well as what fraction of this income savers have chosen to voluntarily disclose. We know for instance that in 2011, French residents

[20] Switzerland comes second to the Cayman Islands in terms of deposits, but an exceptionally high fraction of deposits in Swiss banks seem to belong to individuals (80-90%, whereas our informed guess for the average across all havens is about 50%).

earned CHF 324 million in interest, and chose to declare 33 million, or about 10%. To our knowledge, this unique dataset has never been used before in the literature.[21]

It enables us, for one key haven and 27 counterpart countries, to conduct a direct test of the compliance effect of treaties. We analyze how the share of interest declared has evolved over 2006-2011 for the 15 EU countries that have signed a treaty with Switzerland since 2008 (e.g., France, Spain, Austria), and for the 12 countries that have not (e.g., Belgium, Portugal, Hungary). As shown by Figure 7, there has been a general increase in compliance over the 2006-2011 period. But there is no indication that this trend has been any stronger for the countries that have signed a treaty with Switzerland. And indeed, when we use the same regression framework as in Section 4, we find that treaty signature has no statistically significant effect on the fraction of interest that taxpayers chose to declare.[22] Despite the G20 initiative, the general level of compliance of EU Swiss bank account holders remains low, around 10-20%.[23]

The second type of evidence on tax enforcement comes from the OECD (2011), which has gathered data on the amount of taxes recovered due to increased compliance on the part of offshore account holders. Over the 2009-2011 period, the OECD (2011) reports an increase of almost EUR 14 billion in taxes paid in rich countries. This is certainly far from negligible. However, assuming that evaders paid in taxes and penalties an amount equivalent to 5% of their assets (which is what the OECD reports for Italy, Mexico, and the UK), then the OECD figures imply that about \$350bn in offshore assets may have been disclosed to tax authorities. This figure falls short of the \$6,000bn or so likely held by households in tax havens.[24] Taken at

[21] The data are available on the authors' websites.

[22] See Online Appendix.

[23] The compliance figures reported on Figure 7 are upper bounds, for one simple reason. They are obtained by dividing interest declared by interest earned, but the denominator excludes interest earned by EU residents through sham corporations, and a very large fraction of Swiss bank fiduciary deposits are held through sham corporations.

[24] Based on interviews with wealth managers, the Boston Consulting Group (2010) puts the amount of offshore wealth at \$7,400bn in 2009. This figure is close to the one found by Zucman (2013), who reckons that 8% of households' financial wealth is held in tax havens, which is around \$6,000bn in 2008.

face value, the OECD's findings do not lend support to the view that compliance has considerably improved.

The evidence we have just described is far from systematic. There is no cross-country database on tax compliance comparable to the BIS' bank deposit statistics. So we cannot fully exclude a large increase in compliance in havens other than Switzerland. Better measuring compliance and its determinants is an important challenge for future research.

7 Concluding Remarks

Conventional wisdom among policymakers is that the G20 tax haven crackdown is a success. The evidence presented in this paper challenges this view. It suggests that, so far, treaties have led to a relocation of bank deposits between tax havens but have not triggered significant repatriations of funds. The least compliant havens have attracted new clients, while the most compliant ones have lost some, leaving roughly unchanged the total amount of wealth managed offshore.

Although this is disappointing, we emphasize that the G20 initiative is not useless. We find evidence that some tax evaders have responded to the wave of tax treaties. Many experts were skeptical that upon request information sharing could achieve anything at all. Our results belie the most pessimistic views on the efficacy of treaties: even a weak threat of enforcement is sometimes enough to affect behavior. Further, uncertainties remain on the extent to which treaties have induced tax evaders to comply more with tax laws while keeping their funds offshore.

Yet our results suggest that there is room to improve the fight against offshore tax evasion. First, the G20 could urge tax havens to sign treaties with all countries: a comprehensive multilateral agreement would prevent tax evaders from transferring their funds from haven to haven. Second, our results suggest that even in the presence of a complete network of upon request information exchange treaties, there may remain a scope for improved tax collection by making treaties more demanding.

The G20 tax haven crackdown is a major coordinated initiative against tax evasion at the global level. Another important initiative, at the regional level, is the European Union Savings Directive. The G20 initiative relies on information exchange treaties; the EU Savings Directive imposes a withholding tax on interest income earned by European residents in a number of cooperating tax havens. So far, both policies have pitfalls: treaties are not comprehensive enough; the EU withholding tax exempts equities and derivatives, and does not look through sham corporations that tax evaders routinely use (Johannesen, 2010; Zucman, 2013). Therefore, what is the best tool – treaty or tax – to combat offshore tax evasion remains an open question.

A comprehensive network of treaties providing for automatic exchange of information would put an end to bank secrecy and could make tax evasion impossible. Taxes withheld on all incomes earned by foreign residents in all tax havens could also make tax evasion impossible, while maintaing some form of bank secrecy. Which of the two instruments would maximize tax revenues while minimizing administrative costs, including the costs of negotiating with tax havens? There is need for more research on this question. Policymakers have diverging views: on the one hand, the European Union Commission pushes for automatic exchange of information, just like the U.S. with the Foreign Account Tax Compliance Act (FATCA), but on the other hand countries such as Germany and the U.K. are negotiating a comprehensive withholding tax with Switzerland.

Another question raised by our study is why some havens cooperate more than others. Tax havens have a strong economic interest in bank secrecy. But maybe abandoning bank secrecy has a positive effect on a haven's reputation, which may help it attract other financial activity, such as the incorporation of investment funds. This issue would deserve to be further analyzed.

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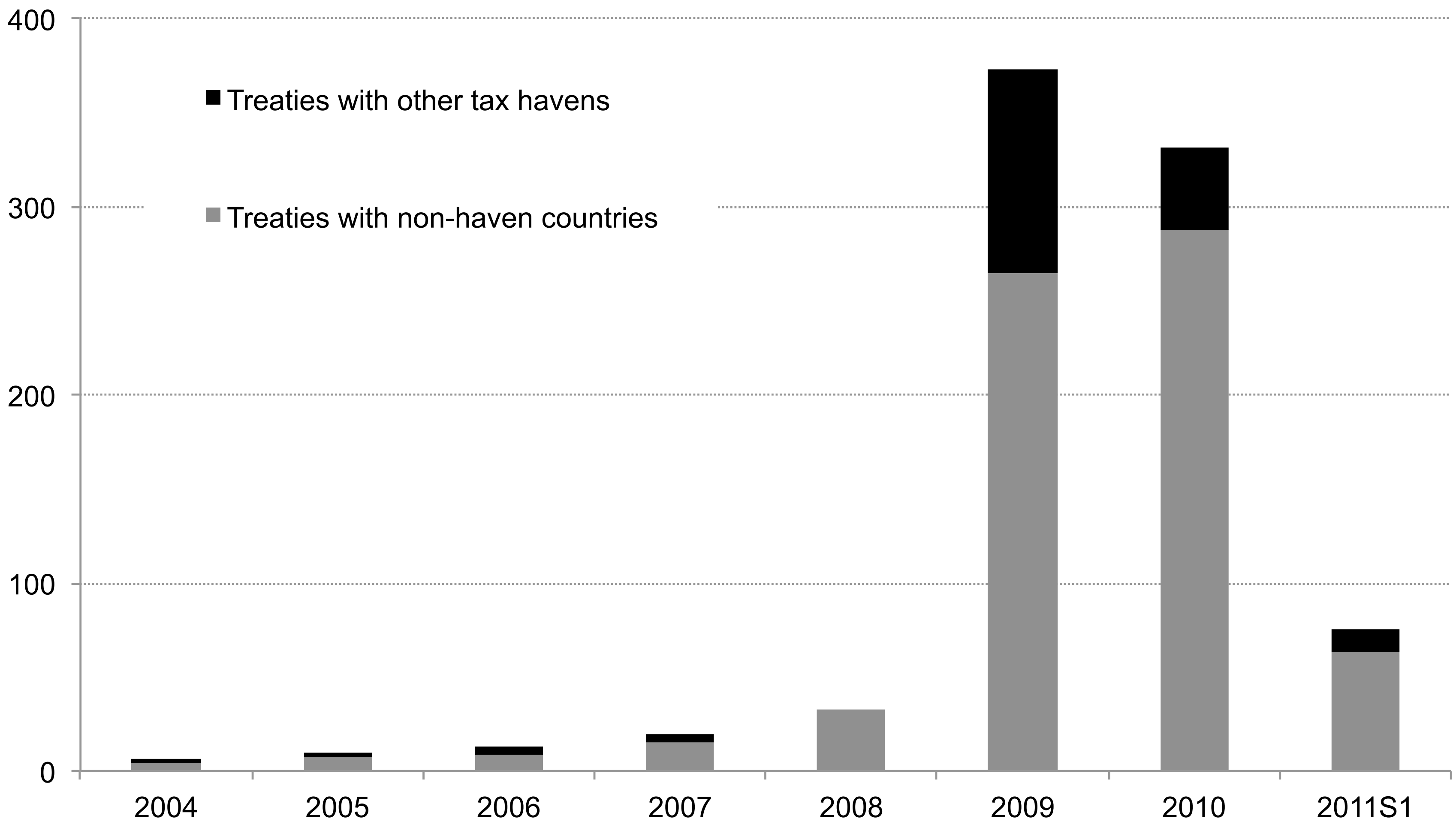
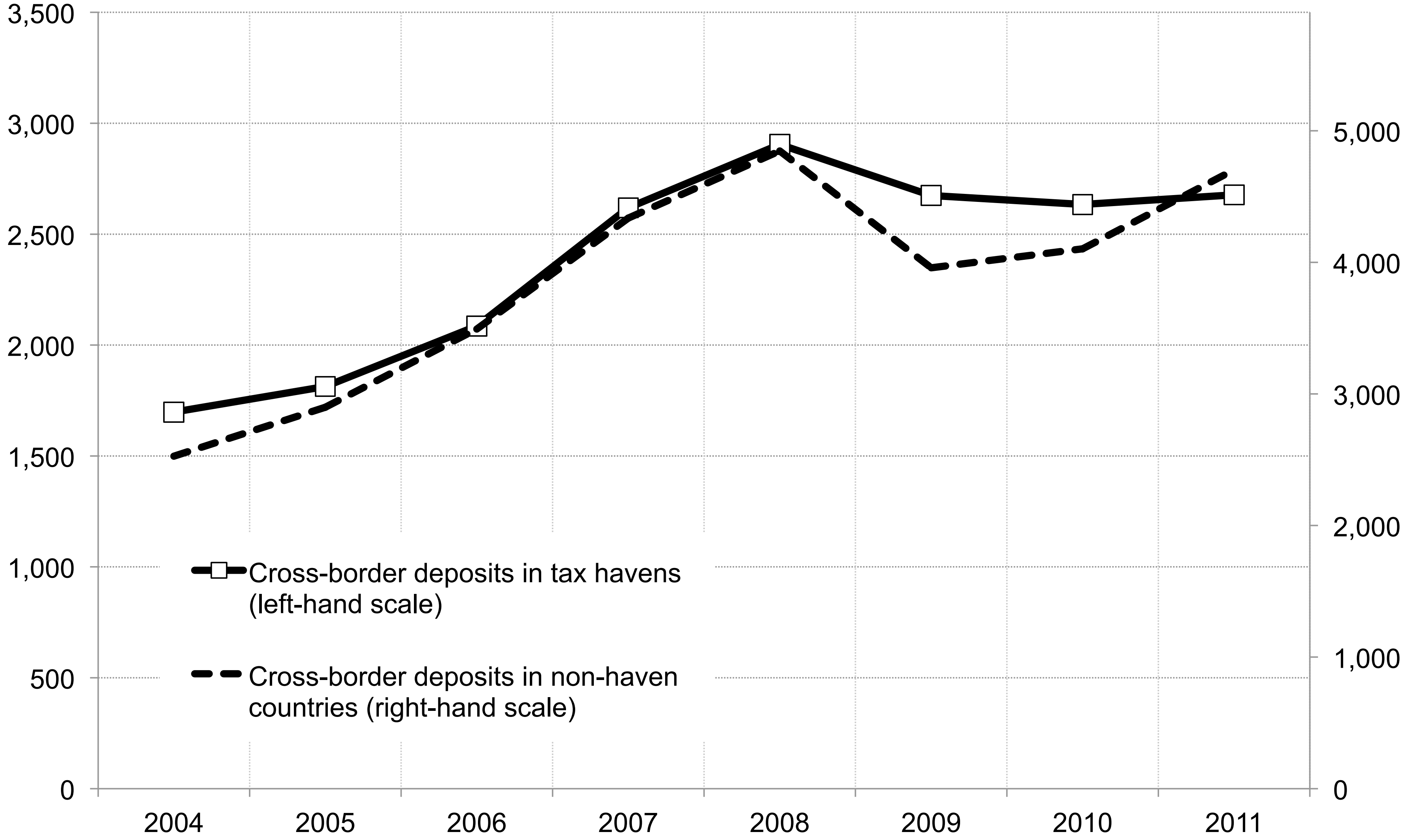
Figure 2.1: Number of Bank Information Exchange Treaties Signed by Tax Havens, by Year



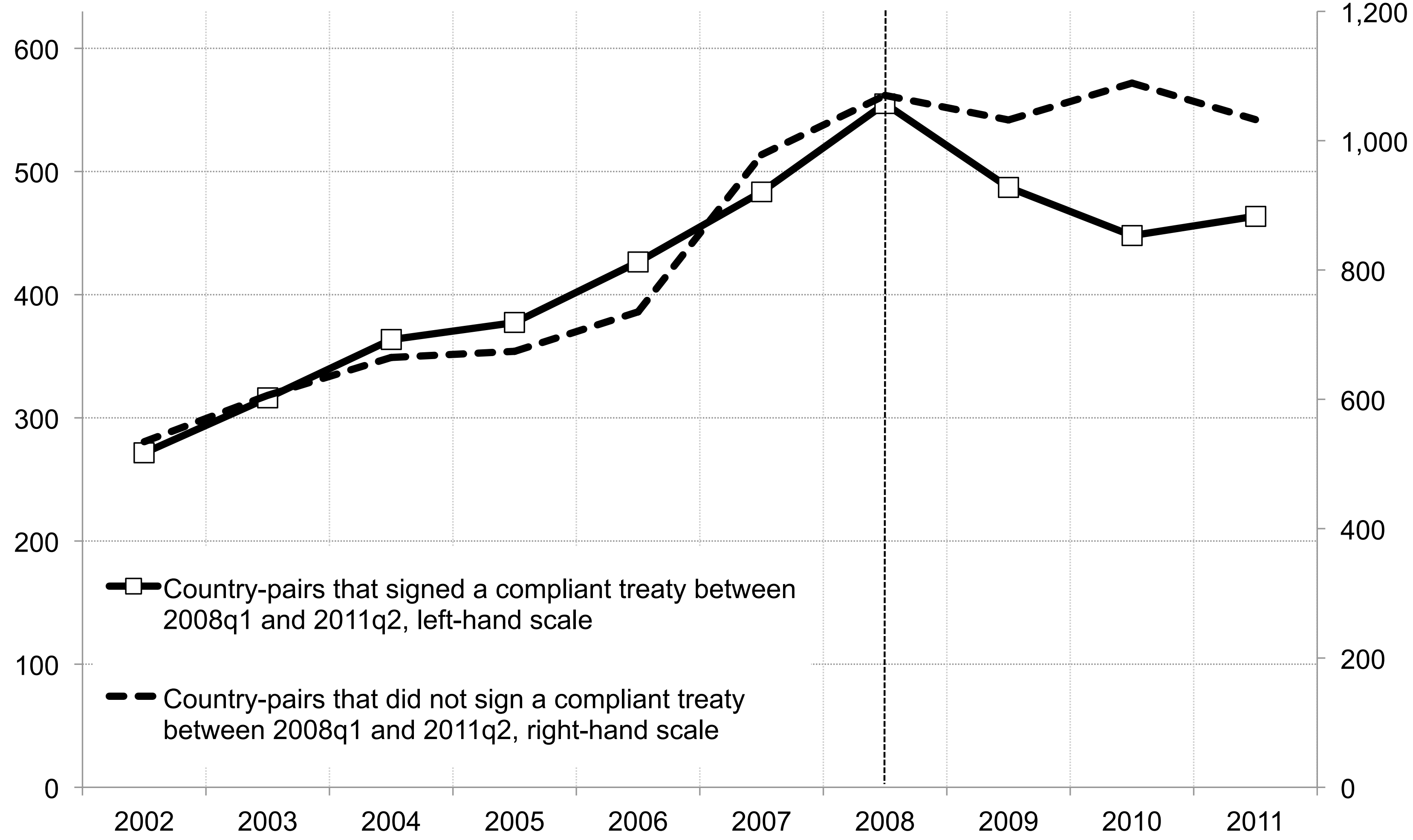
Note: The figure charts the the number of new treaties or amendment to existing treaties allowing for information exchange signed each year by the world's 52 tax havens (see list in the Online Appendix).
Source: www.eoi-tax.org and authors' research (see Online Appendix).

Figure 2.2: Bank Deposits in Haven and Non-Haven Countries, 2004-2011 (bn US$)



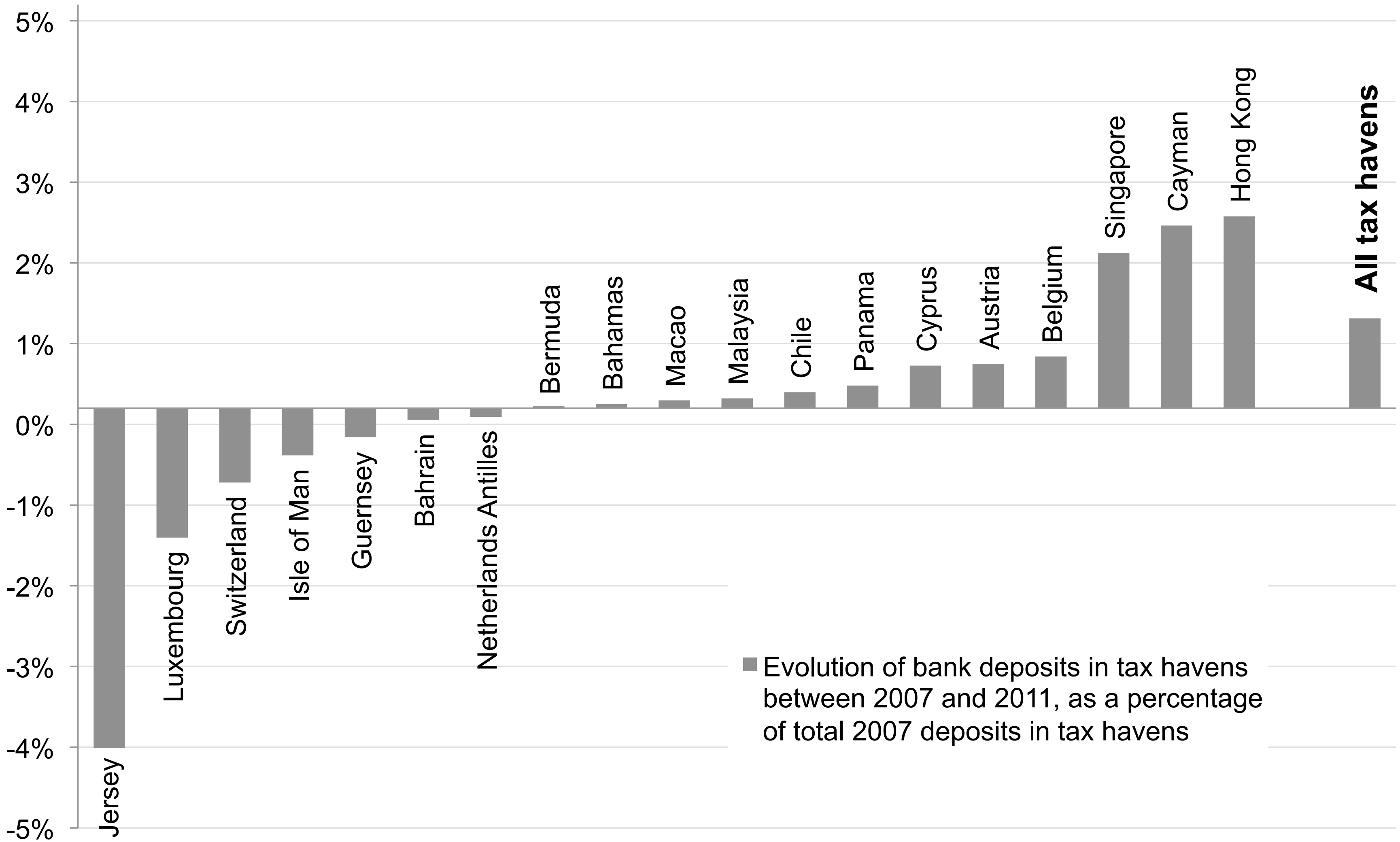
Note: All figures are yearly averages (first semester-average for 2011).
Source: BIS Locational banking statistics, Table 3B, http://www.bis.org/statistics/bankstats.htm.

Figure 2.3: Bank Deposits in Treaty and No-Treaty Country-Pairs, 2002-2011 (bn US$)



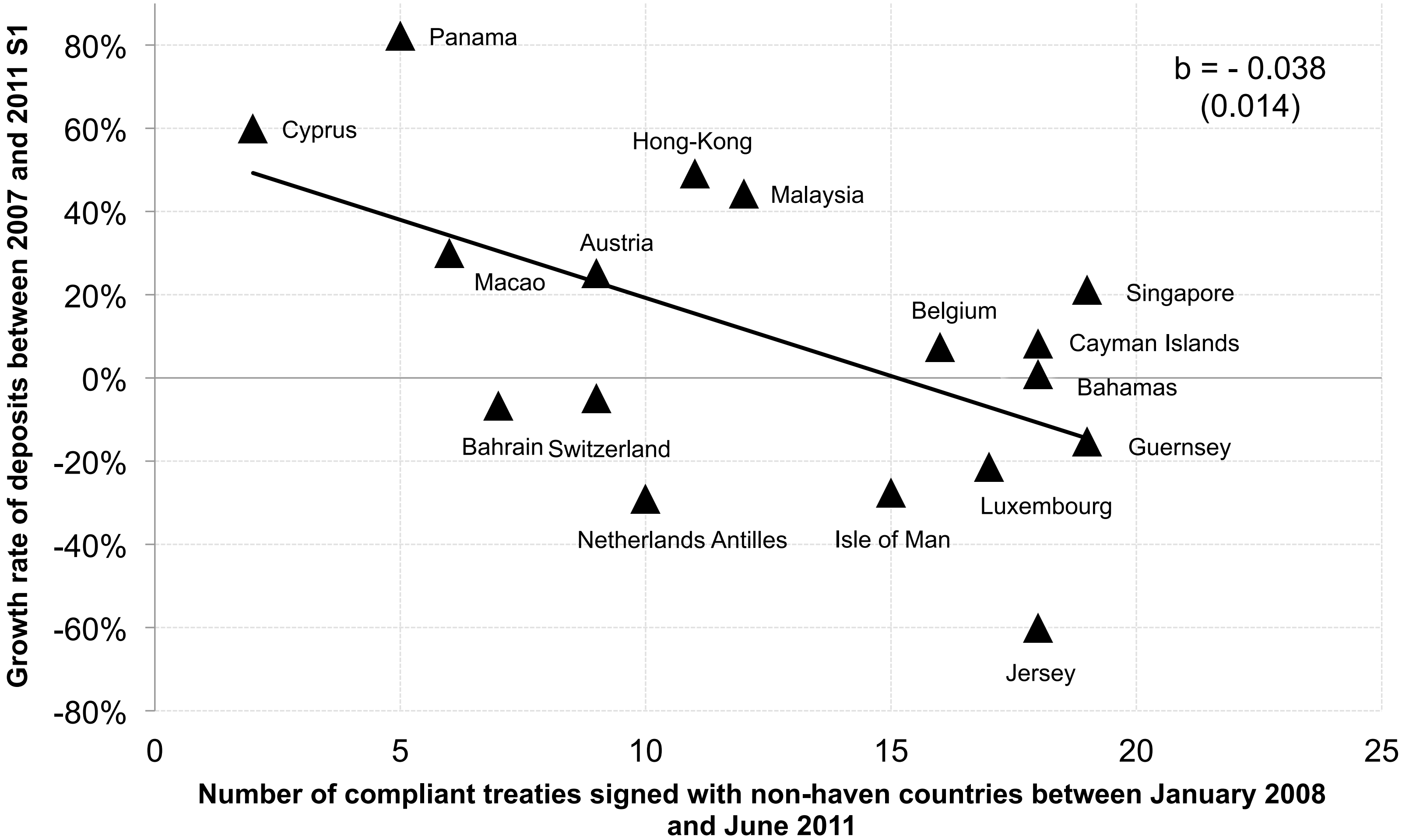
Note: The figure charts the evolution of the deposits held by savers of country i in banks of tax haven j for the set of country-haven pairs (i, j) that signed a treaty deemed compliant by the OECD between January 1st 2008 and June 30th 2011, and the set of country-haven pairs that did not. Saver countries exclude tax havens. Tax havens include Austria, Belgium, Chile, the Cayman Islands, Cyprus, Guernsey, the Isle of Man, Jersey, Luxembourg, Macao, Malaysia, Panama, and Switzerland. All figures are yearly averages (first semester-average for 2011) and expressed in billion U.S. dollars.
Source: BIS, restricted bilateral locational banking statistics.

Figure 2.4: Evolution of Bank Deposits in Each Tax Haven, 2007-2011 (bn US$)



Note: The figure charts the evolution of the foreign-owned deposits in each BIS-reporting tax haven. We compare first semester of 2011 averages with 2007 averages (except for Cyprus which started reporting in 2008q4 and Malaysia which started in 2007q4), and express the difference as a fraction of the deposits held in all tax havens in 2007 ($2,600bn).
Source: BIS Locational banking statistics, Table 3B, http://www.bis.org/statistics/bankstats.htm.

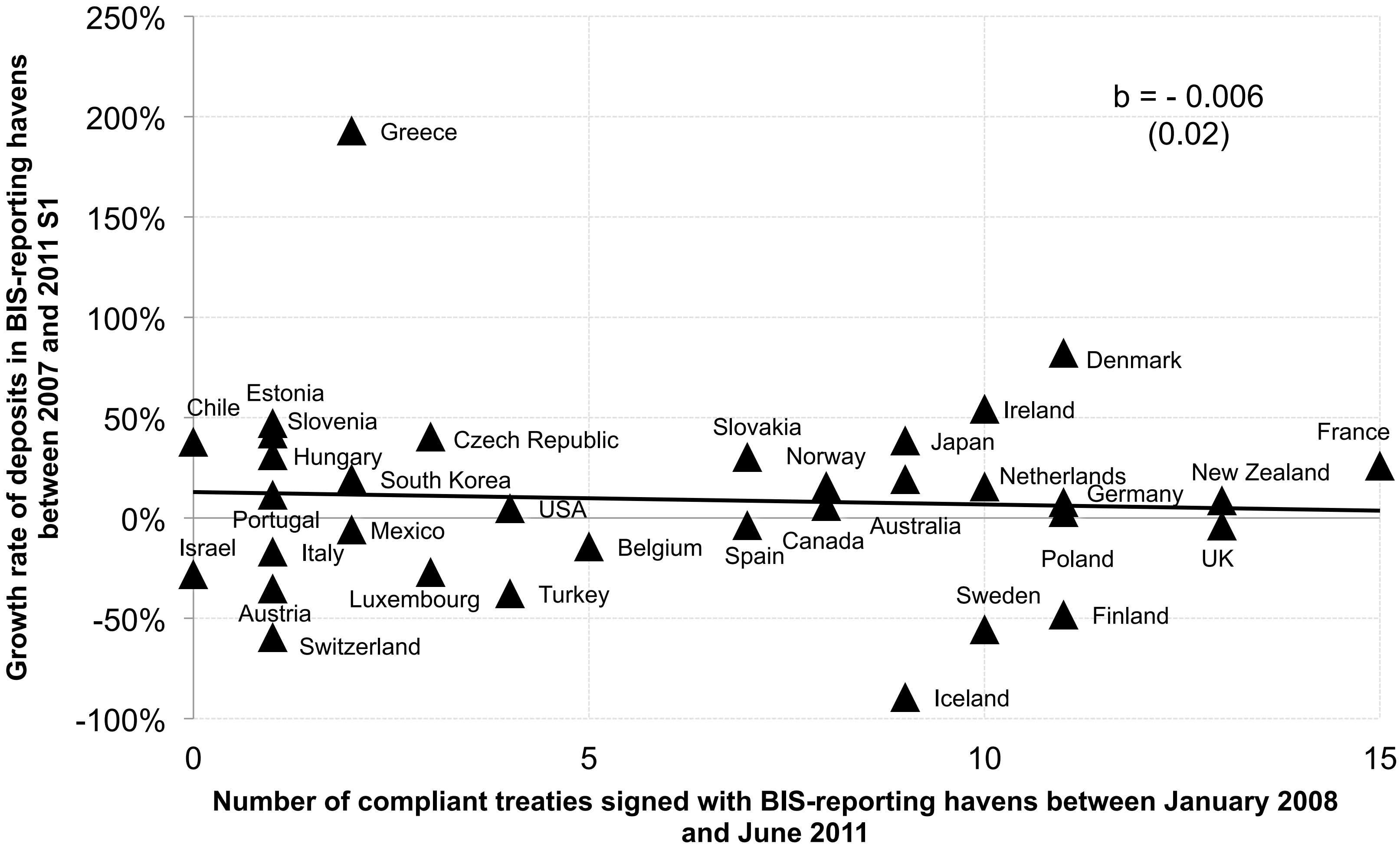
Figure 2.5: Deposit Growth and Treaty Signature Activity of Tax Havens, 2007-2011



<u>Note</u>: The figure charts the growth rate of the deposits in each BIS-reporting tax haven between 2007 (year average, except for Cyprus which started reporting in 2008q4 and Malaysia which started in 2007q4) and 2011 (first semester average), as a function of the number of compliant treaties signed between the beginning of 2008 and the end of the first semester 2011. b is the coefficient of the slope with standard error in parentheses.

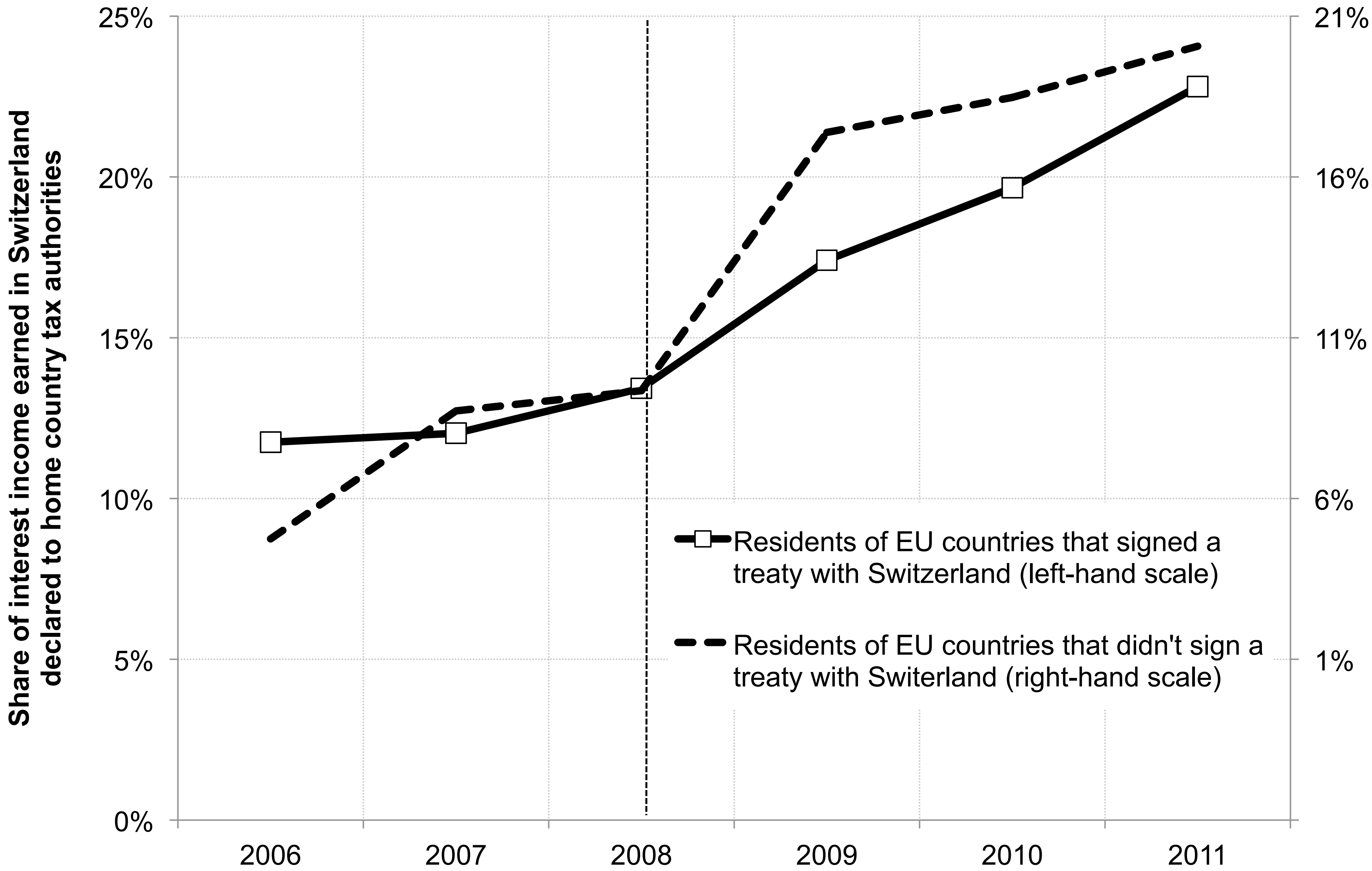
<u>Sources</u>: Deposits: BIS Locational banking statistics, Table 3B, `http://www.bis.org/statistics/bankstats.htm`. Compliant treaties: `www.eoi-tax.org` and authors' research, see Online Appendix.

Figure 2.6: Deposit Growth and Treaty Signature Activity of OECD countries, 2007-2011



Note: The figure charts the growth rate of the deposits held by each OECD country in BIS-reporting tax havens between 2007 (year average) and 2011 (first semester average), as a function of the number of compliant treaties signed between the beginning of 2008 and the end of the first semester 2011. b is the coefficient of the slope with standard error in parentheses.
Sources: Deposits: BIS, restricted bilateral locational banking statistics. Compliant treaties: `www.eoi-tax.org` and authors' research, see Online Appendix.

Figure 2.7: Fraction of Interest Income Earned by EU Residents in Swiss Banks Declared to Home Country Tax Authorities



Source: Administration fédérale des contributions, http://www.estv.admin.ch/euzinsbesteuerung/themen/00703/index.html?lang=fr

Table 2.1: Baseline Panel Regressions of Bilateral Bank Deposits on Treaty Signature

VARIABLES	(1) BANK: havens SAVER: all	(2) BANK: havens SAVER: non-havens	(3) BANK: havens SAVER: havens	(4) BANK: havens SAVER: non-havens	(5) BANK: havens SAVER: non-havens
Signed	-0.0849*	-0.1156**	0.0457		
	(0.0893)	(0.0349)	(0.6926)		
Signed × NewTreaty				-0.1349**	
				(0.0243)	
Signed × DomLaw				0.0163	
				(0.8825)	
Signed (Contemp)					0.0223
					(0.6331)
Signed (+1 quarter)					-0.0927
					(0.1300)
Signed (+2 quarters)					-0.1306**
					(0.0449)
Signed (+3 quarters)					-0.1724***
					(0.0057)
Signed (>3 quarters)					-0.1818**
					(0.0137)
Constant	3.4685***	3.2187***	4.3499***	3.2171***	3.2196***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Observations	39,758	30,960	8,798	30,960	30,960
R-squared	0.0870	0.0796	0.1167	0.0798	0.0803
Number of panelid	1,631	1,285	346	1,285	1,285
Countrypair FE	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES

Note: p-values in parentheses, based on robust standard errors clustered at the country-pair level. *** denotes significance at the 1% threshold, ** at the 5% threshold, and * at the 10% threshold.
The dependent variable is the stock of deposits held by savers of country i in banks of tax haven j at the end of quarter q. The unit of observation is the country-haven pair (i, j) and the sample period goes from 2003q4 to 2011q2. For a given haven j there are up to 220 saving countries i, and we consider the deposits held in 13 tax havens j. *Signed* is a dummy equal to 1 if there exists a treaty providing for information exchange between i and j in quarter q. $NewTreaty$ is a dummy equal to 1 if the event establishing information exchange is a new treaty; $DomLaw$ is a dummy equal to 1 if the event establishing information exchange is a change in haven's j domestic law. *Signed* ($Contemp$) is a dummy equal to 1 in the quarter q when the legal event establishing information exchange between i and j occurs; *Signed* ($+1$ *quarter*) is a dummy equal to 1 in $q + 1$, and so on.
Source: BIS, restricted bilateral locational banking statistics.

Table 2.2: Panel Regressions of Bilateral Bank Deposits Taking Into Account Deposit Shifting

VARIABLES	(1) BANK: havens SAVER: non-havens TREATY COVERAGE: number	(2) BANK: havens SAVER: non-havens TREATY COVERAGE: number	(3) BANK: havens SAVER: non-havens TREATY COVERAGE: number	(4) BANK: havens SAVER: non-havens TREATY COVERAGE: share	(5) BANK: havens SAVER: non-havens TREATY COVERAGE: share	(6) BANK: havens SAVER: non-havens TREATY COVERAGE: share
Signed	-0.1659***	-0.0498	-0.0750	-0.1468**	-0.0816	-0.0933
	(0.0052)	(0.4286)	(0.2410)	(0.0139)	(0.2444)	(0.1852)
Saving tax directive (STD)	-0.2161***	-0.2198***	-0.1553***	-0.2130***	-0.2135***	-0.1815***
	(0.0004)	(0.0003)	(0.0077)	(0.0005)	(0.0005)	(0.0018)
Treaty coverage	0.0059**			0.1272*		
	(0.0402)			(0.0568)		
Treaty coverage × Signed		0.0001			0.0277	
		(0.9719)			(0.7373)	
Treaty coverage × (1- Signed)		0.0120***			0.1752**	
		(0.0033)			(0.0318)	
Treaty coverage × STD × Signed			-0.0030			-0.0679
			(0.3202)			(0.4762)
Treaty coverage × (1-STD) × Signed			0.0066			-0.0927
			(0.1937)			(0.4975)
Treaty coverage × STD × (1-Signed)			-0.0071			0.1913*
			(0.3697)			(0.0962)
Treaty coverage × (1-STD) × (1-Signed)			0.0183***			0.2868***
			(0.0000)			(0.0027)
Constant	3.2147***	3.2115***	3.2094***	3.2285***	3.2275***	3.2259***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Observations	30,960	30,960	30,960	30,610	30,610	30,610
R-squared	0.0829	0.0841	0.0867	0.0835	0.0838	0.0855
Number of panelid	1,285	1,285	1,285	1,264	1,264	1,264
Countrypair fixed effects	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES

Note: p-values in parentheses, based on robust standard errors clustered at the country-pair level. *** denotes significance at the 1% threshold, ** at the 5% threshold, and * at the 10% threshold.
The dependent variable is the stock of deposits held by savers of country i in banks of tax haven j at the end of quarter q. The unit of observation is the country-haven pair (i, j) and the sample period goes from 2003q4 to 2011q2. *Signed* is a dummy equal to 1 if there exists a treaty providing for information exchange between i and j in quarter q. STD is a dummy equal to one if the country-haven pair (i, j) applies the EU Savings Directive. In col. (1)-(3), $Treaty\ coverage$ counts the number of treaties that i has with tax havens other than j. In col. (4)-(6), $Treaty\ coverage$ measures the share of the deposits held in 2004 by residents of country i in BIS-reporting havens that are covered by a treaty in quarter q.
Source: BIS, restricted bilateral locational banking statistics.

Table 2.3: Probit Models of Treaty Signature

VARIABLES	(1) BANK: havens SAVER: non-havens	(2) BANK: havens SAVER: non-havens	(3) BANK: havens SAVER: non-havens	(4) BANK: havens SAVER: non-havens
Deposit growth rate, -4q to 0q	0.0004	0.0011	-0.0010	-0.0013
	(0.6916)	(0.4146)	(0.6283)	(0.7340)
Deposit growth rate, -8q to -4q	-0.0017*	-0.0012	-0.0019	-0.0037
	(0.0849)	(0.3985)	(0.2841)	(0.2745)
Deposits (in logs)			0.0010**	0.0034***
			(0.0398)	(0.0002)
Distance (in logs)			-0.0041***	-0.0039*
			(0.0000)	(0.0513)
GDP (in logs)			0.0041***	0.0991***
			(0.0000)	(0.0041)
Observations	56,069	37,053	11,844	4,743
Time fixed effect	NO	YES	YES	YES
Saver-country fixed effect	NO	NO	NO	YES

Note: p-values in parentheses, based on robust standard errors. *** denotes significance at the 1% threshold, ** at the 5% threshold, and * at the 10% threshold.

This table investigates what determines the signature of a treaty between a country i and a tax haven j. The dependent variable is a dummy equal to 1 if a country i and haven j sign an information exchange treaty in quarter q. The unit of observation is the country-haven pair (i, j) and the sample period goes from 2003q4 to 2011q2. The estimates are marginal effects. *Deposit growth rate* captures the growth rate of the deposits held by savers of country i in haven j before quarter q. We consider two measures of the growth rate of deposits: the percentage growth over the 4 quarters before q and the percentage growth from 8 quarters to 4 quarters before q. *Deposits* is the log of the stocks of deposits held by country i in haven j in quarter q, *GDP* the log of country's i GDP (from the World Bank's World Development Indicator), *Distance* the geodesic distance between i and j (from the CEPII database, http://www.cepii.fr/anglaisgraph/bdd/distances.htm)

Source: BIS, restricted bilateral locational banking statistics.

Table 2.4: Tests of Identification Strategy and of Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Interbank deposits		**OECD countries only**		**Exchange-rate adjusted**		**Country-year fixed effects**	
	BANK: havens		BANK: havens		BANK: havens		BANK: havens	
VARIABLES	SAVER: non-havens		SAVER: OECD		SAVER: non-havens		SAVER: OECD	
Signed	-0.0248	-0.0425	-0.1905***	-0.1230	-0.0890*	-0.0431	-0.2962***	-0.1407*
	(0.7963)	(0.7083)	(0.0094)	(0.1321)	(0.0954)	(0.4898)	(0.0001)	(0.0862)
STD		-0.0224		-0.5302***		-0.2279***		-0.6431***
		(0.8235)		(0.0000)		(0.0002)		(0.0005)
Treaty coverage × Signed		0.0004		0.0052		0.0015		0.0022
		(0.9449)		(0.1956)		(0.5938)		(0.6543)
Treaty coverage × (1- Signed)		-0.0034		0.0128**		0.0125***		0.0115**
		(0.6904)		(0.0210)		(0.0023)		(0.0151)
Constant	3.7524***	3.7532***	4.8144***	4.7834***	3.2197***	3.2197***	3.2197***	3.2197***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Observations	20,489	20,489	8,049	8,049	30,693	30,693	8,049	8,049
R-squared	0.0394	0.0395	0.0852	0.1129	0.0644	0.0693	0.1744	0.1903
Number of panelid	1,004	1,004	307	307	1,270	1,270	307	307
Countrypair fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Saver-year dummies	NO	NO	NO	NO	NO	NO	YES	YES
Bank-year dummies	NO	NO	NO	NO	NO	NO	NO	NO

Note: p-values in parentheses, based on robust standard errors clustered at the country-pair level. *** denotes significance at the 1% threshold, ** at the 5% threshold, and * at the 10% threshold.
The dependent variable is the stock of deposits held by savers of country i in banks of tax haven j at the end of quarter q. The unit of observation is the country-haven pair (i, j) and the sample period goes from 2003q4 to 2011q2. *Signed* is a dummy equal to 1 if there exists a treaty providing for information exchange between i and j in quarter q. STD is a dummy equal to one if the country-haven pair (i, j) applies the EU Savings Directive. *Treaty coverage* counts the number of treaties that i has with tax havens other than j. Col. (3)-(10) consider the deposits held by non-bank agents; col. (1)-(2) the deposits held by banks.
Source: BIS, restricted bilateral locational banking statistics.

Table 2.5: Panel Regressions of Bank Deposits Held Through Sham Corporations

VARIABLES	(1) BANK: havens SAVER: havens TREATY COVERAGE: number	(2) BANK: havens SAVER: havens TREATY COVERAGE: number	(3) BANK: havens SAVER: havens TREATY COVERAGE: share	(4) BANK: havens SAVER: havens TREATY COVERAGE: share
Treaty coverage, banking haven with non-haven countries	-0.0067** (0.0188)	-0.0095*** (0.0015)	-0.5900*** (0.0000)	-0.6045*** (0.0000)
Treaty coverage, banking haven with other tax havens		0.0087 (0.3362)		0.0224 (0.9103)
Signed		0.0536 (0.6726)		0.1005 (0.4022)
Constant	4.3572*** (0.0000)	4.3604*** (0.0000)	4.4043*** (0.0000)	4.4057*** (0.0000)
Observations	8,798	8,798	8,798	8,798
R-squared	0.1188	0.1199	0.1359	0.1365
Number of panelid	346	346	346	346
Countrypair fixed effect	YES	YES	YES	YES
Time fixed effect	YES	YES	YES	YES

Note: p-values in parentheses, based on robust standard errors clustered at the country-pair level. *** denotes significance at the 1% threshold, ** at the 5% threshold, and * at the 10% threshold.
The table investigates how the signature of a treaty between a tax haven (e.g., Switzerland) and a non-haven country (e.g., France) affects the deposits recorded by the BIS as belonging to tax havens (e.g., the deposits in Swiss banks recorded as belonging to Panama). The dependent variable is the stock of deposits recorded as belonging to haven i (e.g., Panama) in the banks of haven j (e.g., Switzerland) at the end of quarter q. The unit of observation is the haven-haven pair (i, j) and the sample period goes from 2003q4 to 2011q2. For a given banking haven j, there are up to 41 "saving" havens i. We consider the deposits held in 13 banking havens j. In col. (1)-(2), *Treaty coverage*, *banking haven with non-havens* counts the number of treaties that j has with non-haven countries (and *Treaty coverage,banking haven with other tax havens* the number of treaties that j has with other havens). In col. (3)-(4), the *Treaty coverage*, variables measure the share of the deposits held by non-haven (reps. haven) countries in haven j in 2004 that are covered by a treaty in quarter q. *Signed* is a dummy equal to 1 if there exists a treaty providing for information exchange between haven i and haven j in quarter q.
Source: BIS, restricted bilateral locational banking statistics.

Chapter 3

Capital is Back: Wealth-Income Ratios in Rich Countries, 1700-2010

Abstract: How do aggregate wealth-to-income ratios evolve in the long run and why? We address this question using 1970-2010 national balance sheets recently compiled in the top 8 developed economies. For the U.S., U.K., Germany, and France, we are able to extend our analysis as far back as 1700. We find in every country a gradual rise of wealth-income ratios, from about 200%-300% in 1970 to 400%-600% in 2010. In effect, today's ratios appear to be returning to the high values observed in Europe in the eighteenth and nineteenth centuries (600%-700%). This can be explained by a long run asset price recovery (itself driven by changes in capital policies since the world wars) and by the slowdown of productivity and population growth, in line with the $\beta = s/g$ Harrod-Domar-Solow formula. That is, for a given net saving rate $s = 10\%$, the long run wealth-income ratio β is about 300% if $g = 3\%$ and 600% if $g = 1.5\%$. Our results have important implications for capital taxation and regulation, and shed new light on the changing nature of wealth, the shape of the production function, and the rise of capital shares.

1 Introduction

This paper addresses what is arguably one the most basic economic questions: how do wealth-income and capital-output ratios evolve in the long run, and why?[1]

Until recently it was difficult to properly address this question, for one simple reason: national accounts were mostly about flows, not stocks. Economists had at their disposal a large body of historical series on flows of output, income and consumption – but limited data on stocks of assets and liabilities. When needed, for example for growth accounting exercises, estimates of capital stocks were typically obtained by cumulating past flows of saving and investment. This is fine for some purposes, but severely limits the set of questions one can ask.

In recent years, the statistical institutes of nearly all developed countries have started publishing retrospective national stock accounts including annual and consistent balance sheets. Following new international guidelines, the balance sheets report on the market value of all the non-financial and financial assets and liabilities held by each sector of the economy (households, government, and corporations) and by the rest of the world. They can be used to measure the stocks of private and national wealth at current market value.

This paper makes use of these new balance sheets in order to establish a number of facts and to analyze whether standard capital accumulation models can account for these facts. We should stress from the outset that we are well aware of the deficiencies of existing balance sheets. In many ways these series are still in their infancy. But they are the best data that we have in order to study wealth accumulation – a question that is so important that we cannot wait for perfect data before we start addressing it, and that has indeed been addressed in the past by many authors using far less data than we presently have. In addition, we feel that the best way for scholars to contribute to future data improvement is to use existing balance sheets in a conceptually coherent manner, so as to better identify their limitations. Our paper, therefore, can also be viewed as an attempt to evaluate the internal consistency of the flow and stock sides of existing national accounts, and to pinpoint the areas in which progress needs to be made.

[1]This chapter was written with Thomas Piketty.

Our contribution is twofold. First, we put together a new macro-historical data set on wealth and income, whose main characteristics are summarized in Table 1. To our knowledge, it is the first international database to include long-run, homogeneous information on national wealth. For the eight largest developed economies in the world – the U.S., Japan, Germany, France, the U.K., Italy, Canada, and Australia – we have official annual series covering the 1970-2010 period. Through to the world wars, there was a lively tradition of national wealth accounting in many countries. By combining numerous historical estimates in a systematic and consistent manner, we are able to extend our series as far back as 1870 (Germany), 1770 (U.S.), and 1700 (U.K. and France). The resulting database provides extensive information on the structure of wealth, saving, and investment. It can be used to study core macroeconomic questions – such as private capital accumulation, the dynamics of the public debt, and patterns in net foreign asset positions – altogether and over unusually long periods of time.

Our second – and most important – contribution is to exploit the database in order to establish a number of new striking results. Looking first at the recent period, we document that wealth-income ratios have been gradually rising in each of the top eight developed countries over the last four decades, from about 200-300% in 1970 to 400-600% in 2010 (Figure 1). Taking a long-run perspective, we find that today's ratios appear to be returning to the high values observed in Europe in the eighteenth and nineteenth centuries, namely about 600-700%, despite considerable changes in the nature of wealth (Figure 2 and 3). In the U.S., the wealth-income ratio has also followed a U-shaped pattern, but less marked (Figure 4).

In order to understand these dynamics, we provide detailed decompositions of wealth accumulation into volume effects (saving) and relative price effects (real capital gains and losses). The results show that the U-shaped evolution of the European wealth-income ratios can be explained by two main factors. The first is a long-run swing in relative asset prices, itself largely driven by changes in capital policies in the course of the twentieth century. Before World War I, capital markets ran unfettered. A number of anti-capital policies were then put into place, which depressed asset prices through to the 1970s. These policies were gradually lifted from the 1980s on, contributing to an asset price recovery.

The second key explanation for the return of high wealth-income ratios is the slowdown of productivity and population growth. According to the Harrod-Domar-Solow formula, in the long run the wealth-income ratio β is equal to the net saving rate s divided by the income growth rate g. So for a given saving rate s =10%, the long-run β is about 300% if g = 3% and about 600% if g = 1.5%. In short: capital is back because low growth is back.

The $\beta = s/g$ formula is simple, yet as we show in the paper surprisingly powerful. It can account for a significant part of the 1970-2010 rise in the wealth-income ratios of Europe and Japan, two economies where population and productivity growth have slowed markedly. It can also explain why wealth-income ratios are lower in the U.S., where population growth has been historically much larger than in Europe – and still continues to be to some extent – but where saving rates are not higher. Last, the Harrod-Domar-Solow formula seems to account reasonably well for the very long-run dynamics of wealth accumulation. Over a few years and even a few decades, valuation effects and war destructions are of paramount importance. But in the main developed economies, we find that today's wealth levels are reasonably well explained by 1870-2010 saving and income growth rates, in line with the workhorse one-good model of capital accumulation. In the long run, assuming a significant divergence between the price of consumption and capital goods seems unnecessary.

Our findings have a number of implications for the future and for policy-making. First, the low wealth-income ratios of the mid-twentieth century were due to very special circumstances. The world wars and anti-capital policies destroyed a large fraction of the world capital stock and reduced the market value of private wealth, which is unlikely to happen again with free markets. By contrast, the $\beta = s/g$ logic will in all likelihood matter a great deal in the foreseeable future. As long as they keep saving sizable amounts (due to a mixture of bequest, life-cycle and precautionary reasons), countries with low g are bound to have high β. For the time being, this effect is strong in Europe and Japan. To the extent that growth will ultimately slow everywhere, wealth-income ratios may well ultimately rise in the whole world.

The return of high wealth-income ratios is certainly not bad in itself, but it raises new issues about capital taxation and regulation. Because wealth is always very concentrated (due in particular to the cumulative and multiplicative processes governing wealth inequality dynamics), high β implies than the inequality of wealth, and potentially the inequality of inherited wealth, is likely to play a bigger role for the overall structure of inequality in the twenty first century than it did in the postwar period. This evolution might reinforce the need for progressive capital and inheritance taxation (Piketty, 2011; Piketty and Saez, 2013). If international tax competition prevents this policy change from happening, one cannot exclude the development of a new wave of anti-globalization and anti-capital policies.

Further, because s and g are largely determined by different forces, wealth-income ratios can vary a lot between countries. This fact has important implications for financial regulation. With perfect capital markets, large differences in wealth-income ratios potentially imply large net foreign asset positions, which can create political tensions between countries. With imperfect capital markets and home portfolios bias, structurally high wealth-income ratios can contribute to domestic asset price bubbles. According to our computations, the wealth-income ratio reached 700% at the peak of the Japanese bubble of the late 1980s, and 800% in Spain in 2008-2009.[2] Housing and financial bubbles are potentially more devastating when the total stock of wealth amounts to 6-8 years of national income rather than 2-3 years only. The fact that the Japanese and Spanish bubbles are easily identifiable in our dataset also suggests that monitoring wealth-income ratios may help designing appropriate financial and monetary policy. In Japan and Spain, most observers had noticed that asset price indexes were rising fast. But in the absence of well-defined reference points, it is always difficult for policy makers to determine when such evolutions have gone too far and whether they should act. We believe that wealth-income ratios and wealth accumulation decompositions provide useful if imperfect reference points.

Last, our findings shed new light on the long run changes in the nature of

[2]See Appendix figure A8. We do not include Spain in our main sample of countries because the Bank of Spain balance sheets that are currently available only start in 1987, and we want to be able to decompose wealth accumulation over a longer period (at least 1970-2010).

wealth, the shape of the production function and the recent rise in capital shares. In the 18^{th} and early 19^{th} century, capital was mostly land (Figure 3), so that there was limited scope for substituting labor to capital. In the 20^{th} and 21^{st} centuries, by contrast, capital takes many forms, to an extent such that the elasticity of substitution between labor and capital might well be larger than 1. With an elasticity even moderately larger than 1, rising capital-output ratios can generate substantial increases in capital shares, similar to those that have occurred in most rich countries since the 1970s. Looking forward, with low growth and high wealth-income ratios, one cannot exclude a further increase in capital shares.

The paper is organized as follows. Section 2 relates our work to the existing literature. In section 3 we present the conceptual framework and accounting equations used in this research. Section 4 is devoted to the decomposition of wealth accumulation in rich countries over the 1970-2010 period. In section 5, we present decomposition results over a longer period (1870-2010) for a subset of countries (U.S., Germany, France, U.K.). We take an even longer perspective in section 6 in which we discuss the changing nature of wealth in the U.K., France and the U.S. since the 18^{th} century. In section 7, we compare the long-run evolution of capital-output ratios and capital shares in order to discuss the changing nature of technology and the pros and cons of the Cobb-Douglas approximation. Section 8 presents some possible directions for future research. The main sources and concepts are presented in the main text, and we leave the complete methodological details to an extensive online Data Appendix, which in particular includes separate sections for each country, and a detailed set of country-specific tables.

2 Related literature

A Literature on national wealth

As far as we know, this paper is the first attempt to gather a large set of national balance sheets in order to analyze the long-run evolution of wealth-income ratios. For a long time, research in this area was impeded by a lack of data. It is only in 1993 that the System of National Accounts, the international standard for national accounting, first included guidelines for wealth. In most rich countries, the publication of time series of national wealth only began in the 1990s and 2000s. In a key country like Germany, the first official balance sheets were released in 2010.

It is worth stressing, however, that the recent emphasis on national wealth largely represents a return to older practice. Until the early twentieth century, economists, statisticians and social arithmeticians were much more interested in computing national wealth than national income and output. The first national balance sheets were established in the late seventeenth and early eighteenth centuries by Petty (1664) and King (1696) in the U.K., Boisguillebert (1695) and Vauban (1707) in France. National wealth estimates then became plentiful in the nineteenth and early twentieth century, with the work of Colqhoun (1815), Giffen (1889) and Bowley (1920) in the U.K., Foville (1893) and Colson (1903) in France, Helfferich (1913) in Germany, King (1915) in the U.S., and dozens of other economists from all industrialized nations. Although these historical balance sheets are far from perfect, their methods are well documented and they are usually internally consistent. One should also keep in mind that it was in many ways easier to estimate national wealth around 1900-1910 than it is today: the structure of property was much simpler, with far less financial intermediation and cross-border positions.

Following the 1914-1945 capital shocks, the long tradition of research on national wealth largely disappeared, partly because of the new emphasis on short run output fluctuations following the Great Depression, and partly because the chaotic asset price movements of the interwar made the computation of the current market value of wealth and the comparison with pre-World War I estimates much more difficult. While there has been some effort to put together historical balance sheets in recent decades, most notably by Goldsmith (1985, 1991), to date no systematic attempt has been made to relate the evolution of wealth-income ratios to the magnitude of saving flows.[3] The reason is probably that it is only recently that official balance

[3] In particular, Goldsmith does not relate his wealth estimates to saving and investment flows. He is mostly interested in the rise of financial intermediation, that is the rise of gross financial assets and liabilities (expressed as a fraction of national income), rather than in the evolution of the net wealth-income ratio. Nineteenth century authors like Giffen and Foville were fascinated by the huge accumulation of private capital, but did not have much estimates of income, saving and investment, so they were not able to properly analyze the evolution of the wealth-income ratio.

sheets have become sufficiently widespread to make the exercise meaningful.

B Literature on capital accumulation and growth

The lack of data on wealth in the aftermath of the 1914-1945 shocks did not prevent economists from studying capital accumulation. In particular, Solow developed the neoclassical growth model in the 1950s. In this model, the long-run capital-output ratio is equal to the ratio between the saving rate and the growth rate of the economy. As is well-known, the $\beta = s/g$ formula was first derived by Harrod (1939) and Domar (1947) using fixed-coefficient production functions, in which case β is entirely given by technology – hence the knife-edge conclusions about growth.[4] The classic derivation of the formula with a flexible production function $Y = F(K, L)$ involving capital-labor substitution, thereby making β endogenous and balanced growth possible, is due to Solow (1956). Authors of the time had limited national accounts at their disposal to estimate the parameters of the formula. In numerical illustrations, they typically took $\beta = 400\%$, $g = 2\%$, and $s = 8\%$. They were not entirely clear about the measurement of capital, however.

Starting in the 1960s, the Solow model was largely applied for empirical studies of growth (see for instance Denison, 1962; Jorgenson and Griliches, 1967; Feinstein, 1978) and it was later on extended to human capital (Mankiw, Romer and Weil, 1992; Barro, 1991). The main difference between our work and the growth accounting literature is how we measure capital. Because of the lack of balance sheet data, in the growth literature capital is typically computed by cumulating past investment flows and attempting to adjust for changes in price – what is known as the perpetual inventory method. By contrast, we measure capital by using national balance sheets in which we observe the actual evolution of the market value of most types of assets: real estate, equities (which capture the market value of corporations), bonds, and so on. We are essentially interested in what non-human private capital is worth for households at each point in time – and in what public capital

Surprisingly enough, socialist authors like Karl Marx – who were obviously much interested in the rise of capital and the possibility that β reaches very high levels – largely ignored the literature on national wealth.

[4]Harrod emphasized the inherent instability of the growth process, while Domar stressed the possibility that β and s can adjust in case the natural growth rate g differs from s/β.

would be worth if it was privatized. This notion is precisely what the economists of the eighteenth and nineteenth century aimed to capture. We believe it is a useful, meaningful, and well defined starting point.[5] There are two additional advantages to using balance sheets: first, they include data for a large number of assets, including non-produced assets such as land which by definition cannot be measured by cumulating past investment flows. Second, they rely for the most part on observed market prices – such as actual real estate transactions and financial market quotes – contrary to the prices used in the perpetual inventory method, which tend not to be well defined.[6]

Now that national balance sheets are available, we can see that some of the celebrated stylized facts on capital – established when there was actually little data on capital – are not that robust. The constancy of the capital-output ratio, in particular, is simply not a fact for Europe and Japan, and is quite debatable for the U.S. Although this constancy is often seen as one of the key regularities in economics, there has always been a lot of confusion about what the level of the capital-output ratio is supposed to be (see, e.g., Kaldor, 1961; Samuelson, 1970; Simon, 1990; Jones and Romer, 2010). The data we presently have suggest that the ratio is often closer to 5-6 in most rich countries today than to the values of 3-4 typically used in macro models and textbooks.[7]

Our results also suggest that the focus on the possibility of a balanced growth path that has long characterized academic debates on capital accumulation (most notably during the Cambridge controversy of the 1960s-1970s) has been somewhat misplaced. It is fairly obvious that there can be a lot of capital-labor substitution in

[5]By contrast, in the famous Cambridge controversy, the proponent of the U.K. view argued that the notion of capital used in neoclassical growth models is not well defined. In our view much of the controversy owes to the lack of balance sheet data, and to the difficulty of making comparisons with pre-World War 1 estimates of national capital stocks.

[6]As we discuss in details in Appendix A.1.2, the price estimates used in the perpetual inventory method raise all sorts of difficulties (depreciation, quality improvement, aggregation bias, etc.). Even when these difficulties can be overcome, PIM estimates of the capital stock at current price need not be equal to the current market value of wealth. For instance, the current value of dwellings obtained by the PIM is essentially equal to past investments in dwellings adjusted for the evolution of the relative price of construction. This has no reason to be equal to the current market value of residential real estate – which in practice is often higher.

[7]Many estimates in the literature only look at the capital-output ratio in the corporate sector (i.e., corporate capital divided by corporate product), in which case ratios of 3 or even 2 are indeed in line with the data (see Figures A70-A71). This, however, completely disregards the large stock of housing capital, as well as non-corporate businesses and government capital.

the long-run, and that many different β can occur in steady-state. But this does not imply that the economy is necessarily in a stable or optimal state in any meaningful way. High steady-state wealth-income ratios can go together with large instability, asset price bubbles and high degrees of inequality – all plausible scenarios in mature, low-growth economies.

C Literature on external balance sheets

Our work is close in spirit to the recent literature that documents and attempts to understand the dynamics of the external balance sheets of countries (Lane and Milesi-Ferretti, 2007; Gourinchas and Rey, 2007; Zucman, 2013). To some extent, what we are doing in this paper is to extend this line of work to domestic wealth and to longer time periods. We document the changing nature of domestic capital over time, and we investigate the extent to which the observed aggregate dynamics can be accounted for by saving flows and valuation effects. A key difference is that our investigation is broader in scope: as we shall see, domestic capital typically accounts for 90%-110% of the total wealth of rich countries today, while the net foreign asset position accounts for -10%-10% only. Nevertheless, external wealth will turn out to play an important role in the dynamics of the national wealth of a number of countries, more spectacularly the U.S. The reason is that gross foreign positions are much bigger than net positions, thereby potentially generating large capital gains or losses at the country level.[8] In essence, one of the things that we attempt to do in this paper is to put the study of external wealth into the broader perspective of national wealth.[9]

D Literature on rising capital shares

Our work is also closely related to the growing literature establishing that capital shares have been rising in most countries over the last decades (Ellis and Smith,

[8]See Obstfeld (2013) and Gourinchas and Rey (2013) for recent papers surveying the literature on this issue.

[9]Eisner (1980), Babeau (1983), Greenwood and Wolff (1992), Wolff (1999), and Gale and Sabelhaus (1999) study the dynamics of U.S. aggregate household wealth using official balance sheets and survey data. With a pure household perspective, however, one is bound to attribute an excessively large role to capital gains, because a lot of private saving takes the form corporate retained earnings, as we discuss in section 4.

2007; Azmat, Manning and Van Reenen, 2011; Karabarbounis and Neiman, 2012). The fact that we find rising wealth-income and capital-output ratios in the leading rich economies reinforces the presumption that capital shares are indeed rising globally. We believe that this confirmation is important in itself, because computing factor shares raises all sorts of issues. In many situations, what accrues to labor and to capital is unclear – both in the non-corporate sector and in the corporate sector, where profits and dividends recorded in the national accounts sometimes include labor income components that are impossible to isolate. Wealth-income and capital-output ratios provide an indication of the relative importance of capital in production largely immune to these issues, although they are themselves not perfect. They usefully complement measures of factor shares.

More generally, we attempt to make progress in the measurement of three fundamentally inter-related macroeconomic variables: the capital share, the capital-output ratio, and the marginal product of capital (see also Caselli and Feyrer, 2007). As we discuss in section 7, rising capital-output ratios together with rising capital shares and declining returns to capital imply an elasticity of substitution between labor and capital higher than 1 – consistent with the results obtained by Karabarbounis and Neiman (2012) over the same period of time.

E Literature on income and wealth inequalities

Last, this paper is to a large extent the continuation of the study of the long run evolution of private wealth in France undertaken by one of us (Piketty, 2011). We extend Piketty's analysis to many countries, to longer time periods, and to public and foreign wealth. However, we do not decompose aggregate wealth accumulation into an inherited and dynastic wealth component on the one hand and a lifecycle and self-made wealth component on the other (as Piketty does for France). Instead, we take the structure of saving motives and the overall level of saving as given. In future research, it would be interesting to extend our decompositions in order to study the evolution of the relative importance of inherited versus life-cycle wealth in as many countries as possible.

Ultimately, the goal is also to introduce global distributional trends in the analysis. Any study of wealth inequality requires reliable estimates of aggregate wealth to start with. Plugging distributions into our data set would make it possible to analyze the dynamics of the global distribution of wealth.[10] The resulting series could then be used to improve the top income shares estimates that were recently constructed for a number of countries (see Atkinson, Piketty, Saez 2011). We see the present research as an important step in this direction.

3 Conceptual framework and methodology

A Concepts and definitions

The concepts we use are standard: we strictly follow the U.N. System of National Accounts (SNA). For the 1970-2010 period, we use official national accounts that comply with the latest international guidelines (SNA, 1993, 2008). For the previous periods, we have collected a large number of historical balance sheets and income series, which we have homogenized using the same concepts and definitions as those used in the most recent official accounts.[11] Here we provide the main definitions.

Private wealth W_t is the net wealth (assets minus liabilities) of households and non-profit institutions serving households.[12] Following SNA guidelines, assets include all the non-financial assets – land, buildings, machines, etc. – and financial assets – including life insurance and pensions funds – over which ownership rights can be enforced and that provide economic benefits to their owners. Pay-as-you-go social security pension wealth is excluded, just like all other claims on future government expenditures and transfers (like education expenses for one's children and health benefits). Durable goods owned by households, such as cars and furniture,

[10] See Davies et al. (2010) for a study of the world distribution of wealth using national balance sheet data.

[11] Section A of the Data Appendix provides a detailed description of the concepts and definitions used by the 1993 and 2008 SNA. Country-specific information on historical balance sheets are provided in Data Appendix sections B (devoted to the U.S.), D (Germany), E (France), and F (U.K.).

[12] The main reason for including non-profit institutions serving households (NPISH) in private wealth is that the frontier between individuals and private foundations is not always entirely clear. The net wealth of NPISH is usually small, and always less than 10% of total net private wealth: currently it is about 1% in France, 3%-4% in Japan, and 6%-7% in the U.S., see Appendix Table A65. Note also that the household sector includes all unincorporated businesses.

are excluded as well.[13] As a general rule, all assets and liabilities are valued at their prevailing market prices. Corporations are included in private wealth through the market value of equities. Unquoted shares are typically valued on the basis of observed market prices for comparable, publicly traded companies.

We similarly define public (or government) wealth W_{gt} as the net wealth of public administrations and government agencies. In available balance sheets, public non-financial assets like administrative buildings, schools and hospitals are valued by cumulating past investment flows and upgrading them using observed real estate prices.

We define market-value national wealth W_{nt} as the sum of private and public wealth:

$$W_{nt} = W_t + W_{gt}$$

National wealth can also be decomposed into domestic capital and net foreign assets:

$$W_{nt} = K_t + NFA_t$$

And domestic capital K_t can in turn be decomposed as the sum of agricultural land, housing, and other domestic capital (including the market value of corporations, and the value of other non-financial assets held by the private and public sectors, net of their liabilities).

An alternative measure of the wealth of corporations is the total value of corporate assets net of non-equity liabilities, what we call the corporations' book value. We define residual corporate wealth W_{ct} as the difference between the book-value of corporations and their market value (which is the value of their equities). By definition, W_{ct} is equal to 0 when Tobin's Q – the ratio between market and book values – is equal to 1. In practice there are several reasons why Tobin's Q can be different from 1, so that residual corporate wealth is at times positive, at times negative. We define book-value national wealth W_{bt} as the sum of market-value national wealth and residual corporate wealth: $W_{bt} = W_{nt} + W_{ct} = W_t + W_{gt} + W_{ct}$. Although

[13]The value of durable goods appears to be relatively stable over time (about 30%-50% of national income, i.e. 5%-10% of net private wealth). See for instance Appendix Table US.6f for the long-run evolution of durable goods in the U.S.

we prefer our market-value concept of national wealth (or national capital), both definitions have some merit, as we shall see.[14]

Balance sheets are constructed by national statistical institutes and central banks using a large number of census-like sources, in particular reports from financial and non-financial corporations about their balance sheet and off-balance sheet positions, and housing surveys. The perpetual inventory method usually plays a secondary role. The interested reader is referred to the Appendix for a a precise discussion of the methods used by the leading rich countries.

Regarding income, the definitions and notations are standard. Note that we always use net-of-depreciation income and output concepts. National income Y_t is the sum of net domestic output and net foreign income: $Y_t = Y_{dt} + r_t \cdot NFA_t$.[15] Domestic output can be thought as coming from some production function that uses domestic capital and labor as inputs: $Y_{dt} = F(K_t, L_t)$.

We are particularly interested in the evolution of the private wealth-national income ratio $\beta_t = W_t/Y_t$ and of the (market-value) national wealth-national income ratio $\beta_{nt} = W_{nt}/Y_t$. In a closed economy – and more generally in an open economy with a zero net foreign position – the national wealth-national income ratio β_{nt} is the same as the domestic capital-output ratio $\beta_{kt} = K_t/Y_{dt}$.[16] In case public wealth is equal to zero, then both ratios are also equal to the private wealth-national income ratio: $\beta_t = \beta_{nt} = \beta_{kt}$. At the global level, the world wealth-income ratio is always equal to the world capital/output ratio.

We are also interested in the evolution of the capital share $\alpha_t = r_t \cdot \beta_t$. With

[14]W_{bt} corresponds to the concept of "national net worth" in the SNA (see Data Appendix A.4.2). In this paper, we propose to use "national wealth" and "national capital" interchangeably (and similarly for "domestic wealth" and "domestic capital", and "private wealth" and "private capital"), and to specify whether one uses "market-value" or "book-value" aggregates. Note that 19^{th} century authors such as Giffen and Foville also used "national wealth" and "national capital" interchangeably. The difference is that they viewed market values as the only possible value, while we recognize that both definitions have some merit (see below the discussion on Germany).

[15]National income also includes net foreign labor income and net foreign production taxes – both of which are usually negligible.

[16]In principle, one can imagine a country with a zero net foreign asset position (so that $W_{nt} = K_t$) but non-zero net foreign income flows (so that $Y_t \neq Y_{dt}$). In this case the national wealth-national income ratio β_{nt} will slightly differ from the domestic capital-output ratio β_{kt}. In practice today, differences between Y_t and Y_{dt} are very small – national income Y_t is usually between 97% and 103% of domestic output Y_{dt} (see Appendix Figure A57). Net foreign asset positions are usually small as well, so that β_{kt} turns out to be usually close to β_{nt} in the 1970-2010 period (see Appendix Figure A67).

imperfect capital markets, the average rate of return r_t can substantially vary across assets. In particular, it can be different for domestic and foreign assets. With perfect capital markets, the rate of return r_t is the same for all assets and is equal to the marginal product of capital. With a Cobb-Douglas production function $F(K, L) = K^{\alpha}L^{1-\alpha}$, and a closed economy setting, the capital share is entirely set by technology: $\alpha_t = r_t \cdot \beta_t = \alpha$. A higher capital-output ratio β_t is exactly compensated by a lower capital return $r_t = \alpha/\beta_t$, so that the product of the two is constant. In an open economy setting, the world capital share is also constant and equal to α, and the world rate of return is also given by $r_t = \alpha/\beta_t$, but the countries with higher-than-average wealth-income ratios invest part of their wealth in other countries, so that for them the share of capital in national income is larger than α. With a CES production function, much depends on whether the capital-labor elasticity of substitution σ is larger or smaller than one. If $\sigma > 1$, then as β_t rises, the marginal product of capital r_t falls less than the rise of β_t, so that the capital share $\alpha_t = r_t \cdot \beta_t$ is an increasing function of β_t. Conversely, if $\sigma < 1$, the marginal product of capital r_t falls more than the rise of β_t, so that the capital share is a decreasing function of β_t.[17]

B The one-good wealth accumulation model: $\beta = s/g$

Generally speaking, wealth accumulation between time t and $t + 1$ can always be decomposed into a volume effect and a relative price effect:

$$W_{t+1} = W_t + S_t + KG_t$$

where:

W_t is the market value of aggregate wealth at time t

S_t is the net saving flow between time t and $t + 1$ (volume effect)

KG_t is the capital gain or loss between time t and $t + 1$ (relative price effect)

[17] A CES production function is given by: $F(K, L) = (a \cdot K^{\frac{\sigma-1}{\sigma}} + (1-a) \cdot L^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}}$. As $\sigma \to \infty$, the production function becomes linear, i.e. the return to capital is independent of the quantity of capital (this is like a robot economy where capital can produce output on its own). As $\sigma \to 0$, the production function becomes putty-clay, i.e. the return to capital falls to zero if the quantity of capital is slightly above the fixed proportion technology.

In the one-good model of wealth accumulation, and more generally in a model with a constant relative price between capital and consumption goods, there is no relative price effect ($KG_t = 0$). The wealth-income ratio $\beta_t = W_t/Y_t$ is simply given by the following transition equation:

$$\beta_{t+1} = \frac{1+g_{wst}}{1+g_t} \cdot \beta_t$$

where:

$1 + g_{wst} = 1 + s_t/\beta_t$ = saving-induced wealth growth rate

$1 + g_t = Y_{t+1}/Y_t$ = growth rate of national income

$s_t = S_t/Y_t$ = net saving rate.[18]

In the long run, with a fixed saving rate $s_t = s$ and growth rate $g_t = g$, the steady-state wealth-income ratio is given by the well-known Harrod-Domar-Solow formula:

$$\beta_t \to \beta = s/g$$

If we were using gross-of-depreciation saving rates rather than net rates, the steady-state formula would be $\beta = s/(g+\delta)$ with s the gross saving rate, and δ the depreciation rate expressed as a proportion of the wealth stock. We find it more transparent to express everything in terms of net saving rates and use the $\beta = s/g$ formula, so as to better concentrate on the saving versus capital gain decomposition. Both formulations are equivalent and require the same data to be implemented.[19]

C The $\beta = s/g$ formula is independent of saving motives

It is worth stressing that the steady-state formula $\beta = s/g$ is a pure accounting equation. By definition, it holds in the steady-state of any micro-founded model,

[18] When one is interested in the dynamics of the private wealth-national income ratio β_t, the saving rate that needs to be used is the private saving rate (household + corporate saving). When one is interested in the national wealth-income ratio β_{tn}, then one has to use the national saving rate (household + corporate + government). We return to these issues below.

[19] Appendix Table A84 provides cross-country data on private depreciation. Detailed series on gross saving, net saving, and depreciation, by sector of the economy, are in Appendix Tables US.12c, JP.12c, etc. Whether one writes down the decomposition of wealth accumulation using gross or net saving, one needs depreciation series.

independently of the exact nature of saving motives. If the saving rate is $s = 10\%$, and if the economy grows at rate $g = 2\%$, then in the long run the wealth income ratio has to be equal to $\beta = 500\%$, because it is the only ratio such that wealth rises at the same rate as income: $g_{ws} = s/\beta = 2\% = g$.

In the long run, income growth g is the sum of productivity and population growth. Among other things, it depends on the pace of innovation and on fertility behavior (which is notoriously difficult to predict, as the large variations between rich countries illustrate).[20] The saving rate s also depends on many forces: s measures the strength of the various psychological and economic motives for saving and wealth accumulation (dynastic, lifecycle, precautionary, prestige, taste for bequests, etc.). The motives and tastes for saving vary a lot across individuals and potentially across countries.[21]

One simple way to see this is the "bequest-in-the-utility-function" model. Consider a dynamic economy with a discrete set of generations $0, 1, .., t, ...$, zero population growth, and exogenous labor productivity growth at rate $g > 0$. Each generation has measure $N_t = N$, lives one period, and is replaced by the next generation. Each individual living in generation t receives bequest $b_t = w_t \geq 0$ from generation $t-1$ at the beginning of period t, inelastically supplies one unit of labor during his lifetime (so that labor supply $L_t = N_t = N$), and earns labor income y_{Lt}. At the end of period, he then splits lifetime resources (the sum of labor income and capitalized bequests received) into consumption c_t and bequests left $b_{t+1} = w_{t+1} \geq 0$, according to the following budget constraint:

$$c_t + b_{t+1} \leq y_t = y_{Lt} + (1 + r_t)b_t$$

The simplest case is when the utility function is defined directly over consumption c_t and the increase in wealth $\Delta b_t = b_{t+1} - b_t$ and takes a simple Cobb-Douglas

[20]The speed of productivity growth could also be partly determined by the pace of capital accumulation (like in AK-type endogenous growth models). Here we take as given the many different reasons why productivity growth and population growth vary across countries.

[21]For estimates of the distribution of bequest motives between individuals, see, e.g., Kopczuk and Lupton (2007). On cross-country variations in saving rates due to habit formation (generating a positive $s(g)$ relationship), see Carroll, Overland and Weil (2000). On the importance of prestige and social status motives for wealth accumulation, see Carroll (2000).

form: $V(c, \Delta b) = c^{1-s} \Delta b^s$.[22] Utility maximization then leads to a fixed saving rate at the level of each dynasty: $w_{t+1} = w_t + s y_t$. By multiplying per capita values by population $N_t = N$ we have the same linear transition equation at the aggregate level: $W_{t+1} = W_t + sY_t$.

Assume a closed economy and no government wealth. Domestic output is given by a standard constant returns to scale production function $Y_{dt} = F(K_t, H_t)$ where $H_t = (1+g)^t \cdot L_t$ is the supply of efficient labor. The wealth-income ratio $\beta_t = W_t/Y_t$ is the same as the capital-output ratio K_t/Y_{dt}. With perfectly competitive markets, the rate of return is given by the marginal product of capital: $r_t = F_K$. Now assume a small open economy taking the world rate of return as given ($r_t = r$). The domestic capital stock is set by $r = F_K$. National income $Y_t = Y_{dt} + r(W_t - K_t)$ can be larger or smaller than domestic output depending on whether the net foreign asset position $NFA_t = W_t - K_t$ is positive or negative. Whether we consider the closed or open economy case, the long-run wealth-income ratio is given by the same formula: $\beta_t \to \beta = s/g$. It depends on the strength of the bequest motive on the one hand, and on the rate of productivity growth on the other.[23]

With other functional forms for the utility function, e.g. with $V = V(c, b)$, or with heterogenous labor productivities and/or saving tastes across individuals, one simply needs to replace the parameter s by the properly defined average bequest taste parameter. In any case we keep the same general formula $\beta = s/g$.[24]

If we introduce overlapping generations and lifecycle saving into the "bequest-in-the-utility-function" model, then one can show that the saving rate parameter

[22] Intuitively, this corresponds to a form of "moral" preferences where individuals feel that they cannot possibly leave less wealth to their children than what they have received from their parents, and derive utility from the increase in wealth (maybe because this is a signal of their ability or virtue). Of course the strength of this saving motive might well vary across individuals and countries.

[23] In addition, with a Cobb-Douglas production function $F(K, H) = K^\alpha H^{1-\alpha}$, the domestic capital-output ratio is given by: $K_t/Y_{dt} = \alpha/r$. Depending on whether this is smaller or larger than $\beta = s/g$, the long run net foreign asset position is positive or negative. In the closed-economy case, $r_t \to r = \alpha/\beta = \alpha \cdot g/s$.

[24] For instance, with $V(c, b) = c^{1-s} b^s$, we get $w_{t+1} = s(w_t + y_t)$ and $\beta_t \to \beta = s/(g+1-s) = \widetilde{s}/g$ (with $\widetilde{s} = s(1+\beta) - \beta$). In a model with general heterogenous labor incomes y_{Lti} and utility functions $V^{ti}(c, b)$, one simply needs to replace s by the properly defined weighted average s_i (see Piketty and Saez, 2013). Note also that if one interprets each period $0, 1, ..., t, ...$ as a generation lasting H years, then the $\beta = s/g$ formula is better viewed as giving a ratio of wealth over generational income $\widehat{\beta} = s/G$, where $G = (1+g)^H - 1$ is the generational growth rate and g is the corresponding yearly growth rate. For g small, the corresponding wealth-yearly income ratio $H \cdot \widehat{\beta}$ is approximately equal to $\beta = s/g$.

s in the $\beta = s/g$ formula now depends not only on the strength of the bequest taste, but also on the magnitude of the lifecycle saving motive. Typically, following the Modigliani triangle logic, the saving rate $s = s(\lambda)$ is an increasing function of the fraction of one's lifetime that is spent in retirement (λ). The long-run β now depends on demographic parameters, life expectancy, and the generosity of the public social security system.[25]

Last, the $\beta = s/g$ formula also applies in the infinite-horizon, dynastic model, whereby each dynasty maximizes $V = \sum_{t \geq 0} U(c_t)/(1+\theta)^t$. One well-known, unrealistic feature of this model is that the long run rate of return is entirely determined by preference parameters and the growth rate: $r_t \rightarrow r = \theta + \gamma g$.[26] In effect, the model assumes an infinite long-run elasticity of capital supply with respect to the net-of-tax rate of return. It mechanically entails extreme consequences for optimal capital tax policy (namely, zero tax). The "bequest-in-the-utility-function" model provides a less extreme and more flexible conceptual framework in order to analyze the wealth accumulation process.[27] But from a purely logical standpoint, it is important to realize that the Harrod-Domar-Solow also holds in the dynastic model. The steady-state saving rate in the dynastic model is equal to $s = \alpha \cdot g/r = \alpha \cdot g/(\theta + \gamma g)$.[28] The saving rate $s = s(g)$ is an increasing function of the growth rate, but rises less fast than g, so that the steady-state wealth-income ratio $\beta = s/g$ is again a decreasing function of the growth rate.[29]

D The two-good model: volume vs. relative price effects

Wherever savings come from, the key assumption behind the one-good model of wealth accumulation and the $\beta = s/g$ formula is that there is no change in the

[25] For a simple model along those lines, see Appendix K.4.

[26] $\gamma \geq 0$ is the curvature of the utility function: $U(c) = \frac{c^{1-\gamma}}{1-\gamma}$ ($\gamma > 1$ is usually assumed to be more realistic).

[27] Depending upon the exact functional form of the utility function $V(c, \Delta b)$ (or $V(c, \Delta b)$), one can generate any elasticity of saving behavior $s(r)$ with respect to the net-of-tax rate of return. The elasticity could be positive or negative, large or small, leaving it to empirical studies to settle the issue. Available estimates tend to suggest a low positive long run elasticity (Piketty and Saez, 2013).

[28] $\alpha = r \cdot \beta$ is the capital share. Intuitively, a fraction g/r of capital income is saved in the long-run, so that dynastic wealth grows at the same rate g as national income.

[29] With a Cobb-Douglas production function (fixed capital share), the wealth-income ratio is simply given by $\beta = \alpha/r = \alpha/(\theta + \gamma \cdot g)$ and takes its maximum value $\overline{\beta} = \alpha/\theta$ for $g = 0$.

relative price between capital and consumption goods. Needless to say, this is a strong assumption. In practice, relative asset price effects often vastly dominate volume effects in the short run, and sometimes in the medium run as well. One key issue addressed in this paper is whether relative price effects also matter for the analysis of long-run wealth accumulation.

There are many theoretical reasons why they could matter, particularly if the speed of technical progress is not the same for capital and consumption goods. One extreme case would be a two-good model where the capital good is in fixed supply: $K_t = K_0$ (say, fixed land supply). The market value of wealth if given by $W_t = q_t \cdot K_0$, where q_t is the price of the capital good (say, land price) relative to the consumption good. Assume fixed population and labor supply $L_t = N_t = N_0$, positive labor productivity growth $g > 0$ and the same utility function $V(c, \Delta b) = c^{1-s} \Delta b^s$ as that described above, where $\Delta b_t = b_{t+1} - b_t = w_{t+1} - w_t$ is the difference (in value) between left and received bequests. Then one can easily see that the relative price q_t will rise at the same pace as output and income in the long run, so that the market value of wealth rises as fast as output and income. By construction, there is no saving at all in this model (since the capital good is by assumption in fixed supply), and the rise in the value of wealth is entirely due to a relative price effect.[30] This is the opposite extreme of the one-good model, whereby the rise in the value of wealth is entirely due to a volume effect.

In practice, there are all sorts of intermediate cases between these two polar cases: in the real world, volume effects matter, but so do relative price effects. Our approach is to let the data speak. We decompose the evolution of the wealth-income ratio into two multiplicative components (volume and relative price) using the following accounting equation:

$$\beta_{t+1} = \frac{(1 + g_{wst})(1 + q_t)}{1 + g_t} \beta_t$$

where:

[30] E.g. with a Cobb-Douglas production function $Y = K^\alpha H^{1-\alpha}$, we have: $Y_t = Y_0 \cdot (1 + \overline{g})^t$ (with $Y_0 = K_0^\alpha N_0^{1-\alpha}$ and $1 + g' = (1 + g)^{1-\alpha}$; if g small, $\overline{g} \approx (1 - \alpha) \cdot g$); $q_t = q_0 \cdot (1 + \overline{g})^t$ (with $\beta_t = W_t / Y_t = q_0 \cdot K_0 / Y_0 = s/\overline{g}$, i.e. $q_0 = (s/\overline{g}) \cdot (Y_0 / K_0)$); and $Y_{Kt} = r \cdot W_t = \alpha \cdot Y_t$, i.e. $r = \alpha \cdot \overline{g}/s$. In effect, the relative capital price rises as fast as income and output, and the level of the relative capital price is set by the taste for wealth.

$1 + g_{wst} = 1 + s_t/\beta_t =$ saving-induced wealth growth rate

$1 + q_t =$ capital-gains-induced wealth growth rate

$1 + g_t = Y_{t+1}/Y_t =$ growth rate of national income

$1+q_t$ is the real rate of capital gain or loss (i.e., the excess of asset price inflation over consumer price inflation) and can be estimated as a residual. We do not try to specify where q_t comes from (one can think of stochastic production functions for capital and consumption goods, with different rates of technical progress in two sectors), and we infer it from the data at our disposal on $\beta_t, ..., \beta_{t+n}$, $s_t, ..., s_{t+n}$, and $g_t, ...g_{t+n}$. In effect, if we observe that the wealth-income ratios rises too fast as compared to recorded saving, we record positive real capital gains q_t. Although we tend to prefer the multiplicative decomposition of wealth accumulation (which is more meaningful over long time periods), we also present additive decomposition results. The disadvantage of additive decompositions (which are otherwise simpler) is that they tend to overweight recent years. The exact equations and detailed decomposition results are provided in Appendix K. In the next two sections, we will present the main decomposition results, starting with the 1970-2010 period, before moving to longer periods of time.

4 Wealth-income ratios in rich countries 1970-2010

A The rise of private wealth-income ratios

The first fact that we want to understand is the gradual rise of private wealth-national income ratios in rich countries over the 1970-2010 period – from about 200-300% in 1970 to about 400-600% (Figure 1 above). We begin with a discussion of the basic descriptive statistics.

Private wealth-national income ratios have risen in every developed economy since 1970, but there are interesting cross-country variations. Within Europe, the French and U.K. trajectories are relatively close: in both countries, private wealth rose from 300-310% of national income in 1970 to 540-560% in 2010. In Italy, the rise was even more spectacular, from less than 250% in 1970 to more than 650% today.

In Germany, the rise was proportionally larger than in France and the U.K., but the levels of private wealth appear to be significantly lower than elsewhere: 200% of national income in 1970, little more than 400% in 2010. The relatively low level of German wealth at market value is an interesting puzzle, on which we will return. For the time being, we simply note that we are unable to identify any methodological or conceptual difference in the work performed by German statisticians (who apply the same SNA guidelines as everybody else) that could explain the gap with other European countries.[31]

Outside Europe, national trajectories also display interesting variations. In Japan, private wealth rose sharply from less than 300% of national income in 1970 to almost 700% in 1990, then fell abruptly in the early 1990s and stabilized around 600%. The 1990 Japanese peak is widely regarded as the archetype of an asset price bubble, and probably rightly so. But if we look at the Japanese trajectory from a longer run, cross-country perspective, it is yet another example of the 1970-2010 rise of wealth-income ratios – fairly close to Italy in terms of total magnitude over the 40 years period.

In the U.S., private wealth rose from slightly more than 300% of national income in 1970 to almost 500% in 2007, but then fell abruptly to about 400% in 2010 – so that the total 1970-2010 rise is the smallest in our sample. (The U.S. wealth-income ratio is now rising again, so this might change in the near future). In other countries the wealth-income ratio stabilized or fell relatively little during the 2008-2010 financial crisis.[32] In Canada, private wealth rose from 250% of national income in 1970 to 420% in 2010 – a trajectory that is comparable to Germany, but a with a somewhat larger starting point. The Australian trajectory is similar to that of France and the U.K., with private wealth going from a bit more than 300% in 1970 to about 500-550% in 2010.

[31]See Appendix D on Germany. We made sure that the trend is unaffected by German unification in 1990. The often noted difference in home ownership rates between Germany and other European countries is not per se an explanation for the lower wealth-income ratio. For a given saving rate, one can purchase different types of assets, and there is no obvious reason in general why housing assets should deliver higher capital gains than financial assets. We return to this issue below.

[32]With the interesting exception of Spain, where private wealth fell with a comparable magnitude as in the U.S. since 2007 (i.e., by the equivalent of about 50%-75% of national income, or 10%-15% of initial wealth). See Appendix Figure A8.

The general rise in private wealth-national income ratios would be even more spectacular should we use disposable personal income – i.e., national income minus taxes plus cash transfers – at the denominator. Disposable income was over 90% of national income until 1910, then declined to about 80% in 1970 and to 75%-80% in 2010, in particular because of the rise of freely provided public services and in-kind transfers such as health and education. As a consequence, the private wealth-disposable income ratio is well above 700% in a number of countries in 2010, while it was below 400% in every country in 1970.[33] Whether one should use national or disposable income as denominator is a matter of perspective. If one aims to compare the monetary amounts of income and wealth that individuals have at their disposal, then looking at the ratio between private wealth and disposable income seems more appropriate. But in order to study the wealth accumulation process and to compare wealth-income ratios over long periods of time, it seems more justified to look at economic values and therefore to focus on the private wealth-national income ratio – as we do in the present paper.[34]

B Growth rates vs. saving rates

How can we account for the general rise of wealth-income ratio, as well as for the cross country variations? According to the one-good capital accumulation model and the Harrod-Domar-Solow formula $\beta = s/g$, the two key forces driving wealth-income ratios are the saving rate s and the income growth rate g. So before we present our decomposition results, it is useful to have in mind the magnitude of

[33]See Appendix Figure A9. Also note that if we were to include durable goods into our wealth definition, then wealth-income ratios would be even higher – typically by the equivalent about 50% of national income. However the value of durable goods seems to be approximately constant over time as a fraction of national income, so this would not significantly affect the upward trend.

[34]In the end it really depends on how one views government provided services. If one assumes that government expenditures are useless, and that the rise of government during the 20^{th} century has limited the ability of private individuals to save, accumulate and transmit private wealth, then one should use disposable income as denominator. But to the extent that government expenditures are mostly useful (in the absence of public spending in health and education, then individuals would have to had to pay at least as much to buy similar services on the market), it seems more justified to use national income. One additional advantage of using national income is that it tends to be better measured. Disposable income can display large time-series and cross-country variations for purely definitional reasons. In European countries, for instance, disposable income typically jumps from 70% to about 80% of national income if one includes in-kind health transfers (such as insurance reimbursements), and to about 90% of national income if one includes all in-kind transfers (education, housing, etc.). See Appendix Figure A65.

growth and saving rates in rich countries over the 1970-2010 period. The basic fact is that there are important variations across countries, for both growth and saving rates, and that they seem largely unrelated (Table 2).[35]

Variations in income growth rates are mostly due to variations in population growth. Over 1970-2010, average per capita growth rates have been virtually the same in all rich countries: they are always between 1.6% and 2.0%, and for most countries between 1.7% and 1.9%. Given the data imperfections we face, it is unclear whether differences of 0.1%-0.2% are statistically significant. For instance, the rankings of countries in terms of per capita growth are reversed if one uses consumer price indexes rather than GDP deflators, or if one looks at per-worker rather than per-capita growth.[36]

In contrast, variations in population growth are large and significant. Over 1970-2010, average population growth rates vary from less than 0.2% per year in Germany to over 1.4% in Australia. Population growth is over 1% per year in New World countries (U.S., Canada, Australia), and less than 0.5% in Europe and Japan. As a consequence, total growth rates are about 2.5%-3% in the former group, and closer to 2% in the latter. Differences in population growth are due to differences in both migration and fertility. Within Europe, for example, we observe the well known gap between high fertility countries such as France (with population growth equal to 0.5% per year) and low fertility countries like Germany (less than 0.2% per year, with a sharp fall at the end of the period).[37]

Variations in saving rates are also large. Average net-of-depreciation private saving rates vary from 7%-8% in the U.S. and the U.K. to 14%-15% in Japan and Italy, with a large group of countries around 10%-12% (Germany, France, Canada,

[35] Here we focus upon the long run picture, so we mostly comment about the 40-year averages. Complete breakdowns of growth and saving rates by decades are available in the Appendix country tables.

[36] In particular, the U.S. and Japan both fall last in the ranking if we deflate income by the CPI rather than the GDP deflator (see Appendix Table A165). Differences in total factor productivity (TFP) growth also appear to be relatively small for most countries. A more complete treatment of TFP growth variations across countries should also include differences in growth rates of work hours, human capital investment (such as higher education spendings), etc. It is far beyond the scope of the present work.

[37] Population growth in Japan over the 1970-2010 period appears to be relatively large (0.5%), but it is actually much higher in 1970-1990 (0.8%) than in 1990-2010 (0.2%). Japan is also the country with the largest fall in per capita growth rates, from 3.6% in 1970-1990 to 0.5% in 1990-2010. See Appendix Table JP.3.

Australia). In theory, one could imagine that low population growth, aging countries have higher saving rate, because they need to accumulate more wealth for their old days. Maybe it is not a coincidence if the two countries with the highest private saving rate (Japan and Italy) also have low population growth. In practice, however, the negative relationship between population growth and saving rates is weak. Countries like Canada and Australia have both higher population growth and higher saving rates than countries like the U.K. and the U.S. Saving rates seem to vary for all sorts of reasons other than life-cycle motives. They might also reflect differences in tastes for saving and/or wealth accumulation and transmission,[38] as well as differences in psychological perceptions of the need for saving (i.e. different levels of trust and confidence in the future).[39]

In brief: as a first approximation, productivity growth is the same everywhere in the rich world, but fertility decisions, migration policy and saving behavior vary widely and are largely unrelated to one another. This potentially creates a lot of room for wide, multi-dimensional variations in wealth-income ratios $\beta = s/g$.

C Basic decomposition: volume vs. price effects

We now present our basic decomposition results. The key finding is that capital gains account for a significant part of the total 1970-2010 increase in β – about 40% on average according to our preferred specifications – but that a large part of the increase in β would have still occurred without capital gains – about 60% on average. Given the values taken by s and g over the 1970-2010 period, and given the steady-state formula $\beta = s/g$, the wealth-income ratios β observed in 1970 were too low and had to increase. The rise in β in rich countries over the past decades, therefore, is more than a bubble. It reflects structural forces that would also apply in any one-good model.

We start with additive and multiplicative decomposition of private wealth accumulation (Table 3). Take the U.S. case. Private wealth was equal to 342% of national income in 1970, and is equal to 410% of national income in 2010. U.S.

[38] See, e.g., Hayashi (1986) on Japanese tastes for bequest.

[39] If we plot saving rates against growth rates at a cross-country level, we find a weakly significant negative relationship for private saving, and no relationship at all for national (private plus government) saving. See Appendix Figures A122 and A123.

national income has been multiplied by about 3 over this 40 years period, so that the initial 1970 private wealth stock represents only 113% of 2010 national income. That is, in the absence of any new saving and real capital gain or loss, the private wealth-national income ratio would have fallen from 342% in 1970 to 113% in 2010. If we now sum up all 1970-2010 private saving flows, we obtain total cumulated savings that represent 236% of 2010 national income. We conclude that the residual capital gain is equal to 60% of 2010 national income. Cumulated new savings explain 80% of the accumulation of wealth in the U.S. between 1970 and 2010, while residual capital gains explain 20%.

In other countries, cumulated savings also generally explain around 80-90% of 1970-2010 private wealth accumulation: 93% in Japan, 78% in France, 85% in Italy and 92% in Canada. In all these countries, there seems to be slightly too little saving to fully account for the observed accumulation of wealth – but the gap is small. There are exceptions, however. In Germany, cumulated savings represent 116% of observed wealth accumulation: there seems to be too much measured savings or too little observed wealth. In Australia, and even more so in the U.K., it is the opposite: savings are too small to explain the observed wealth accumulation.[40] The multiplicative decompositions – which put similar weight on each year – yield similar conclusions.

The reader should have in mind that a substantial fraction of private saving takes the form of corporate retained earnings (Table 4), in particular because of tax considerations that vary across countries.[41] If we were to omit retained earnings from the private wealth accumulation equation, then personal savings alone would be far too small to explain the observed evolution of the wealth-income ratios of many countries. We would find very large residual capital gains.[42] Such capital gains, however, would be spurious, in the sense that they correspond to the accumulation of earnings retained within corporations in order to finance new investment (thereby leading to rising stock prices), rather than to a true relative

[40] The U.K. case is particularly striking. With a private saving rate equal to 7.3% over the 1970-2010 period, and a growth rate rate equal to 2.2%, private wealth should be much less than 500% of national income in 2010. We discuss the various possible explanations below.

[41] Retained earnings and the ensuing capital gains are generally less taxed than dividend payments.

[42] See Appendix Table A105.

price effect.

Although savings usually explain 80-90% of the total accumulation of private wealth between 1970 and 2010, this result does not mean that savings explain 80-90% of the rise in the wealth-income ratio. The fraction of the 1970-2010 rise of the ratio that can be accounted for by saving alone varies widely between countries (e.g. it is very large for Japan, and it is much smaller for the U.S.), and is on average of the order of 60%.[43]

D Private wealth vs. national wealth

We now move from private to national wealth accumulation. In recent decades, a significant part of private saving in rich countries has been absorbed by negative government saving (i.e., government deficits that are larger than government investment). As a consequence, national saving rates are in most countries significantly smaller than private saving rates (see Table 4).

Since government saving has been negative, it is not surprising to see that net government wealth – which in rich countries has always been relatively small as compared to private wealth – has significantly declined since 1970 (Figure 5). This is due both to privatization policies – leading to a reduction in government assets – and to the gradual increase in public debt.

In the U.S., as well as in Germany, France, and the U.K., net government wealth was around 50%-100% of national income in the 1970s-1980s, and is now close to zero. In Italy, net government wealth became negative in the early 1980s, and is now below -50%; in Japan, it was historically larger – up to about 100% of national income in 1990 – but fell sharply during the 1990s-2000s and is now close to zero. In Canada, the government turned strongly negative in the late 1980s – with a trough of -60% in 1995, like Italy in 2010 – but is now back to zero. Australia is the only country in our sample with persistently and significantly positive net government wealth.

Although there are data imperfections, the fall in government wealth definitely appears to be quantitatively much smaller than the rise of private wealth. As a

[43]See Appendix Table A.104. More on this below.

result, national wealth – the sum of private and government wealth – has increased a lot, from 250-400% of national income in 1970 to 400-650% in 2010 (Figure 6). E.g. in Italy, net governement wealth fell by the equivalent of about one year of national income, but net private wealth rose by over four years of national income, so that national wealth increased by the equivalent of over three years of national income.

Table 5 presents our results on the decomposition of 1970-2010 national wealth accumulation. Saving flows still account for the vast majority of wealth accumulation, but the fit is less good than for private wealth. E.g. in the U.S., savings account for 88% of total private wealth growth in the multiplicative model (Table 3), but for only 72% of national wealth growth (Table 5).[44]

The "excess wealth" phenomenon – too much 2010 national wealth given 1970-2010 saving flows – is particularly important in four countries: the U.K., France, Italy and Australia. One explanation might be that national savings are substantially under-estimated because they do not include research and development expenditure. However, even after we include generous estimates of R&D expenditure in saving flows, in many countries the 2010 observed levels of national wealth are significantly larger than those predicted by 1970 wealth levels and 1970-2010 saving flows alone (Figure 7a).[45] On average, in our preferred specification (national wealth accumulation, with R&D expenditure included in saving), about 60% of the 1970-2010 rise of the wealth-income ratio can be accounted for by saving flows, while about 40% corresponds to capital gains.[46] Take the case of France: predicted national wealth in 2010 – on the basis of 1970 initial national wealth and cumulated 1970-2010 national saving including R&D – is equal to 491% of national income, while observed national wealth is equal to 605%. We have the equivalent of over 100% of national income in "excess wealth".

[44]Here we only show the multiplicative decompositions. Additive decompositions are in Appendix Table A101.

[45]R&D has been included in investment in the latest SNA guidelines (2008), but this change has so far only been implemented in Australia. The computations reported in Figures 7a-7b include generous estimates of R&D investment based on the level of R&D expenditure observed in the U.S. in the 1970-2010 period (see Appendix A.5.2 for a detailed discussion).

[46]See Appendix A.5.2 and Appendix Table A.99.

E Discussion of results

How can we account for the excess wealth phenomenon in most rich countries?

First, saving flows might be under-estimated for reasons other than R&D. Given the limitations of national accounts (in particular regarding the measurement of depreciation), this possibility certainly cannot completely be ruled out.[47] One would need, however, large and systematic errors to account for the amount of excess wealth we find.

Second, we might somewhat underestimate the value of public assets at the beginning of the period in countries like the U.K., France and Italy. According to this explanation, part of the "excess wealth" simply corresponds to the fact that private agents have acquired privatized assets at relatively cheap prices. From the viewpoint of households this is indeed a capital gain, but from a national wealth perspective it is a pure transfer from public to private hands, and it should be neutralized by raising the level of 1970 wealth. Whenever possible, we have attempted to count government assets at equivalent market values throughout the period (including in 1970), but we might still under-estimate 1970 government wealth levels.

In our view, the main explanation for the "excess wealth" phenomenon is a large rise in relative asset prices. As we shall see below, rising asset prices – both housing and stock market prices – in the U.K. and France since the 1970s-1980s can themselves be understood as the outcome of a long term asset price recovery. Asset prices fell substantially during the 1910-1950 period, and have been rising regularly ever since 1950. Although the recovery of asset prices provides a plausible explanation for the "excess wealth" phenomenon, there may have been some overshooting, particularly in housing prices. Given that the four main "excess wealth" countries – UK, France, Italy, Australia – have by far the largest level of housing wealth in our sample (over 300% of national income in 2010, a level that was only attained by Japan around 1990), it is indeed tempting to conclude that part of the capital gains we measure owe to abnormally high real estate prices in 2010.

To a large extent, the housing bubble explanation for the rise of wealth-income ratios is complementary to the real explanation. In countries like France and Italy,

[47] Appendix Section A.1.2 discusses issues in the measurement of depreciation.

savings are sufficiently large relative to growth to generate a significant increase in the wealth-income ratio. If in addition households in these countries have a particularly strong taste for domestic assets like real estate (and/or do not want to diversify their portfolio internationally as much as they could) then maybe it is not too surprising if this generates high upward pressure on housing prices.

In Germany, we have a phenomenon opposite to that of "excess wealth." Given the relatively large saving flows and low growth rates in 1970-2010, we should observe more wealth in 2010 than 400% of national income. According to our estimates, "missing wealth" in Germany is of the order of 50-100% of national income (Figure 7a). German statisticians might over-estimate saving and investment flows, or under-estimate the current stock of private wealth, or both.

Yet another possibility is that Germany has not experienced any asset price recovery so far because the German legal system still today gives important control rights over private assets to stakeholders other than private property owners. Rent controls, for instance, may have prevented the market value of real estate from increasing as much as in other countries. Voting rights granted to employee representatives in corporate boards may similarly reduce the market value of corporations.[48] Germans might also have less taste for expensive capital goods (particularly housing goods) than the French, the British and the Italians, maybe because they have less taste for living in a large centralized capital city and prefer a more polycentric country, for historical and cultural reasons. With the data we have at our disposal, we are not able to put a precise number on each explanation.

Last, it is worth noting that when we compute a European average wealth accumulation equation – by taking a weighted average of Germany, France, U.K. and Italy – then the "excess wealth" phenomenon largely disappears (Figure 7b). Europe as a whole has less residual capital gains than the U.K., France, and Italy (thanks to Germany). Had we regional U.S. balance sheets at our disposal, maybe we would find regional asset price variations within the U.S. that would not be too

[48] Whether this is good or bad for productive efficiency is a complex issue which we do not address in this paper (at first sight, low equity values do not seem to prevent German firms from producing good products). In this "stakeholder" view of the firm, the market value of corporations can be interpreted as the value for capital owners, while the book value can be interpreted as the value for all stakeholders. Both views have their merits. See Appendix for further discussion.

different from those we find in Europe. So one possibility is that substantial relative asset price movements happens permanently within relatively small national or regional economic units, but tend to correct themselves at more aggregate levels. German asset prices might rise in the near future and fall in other European countries.

F Domestic capital vs. foreign wealth

So far we analyzed the accumulation of aggregate private and national wealth, without paying attention to the composition of wealth portfolios, and in particular irrespective of whether wealth is invested domestically or abroad. National wealth, as we have seen, can be written as the sum of domestic capital and net foreign wealth.[49] The basic fact to have in mind is that net foreign wealth – whether positive or negative – has been a relatively small part of national wealth in rich countries throughout the 1970-2010 period (see Figure 6).

Despite this fact, external wealth has turned out to play an important role in the general evolution of wealth-income ratios. First, Japan and Germany have accumulated sizable positive net foreign positions in the 1990s-2000s, due to their large trade surpluses. In the early 2010s, both countries own the equivalent of between 40% and 70% of national income in net foreign assets. Although Japan's and Germany's net foreign positions are still substantially smaller than the positions reached by the U.K. and France around 1900-1910, they are starting to be substantial. And the German position is rising fast. As a result, in Japan and Germany, the rise in net foreign assets represents between one quarter and one third of the total rise of the national wealth-national income ratio (Table 6a). In most of the other countries in our database, by contrast, net foreign positions are currently slightly negative – typically between -10% and -30% of national income[50] – and have been declining.

[49] Remember that a country's net foreign wealth is equal to its gross foreign assets (assets owned by residents in the rest of the world) minus its gross foreign liabilities (domestic assets owned by rest-of-the-world residents). Domestic capital is national wealth minus net foreign wealth, i.e. is equal to the market value of all domestic capital assets located in the home country, whether they are owned by the personal, government, or corporate sector, or by the rest of the world (see below for a decomposition between housing and other capital goods).

[50] Australia and Spain, however, have large negative foreign position in the early 2010s (between -50% and -100% of national income).

As a result, the rise in the domestic capital-output ratio has been larger than the rise in the national wealth-income ratio. One caveat is that the official net foreign asset positions do not include the sizable assets held by a number of rich country residents in tax havens. In all likelihood, including these assets would turn the rich world's total net foreign asset position from slightly negative to slightly positive. The improvement would probably be particularly large for Europe (Zucman, 2013).

Second, there has been a huge rise in the gross foreign positions of countries since the 1970s. A significant share of each country's domestic capital is now owned by other countries. The rise in cross-border positions is highly significant everywhere – it is spectacular in Europe, a bit less so in the world's largest economies, the U.S. and Japan.[51] One implications is that capital gains and losses on foreign portfolios can be large and volatile over time and across countries. And indeed, we find that foreign portfolios have generated large capital gains in the U.S. (but also the U.K. and Australia) and significant capital losses in some other countries (Japan, Germany, France). Strikingly, in Germany virtually all capital losses at the national level can be attributed to foreign assets (Table 6b). In the U.S., net capital gains on cross-border portfolios represent one third of total capital gains at the national level, and the equivalent of the total rise in the U.S. national wealth-national income ratio since 1970.[52]

G Housing vs. other domestic capital goods

Last, we present decomposition results for housing versus other domestic capital assets.

The accumulation of housing wealth has played a large role in the total accumulation of domestic capital, but with significant variations between countries. In

[51] In 2010, gross assets held in France by the rest of the world amount to about 310% of national income, while gross assets held by French residents in the rest of the world amount to about 300% of national (hence a negative position of about -10%, in the official data). For the U.S., gross foreign assets amount to about 120% of national income, and gross liabilities to about 100% of national (hence a negative position equal to about -20%). For detailed series, see Appendix figures A39-A42.

[52] Our results on the net capital gains on U.S. external wealth are consistent with the findings of Gourinchas and Rey (2007). What we add to this line of work is a global macro perspective that includes the accumulation of both domestic and foreign capital. Note that we include all "other volume changes" in saving flows. We provide detailed accumulation results isolating saving, "other volume changes", and capital gains in the country-specific tables of the Appendix.

the U.K., France and Italy, the rise in domestic capital-national income ratios (or domestic capital-output ratios) is almost entirely due to the rise of housing (Table 7). In Japan, housing represents less than half of the total rise of domestic capital – and an even smaller proportion of the total rise of national wealth, given the large accumulation of net foreign assets.[53]

In most countries, other domestic capital goods have also contributed to the rise of national wealth, in particular because their market value has tended to increase. Tobin's Q ratios between market and book value of corporations were much below 1 in the 1970s and are closer to 1 (and at times above 1) in the 1990s-2000s.[54] But there are again interesting cross-country variations. Tobin's Q is very low in Germany: is has remained well below 1 (typically around 0.5), contrary to the U.K. and the U.S. One interpretation is the "stakeholder effect" described above: shareholders of German companies do not have full control of company assets – in effect they share their voting rights with workers' representatives and sometime regional governments – which might push Q below 1.[55] Yet another possibility is that some of the variations in Q reflect data limitations. Quite puzzlingly, indeed, in most countries Q appears to be structurally below 1, despite the fact that intangible capital is imperfectly accounted for, which in principle should push it above 1. Part of the explanation may be that the book-value of corporations – corporate assets as measured by statisticians using the perpetual inventory method – tends to be over-estimated in national accounts.[56] This is another area in which existing statistics might need to be improved.

[53] One caveat is that the frontier between housing and other capital goods is not always entirely clear. Sometimes the same buildings are reallocated between housing and offices, and housing services can be provided by hotels and real estate companies. Also, the various countries do not always use the same methods and concepts (e.g., in Japan, tenant-occupied housing is partly counted in other domestic capital, and we could not fully correct for this). This is definitely are area where progress still needs to be made. Appendix A.9 pinpoints the key areas in which we believe national accounts could be improved.

[54] See Appendix Figure A92. Note, however, that because of the general increase in corporate capital, book-value national wealth (expressed as a fraction of national income) has increased almost as much as market-value national wealth (see Appendix figure A25).

[55] In Germany, book-value national wealth is substantially above market-value national wealth (about 5 years of national income instead of 4 years). The opposite occurs in the U.K.

[56] See the detailed discussion in Appendix A.1.2 and A.2.1.

5 Wealth-income ratios in rich countries 1870-2010

It is impossible to properly understand the rise of wealth-income ratios in rich countries in the recent decades without putting the 1970-2010 period into a longer historical perspective. As we have seen, a significant part of the rise of β since the 1970s is due to capital gains: about 40% on average, with large differences between countries. The key question is the following: is this due to a structural, long-run rise in the relative price of assets (caused for instance by uneven technical progress), or is it a recovery effect? Our conclusion is that it is mostly a recovery effect. The capital gains observed during the 1970-2010 largely seem to compensate the capital losses observed during earlier parts of the 20^{th} century.

We have reached this conclusion by analyzing the evolution of wealth-income ratios over the 1870-2010 period. Due to data limitations, our long term analysis is restricted to four countries: the U.S., the U.K., Germany and France. The key descriptive statistics are the following. For the three European countries, we find a similar U-shaped pattern: today's private wealth-national income ratios appear to be returning to the high values observed in 1870-1910, namely about 600%-700% (Figure 2 above). For the U.S., the U-shaped pattern is much less strong (Figure 4 above). In addition, European public wealth-national income ratios have followed an inverted U-curve over the past century.[57] But the magnitude of the pattern for public wealth is very limited compared to the U-shape evolution of private wealth, so that European national wealth-income ratios are strongly U-shaped too. Last, in 1900-1910, European countries held a very large positive net foreign asset position – around 100% of national income on average. Interestingly, the net foreign position of Europe has again turned (slightly) positive in 2000-2010, when the national wealth-income ratio again exceeded that of the U.S. (Figure 8).

Starting from this set of facts, and using the best historical estimates of saving and growth rates, we have estimated detailed wealth accumulation equations over

[57] Net public wealth was significantly positive (around 100% of national income) during the 1950s-1970s, due to large public assets and low debt. Since then, public wealth has returned to the low level observed on the eve of World War 1.

the 1870-2010 period. As Table 8 shows, the total accumulation of national wealth over this 140-year-long period seems to be well accounted for by saving flows. In order to fully reconcile the stock and flow data, we need a small residual capital gain for the U.S., France and the U.K., and a small residual capital loss for Germany. But in all cases saving flows account for the bulk of wealth accumulation: capital gains seem to wash out in the long run.[58]

Looking at each sub-period, we find in every European country a strong U-shaped relative capital price effect. In the U.K., for example, we find a negative rate of real capital losses equal to -1.9% per year between 1910 and 1950, followed by real gains of +0.9% per year between 1950 and 1980 and 2.4% between 1980 and 2010 (Table 9). The pattern is similar for France. In these two countries, there seems to have been a slight over-shooting in the recovery process, in the sense that the total cumulated relative asset price effect over the 1910-2010 period appears to be somewhat positive (+0.2% per year in the U.K., +0.3% in France). In Germany, by contrast, the recovery is yet too come (-0.8% between 1910 and 2010).

We emphasize that the imperfections of our data do not allow us to put a precise number on asset overvaluation or undervaluation in 2010. In any multi-sector model with uneven technical change between capital and consumption goods, one should expect capital gains and losses that could potentially vary between countries (for instance depending on comparative advantage). The residual capital gains/losses we estimate might also reflect measurement issues: 1870-2010 saving flows might be somewhat underestimated in the U.K. or France and overestimated in Germany. At a modest level, our point is simply that the one-good capital accumulation model seems to do a relatively good job in the long run, and that the stock and flow sides of historical national accounts are roughly consistent with one another – a result we already find quite remarkable.

Table 10 provides a detailed decomposition of the huge decline in wealth-income ratios that occurred in Europe between 1910 and 1950. In the U.K., war destructions play a negligible role – an estimated 4% of the total decline in β. Low national

[58]These results are robust to a wide range of specifications. Appendix Tables A108 to A137 present the complete decomposition results, for each country and sector of the economy, for both the additive and multiplicative models.

saving during this period accounts for 46% of the fall in β and negative valuation effects (including losses on foreign portfolios) for the remaining 50%. In France and Germany, cumulated physical war destructions account for respectively 27% and 25% of the fall in β. Low national saving and real capital losses explain about half of the remaining three quarters. Interestingly, the private wealth-national income ratio has declined less in the U.K. than in France and Germany between 1910 and 1950, but the reverse holds for the national wealth-income ratio (due to the large negative U.K. public wealth around 1950).[59]

The U.S. case is again fairly different from that of Europe. The fall of β during the 1910-1950 period was more modest, and so was the recovery during the 1950-2010 period. Regarding capital gains, we find in every sub-period a small but positive relative price effect. As was already noted above, the capital gain effect becomes bigger in the recent decades and largely derives from the U.S. foreign portfolio – it seems too big to be accounted for by underestimated saving and investment flows.

6 The changing nature of national wealth, 1700-2010

A The changing nature of wealth in Old Europe

What do we know about the evolution of wealth-income ratios prior to 1870? In the U.K. – the country with the most comprehensive historical balance sheets – the national wealth-national income ratios appears to have been approximately stable during the 18^{th} and 19^{th} centuries – around 600-700%, or possibly somewhat higher (Figure 3 above). In France, where a large number of national wealth estimates were also established during those two centuries, the picture is similar (Figure 9).

We should make clear that the raw data sources available for the 18^{th}-19^{th} centuries are insufficient to precisely compare the levels of wealth-income ratios between the two countries or between the various sub-periods. But the general pattern def-

[59] U.K. net public wealth then turned positive during the 1950s-1960s. See Appendix figure A16 and A22.

initely seems to be robust. All available estimates, coming from many different authors using independent methodologies, provide the same orders of magnitude. National wealth always seems to be between 6 and 8 years of national income (usually around 7 years) from 1700 to 1914 in two countries, with no obvious trend in the long run.

Strikingly, the wealth-income ratio around 2010 is now relatively close to what it was in the 18^{th} centuries in both the U.K. and France, in spite of considerable changes in the nature of wealth. The general picture is relatively straightforward. The value of agricultural land – including land improvement of all sorts – was between 4 and 5 years of national income in the U.K. and the France in the early 18^{th} centuries, and is now less than 10% national income in both countries. But land has been replaced by other forms of capital – housing and other domestic capital (offices, machines, patents, etc.) – to such an extent that the wealth-income ratio appears to be almost as high today as three hundred years ago. In the long run, the decline of the share of agricultural land in national capital mirrors that of the share of agriculture in national income, from over two thirds in the 18^{th} century to a few percent today – with a faster and earlier historical decline in the U.K. The huge variations in the share of net foreign assets in national wealth are also striking. Net foreign assets were virtually zero in the 18^{th} century. They reached very high levels in the late 19^{th} and early 20^{th} century – almost 2 years of national income in the U.K. around 1910, over 1 year in France. Following the wars and the collapse of the British and French colonial empires, they came back to virtually zero around 1950.

Why is it that wealth-income ratios were so high in the 18^{th}-19^{th} centuries, and why do they seem to be approaching these levels again in the 21^{st} century? A natural explanation lies in the $\beta = s/g$ steady-state formula. With slow growth, even moderate saving rates naturally lead to large wealth-income ratios. Growth was low until the 18^{th}-19^{th} centuries, and is likely to be low again in the 21^{st} century as population growth vanishes, thereby potentially generating high wealth-income ratios again.

This is probably an important part of the explanation. Unfortunately, data limitations make it difficult to evaluate the exact role played by alternative explanations, such as structural capital gains and losses and changes in the value of natural resources (un-accumulated wealth).

The main difficulty is that pre-1870 estimates of saving and investment flows appear to be too fragile to be used in wealth accumulation decompositions. Also, with very low growth – annual growth rates were typically much less than 1% until the 18^{th} century – it is clear than any small error in the net-of-depreciation saving rate s can make a huge difference in terms of predicted steady-state wealth-income ratio $\beta = s/g$. In preindustrial societies where $g \approx 0.5 - 1\%$, whether the net saving rate is $s = 5\%$ or $s = 8\%$ is going to matter a lot. Historical estimates suggest that there was substantial investment going on in traditional societies, including in the rural sector. Annual spendings on land improvement (drainage, irrigation, afforestation etc.) alone could be as large as 3-4% of national income. This suggests that a large fraction of total agricultural land value in 18^{th} century U.K. and France actually derived from past investment. In all likelihood, the "pure land value" (i.e., the value of the pure natural resource brought by land, before any investment or improvement, as it was discovered thousands of years ago, at prehistoric times) was much less than 4 years of national income. Some estimates made in the 18^{th} century tend to suggest that it was around 1 year of national income.[60] Saving and investment series are unfortunately not sufficiently reliable to definitively address the question. The residual "pure land" value could be less than 0.5 year, or up to 2 years of national income.

B The nature of wealth: Old Europe vs. the New World

In order to make some progress on this question, it is useful to compare the value of land in Old Europe (U.K., France, Germany) and in the New World. For the U.S., we have put together historical balance sheets starting around 1770 (Figure 10). The robust finding, which we also obtain with Canada, is that the value of agricultural land in the late 18^{th} and early 19^{th} centuries is much less in the

[60] See in particular the famous estimates by Thomas Paine (1795), who proposed to the French National Assembly to confiscate the "pure land" component of inheritance, which he estimated to be about 1 year of national income. On saving and investment series covering the 18^{th}-19^{th} centuries, particularly for the U.K. and France, see data Appendix.

New World – 1 to 2 years of national income – than in Old Europe – 3 to 4 years.[61] Part of the explanation could well be lower accumulated investment and land improvement relative to economic and population growth in the New World (i.e., a lower cumulated s/g ratio).

However, available evidence suggests that the relatively low New World wealth-income ratios can also be explained by a "land abundance" effect. Land was so abundant in the New word that its price per acre was low. The right model to think about this effect involves a production function with an elasticity of substitution lower than 1 between land and labor – a necessary condition for the price effect to dominate the volume effect.

To see this, think of a two-good model of the form introduced in section 3.4 above. That is, assume that the capital good solely consists of land and is in fixed supply: $K_t = K_0$. For the sake of simplicity, assume that no land improvement is possible. The market value of land if given by $W = q \cdot K_0$, where q is the price of land relative to the consumption good. The production function $Y = F(K, L)$ transforms capital input (land) K and labor input L into output Y. Assume that $F(K, L)$ is a CES function with elasticity σ, and that there is zero productivity and population growth.

Consider two countries 0 and 1 with similar technology and preferences. Assume that country 1 (America) has more land relative to labor than country 0 (Old Europe): $K_1/L_1 > K_0/L_0$. Then one can easily see that country 1 will end up with lower land value (relative to income) than country 0 (i.e., $\beta_1 < \beta_0$, with $\beta_1 = W_1/Y_1 = q_1 \cdot K_1/Y_1$ and $\beta_0 = W_0/Y_0 = q_0 \cdot K_0/Y_0$) if and only if the elasticity of substitution σ is less than one. This result directly follows from the fact that the capital share α is smaller in country 1 than in country 0 if and only if the elasticity of substitution is less than one: $\alpha_1 = F_K \cdot K_1/Y_1 < \alpha_0 = F_K \cdot K_0/Y_0$ if and only if $\sigma < 1$. The capital share is lower in the land-abundant country. Under standard assumptions on preferences and equilibrium rates of return, this also implies that

[61] For the long run evolution of wealth composition in Germany and Canada, see Appendix figures A46 and A47. The German pattern is close to that of the U.K. and France (except that the net foreign asset position of Germany around 1900-1910 is less strongly positive than in the two colonial powers). The Canadian pattern is close to that of the U.S. (except that net foreign asset position is strongly negative throughout the 19^{th} century and much of the 20^{th} century).

land value is lower in the land-abundant country: $\beta_1 < \beta_0$.[62]

Intuitively, an elasticity of substitution $\sigma < 1$ means that there is not much that one can do with capital when there is too much of it. The marginal product of land falls to very low levels when a few million individuals own an entire continent. The price effect dominates the volume effect. It is exactly what one should expect to happen in a relatively low-tech economy where there is a limited set of things that one can do with capital. At the opposite extreme, in a high-tech economy where there are lots of alternative uses and forms for capital (a robot economy), it is natural to expect higher elasticities of substitution, either closer to 1 (Cobb-Douglas) or even larger than one (as we shall see below).

To summarize: part of the initial difference in β between Europe and America in the 18^{th}-19^{th} centuries seems to be due to a relative price effect (due to land abundance) rather than to a pure saving effect (via the $\beta = s/g$ formula). Both logic actually tend to reinforce each other: the lower land prices and higher wage rates attract labor to the New World, implying very large population growth rates and relatively low steady-state $\beta = s/g$ ratios.[63]

The lower land values prevailing in America during the 1770-1860 period were to some extent compensated by the slavery system. Land was so abundant that it was almost worthless, implying that it was difficult to be really rich by owning land. However, the landed elite could be rich and control a large share of national income by owning the labor force. In the extreme case where a tiny elite owns the entire labor force, the total value of the slave stock can in principle be very

[62] With a dynastic utility model, the rate of return is set by the rate of time preference ($r = \delta$), so that $\beta_1 = \alpha_1/r < \beta_2 = \alpha_2/r$. With a bequest-in-the-utility-function model $V(c,b) = c^{1-s}b^s$, then the wealth-income ratio is set by $\beta = s/(1-s)$ (see section 3.4 above), so that the difference in capital share entirely translates into a difference in rates of return: $r_1 = \alpha_1/\beta < r_2 = \alpha_2/\beta$. However to the extent that the interest elasticity of saving $s = s(r)$ is positive, this also implies $\beta_1 < \beta_2$. A similar intuition applies to the case with $V(c,b) = c^{1-s}\Delta b^s$ (assuming positive population or productivity growth so as to obtain a well-defined steady-state $\beta = s/g$).

[63] There is a large historical literature on the factor flows that characterized the 19^{th} Atlantic economy. In order to explain why both labor and capital flew to the New World, one needs to introduce a three-factor production function (see, e.g., Taylor and Williamson, 1994, and O'Rourke and Williamson, 2005). One could also argue that transatlantic differences in land value (rural, urban and suburban) still matter today. However they go together with different tastes over housing in city centers versus suburban areas, so that it is difficult to disentangle the various effects. The fact that the bulk of 1870-2010 wealth accumulation is well explained by volume effects – both in Europe and in the U.S. – suggests that today's differences in pure land values are less central than they used to be.

large, say as large as 20 years of national income (assuming the labor share is 100% of output and the rate of return is equal to 5%). In the case of antebellum U.S., the situation was less extreme, but the value of the slave stock was still highly significant. By putting together the best available estimates of slave prices and the number of slaves, we have come to the conclusion that the market value of slaves was between 1 and 2 years of national income for the entire U.S., and up to 3 years of income in Southern states. When we add up the value of slaves and the value of land, we obtain wealth-income ratios in the U.S. South which are relatively close to those of the Old World. Slaves approximately compensate the lower land values (Figures 11 and 12).

Needless to say, this peculiar form of wealth has little to do with "national" wealth and is better analyzed in terms of appropriation and power relationship than in terms of saving and accumulation. We view these "augmented" national balance sheets as a way to illustrate the ambiguous relationship of the New world with wealth and inequality. To some extent, America is the land of equal opportunity, i.e. the place where wealth accumulated in the past does not matter too much. But at the same time, America is also the place where a new form of wealth and class structure – arguably more extreme and violent than the class structure prevailing in Europe – flourished, whereby part of the population owned another part.[64]

7 Capital-output ratios vs. capital shares

So far we have mostly focused on the evolution of wealth-income and capital-output ratios. We now compare the long-run evolution of capital-output ratios and capital shares in order to briefly discuss the changing nature of technology and the pros and cons of the Cobb-Douglas approximation in the very long run.

The first basic fact is that capital shares did rise in rich countries during the 1970-2010 period, from about 15%-25% in the 1970s to 25%-35% in the 2000s-2010s, with large variations over time and across countries (Figure 13). However they did not rise as much as national wealth-national income and domestic capital-

[64] During the 1770-1860 period, slaves made as much as 15%-20% of total U.S. population (up to 40% in Southern states). See Appendix Table US.3b.

output ratios, so that the average of return to wealth – which can be computed as $r_t = \alpha_t/\beta_t$ – declined somewhat (Figure 14).[65] Of course, this decline is what one would expect in any model: when there is more capital, the rate of return to capital must go down. The interesting question is whether it falls more or less than the quantity of capital. According to our data it has fallen less, implying a rising capital share.

There are several ways to think about this piece of evidence. One can think of a model with imperfect competition and an increase in the bargaining power of capital (e.g., due to globalization and increasing capital mobility). One can also think of a production function with three factors – capital, high skill labor and low skill labor – where capital is more strongly complementary with skilled than with unskilled labor. With a rise in skills, and possibly with skill-biased technical change, it can easily generate a rising capital share.

Yet another – and more parsimonious – way to obtain the same result is a standard two-factor, CES production function $F(K, L)$ with an elasticity of substitution $\sigma > 1$.[66] Importantly, the elasticity does not need to be hugely superior to one in order to account for the observed trends. With an elasticity σ around 1.2-1.6, a doubling of capital-output ratio β can lead to a large rise in the capital share α. With large changes in β, one can obtain substantial movements in the capital share with a production function that is only moderately more flexible than the standard Cobb-Douglas function. For instance, with $\sigma = 1.5$, the capital share rises from $\alpha = 28\%$ to $\alpha = 36\%$ if the wealth-income ratio jumps from $\beta = 2.5$ to $\beta = 5$, which is roughly what has happened in rich countries since the 1970s. The capital share would reach $\alpha = 42\%$ in case further capital accumulation takes place and the wealth-income ratio attains $\beta = 8$. In case the production function becomes even more flexible over time (say, $\sigma = 1.8$), the capital share would then be as large as $\alpha = 53\%$.[67]

[65] The results are robust to the various ways of taking into account government capital and interest payment in these computations, which are discussed in Appendix A.7.5.

[66] Needless to say, one can also combine these various models. Karabarbounis and Neiman (2012) for instance use a model with both imperfect competition and an elasticity of substitution that is larger than one.

[67] In a perfectly competitive model with $Y = F(K, L) = (a \cdot K^{\frac{\sigma-1}{\sigma}} + (1-a) \cdot L^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}}$, the rate of return is given by $r = F_K = a \cdot \beta^{-1/\sigma}$ (with $\beta = K/Y$), and the capital share is given by $\alpha = r \cdot \beta = a \cdot \beta^{\frac{\sigma-1}{\sigma}}$. With $a = 0.21$ and $\sigma = 1.5$, α goes from 28% to 36% and 42% as β rises

We do not claim that this scenario will necessarily happen. Our point is simply that it cannot be excluded. Constant capital-output ratios and capital shares are more of a belief than a well-grounded fact. Capital-output ratios have no strong reason to stay constant: s and g vary for all sorts of reasons over time and across countries, so it is natural to expect $\beta = s/g$ to vary widely. Relatively small departures from standard Cobb-Douglas assumptions then imply that the capital share $\alpha = r \cdot \beta$ can also vary substantially.

In our view, it is natural to imagine that σ was possibly much less than 1 in the 18^{th}-19^{th} centuries and became significantly larger than 1 in the 20^{th}-21^{st} centuries. One expects a higher elasticity of substitution in more diversified economies where capital can take many forms.

If we now look at the very long run evolution of factor shares, there seems to be evidence – both in the U.K. and France – that the capital share was somewhat larger in the 18^{th}-19^{th} centuries (say, around 40%) than it is in the late 20^{th} and early 21^{st} century (say, around 30%). One possible interpretation is that the capital-output ratio β is still somewhat lower today than what it used to be in the distant past, and that the capital share α will slowly return to about 40% as β keeps increasing in the coming decades – consistent with an elasticity of substitution larger than 1. However, it could also be that the labor exponent in the production function has declined structurally since the 18^{th}-19^{th} centuries, because of the rise of human capital. Over time, human inputs may have become relatively more important than non-human capital inputs in the production process. With the data we have at our disposal, we are not able to say. The long-run U.K. and French data, however, suggest that if such a "rise of human capital" happened, it was probably relatively modest.

The fact that the capital share α was historically low in the mid-20^{th} century (when β was also low) can also be viewed as evidence for $\sigma > 1$. Indeed, α and β move in the same direction if $\sigma > 1$, and in opposite directions if $\sigma < 1$.

We stress that our discussion of capital shares and production functions should be viewed as merely exploratory and illustrative. In many ways, it is more difficult to measure capital shares α than wealth-income ratios β. The measurement of α

from 2.5 to 5 and 8. With $\sigma = 1.8$, α rises to 53% if $\beta = 8$.

– and therefore of the average rate of return $r = \alpha/\beta$ – is complicated by self-employment and tax optimization behavior of business owners (a growing concern in a number of countries), by the measurement of housing product (which is not fully homogenous internationally), and also by the problem of "informal" financial intermediation. National accounts deduct from the return to capital the costs of formal intermediation services (provided by banks and real estate agents), but do not deduct the time spent by capital owners to manage their portfolios, to spot the right investment opportunities, and so on. Such costs are difficult to measure, and might well vary over time. In particular, they might be larger in fast growing economies rather than in the stagnant, rural economies of the 18^{th} century. For this reason, we may tend to over-estimate average rates of return to capital when we compute them using national accounts capital income flow series (via the $r = \alpha/\beta$ formula), especially in high-growth economies. In this paper, we have tried to show that an alternative way to address the issue of the relative importance of capital and labor in the economy is to study the evolution of β rather than the evolution of α – which so far has been the focus of most of the attention. Ideally, both evolutions need to be analyzed together.

8 Directions for future research

Our analysis could be extended in various ways. First, it would be interesting to extend our study of wealth-income ratios at the world level. Throughout the 1870-2010 period, the top eight developed economies analyzed in this paper represent between one half and three quarters of world output. By making plausible assumptions about the evolution of other countries' wealth-income ratios, we have estimated the evolution of the world wealth-income ratio between 1870 and 2010. Unsurprisingly, we find a spectacular U-shaped pattern (Figure 16). Prior to World War 1, the world wealth-income ratio was high and rising. Europe made about half of world output around 1900-1910 and had a high wealth-income ratio; β was rising in the U.S. and other parts of the world. The world ratio then fell abruptly during the 1910-1950 period. According to our estimates, it has been recovering since then and is currently approaching its 1910 nadir. The exact levels are approximate, but the general shape appears to be robust.[68]

We also report on Figure 16 one possible evolution of the wealth-income ratio in 2010-2100. This projection is based upon specific and uncertain assumptions about the future. We take the projected population growth rates from the U.N. central scenario (with near zero or negative population growth pretty much everywhere after 2050, except in Africa). We assume rapid convergence of emerging countries (at current pace) and stabilization of per capita growth rates at relatively low levels in frontier economies (1.4%). Last, we assume that saving rates will stabilize around 10-12% of national income. If this happens, then the world wealth-income ratio β will keep rising to about 600-700% by 2070-2100, i.e. approximately the same level as Europe in the 18th-19th centuries. Needless to say, this is only one possible scenario. Much will depend on the evolution of fertility behavior, life expectancy, innovation, the shape of the production function ($\sigma > 1$ or < 1), and the various psychological and economic motives for saving.[69] Our bottom line is simply that with low growth there are strong and powerful economic forces pushing toward high wealth-income ratios in the global economy of the 21^{st} century, just like in the low growth societies of the past.

Next, it would be interesting to include individual-level wealth inequality in the analysis. In this paper, we have emphasized the importance of aggregate wealth-income ratios and net foreign wealth positions, i.e. inequality of wealth between countries. However there is evidence – for example from Forbes' global billionaires list – that the evolution of wealth inequality between individuals is also quite spectacular (possibly even more). Over the past 20-30 years, the very top of the world wealth distribution seems to have been rising at a rate that is substantially above that of average wealth – which is itself substantially above the growth rate of per capita income and output, given the rise in global β. One explanation could be that

[68] See Appendix Table A8 for the detailed computations and assumptions behind Figure 16. Note that the national wealth-national income ratio is less strongly U-shaped than the private wealth-national income ratio, due to the high level of global public assets in the 1950s-1970s.

[69] Private saving rates around s =10-12% are in line with what we observe in rich countries – particularly Europe and Japan – in recent decades, so it makes sense to use such values in our benchmark scenario. However if we include government dissaving then national saving rates in rich countries are substantially lower than 10-12% and are on a declining trend, see Appendix Figures A96 to A103. It is also possible that saving rates will eventually react more strongly than expected to a decline in rates of return.

growth slowdown can contribute to both a rise of the aggregate wealth-income ratio and to an increase of wealth inequality. Indeed, in any dynamic wealth accumulation model with heterogeneity and random multiplicative shocks, the steady-state variance and inverted Pareto coefficient is an increasing function of the $r - g$ differential between the net-of-tax rate of return and the growth rate of the economy (see, e.g., Atkinson, Piketty and Saez, 2011).

Last, we plan to extend the analysis presented here to investigate the evolution of the share of inherited wealth in aggregate wealth. The return of high wealth-income ratios does not necessarily imply the return of inherited wealth. In case wealth is distributed in a relatively egalitarian manner and mostly derives from lifecycle accumulation, then one can have high and rising β with no corresponding rise in inheritance. To see this, observe that the annual flow of inheritance, expressed as a proportion of national income, which we note b_{yt}, can be decomposed as the product of three terms: $b_{yt} = \mu_t \cdot m_t \cdot \beta_t$ (where β_t is the aggregate-wealth income ratio, m_t is the annual mortality rate, and μ_t is the ratio between average wealth at death and the average wealth of the living). With pure lifecycle wealth, $\mu_t = 0$, so that $b_{yt} = 0$, irrespective of how large β_t might be.

In the case of France, the long-run U-shaped pattern for the inheritance flow b_{yt} actually turns out to be even more spectacular than the U-shaped pattern observed for β_t, due to the fact that μ_t has also followed a marked U-curve. The relative wealth of the elderly was historically low in the postwar period, so that there was not much to inherit in the 1950s-1960s (Piketty, 2011). However this certainly does not imply that the same evolution applies everywhere. As we have seen, there are large variations in the quantity of wealth that different countries accumulate, so it is natural to expect large differences in the importance of inherited wealth.

The historical series available so far regarding the inheritance flow are too scarce to reach firm conclusions on this important issue. Existing estimates suggest that the French U-shaped pattern also applies to Germany (Schinke, 2012), and to a lesser extent to the U.K. (Atkinson, 2012) and the U.S. (see Piketty and Zucman, 2013, for a survey). Cross-country variations could be due to differences in pension systems and the share of private wealth that is annuitized and therefore non transmissible. From a theoretical perspective, however, it is unclear why there should be much crowding out between lifecycle wealth and transmissible wealth in an open economy: any extra pension wealth should be invested abroad. It could be that there are differences in tastes for wealth transmission across countries. Wealthy individuals in the U.K. and in the U.S. may have less taste for bequest than their French and German counterparts.[70] But there are also important data problems that could partly explain why the rise of the inheritance flow appears to be more limited in some countries than in others. Wealth surveys tend to vastly underestimate inheritance receipts, not to mention inter vivos gifts, which play a large role in the recent French and German evolution (and which can be properly measured only by using administrative data). All of this raises important challenges for future research.

[70] One can interpret the lower $\beta = s/g$ observed in the U.S. in terms of lower bequest taste: with higher population growth and the same bequest taste (per children) as in Europe, the U.S. should save more. However a significant part of U.S. population growth historically comes from migration, so this interpretation is certainly not fully accurate.

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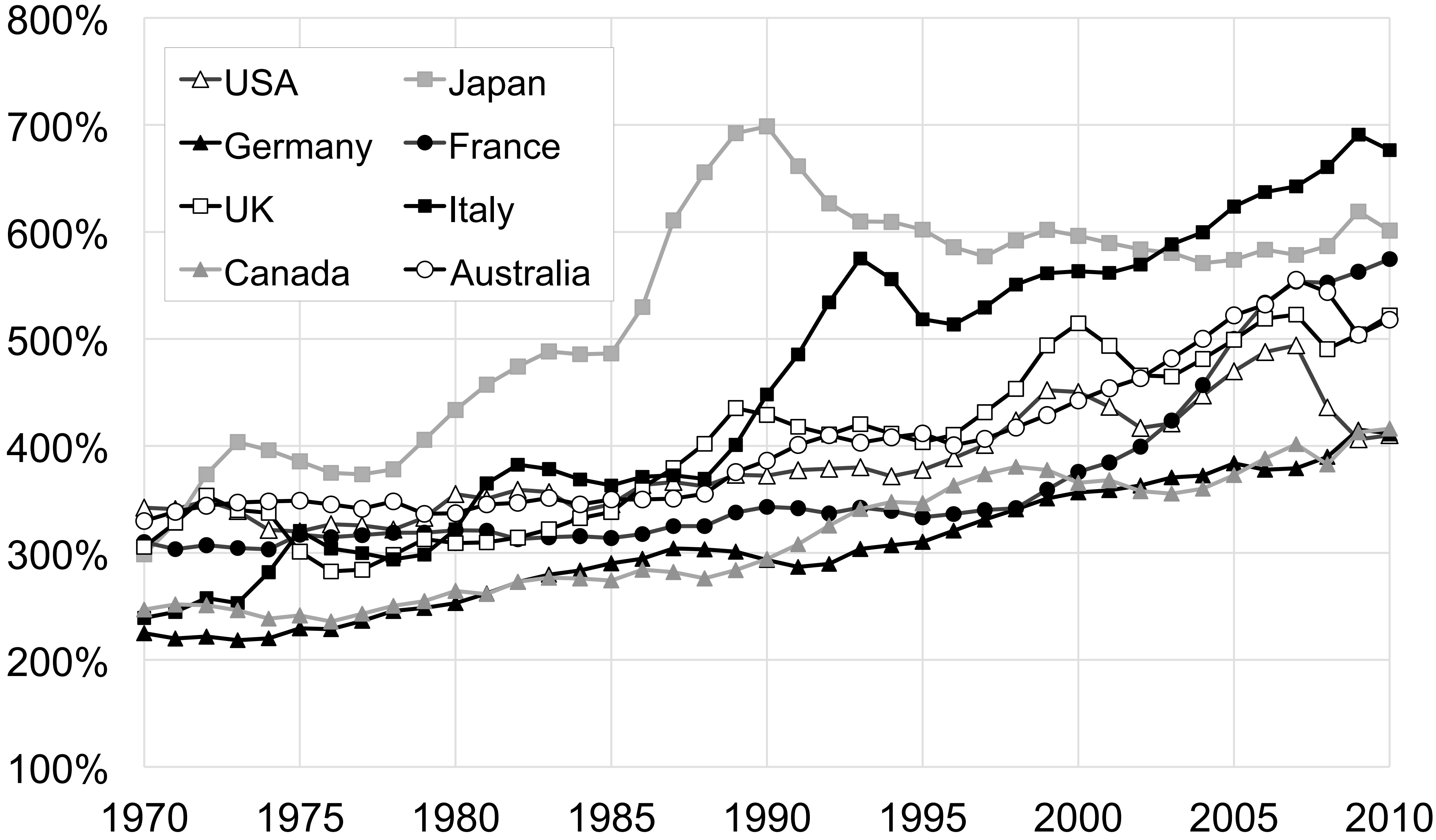
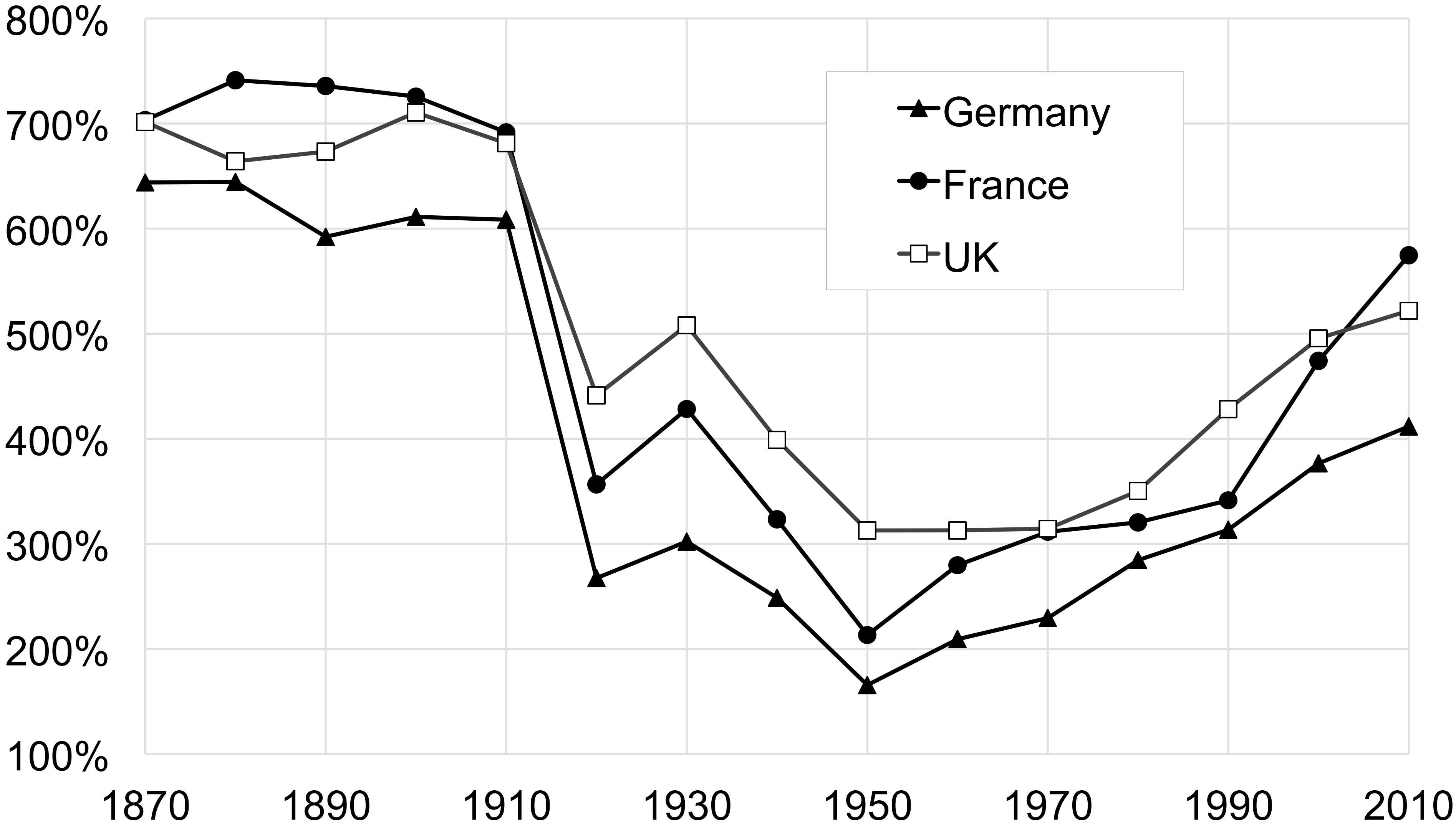
Figure 1: Private wealth / national income ratios 1970-2010



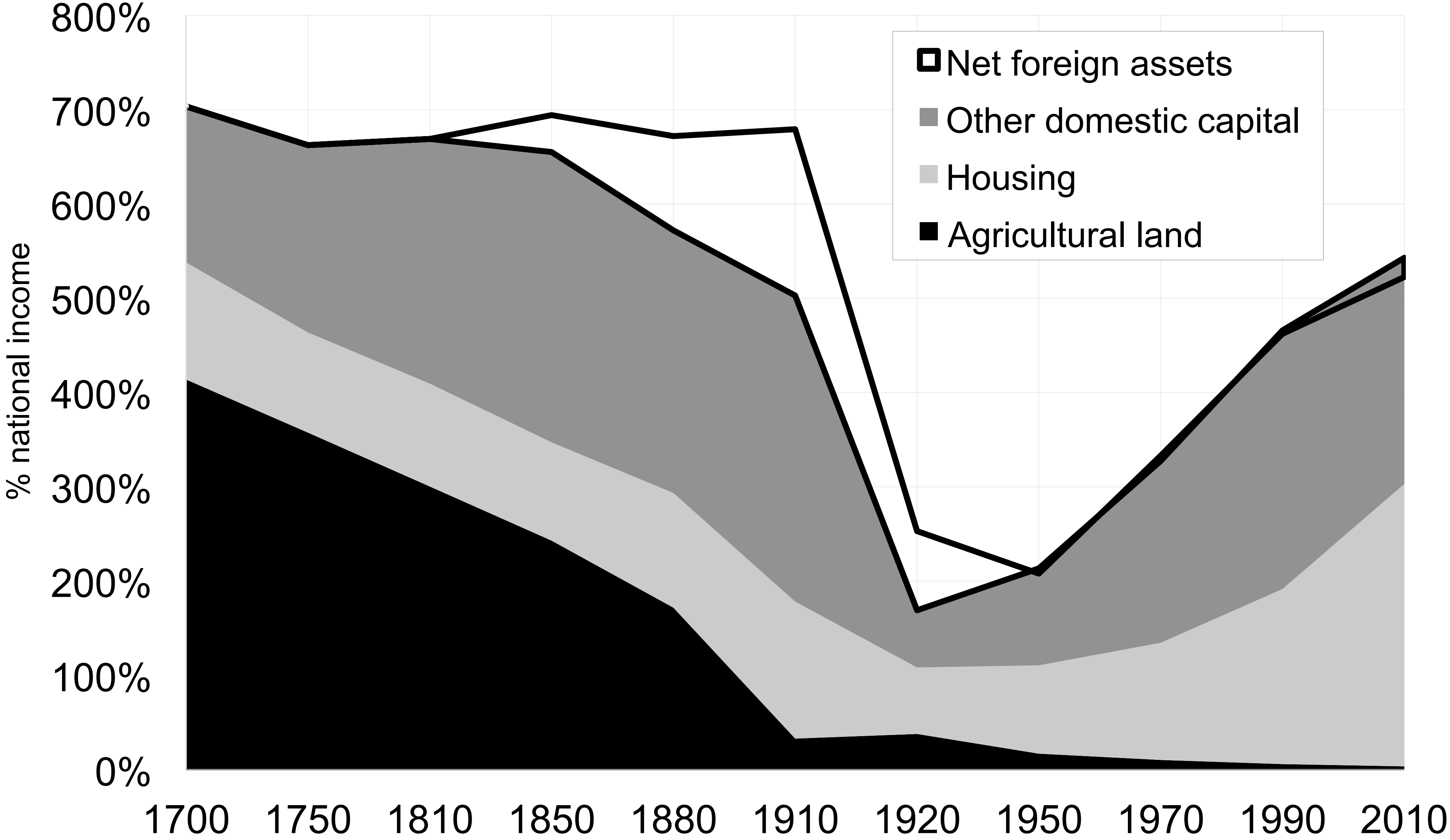
Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

Figure 2: Private wealth / national income ratios in Europe 1870-2010



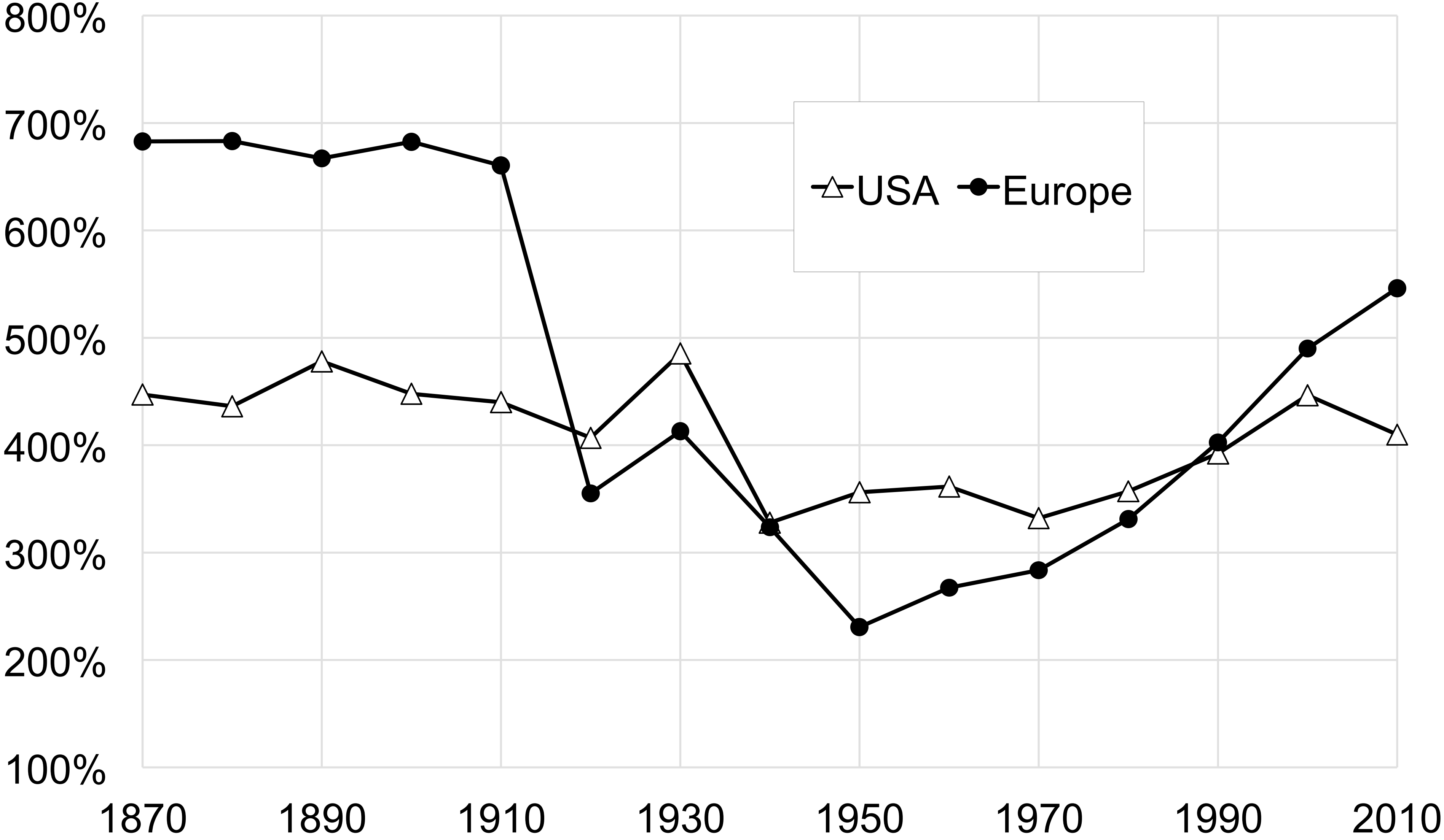
Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors). Data are decennial averages (1910-1913 averages for 1910)

Figure 3: The changing nature of national wealth: UK 1700-2010



National wealth = agricultural land + housing + other domestic capital goods + net foreign assets

Figure 4: Private wealth / national income ratios 1870-2010: Europe vs. USA



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors). Data are decennial averages (1910-1913 averages for Europe)

Figure 5: Private vs. governement wealth 1970-2010

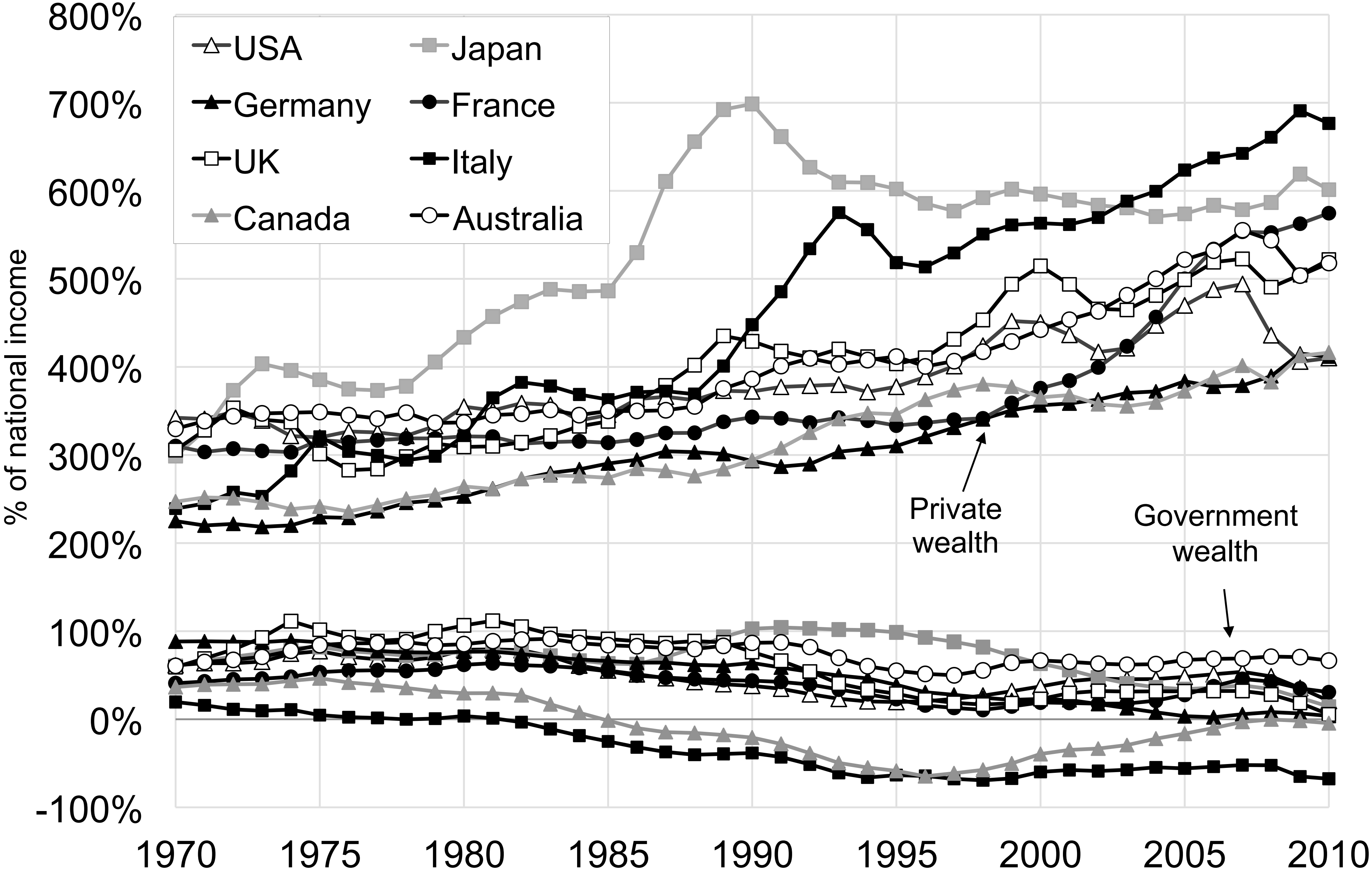
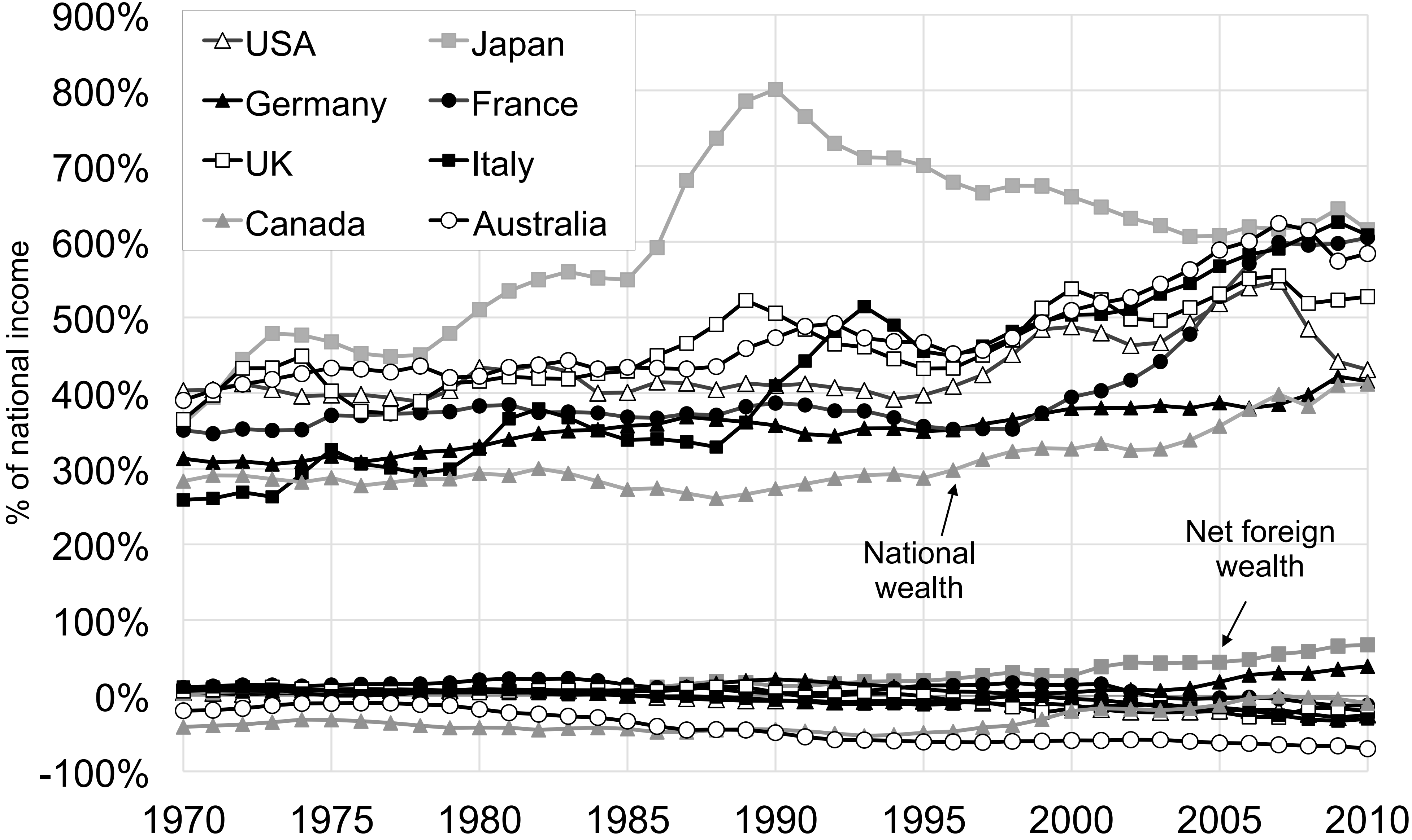


Figure 6: National vs. foreign wealth, 1970-2010



Authors' computations using country national accounts. Net foreign wealth = net foreign assets owned by country residents in rest of the world (all sectors)

Figure 7a: Observed vs. predicted national wealth / national income ratios (2010)

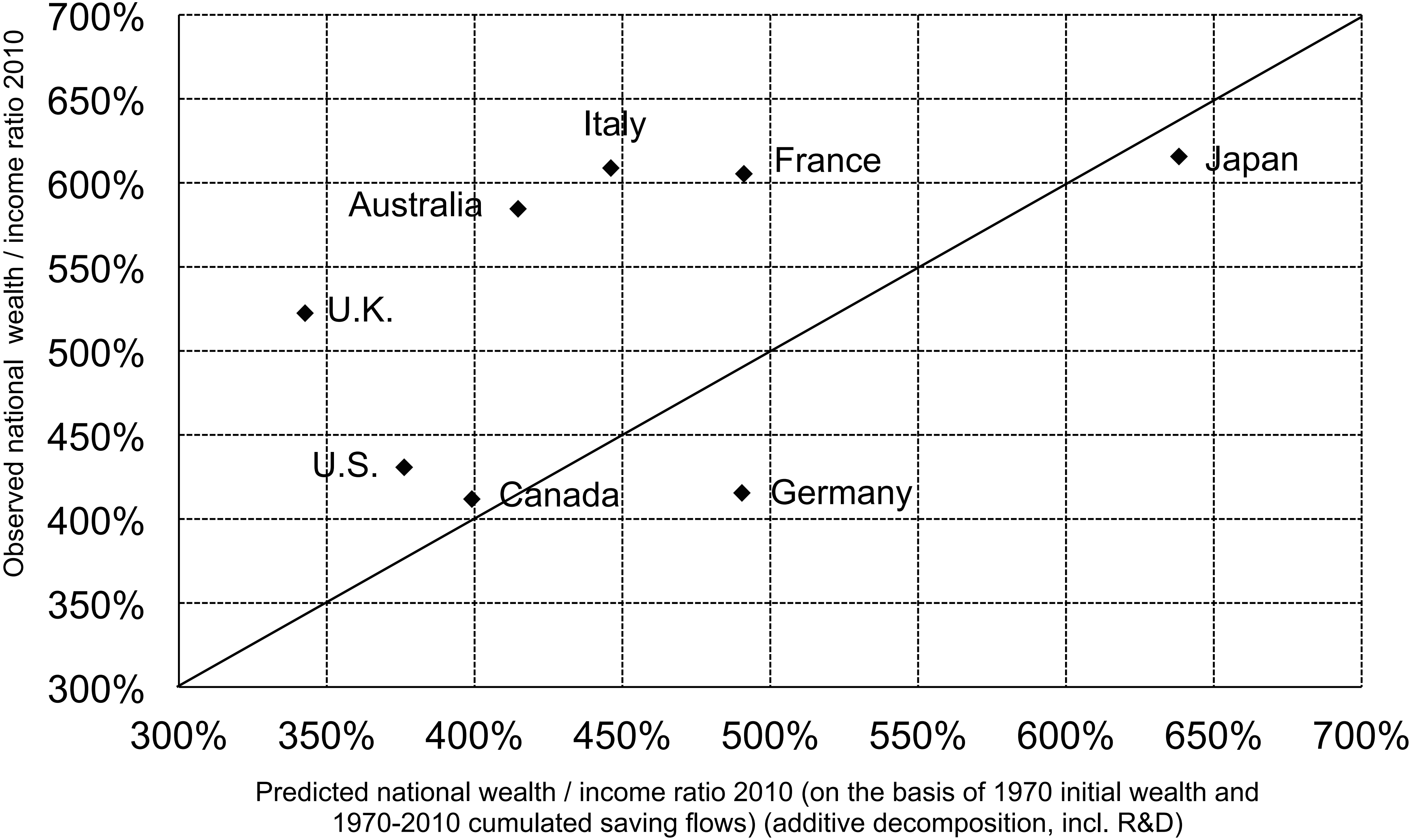


Figure 7b: Observed vs. predicted national wealth / national income ratios (2010)

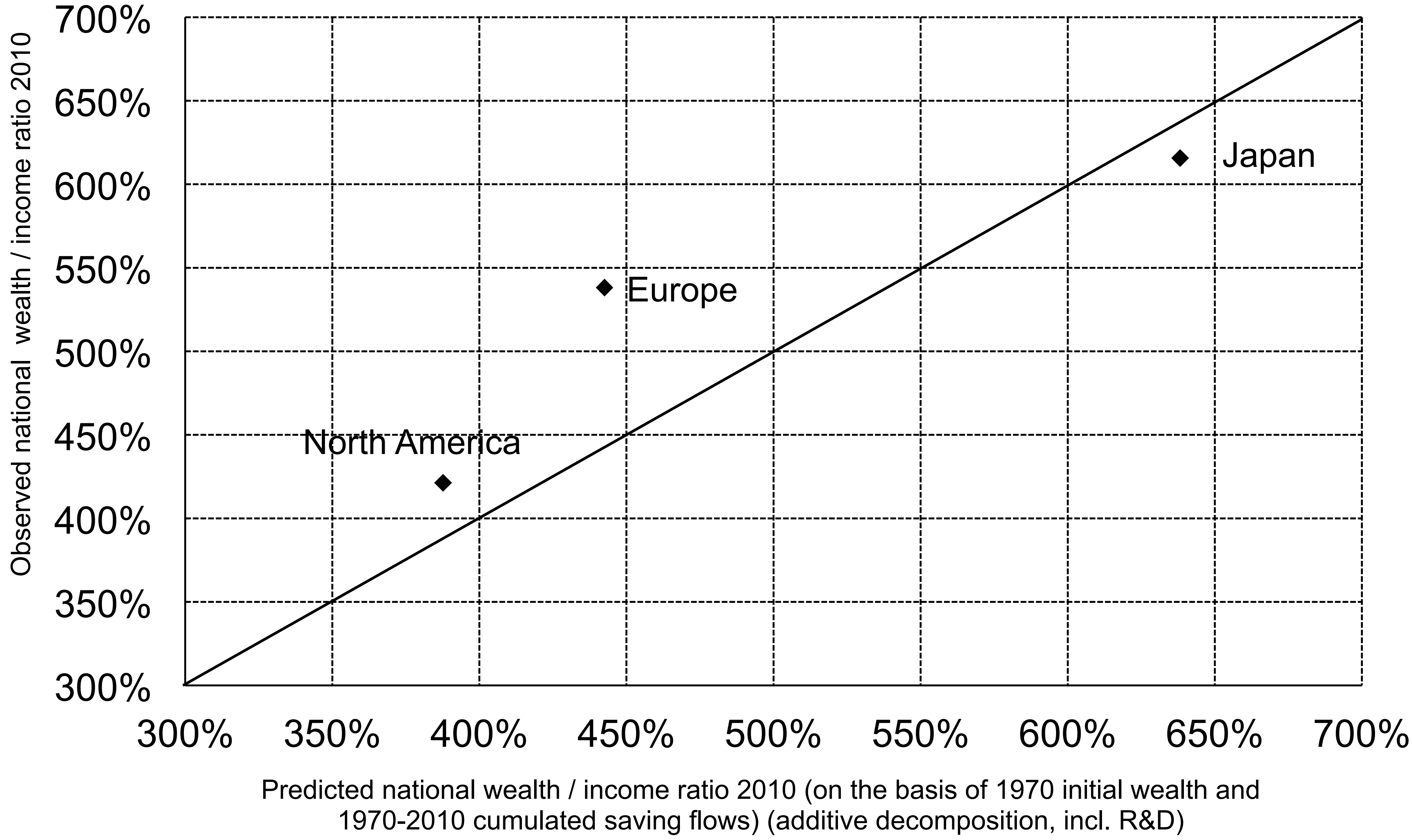


Figure 8: National and foreign wealth 1870-2010: Europe vs. USA

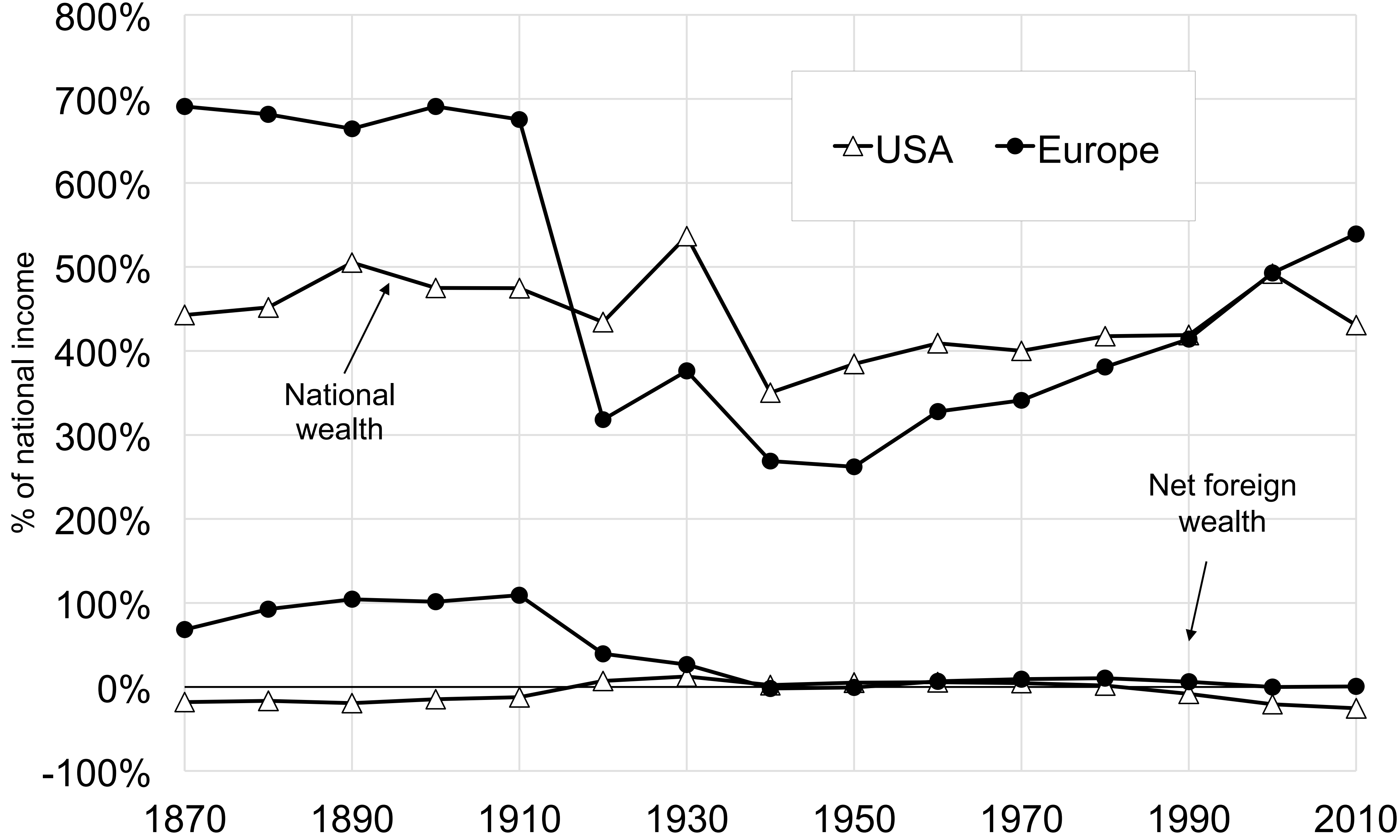
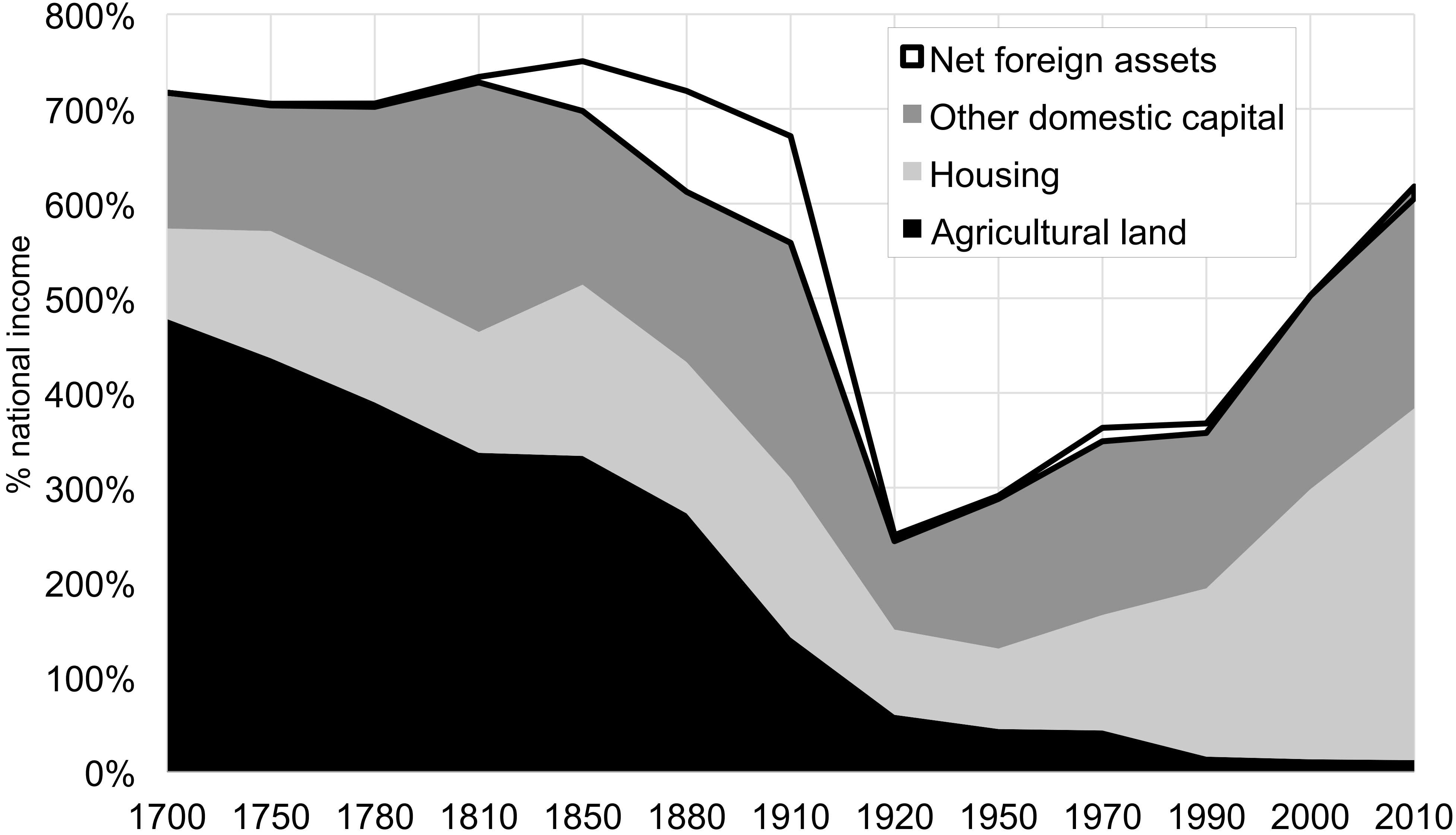
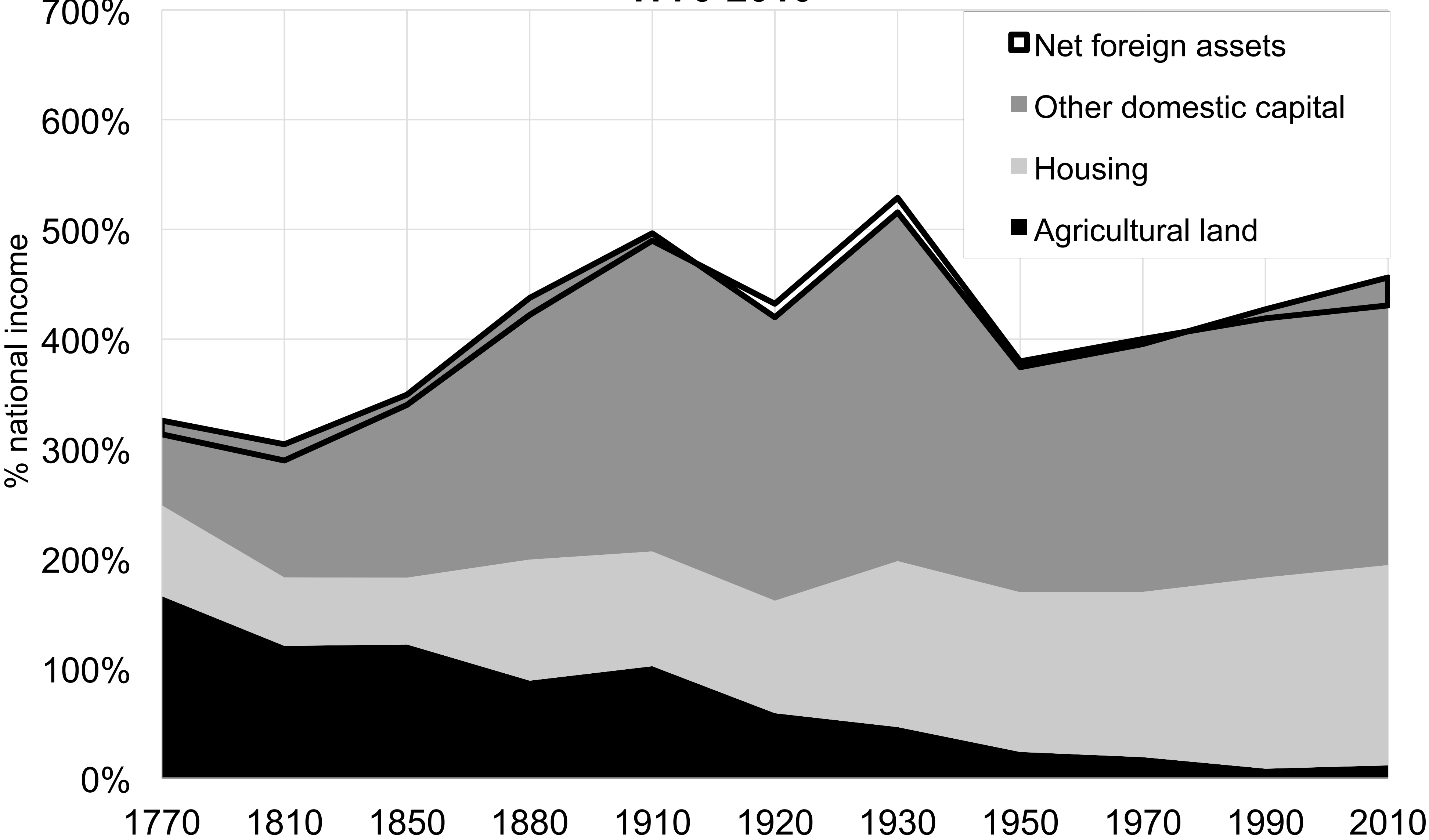


Figure 9: The changing nature of national wealth: France 1700-2010



National wealth = agricultural land + housing + other domestic capital goods + net foreign assets

Figure 10: The changing nature of national wealth: US 1770-2010



National wealth = agricultural land + housing + other domestic capital goods + net foreign assets

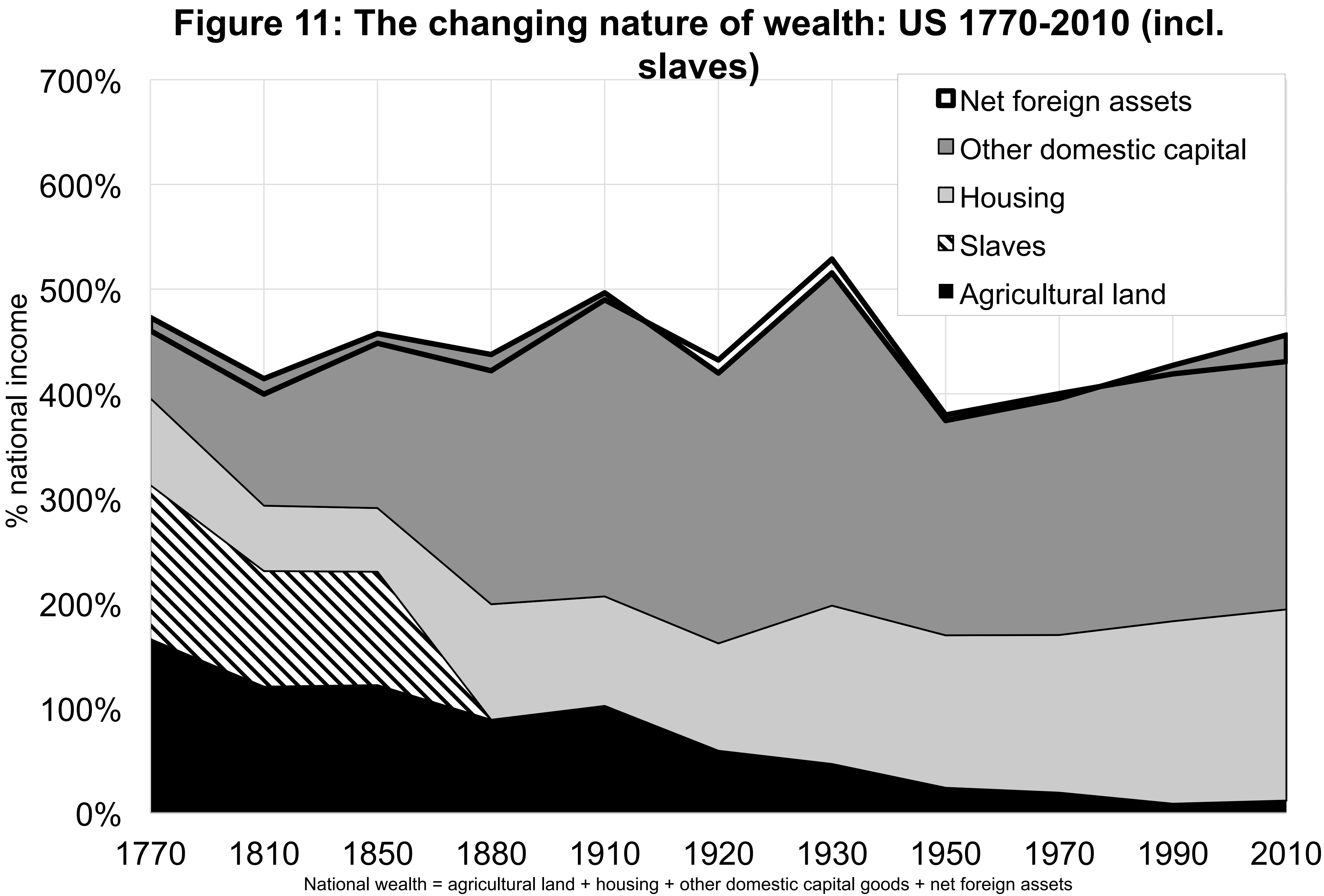


Figure 11: The changing nature of wealth: US 1770-2010 (incl. slaves)
700%
600%
500%
400%
300%
200%
100%
0%
% national income
Net foreign assets
Other domestic capital
Housing
Slaves
Agricultural land
1770
1810
1850
1880
1910
1920
1930
1950
1970
1990
2010
National wealth = agricultural land + housing + other domestic capital goods + net foreign assets

Figure 12: National wealth in 1770-1810: Old vs. New world

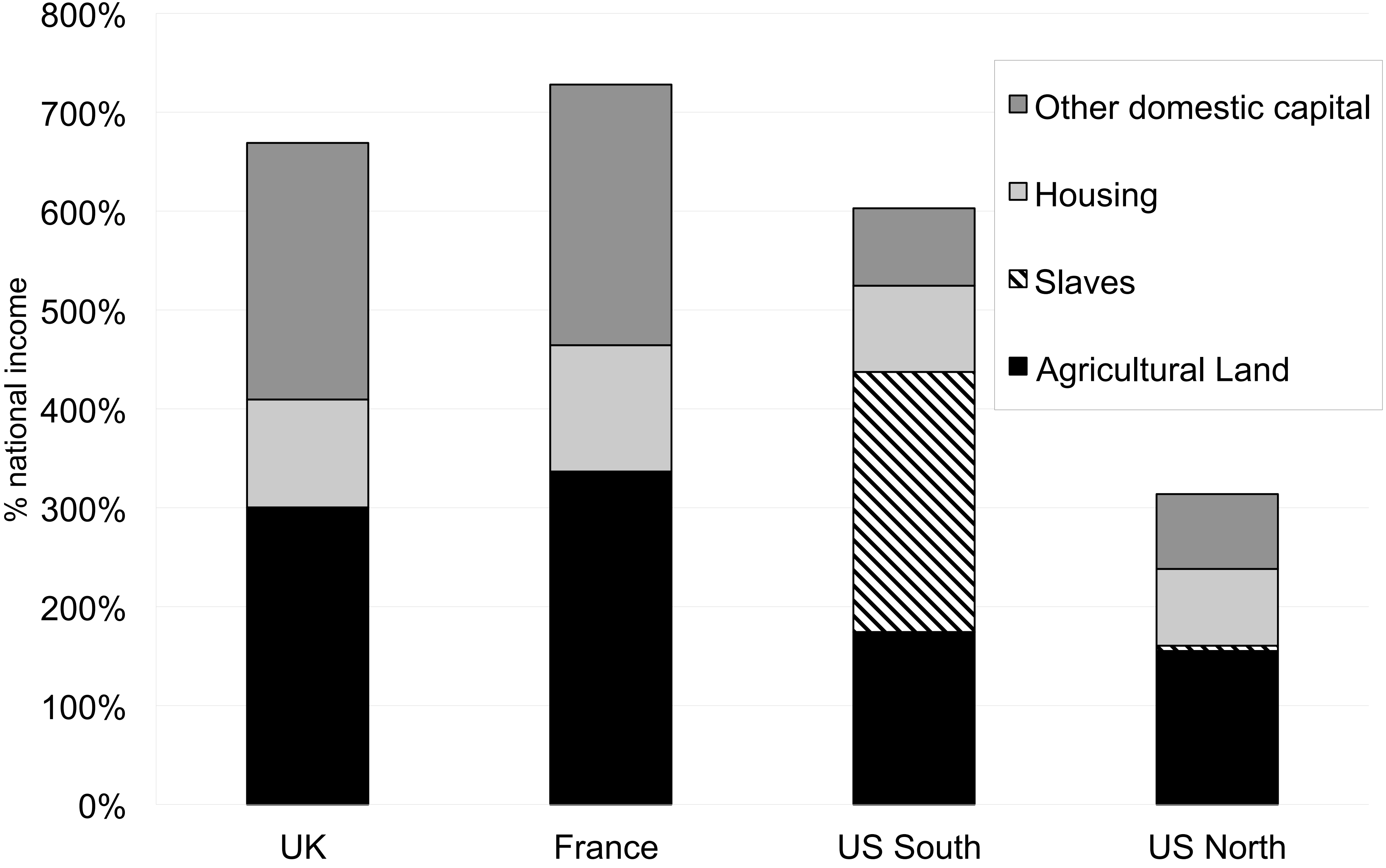


Figure 13: Capital shares in factor-price national income 1975-2010

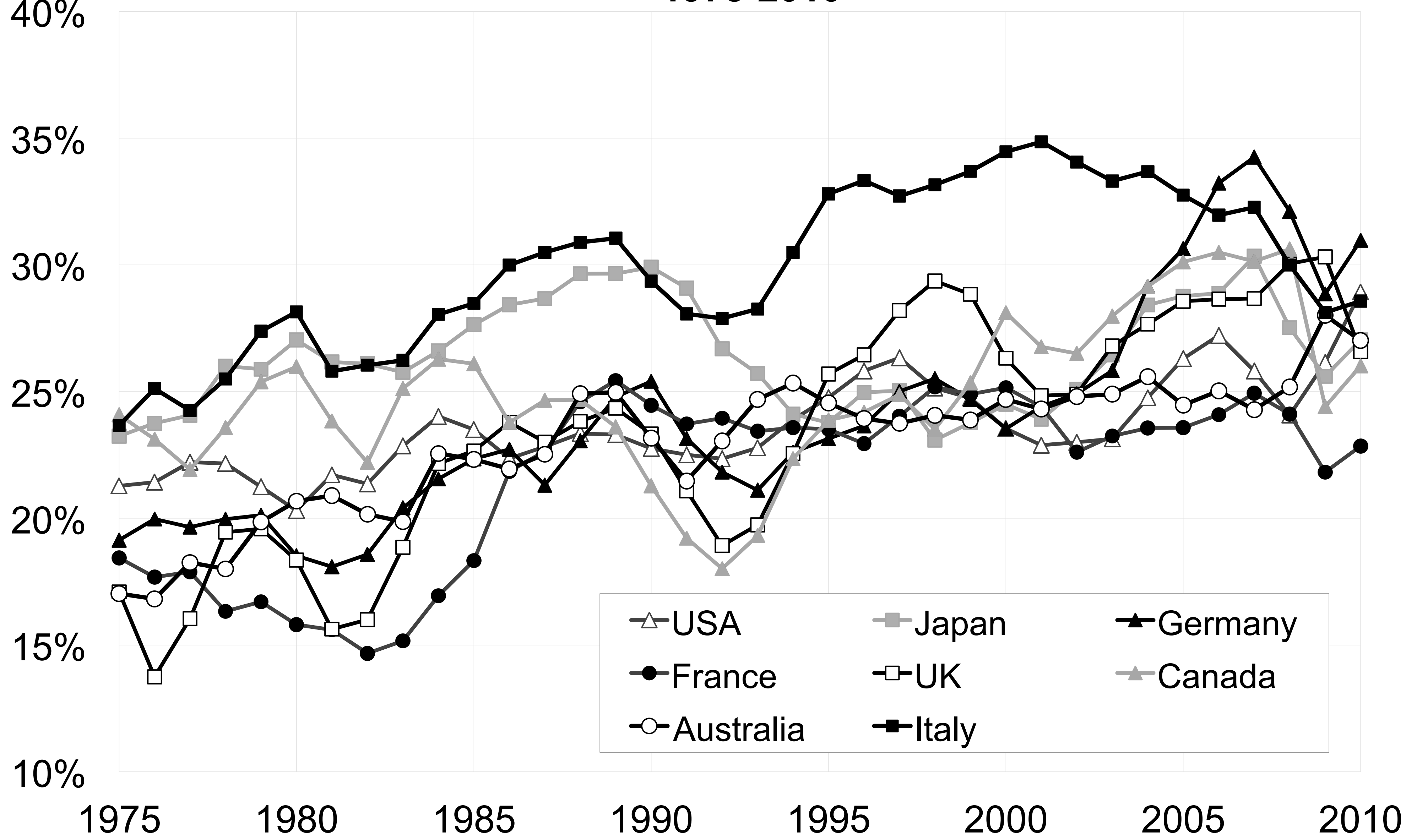


Figure 14: Average return on private wealth 1975-2010

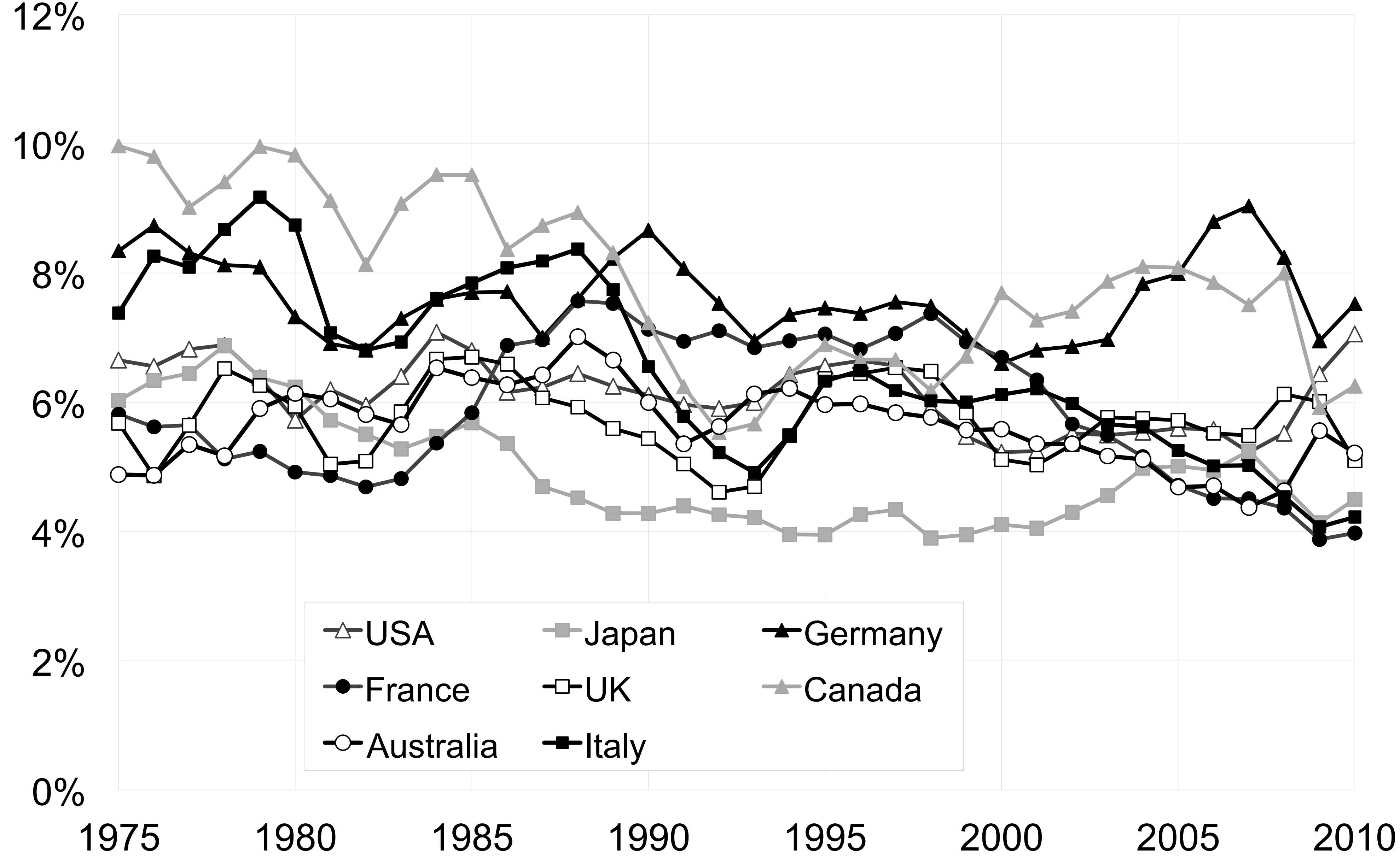


Figure 15: Factor shares in factor-price national income 1820-2010: UK and France

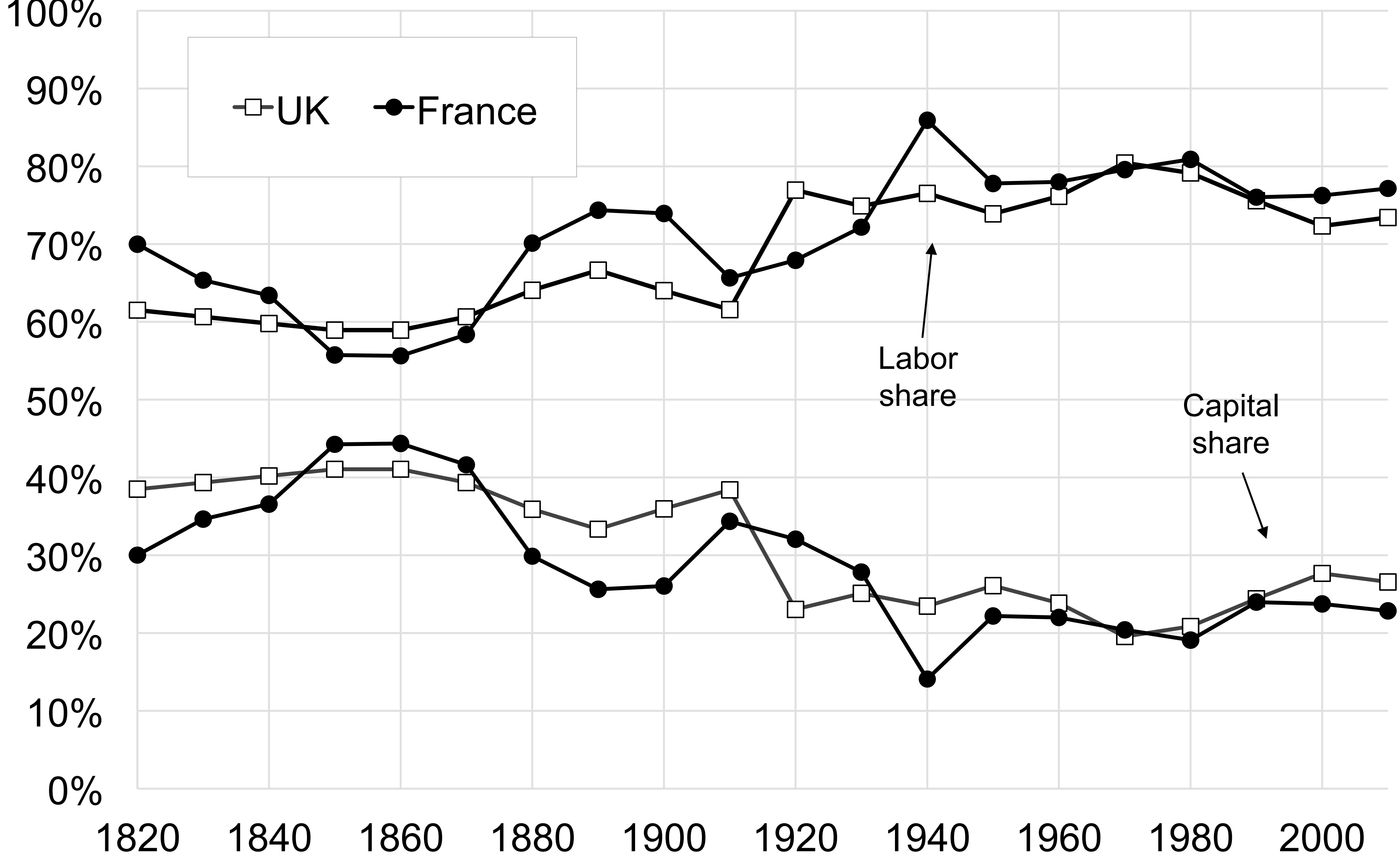
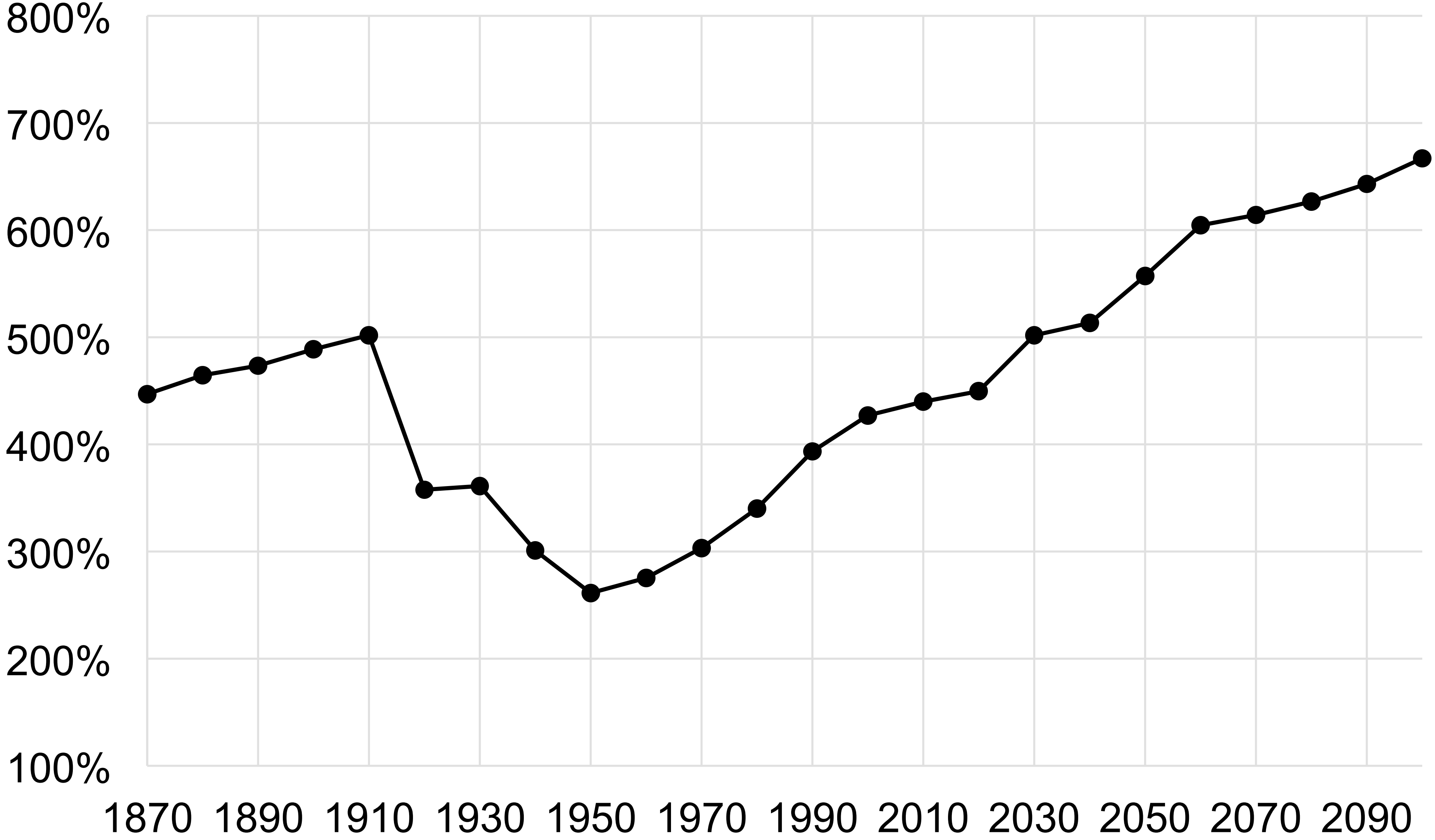


Figure 16: World private wealth / national income ratio 1870-2100



Authors' computations and simulations using country national accounts and UN growth projections. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

Table 1: A new macro database on income and wealth			
	Total period covered in database	Annual series	Decennial estimates
U.S.	**1770-2010**	1869-2010	1770-2010
Japan	**1960-2010**	1960-2010	
Germany	**1870-2010**	1870-2010	
France	**1700-2010**	1896-2010	1700-2010
U.K.	**1700-2010**	1855-2010	1700-2010
Italy	**1965-2010**	1965-2010	
Canada	**1970-2010**	1970-2010	
Australia	**1970-2010**	1970-2010	

Income and wealth database constructed by the authors using country national accounts (official series and balance sheets and non-official historical estimates). See country appendices for sources, methods and detailed series.

Table 2: Growth rate vs private saving rate in rich countries, 1970-2010

	Real growth rate of national income	Population growth rate	Real growth rate of per capita national income	**Net private saving rate** (personal + corporate) (% national income)
U.S.	**2.8%**	1.0%	1.8%	**7.7%**
Japan	**2.5%**	0.5%	2.0%	**14.6%**
Germany	**2.0%**	0.2%	1.8%	**12.2%**
France	**2.2%**	0.5%	1.7%	**11.1%**
U.K.	**2.2%**	0.3%	1.9%	**7.3%**
Italy	**1.9%**	0.3%	1.6%	**15.0%**
Canada	**2.8%**	1.1%	1.7%	**12.1%**
Australia	**3.2%**	1.4%	1.7%	**9.9%**

Authors' computations using country national accounts. All real growth rates use chain-weighted GDP deflators. For alternative deflators, see Appendix Table A3 and Country Tables US.3, JP.3, etc.

Table 3: Accumulation of private wealth in rich countries, 1970-2010

	Private wealth-national income ratios		Additive decomposition of 2010 private wealth-national income ratio			Multiplicative decomposition of 1970-2010 wealth growth rate		
	β (1970)	β (2010)	Initial wealth effect	Cumulated new savings	Capital gains or losses	Real growth rate of private wealth g_w	Savings-induced wealth growth rate $g_{ws} = s/\beta$	Capital-gains-induced wealth growth rate q
U.S.	342%	410%	113%	236% ***80%***	60% ***20%***	3.3%	2.9% ***88%***	0.4% ***12%***
Japan	299%	601%	110%	456% ***93%***	35% ***7%***	4.3%	3.4% ***78%***	0.9% ***22%***
Germany	225%	412%	104%	356% ***116%***	-48% ***-16%***	3.5%	4.3% ***121%***	-0.8% ***-21%***
France	310%	575%	130%	346% ***78%***	99% ***22%***	3.8%	3.4% ***90%***	0.4% ***10%***
U.K.	306%	522%	128%	193% ***49%***	201% ***51%***	3.6%	1.9% ***55%***	1.6% ***45%***
Italy	239%	676%	114%	480% ***85%***	83% ***15%***	4.6%	4.2% ***92%***	0.4% ***8%***
Canada	247%	416%	80%	308% ***92%***	28% ***8%***	4.2%	4.3% ***103%***	-0.1% ***-3%***
Australia	330%	518%	94%	275% ***65%***	149% ***35%***	4.4%	3.4% ***79%***	0.9% ***21%***

In the U.S., private wealth amounts to 410% of national income in 2010. 80% of the 2010 level of wealth can be accounted for by cumulated saving flows, and 20% by real capital gains. The real growth rate of national wealth has been 3.3% per year between 1970 and 2010. This can be decomposed into a 2.9% savings-induced growth rate (88% of the total growth rate of wealth) and a 0.4% residual term (capital gains and/or measurement errors, 12% of the total growth rate of wealth).

Authors' computations using country national accounts. Other volume changes were included in saving. For full decomposition, see Appendix Country Tables US.4a, JP.4a, etc.

Table 4: Saving rates 1970-2010: national vs. private

Average saving rates 1970-2010 (% national income)	Net national saving (private + government)	Net private savings (personal + corporate)	*incl. personal savings*	*incl. corporate savings (retained earnings)*	Net government saving
U.S.	5.2%	7.7%	4.6% ***60%***	3.1% ***40%***	-2.4%
Japan	14.6%	14.6%	6.8% ***47%***	7.8% ***53%***	0.0%
Germany	10.2%	12.2%	9.4% ***76%***	2.9% ***24%***	-2.1%
France	9.2%	11.1%	9.0% ***81%***	2.1% ***19%***	-1.9%
U.K.	5.3%	7.3%	2.8% ***38%***	4.6% ***62%***	-2.0%
Italy	8.5%	15.0%	14.6% ***97%***	0.4% ***3%***	-6.5%
Canada	10.1%	12.1%	7.2% ***60%***	4.9% ***40%***	-2.0%
Australia	8.9%	9.9%	5.9% ***60%***	3.9% ***40%***	-0.9%

Authors' computations using country national accounts. 1970-2010 averages are obtained by weighthing yearly saving rates by real national income.

Table 5: Accumulation of national wealth in rich countries, 1970-2010

	National wealth-national income ratios		Decomposition of 1970-2010 wealth growth rate		
			Real growth rate of national wealth	Savings-induced wealth growth rate	Capital-gains-induced wealth growth rate
	β (1970)	β (2010)	g_w	$g_{ws} = s/\beta$	q
U.S.	404%	431%	3.0%	2.1% ***72%***	0.8% ***28%***
Japan	359%	616%	3.9%	3.1% ***78%***	0.8% ***22%***
Germany	313%	416%	2.7%	3.1% ***114%***	-0.4% ***-14%***
France	351%	605%	3.6%	2.7% ***75%***	0.9% ***25%***
U.K.	314%	523%	3.5%	1.5% ***42%***	2.0% ***58%***
Italy	259%	609%	4.1%	2.6% ***63%***	1.5% ***37%***
Canada	284%	412%	3.8%	3.4% ***89%***	0.4% ***11%***
Australia	391%	584%	4.2%	2.5% ***61%***	1.6% ***39%***

Authors' computations using country national accounts. Other volume changes were included in savings-induced wealth growth rate. For full decomposition, see Appendix Country Tables US.4d, JP.4d, etc.

Table 6a: Accumulation of national wealth in rich countries, 1970-2010: domestic capital vs foreign wealth

	1970 national wealth / national income ratio			2010 national wealth / national income ratio			1970-2010 rise in national wealth / national income ratio		
		incl. Domestic capital	*incl. Foreign wealth*		*incl. Domestic capital*	*incl. Foreign wealth*		*incl. Domestic capital*	*incl. Foreign wealth*
U.S.	404%	*399%*	*4%*	431%	*456%*	*-25%*	27%	*57%*	*-30%*
Japan	359%	*356%*	*3%*	616%	*548%*	*67%*	256%	*192%*	*64%*
Germany	313%	*305%*	*8%*	416%	*377%*	*39%*	102%	*71%*	*31%*
France	351%	*340%*	*11%*	605%	*618%*	*-13%*	254%	*278%*	*-24%*
U.K.	365%	*359%*	*6%*	527%	*548%*	*-20%*	163%	*189%*	*-26%*
Italy	259%	*247%*	*12%*	609%	*640%*	*-31%*	350%	*392%*	*-42%*
Canada	284%	*325%*	*-41%*	412%	*422%*	*-10%*	128%	*97%*	*31%*
Australia	391%	*410%*	*-20%*	584%	*655%*	*-70%*	194%	*244%*	*-50%*

Table 6b: National wealth accumulation in rich countries: domestic vs. foreign capital gains

	1970-2010 capital gains on national wealth (% of 2010 national income)	Decomposition of 1970-2010 capital gains	
		Domestic wealth	Foreign wealth
U.S.	105%	72%	33%
Japan	27%	45%	-18%
Germany	-25%	-3%	-22%
France	164%	179%	-15%
U.K.	235%	217%	18%
Italy	213%	240%	-27%
Canada	63%	55%	7%
Australia	220%	178%	41%

Authors' computations using country national accounts. Other volume changes were put in saving flows and thus excluded from capital gains.

Table 7: Domestic capital accumulation in rich countries, 1970-2010: housing vs other domestic capital

	1970 domestic capital / national income ratio			2010 domestic capital / national income ratio			1970-2010 rise in domestic capital / national income ratio		
		incl. Housing	*incl. Other domestic capital*		*incl. Housing*	*incl. Other domestic capital*		*incl. Housing*	*incl. Other domestic capital*
U.S.	399%	*142%*	*257%*	456%	*182%*	*274%*	57%	*41%*	*17%*
Japan	356%	*131%*	*225%*	548%	*220%*	*328%*	192%	*89%*	*103%*
Germany	305%	*129%*	*177%*	377%	*241%*	*136%*	71%	*112%*	*-41%*
France	340%	*104%*	*236%*	618%	*371%*	*247%*	278%	*267%*	*11%*
U.K.	359%	*98%*	*261%*	548%	*300%*	*248%*	189%	*202%*	*-13%*
Italy	247%	*107%*	*141%*	640%	*386%*	*254%*	392%	*279%*	*113%*
Canada	325%	*108%*	*217%*	422%	*208%*	*213%*	97%	*101%*	*-4%*
Australia	410%	*172%*	*239%*	655%	*364%*	*291%*	244%	*193%*	*52%*

Table 8: Accumulation of national wealth in rich countries, 1870-2010

	Market-value national wealth-national income ratios		Real growth rate of national income	Decomposition of 1870-2010 wealth growth rate		
				Real growth rate of wealth	Savings-induced wealth growth rate	Capital-gains-induced wealth growth rate
	β (1870)	β (2010)	g	g_w	$g_{ws} = s/\beta$	q
U.S.	413%	431%	3.4%	3.4%	2.6% ***76%***	0.8% ***24%***
Germany	745%	416%	2.3%	2.0%	2.6% ***128%***	-0.6% ***-28%***
France	689%	605%	2.1%	2.0%	1.8% ***91%***	0.2% ***9%***
U.K.	656%	523%	1.9%	1.8%	1.6% ***89%***	0.2% ***11%***

The real growth rate of national wealth has been 3.4% per year in the U.S. between 1870 and 2010. This can be decomposed into a 2.6% savings-induced growth rate and a 0.8% residual term (capital gains and/or measurement errors).

Authors' computations using country national accounts. War destructions & other volume changes were included in savings-induced wealth growth rate. For full decomposition, see Appendix Country Tables US.4c, DE.4c, etc.

Table 9: Accumulation of national wealth: US, UK, Germany, France, 1870-2010

	Market-value national wealth-national income ratios		Real growth rate of national wealth	Savings-induced wealth growth rate (incl. war destructions)	Capital-gains-induced wealth growth rate
	β_t	β_{t+n}	g_w	$g_{ws} = s/\beta$	q
	Panel A: United States				
1870-2010	413%	431%	3.4%	2.6% *76%*	0.8% *24%*
1870-1910	413%	469%	4.3%	2.9% *68%*	1.4% *32%*
1910-2010	469%	431%	3.1%	2.5% *80%*	0.6% *20%*
1910-1950	469%	380%	2.7%	2.2% *82%*	0.5% *18%*
1950-1980	380%	434%	4.0%	3.7% *94%*	0.2% *6%*
1980-2010	434%	431%	2.7%	1.6% *58%*	1.1% *42%*
	Panel B: United Kingdom				
1870-2010	656%	527%	1.8%	1.5% *83%*	0.3% *17%*
1870-1910	656%	694%	2.1%	1.7% *79%*	0.4% *21%*
1910-2010	719%	527%	1.6%	1.4% *86%*	0.2% *14%*
1910-1950	719%	241%	-1.3%	0.6% *-43%*	-1.9% *143%*
1950-1980	241%	416%	4.0%	3.0% *76%*	0.9% *24%*
1980-2010	416%	527%	3.4%	1.0% *28%*	2.4% *72%*
	Panel C: Germany				
1870-2010	745%	416%	2.0%	2.6% *128%*	-0.6% *-28%*
1870-1910	745%	637%	2.1%	2.3% *107%*	-0.1% *-7%*
1910-2010	637%	416%	2.0%	2.8% *137%*	-0.8% *-37%*

1910-1950	637%	223%	-1.4%	0.0% ***-3%***	-1.5% ***103%***
1950-1980	223%	330%	6.3%	6.8% **108%**	-0.5% **-8%**
1980-2010	330%	416%	2.5%	2.5% ***101%***	0.0% ***-1%***
	Panel D: France				
1870-2010	689%	605%	2.0%	1.8% ***91%***	0.2% ***9%***
1870-1910	689%	747%	1.3%	1.4% ***103%***	0.0% ***-3%***
1910-2010	747%	605%	2.2%	2.0% ***89%***	0.3% ***11%***
1910-1950	747%	261%	-1.2%	-0.1% ***8%***	-1.1% ***92%***
1950-1980	261%	383%	5.9%	4.7% **80%**	1.2% **20%**
1980-2010	383%	605%	3.4%	2.2% ***65%***	1.2% ***35%***

The real growth rate of national wealth has been 3.1% per year in the U.S. between 1910 and 2010. This can be decomposed into a 2.5% savings-induced growth rate and a 0.6% residual term (capital gains and/or measurement errors).

Authors' computations using country national accounts. War destructions & other volume changes were included in savings-induced wealth growth rate. For full decomposition, see Appendix Country Tables US.4c, DE.4c, etc.

Table 10: Accumulation of national wealth in rich countries, 1910-1950

	National wealth-national income ratios		Decomposition of 1950 national wealth-national income ratio			
	β (1910)	β (1950)	Initial wealth effect	Cumulated new savings	Cumulated war destructions	Capital gains or losses
U.S.	469%	380%	132%	193%	0%	55%
Germany	637%	223%	400%	109% ***31%***	-120% ***29%***	-165% ***40%***
France	747%	261%	421%	144% ***38%***	-132% ***27%***	-172% ***35%***
U.K.	719%	208%	409%	75% ***46%***	-19% ***4%***	-256% ***50%***

Germany's national wealth-income ratio fell from 637% to 223% between 1910 and 1950. 31% of the fall can be attributed to insufficient saving, 29% to war destructions, and 40% to real capital losses.

Appendix A

Missing Wealth of Nations: Appendix

The goal of this Appendix is to allow the reader to reproduce all the results of the paper starting from readily available public statistics. I describe line by line each of the steps that leads from the published data to the results. The Appendix is supplemented by an Excel file containing all relevant formulas and by a set of Stata files.[1]

The main paper summarizes the key steps. This Appendix gives additional details, provides consistency and robustness checks, compares the choices made in this research with those made in other studies, lists all relevant references, and produces additional results excluded from the main paper for the sake of conciseness. The Appendix is structured as follows:

- Section A studies the assets side: starting from the updated and extended version of the External Wealth of Nations database constructed by Lane and Milesi-Ferretti (2007), I explain how I construct estimates of the total amount of securities assets identifiable worldwide.
- Section B does the same for the liabilities side.
- Section C investigates the discrepancy between total identifiable assets and liabilities. In particular, it describes the construction of the 238×238 bilateral assets matrices that reveal the source of the assets-liabilities gap, using bilateral data provided in the IMF Coordinated Portfolio Investment Survey.
- Section D studies the anomalies at the flow level, that is, in the world balance of payments and in individual countries' balances of payments.
- Section E gives more details on the offshore fortunes in Switzerland.
- Section F lists the complete references used to compute the officially reported net foreign asset positions of rich countries (Figure 1 of the paper), and presents various robustness checks for the claim that the eurozone and the rich world are net creditors, ant not net debtors as in the official statistics.

A Global Aggregate Securities Assets (Tables A1 and A4-A9)

A Key data sources

The key data source for this research is the updated and extended version of the External Wealth of Nations database (EWNII) constructed by Lane and Milesi-Ferretti (2007), which contains data for 178 economies. I have used the dataset released in August 2009 on Philip Lane's website.[2]

Some financial centers are not covered in the August 2009 version of the database, most notably the Cayman Islands, Bermuda, Jersey, Guernsey, and the Isle of Man. But these countries provide data on their aggregate portfolio holdings in the IMF Coordinated Portfolio Investment Survey (CPIS).

[1] Available online at: http://www.parisschoolofeconomics.eu/en/zucman-gabriel/.

[2] http://www.philiplane.org/EWN.html.

With a few minor exceptions (detailed below), for the countries i in both datasets, the aggregate portfolios assets data $\hat{A}_i$ in the EWNII and the CPIS are rigorously identical. So starting with the total assets $\sum_i \hat{A}_i$ in the CPIS or in the EWNII does not make any practical difference. Because the CPIS includes a number of financial centers that are presently excluded from the EWNII, I start with the CPIS world totals. I have worked with the August 2010 release of the CPIS,[3] which included final data for 2001-2008. I have not used the preliminary 2009 data.

Col. 1 of Table A1 simply reproduces the line "Total value of investment" of Tables 12, 12.1 and 12.2 of the CPIS. In 2008, 74 countries and jurisdictions were participating.

Col. 2 reproduces the line "SEFER+SSIO". It gives the value of the securities held by the reserve managers (central banks) and international organizations that participate in the survey. The list of participants is confidential. By subtracting col. 2 to col. 1, we obtain the value of the privately held portfolios reported in the CPIS.

I list below the few cases in which CPIS and EWNII data differ, and I explain why I choose to keep the CPIS data.

A.1 The case of Germany

Before 2006, the portfolio asset figures published in the German international investment position were established on the basis of modified cumulated flows, except for the banking sector.[4] By contrast, the CPIS data were constructed just like in other countries: using stock position surveys of end-investors and custodians.[5] There was consequently a discrepancy between the portfolio figures reported in the IIP (hence in the EWNII) and in the CPIS: between 2001 and 2005, portfolio assets in the IIP were 10-20% larger than in the CPIS (corresponding to a gap of USD 161-265bn). The German Central Bank interpreted the gap as roughly capturing the securities held by German households with nonresident custodians or "on their own account" (i.e., without using any custodian bank at all).[6]

Since 2006, both the IIP and the CPIS data have been based on a new, high quality security-by-security portfolio stock survey. Accordingly, the IIP (hence EWNII) and CPIS data have been identical since then.

In the paper, I use the CPIS data rather than the IIP series, and I do not correct the CPIS figures. I do so for three reasons. First, the methods used by Germany to compile its CPIS data have always been consistent with those used by all other large countries (i.e., stock position surveys covering the household sector through a survey of domestic custodians). Second, if the gap between modified cumulated flows (reported in the IIP before 2006) and the stock surveys really captured portfolios held offshore by the household sector, as the German Central Bank suggests, then I want to include this gap in my estimate of unrecorded offshore assets Ω, which implies to use the CPIS data when reckoning all identifiable securities assets. Lastly,

[3]Downloaded from http://www.imf.org/external/np/sta/pi/cpis.htm.

[4]See the country notes for Germany in the IMF *Balance of Payments Statistics*.

[5]See the metadata for Germany on the CPIS website (available from the author upon request). At the time of this paper, the metadata posted online referred to the procedures used for the conduct of the 2003 CPIS.

[6]See the German metadata for the 2003 CPIS.

the interpretation of the gap between the stock survey and the cumulated flow estimates is uncertain, so we should not have strong priors on how to deal with it. Many other factors can explain a discrepancy between cumulated flows and stock surveys data, and conversely portfolios held offshore need not generate flows captured by domestic balances of payments.

A.2 The case of Singapore

Portfolio equity assets in the August 2009 release of the EWNII database (based on cumulated flows) were between 1.5 and 3 times larger than in the August 2010 release of the CPIS (which corresponds to a gap of USD 50-100bn). Lane and Milesi-Ferretti (2007) discarded the CPIS data in light of the high equity liabilities recorded by the U.S. vis-a-vis Singapore in the Treasury International Capital (TIC) system. In fact, the equity liabilities recorded by the U.S. vis-a-vis Singapore were larger than the equity assets recorded by Singapore on *all* foreign countries.

The discrepancy between Singapore's U.S. holdings as seen from the U.S. TIC and as seen from the CPIS could be explained by two factors:

- The equity liabilities recorded by the U.S. TIC vis-à-vis Singapore include the U.S. securities held by Singapore's central bank (reserve assets) and Singapore's two sovereign wealth funds, the Government Investment Corporation (GIC) and Temasek, while both reserve and sovereign wealth funds' assets used to be excluded from the portfolio of U.S. equities reported by Singapore in the CPIS (IMF, 2007, p. 15).[7]
- Non-Singaporean residents may invest in U.S. equities through offshore accounts in Singapore: their holdings would be captured as equity liabilities vis-à-vis Singapore by the U.S., but would not be recorded as U.S. assets by Singapore (the custodial center bias of Bertaut et al. (2006)).

As it was impossible to know which of the factors was more important, I chose to keep the CPIS data rather than the EWNII figure, implicitly assuming that GIC's and Temasek's assets were included in the SEFER like official reserves.[8]

Conversely, debt assets in the EWNII were smaller than in the CPIS. The debt figures in the EWNII come from the IIP, which used to exclude part of Singapore's

[7]In March 2008, 34% of GIC's assets were invested in the U.S., and 44% were in public equities, so around around 15% of GIC's assets were in U.S. portfolio equities (GIC, 2008, p. 11) . We know that GIC managed "well over USD 100bn" in foreign assets (GIC, 2008, p. 6), so at least USD 15bn of the discrepancy between Singapore's U.S. holdings as seen from the CPIS and the TIC could be explained by GIC. Temasek's holdings, however, were almost entirely invested in Asia (Temasek, 2008, p. 12), and Singapore's central bank was most likely invested in bonds rather than in equities.

[8]I did so because sovereign wealth funds were included in Singapore's international investment position (IMF, 2007, p. 15), suggesting that they might also be included in the SEFER. However, this turned out afterwards to be probably wrong: in 2012, Singapore extended its coverage of portfolio asset holdings to include the assets of sovereign wealth funds. For 2007, the revised portfolio claims (both IIP and CPIS) reach \$258bn which exceeds both the amount reported in the 2010 release of the CPIS (\$176bn) and in the 2009 EWN (\$250bn). So one should keep in mind that my 2007 portfolio equity asset total is probably about \$75bn too small because of the failure to properly account for Singapore's sovereign wealth funds. I am grateful to an anonymous referee for pointing this issue to me.

banking sector, namely the so-called Asian Currency Units. Asian Currency Unites are departments of Singaporean banks, with a distinct balance sheet, which are licensed to deal in foreign currencies, i.e. to accept deposits and to grant loans in currencies other than the Singaporean dollar. Prior to the implementation of the 6th edition of the IMF balance of Payments and International Investment Position Manual in 2012, they were treated as non-residents in the IIP but included as residents for the purpose of CPIS. I chose, therefore, to retain the CPIS debt data.

A.3 The case of Mauritius

Equity assets in the EWNII database (based on cumulated flows) are much lower than in the CPIS (EWNII figures are close to 0, vs. USD 155bn in the 2007 CPIS). Mauritius records much more portfolio assets in the CPIS than portfolio liabilities in its IIP. However, from what we know, the CPIS data seem reliable; if anything they probably understate rather than overstate Mauritius' holdings. According to the latest metadata provided to the CPIS, the government, nonfinancial corporations, and the household sectors are not covered by Mauritius' asset survey.[9]

Other minor divergences between CPIS, EWNII and published international investment positions portfolio asset data are due to data revisions. I systematically use the CPIS data, which were the most recent at the time I wrote this paper.

In spite of recent efforts made to insure a comprehensive coverage, the CPIS data have some shortcomings. After a careful examination of all the country metadata provided on the CPIS website, I have identified two deficiencies that have a non-negligible effect on global aggregates: the partial coverage of the Cayman Islands, and, less importantly, the exclusion of the Netherlands' offshore sector. I explain below how I address these shortcomings.

B Correction for the Cayman Islands (Table A6)

Over the 2001-2008 period, the Cayman Islands reported only the portfolio assets of its banks, disregarding its mutual fund industry, among others. Given the huge size of the Cayman fund industry (more than 9,000 mutual funds registered in 2008), it is crucial to upgrade the data reported by the Cayman Islands. In order to estimate the value of the foreign securities owned by all sectors of the Cayman Islands, I have developed two methods that yield convergent results. Detailed results for each method and consistency checks are reported in the first three panels of Table A6. My preferred estimate for the Cayman Islands' total portfolio assets is reported in col. 3 of Table A1.

B.1 Estimates based on a gravity model of asset holdings

The first method consists in estimating (i) the value of all U.S. securities held by the Cayman Islands, and (ii) the share represented by U.S. securities in the portfolio of the Cayman Islands.

[9] At the time of this paper, the online metadata referred to the 2003 CPIS.

U.S. securities held by the Cayman Islands U.S. securities held by the Cayman Islands are long term (maturity larger than one year) and short term (maturity less than one year).

For long term securities, the data come from the U.S. Treasury International Capital system (TIC) survey of long term portfolio liabilities. The survey gives the value of the U.S. equities and long term debt securities held by foreigners, broken down by country. The U.S. TIC liability survey has been conducted yearly since 2002; data are for the end of June (before 2002, the survey was conducted at year-end, every 4 to 6 years). In order to obtain year-end data, I use the monthly estimates produced by Bertaut and Tryon (2007).[10] On December 31st 2007, the U.S. recorded nearly USD 800bn of long-term portfolio liabilities vis-a-vis the Cayman Islands: USD 469bn in long term debt (Table A6 line 3) and USD 329bn in equities (Table A6 line 2). I assume that the TIC data accurately reflect the holdings of U.S. securities by entities incorporated in the Cayman Islands, i.e. that we can disregard the custodial center bias (see Bertaut et al., 2006).

For short term securities, I use the TIC survey of U.S. cross-border banking liabilities. The survey includes a monthly estimate of short term U.S. Treasury obligations liabilities and of other short term negotiable U.S. securities held by foreigners, broken down by country. I assume, again, that we can disregard the custodial center bias. Therefore, the figures for the Cayman Islands' U.S. short term assets (Table A6 line 4) directly come from the TIC banking liabilities dataset.[11]

The share of U.S. assets in the Cayman Islands' external portfolio To compute the share represented by U.S. securities in the Cayman Islands' portfolio, I estimate the following gravity-like model of bilateral cross-border portfolio holdings:

$$log(1 + A_{ijt}) = \phi_j + \theta_t + \beta Z_{ijt} + \gamma X_{it} + \epsilon_{ijt} \tag{A.1}$$

where A_{ijt} denotes the portfolio holdings of country i on country j in year t, ϕ_j denotes host-country fixed-effects, θ_t year fixed-effects, Z_{ijt} is a vector of bilateral controls, and X_{it} a vector of source-level controls. This model has been used for similar imputation purposes by Lane and Shambaugh (2010). As a benchmark, I start with the exact specification reported in the appendix of Lane and Shambaugh (2010). Z_{ijt} includes the *log* of distance, the *log* of the GDP gap and of the GDP per capita gap, the longitude gap (which should proxy for time zone differences), as well as dummies indicating a common language, the existence of a colonial relationship, and whether i and j are both industrial countries. X_{it} includes i's population, latitude, GDP per capita, and whether it is landlocked. All data come from the

[10] I use the March 2010 update of the dataset, downloaded on October 18th, 2010, from http://www.federalreserve.gov/pubs/ifdp/2007/910/ifdp910appendix.htm. It contains data until June 2009 for a sample of about 80 countries including the Cayman Islands. Survey data are collected by the U.S. Treasury for about 200 countries, but the sample in Bertaut and Tryon (2007) is constrained by the availability of transaction series, which are used to link stock positions estimates.

[11] Downloaded on October 18th, 2010 from http://www.ustreas.gov/tic/. I add columns 7 and 8. Data are unavailable prior to 2003, so for 2001 and 2002 I use the 2003 figure and the percent change of U.S. long term debt liabilities vis-a-vis the Cayman Islands. Note that col. 7 of the TIC banking liabilities dataset includes official holdings in addition to bank holdings, but the total is negligible.

CEPII database,[12] except GDP and population data which are from the World Bank World Development Indicators (WDI). The benchmark regression excludes offshore financial centers,[13] and is run on equity and debt (short term plus long term) separately. As Table A9B shows, the regression has a high explanatory power, with R^2 around 0.75 depending on the asset class and on the time frame. All controls have expected signs, except for the longitude gap which enters positively (though weakly).

In the final regressions, I exclude the longitude gap and extend the benchmark model to take into account OFCs (as host and source countries). I complement the CEPII and WDI databases when controls for OFCs are unavailable.[14] In equation (1), I add in X_{it} a dummy indicating whether i is an OFC. In order to capture more precisely the specificity of OFCs investment patterns (e.g., their links with other OFCs through master/feeder funds arrangements, their ties with the developed countries that ultimately sponsor the financial firms operating in OFCs), I also add in Z_{ijt} an interacted term $OFC_i \times \phi_j$. The augmented regressions still have R^2 around 0.7 and all coefficients keep sensible signs and magnitudes.

From the predicted bilateral claims A^p_{ijt}, we can compute the predicted share of each country j in i's portfolio at time t as:

$$\omega^p_{ijt} = \frac{A^p_{ijt}}{\sum_j A^p_{ijt}}$$

Some predicted shares are slightly negative, in which case I replace them by 0.[15]

In Table A17 and Figures A2 to A7, I investigate the fit of the model by looking at its predictions in-sample. I consider the country allocation of the equity and debt portfolio generated by the model for the 3 largest cross-border investors whose assets survey is considered particularly reliable: the U.S., Japan, and France. I then compare the predicted shares of each country j in the U.S., Japanese, and French portfolio with the observed shares (from the CPIS). The model generates sensible predicted values, especially for equities. The fit is a bit less satisfactory for debt securities, but debt securities play a much less important role in the present paper than equities: 2/3 of the missing wealth of nations comes from equities, 1/3 from debt.

Conversely, in Table A16, I compare the mean predicted shares $\bar{\omega}^p_{ijt}$ of a set of developed countries j with the mean actual shares $\bar{\omega}_{ijt}$, where the (unweighted)

[12] http://www.cepii.fr/anglaisgraph/bdd/distances.htm.

[13] For all the regressions, the OFCs considered are the 42 countries with "significant offshore activity" reported in Table 2 of IMF (2000), with the exception of Switzerland which has no offshore fund industry, hence is better considered not as an OFC for these regressions.

[14] The CEPII database lacks information on Jersey, Guernsey and the Isle of man. I take the same values as for the U.K. (note that in the database, the distance between a country and itself is not zero). For missing GDP and population figures, I use Table 5 of Lane and Milesi-Ferretti (2010).

[15] Note that a negative A_{ijt} is possible a priori: it means that i has a short position on securities issued by j. However, this is here mostly an artifact of the linear model. To avoid it, one could estimate shares directly through a logit transformation, like in Kubelec and Sà (2010). That is, one could run regressions of the form $log(\frac{\omega_{ijt}}{1-\omega_{ijt}}) = \phi_j + \theta_t + \beta Z_{ijt} + \gamma X_{it} + \epsilon_{ijt}$. Such a model generates positive predicted shares, but the downside of the logit transformation is that it eliminates the many observations for which $A_{ij} = 0$.

means are computed over the sample of countries i that participate in the CPIS. On average, CPIS-participating countries invest 23%-30% of their equity portfolio in the U.S. and 28%-35% of their debt portfolio in the U.S. (depending on the year). The gravity model reproduces this U.S. share well.

Lastly, while one might fear that the gravity model is inadequate for offshore financial centers, it turns out that the basic model used by Lane and Shambaugh (2010) fits the investment patterns of the CPIS-participating offshore centers well, as Table A9C shows. That is, the gravity model does a good job at explaining the portfolio investment patterns of Bermuda, Jersey, Guernsey, Hong-Kong, Isle of Man, Bermuda, Bahamas, etc. This provides a sensible basis for relying on the gravity model to predict the investment patterns of the Cayman Islands and of the handful of non-CPIS participating offshore centers such as Andorra and the British Virgin Islands (see Section A6 below).

The model predicts that U.S. equities form 30-50% of the total equities held by Cayman-incorportated entities (with an upward trend during the 2001-2008 period) and U.S. debt securities 58-65% of total debt securities held by Cayman entities (Table A6 lines 6 and 7). Combining these predicted shares with the value of the U.S. securities held by the Cayman Islands yields an estimate for the total value of Cayman-owned cross-border equities (Table A6 line 9) and debt securities (Table A6 line 10). For instance, I find that the Cayman Islands had around USD1.2 tr of foreign securities assets at year-end 2008 (Table A6 line 8). Note that only USD 50bn were reported in the CPIS. With around USD 1.2tr of portfolio assets, the Cayman Islands was the 9th largest country by size of cross-border holdings, behind China, but above the Netherlands, Italy, and Switzerland.

Because the correction for the Cayman Islands is important, we need to make sure that it is consistent with all available information. I provide below a second estimate of total Cayman holdings based on an independent dataset.

B.2 Estimates based on hedge fund holdings

Since 2006, the Cayman Islands Monetary Authority (CIMA) has published an *Investment Statistical Digest* producing the results of a survey of Cayman-domiciled mutual funds.[16] This dataset provides unique, good quality, and relatively well documented information.

More precisely, the *Digests* provide the gross and net assets managed by a large sample of Cayman funds, their asset allocation, as well as other information not directly relevant here.[17] For the first round of the survey (2006), whose results are presented in CIMA (2007), only the funds that had a December 31st financial year-end were asked to report. Over the 8,134 funds domiciled in the Cayman Islands, 6,718 had a December 31st year-end. Among them, 466 did not report because they had registered after June 30th 2006, which allowed them to avoid the survey. 520

[16] As of November 2010, three *Digests* had been published (CIMA, 2007, 2008, 2009) available online at http://www.cimoney.com.ky/about_cima/about_feedra.aspx?id=488.

[17] e.g. subscriptions, redemptions, total dividends and distributions, net income, fraction of funds listed (and the country of the exchange), nature of the funds (master/feeder, funds of funds, stand alone), location of the investment manager, investment strategy (long/short equity, fixed income, global macro, event driven, multi-strategy, etc.), location of the registrar and transfer agent, etc.

had their audit waived mainly because they had not yet started operations, were dormant or under termination/liquidation. 680 were expected to report but did not (they were probably dormant as well). This leaves 5,052 funds that actually participated in the survey.[18] CIMA (2008) gives two sets of figures for 2007: one for all funds, and one for the funds with a December 31st year-end, in order to insure continuity with the 2006 survey. CIMA (2009) provides data for 2008 on all reporting funds irrespective of their accounting schedule.

At year-end 2006, the 5,052 reporting funds had USD 2.3tr of gross assets and USD 1.4tr of net assets. Net means here gross assets minus loans taken by the funds. 90% of the respondents, accounting for 83.3% of the reported gross assets, disclosed their asset allocation (with the following breakdown: money market claims, long equities, long bonds, investments in master funds, investments in other funds, derivative assets, other assets, short equities, short bonds, other liabilities, derivative liabilities). This dataset provides us with almost all the relevant information needed to infer the cross-border portfolio claims of Cayman funds. From the viewpoint of external portfolio accounting, what matters is simply their net holdings of foreign securities, with net meaning here long position portfolio assets minus short position portfolio assets.[19]

Computing the foreign debt holdings of Cayman funds is, then, almost straightforward. Let's assume that all the debt securities they own have been issued by foreigners.[20] Adding money market assets (i.e., short term debt) to long bond assets and subtracting short bond assets gives a cross-border portfolio debt asset figure for responding funds consistent with IMF accounting practices.[21] I then apply a simple multiplicative factor of 1/0.83 to get an estimate for all funds whose financial year ended on December 31st.[22] Lastly, I apply (for 2006 only) a second multiplicative factor equal to 1 - (gross assets of funds with December 31st year-end) / (gross assets of all funds expected to report) to get an estimate for all Cayman funds.[23] The results are reported in line 16 of Table A6, which shows, e.g., that Cayman funds had USD 283bn of portfolio debt assets at the end of 2006.

Things are more complicated for equities, because we cannot assume that all the equities held by Cayman funds have been issued by foreign residents. More precisely, the funds hold a great deal of claims on themselves through master/feeder and funds of funds arrangements. In a master/feeder structure, a feeder collects money from savers and invests the proceeds in a second fund, the master, which in turns directly buys stocks, bonds, etc. If the feeder and the master are domiciled in the same country, then the claims owned by the feeder on the master should not be

[18]The previous explanations come from CIMA's FAQ: http://www.cimoney.com.ky/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=1814.

[19]CPIS guidelines explicitly indicate to count short positions as negative assets: "Securities acquired under reverse repos or securities borrowing arrangements and subsequently sold to a third party should be reported as a negative holding—namely, a short position." (IMF, 2002, p. 95).

[20]Though large in absolute terms (USD 1.1tr in 2008 according to the Bank for International Settlement), debt securities issued in the Cayman Islands are only 1.2% of global debt securities.

[21]I also include the small category of "other assets" in debt assets.

[22]i.e., I assume that the 466 recent funds + the 520 whose audit was waived + the 680 that did not report though they were expected to had 0 asset.

[23]This second multiplicative factor is computed using the 2007 *Digest*.

counted as cross-border equities. The same goes for funds of funds. We learn from CIMA's *Digests* that around 75% of all the funds domiciled in the Cayman Islands are involved in master/feeder or fund of funds structures. It is a first order issue.

To take it carefully into consideration, we need to know what fraction of Cayman fund assets are invested in master and other funds, and where those funds are domiciled. We do have the first information. In 2006, for instance, 32% (USD 626bn) of the USD 1,930bn of allocated gross assets were invested in master funds, and 11% (USD 207bn) in other funds. However, we do not know if those master and other funds were located in the Cayman Islands or abroad. CIMA (2008, p. 10) states that in a standard feeder/master arrangement, "the feeder fund is [typically] registered in an offshore jurisdiction, such as the Cayman Islands, and invests into the onshore master fund, which is predominately domiciled in the U.S. The master fund is often not registered in an offshore jurisdiction, and holds the actual investments of the two-fund structure."[24] We can also consult the list of investment funds registered in the Cayman Islands:[25] in November 2010, around 300 of the 9,000 registered funds had "master" in their name. Foreign master funds are likely to be numerous, suggesting that we should count the bulk of Cayman funds' claims on master and other funds as equity assets for the Cayman Islands.

There is one caveat here: it is not clear whether claims of domestic feeders on foreign masters should be counted as portfolio equity assets or as direct investments. In principle, if a feeder fund owns less than 10% of its foreign master, then its claim on the master should be counted as a portfolio equity asset; if a feeder fund owns more than 10% of its foreign master, its claims should be counted as a direct investment.

Accordingly, I make the agnostic assumption that 50% of all the claims of Cayman funds on master and other funds are portfolio equity assets for the Caymans (and 50% are claims on Cayman master and other funds, or direct investments in foreign masters). The 50-50% split is arbitrary; future research should improve it. It yields an estimated USD 952bn figure for foreign equity holdings of Cayman funds at the end of 2006 (Table A6, line 15).[26]

By adding the securities held by Cayman banks to those held by the funds, we get a figure for the Caymans' total cross-border portfolio assets as estimated from Cayman sources. Bank holdings directly come from the CPIS (and are reproduced in Table A6, lines 11, 12 and 13). The total bank plus fund holdings are displayed in line 17. We can check that when fund holdings can be computed (i.e., since 2005[27]), the Cayman-data-based estimate is very close to the U.S.-data-based estimate (TIC and gravity model). Both methods indicate foreign holdings in the range of USD

[24]Several hedge funds specialists confirm that this offshore feeder / onshore master structure was indeed widespread at least until 2010 (when a E.U. directive on hedge funds was expected to lead to the relocation of some hedge funds in Europe). For instance, the director of a group providing services to the asset management industry mentions "the traditional Ireland-Cayman master-feeder structures in the hedge fund world" in Hedgeweek: http://tiny.cc/8e62n.

[25]http://www.cimoney.com.ky/WorkArea/DownloadAsset.aspx?id=3861

[26]More precisely, I add long equities assets, 50% of the investments in master funds and other funds, and subtract short equities assets. I then apply the multiplicative factors described above for debt securities.

[27]The 2006 *Digest* (CIMA, 2007) gives the beginning of year net asset value (NAV) of reporting funds, i.e. their end-2005 NAV. I assume a similar asset allocation in 2005 as in 2006.

0.8-0.9tr in 2005, peaking at USD 1.6-1.8tr in 2007 and down to USD 1.2-1.3tr in 2008. Note, however, that the debt/equity breakdown is quite different whether one looks at the TIC dataset or at the CIMA dataset. The debt share is higher according to U.S. sources.

B.3 Coherence between both estimates and uncertainties

To sum up, two different methods, based on fully independent data sources, yield convergent estimates for the value of the portfolio assets of the Cayman Islands. These are reasonable figures to start with (much more reasonable that the negligible bank holdings reported in the CPIS). However, each method has its limitations. In what follows, I provide additional consistency checks, describe in more details the main uncertainties that remain, analyze where they come from, and give their order of magnitude when possible.

First, it is clear that the 50-50 assumption made for dealing with Cayman funds investments in master and other funds is unsatisfactory. We can provide bounds for the funds' foreign equity holdings by considering two extreme cases. In the lower-bound scenario, all master and other funds in which Cayman funds invest are domiciled in the Cayman Islands, so all the corresponding equity claims are domestic. In the upper bound scenario, all master and other funds are domiciled abroad and feeders are small compared to master funds, so their assets must be counted as portfolio rather than direct investments. The implied lower bound for foreign equity holdings equals USD 400bn in 2006, and the upper bound reaches USD 1,503bn. There is a substantial USD 1tr uncertainty.[28]

Second, other financial institutions besides funds and banks operate in the Cayman Islands: a large number of structured finance entities (special purpose vehicles – SPVs – or entities – SPEs), as well as holding companies, captive insurances, and international business companies (IBCs).[29] Their claims are not included in my "Cayman-based" estimate (line 17), but they are captured by the TIC dataset, hence included in my "U.S.-based" estimate (line 1). The fact that both methods yield convergent results only makes sense if SPVs, holding companies, insurance, and IBCs have negligible cross-border portfolios compared to investment funds. Is it reasonable on a priori grounds? To a large extent, yes. First, before the financial crisis, SPVs were largely used by onshore banks to securitize loans. Thus, they typically had loans (e.g. mortgage), i.e."other investments", on the asset side (the acquisition of which they financed by issuing international bonds). A particular kind of SPV called structured investment vehicles (SIVs) used to have portfolio holdings: they invested in long term assets such as asset-backed securities and cor-

[28]Note that given the widespread indications that many master funds are onshore, the lower bound scenario is really extreme. However, the U.S. TIC survey recorded only USD 20bn of U.S. investment funds liabilities vis-a-vis the Cayman Islands in June 2007 – maybe because not so many masters are actually domiciled in the U.S., maybe because the investments made by Cayman feeders in U.S. masters are counted by the U.S. as direct investment liabilities, or maybe because the TIC missed a lot of liabilities, since many U.S. hedge funds have apparently been unaware of their reporting duties for a long time. The third scenario seems most plausible.

[29]For a description of the main financial activities undertaken in the Cayman Islands and especially in the famous Ugland House building that hosted 18,857 entities in March 2008, see the U.S. Government Accountability Office (2008).

porate bonds, which they financed by borrowing short term, seeking to make a profit from the spread, juste like traditional banks (hence the term "shadow bank" used to describe them). To my knowledge, there is no good data on the aggregate holdings of SIVs, but industry reports suggest that they were limited, even at their 2007 peak (around USD 200-300bn, i.e. 10 times less than funds). SIVs basically disappeared at the end of 2008.[30] As regards holding companies domiciled in the Cayman Islands, they should have direct investment assets (they control foreign affiliates), not portfolio investments. The captive insurance sector is negligible: according to CIMA, it had USD 34bn of assets in April 2008 (U.S. Government Accountability Office, 2008, p. 9). Lastly, we know very little on the holdings of IBCs.[31] All in all, it seems reasonable to consider that the bulk of the Cayman Islands' foreign securities holdings belong to the mutual funds sector. Therefore, the consistency between U.S. data and CIMA data is meaningful. There remains, however, some uncertainty on the securities holdings of SPVs and IBCs.

Third, TIC data may be a poor proxy for Cayman holdings of U.S. assets. Source-based estimates of a country i's holdings on j $\hat{A}_{ij}$ can substantially differ from host-based data L_{ji} because of cross-border custody. Now, there are reason to believe that cross-border custody is widespread in the Cayman Islands. First, Cayman funds are mostly managed and administered from abroad, which means that their assets may in fact be held by foreign custodians. According to CIMA's *Digests*, at least 50% of Cayman fund assets are managed from the United States. These assets are likely to be in custody in the U.S., hence properly identified as liabilities of the U.S. vis-a-vis the Cayman Islands by the TIC system. But 20% are managed from the U.K. and 6% from Switzerland and Liechtenstein. They may be in custody in U.K. or Swiss bank, hence wrongly attributed to the U.K. or to Switzerland. Thus, TIC data may significantly under-estimate the true U.S. holdings of Cayman funds.

On the other hand, it is likely that wealthy foreigners use Cayman custodians to manage their portfolios of U.S. securities. BIS data show that Cayman banks are huge net importers of cash deposits of "non-bank" agents. Anecdotal evidence confirms that rich persons use the Cayman Islands for wealth management purposes.[32] The U.S. securities held by Cayman banks on behalf of foreign residents are recorded as liabilities of the U.S. vis-a-vis the Cayman Islands by the TIC survey, though

[30] See "Sigma collapse marks end of SIV era", Financial Times, October 1st 2008.

[31] We can gain some insight here by looking at Jersey, a huge center for the incorporation of IBCs, with 33,000 incorporated companies at the end of 2008 (see Jersey's *Financial Services Industry – Quarterly Report*, available online at http://www.jerseyfinance.je/Technical/Statistics/). The CPIS gives the sectoral breakdown of Jersey's portfolio (CPIS Table 3). Col. 7 of the CPIS Table 3 for Jersey gives the assets of "other" financial intermediaries which are neither insurance companies nor mutual funds, i.e. of SPEs and IBCs. At the end of 2008, their foreign portfolios amounted to USD 188bn. Some evidence suggest that the IBC business is somewhat more developed in Jersey than in the Cayman Islands. For instance, there are many more trusts companies, corporate services providers, and consultants in Jersey as in the Cayman Islands. The number of such companies should go hand in hand with the number of IBCs, since their job is basically to provide directors, nominees, trustees, etc., for the administration of offshore corporations (and the management of SPVs).

[32] See, e.g., the detailed testimony of a former Cayman Islands banker to the U.S. Senate (2001). Note also that 8,000 U.S. persons reported to the IRS that they owned an account in the Cayman Islands in 2008 (U.S. Government Accountability Office, 2008), a lower bound for the true figure.

they should not. Thus, TIC data may over-estimate the true U.S. holdings of the Cayman Islands.

It is impossible on a priori grounds to say which problem is likely to dominate. We can, however, see what happens in Bermuda, the CPIS-participating OFC which is the most akin to the Cayman Islands.[33] Between 2001 and 2004, Bermuda's CPIS-reported claims on the U.S. $\hat{A}_{ij}$ were very close to U.S. TIC-recorded liabilities vis-a-vis Bermuda L_{ji} (the $\hat{A}_{ij}/L_{ji}$ ratio was between 0.9 and 1.17[34]). Since 2005, Bermuda's U.S. claims have been between 1.3 and 1.5 larger than TIC-recorded liabilities. The Bermudian example shows that the TIC data must be taken with care, and suggests that I may significantly under-estimate the Cayman Islands' holdings of foreign securities.

To sum up, the best available estimate, backed by two fully independent dataset, is that total Cayman holdings of foreign securities amounted to USD 1.2tr in 2008, down from USD 1.6tr in 2007. The key uncertainties that surround these figures are: (i) the location of the master funds in which Cayman hedge funds invest; (ii) the extent to which Cayman funds use non-Cayman and non-U.S. custodians; (iii) the holdings of SPVs and trusts. Overall, it is likely that my estimate understates the foreign holdings of the Cayman Islands. Hence, the figures in Table A6 and col. 3 of Table A1 should be considered as being on the low-end.

But importantly, the uncertainty surrounding Cayman holdings is irrelevant for the computation of the unrecorded global offshore wealth of households Ω. This is because I compute the Cayman Islands' cross-border portfolio *liabilities* using the same data and the same assumptions as those used to estimate Cayman assets (see Section B below). For instance, fund holdings may be USD 1tr larger than my preferred estimate, but if it is the case, the Cayman Islands' equity liabilities would also be USD 1tr larger than my preferred estimate. This would leave unchanged the global asset-liability discrepancy.

C Other corrections for CPIS-reporting countries

Besides the crucial correction for the Cayman Islands, I only make two minor corrections to the raw assets data reported in the CPIS.

C.1 Netherlands SFIs

The first is to upgrade the assets reported by the Netherlands, which exclude the assets of Netherlands' special financial institutions (SFIs). SFIs are holding com-

[33] Bermuda is the largest "small international financial center" in the CPIS, and like the Cayman Islands a U.K. Overseas Territory (hence has English as official language), located close to the Caribbean sea (Bermuda is in the Atlantic), with a very high GDP per capita (USD 90,698 versus USD 57,222 for the Cayman Islands (Lane and Milesi-Ferretti, 2010)) and a fixed exchange rate with the U.S. dollar. Bermuda also hosts an important hedge fund industry (Sullivan, 2008).

[34] This, however, conceals important discrepancies by asset class: Bermuda reported significantly more debt assets on the U.S. than the U.S. recorded debt liabilities vis-a-vis Bermuda (with a $\hat{A}_{ij}/L_{ji}$ ratio of 1.1-1.6). The opposite was true for equities (with a $\hat{A}_{ij}/L_{ji}$ ratio of 0.2-0.4). The debt discrepancy can be explained by Bermuda's holdings of U.S. international securities through custodians in Luxembourg and Belgium (Clearstream and Euroclear Bank), and more generally by the fact that Bermuda, still a relatively small OFC, may not have developed yet a substantial domestic custody industry.

panies, finance companies that extend loans to foreign group corporations and are financed from abroad, and more generally "resident enterprises or institutions, irrespective of their legal form, in which non-residents hold a direct or indirect participating interest through a shareholding or otherwise and whose objective is or whose business consists to a major extent of receiving funds from non-residents and channelling them to non-residents" (De Nederlandsche Bank, 2009, p. 3).

All figures sent by the Netherlands to the IMF, whether for its balance of payments, international investment position, or for the CPIS, exclude the assets of SFIs.[35] The EWNII figures are equal to those reported to the IMF. Now, all data should be based on the residence principle defined by the Balance of Payments Manual (IMF, 1993). So, throughout the paper, I use the IIP published by the DNB with SFIs included. It does not make a great difference on the portfolio assets side (less than USD 100bn), since SFIs are mainly holding companies that don't own portfolio assets but direct investments. However, it makes a significant difference (more than half a trillion USD) on the liabilities side.

C.2 Other

The second correction consists in filling in the gap for the few CPIS countries that have not participated each year. For instance, Bahrain did not report in 2002 and 2003. To fill in the gap, I simply use Bahrain's share in total CPIS-countries assets in 2004, and apply it to the 2002 and 2003 totals. The same interpolation technique is used for Barbados (2001-2002), Gibraltar (2001-2003), India (2001-2003), Latvia (2001-2005), Kuwait (2001-2002) and Mexico (2001-2002). Col. 4 of Table A1 adds the correction for Netherlands' SFIs and for the missing years.

The key limitation of the CPIS is that a number of countries did not participate during the period covered by the present study (2001-2008), in particular most Middle-Eastern oil-exporters (Oman, Qatar, Saudi Arabia, the United Arab Emirates, Iran and Iraq), China, Taiwan, and the British Virgin Islands. I explain below how I construct estimates of the aggregate securities holdings of (i) China, (ii) Middle-Eastern oil exporters and (iii) all other non-CPIS participating countries.

D China (Table A7)

China did not participate in the CPIS, and we know that it did not participate in the SEFER either (figures reported in the SEFER are too low to be consistent with a participation of China, see Wooldridge (2006).)

I start with the Chinese data on official foreign exchange assets, reported in the IMF International Financial Statistics (IFS) line 1d.d, and reproduced in Table A7, line 2. I assume that 85% of China's foreign exchange reserves are invested in

[35]See the country notes for the Netherlands in the IMF *Balance of Payments Statistics* (2009): "The residence of enterprises operating in free trade zones is not recorded following the residency criteria of BPM5. Special Financial Institutions (SFIs) are considered residents of the Netherlands [in the BPM5]. These entities play a significant role in the Dutch balance of payments. However, the size of their transactions also leads to distortions of individual balance of payments items. For this reason, DNB [de Nederlandsche Bank] publishes two balance of payments statements: one including and one excluding SFIs. The Dutch balance of payments reported to the IMF consists of only national figures, i.e., SFIs are excluded."

securities.[36] The 85% figure is on a best-guess basis. On average, reserve assets tend to be invested more conservatively, i.e., with a higher fraction in non-risky bank deposits (around 25% since the middle of the 1990s[37]). However, the BIS dataset on the deposits held by official monetary institutions shows that only 3% of Chinese reserves were deposited in BIS-reporting banks at the end of March 2006 (Wooldridge, 2006, p. 37). China's central bank may be particularly risk-taking or may hold the bulk of its foreign currency banknotes in Chinese onshore banks — which do not report to the BIS. The 85% figure tries to catch a balance between the two scenarios. If we were to assume that all Chinese foreign exchange reserves are invested in securities, the resulting estimate of Ω would only be trivially affected.

The figures for China's portfolio of publicly-held foreign securities are displayed in line 3 of Table A7 and col. 6 of Table A1. I also estimate the amount of China's privately-held portfolios (i.e., non reserve assets), based on China's (imperfect) international investment position (Table A7, line 9, 10, and 11). The IIP starts in 2004 and is established at book value, which means that equity assets were underestimated during the bull market of 2004-2007. Accordingly, for equities, I only use the 2008 IIP figure: on december 31st 2008 the global stock market was low, with major stock indices flat or negative on a 10 years period, so at that time book values were probably not far from market values. I then extrapolate backwards using the proportional change of U.S. equity liabilities vis-a-vis China (from the monthly TIC estimates of Bertaut and Tryon (2007)). For debt assets, I use the IIP figures for 2004-2008 and extrapolate backwards similarly.

At the end of 2008, the resulting Chinese portfolio of foreign securities (Table A7 line 15, and Table A1 col. 5) amounted to USD 1.9tr, of which 87% were reserve assets. It means that China was the 7th largest holder of foreign securities, with assets comparable to those of Germany and Luxembourg (USD 2.1tr).

Regarding portfolio composition, I compute the share of equities in China's portfolio using the share of equities in its portfolio of U.S. assets (from the TIC survey of U.S. liabilities). At year-end 2008, 95% of China's foreign portfolio consisted of bonds. China was accordingly the 3rd largest foreign bond-holder in the world, close to France (USD 2.0tr) and behind Japan.

Lastly, my estimate for total public plus private Chinese securities assets can be compared with the TIC data on Chinese holdings of U.S. securities (Table A7 line 19-22). The ratio between China's (observed) U.S. securities holdings and China's (estimated) total foreign securities appears to be very stable in the 69-76% range throughout the period (Table A7 line 23). This is coherent with other studies[38]

[36] Foreign exchange reserves (1d.d) "include monetary authorities' claims on nonresidents in the form of foreign banknotes, bank deposits, treasury bills, short- and long-term government securities, ECUs (for periods before January 1999), and other claims usable in the event of balance of payments need" (IMF, 2009). By adding reserve positions in the IMF and the U.S. dollar value of SDR holdings by monetary authorities, we get Total Reserves Minus Gold (line 1 l.d, reproduced here in Table A7, line 1); adding Official Gold Holdings (line 1ad) we get total reserve assets.

[37] See Wooldridge (2006, p. 31). The same pattern emerges when we restrict the attention to reserves invested in U.S. dollars: McCauley (2005, p. 59) documents that 24.2% of estimated dollar reserves at end-June 2004 were bank deposits (17.9% in non-U.S. banks, 6.3% in U.S. banks).

[38] See, e.g., Setser and Pandey (2009), who compute a U.S. share of 66% in February 2009. The small discrepancy with my estimate comes from the fact that Setser and Pandey try to capture

and suggests that China had probably not significantly diversified away from the U.S. dollar over the period. Estimating the value of China's foreign securities by using the TIC survey and assuming a constant U.S. share (say 70%) would give fully convergent results.

E Middle Eastern oil exporters (Table A8)

Middle Eastern oil exporting countries are Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. Sovereign Wealth Funds (SWFs) play an important role in their accumulation of foreign claims. SWFs are publicly controlled funds investing budgetary and extra-budgetary savings (here coming mainly from oil revenues). At the time of this paper, Middle East countries' SWF assets were not considered reserve (IMF, 2007, p. 14), contrary for instance to Russia's. Thus, we can distinguish three kinds of investors in Middle East oil exporting countries: i) central banks (accumulating reserve assets); ii) sovereign wealth funds, iii) other investors (wealthy private families, other households, private financial and non-financial corporations). I call public assets reserve plus SWF assets.

E.1 Available data and assumptions

Data on Middle Eastern oil exporters are scarce. In Table A8, I gather the available evidence and present my computations. Each country publishes its reserve holdings (Table A8 line 17), but these figures exclude SWF holdings (and include deposits, not only securities),[39] so the coverage of Gulf countries' foreign holdings in standard dataset is significantly incomplete. We only have good data for Saudi Arabia.[40]

China's holdings held offshore, e.g. with Hong-Kong or U.K. custodians (this also explains why they have a somewhat larger figure for total Chinese assets, i.e. USD 2.2tr in February 2009 vs. USD 1.9tr for my december 2008 estimate).

[39]In 2010, Saudi Arabia revised its reporting method. Before 2010, Saudi Arabia's sovereign wealth fund assets, which are managed by the Saudi Arabian Monetary Agency (SAMA), were excluded from the reserve figures reported by Saudi Arabia to the IMF. From 2010 on, SAMA's sovereign wealth funds are classified as reserve assets. Saudi Arabia has provided revised reserve figures starting in 2005. In order to insure continuity, in line 17 of Table A8 I stick to the old classification, in which reported reserves asset exclude Saudi Arabia's sovereign wealth fund.

[40]SAMA publishes its balance sheet monthly (http://www.sama.gov.sa/sites/samaen/ReportsStatistics/statistics/Pages/MonthlyStatistics.aspx). The first column of Table 8a in SAMA (2010b, p. 16) refers to reserve assets (labelled "issuance department assets" in the annual report (SAMA, 2010a, p. 416)) in the old definition of reserve assets (see the above footnote). At the end of 2008, Saudi Arabia had 121,066 million riyals in reserve (including gold), i.e. USD 32.3bn, of which 1,556 million Riyal in gold holdings (SAMA, 2010b, Table 9 p. 20). This is strictly consistent with the data reported to the IMF in the 2008 edition of the *International Financial Statistics* (i.e., before SAMA changed its reporting method). Col. 2-6 of SAMA (2010b, Table 8a) refer to Saudi Arabia's sovereign wealth fund holdings (labelled "banking department assets" in the annual report). At the end of 2008, Saudi Arabia's SWF had 1,154,247 million riyals in foreign securities (USD 307.8bn) and 379,487 million riyals in deposits with banks abroad (USD 101bn, i.e. bank deposits amounted to 24% of the SWF assets). Lastly, SAMA (2010b, Table 8a part 2 p. 17) reports the assets of the "independent organizations" managed by SAMA (these are the Public Pension Agency, the General Organization for Social Insurance, the Development Funds and other institutions). At the end of 2008, they had 227,648 million Riyals (USD 60.7bn) in foreign securities. Assuming that 75% of SAMA's IMF-reported foreign exchange reserves were

Several figures on SWFs holdings circulate in the public domain, but they are not based on official publications. At the time of this paper, there is no way to assess their accuracy: they could be far from the truth.[41] Private assets should be captured by the portfolio part of the IIP, or by cumulating outward private flows, but only Kuwait and Bahrain compile an IIP and participate in the CPIS, and few countries provide detailed flow data.[42]

Given the difficulties in identifying all Middle Eastern oil exporters' holdings, I simplify matters as follows. I include all the securities held offshore by Middle Eastern oil exporters in my "unrecorded household offshore wealth" total Ω. Therefore, for the purpose of computing the sum of all identifiable assets worldwide (Table A1), we only need to estimate the onshore holdings of oil exporters. The best way to do so is to use counterpart countries data, i.e, most notably the TIC survey of U.S. portfolio liabilities. By definition, the TIC survey tells us the value of all the U.S. securities directly held by oil exporters – that is, through banks in the Middle East, not through Swiss or U.K. custodians. We can then apply an estimate of the share represented by U.S. securities in the portfolio of Middle Eastern oil exporters to get the value of their total onshore portfolio.

The U.S. Treasury does not publish country-level holdings of Middle-Eastern oil exporters, but an aggregate figure for Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. I take the value of the U.S. long-term securities held by oil exporters (Table A8 line 7) directly from the monthly TIC estimates produced by Bertaut and Tryon (2007). For short-term securities, the Treasury survey of U.S. banking liabilities cannot be used, because it does not disentangle between Asian oil-exporters' different kinds of short-term claims (deposits, securities, other). I compute Middle Eastern oil exporting countries' holdings of short term U.S. debt (Table A8 line 10) from their holdings of long-term securities, assuming a short-term/long-term ratio equal to the average short-term/long-term ratio for all foreign official institutions' holdings of U.S. securities.[43]

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invested in securities, Saudi Arabia had USD 390bn in foreign securities at the end of December 2008, disregarding its private holdings. Note that in the revised reserve figure published in the 2010 edition of the IMF *International Investment Statistics*, Saudi Arabia has USD 440bn in reserve assets (line 1d.d., which includes deposits) at the end of 2008.

[41] The greatest uncertainty surrounds the holdings of the Abu Dhabi Investment Authority (ADIA), with, at the end of 2007, "some estimates as low as USD 250bn and as high as USD 1.3tr" (Setser and Ziemba, 2007, p. 6).

[42] Qatar and the United Arab Emirates don't disseminate BoP data. When BoP or other flow data exist, there is often no distinction between equity and debt. Lane and Milesi-Ferretti (2007) provide portfolio asset estimates based on cumulated flows for Iran, Oman, Qatar and the United Arab Emirates. Equity assets of Qatar and Iran are set to zero. As far as debt is concerned, there is no breakdown between portfolio and other debt (i.e., bank deposits and loans).

[43] Total long-term U.S. holdings of foreign official institutions (FOI) come from the March 2010 release of the Bertaut and Tryon (2007) database; total short-term U.S. securities of FOI are line 5 + line 6 of the Historical Liabilities to Foreigners by Type and Holder dataset, downloaded on June 16, 2010 from http://www.ustreas.gov/tic. Note that "foreign institutions" in the TIC survey include sovereign wealth funds: "Contrary to the assumptions of many data users, the holdings of foreign official institutions as reported in the TIC system consist of more than the foreign reserve asset holdings of central banks and of other foreign government institutions involved in the formulation of international monetary policy. They also include the holdings of foreign government-sponsored investment funds and other foreign government institutions." (Bertaut et al., 2006, p. A63).

To estimate the share represented by U.S. in the portfolio of Middle Eastern oil exporters, I have looked at all the geographical breakdown estimates published recently.[44] They share three convictions: (i) the U.S. share is high, much higher than the U.S. share in exports or the average share of the U.S. in global cross-border positions. (ii) However, most authors point to a somewhat declining share of the U.S. in recent year — though the exact magnitude of the decline is debated — and a diversification towards Europe, Japan, and emerging economies. (iii) The diversification strategy mainly concerns the most "aggressive" SWFs (Abu Dhabi Investment Authority, Kuwait Investment Authority, Qatar Investment Authority), whereas the biggest player, the Saudi Arabian Monetary Agency, may still invest the bulk of its assets in the U.S.

I find that assuming for 2001 a 70% share of U.S. assets, and then a regular decline of 2 percentage points per year fits the various available estimates best (Table A8 line 14). The 70% figure for 2001 matches the USD share of oil exporting countries' deposits in BIS-reporting banks (Stever et al., 2006, p. 18), and corresponds to the oldest estimates (usually in the 70-75% range). The 56% figure for 2008 matches the most recent estimates and various back-of-the-envelope computations suggesting that only 50% of Gulf countries' capital outflows have been invested in the U.S. in recent years.

E.2 Results and discussions

The resulting onshore portfolio of Middle Eastern oil exporters is displayed in col. 7 of Table A1 and line 15 of Table A8. In 2008, for instance, oil exporters owned USD 582bn of foreign securities onshore. Though mostly publicly held, a surprisingly high share of their portfolio seems to be invested in equities (40-50% throughout the period, except at the end of 2008), suggesting a markedly different investment pattern than in China.[45]

How large is the likely offshore portfolio of Middle Eastern oil exporters? Historically, oil exporters have been key players in the offshore wealth management market: in the beginning of the 1980s, Middle East countries owned around 20% of Switzerland's fiduciary deposits (see Table A25 col. 3). Today, a significant fraction of their holdings are certainly in custody in U.K. and Swiss banks, hence wrongly attributed by the U.S. TIC to the U.K. and Switzerland.[46] This is particularly true for wealthy private families, for which going offshore is a sensible diversification strategy.

[44]These are: APICORP (2006), Setser and Ziemba (2007), Woertz (2007), Handy et al. (2008) and Setser and Ziemba (2009).

[45]The high share of equity assets in Gulf countries' portfolio is consistent with available anecdotal evidence. For instance, McKinsey (2007, p. 53) estimates that 46% of the assets held by petrodollars investors are in equities, 42% in bonds and cash, and the remaining 12% in FDIs and alternative investments.

[46]Here, one should not confuse the process of using a foreign institution for securities trading, i.e. using a U.K. broker to buy U.S. bonds, and using an offshore custodian for safekeeping, i.e. when a country i entrusts its claims on j to a custodian which is neither in i nor in j. Middle Eastern oil exporters, as others, routinely use foreign brokers, which explains why oil exporters are not very apparent in the U.S. Treasury transactions dataset. The use of foreign custodians, however, is a very different thing, and less frequent (which is why the "transaction center bias" is much more pronounced in the TIC data than the "custodial center" bias).

We can guess the size of Middle Eastern oil exporting countries' offshore portfolio by comparing my estimate of their onshore holdings (Table A8 line 15) with other estimates that include offshore holdings.

Setser and Ziemba (2009) put Gulf Cooperation Council (GCC[47]) States' assets at USD 1,200bn in 2008. Assuming that 85% were invested in securities (which is more than in Saudi Arabia, where the securities share is 75%), and that Iran and Iraq (the 2 non-GCC oil exporters) have 0 portfolio asset, this figure implies that Middle Eastern oil exporters had securities holdings of around USD 900bn at the end of 2008 (Table A8 line 25). Setser and Ziemba (2009) cumulate the GCC States' current account balances overtime, a method that should in theory capture offshore holdings.[48] Their securities asset figure is between 1.4 and 1.7 larger than my estimate of Middle East oil exporters' onshore holdings: if Setser and Ziemba (2009) are right, around 40% of oil exporters' foreign securities are held offshore (Table A8 line 27).

Lane and Milesi-Ferretti (2007) also estimate the total assets of Middle East oil exporters. Their portfolio equity figure (Table A8 line 30) is comparable to my onshore estimate.[49] They don't have a portfolio debt figure, but we can infer one from their total debt asset figure as follows. Debt assets include portfolio debt, deposits with foreign banks, loans, trade credit, and other debt assets. By definition, private debt assets plus reserves minus deposits in BIS-reporting banks is an upper bound for portfolio debt assets.[50] In line 31 of Table A8, I assume that 20% of the (debt assets + reserve - deposits in BIS banks) residual takes the form of loans, trade credit, deposits in non-BIS reporting banks, etc., and that 80% takes the form of debt securities. In this computation, I exclude Bahrain which publishes an IIP (Bahrain's sovereign wealth fund has negligible holdings), and add Bahrain's reported portfolio debt asset in the end.

Summing the portfolio equities and debt securities figures, we get an estimate of the securities held onshore and offshore by Middle Eastern oil exporters. Subtracting my onshore holding estimate, we get the implied offshore holdings (Table A8 line 36). They are comparable, if a bit higher, to those implied by Setser and Ziemba's (2009) study: Lane and Milesi-Ferretti's figures imply that 50-60% of Middle Eastern oil exporters' portfolio is held offshore. This is around 10% of my "unrecorded household offshore wealth" total Ω (Table A8 line 38).

Anecdotal evidence suggests that public institutions and not only wealthy families use offshore custodians.[51] As the focus of this paper is on private offshore

[47] GCC States are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates.

[48] Setser and Ziemba (2007) assume that all surpluses are channeled to public investment funds (reserve or SWF), except for Saudi Arabia where they assume that one quarter goes to private hands. Their estimate can thus be read as including almost all GCC assets, public plus private.

[49] Note that in some cases (Qatar, Iran), equity assets are 0 in the EWNII database, and Iraq is not included in the database.

[50] It is an upper bound because deposits in BIS banks do not capture all cross-border deposits: Middle East countries can have deposits in non-BIS reporting banks. And debt assets include loans and trade credits in addition to deposits.

[51] See McCauley (2005). Official offshore holdings have historically been important for bank deposits, and driven by the positive yield differential between interests on eurodollar accounts in London and interests on onshore U.S. bank accounts. The differential existed because (i) capital controls *de facto* segmented the onshore and offshore dollar money market, and (ii) U.S. reserve requirements made it costlier for U.S. banks to borrow in the U.S. and advantageous to finance

wealth, some might find desirable to exclude central banks' or sovereign wealth funds' offshore holdings from Ω. But the distinction between private and public wealth is not always clear, and the fact that public institutions and not only private individuals use offshore custodians is interesting *per se*. It may reflect fears of assets freezing, as happened in the past (for instance when the U.S. froze Iranian assets in 1979[52]), fears of stricter financial disclosure rules in the wake of 9/11, or infrastructure risks (trading of U.S. Treasury securities was interrupted in the U.S. in September 2001, but still functioned in Europe). It has been an important driver in the development of the offshore wealth management business, and is still part of the puzzling anomalies in global accounts. The use of offshore banks by official institutions explains, in particular, why BIS figures on central bank accumulation of USD deposits differ from U.S. sources on official financing of the U.S. current account deficit, a discrepancy that has preoccupied economists and policy-makers alike (McCauley, 2005; Summers, 2004). I choose, accordingly, to include Middle Eastern oil exporters' official offshore holdings in Ω.

Although oil exporters raise important data challenges, we can be confident that my estimate for their onshore holdings is meaningful, i.e. that it includes all onshore holdings (around USD 600bn in 2008), and that offshore holdings (maybe around USD 500bn in 2008) are not many times larger than onshore holdings. I provide below two additional consistency checks supporting this claim.

First, we can turn to the Japanese survey of portfolio liabilities[53] to get an idea of Middle Eastern countries' identifiable investments in Japan, and see if they are in line with my estimate of their total onshore holdings. They are. Middle Eastern countries' identifiable assets in Japan reached USD 100bn at the end of 2008, which is around 15% of their estimated total onshore portfolio (Table A8 line 39). This figure is higher than Japan's share of world GDP, but well in line with the diversification assumption: oil exporters' Japanese holdings seems to have been multiplied by 10 in nominal terms between 2001 and 2008, pushing the ratio between Middle Eastern identifiable investments in Japan and in the U.S. from 0.1 to 0.3 (Table A8 line 41).

Second, we have good data for Saudi Arabia, which is by far the largest oil exporter (Saudi's exports top Kuwait's and UAE's taken together). Saudi Arabia's net oil balance is 40-45% of the Middle East's (Table A8 line 44).[54] Now, Saudi Arabia's total foreign portfolio assets account for 45-55% of my estimated Middle Eastern countries' onshore holdings throughout the 2001-2008 period.[55] The figure for Saudi assets (line 42 of Table A8) includes reserve, SWF and pension funds

themselves from London, driving up the interests rates there, even after the abolition of U.S. capital controls in 1974. Although the yield differential has disappeared since the end of the 1980s, the habit of holding a large share of reserve USD deposits in offshore banks has remained (McCauley, 2005, p. 62). Much less, however, is known regarding the use of offshore custodians for reserve securities holdings, which is our primary concern here, and cannot be explained by any yield differential.

[52]See Hufbauer et al. (1990) cited in McCauley (2005, p. 60)

[53]Table 4 of the CPIS downloaded on October 25th, 2008, from http://www.imf.org/.

[54]Data are from the IMF World Economic Outlook.

[55]Except in 2008, where Saudi Arabia's share rises to 66%, which is consistent with the widely shared belief that SAMA has a more conservative portfolio than ADIA, KIA and QIA, i.e. was more heavily invested in bonds and in U.S. dollars when the financial crisis hit.

assets,[56] whether held onshore or offshore. The consistency between Saudi Arabia's total assets divided by total Middle Eastern onshore holdings, and Saudi Arabia's share in the Middle East's net oil balance, suggests that offshore public wealth is not many times greater than onshore public wealth (otherwise SAMA's holdings would be a much greater percentage of the estimated onshore holdings of Middle Eastern countries). Total Gulf holdings are larger than their onshore holdings, but not many times so.[57]

Some uncertainties remain about the portfolios held by oil exporters. However, the estimate presented in col. 7 of Table A1 rests on solid foundations, namely the U.S. TIC data for (directly-held) assets in the U.S. Total holdings of Middle Eastern countries are larger, but (i) not hugely so (maybe around twice larger); (ii) assets not captured in col. 7 of Table A1 are, by construction, offshore assets that we want to include in Ω, hence exclude from Table A1.

F Other countries (Table A9)

Besides China and most Middle-East countries, smaller investors with non-zero portfolios do not report to the CPIS, most notably Algeria, Angola, the British Virgin Islands, Croatia, Libya, Nigeria, Morocco, Peru, Serbia, Slovenia, Taiwan, and Vietnam. I estimate on the one hand their private holdings and on the other their reserve assets. Table A9 presents the computations, which are summarized in col. 11 of Table A1 (private holdings) and col. 12 of Table A1 (reserve holdings).

F.1 Private assets

Private (i.e., portfolio) holdings of non-CPIS participating countries, besides China and Middle East oil exporters, come from two sources. Most data come from the updated and extended External Wealth of Nations mark II (EWNII) database (Lane and Milesi-Ferretti, 2007). Data for small international financial centers (Andorra, Anguilla, Liechtenstein, Monaco, Montserrat, Nauru, Palau, the British Virgin Islands, etc.) come from my own computations.

External Wealth of Nations countries Most non-CPIS participating countries are included in the EWNII. When no international investment position is compiled, EWNII stock estimates are built by cumulating balance of payments flows with valuation adjustments. The reader is referred to Lane and Milesi-Ferretti's (2007) paper and its appendix for all the details.

I take the equity asset figures of non-CPIS countries covered by the EWNII directly from the EWNII database. At the time I wrote this Appendix, the EWNII

[56] Note that Saudi Arabia's private mutual funds holdings, not included here, are negligible (USD 4.2bn of foreign securities assets at the end of 2008 (SAMA, 2010a, p. 284).

[57] Note, however, that SAMA data slightly understate Saudi Arabia's total holdings. For instance, Saudi Arabia's holdings in BIS-reporting banks are slightly higher than cross-border bank deposits reported by SAMA. In December 2008, SAMA reported USD 101bn (SWF) + 8bn (25 % of reserve, old definition) + 4bn (pension funds) = USD 113bn of foreign bank deposits; the BIS locational banking dataset put Saudi Arabia's foreign deposits at USD 180bn, of which USD 39bn belonged to the non-bank sector not covered by SAMA (see BIS Table 7A and 7B, http://www.bis.org/statistics/bankstats.htm).

ended in 2007. I compute the 2008 equity asset levels as 0.575 times the 2007 level. The 0.575 factor is equal to the ratio: equity assets privately owned in the 2008 CPIS / equity assets privately owned in the 2007 CPIS.

Things are more complicated for portfolio debt, because in most cases, the EWNII only gives a figure for portfolio debt plus other debt assets (which include, e.g., cross-border bank accounts). Portfolio debt is identified only for the countries that publish their international investment position. For them, total debt assets are, on average, 5 times larger than portfolio debt assets (it is an unweighted average). Accordingly, I compute portfolio debt as 20% of total debt when the former is missing. I compute the 2008 level as 0.913 of the 2007 level. 0.913 is equal to the ratio: debt assets privately owned in the 2008 CPIS / debt assets privately owned in the 2007 CPIS.

Lines 7 to 12 of Table A9 present the results. As the reader can see, the largest non-CPIS country covered by the EWNII, besides China and Middle East oil exporters, is Taiwan (Table A9 line 10).

Small Offshore Financial Centers Countries which are not in the EWNII database are mostly small offshore financial centers.[58] I proceed as follows. First, I compute their portfolio liabilities by summing all the claims that CPIS-participating countries report on them. Second, I assume that they have a zero net portfolio position, so their assets $\hat{A}_i$ are given by:

$$\hat{A}_i = \sum_j \hat{A}_{ji}$$

Note that the CPIS-derived liabilities $\sum_j \hat{A}_{ji}$ are not computed from the raw CPIS data, but from the modified CPIS data that correct for the Cayman Islands' non-bank sector. The correction matters because Cayman funds have significant links with funds in other OFCs (through master/feeder structures). In particular, the extended gravity model suggests that Cayman funds owned more than USD 100bn on the British Virgin Islands in 2008. In turn, it implies that the British Virgin Islands had at least USD 100bn in foreign assets. The methodology used in this paper makes sure that *all* countries and jurisdictions are included in my estimate of total securities assets and that the entire dataset is internally consistent.

Lines 13 to 18 of Table A9 present my estimate of the portfolio claims held by the small international financial centers which are neither included in the CPIS nor in the EWNII. As the reader can see, the largest center is the British Virgin Islands (line 16) which, I estimate, had USD 231bn in portfolio claims at the end of 2007.[59]

The total private holdings of non-CPIS countries, excluding China and Middle

[58] All other countries or territories have negligible assets. The only exception is Iraq. It is absent from the EWNII database, but I include it in my Middle Eastern oil exporters aggregate.

[59] Note that in official IIP statistics Liechtenstein is included in Swiss data and Monaco in French data. Hence by including these countries' assets in my world total, I somewhat over-estimate the global amount of identifiable claims. This issue is mitigated by the fact that I also include these countries' liabilities in my global amount of identifiable liabilities. So my global gross securities positions are slightly too high, an issue which on net makes practically no difference (i.e., should not affect my estimate of the total unrecorded wealth). I am grateful to an anonymous referee for pointing this issue to me.

Eastern oil exporters, are displayed in lines 5 and 6 of Table A9, and copied in col. 11 of Table A1.

F.2 Reserve assets

The reserve assets of non-CPIS countries, excluding China and oil exporters, are displayed in the first panel of Table A9 (lines 1 to 4) and copied in col. 12 of Table A1. In order to compute them, I start with the foreign exchange figures that each country reports to the IMF (*International Financial Statistics*, line 1d.d[60]). All reserve assets are not invested in securities (some of them are invested in bank deposits), and we don't know the deposits / securities breakdown. Following Wooldridge (2006, p. 31), I assume that securities account for 75% of foreign exchange reserves and bank deposits for 25%. The SEFER survey shows that around 1.5% of the securities held as reserve are invested in equities, and 98.5% in bonds. Therefore, I assume that bonds are 74% of foreign exchange reserves and equities 1%.

G Total securities assets (Tables A1, A4-A5)

Total identifiable securities assets (Table A1 col. 13) are obtained by summing CPIS-reported assets (including securities held as reserve and by international organizations), the corrections for CPIS-participants (Cayman Islands and other), and the assets of China, Middle-Eastern oil exporters, and other non-CPIS countries. We see that the CPIS captures the vast majority of all identifiable assets: the ratio between CPIS-reported claims and all identifiable claims was 86% in 2008 (Table A1 col. 15). The ratio has decreased over the period, starting from 93% in 2001. The coverage of the CPIS has somewhat deteriorated.

Securities held as reserve and by international organizations are displayed in col. 14 of Table A1, which is obtained by summing SEFER+SSIO assets, and the reserves of China, oil exporters, and other non-CPIS countries. There is a straightforward way to check that this total is correct. By definition, it must almost be equal to the difference between total non-gold reserve assets held by official monetary institutions, which are reported by all countries in the IMF *International Financial Statistics*,[61] and total reserve held as deposits, which are reported by the Bank for International Settlement (BIS).[62] We can see in col. 16 of Table A1 that it is indeed the case. The small discrepancy between col. 14 and col. 16 of Table A1 can be explained by three factors:

- Some reserves may be held in banks that do not report to the Bank for International Settlement (for instance part of China's reserves may be held in

[60] "Under Total Reserves Minus Gold (1l.d), the line for Foreign Exchange (1d.d) includes monetary authorities' claims on nonresidents in the form of foreign banknotes, bank deposits, treasury bills, short- and long-term government securities, ECUs (for periods before January 1999), and other claims usable in the event of balance of payments need." (*International Financial Statistics*, December 2009, Introduction, p. xiv).

[61] And summarized in the IMF COFER database, downloaded on July 27, 2010 from http://www.imf.org/external/np/sta/cofer/eng/index.htm. The total reserve figure in the COFER is the sum of IFS line 1d.d. for all countries.

[62] BIS locational banking statistics, Table 5C, downloaded on October 22, 2010 from http://www.bis.org/statistics/bankstats.htm.

China).

- The SEFER+SSIO total includes the holdings of international organizations, contrary to the "total non gold reserves minus deposits in BIS-banks" residual.

- Some sovereign wealth funds' holdings might be classified differently in the IMF *International Financial Statistics* and in the SEFER.

Despite these three minor limitations, and considering that col. 14 and col. 16 of Table A1 are almost identical, we can be confident that I have properly accounted for all official holdings in Table A1.

Note that the coverage of reserve holdings by the SEFER survey is significantly worse than the coverage of portfolio holdings by the CPIS. The ratio between all publicly-held securities (col. 14) and SEFER-reported claims (col. 2) is larger than 1.67 in 2008, and has sharply deteriorated, reflecting the fact that China is not reporting to the SEFER.

Table A4 describes who are the main holders of foreign securities. We can distinguish two categories: industrial, emerging and developing countries (left panel) and offshore financial centers (right panel). Note that the figures for industrial, emerging and developing countries only include privately-held portfolios (securities held as reserve assets are aggregated in col. 7). Including reserve holdings changes the ranking of the main investors. For instance, in 2008, Japan was the 4th largest investor in terms of privately held portfolios, after the U.S., U.K. and France. But if we were to include Japan's foreign securities held as reserve (which are included in col. 7), then Japan would move to the 2nd position.

In 2008, 23% of all identifiable securities assets were held by mutual funds and other financial corporations located in offshore financial centers, most notably in Luxembourg, Ireland and the Cayman Islands. This share is slowly growing (21% in 2001). Note also that if we include the amount of unrecorded offshore wealth (Table A4 col. 9, which is simply Table A3 col. 3) in the total "holdings" of offshore financial centers, then OFCs managed in 2008 31.5% of all (recorded plus unrecorded) cross border securities, a figure which could be disentangled as follows:

- 20% of all cross-border securities were held by mutual funds, banks, special investment vehicles etc. incorporated in tax havens. They appeared on the balance sheet of these institutions, and were well captured by international statistics. Therefore, the *on-balance sheet* wealth management business of tax havens accounted for 1/5 of global cross-border asset trade.

- 11% were held by households through banks in tax havens. They did not appear on the banks' balance sheet, and went unrecorded worldwide. The *off-balance sheet* wealth management business of tax havens accounted for more than 10% of global cross-border asset trade.

Table A5 gives the sectoral breakdown of the portfolios reported to the CPIS: 25% of the securities reported in the CPIS are held by banks; 66% are held by other financial corporations (mutual funds, insurance companies), non-financial corporations and households; and 8% by the public sector. There is substantial heterogeneity across countries; e.g., 75% of Norway's portfolio is publicly held (by Norway's pension fund).

B Global Aggregate Securities Liabilities (Tables A2 and A10-A12)

A External Wealth of Nations data

For portfolio liabilities, I start with the updated and extended version of the External Wealth of Nations (EWNII) dataset constructed by Lane and Milesi-Ferretti (2007). It includes data for the period 1970-2007 and for 178 economies. Col. 1 of Table A2 simply reproduces the total portfolio liability figures of the EWNII. The EWNII has the widest coverage: the sum of all liabilities reported there is slightly larger the sum of all liabilities reported in the published international investment positions sent to the IMF (see Table A2 col. 2).

At the time of this paper, the EWNII ended in 2007. For 2008, I use the international investment position figures published by the IMF. When no IIP is compiled, I assume that 2008 equity liabilities were 57% of 2007 liabilities (95% for debt). These multiplicative factors are equal to the ratio: total (public plus private) assets reported in the 2008 CPIS/total (public plus private) assets reported in the 2007 CPIS.

B Correction to liabilities reported in EWNII

I make a few corrections to the portfolio liabilities figures reported in the EWNII.

B.1 No portfolio debt liabilities

In some cases, there is no breakdown in the EWNII between portfolio debt liabilities and other debt, such as bank accounts. To deal with that, I proceed as follows. When portfolio debt liabilities figures are available in published international investment positions sent to the IMF, I use them. When no portfolio debt liability figure is available, I estimate the portfolio debt liabilities L_j of a country j as:

$$L_j = \sum_i \hat{A}_{ij}^{corr}$$

Where $\sum_i \hat{A}_{ij}^{corr}$ denotes the claims reported on j by all CPIS-participating countries, including my corrections (e.g., for the Cayman Islands), *and* by all non-CPIS participating countries (e.g., the claims of China and Middle East oil exporters on j[63]). This is to keep an internally consistent dataset. The results are displayed in col. 3 of Table A2. The correction is negligible.

B.2 Netherlands

Like for assets, I use the Dutch international investment position that includes special financial institutions (SFIs), rather than the investment position figures reported to the International Monetary Fund (and used in the External Wealth of Nations) which excludes SFIs. It adds more than half a trillion USD portfolio debt liabilities in 2008 (see Table A2 col. 4).

[63]Section C explains how I estimate the bilateral holdings of non-CPIS participating countries.

B.3 CPIS-derived liabilities larger than reported liabilities (Table A12)

For most countries j, the raw CPIS-derived liabilities $\sum_i \hat{A}_{ij}$ are smaller than the liabilities L_j reported in the EWNII. Even if all recording systems were perfect, this was to be expected since all countries do not participate in the CPIS.

However for a few countries j, $\sum_i \hat{A}_{ij} > L_j$ (Table A12). This is counter-intuitive: it means that either too much assets are reported by creditor countries in the CPIS vis-a-vis j, or that the EWNII figures underestimate the portfolio liabilities of j. The latter is more likely, for a number of reasons. First, EWNII liabilities are put to 0 in some cases when no balance of payments information is available (e.g. in Panama, Paraguay, or Liberia). Next, liability figures in published international investment positions may miss some liabilities issued offshore (bonds directly issued on the international markets), even with high-standard reporting systems. The French international investment position, for instance, does not record the short-term debt securities issued by French corporations on the international market. This explains why the CPIS-derived short-term debt liabilities of France are larger than the short-term debt liabilities recorded by France in its IIP (which is directly used for the EWNII). Third, when the discrepancy is non-negligible in some years, it can be linked to a particular weakness in the IIP data collection of debtor countries.

Consider the Italian example. In Italy, portfolio liabilities used to be estimated by cumulating adjusted flows before a stock survey was conducted at the end of 2008. The Central Bank of Italy notes that the survey led to a substantial increase in Italy's equity liabilities (Banca d'Italia, 2010, p. 2):

> "The new system for the collection of data on investment portfolio stocks is now based on the anonymous security-by-security reporting of the stocks held for investors by depositories. [...] The application of the new method entailed very small revisions for the foreign assets (equities and bonds) in residents' portfolios, for which an annual survey was already made that was very similar to that adopted in the new system [...]. On the liabilities side (equities and bonds issued by residents and held by non-residents) the new system produced stocks that were significantly larger than those published previously. At the end of 2008 liabilities towards non-residents consisting of debt securities amounted to EUR 1,036.7bn under the new system, against EUR 988.5bn under the old system; those consisting of equities and investment funds amounted to EUR 133.7bn under the new system, against EUR 24.3bn under the old system. The gap reflects the imperfections of the method of compiling the statistics under which the data where obtained by summing the flows and adding the valuation adjustments, which gave rise to a systematic distortion over time."

Similar weaknesses can be identified in most of the countries where reported portfolio liabilities in the EWNII are less than the raw CPIS-derived liabilities. The Canadian international investment position at market value relies mostly on flows for equity liabilities combined with a partial survey of stock positions; only 53% of domestic corporations were surveyed in 2004 (Statistics Canada, 2004, p.

73). At the time of this paper, Germany's portfolio liabilities were still computed by cumulating flows (vs. security-by-security custodial and investor surveys for assets).[64] In Cyprus, portfolio liabilities were only estimated for listed companies.[65] Lastly, note that international investment positions data can be revised several years after their first publication (e.g., to take into account stock surveys).[66]

In the paper, I make the assumption that liability estimates L_j are accurate. Accordingly, in the few cases where liability figures have obvious deficiencies, it is important to correct them. So when the raw CPIS-derived liabilities $\sum_i \hat{A}_{ij}$ exceed the reported liabilities L_j, I simply replace the EWNII L_j figures by the CPIS-derived liabilities $\sum_i \hat{A}_{ij}$.[67] When doing so, I use the raw CPIS data, not the augmented claims that take into account the Cayman Islands' non-bank sector.[68] This is to make sure that any mistake made in the allocation of the Cayman hedge funds' holdings does not affect the present correction. Note that the IMF made a similar correction when it computed its own global missing stock table for 2002.[69]

The correction is displayed in col. 4 of Table A2, which is simply col. 11 of Table A12. The correction is not negligible, but one order of magnitude smaller than the total missing portfolio wealth (e.g. USD 612bn in 2007 vs. more than USD 5tr of missing wealth). The choice to upgrade the available liability figures in a few cases does not explain any significant part of the gap between securities assets and liabilities at the global level. On the contrary, I have only made limited correction to available liability figures; by definition, the corrections I make in Table A12 are on the low-end, since the raw CPIS-derived portfolio liability understates what would be the true liability L_j recorded by j if its liability survey was accurate.

Looking forward, it seems likely that some portfolio liability figures will be revised. At the time of this research, some large countries (e.g., Germany) still cumulate flows to estimate their portfolio liabilities, whereas they use security-by-security stock surveys for the assets side of their international investment position. The Italian experience shows that cumulating flows can introduce significant inaccuracies. Second, the huge amount of offshore debt issuance makes it difficult to accurately monitor all portfolio debt liabilities.[70] Third, most statistical efforts

[64] See the country notes for Germany in the IMF *Balance of Payments Statistics*. As of 2010, "Portfolio investment liabilities are not yet compiled from stock data, but on the basis of modified accumulated flows. It is planned to use stock data for the future in line with further enhancements of the ECB Centralized Securities Database".

[65] See the country notes for Cyprus in the IMF *Balance of Payments Statistics*: "Concerning portfolio investment liabilities, the CSE reports to the CBC stocks of liabilities of listed companies vis-à-vis nonresidents (i.e., equity capital held by nonresident shareholders)".

[66] For instance, the 2007 equity liabilities of Germany were revised upwards by around USD 50bn, and it was not reflected in the version of the External Wealth of Nations database used at the time of this paper.

[67] Note that Lane and Milesi-Ferretti (2007) already used the CPIS-derived liabilities of Italy instead of the official (old) IIP – they had rightly anticipated that the officially reported figures were too low. Accordingly I do not correct Italy's liability figures reported in the EWNII (see Table A12). I just generalize Lane and Milesi-Ferretti's approach to the few other cases in which reported liabilities in the EWNII or IMF IIP are suspiciously low.

[68] I simply modify the raw CPIS figure by allocating the confidential and unallocated CPIS claims (see Section C below). This has negligible consequences, but is more coherent.

[69] see CPIS Table 14, "Global Discrepancy in Portfolio Investment at end-December 2002", http://www.imf.org/external/np/sta/pi/globaldi.htm#tab14.

[70] We don't know whether offshore issuance of debt securities bias upwards or downwards the

have been focused on improving and harmonizing the methods used to compile assets data. There is no such thing as a coordinated portfolio investment liabilities survey.

If improved techniques for liability surveys lead some countries to upgrade their portfolio liability figures, this will increase the gap between identifiable securities assets and liabilities, thus increase my estimate of the amount of unrecorded offshore wealth Ω. As the Italian experience shows, this is a plausible perspective for Germany (where reported equity liabilities, based on modified cumulated flows, have been smaller in recent years than the raw-CPIS derived liabilities).

C Small offshore financial centers

The External Wealth of Nations database has no information on small international financial centers, and a few other small countries. I proceed as follows.

C.1 Cayman Islands

For the debt liabilities of the Cayman Islands, I start with the Bank for International Settlements securities statistics (BIS Table 11, and Table 14A and 14B for a breakdown between short-term and long-term debt).[71] They show that the Cayman Islands had issued around USD 1.1tr of international debt in 2008 (Table A6 line 20). If these securities are entirely owned by foreigners, then it gives a good picture of the Cayman Islands' debt liabilities. Note that Cayman funds and structured investment vehicles (SIVs) probably own some of the Cayman-issued debt securities, but we cannot quantify these holdings.

We can compare the BIS figures with the debt claims reported by creditor countries on the Cayman Islands[72] (Table A6 line 21). Overall, the two series are well in line. However, creditor-reported debt claims on the Cayman Islands are 1.25-1.3 larger in 2004 and 2005 than the BIS figures. The BIS has probably missed some Cayman-issued securities. Accordingly, I compute the debt liabilities of the Cayman Islands as the maximum of the BIS and creditor-derived figures (Table A6 line 19).

For equity liabilities, I compute fund equity liabilities and non-fund equity liabilities separately.

For fund liabilities, I use CIMA's *Investment Digests* (CIMA, 2007, 2008, 2009). Specifically, I start with the total net asset values (NAV) of Cayman funds reported in the *Digests*. These NAV overstate the cross-border equity liabilities of Cayman

global liability figure. For instance, all debt securities issued offshore by U.S. corporations are counted by the U.S. Treasury as foreign liabilities, though some of them could be held by U.S. residents. In this case, offshore issuance biases L_j upwards. By contrast, French statisticians disregard short-term debt issued by French corporations on the international market. In this case, offshore issuance biases L_j downwards. Note that the French figures are not affected by the correction described above, because I don't disentangle between short term and long term debt, and that overall CPIS-derived debt liabilities of France are lower than the liabilities France reports in its IIP.

[71] http://www.bis.org/statistics/secstats.htm.

[72] Note that the BIS and CPIS dataset are completely independent: the BIS dataset aggregates security-by-security information coming from several market sources (Dealogic, Thomson Financial Securities Data, ISMA, etc.).

funds, because a substantial fraction of Cayman funds are held by other Cayman funds in master/feeder and funds of funds structures. To deal with that, I assume that 50% of the Cayman Islands' funds investments in master and other funds are investments in domestic funds. Accordingly, I subtract to the NAV of Cayman-domiciled funds 50% of their investments in master and other funds. The remainder captures the net asset value of the funds owned by the rest of the world. This way of proceeding is fully consistent with the strategy adopted in Section A to estimate Cayman funds' holdings of foreign securities. Before 2005 (the first year for which CIMA provides any figure), I extrapolate backwards using the proportional change of the total securities assets of the Cayman Islands (Table A6 line 8).

The resulting fund equity liabilities are displayed in line 22 of Table A6. Note that the funds' equity liabilities are smaller than their portfolio assets (Table A6 line 14). This is the result of two opposing effects. On the one hand, hedge funds are leveraged: they borrow cash to buy securities. This drives their gross portfolio holdings above their net asset value. On the other hand, hedge funds do not invest only in securities, but also, for instance, in derivatives (more than USD 100bn in 2008): this tends to make their portfolio holdings smaller than their NAV, hence smaller than their portfolio liabilities. In 2006, 2007 and 2008, the leverage effect dominates; in 2005 the two effects cancel out.

For the equity liabilities of the non-fund corporations domiciled in the Cayman, I use the TIC survey of U.S. foreign assets. At the end of December 2008, equity assets of the U.S. on the Cayman non-fund sector amounted to USD 61bn (Table A6 line 24), down from USD 184bn in 2007 (Department of the Treasury et al., 2009, Table 30 p. 68).[73] This gives a lower bound for the non-fund equity liabilities of the Caymans. It is hard to assess whether this lower bound is far from the truth or not, so I assume that the Cayman non-fund liabilities are simply equal to the U.S. non-fund equity assets on the Caymans.[74]

Total equity liabilities for the Cayman Islands (Table A6 line 22) are the sum of the funds and non-funds liabilities. We can compare these equity liability figures with the equity claims reported by creditor countries on the Cayman Islands (CPIS data corrected plus imputed claims; Table A6 line 25). There is a huge gap. My preferred estimate of Cayman equity liabilities is 2 to 3 times larger than the creditor-derived equity liabilities of the Caymans (Table A6 line 22/25). More importantly, the gap is robust to almost any assumption one can make on the geographical structure of feeder/master and funds of funds arrangements. Take for instance CIMA's 2007 *Investment Statistical Digest*. It shows that the funds had a USD 2,265bn net asset value, and that they invested around USD 1,559bn in

[73] I add columns 2 (common stock) and 4 (preferred & other).

[74] To get an independent estimate of non-fund equity liabilities, I have tried the following method. I have used public data on security-by-security holdings of Norway's sovereign wealth funds, broken down by country (available online at http://www.nbim.no/en/Investments/holdings-/). This dataset gives the value of Norway's SWF investment, as well as its share in the capital of each company in which it invests. Thus, we know the total market capitalization of all Cayman Islands' companies in which Norway's SWF invests (note that the SWF does not invest in mutual funds, except for some real estate investment companies). This provides a lower bound for the equity liabilities of the Cayman Islands non-fund sector. In december 2009, 31st, this lower bound is USD 94.2bn; at the same time, U.S. non fund equity claims on the Cayman reached USD 109bn.

other funds.[75] If we assume that 90% of these funds were in fact domiciled in the Cayman Islands, then we must subtract 0.9×1,559bn to the total Cayman funds NAV in order to obtain the value of their cross-border equity liabilities. Even after this subtraction, the Cayman equity liabilities are still larger than the total claims of creditor countries (CPIS corrected plus imputed). Since the 90% assumption is strongly at odds with CIMA's indications that most mater funds are not in the Caymans, there is definitely a significant hole in the identification of the owners of the shares issued by Cayman funds.

The low level of assets recorded by the U.S. on Cayman funds is especially striking. At the end of 2008, the U.S. TIC survey shows that U.S. residents reported only USD 35bn of claims on Cayman funds (Department of the Treasury et al., 2009, Table 30 p. 68). This is 20 times less than U.S. portfolio assets owned by the Cayman Islands (which mostly belong to its fund sector), and 30 times less than my preferred estimate of Cayman fund foreign equity liabilities. Given the strong links between the U.S. and the Cayman Islands, it is pretty obvious that the TIC considerably under-estimated the claims on Cayman funds beneficially owned by U.S. residents.

There are four possible explanations. First, U.S. residents may simply hold these claims in self-custody. For instance, a U.S. person can directly invest USD 10mn in a Cayman fund, without any security materializing this claim. The TIC reporting system cannot capture such holdings, and consequently understates U.S. foreign assets. Second, U.S. individuals can use foreign custodians, for instance entrust their claims on Cayman funds to foreign banks (Swiss, Cayman, etc.). In this case, the TIC survey also understates the true amount of U.S. claims on the Caymans.

A third possibility is that the TIC does a pretty good job at capturing the foreign mutual funds shares owned by U.S. residents, and that the bulk of the Cayman Islands' fund liabilities are owned by shell corporations in other tax havens (some, probably most of them, with U.S. resident beneficial owners). For U.S. tax-compliant individuals, investing in an offshore feeder fund is not interesting, because of the passive foreign investment company rules (PFIC). The PFIC rules prevent U.S. investors from avoiding the income tax by investing in foreign funds that don't distribute any income but capitalize all their gains. They aim at leveling out the treatment of domestic and foreign funds.[76] However, the PFIC status is self-reported by taxpayers: the related taxes can be avoided. Accordingly, non-compliant taxpayers have an incentive to invest trough offshore funds (as long as the funds do not earn too much income subject to withholding taxes[77]). Knowing this, compliant hedge fund managers discourage U.S. persons from investing in

[75] More precisely, reporting funds invested USD 990bn in master funds and USD 405bn in other funds; and reporting funds accounted for 89.5% of total gross assets.

[76] Shareholders of a U.S. mutual fund pay taxes each year on their pro-rata share of income and capital gains earned by the fund. Investors in a French mutual fund, by contrast, only pay taxes on distributed income and on realized capital gains when they sell their shares.

[77] To make things clearer, consider the simple example of a Cayman hedge fund investing in U.S. equities and in U.S. debt, and a U.S. person buying a share of this fund. To what extent can she minimize her tax liability? First, since there is no automatic exchange of information between the Cayman Islands and the U.S., the IRS cannot know the income she earns trough the fund: the income tax can be evaded. Second, the fund is not taxed in the Cayman Islands. Third, dividends paid by the U.S. to the funds are subject to a 30% withholding tax that is not refundable. But U.S.-source cross-border interest payments are not subject to any withholding tax, and neither are

their offshore feeder funds. They direct them towards their onshore feeder, and use only offshore feeders for tax-exempt U.S. investors (for instance foundations). The solution for U.S. non-compliant taxpayers consists in putting a non-U.S. shell corporation between the offshore feeder and themselves.[78] In principle, this foreign corporation is a FDI asset for the U.S. (on the tax haven in which the shell entity is incorporated). In practice, this FDI asset goes unrecorded in the U.S. international investment position. The shell entity owns a portfolio equity claim on the offshore feeder. This portfolio equity claim is most probably unrecorded by the country where the shell entity is incorporated (e.g., the Bahamas). This mechanism may explain why the TIC survey records so few U.S. claims on Cayman funds. The low level of recorded claims would not be due to a deficiency of the TIC survey. However, it would leave unchanged the fact that the U.S. under-estimates its net foreign asset position (since, most probably, it does not record the foreign direct investments made by U.S. residents who set up shell corporations in tax havens to hold their portfolio securities).

A fourth, and most likely explanation, for the low level of U.S. claims on Cayman funds, is the fact that U.S. hedge and private equity funds have been unaware of their reporting duties to the TIC for a long time. So a significant amount of claims held by U.S. feeders on offshore Cayman masters probably goes unrecorded. The Federal Reserve Board and the U.S. Treasury are currently working on improving their coverage of U.S.-based funds. Looking forward, these improvements will make it possible to know which of the four above explanations accounts best for the low level of U.S. claims recorded on Cayman funds.

Note that the level of claims on foreign mutual funds recorded in the TIC survey is extremely low for all countries, not only for the Cayman Islands. At the end of 2008, over the USD 2,748bn of U.S. equity claims on foreigners, only USD 109bn were on foreign funds. In particular, claims on the 2 largest offshore fund centers, Ireland and Luxembourg, were negligible (resp. USD 7.6bn and USD 4.5bn). In addition to cross-border or self-custody problems, in addition to the use of shell corporations, and in addition to the problems in the reporting of U.S. hedge funds, such low holdings reflect the fact that foreign retail funds are often not registered under the United States Investment Company Act of 1940, which means that their shares cannot be sold to U.S. residents through U.S. banks.[79]

To sum up, the available evidence indicates that the Cayman Islands had large equity liabilities at the end of 2008 (around USD 1tr), and that the bulk of the corresponding claims were missing from counterpart country assets data around the world.

Putting the debt and equity liabilities of the Cayman Islands together, we obtain the Cayman Islands' total portfolio liabilities displayed in line 18 of Table A6.

capital gains. This makes easy for the fund to generate untaxed income (moreover, the withholding tax on dividends can be avoided through the use of derivatives). To sum up, the capital income tax liability of the U.S. investor can easily be reduced to 0, see Sheppard (2008).

[78] At the time of this paper, hedge funds had very limited "know your customer" obligations and were exempt from most anti-money laundering rules. That is, hedge fund managers were not required by law to know if the beneficial owners of the shell corporations investing in their funds were U.S. citizens or not.

[79] Note, however, that this legislation can be bypassed by investing in an offshore hedge fund that invests in turn in offshore retail funds, since hedge funds are not subject to the Act.

Portfolio liabilities appear to be substantially larger than assets (Table A6 line 8); this is true for both equities (line 22) and debt securities (line 19).

The negative portfolio equity position was to be expected: all offshore mutual fund centers have a negative portfolio equity position, because claims on mutual funds are always counted as equities, even though the funds also invest in bonds.[80]

The negative portfolio debt position is consistent with large-scale securitization taking place through Cayman special purpose vehicles. In a typical securitization operation, a SPV acquires a loan (e.g., mortgage), backing this purchase by issuing international bonds, in particular asset-backed securities (ABS). Securitization is what explains the huge amount of Cayman-issued international debt. Numerous industry reports indicate that the Cayman Islands was the biggest center for securitization in the 2000s. This is confirmed by TIC data on U.S. holdings of foreign ABS: for instance, the U.S. owned USD 330bn of foreign long-term ABS in December 2007, of which USD 199bn had been issued in the Cayman Islands (Department of the Treasury et al., 2009, Table 26 p. 56). Securitization implies that Cayman-based SPVs should have a positive net position in "other investments" to balance their negative portfolio debt position. However, there is no data available on SPV assets to confirm this prediction.

C.2 Other small offshore centers (Tables A10 and A11)

For the other offshore centers with non-trivial positions not covered by the updated and extended version of the External Wealth of Nations database (the Bahamas, Bermuda, Jersey, Guernsey, the Isle of Man, the Netherlands Antilles, the British Virgin Islands and Liechtenstein), I essentially follow the same method as for the Cayman Islands.

I compute their equity liabilities (Table A10) as max(fund liabilities plus non-fund liabilities; creditor-derived equity liabilities). Fund liabilities are computed as follows:

- Bahamas, Isle of Man, British Virgin Islands: 0 (no data).
- Bermuda: I use the 2001-2008 issues of Bermuda Monetary Authority's *Reports and Accounts*. In 2008, for instance, Bermuda Monetary Authority (BMA) states that Bermuda's funds had a net asset value equal to 171.19 billion Bermudian dollars (BMA, 2009, p. 5), which is USD 171.19bn (Table A10 line 12). I do not try to correct the net asset value figures reported to account for master/feeder structures.
- Jersey: I use the sectoral breakdown of Jersey's portfolio assets reported to the CPIS (CPIS Table 3). In 2008, for instance, Jersey reported to the CPIS that its mutual fund sector had USD 79bn in portfolio assets. I assume that the funds had USD 79bn in equity liabilities (Table A10 line 14).
- Guernsey, Netherlands Antilles: Same as Jersey

[80] At the end of 2008, Luxembourg had USD 1,413bn of portfolio equity assets versus USD 2,821bn of liabilities; Ireland had USD 649bn of portfolio equity assets versus USD 1,148bn of liabilities.

- Liechtenstein: I use various issues of the Annual Report of Liechtenstein's Financial Market Authority (FMA). In 2008, for instance, FMA (2009, p. 9) states that Liechtenstein's funds had a net asset value equal to 26.43 billion Swiss Francs, which is USD 28bn (Table A10 line 19). I do not try to correct the net asset values reported to account for master/feeder structures.

I compute the non-fund equity liabilities just like for the Cayman Islands, assuming that they are equal to the non-fund equity claims of the U.S. reported in the TIC (see panel 3 of Table A10). Note that because fund data are missing in three relatively important fund centers (Bahamas, Isle of Man, and BVI), and because claims on offshore funds are poorly captured in asset surveys across the world, I probably under-estimate the portfolio equity liabilities of small international financial centers, hence probably under-estimate the unrecorded amount of offshore wealth Ω.

I compute the portfolio debt liabilities, just like for the Cayman Islands, as max(BIS-reported international debt outstanding, creditor-derived portfolio debt liabilities), see Table A11.

Overall, I estimate that the portfolio liabilities of the small international financial centers (SIFC) not covered by the EWNII database (including the Cayman Islands) accounted for 8-10% of all portfolio liabilities, depending on the year (Table A3 col. 8). This is consistent with the work of Lane and Milesi-Ferretti (2010), who estimate (Table 7 p. 24) that the SIFC accounted for 8% of all-cross border liabilities (portfolio plus FDI plus other etc.) at the end of 2008.

D Other non-EWNII countries and international organizations

Col. 9 of Table A2 gives the portfolio liabilities of all remaining countries (New Caledonia, Réunion, French Polynesia, Puerto Rica, Niue, Suriname, Greenland, Gibraltar, Monaco, Montserrat, etc.), which are very small countries with negligible claims. I equate their portfolio liabilities to the creditor-derived values.

Col. 10 of Table A2 gives the portfolio liabilities of international organizations. For debt, the data come from the BIS database on international securities outstanding (BIS Tables 14A and A4B). For equities, the figures are equal to the equity assets reported in the CPIS-SEFER on international organizations.

E Total securities liabilities (Table A2)

Total securities liabilities are reported in col. 11 of Table A2: this is the sum of the liabilities reported in the EWNII, of the corrections made to the EWNII, and of the liabilities of small international financial centers (Cayman Islands, other), of the remaining small countries and of international organizations.

We can compare this total to the liabilities reported in the EWNII: I estimate that the EWNII has covered 86-87% of all portfolio liabilities throughout the 2001-2008 period (Table A2 col. 12).

It is interesting to compare the portfolio debt liability figures reported in col. 11 of Table A2 with the Bank for International Settlement's series on international debt securities outstanding (Table A2 col. 13). The BIS statistics are compiled completely independently from international investment positions: the BIS uses commercial database on security issues across the world. The BIS defines international securities (as opposed to domestic securities) as "all foreign currency issues by residents and non-residents in a given country and all domestic currency issues launched in the domestic market by non-residents. In addition, domestic currency issues launched in the domestic market by residents are also considered as international issues if they are specifically targeted at non-resident investors" (BIS, 2009, p. 21). Domestic securities are securities issued by residents in domestic currency and targeted at resident investors. Accordingly, all international securities from the BIS viewpoint are not necessarily foreign liabilities from an IIP viewpoint, and vice-versa. Residents can sell securities denominated in foreign currency to residents on the domestic market, or sell securities to residents on the offshore market: both are treated as "international securities" by the BIS, but do not constitute foreign liabilities or assets from a balance of payments perspective (IMF, 1993). Conversely, foreigners can buy securities issued by domestic governments in domestic currency and targeted at resident investors (e.g., foreigners do buy U.S. public debt securities, which are nevertheless considered as "domestic" by the BIS). But all in all, there should be a broad correspondence between cross-border debt securities liabilities and the outstanding amount of international debt issued.

Now, the ratio between international debt securities as computed by the BIS, and my estimate of total cross-border debt liabilities is actually pretty stable, close to 1 over the period (Table A2 col. 14). This suggests that international investment positions probably don't miss, on net, a significant amount of debt liabilities; in particular they seem to do a decent job, on aggregate, at capturing the debt securities issued offshore (which are a considerable fraction of all international debt securities).

C Bilateral Securities Assets Data (Tables A3 and A13-A18)

The first 3 columns of Table A3 summarize the results of Table A1 (securities assets) and Table A2 (securities liabilities). For each asset class, there is a substantial discrepancy between identifiable assets and liabilities, which most probably comes from the failure to record the portfolios held offshore by households.

Col. 12 of Table A3 shows the asset allocation of the unrecorded offshore portfolio: around 2/3 of the missing securities are equities, 1/3 are bonds. In col. 13, I compare the missing assets to the liability totals: around 20% of all cross-border equities issued have no identifiable owner; the discrepancy is lower for bonds (between 3% and 10%). Lastly, in col. 14 and 15, I give a rough indication of how the missing portfolio compares to the world market capitalization. The bond market capitalization comes from the BIS: it is the sum of all international bonds outstanding (BIS Table 11) and domestic bonds outstanding (BIS Table 16). The equity market capitalization is from Global Financial Data.[81]

[81] Note that the World Federation of Exchange also publishes an estimate of the global equity market capitalization, which is comparable, if slightly lower.

A Construction of the comprehensive bilateral asset matrices (Table A15)

To know where the missing wealth is invested – that is, which countries have issued the securities for which no owner can be identified –, we need exhaustive bilateral securities asset data $\hat{A}_{ij}$. I compute one matrix per year between 2001 and 2008 and per instrument (equity and debt, with no distinction between short term and long term debt). Each matrix has 238 lines (all countries and jurisdictions considered by the IMF plus a line for international organizations) and 238 columns. The resulting database has 906,304 observations (238×238×8 source-host-year triplets = 453,152, multiplied by two asset classes).

The main data source is the CPIS, with data from 74 source countries and jurisdictions in 2008 to 237 host countries and jurisdictions plus an aggregate "international organization" host entity. I explain below the corrections I make to the raw CPIS data, and how I construct $\hat{A}_{ij}$ for the countries i that don't participate in the CPIS.

A.1 Corrections for CPIS countries

Unallocated and confidential claims For 1-2% of total CPIS-countries assets, the host country is not specified, whether because compilers have been unable to identify it ("other countries (unallocated)") or for confidentiality reasons ("other countries (confidential data)"):

$$\hat{A}_i = \sum_j \hat{A}^a_{ij} + \hat{A}^u_i + \hat{A}^c_i$$

where $\hat{A}^a_{ij}$ are claims of i on j, $\hat{A}^u_i$ are i's unallocated claims and $\hat{A}^c_i$ its confidential claims.[82] Failing to allocate $\hat{A}^u_i$ and $\hat{A}^c_i$ would bias the discrepancy between reported portfolio liabilities and creditor-derived liabilities upwards. Accordingly, I fully allocate confidential and unallocated claims as follows.

First, I assume that all these claims are vis-a-vis countries k for which no positive $\hat{A}_{ik}$ is reported by i in the CPIS.[83] Second, I use the gravity model of bilateral holdings to predict the shares of each host country k in each country i's portfolio, that is, I compute

$$\omega_{ikt} = \frac{\hat{A}^p_{ikt}}{\sum_j \hat{A}^p_{ijt}}$$

Third, I rescale the predicted shares such that for each country i and year t, $\sum_k \omega_{ikt} = 1$. Lastly, I allocate the confidential and unallocated claims by applying the rescaled weights to $\hat{A}^u_i + \hat{A}^c_i$.

Official monetary institutions and international organizations, whose assets are aggregated under the line "SEFER-SSIO," also have confidential and unallocated

[82] Note also than in some cases in the raw CPIS files, $\hat{A}_i$ is slightly lower than $\sum_j \hat{A}^a_{ij} + \hat{A}^u_i + \hat{A}^c_i$. This could be due to data revisions affecting $\hat{A}_i$ but not the source-host pairs. When this occurs, I add the residual $\hat{A}_i - (\sum_j \hat{A}^a_{ij} + \hat{A}^u_i + \hat{A}^c_i)$ to $\hat{A}^u_i$.

[83] This assumption is necessarily true for confidential claims.

claims. Since it is not possible to use the gravity model in this case, I simply assume that they are invested in the same way as allocated SEFER-SSIO claims (cf. Table A19).

Other Some CPIS countries i did not participate each year (most notably Bahrain, Kuwait, and Mexico). I explained in Section A how I compute their aggregate portfolio holdings $\hat{A}_i$ when data are missing. I allocate their total claims using the predicted shares of the gravity model. I allocate the portfolio claims of the Cayman Islands' non bank sector similarly. Wa also saw that the Netherlands did not report the holdings of its special financial institutions (SFIs). I assume that SFIs have the same investment patterns as the Netherlands in general.

A.2 Bilateral data for non-CPIS countries

To allocate the aggregate claims $\hat{A}_i$ of non-CPIS participating countries to each host country j, the key distinction is between publicly held securities (reserves or sovereign wealth funds) and privately held securities.

Non-CPIS private claims To allocate the private holdings of non-CPIS participating countries, I simply use the shares predicted by the gravity model of bilateral holdings.

China and other reserve assets For public holdings, it does not make sense to use the model, since reserve assets are invested very differently than private portfolios. The SEFER-SSIO survey gives the reserve claims of an undisclosed sample of countries and international organizations on 238 host countries (including international organizations). Table A15 summarizes the investment pattern of participating central banks and international organizations. Reserve holdings are much more invested in U.S. debt securities than private portfolios (more than 50% of SEFER reserves are, vs. around 25% of private assets). In 2008, the remaining SEFER-SSIO claims were invested in German (around 15%), French (5.5%), U.K. (4%) and Japanese (4%) public bonds, as well as in bonds issued by international organizations (8.5%).

For China, I do as if all holdings were public.[84] We know that around 70% of China's holdings were invested in the U.S. throughout the period (Table A6, line 23). The problem boils down to allocating China's non U.S. assets. I assume that the share of Germany, Japan, France, etc. in China's non-U.S. holdings is the same as in the SEFER survey. That is, I make the assumption that, though China is more invested in U.S. assets than most other central banks, it follows the average pattern as regards its non-U.S. investments. This assumption is fully consistent with information that recently leaked on the composition of China's foreign exchange reserves. In September 2010, the *China Securities Journal*, an official newspaper, reported the currency composition of China's foreign exchange

[84] As Table A7 shows (line 18), reserve assets account for around 80% of China's portfolio. To a large extent, the remaining 20% are, in fact, public too. They are not officially counted as reserve because they are not managed by China's central bank, but by China's state banks and China's Investment Corporation (CIC), China's sovereign wealth fund.

reserves: at that time, 65% of China's $2,450bn of foreign exchange reserves was in U.S. dollars, 26% in euros, 5% in pounds, and 3% in yen.[85] In all likelihood, all eurozone bonds held by China are in euros, all U.K. bonds in pounds, all Japanese bonds in yen, and all U.S. bonds in U.S. dollars, so the currency breakdowns give us the country allocation of China's reserve portfolio. It turns out that the non-U.S. portfolio of China, as revealed by the *China Securities Journal*, is very close to the average non-U.S. portfolio os SEFER-participating countries (see Table A15).

For other non-SEFER-reported reserve assets (mainly Taiwanese), I assume that, on aggregate, they are invested like in the SEFER-SSIO survey (e.g., around 50% in U.S. assets, 15% in German bonds, etc.). These are approximations; for instance, the share of Japan may be higher than what the SEFER survey suggests.[86]

In 2008, the exact allocation of USD 1.1tr of securities held as reserve was uncertain (the 1.1.tr figure corresponds to the 30% of China's portfolio not invested in the U.S. plus the USD 650bn of non-SEFER, non-oil, non-Chinese reserve holdings). But there is no doubt that these assets were mostly invested in high-quality public bonds, i.e. mainly in U.S., German, Japanese, U.K., French, and international organizations' bonds. The residual uncertainty (what was the exact share of the U.K.? of Japan?) cannot affect any of the main findings of the paper.

Middle East oil exporters By construction, we have assumed that Middle East oil exporters had 70% of their portfolio invested in U.S. securities in 2001, and that this share declined by 2 percentage point each year to reach 56% in 2008. Just like for China, the problem boils down to estimating the share of each non-U.S. country in the portfolio of oil exporters. Should we use the gravity model, on the basis that these are private holdings? Or should we use the SEFER patterns? Anecdotal evidence suggests that oil exporters' sovereign wealth funds invest more aggressively than central banks, that is less in high quality public bonds, and more in equities and in developing countries.[87] I choose, accordingly, to use the gravity model to allocate their non-U.S. portfolio.[88] The model generates country shares that are consistent with available evidence. For instance, it predicts substantial equity investment in Asian emerging and developing countries (Taiwan, Hong-Kong, South Korea, India, Indonesia) as well as in the main offshore mutual fund centers, consistent with available indications that SWF do have some hedge and private equity fund shares.[89] In absolute terms, the model predicts relatively modest investments in

[85] I am gratefully to Pierre-Olivier Gourinchas for pointing this source to me. See Gourinchas et al. (2011) for more details.

[86] At the end of 2008, the SEFER survey captured a bit less than 60% of all securities held as reserves.

[87] In its first publicly available annual report, the Abu Dhabi Investment Authority states that its neutral benchmark portfolio has between 35% and 45% of developed countries equities, and between 10% and 20% of emerging market equities (ADIA, 2009). This is very different from traditional reserve holdings patterns (the SEFER-SSIO survey reports virtually no equity claims, see Table A19).

[88] Since we only have information on aggregate holdings of oil exporters and not country level holdings, I take Saudi Arabia to represent all Middle East oil exporters in the model; i.e., the predicted shares are obtained by applying the model estimated coefficients to Saudi Arabia's vector of covariates.

[89] For instance, ADIA gives a 5%-10% share for alternative investments in its benchmark portfolio.

European equities (e.g., USD 2-3bn in France). The French central bank conducts each year a survey on the foreign ownership of France's largest companies (CAC40). Middle East countries owned less than 1% of CAC40 corporations at the end of 2009 (Le Roux, 2010, Table 2, p. 22), i.e. less than USD 10bn. The model is consistent with this fact. However, it fails to produce any significant amount of claims on Japan, which is at odds with Japan's estimates of its liabilities vis-a-vis Middle East countries (CPIS Table 4).

There remain uncertainties on where Middle East sovereign wealth funds invest. However, these uncertainties cannot explain the main discrepancies described in the present work, for instance the USD 1 trillion discrepancy between equity liabilities of Luxembourg and identifiable equity claims on Luxembourg – simply because there is absolutely no evidence that sovereign wealth funds massively invest in Luxembourg funds.

B Where the missing wealth is invested (Tables A3, A13-A14 and A18)

Table A13 (for equity) and A14 (for debt) gives the discrepancy between debtor-reported liabilities L_j and creditor-derived liabilities $\sum_j \hat{A}_{ij}$ for each year and country j. The main discrepancies are reported in col. 4 to 11 of Table A3.

In recent years, half of the missing wealth has been invested in mutual funds incorporated in Luxembourg, Ireland and the Cayman Islands. These funds are only intermediaries: in turn, they invest in U.S., Japanese, or German securities. The missing wealth is thus ultimately invested in these countries. If we make Luxembourg, Irish and Cayman funds transparent, we can see that a large proportion of all foreign equity investments in the U.S. cannot be traced to any ultimate owner.

To see why, consider first all foreign investments in the U.S. through Luxembourg, Cayman and Irish (LCI) funds. We can decompose the U.S. equity liability vis-à-vis LCI, $\hat{L}_{US,LCI}$, as follows:

$$\hat{L}_{US,LCI} = \frac{E_{LCI,US}}{A_{LCI}}[\sum_i \hat{A}_{i,LCI} + (L_{LCI} - \sum_i \hat{A}_{i,LCI})]$$

where $\sum_i \hat{A}_{i,LCI}$ denotes all recorded foreign equity investments in LCI mutual fund shares, the difference between parentheses is equal to all unrecorded investments in LCI funds, and the bracket is multiplied by the share of U.S. equities (E) in LCI fund assets (A_{LCI}). This formula assumes, for simplicity, that LCI funds invest similarly whether the money invested in them is recorded or unrecorded in the residence country of the investor. It also assumes that all equity investments from Luxembourg, the Cayman Islands, and Ireland are undertaken by mutual funds (which is almost true).

Table A18a shows the result of this simple decomposition in 2008. Looking only at Luxembourg, Irish and Cayman funds, almost 10% of all foreign equity investments in the U.S. cannot be traced to any ultimate owner – simply because more than half these offshore mutual funds have unidentifiable owners!

Second, we can use the discrepancy between the portfolio assets reported by Switzerland on the U.S. and the portfolio liabilities recorded by the U.S. vis-à-vis

Switzerland to estimate the value of the unrecorded portfolio of U.S. securities held by non-Swiss residents through Swiss banks (Table A18b).

In principle, the assets recorded by Switzerland on the U.S. should equal the liabilities recorded by the U.S. vis-a-vis Switzerland. But because of cross-border custody, Swiss-reported data ($\hat{A}_{kj}$) and U.S.-recorded data ($\hat{L}_{jk}$) are inconsistent. To see why, denote with an upper letter the location of custodian banks. Then if we disregard Switzerland's reserve holdings of U.S. securities, the discrepancy between Swiss-reported portfolio assets and U.S.-recorded portfolio liabilities writes:

$$\hat{L}_{jk} - \hat{A}_{kj} = \sum_{m \neq k} a^k_{mj} + \sum_{m \neq k} \tilde{a}^k_{mj} - \sum_{i \neq k} a^i_{kj}$$

Generally speaking, as the formula shows, bilateral anomalies are hard to interpret. They are not necessarily caused by households' accounts in tax haven. If French banks entrust their U.S. securities to Swiss banks (a^k_{mj} in the above equation), then the liabilities recorded by the U.S. vis-a-vis Switzerland will tend to be larger than the assets reported by Switzerland on the U.S. – and this anomaly does not involve unrecorded offshore wealth, because financial corporations' offshore holdings are well recorded in the French international investment position.

Conversely, if Swiss insurance companies entrust their U.S. bonds to Belgium banks (a^i_{kj} in the above equation), then the liabilities recorded by the U.S. vis-a-vis Switzerland will tend to be smaller than the assets reported by Switzerland on the U.S. Now, many bonds issued by U.S. residents are held in custody in the two international central securities depositories, one of which is in Belgium (Euroclear Bank) and the other in Luxembourg (Clearstream).

The gap between U.S.-recorded portfolio liabilities vis-à-vis Switzerland and Swiss-reported U.S. portfolio assets reflects the amount of unrecorded U.S. securities held by foreign households in Swiss banks ($\tilde{a}^k_{mj}$ in the above equation) if three conditions are met:

1. All Swiss-owned U.S. securities are held in Switzerland,
2. Non-Swiss banks or insurance companies do not use Swiss custodians to keep their U.S. securities,
3. Switzerland does not hold U.S. securities as reserve assets.

These three conditions are likely met for U.S. equities (but not for bonds). A straightforward comparison between the CPIS data for Switzerland and the U.S. TIC figures (Bertaut and Tryon, 2007) then shows that each year since 2001, equity liabilities of the U.S. vis-à-vis Switzerland, as recorded by the U.S., have been around 2.5 times larger than the equity assets recorded by Switzerland on the U.S. To put it differently, around 60% of all U.S. equity investments recorded by the U.S. as belonging to Switzerland cannot be traced to any ultimate owner. This represents 3-4% of all foreign equity investments in the U.S. In total, because of household unrecorded offshore accounts, at least 15% of all U.S. cross-border portfolio equities cannot be attributed to any ultimate owner.

D Missing Flows in Balance of Payments (Tables A19-A22)

The stock discrepancies described in this paper have their exact counterpart at the flow level, in the world balance of payments computed by the International Monetary Fund independently from the present study. In this Section, I give more details on cross-border flows and on how tax havens affect the way cross-border flows are recorded. First, Tables A19 summarizes all identifiable credits in the world current account and Table A20 all debits (Section D.1). Second, Table A21 shows the discrepancies between credits and debits: each year, in particular, more investment income is paid than received globally, the flow counterpart of missing assets in international investment positions (Section D.2). Third, Table A22 gives some background on the yields on cross-border investments at the global level (Section D.3). It shows that the yield on the stock of missing securities is similar to the yield on the stock of recorded cross-border securities. Lastly, Section D.4 investigates in details how transfers of funds in and out of tax havens affect individual countries' balances of payments.

A Total credits and debits at the world level (Tables A19-A20)

In the Balance of Payments Statistics (BoPS), the IMF publishes a world Table that includes all country reports plus IMF-staff estimates for non-reporters.[90]

The world Table starts in 1994, so all data from 1994-on directly come from the IMF world Table. Before 1994, global totals are my own estimates based on all country reports and straightforward interpolations. Specifically, I start with the 1994 values, and then use the proportional change of the total credits or debits reported by all countries to extrapolate backwards.

Note that almost all reporting countries give a breakdown of the current account by main components (trade, income, transfers). The category which has the worst coverage is transfers, so I compute transfers as current account minus trade minus income.

Inside the income balance, compensation of employees is almost negligible. To avoid spurious variations in the figures for compensation of employees, I compute investment income totals as income minus compensation of employees.

Inside the investment income balance, almost all countries provide an estimate of direct investment income, but a smaller number of countries give an estimate for

[90]See the Balance of Payments Statistics Methodology: "[The World Table] aggregates country data by major balance of payments components. The user should note that this aggregation is done only once a year and that the aggregates included in the BOPS CD-ROM correspond to the most recent issue of BOPSY. For each component, data for countries, country groups, and the world are provided. In addition to data reported by countries as shown in the analytic and standard presentations, the tables in this section also include data for international organizations. Missing data have been estimated for countries by Fund staff to the extent possible. For the balance of payments, the estimation procedure is based largely on the use of the WEO database. Data published in BOPSY may differ from balance of payments data published in the WEO mainly due to timing and coverage differences (for example: BOPSY Part 2 includes data on international organizations)."

their other plus portfolio income balance. I compute other plus portfolio income as investment income minus direct investment income.

Note that in the IMF-computed world Table, there is no breakdown in the investment income balance between portfolio investment income and other investment income balance (however, there is a portfolio investment figure in the *financial* account of the world balance of payments).[91] Inside the direct investment income balance, the breakdown between undistributed reinvested earnings, distributed income and debt and is fragile – hence, I do not report it here.

In col. 11 of Table A19, we can see the rising trend in global exports since 1975: total trade balance credits (that is, exports) were 32% of world GDP in 2008, vs. 14% in 1975.

B Missing flows at the world level (Table A21)

Table A21 gives the difference between identifiable current account credits (Table A19) and debits (Table A20) for each category of the current account. As is well known, the world has tended to run a current account deficit (Table A21 col. 2). Note the spectacular trend reversal in 2004, with the current account surplus reaching USD 400bn in 2007, mainly driven by the trade surplus (col. 3).

The chronic current account deficit has been driven by the income balance (Table A21 col. 6), which has systematically recorded a deficit since the end of the 1970s. To put it differently, more income has always been paid (debit) than received (credit) at the global level. Inside the income balance, there are in fact two anomalies: a recurring *positive* foreign direct investment income discrepancy (Table A21 col. 7): each year, more direct investment income is apparently received than paid. What causes this anomaly is not entirely clear.

One possibility is that poor countries under-estimate their FDI liabilities, because they tend to record book values while rich countries try to estimate market values. Now, statisticians usually estimate FDI income by applying appropriate yields to estimated stock positions. If positions are under-estimated in poor countries, FDI income paid will be under-estimated too: rich countries will record more FDI income credits from poor countries than poor countries will record FDI income debits to rich countries.

A second possibility is that the FDI income discrepancy comes from inadequate coverage of tax havens. If the income paid by a Bermudian affiliate to its U.S. parent is well recorded by the U.S., but inadequately captured in Bermuda, then we are bound to observe that more direct investment income is received (credit) than paid (debit). In principle, the IMF captures all countries and territories in its world table, but in the absence of first-hand data on FDIs in some tax havens, FDI income debits of tax havens may be undercounted.

[91] Note also that inside the portfolio investment income balance, not all countries give a breakdown between equity and debt. If one sums the portfolio debt and equity income figures of all reporting countries, then one gets a larger discrepancy for debt income than for equity income (contrary to what happens at the stock level, where more equities are missing than bonds). This spurious result comes from the fact that the major offshore mutual funds are not covered by the BoPS. Since the Cayman Islands, Jersey, Guernsey, Bermuda, etc. are by definition short equity (just as Luxembourg is), including them in the BoPS would greatly increase the portfolio equity income discrepancy.

Even if all tax havens are covered by the IMF global table, it is possible that some of them do not record direct investment income properly. In 2005, for instance, U.S. corporations repatriated a large amount of undistributed profits from tax havens to benefit from a one time tax break. This led to a large decrease in the global discrepancy for "net reinvested earnings and undistributed profits",[92] which does not make sense unless tax havens imperfectly record their direct investment income.

To understand why, consider what was recorded (correctly) in the U.S. balance of payments. U.S. corporations repatriated a lot of undistributed earnings, which translated into large "distributed earnings" credits in the U.S. balance of income earned on U.S. direct investments abroad (USD 299bn in 2005 vs. USD 82bn in 2004). On the other hand, U.S. corporations dis-invested in their foreign affiliates, which translated into a negative "reinvestment earnings" line in the U.S. balance of income earned on U.S. direct investments abroad (USD -31bn in 2005 vs. USD + 142bn in 2004). Overall this had no major impact on the U.S. "net distributed profits plus reinvested earnings" line.

It should have gone similarly for tax havens. The fact that the global discrepancy for "net reinvested earnings and undistributed profits" decreased suggests, however, that tax havens properly recorded the increase in earnings distribution (more distributing earnings debits), but failed to record the decrease in their reinvestment earnings debits, hence recorded more "net distributed profits plus reinvested earnings" debits than usually. If tax havens also fail to record properly their reinvestment earnings debits in normal times, it could explain why more direct investment income credits are structurally recorded than debit.

The portfolio and other income discrepancy (Table A21 col. 8) has a much clearer interpretation than the FDI income discrepancy: as argued in the paper, it reflects unrecorded credits in offshore accounts. A dividend paid by a U.S. corporation to the Swiss account of a French resident is recorded as a portfolio income debit by the U.S., but neither France nor Switzerland records any credit.

In the right panel of Table A21, I compute cumulative discrepancies, which are then converted to constant 2008 U.S. dollars. Col. 12, for instance, can be interpreted as follows. If balance of payments are accurate, except for the fact that the dividends and interest earned in offshore accounts are counted as debits but not as credits, and that, for whatever reason, more direct investment (DI) income is received than paid, then the cumulated discrepancy on non-DI investment income in constant U.S. dollars tells us the purchasing power of all the interest and dividends that have been paid to offshore accounts over time, if these unrecorded dividends and interest have always stayed on 0% interest bearing bank accounts after being received.

As we can see in Figure A1, had the discrepancy on non-DI investment income not existed, the world current account deficit cumulated since 1975 would have been 0 in 2002, instead of almost 2.5 trillions of 2008-US dollars. In other words, as Motala (1997) had already noted, the main driving force of the current account discrepancy is by far the non-DI income discrepancy, which very likely comes from unrecorded accounts in tax havens.[93]

[92] In 2004, the discrepancy, based on the reports of 121 countries, was USD 136bn; it dropped to USD 35bn in 2005, and went up to USD 183bn in 2006.

[93] Note that I focus on the non-DI investment income discrepancy rather than on the non-

C Yields on cross-border bank deposits and portfolio claims (Table A22)

Table A22 presents what we know about the yield on cross-border bank accounts and portfolio securities at the global level. To compute yields, we need comparable stock and flow data. The left Panel of Table A18 computes the yield on identifiable cross-border bank accounts and portfolios; the right Panel on the unrecorded offshore portfolio.

Total cross-border bank liabilities (col. 1) directly come from the BIS locational banking statistics Table 2a. Note than bank liabilities are more than bank accounts, because banks also have, e.g., bond liabilities. The BIS series on cross-border bank accounts (Table 3a of the locational banking statistics) starts in 1995 only, so in col. 2, I use the BIS series after 1995, and I use the proportional change of cross-border bank liabilities before.

Cross-border portfolios in col. 3 are simply all identifiable portfolio securities liabilities (that is, col. 11 of Table A2). Summing cross-border portfolios and cross-border bank accounts, we get a total figure (Table A22 col. 5) than can be directly compared with the “other and portfolio income” debit figure in the world current account (Table A22 col. 6). The implied yield on identifiable cross-border bank accounts and portfolios is displayed in col. 7 (3-4% in recent years).

The right panel of Table A22 shows that the unrecorded offshore portfolio has a similar yield as the recorded portfolio. The flow of unrecorded other+portfolio income divided by the stock of unrecorded securities is also equal to 3-4% in recent years.[94] An interesting implication of this finding is that it makes sense to use the observed “portfolio+ other income” flow discrepancy, along with the yield on cross-border portfolios and bank deposits, to give rough estimates of the unrecorded stock of household offshore wealth Ω before 2001 (the first year for which we have reasonably comprehensive and accurate portfolio stock data at the global level). Col. 11 presents my estimate of Ω obtained by capitalizing the missing flows with the observed yield on cross-border investments.

D How transfers of funds to tax havens affect individual countries’ balance of payments

The *holding* of portfolio securities by households through bank accounts in tax havens causes anomaly in international investment positions: less security assets than liabilities are recorded globally. It also causes anomalies in balance of payments statistics: less dividends and interest credits than debits are recorded globally. The *transfers* of funds to and from tax havens can also cause anomalies in balance of payments statistics, although this is not systematically the case. To see why, in the following I study five concrete cases.

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reinvested earnings investment income discrepancy as Motala (1997) because the non-reinvested earnings investment income balance is strongly affected by the problematic recording of the repatriation of U.S. overseas profits in 2005.

[94] Note that here, I make the simplifying assumptions that there are no unrecorded bank accounts at the global level, because international statisticians share data on bank deposits through the Bank for International Settlement.

D.1 Case 1: U.S. residents carrying banknotes, gold, or diamonds to Switzerland

First, let's consider the case of a U.S. resident transferring assets to Switzerland by carrying banknotes, gold, or diamond overseas. We know that such transfers still exist today.[95] When such transfers occur, the U.S. balance of payments does not record any transaction – neither any credit, nor any debit. Both the U.S. international flow and stock statistics fully miss the funds held by households in tax havens. Because they both miss these funds, balance of payments and international investment position statistics are consistent.

Note that if the funds have been legally earned in the U.S., then they are likely to cause anomalies within the set of U.S. *domestic* accounts. The inconsistency will take the form of a discrepancy between net personal lending/borrowing as measured in the national income and product accounts (NIPA) and net personal lending/borrowing as measured in the flow of funds accounts (FFA). In the NIPA, net personal lending/borrowing is essentially computed as a residual, i.e. as income minus consumption minus capital formation (mainly housing investment) minus capital transfers (mainly estate taxes paid). If both income, consumption, capital formation, and capital transfers data are accurate, then net lending/borrowing data are accurate in the NIPA. In the flow of funds accounts, on the other hand, statistics on net lending/borrowing come from records of banks and other financial institutions. If households make unrecorded transfers to their offshore accounts (e.g., by carrying diamonds overseas), the FFA will miss the increase in the value of U.S. households' offshore bank deposits. Net lending/borrowing in the NIPA (the "current plus capital account" balance of the U.S. economy) will be higher than net lending/borrowing in the FFA (the "financial account" balance of the U.S. economy). This discrepancy in domestic accounts is the equivalent of the "net error and omissions" discrepancy in balance of payments statistics. It will show up in BEA's integrated macroeconomic accounts, which attempt to reconcile NIPA and FFA in a consistent framework.[96]

When funds are illegally earned (e.g., drug-dealing), then they are probably not picked up as income in the NIPA, hence not as saving either. They go completely unrecorded in NIPA, flow of funds, balance of payments, and international investment positions data – that is, in the full set of U.S. statistics.

What is important to notice, here, is that the use of tax havens by households does not necessarily cause anomalies in the balance of payments data of individual countries. It does not even necessarily cause anomalies within the complete set of national and international accounts of individual countries.

[95] In 2008, in the frame of a U.S. initiative against offshore tax evasion through Swiss banks, a Swiss banker testified to the U.S. Senate that he had carried diamonds overseas on behalf of some of his American clients, see U.S. Senate (2008, p. 100).

[96] Specifically, the anomaly will show up as a "statistical discrepancy" in households' accounts S.3.a line 86 series FU157005045, see http://www.bea.gov/national/nipaweb/Ni_FedBeaSna/Index.asp.

D.2 Case 2: U.S. residents making wire transfers to their Bahamian accounts

A second way to transfer funds to tax havens is to make wire transfers. Let's take the case of a U.S. person who transfers funds from her U.S. bank account to her Bahamian bank account. Such transfers will cause anomalies in the U.S. balance of payments. The IMF balance of payments manual (IMF, 1993) states that when a U.S. person sends funds electronically from the U.S. to the Bahamas, this must be recorded twice: both as an "other investment credit" (the interbank assets held by the U.S. bank on the Bahamian bank decrease) and an "other investment debit" (a U.S. person purchases a Bahamian asset, namely a Bahamian bank deposit).[97] In principle, credits will be well recorded, but the debits is not. Here is why.[98]

Let's assume that a U.S. person P starts with having a \$100 deposit claim on Citi in New York; Citi will also have a \$100 fed funds claim on the Fed. P decides to wire the \$100 to her Bahamian bank (BB). BB does not have an account at the Fed, but it does use JPMC as its correspondent bank in the US. So P tells Citi to wire the \$100 to BB for the benefit of a particular account ZZZ. Citi contacts BB and learns that they use JPMC as their correspondent, so it wires the funds to JPMC for the benefit of BB's account ZZZ. Citi sends the wire instructions to the Fed. After the wire, Citi no longer has the claim on the Fed or the liability to P. JPMC has a new claim on the Fed and it has a new liability to BB. BB has a new claim on JPMC and P has a new claim on BB. In the US, banking flows are computed as the change in observed positions each month: the system for short-term instruments (anything less than one year original maturity, including bank deposits) is custodial-based; flows are not looked at. Now, looking at bank positions, JPMC's deposit liabilities to the Bahamas have gone up by \$100 (an inflow or increase in liabilities, i.e. a credit). But unless P puts her deposit with BB in custody at Citi or some other US bank, the US TIC system will not see an offsetting outflow or increase in claims (i.e., no debit will be recorded). There will be negative net errors and omissions in the U.S. balance of payments.

There are trillions of cross-border payments each year; identifying the exact nature of each of those payments (i.e., what cross-border real or financial transactions they offset) is fraught with difficulties. That is why many countries, like the U.S., track the change in positions rather than the flows for a large number of instruments. One should note that even in transaction-based statistical systems it is in practice impossible to accurately capture the wire transfers of funds to offshore havens: statisticians see interbank flows of funds, but they cannot know that the counterpart of those flows are purchases of offshore bank deposits by the household sector. This is especially true given that households who transfer funds to tax havens may try to conceal such transfers. For example, instead of transferring funds from a personal account in France to a Swiss account, a French person can

[97] Note in particular that the latter operation must not be recorded as a "current transfer" in the current account but as a financial account transaction, see paragraph 12.24 of the 6th version of the Balance of Payments Manual: "Funds sent abroad by individuals who are resident in the economy in which they are employed, self-employed, or operating a business, for the purpose of making a deposit in his or her own account with a bank located abroad, represent a financial investment, which is recorded in the financial account, rather than as a personal transfer."

[98] I am grateful to an anonymous referee for providing the following detailed example to me.

send funds through a French corporate bank account (e.g., the account of a wealth-holding company, a foundation, or a small business that she controls). This makes it impossible for French statisticians – and anti-money laundering authorities – to know that the funds they see flowing from a domestic to a Swiss bank are the counterpart of the purchase by a French household of Swiss bank deposit. No "other investment" debit will be recorded and there will be more negative "net errors and omissions" in France.

D.3 Case 3: Trade mis-invoicing

A relatively simple way to conceal transfers of funds abroad is trade mis-invoicing. Think of a Chinese importer who wants to send funds to Switzerland. There are strong capital controls in a number of developing economies, including in China: transfers of funds to foreign banks by the private sector are generally allowed only if these transfers finance trade operations. Now a Chinese importer can strike a deal with a Swiss-based exporter to mis-invoice its imports: e.g., the importer will pay more than the real value of the goods or services imported, and he will get the difference back on a Swiss account. Such mis-invoicing allows to circumvent capital controls relatively easily because the flows of funds to foreign banks seem to be backed by legitimate trade operations. Such mis-invoicing may cause "net errors and omissions" in China's balance of payments: because the goods and services imported will be of lower value than the funds sent abroad to pay for them, more debits than credits will in principle be recorded in the Chinese balance of payment, causing negative "net errors and omissions." However, this is not necessarily the case, because Chinese statisticians may use the inflated bills provided by the exporters to compute the value of China's imports – in which case there will be no "errors and omissions."

The literature on capital flight has traditionally focused on trade mis-invoicing – in particular on trade mis-invoicing between developing economies and tax havens (Cuddington, 1986; Cumby and Levich, 1987; Dooley, 1988; Claessens, 1997; Boyce and Ndikumana, 2001). But trade mis-invoicing also affects rich countries. A French person who wants to send funds to Switzerland without attracting attention from anti-money laundering authorities can create a sham corporation that issues fictitious bills, and justify the transfers of funds to offshore tax havens by showing these bills. In appearance, transfers of funds to tax havens will be justified by trade operations. The trade operations will be entirely fictitious, so in principle French statisticians should not record any goods or service import and there should be negative "net errors and omissions" in the French balance of payments. However, they might again be induced to record service imports on the basis of the fake bills. In this case, imports will be over-estimated in the French current account, asset purchases will be under-estimated in the financial account of the French balance of payments, and there will be no errors and omissions.

Just as it may cause negative "errors and omissions" in China and France, trade mis-invoicing may also cause positive "errors and omissions" in tax havens, since tax havens will receive funds larger than the underlying goods or services that they are supposed to export.

D.4 Case 4: London traders paid on Jersey accounts

Next, think of the employee of a London-based bank who is paid directly on her offshore account in Jersey. Assuming that nobody does anything to conceal this transfer, U.K. statisticians should be able to correctly record it. For the sake of the argument, let's assume that they do, i.e. that when London banks pay their traders directly on their Jersey accounts, U.K. statisticians correctly record the related flows of funds both as credits (funds flow from U.K. banks to Jersey banks) and debits (U.K. residents purchase Jersey bank deposits).There are, then, two cases.

First, some of the U.K. traders who are paid in Jersey will simply leave their funds in the form of Jersey bank deposits. These deposits will be recorded by the Bank for International Settlements (BIS) as cross-border bank liabilities of Jersey vis-à-vis the U.K. If U.K. statisticians use the BIS data, then they will capture these funds in the U.K.'s international investment position. If U.K. statisticians form their estimate of offshore bank deposits simply by cumulating recorded outflows, they will also correctly capture the funds held offshore by U.K. residents in the U.K.'s IIP. Both the flows of funds into tax havens and the stocks of offshore assets will be duly recorded in U.K. statistics. These funds will be part of the 2% of households' financial wealth that, I estimate, is held by households in offshore tax havens and partly goes recorded in international investment statistics.

Second, some of the U.K. traders who are paid in Jersey will make financial investments through their offshore accounts. They will, say, buy Irish mutual fund shares. Absent information exchange between Jersey and the U.K., those purchases will not be recorded in the U.K. balance of payments. In addition, U.K. statisticians will miss these Irish fund shares when they conduct their asset survey for the CPIS. Both the purchases of portfolio securities from offshore accounts and the stocks of portfolio securities held offshore will be missed in U.K. statistics.

Overall, the "other investment" category in both the U.K. balance of payments and international investment position will be accurate, but the "portfolio investment" category will be biased. Three implications follow:

a. Portfolio security outflows will be consistent will portfolio security positions: both will be similarly downwards biased.

b. If households purchase portfolio securities through their offshore accounts and if statisticians use the BIS data to compute the amount of "other investment" assets, then statisticians will duly record transfers of funds to tax havens, but they will miss the portfolios held offshore by households. Recorded "other investment assets" (i.e., the BIS data) will be lower than would be implied from outflows.

c. If households purchase portfolio securities through their offshore accounts and if statisticians compute the amount of "other investment" assets by cumulating "other investment" flows, then both the transfers of funds to tax havens and households' offshore holdings will be accurately recorded in the short run. However, both will be recorded as "other investments" (i.e., bank deposits) – never as portfolio securities. In the short run this is not a major issue. But in the long-run it means that the IIP will be unable to capture any increase in the price of the portfolio securities held offshore. The IIP will under-estimate the market value of the funds held offshore by households. The bias will grow over time.

There is no single prediction as to what exact anomaly the transfers of funds to tax havens cause when U.K. trader are paid on Jersey accounts. However, since the IMF has been advocating the use of BIS data over the last 20 years (Motala, 1997, p. 25), the most likely scenario is the one described in point b. above: a discrepancy between cumulated "other investment" outflows and "other investment" asset positions.

D.5 Case 5: French investors transferring portfolio securities to Swiss custodians

Households can do more than simply move bank deposits into foreign banks. In principle, they can also transfer portfolios of securities from domestic custodian banks to foreign custodian banks. Such transfers are well documented for large financial institutions, see for instance Le Roux (2010, p. 24) in the case of France. However, to my knowledge the IMF Balance of Payments Manual does not indicate how transfers of portfolio securities from domestic to foreign custodians should be recorded.

For the specific case of France, transfers of portfolios are dealt with as follows.[99] As of today, French statisticians base their estimates of portfolio outflows on observed changes in portfolio stock data (corrected for valuation changes). When a French person transfers portfolios to an offshore custodian, these portfolios leave the scope of France's asset survey. In order to avoid recording a portfolio investment sale (credit), French statisticians record a negative "other change" in the statistics that attempt to reconcile flow and stock data. That is, flow data are accurate, stock data are inaccurate, and the discrepancy is reflected in the "other change" category of the reconciliation account.[100]

D.6 Summary

Transfers of funds into tax havens pose considerable statistical difficulties. However, a number of predictions stand out as to how they should be recorded:

1. When funds are wire into offshore accounts, there may be negative "net errors and omissions" in the balances of payments of countries experiencing capital flight, depending on national statistical practices;

2. Tax havens, similarly, may record positive net errors;

[99] This description is based on personal communication with French statisticians in charge of these questions at the Bank of France. They do not reflect the official position of the Bank of France, but simply my personal understanding.

[100] Note, however, that there is no systematic procedure to spot the transfers of portfolios abroad. The identification is on a case-by-case basis. When French statisticians fail to notice such transfers, portfolio investment sales (credits) are erroneously recorded in the French balance of payments. Portfolio flow and stock figures are then consistent (both are similarly downwards biased) and transfers of portfolios cause negative "net errors and omissions" in the French balance of payments.

3. In principle, transfers of funds into tax havens should not make portfolio outflow and portfolio stock data inconsistent: both should be similarly underestimated. One exception is when households transfer the custody of their portfolio securities to offshore banks, in which case cumulated portfolio investment flows should be larger than observed positions. In the statistics that attempt to reconcile flow and stock data, there should be negative "other changes" for "portfolio investment" assets;

4. In some cases, transfers of funds into into tax havens could cause a discrepancy between "other investment" outflows and "other investment assets" (e.g., when U.K. traders are paid on their Jersey accounts). In the statistics that attempt to reconcile flow and stock data, there should be negative "other changes" for "other investment" assets.

As Lane and Milesi-Ferretti (2007, Table 3 p. 243) have documented, a number of countries where capital flight may be important, such as Italy and Russia, have experienced large negative "net errors and omissions" over the 1970-2004 period; conversely, Switzerland has experienced large positive "net errors and omissions." More recently, the eurozone as a whole has experienced large negative "net errors and omissions" (ECB, 2009, Chart 1 p. 2). As the ECB has argued, these errors can to a significant extent be explained by the use of tax havens by eurozone households – more precisely by the fact that the purchases of Irish and Luxembourg fund shares by eurozone residents through offshore accounts go unrecorded.[101] Note that the ECB has taken steps to solve this problem (ECB, 2009). In particular, it has improved its coverage of Irish and Luxembourg fund share purchases by eurozone residents. These steps are important. Part of the new purchases of Irish and Luxembourg fund shares by eurozone residents that used to go unrecorded are now duly recorded in the eurozone's balance of payments. But the bulk of the *stock* of Luxembourg and Irish fund shares held in tax havens by eurozone residents is still

[101]The mechanism can be summarized as follows. Generally speaking, the ECB computes the eurozone's balance of payments and IIP by using eurozone countries *bilateral* BOPs and IIPs, and summing individual eurozone countries' *bilateral* credits, debits, assets and liabilities with non-eurozone countries. There are two exceptions, however. First, the ECB estimates the purchases and holdings of eurozone portfolio securities by non eurozone residents as follows: the ECB starts with the *total* transactions in/holdings of securities issued by eurozone residents. It then subtracts the recorded acquisitions/holdings of such securities by residents of the eurozone (ECB, 2007, p. 15-16). The ECB applies the same method to estimate the portfolio income paid by the eurozone to the rest of the world. Now take a French resident who purchases an Irish mutual fund share through a Luxembourg offshore account. Ireland records a "portfolio investment credit" (Ireland's external liabilities increase). But France records nothing (because French statisticians are unaware of this purchase) and Luxembourg does not record any portfolio transaction (in keeping with the residence principle). So the eurozone records a portfolio investment credit – as if the Irish fund shares had been bought by a non-eurozone resident. The problem is that the ECB will not record any debit to balance this credit. Ireland, indeed, records an "other investment" debit vis-à-vis Luxembourg (the net interbank assets of Ireland on Luxembourg increase). Luxembourg records an "other investment" credit vis-à-vis Ireland. These "other investments" are well recorded by the ECB as intra-eurozone transactions, so the eurozone does not record any "other investment" transaction with the rest of the world. Overall, there are more credits than debits recorded by the eurozone, causing "negative net errors and omissions." In a nutshell: cross-border custody within the eurozone causes "negative errors and omissions" in the eurozone's balance of payments.

not recorded in the eurozone IIP.[102]

In the U.S., "net errors and omissions" display no particular trend. Does that invalidate my findings that a significant amount of claims held by U.S. residents on foreign countries go unrecorded in the U.S. IIP? Not at all. As we have seen, not all transfers of funds into tax havens cause "net errors and omissions." Conversely, many factors unrelated to tax havens can cause positive or negative "errors and omissions". We do know that even parts of the balance of payments that are widely considered reliable are in fact subject to substantial errors, including in countries that follow the highest statistical standards. The U.S. Census Bureau (1998), for instance, has argued that U.S. goods exports have tended to be systematically underestimated, by as much as 10% – although many see the trade balance as one of the most reliable part of the balance of payments. For these reasons, it is very hard to use "net errors and omissions" to shed light on the magnitude of capital flight in individual countries. There is no consensus among statisticians on what "net errors and omissions" mostly capture, and this certainly varies across countries.

What about "other changes" in the flow-stock reconciliation accounts? "Other changes" on U.S. "other investment assets" have tended to be positive (Lane and Milesi-Ferretti, 2009, p. 190), rather than negative. But we can identify several reasons as to why this is the case. "Other changes" which are not caused by tax havens can easily dwarf the "other changes" potentially caused by tax havens. Remember that in a given year t, the change in the stock of a country's external assets can be written as: $\Delta Stocks_t = Flows_t + Valuation_t + OtherChange_t$ where $\Delta Stocks_t$ denotes the change in stocks between the beginning and the end of year t, $Flows_t$ the net acquisitions of foreign assets in year t, and $Valuation_t$ the net capital gains on foreign assets. $OtherChange_t$ includes everything that cannot be simply attributed to either flows or valuation effects. For instance, $OtherChange_t$ includes the effects of:

- Changes in the reporting population over year t,
- Changes in statistical methods and concepts during year t,
- Correction to end-of-year $t-1$ data using more accurate surveys.

All of these factors can have large effects on "other changes" statistics and the U.S. has tended to record net positive "other changes" on its "other investment" assets for a combination of the above reasons. First, as Lane and Milesi-Ferretti (2009, p. 190) explain, the structurally positive other changes on the U.S. "other investment" assets can be explained by a continuous extension of the reporting population: "Since the scope of [U.S. "other investment" asset] surveys has progressively expanded over time and the methodology improved, the most plausible explanation for the residual term is the change in coverage: in effect, the estimated flow can be viewed as the change in position that can be attributed to the existing set of reporters, while the residual term relates to the positions of new reporters."

Changes in statistical methods have also played a large role. In the early 1990s, for instance, the U.S. substituted BIS data for U.S. sources to estimate the value

[102] All the fund shares that have been purchased before 2004 are not; all the fund shares that are owned by eurozone residents through non-eurozone tax havens – e.g., Switzerland – are not either.

of the bank deposits held offshore by U.S. households and non-bank corporations. As the IMF (1996, p. 13) indicates, "the result of these substitutions on the U.S. balance of payments and international investment position accounts was dramatic; the stock of U.S. nonbank financial claims on nonresidents as of year-end 1993 was increased, in total, by over $200 billions."

Lastly, the use of more accurate surveys has strongly affected the "other changes" on U.S. "other investment" assets in recent years. In 2008, for example, the "other investment" assets of U.S. non-bank agents were substantially revised "to account for U.S. nonbank financial intermediaries claims associated with the issuance of asset-backed commercial paper (ABCP) that were not captured in BEA's direct investment reporting system. Claims were revised up $226.0 billion for 2005 and up $316.0 billion for 2006." (Bach, 2008, p. 42).

In my view, the positive "other changes" on U.S. "other investment" assets should not been seen as evidence that U.S. residents do not transfer funds to offshore tax havens: as we have seen, not all transfers should translate into negative "other changes," and there are known factors that can explain the positive "other changes" on U.S. "other investment" assets. In the eurozone, "other changes" on "other investment" assets display no particular trend; they have been quite close to 0 on average over the 2000-2008 period (but as we have seen, there have been large "net errors and omissions" over the period, at least before the ECB revised its data).

Can we use observed "net errors and omissions" and "other changes" to shed light on which countries are most affected by tax havens? I think that this is fraught with difficulties, for four reasons. First, transfers of funds into tax havens are recorded in many ways – as we have seen, some go fully unrecorded, some are partially recorded, causing "errors and omissions," some are fully recorded, causing "other changes" in flow-stock reconciliation accounts. Second, it is impossible to know on a priori grounds which fraction goes fully unrecorded, which fraction goes partially recorded, and which fraction goes fully recorded. These fractions depend in particular on the source of the wealth owned by individuals who have offshore accounts: funds with illegitimate origins are more likely to go fully unrecorded, for instance. Now, the question as to which fraction of the funds in tax havens has a legitimate source and which fraction a criminal source (e.g., drug dealing) is important but falls beyond the scope of this paper. Third, the identification of transfers of funds into tax havens depends a great deal on national statistical practices. On that matter, and contrary to what happens for portfolio stock positions, there has never been any serious attempt at harmonizing practices globally. Last but not least, "net errors and omissions" and "other changes" in stock-flow reconciliation accounts can have many other explanations in addition to the transfers of funds into tax havens. Unfortunately, at this stage it seems hard to use these anomalies to shed light on the wealth held by households in tax havens.

E Offshore Fortunes in Switzerland (Tables A23-A26)

Table A23 summarizes the custodial holdings of Swiss banks. The data are based on various editions of the Swiss National Bank's "Banks in Switzerland" and "Monthly

Statistical Bulletin," see the main paper for all relevant details. The value of the offshore portfolio managed by Swiss banks (that is, the portfolio of foreign securities belonging to non-Swiss residents) is in col. 5. Its composition is in col. 6 to 11. Offshore securities managed by Swiss banks account for around 1/3 of all offshore securities of households Ω (see Table 23 col. 12).

Table A24 gives the geographical breakdown of Switzerland's fiduciary deposits, which is the best proxy one can have to estimate who owns the offshore fortunes managed by Swiss banks. Country groups are defined as follows:

- Tax havens: Andorra, Antigua and Barbuda, Aruba, Bahamas, Bahrain, Barbados, Belize, Bermuda, British Antilles, British Overseas Territories, Cayman Islands, Costa Rica, Cyprus, Dominica, Gibraltar, Grenada, Guernesey, Hong Kong, Isle of Man, Jersey, Lebanon, Liberia, Liechtenstein, Luxembourg, Macao, Malaysia, Malta, Marshall Islands, Mauritius, Monaco, Nauru, Netherlands Antilles, Palau, Panama, Samoa, San Marino, Seychelles, Singapore, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Turks and Caicos Islands, Uruguay, Vanuatu.

- Europe: Albania, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, "Eastern Europe,"[103] Estonia, Finland, France, German Democratic Republic, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Macedonia, Moldova, Netherlands, Norway, "Other Western Europe,"[104] Poland, Portugal, Romania, Serbia and Montenegro, Slovak Republic, Slovenia, Spain, Sweden, Tchecoslovakia, Ukraine, United Kingdom, Vatican, Yugoslavia.

- Middle East: Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Oman, "Other Middle East,"[105] Qatar, Saudi Arabia, Syria, United Arab Emirates, West Bank and Gaza, Yemen.

- Latin and South America: Argentina, Bolivia, Brazil, "Central America,"[106] Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Falkland Islands, Guatemala, Haiti, Honduras, Mexico, Nicaragua, "Other South America,"[107] Paraguay, Peru, Venezuela.[108]

- Asia: Afghanistan, Armenia, Australia, Azerbaijan, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Fiji, French Polynesia, Georgia, India, Indonesia, Japan, Kazakhstan, Kiribati, Dem. Rep. of Korea, Rep. of Korea, Kyrgyz Republic, Lao, Maldives, Micronesia, Mongolia, Myanmar, Nepal, New Caledonia, New Zealand, "Other Asia,"[109] Pakistan, Papua New Guinea,

[103] An aggregate category used by the SNB between 1976 and 1984.
[104] A residual category used by the SNB between 1976 and 1984.
[105] A residual category used by the SNB between 1975 and 1984.
[106] An aggregate category used by the SNB between 1976 and 1984.
[107] A residual category used by the SNB between 1976 and 1984.
[108] Note that after the EU savings directive(2005), a fraction of Venezuela's holdings are included in the tax havens category, under strong suspicion that they correspond to the holdings of sham corporations created to avoid the directive in 2005.
[109] A residual category used by the SNB between 1976 and 1984.

Philippines, Russian Federation, Solomon Islands, Sri Lanka, St Helen, Taiwan, Tajikistan, Thailand, Timor-Leste, Tonga, Turkey, Turkmenistan, Tuvalu, USSR, United States minor Islands, Uzbekistan, Vietnam, Wallis et Futuna.

- Africa: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Dem. Rep., Congo, Rep., Côte d'Ivoire, Djibouti, Equatorial,, Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Libya, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Namibia, Niger, Nigeria, "North Africa,"[110] "Other Africa,"[111] Rwanda, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Sao Tome and Principe, Tanzania, Togo, Tunisia, Uganda, Western Sahara, Zambia, Zimbabwe.

- North America: Canada, United States of America.

- Caribbean: Cuba, Guyana, Jamaica, Suriname, Trinidad and Tobago.

Table A25 and A26 present two distributions of Switzerland's fiduciary deposits by country group. The first distribution (Table 25) gives the raw shares of each country group. In the second distribution (Table A26), I attempt to make tax havens' "holdings" transparent as follows. Denote f_i the true value of the fiduciary deposits held by residents of country i in Swiss banks. What we observe is $\tilde{f}_i = (1 - k_i) f_i$ where k_i is the propensity of country i's residents to use sham wealth-holdings entities in tax havens. I make tax havens transparent assuming that Middle East countries do not use sham entities ($k_i = 0$ for Middle East countries), and that k_i is constant across all other (non-haven) countries. To put it differently, I assume that, except for Middle East countries, each non-haven country ultimately owns the deposits assigned to tax haven countries in the same proportion as it owns the deposits assigned to non-haven countries.

This is a rough way to get rid of the meaningless "tax havens' holdings" column. This way of doing things under-estimates Europe's holdings after the European Union savings Directive, since Europeans have massively shifted their holdings to sham entities in 2005. After 2005, k_i is certainly larger in Europe than elsewhere. Accordingly, I only report figures until 2004 in Table A26. Another problem is that there is no reason why k_i should be independent of country i's characteristics. In particular, we have reasons to believe that k_i is positively correlated with i's tax rate, since using sham entities in tax havens minimizes the probability for a tax evader to be caught. If this is true, then the figures in Table A26 under-estimate the share of fiduciary deposits belonging to residents of high-tax countries – that is, in particular, to Europeans. I plan in future research to improve the method used to make tax havens transparent.

[110] An aggregate category used by the SNB between 1976 and 1984.

[111] A residual category used by the SNB between 1976 and 1984.

F Net Foreign Asset Positions (Tables A27-A32)

A Official data (Table A27)

In this section, I list the sources used to compute the officially reported net foreign asset positions of rich countries (Table A27, and Figure 1 of the Paper).[112]

I define rich countries as all eurozone members as of December 31st 2010,[113] plus five non-eurozone European countries (the U.K., Switzerland, Sweden, Norway, and Iceland, labelled "other Europe" in Table A27), Australia, New-Zealand, Canada, the U.S., and Japan.

I systematically start with the international investment positions reported by national or regional statistical agencies on their websites, that I convert to U.S. dollars using end of period exchange rates from the IMF International Financial Statistics. We have complete time series starting in 1985 or earlier for the U.S. (Bureau of Economic Analysis), Japan (Japanese Ministry of Finance),[114] the U.K. (Official of National Statistics), and Switzerland (Swiss National Bank). In all other instances, we only have partial time series: starting in 1999 for the eurozone 16 (ECB), 1999 for Sweden (Statistics Sweden), 1998 for Norway (Statistics Norway), 1989 for Iceland (Central Bank of Iceland), 1998 for Denmark (Denmarks Nationalbank), 2001 for Australia (Australian Bureau of Statistics), 2005 for Canada (Statistics Canada),[115] and 2000 for New Zealand (Statistics New Zealand).

When no official data is reported by national or regional statistical agencies, I use the series "net IIP as officially reported" in the updated and extended External Wealth of Nations database compiled by Lane and Milesi-Ferretti (2007).[116] This concerns Norway (1980-1993),[117] Sweden (1985-1998), Iceland (1988), Denmark (1991-1997), Australia (1988-2000), and New Zealand (1991-1999).

Lastly, when a country or region has not reported any data on its website or to the IMF, I use the NFA estimates of Lane and Milesi-Ferretti (2007). This concerns the eurozone before 1999,[118] Iceland (1985-1987), Denmark (1985-1990), Australia

[112] These sources, as well as the links to the data, are in the sheet "RawData" of the Excel file that supplements the present Appendix, see formulas in Table A27.

[113] "eurozone 16", i.e.: Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, and Spain.

[114] Note that the Japanese Ministry of Finance compiled two NFA series, one in yen and one in USD. In 1985 and 1994, the yen series converted to USD differs from the official series in USD. In this case, I use the official NFA directly expressed in USD (which is consistent with the data sent to the IMF).

[115] Canada publishes an IIP at book value and an IIP at market value, I take the market value IIP.

[116] This series refer to the IIP sent by individual countries to the IMF. In some cases, countries choose not to disseminate IIP series before a certain date, e.g. because there has been a change of methodology. Using the IIPs sent to the IMF allows to recover the older series.

[117] For Norway there are no official data between 1993 and 1998, I fill the gap by linear interpolation.

[118] Specifically, before 1999, the net foreign asset position of the eurozone 16 is computed as the sum of the net foreign asset positions of the 16 member countries in Lane and Milesi-Ferretti (2007). Note that in 1999, the official eurozone NFA (USD -396bn) is close to the sum of the 16 net foreign asset positions estimates of Lane and Milesi-Ferretti (USD - 366bn), so I just paste the two series together. After 1999, however, there is a significant divergence between the ECB NFA and the sum of Lane and Milesi-Ferretti's country level estimates. One of the reasons is that

(1985-1987), Canada (1985-2004), and New Zealand (1985-1990).

In the left Panel of Table A27, I divide each net foreign asset position by world GDP. In the right Panel, I divide each net foreign asset position by the relevant regional or country GDP (i.e., I divide the U.S. NFA by the U.S. GDP, the eurozone 16 NFA by the eurozone 16 GDP, etc.). All GDP figures come from the World Bank's World Development Indicators[119]).

B Corrected net foreign asset positions (Tables A28-A32)

Corrected net foreign asset positions account for the unrecorded holdings of households in tax havens. I propose different scenarios, based on different assumptions on the share of unrecorded offshore fortunes Ω owned by residents of rich countries, eurozone residents, U.S. residents, etc.

Specifically, we have a good idea of who owns the unrecorded offshore fortunes in Swiss banks, which, as col. 12 of Table A23 shows, have accounted for around 1/3 of all unrecorded offshore fortunes Ω. In Table A28, I investigate how the eurozone's net foreign asset position (as a percentage of eurozone GDP) evolves each year when we account for eurozone households' offshore fortunes. Table A29 presents similar computations for the U.S.

Tables A30, A31, and A32 present robustness checks.

My estimate of households' unrecorded offshore fortunes Ω is larger than the world net foreign asset discrepancy (the puzzling net debt of the world) that we can compute from Lane and Milesi-Ferretti's updated and extended External Wealth of Nations database. In principle, this can affect the claim made in the paper that the eurozone and the rich world are in actual facts net creditors.

Table A30 explores the sources of the difference between Ω and the NFA discrepancy. From 2001 to 2004, my estimate of households' unrecorded offshore assets Ω is comparable to the NFA discrepancy. The small divergence can be fully explained by three factors: the positive FDI discrepancy in the EWNII database (most likely caused, I argue, by errors in the accounts of developing countries); the inclusion in the EWNII of Middle East oil exporters' offshore holdings (which I include in Ω); and the small corrections I make to the portfolio liability data of some EWNII nations (which affect both developing and developed countries, though marginally).

From 2005 to 2007, the net debt of the world shrinks in the EWNII, while my estimate of households' unrecorded offshore holdings keeps growing. Around one fourth of the difference between Ω and the NFA discrepancy can be explained by the cumulated trade balance discrepancy. If, as I argue in the paper, the trade discrepancy comes from errors in the balance of payments of developing countries (e.g., missing imports in China, see Fisman and Wei (2004)), then it is bound to bias upwards the net foreign asset positions of developing countries, which are still mostly obtained by cumulating balance of payments flows (in particular for the "other assets" category).

the ECB NFA is built with direct investment equity capital mostly at book value, which tends to under-estimate the eurozone's net foreign asset position. I stick, however, to the principle of starting from published sources first when those are available. If the eurozone turns into a net creditor when one adds offshore holdings to the ECB NFA, as argued in the paper, then it does even more so if one uses alternative NFA figures for the eurozone with FDI at market values.

[119]Downloaded in April 2011 from http://data.worldbank.org/.

In 2005, 2006 and 2007, however, around a third of the difference between Ω and the NFA discrepancy remains unexplained. Two potential factors are (i) some divergence between portfolio asset data in the CPIS and in the EWNII (for instance due to data revisions), and (ii) the net position of non-EWNII countries. In principle, the OFCs not included in the EWNII (but included in my database) should be roughly balanced; however, small imbalances should not be ruled out. For instance, the Cayman SPVs that held U.S. mortgages may have suffered adverse negative shocks when U.S. housing prices started decreasing, which could have driven the Cayman IIP in the red, thus making the OFCs not included in the EWNII net debtors.

Table A31 redoes the computations of Table A28 (the eurozone's net foreign asset position, under various allocations of Ω), but accounting for the fact that the eurozone may *over*estimate some of its foreign assets or under-estimate some of its foreign liabilities.

First, to be fully consistent with the method used to compute Ω, I correct the official eurozone portfolio liabilities to account for the fact that CPIS-derived liabilities are sometimes larger than reported portfolio liabilities. That is, I subtract col. 13 of Table A12 from the eurozone's official net foreign asset position reported in Table A27.

Then, I compute the unexplained difference between Ω and the NFA discrepancy – that is, the difference that can in principle be due to errors in the published accounts of any country. This is simply the sum of Table A30 lines 2 (the FDI discrepancy), line 3 (the derivative discrepancy), line 6 (the cumulated trade discrepancy after 2004), and line 7 (other).

Lastly, I assume that 25% of this unexplained discrepancy is due to errors in the accounts of eurozone countries, and I subtract the resulting figure from the eurozone's official net foreign asset position. 25% corresponds to the share of eurozone cross-border liabilities in total cross-border liabilities, so in effect I assume that the residual measurement errors are distributed across countries proportionally to the size of their international balance sheets. Note that there are strong reasons to believe that they are not, i.e. that the residual measurement errors essentially come from developing countries. The 25% assumption must been seen as a worst-case scenario.

Importantly, the finding that the eurozone is a net creditor when we account for its residents' offshore assets is robust to this worst-case scenario. Even factoring in large, unexplained measurement errors in eurozone accounts, if eurozone residents own 50% of Ω, the eurozone is still a net creditor (see bottom Panel of Table A31), with an average NFA of +2% of eurozone GDP over 2001-2007 (vs. -13% with no offshore account).

Table A32 presents a similar robustness check for the finding that the rich world is a net creditor. That is, I start by subtracting col. 12 of Table A12 to the rich world's official net foreign asset position reported in Table A27; I then assume that 50% of the unexplained difference between the NFA discrepancy and Ω is due to errors in the published accounts of rich countries. The most plausible scenarios still make the rich world balanced (say, with 60% of Ω) or slightly positive.

The findings of this paper are thus robust to making the world IIP fully balanced, even under adverse assumptions on the quality of rich countries' international investment positions.

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Table A1: Global Cross-Border Securities Assets

Billions of current USD

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
			Correction for CPIS reporting countries		Correction for non-CPIS reporting countries											
	CPIS assets	*Of which: SEFER + SSIO*	Cayman Islands non-bank sector	Other	**China**	*Of which: held as reserve*	**Middle-East oil exporters (onshore)**	*Of which: held as reserve*	*Of which: reported in CPIS*	**Other**	*Of which: private portfolios*	*Of which: reserve*	**Total securities assets**	*Of which: reserves + int'l orga.*	*Memo: (CPIS + SEFER) / Total assets*	*Memo: reserve minus bank deposits*
							Panel A: All securities									
2001	**12,711**	*1,282*	292	36	**214**	*180*	**146**	*49*	*22*	**363**	*174*	*189*	**13,741**	*1,700*	*93%*	*1,657*
2002	**14,116**	*1,429*	371	47	**290**	*243*	**137**	*55*	*21*	**422**	*192*	*230*	**15,362**	*1,958*	*92%*	*1,986*
2003	**19,047**	*1,850*	556	59	**407**	*343*	**167**	*58*	*29*	**573**	*282*	*292*	**20,780**	*2,543*	*92%*	*2,442*
2004	**23,269**	*2,145*	800	47	**611**	*518*	**248**	*78*	*35*	**695**	*340*	*355*	**25,634**	*3,096*	*91%*	*2,986*
2005	**25,892**	*2,221*	839	65	**814**	*696*	**310**	*96*	*46*	**849**	*444*	*405*	**28,723**	*3,418*	*90%*	*3,371*
2006	**32,964**	*2,558*	1,252	58	**1,174**	*906*	**431**	*124*	*63*	**1,154**	*660*	*495*	**36,972**	*4,083*	*89%*	*4,068*
2007	**39,065**	*3,109*	1,544	91	**1,585**	*1,299*	**590**	*201*	*79*	**1,375**	*790*	*585*	**44,170**	*5,195*	*88%*	*5,257*
2008	**30,718**	*3,643*	1,203	84	**1,906**	*1,654*	**587**	*180*	*74*	**1,183**	*536*	*647*	**35,607**	*6,124*	*86%*	*6,197*
							Panel B: Equities									
2001	**5,200**	*17*	164	7	**5**	*4*	**65**	22	*6*	**119**	*116*	*3*	**5,554**	*46*	*94%*	
2002	**4,796**	*14*	197	9	**4**	*3*	**56**	22	*5*	**118**	*114*	*3*	**5,174**	*43*	*93%*	
2003	**6,950**	*27*	334	9	**3**	*3*	**87**	31	*8*	**170**	*166*	*4*	**7,546**	*64*	*92%*	
2004	**8,705**	*35*	402	4	**4**	*3*	**123**	39	*11*	**198**	*194*	*5*	**9,426**	*82*	*92%*	
2005	**10,586**	*35*	430	5	**4**	*3*	**153**	48	*16*	**258**	*253*	*5*	**11,421**	*92*	*93%*	
2006	**14,249**	*43*	616	10	**20**	*16*	**213**	61	*25*	**428**	*421*	*7*	**15,511**	*127*	*92%*	
2007	**17,094**	*54*	773	24	**104**	*83*	**259**	88	*33*	**517**	*509*	*8*	**18,738**	*234*	*91%*	
2008	**9,836**	*39*	458	22	**95**	*74*	**183**	56	*39*	**292**	*283*	*9*	**10,846**	*178*	*91%*	
							Panel C: Debt									
2001	**7,511**	*1,265*	128	29	**208**	*176*	**82**	28	*15*	**245**	*58*	*187*	**8,187**	*1,655*	*92%*	
2002	**9,319**	*1,415*	174	38	**287**	*241*	**81**	33	*16*	**305**	*78*	*227*	**10,188**	*1,915*	*91%*	
2003	**12,097**	*1,823*	222	50	**404**	*340*	**79**	28	*21*	**403**	*115*	*288*	**13,234**	*2,479*	*91%*	
2004	**14,564**	*2,110*	398	43	**607**	*515*	**125**	39	*25*	**497**	*147*	*350*	**16,209**	*3,014*	*90%*	
2005	**15,306**	*2,186*	409	60	**809**	*693*	**157**	49	*30*	**591**	*192*	*399*	**17,302**	*3,326*	*88%*	
2006	**18,715**	*2,515*	636	48	**1,154**	*890*	**218**	63	*38*	**727**	*239*	*488*	**21,460**	*3,956*	*87%*	
2007	**21,970**	*3,055*	770	67	**1,481**	*1,216*	**332**	113	*46*	**858**	*281*	*577*	**25,432**	*4,961*	*86%*	
2008	**20,882**	*3,604*	744	62	**1,811**	*1,580*	**404**	124	*34*	**891**	*253*	*638*	**24,761**	*5,946*	*84%*	

Table A2: Global Cross-Border Securities Liabilities

Billions of current USD

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
			Correction to EWNII data			**Non EWNII countries**								
						Small OFCs								
	EWNII liabilities	*Memo: IMF IIPs*	No debt data	Netherlands SFIs	raw CPIS derived liabilities > reported liabilities	Cayman Islands	Other small OFCs	*Memo: small OFCs / Total*	Other	int'l orga.	**Total securities liabilities**	*EWNII liabilities / Total liabilities*	*Memo: Int'l debt securities (BIS)*	*Cross-border debt / International debt*
						Panel A: All securities								
2001	**14,055**	*13,144*	35	265	242	708	563	*7.8%*	17	386	**16,273**	*86%*		
2002	**15,332**	*15,233*	31	326	198	838	565	*7.9%*	17	446	**17,754**	*86%*		
2003	**20,483**	*20,256*	47	435	269	1,090	780	*7.9%*	19	514	**23,638**	*87%*		
2004	**25,200**	*24,957*	58	458	225	1,457	953	*8.3%*	30	569	**28,950**	*87%*		
2005	**28,163**	*27,764*	75	394	456	1,592	1,119	*8.4%*	41	559	**32,399**	*87%*		
2006	**35,459**	*34,692*	104	516	430	2,142	1,431	*8.8%*	52	599	**40,732**	*87%*		
2007	**42,411**	*41,565*	168	626	619	2,847	1,867	*9.6%*	93	670	**49,301**	*86%*		
2008	**34,647**	*34,497*	123	607	523	2,241	1,227	*8.6%*	58	671	**40,097**	*86%*		
						Panel B: Equities								
2001	**6,370**	*5,566*		7	34	319	384	*9.9%*	10	3	**7,126**	*89%*		
2002	**5,863**	*5,790*		8	40	386	359	*11.2%*	9	9	**6,675**	*88%*		
2003	**8,340**	*8,135*		11	63	561	494	*11.1%*	9	8	**9,486**	*88%*		
2004	**10,223**	*10,021*		12	95	784	626	*12.0%*	16	15	**11,770**	*87%*		
2005	**12,180**	*11,811*		11	301	857	757	*11.4%*	19	16	**14,140**	*86%*		
2006	**16,006**	*15,338*		43	261	1,195	988	*11.8%*	26	12	**18,531**	*86%*		
2007	**19,195**	*18,282*		18	470	1,669	1,304	*13.1%*	43	10	**22,711**	*85%*		
2008	**11,288**	*11,145*		14	472	1,106	748	*13.6%*	20	13	**13,662**	*83%*		
						Panel C: Debt								
2001	**7,686**	*7,578*	35	258	208	389	179	*6.2%*	7	383	**9,146**	*84%*	*7,597*	*1.00*
2002	**9,469**	*9,443*	31	318	159	452	206	*5.9%*	8	436	**11,079**	*85%*	*9,272*	*1.02*
2003	**12,143**	*12,121*	47	424	206	529	287	*5.8%*	10	506	**14,152**	*86%*	*11,702*	*1.04*
2004	**14,977**	*14,936*	58	446	130	673	327	*5.8%*	14	555	**17,180**	*87%*	*13,935*	*1.07*
2005	**15,982**	*15,953*	75	383	156	735	362	*6.0%*	22	543	**18,258**	*88%*	*14,600*	*1.09*
2006	**19,453**	*19,354*	104	473	169	947	442	*6.3%*	26	587	**22,201**	*88%*	*18,415*	*1.05*
2007	**23,216**	*23,283*	168	608	149	1,177	563	*6.5%*	50	659	**26,591**	*87%*	*22,700*	*1.03*
2008	**23,358**	*23,353*	123	592	51	1,135	479	*6.1%*	38	657	**26,435**	*88%*	*23,845*	*0.98*

Table A3 – Global Discrepancy Between Cross-Border Securities Assets and Liabilities

Billions of current USD

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[9]	[10]	[11]	[12]	[13]	[14]	[15]
	Global Securities Assets	Global Securities Liabilities	**Discrepancy**	**Where the missing securities are invested: $L_j - \Sigma_i \hat{A}_{ij}$**							**Offshore asset allocation**	*Missing wealth / Cross-border securities*	**World market cap**	*Missing wealth / World market cap*
	$\Sigma_i\Sigma_j \hat{A}_{ij}$	$\Sigma_j L_j$	$\Omega = \Sigma_j L_j - \Sigma_i \Sigma_j$	Luxembourg	Cayman islands	Ireland	United States	Japan	Swtizerland	Other				
							Panel A: All securities							
2001	13,741	16,273	**2,532**	305	265	165	509	93	125	1,069		*16%*	65,130	
2002	15,362	17,754	**2,392**	362	274	220	401	70	113	953		*13%*	66,086	
2003	20,780	23,638	**2,858**	465	347	314	495	94	131	1,012		*12%*	82,453	
2004	25,634	28,950	**3,316**	570	477	433	539	151	147	1,000		*11%*	95,686	
2005	28,723	32,399	**3,676**	733	463	515	492	188	136	1,148		*11%*	102,465	
2006	36,972	40,732	**3,760**	766	559	527	354	231	135	1,187		*9%*	121,338	
2007	44,170	49,301	**5,131**	1,039	857	682	264	360	110	1,820		*10%*	143,297	
2008	35,607	40,097	**4,490**	912	841	603	210	291	98	1,536		*11%*	119,080	
							Panel B: Equities							
2001	5,554	7,126	**1,573**	311	203	175	411	37	116	321	62%	*22%*	27,907	*6%*
2002	5,174	6,675	**1,501**	368	252	226	299	27	106	223	63%	*22%*	23,510	*6%*
2003	7,546	9,486	**1,940**	476	347	316	341	53	117	291	68%	*20%*	32,037	*6%*
2004	9,426	11,770	**2,344**	582	477	386	382	72	122	324	71%	*20%*	38,152	*6%*
2005	11,421	14,140	**2,719**	747	463	441	279	135	117	538	74%	*19%*	43,319	*6%*
2006	15,511	18,531	**3,020**	781	559	524	187	125	111	734	80%	*16%*	53,375	*6%*
2007	18,738	22,711	**3,972**	1,060	798	706	192	150	101	965	77%	*17%*	64,563	*6%*
2008	10,846	13,662	**2,816**	930	600	637	177	50	94	329	63%	*21%*	35,811	*8%*
							Panel C: Debt							
2001	8,187	9,146	**959**	-6	62	-10	98	57	9	749	38%	*10%*	37,224	*3%*
2002	10,188	11,079	**891**	-7	22	-6	103	43	6	729	37%	*8%*	42,577	*2%*
2003	13,234	14,152	**918**	-11	0	-2	154	41	15	721	32%	*6%*	50,416	*2%*
2004	16,209	17,180	**972**	-12	0	47	157	78	25	676	29%	*6%*	57,534	*2%*
2005	17,302	18,258	**956**	-13	0	74	213	53	19	610	26%	*5%*	59,145	*2%*
2006	21,460	22,201	**740**	-14	0	3	168	106	25	453	20%	*3%*	67,962	*1%*
2007	25,432	26,591	**1,159**	-21	59	-25	72	210	8	856	23%	*4%*	78,734	*1%*
2008	24,761	26,435	**1,674**	-18	241	-33	33	241	4	1,206	37%	*6%*	83,269	*2%*

Table A4: Main Holders of Cross-Border Securities

Billions of current USD

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
	Industrial, emerging and developing countries									**Offshore financial centers**						
	United States	United Kingdom	Japan	Germany	France	Other (private)	Reserve + Int'l orga.	**Total onshore**	*Memo: Unknown Owner (Ω)*	Luxem-bourg	Ireland	Cayman Islands	Bermuda	Hong-Kong	Other	**Total offshore centers**
	Panel A: All securities															
2001	2,304	1,304	1,290	792	710	2,750	1,700	**10,849**	*2,532*	821	433	342	162	273	860	**2,891**
2002	2,246	1,360	1,395	898	932	3,166	1,958	**11,955**	*2,392*	923	574	426	188	320	976	**3,407**
2003	3,134	1,670	1,721	1,205	1,370	4,412	2,543	**16,055**	*2,858*	1,333	836	618	254	432	1,252	**4,725**
2004	3,764	2,110	2,010	1,515	1,751	5,525	3,096	**19,771**	*3,316*	1,616	1,072	858	310	654	1,354	**5,863**
2005	4,591	2,374	2,115	1,553	1,873	6,290	3,418	**22,215**	*3,676*	1,841	1,182	911	392	707	1,474	**6,508**
2006	5,972	3,141	2,343	2,310	2,464	7,980	4,083	**28,294**	*3,760*	2,431	1,620	1,334	449	1,055	1,788	**8,678**
2007	7,192	3,393	2,524	2,625	2,965	9,656	5,195	**33,549**	*5,131*	2,883	1,970	1,634	574	1,373	2,188	**10,621**
2008	4,268	2,426	2,377	2,149	2,553	7,584	6,124	**27,481**	*4,490*	2,120	1,627	1,253	396	1,069	1,661	**8,126**
	Panel B: Equities															
2001	1,613	558	**227**	381	202	1,359	46	**4,387**	*1,573*	319	134	164	31	95	425	**1,167**
2002	1,385	493	**211**	331	200	1,305	43	**3,969**	*1,501*	305	153	202	31	96	419	**1,205**
2003	2,080	664	**274**	441	340	1,861	64	**5,724**	*1,940*	488	223	339	62	153	556	**1,822**
2004	2,560	879	**365**	524	443	2,285	82	**7,138**	*2,344*	638	305	404	65	200	677	**2,288**
2005	3,318	1,076	**409**	529	525	2,739	92	**8,688**	*2,719*	808	383	432	87	228	795	**2,733**
2006	4,329	1,366	**510**	928	743	3,633	127	**11,637**	*3,020*	1,148	573	618	114	339	1,082	**3,874**
2007	5,248	1,509	**573**	954	827	4,482	234	**13,827**	*3,972*	1,413	649	776	138	515	1,420	**4,911**
2008	2,748	824	**395**	590	455	2,708	178	**7,897**	*2,816*	758	431	459	81	275	945	**2,949**
	Panel C: Debt															
2001	691	746	1,062	410	509	1,390	1,655	**6,463**	*959*	502	299	179	131	179	435	**1,724**
2002	861	867	1,184	567	732	1,861	1,915	**7,987**	*891*	618	421	224	157	224	557	**2,202**
2003	1,054	1,006	1,447	764	1,029	2,552	2,479	**10,331**	*918*	845	612	279	192	279	696	**2,903**
2004	1,204	1,230	1,645	992	1,308	3,240	3,014	**12,633**	*972*	978	767	454	245	454	677	**3,575**
2005	1,273	1,298	1,706	1,024	1,348	3,551	3,326	**13,527**	*956*	1,033	799	480	305	480	679	**3,775**
2006	1,643	1,774	1,833	1,382	1,721	4,347	3,956	**16,657**	*740*	1,283	1,047	716	335	716	706	**4,804**
2007	1,944	1,885	1,950	1,671	2,138	5,174	4,961	**19,722**	*1,159*	1,469	1,321	858	435	858	767	**5,710**
2008	1,519	1,602	1,982	1,560	2,099	4,876	5,946	**19,584**	*1,674*	1,362	1,196	794	315	794	716	**5,177**

Table A5: Sectoral Breakdown of Portfolio Claims Reported in the CPIS, 2008

	Public sector	Private sector		
		Total	*Of which: banks*	*Of which: non banks*
Argentina	7%	93%	*0%*	*93%*
Australia	4%	96%	*5%*	*90%*
Austria	5%	95%	*39%*	*56%*
Bahrain	2%	98%	*95%*	*3%*
Barbados	0%	100%	*100%*	*0%*
Bermuda	0%	100%	*1%*	*98%*
Bulgaria	0%	100%	*50%*	*50%*
Cayman Islands	0%	100%	*100%*	*0%*
Chile	33%	67%	*1%*	*66%*
Colombia	11%	89%	*1%*	*88%*
Costa Rica	0%	100%	*44%*	*56%*
Cyprus	0%	100%	*94%*	*6%*
Czech Republic	1%	99%	*35%*	*64%*
Denmark	5%	95%	*16%*	*79%*
Egypt	0%	100%	*99%*	*1%*
Finland	51%	49%	*15%*	*34%*
France	8%	92%	*31%*	*61%*
Greece	13%	87%	*50%*	*37%*
Guernsey	0%	100%	*28%*	*72%*
Hungary	0%	100%	*4%*	*96%*
India	0%	100%	*3%*	*97%*
Indonesia	0%	100%	*40%*	*60%*
Israel	0%	100%	*18%*	*82%*
Italy	5%	95%	*13%*	*82%*
Japan	0%	100%	*26%*	*74%*
Jersey	1%	99%	*2%*	*97%*
Kazakhstan	85%	15%	*7%*	*8%*
Kuwait	3%	97%	*21%*	*77%*
Macao	14%	86%	*27%*	*59%*
Malaysia	0%	100%	*14%*	*86%*
Mexico	0%	100%	*35%*	*65%*
Netherlands	2%	98%	*12%*	*86%*
Netherlands Antilles	0%	100%	*9%*	*91%*
Norway	75%	25%	*4%*	*21%*
Pakistan	0%	100%	*97%*	*3%*
Poland	2%	98%	*11%*	*87%*
Portugal	13%	87%	*29%*	*57%*
Romania	0%	100%	*13%*	*87%*
Russian Federation	2%	98%	*64%*	*34%*
South Africa	0%	100%	*3%*	*97%*
Spain	22%	78%	*23%*	*56%*
Sweden	20%	80%	*20%*	*60%*
Thailand	5%	95%	*13%*	*82%*
Turkey	1%	99%	*78%*	*21%*
Ukraine	0%	100%	*7%*	*93%*
United Kingdom	0%	100%	*40%*	*60%*
Uruguay	0%	100%	*36%*	*64%*
Venezuela	65%	35%	*14%*	*21%*
Weighted Mean	**8%**	**92%**	***25%***	***66%***

Table A6: Portfolio Assets and Liabilities of the Cayman Islands (bn of USD)

		2001	2002	2003	2004	2005	2006	2007	2008
[1]	**Holdings of U.S. securities (TIC)**	160	194	276	401	445	646	851	706
[2]	*Equities*	*57*	*65*	*117*	*140*	*165*	*221*	*329*	*213*
[3]	*Long term debt*	*92*	*115*	*143*	*227*	*255*	*386*	*469*	*410*
[4]	*Short term debt*	*11*	*13*	*16*	*34*	*25*	*40*	*54*	*83*
[5]	Estimated share of U.S. securities (gravity)								
[6]	*Equities*	*35%*	*32%*	*34%*	*35%*	*38%*	*36%*	*42%*	*46%*
[7]	*Debt*	*57%*	*57%*	*57%*	*57%*	*58%*	*59%*	*61%*	*62%*
[8]	**Total assets (est. from TIC + gravity)**	**342**	**426**	**618**	**858**	**911**	**1,334**	**1,634**	**1,253**
[9]	*Of which: equities*	164	202	339	404	432	618	776	459
[10]	*Of which: debt*	*179*	*224*	*279*	*454*	*480*	*716*	*858*	*794*
	Consistency checks								
[11]	Bank assets (CPIS)	51	55	62	58	72	82	90	50
[12]	*Of which: equities*	*0*	*5*	*5*	*2*	*2*	*2*	*2*	*1*
[13]	*Of which: debt*	*51*	*50*	*57*	*56*	*70*	*80*	*88*	*49*
[14]	Fund assets (CIMA)	*n.a.*	*n.a.*	*n.a.*	*n.a.*	768	1,234	1,708	1,216
[15]	*Of which: equities*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*608*	*952*	*1,188*	*825*
[16]	*Of which: debt*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*160*	*283*	*520*	*391*
[17]	Banks + Funds (CPIS + CIMA)	*n.a.*	*n.a.*	*n.a.*	*n.a.*	***841***	***1,316***	***1,798***	***1,266***
[18]	**Liabilities**	**678**	**811**	**1,050**	**1,396**	**1,504**	**2,012**	**2,662**	**2,181**
[19]	Debt	389	452	529	673	735	947	1,177	1,135
[20]	*International debt (BIS)*	*389*	*452*	*493*	*521*	*536*	*869*	*1,177*	*1,135*
[21]	*Creditor derived debt liabilities*	*327*	*430*	*529*	*673*	*735*	*947*	*1,119*	*894*
[22]	*Equities*	319	386	561	784	857	1,195	1,669	1,106
[23]	*Mutual fund shares (CIMA, est.)*	*289*	*359*	*521*	*723*	*768*	*1,066*	*1,485*	*1,045*
[24]	*U.S. equities on non-fund sector (TIC)*	*30*	*27*	*40*	*61*	*88*	*129*	*184*	*61*
[25]	*Creditor-derived equity liabilities*	*117*	*134*	*215*	*307*	*394*	*636*	*872*	*506*
[26]	**Net portfolio position**	-335	-385	-432	-538	-592	-678	-1,029	-928
[27]	*Equity*	*-125*	*-157*	*-181*	*-319*	*-336*	*-448*	*-710*	*-586*
[28]	*Debt*	*-211*	*-228*	*-250*	*-219*	*-256*	*-230*	*-319*	*-341*

Table A7: China' Cross-Border Securities Assets (bn of USD)

		2001	2002	2003	2004	2005	2006	2007	2008
	Public assets								
[1]	*Memo: total reserve minus gold*	*216*	*291*	*408*	*615*	*822*	*1,068*	*1,530*	*1,949*
[2]	Foreign exchange reserves	212	286	403	610	819	1,066	1,528	1,946
[3]	Foreign portfolio reserves (85% of exchange res.)	**180**	**243**	**343**	**518**	**696**	**906**	**1,299**	**1,654**
[4]	*Of which: equities*	*4*	*3*	*3*	*3*	*3*	*16*	*83*	*74*
[5]	*Of which: debt*	*176*	*241*	*340*	*515*	*693*	*890*	*1,216*	*1,580*
	Private assets								
[6]	External Wealth of Nations II, August 2009	8	6	5	98	123	273	290	n.a.
[7]	*Of which: equities*	*8*	*6*	*5*	*6*	*6*	*9*	*25*	n.a.
[8]	*Of which: debt*	*0*	*0*	*0*	*92*	*117*	*264*	*265*	n.a.
[9]	International Investment Position	n.a.	n.a.	n.a.	92	117	265	285	252
[10]	*Of which: equities*	n.a.	n.a.	n.a.	*0*	*0*	*1*	*20*	*21*
[11]	*Of which: debt*	n.a.	n.a.	n.a.	*92*	*117*	*264*	*265*	*231*
[12]	Prefered estimate	**33**	**47**	**64**	**93**	**118**	**268**	**286**	**252**
[13]	*Of which: equities*	1	1	1	1	1	4	21	21
[14]	*Of which: debt*	32	46	64	92	117	264	265	231
	Total assets								
[15]	Total foreign securities held by China	**214**	**290**	**407**	**611**	**814**	**1,174**	**1,585**	**1,906**
[16]	*Of which: equities*	5	4	3	4	4	20	104	95
[17]	*Of which: debt*	208	287	404	607	809	1,154	1,481	1,811
[18]	Public assets / total assets	84%	84%	84%	85%	86%	77%	82%	87%
	U.S. assets								
[19]	U.S. long term securities held by China (TIC)	152	213	294	405	581	788	1,030	1,275
[20]	*Of which: equities*	4	3	2	3	3	14	72	72
[21]	U.S. short-term securites held by China (TIC)	1	1	2	21	27	25	66	169
[22]	Total U.S. securities held by China (TIC)	153	214	296	426	608	813	1,096	1,444
[23]	U.S. securities / Total foreign securities	71%	74%	73%	70%	75%	69%	69%	76%

Table A8: Middle-East Oil Exporting Countries' Cross-Border Securities Assets (bn of USD)

		2001	2002	2003	2004	2005	2006	2007	2008
	Assets reported in the CPIS								
[1]	Bahrain	15	14	19	24	31	40	47	33
[2]	*Of which: equities*	*3*	*2*	*4*	*4*	*7*	*9*	*10*	*6*
[3]	Kuwait	6	7	10	12	15	23	32	40
[4]	*Of which: equities*	*3*	*3*	*4*	*6*	*9*	*16*	*24*	*33*
[5]	Bahrain + Kuwait	22	21	29	35	46	63	79	74
[6]	*Of which: equities*	*6*	*5*	*8*	*11*	*16*	*25*	*33*	*39*
	Middle East oil exporters' onshore assets								
[7]	U.S. long term securities held onshore by ME oil exp. (TIC)	82	73	87	127	163	231	302	283
[8]	*Of which: equities*	*45*	*38*	*58*	*79*	*95*	*128*	*150*	*102*
[9]	*Of which: long-term debt*	*36*	*35*	*30*	*48*	*68*	*103*	*152*	*181*
[10]	U.S. short-term securities held onshore by ME oil exp. (est., TIC)	21	20	23	31	29	28	40	45
[11]	*Memo: Total U.S. short term claims (i.e. incl. bank accounts)*	n.a.	n.a.	*25*	*41*	*51*	*70*	*81*	*119*
[12]	Total U.S.debt securities held onshore by ME oil exp. (est.)	57	55	52	80	97	131	192	226
[13]	**Total U.S. securities held onshore by ME oil exp. (est., TIC)**	**103**	**93**	**110**	**159**	**192**	**259**	**342**	**329**
[14]	**Assumed U.S. share**	**70%**	**68%**	**66%**	**64%**	**62%**	**60%**	**58%**	**56%**
[15]	**Implied total securities held onshore by ME oil exporters**	**146**	**137**	**167**	**248**	**310**	**431**	**590**	**587**
[16]	*Of which: equities*	*65*	*56*	*87*	*123*	*153*	*213*	*259*	*183*
[17]	*Memo: foreign exchange reserves (old classification for Saudi Arabia)*	*66*	*74*	*78*	*104*	*129*	*165*	*269*	*240*
[18]	*Of which: Bahrain + Kuwait*	*12*	*11*	*9*	*10*	*12*	*16*	*21*	*21*
[19]	Portfolios held as reserve assets (75% of reserves)	49	55	58	78	96	124	201	180
[20]	Implied portfolios held onshore by SWFs and by private agents	97	82	108	170	213	308	389	407
[21]	Implied onshore portfolios missed by CPIS	125	116	138	212	264	369	511	513
[22]	*Of which: equities*	58	50	79	112	137	189	225	143
[23]	*Of which: debt*	67	65	58	100	127	180	286	370
	Consistency checks								
[24]	Setser & Ziemba (2009) estimate of GCC foreign assets	280	270	380	500	690	900	1,280	1,200
[25]	*Assuming 85% in portfolio assets and Iran=Iraq=0*	238	230	323	425	587	765	1,088	1,020
[26]	*Implied offshore portfolio of ME oil exporters*	92	93	156	177	277	334	498	433
[27]	*Implied share of ME oil exp' portfolios held offshore*	38%	40%	48%	42%	47%	44%	46%	42%
[28]	*Implied share of missing wealth Ω belonging to ME oil exp.*	4%	4%	5%	5%	8%	9%	10%	10%
[29]	Lane & Milesi-Ferretti's (2007) estimate of ME oil exp' foreign secs	334	346	430	535	679	884	1,160	n.a.
[30]	*Portfolio equities (EWNII)*	100	85	117	145	176	239	312	n.a.
[31]	*Debt securities (portfolio + reserve)*	234	261	313	390	503	645	849	n.a.
[32]	*Memo: Total debt assets (portfolio+other, EWNII) excl. Bahrain*	361	379	431	530	695	905	1,164	*n.a.*
[33]	*Memo: Reserve assets (EWNII), excl. Bahrain*	*68*	*77*	*83*	*100*	*119*	*145*	*235*	*n.a.*
[34]	*Memo: deposits in BIS banks (BIS Table 7A), excl. Bahrain*	151	149	146	169	217	285	389	378
[35]	*Memo: Portfolio debt of Bahrain (EWNII)*	*12*	*16*	*19*	*20*	*25*	*34*	*40*	*n.a.*
[36]	*Implied offshore portfolio of ME oil exporters*	*188*	*209*	*263*	*287*	*369*	*452*	*570*	*n.a.*
[37]	*Implied share of ME oil exp' portfolios held offshore*	*56%*	*60%*	*61%*	*54%*	*54%*	*51%*	*49%*	*n.a.*
[38]	*Implied sahre of missing wealth Ω belonging to ME oil exp.*	*7%*	*9%*	*9%*	*9%*	*10%*	*12%*	*11%*	*n.a.*
[39]	Japanese securities held by Middle-East oil exporters (CPIS)	11	14	20	30	48	58	81	100
[40]	*Of which: equities*	9	11	17	22	34	40	43	34
[41]	Japanese assets / U.S. assets	11%	15%	18%	19%	25%	23%	24%	30%
[42]	Saudi Arabia's foreign securities (Reserve + SWF + pension)	75	78	91	117	159	235	290	390
[43]	*Saudi Arabia's foreign sec. / Middle East est. onshore foreign sec.*	*51%*	*57%*	*55%*	*47%*	*51%*	*55%*	*49%*	*66%*
[44]	*Saudi Arabia's net oil balance / Middle East net oil bal.*	*44%*	*44%*	*45%*	*46%*	*43%*	*42%*	*40%*	*41%*

Table A9: Other non-CPIS Countries Securities Assets (bn of USD)

		2001	2002	2003	2004	2005	2006	2007	2008
	Public assets								
[1]	*Memo: total reserve minus gold*	*252*	*307*	*389*	*473*	*540*	*660*	*780*	*863*
[2]	Foreign portfolio reserves (75% of exchange res.)	**189**	**230**	**292**	**355**	**405**	**495**	**585**	**647**
[3]	*Of which: equities (1%)*	*3*	*3*	*4*	*5*	*5*	*7*	*8*	*9*
[4]	*Of which: debt (74%)*	*187*	*227*	*288*	*350*	*399*	*488*	*577*	*638*
	Private assets								
[5]	*Of which: equities*	116	114	166	194	253	421	509	283
[6]	*Of which: debt*	58	78	115	147	192	239	281	253
[7]	**External Wealth of Nations II countries**	**112**	**127**	**192**	**241**	**296**	**376**	**466**	**335**
[8]	*Of which: equities*	*64*	*61*	*94*	*117*	*145*	*199*	*266*	*153*
[9]	*Of which: debt*	*48*	*66*	*98*	*124*	*151*	*177*	*200*	*182*
[10]	Memo: Taiwan	63	78	131	168	208	255	307	214
[11]	*Of which: equities*	*43*	*43*	*68*	*86*	*107*	*147*	*197*	*113*
[12]	*Of which: debt*	*20*	*35*	*63*	*82*	*101*	*108*	*110*	*101*
[13]	**Small International Financial Centers**	**62**	**65**	**90**	**99**	**148**	**284**	**324**	**201**
[14]	*Of which: equities*	*52*	*53*	*72*	*77*	*107*	*221*	*243*	*130*
[15]	*Of which: debt*	*10*	*11*	*17*	*23*	*40*	*62*	*81*	*70*
[16]	Memo: British Virgin Islands	50	50	77	79	115	235	231	136
[17]	*Of which: equities*	*42*	*41*	*64*	*65*	*91*	*196*	*199*	*107*
[18]	*Of which: debt*	*7*	*8*	*13*	*14*	*24*	*39*	*31*	*28*

Table A9B: Bilateral Portfolio Holdings, Panel Regressions

	Equity	Debt	Equity	Debt
Bilateral controls				
Log distance	-0.561***	-0.733***	-0.450***	-0.594***
	(0.017)	(0.018)	(0.010)	(0.010)
Longitude gap	0.003***	0.003***		
	(0.000)	(0.000)		
Common language	0.394***	-0.110***	0.451***	0.014
	(0.030)	(0.032)	(0.022)	(0.023)
Colonial relationship after 1945	0.251***	0.447***	0.343***	0.488***
	(0.055)	(0.060)	(0.038)	(0.041)
Both countries industrial	2.739***	2.806***	2.499***	2.303***
	(0.043)	(0.046)	(0.036)	(0.036)
Log of GDP gap	-0.307***	-0.159***	-0.230***	-0.149***
	(0.009)	(0.010)	(0.007)	(0.007)
Log of GDP p.c. gap	-0.250***	-0.149***	-0.260***	-0.195***
	(0.009)	(0.010)	(0.007)	(0.007)
OFC source x host dummy	No	No	Yes	Yes
Source country controls				
Latitude	-0.003***	-0.003***	-0.005***	-0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Landlocked dummy	-0.087***	0.208***	0.144***	0.303***
	(0.024)	(0.026)	(0.021)	(0.021)
Population	0.517***	0.518***	0.447***	0.480***
	(0.010)	(0.010)	(0.007)	(0.007)
GDP per capita	1.123***	0.969***	1.220***	1.157***
	(0.015)	(0.016)	(0.012)	(0.012)
OFC dummy			1.235***	1.800***
			(0.141)	(0.143)
Year fixed-effect	Yes	Yes	Yes	Yes
Host-country fixed effects	Yes	Yes	Yes	Yes
Offshore centers included	No	No	Yes	Yes
Observations	33,746	34,037	57,122	57,670
Adjusted R-squared	0.734	0.739	0.685	0.707

OLS regressions, pooled data 2001-2008
* p<0.05, ** p<0.01, *** p<0.001. Standard errors in parentheses.
Data sources: IMF Coordinated Portoflio Survey, 2001-2008

Table A9C: Bilateral Portfolio Holdings in and of Offshore Financial Canters, Panel Regressions

Source countries	**Non-OFCs**		**OFCs**		**OFCs**	
Host countries	**OFCs**		**Non-OFCs**		**All**	
	Equity	Debt	Equity	Debt	Equity	Debt
Bilateral controls						
Log distance	-0.340***	-0.596***	-0.774***	-0.792***	-0.658***	-0.651***
	(0.028)	(0.028)	(0.022)	(0.02)	(0.019)	(0.017)
Common language	0.471***	-0.202***	0.376***	0.143***	0.374***	0.125***
	(0.059)	(0.059)	(0.046)	(0.043)	(0.04)	(0.038)
Colonial relationship after 1945	0.620***	1.444***	0.274***	0.311***	0.502***	0.307***
	(0.126)	(0.13)	(0.076)	(0.077)	(0.062)	(0.062)
Both countries industrial	1.897***	1.972***	2.145***	1.688***	2.030***	1.673***
	(0.126)	(0.127)	(0.087)	(0.076)	(0.085)	(0.074)
Log of GDP gap	0.003	0.013	-0.228***	-0.275***	-0.203***	-0.204***
	(0.039)	(0.041)	(0.014)	(0.013)	(0.012)	(0.012)
Log of GDP p.c. gap	-0.250***	-0.139***	-0.140***	-0.220***	-0.159***	-0.224***
	(0.018)	(0.017)	(0.018)	(0.017)	(0.016)	(0.014)
Source country controls						
Latitude	-0.003***	-0.002*	-0.023***	-0.025***	-0.022***	-0.024***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Landlocked dummy	0.270***	0.424***	0.562***	0.552***	0.691***	0.647***
	(0.061)	(0.062)	(0.053)	(0.05)	(0.05)	(0.046)
Population	0.410***	0.548***	0.356***	0.433***	0.391***	0.456***
	(0.043)	(0.045)	(0.012)	(0.011)	(0.011)	(0.011)
GDP per capita	1.055***	0.926***	1.545***	1.740***	1.587***	1.724***
	(0.047)	(0.049)	(0.03)	(0.028)	(0.028)	(0.025)
Year fixed-effect	Yes	Yes	Yes	Yes	Yes	Yes
Host-country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,466	8,313	11,822	12,257	14,910	15,320
Adjusted R-squared	0.644	0.636	0.650	0.736	0.643	0.710

OLS regressions, pooled data 2001-2008
* p<0.05, ** p<0.01, *** p<0.001. Standard errors in parentheses.
Data sources: IMF Coordinated Portoflio Survey, 2001-2008

Table A10: Cross-Border Equity Liabilities of Small Offshore Financial Centers (bn of USD)

		2001	2002	2003	2004	2005	2006	2007	2008
	Portfolio equity liabilities								
[1]	Bahamas	10	16	21	22	30	28	35	20
[2]	Bermuda	195	184	251	335	360	404	556	312
[3]	Cayman Islands	319	386	561	784	857	1,195	1,669	1,106
[4]	Jersey	63	41	49	56	77	93	149	89
[5]	Guernsey	33	38	53	77	101	146	195	119
[6]	Isle of Man	1	2	3	9	3	6	8	5
[7]	Netherland Antilles	28	27	37	42	65	80	122	63
[8]	BVI	43	42	65	67	93	200	204	110
[9]	Liechtenstein	9	8	15	18	27	33	35	28
[10]	**Total**	703	745	1,055	1,409	1,614	2,183	2,973	1,854
	Memo: investment funds foreign liabilities								
[11]	Bahamas								
[12]	Bermuda	56	68	116	158	188	212	249	171
[13]	Cayman Islands	289	359	521	723	768	1,066	1,485	1,045
[14]	Jersey	63	41	48	55	76	90	144	79
[15]	Guernsey	29	35	49	72	96	134	184	114
[16]	Isle of Man								
[17]	Netherland Antilles	14	13	0	12	20	24	35	26
[18]	BVI								
[19]	Liechtenstein	9	7	15	18	27	32	34	28
	Memo: non-fund equity liabilities / U.S.								
[20]	Bahamas	1	1	2	2	2	1	1	1
[21]	Bermuda	118	89	107	152	173	189	252	141
[22]	Cayman Islands	30	27	40	61	88	129	184	61
[23]	Jersey	0	0	1	0	1	3	5	11
[24]	Guernsey	4	3	4	5	6	11	11	5
[25]	Isle of Man	0	0	0	0	0	1	1	0
[26]	Netherland Antilles	14	15	23	29	45	56	88	37
[27]	BVI	1	1	2	3	5	4	5	3
[28]	Liechtenstein	0	0	0	0	0	0	0	0
	Memo: creditor-derived equity liabilities								
[29]	Bahamas	10	16	21	22	30	28	35	20
[30]	Bermuda	195	184	251	335	352	404	556	303
[31]	Cayman Islands	117	134	215	307	394	636	872	506
[32]	Jersey	8	9	17	32	37	41	59	53
[33]	Guernsey	12	14	17	23	33	54	68	50
[34]	Isle of Man	1	2	3	9	3	6	8	5
[35]	Netherland Antilles	24	26	37	42	63	78	120	56
[36]	BVI	43	42	65	67	93	200	204	110
[37]	Liechtenstein	4	6	3	2	5	6	12	8

Table A11: Cross-Border Portfolio Debt Liabilities of Small Offshore Financial Centers (bn of USD)

		2001	2002	2003	2004	2005	2006	2007	2008
	Portfolio debt liabilities								
[1]	Bahamas	4	5	6	10	10	8	17	10
[2]	Bermuda	24	23	27	28	33	38	44	53
[3]	Cayman Islands	389	452	529	673	735	947	1,177	1,135
[4]	Jersey	41	61	109	134	162	208	292	225
[5]	Guernsey	17	14	20	22	22	27	32	27
[6]	Isle of Man	1	1	2	4	2	3	4	4
[7]	Netherland Antilles	81	91	102	104	103	112	128	118
[8]	BVI	10	10	21	23	24	39	32	29
[9]	Liechtenstein	0	1	1	2	6	7	13	14
[10]	**Total**	569	658	816	1,000	1,098	1,389	1,740	1,614
	Memo: International debt issued (BIS)								
[11]	Bahamas	2	2	3	4	6	5	9	9
[12]	Bermuda	24	23	27	28	32	35	44	53
[13]	Cayman Islands	389	452	493	521	536	869	1,177	1,135
[14]	Jersey								
[15]	Guernsey								
[16]	Isle of Man								
[17]	Netherland Antilles	81	91	102	104	103	112	128	118
[18]	BVI	10	10	21	23	23	25	31	29
[19]	Liechtenstein	0	0	0	0	0	0	1	1
	Memo: Creditor-derived debt liabilities								
[20]	Bahamas	4	5	6	10	10	8	17	10
[21]	Bermuda	15	16	20	26	33	38	40	42
[22]	Cayman Islands	327	430	529	673	735	947	1,119	894
[23]	Jersey	41	61	109	134	162	208	292	225
[24]	Guernsey	17	14	20	22	22	27	32	27
[25]	Isle of Man	1	1	2	4	2	3	4	4
[26]	Netherland Antilles	45	51	58	66	75	99	123	91
[27]	BVI	7	8	13	14	24	39	32	29
[28]	Liechtenstein	0	1	1	2	6	7	13	14

Table A12: Raw CPIS-derived liabilities > reported liabilities (bn of USD)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
	Panel A: Equities												
	Belgium	Germany	U.K.	Cyprus	Panama	Canada	Egypt	India	China	Other	**Total**	*Of which: Rich World*	*Of which: Euro area*
2001	20	0	0	0	0	0	0	0	0	14	**34**	*20*	*20*
2002	16	0	0	0	0	0	0	0	0	24	**40**	*16*	*16*
2003	20	0	0	0	16	21	0	0	0	6	**63**	*41*	*20*
2004	35	24	0	0	22	0	0	0	0	14	**95**	*59*	*59*
2005	45	66	82	0	25	63	0	0	0	18	**301**	*257*	*111*
2006	71	66	0	0	26	65	0	0	0	33	**261**	*202*	*137*
2007	67	147	13	12	32	128	16	26	0	29	**470**	*367*	*226*
2008	12	45	35	0	15	160	0	98	67	40	**472**	*252*	*57*
	Panel B: Debt												
	Belgium	Germany	Luxembourg	Greece	Ireland	Malaysia	Singapore			Other	**Total**	*Of which: Rich World*	*Of which: Euro area*
2001	0	124	47	0	0	0	0			37	**208**	*171*	*171*
2002	11	74	55	0	0	0	0			19	**159**	*140*	*140*
2003	0	132	30	13	0	17	0			13	**206**	*175*	*175*
2004	0	0	66	22	0	0	0			42	**130**	*88*	*88*
2005	0	0	77	14	0	10	14			40	**156**	*92*	*92*
2006	15	0	89	0	0	0	13			51	**169**	*105*	*105*
2007	0	0	79	0	0	13	24			34	**149**	*79*	*79*
2008	0	0	0	0	12	0	11			27	**51**	*12*	*12*

Table A13: Reported equity liabilities minus creditor-derived liabilities (bn of USD)

	2001	2002	2003	2004	2005	2006	2007	2008
Afghanistan, Islamic State of	0	0	0	0	0	0	0	0
Albania	0	0	0	0	0	-1	0	0
Algeria	0	0	0	0	0	0	-1	-1
American Samoa	0	0	0	0	0	0	0	0
Andorra	0	0	0	0	0	0	0	0
Angola	0	0	0	0	0	0	-1	0
Anguilla	0	0	0	0	0	0	0	0
Antigua and Barbuda	0	0	0	-1	0	-1	-3	-1
Argentina	0	0	-1	-1	0	0	0	0
Armenia	0	0	0	0	0	0	-1	0
Aruba	0	0	0	0	0	0	-1	0
Australia	20	12	25	13	9	9	24	4
Austria	8	-5	12	15	19	25	28	13
Azerbaijan	0	0	0	0	0	0	-1	0
Bahamas, The	0	0	0	0	0	0	0	0
Bahrain	-1	0	-1	-1	-1	-1	-2	-1
Bangladesh	0	-1	0	0	0	0	-1	0
Barbados	0	0	0	0	0	0	0	0
Belarus	0	0	0	0	0	0	-1	0
Belgium	-1	-1	-1	-2	-2	-2	-4	-2
Belize	0	0	0	-1	-1	-1	-2	-1
Benin	0	0	0	0	0	0	-1	0
Bermuda	0	0	0	0	8	0	0	10
Bhutan	0	0	0	0	0	0	-1	0
Bolivia	0	0	0	0	0	0	0	0
Bosnia and Herzegovina	0	0	0	0	0	-1	-1	0
Botswana	0	0	0	0	0	-1	-2	-1
Brazil	4	3	3	9	24	25	81	17
British Indian Ocean Territory	0	0	0	0	0	0	0	0
Brunei Darussalam	0	0	0	0	0	-1	-1	-1
Bulgaria	0	0	0	0	0	0	0	-1
Burkina Faso	0	0	0	0	0	0	-1	0
Burundi	0	0	0	0	0	0	-1	0
Cambodia	0	0	0	0	0	0	-1	-1
Cameroon	0	0	0	0	0	-1	-1	-1
Canada	5	-14	-32	-5	-10	-10	-15	-9
Cape Verde	0	0	0	0	0	0	-1	0
Cayman Islands	203	252	347	477	463	559	798	600
Central African Republic	0	0	0	0	0	0	-1	0
Chad	0	0	0	0	0	0	-1	0
Chile	0	-1	-1	-2	-2	-4	-7	-5
China, P.R.	-5	-5	-7	-8	-11	-14	28	-11
Christmas Island	0	0	0	0	0	0	0	0
Cocos (Keeling) Islands	0	0	0	0	0	0	0	0
Colombia	0	0	0	1	3	3	4	-1
Comoros	0	0	0	0	0	0	-1	0
Congo, Dem. Rep. of	0	0	0	0	0	0	-1	0
Congo, Rep. of	0	0	0	0	0	0	-1	0
Cook Islands	0	0	0	0	0	0	0	0
Costa Rica	0	-1	0	0	0	-1	-1	0
Croatia	0	0	0	0	0	1	2	0
Cuba	0	0	0	0	0	0	0	0
Cyprus	0	-1	-1	-2	-1	-2	-2	-2
Czech Republic	1	2	1	2	0	0	-5	-4
Côte d'Ivoire	0	0	0	0	0	0	0	0
Denmark	5	2	2	10	6	3	8	1
Djibouti	0	0	0	0	0	0	-1	0
Dominica	0	0	0	0	0	-1	-2	-1
Dominican Republic	0	0	0	0	0	0	-1	0
Ecuador	0	0	0	0	0	0	-1	0
Egypt	1	1	0	-1	-2	-3	-4	-4
El Salvador	0	0	0	0	0	0	0	0
Equatorial Guinea	0	0	0	0	0	0	-1	0
Eritrea	0	0	0	0	0	-1	-2	-1
Estonia	0	0	0	0	-1	-2	-1	-1
Ethiopia	0	0	0	0	0	-1	0	0
Falkland Islands (Malvinas)	0	0	0	0	0	0	0	0
Faroe Islands	0	0	0	0	0	0	0	0
Fiji	0	0	0	0	0	-1	-1	-1
Finland	15	7	6	-2	0	10	7	-6
France	20	48	68	51	67	98	22	10
French Guiana	0	0	0	0	0	0	0	0
French Polynesia	0	0	0	0	0	0	0	0

French Southern Territories	0	0	0	0	0	0	0	0
Gabon	0	0	0	0	0	0	0	0
Gambia, The	0	0	0	0	0	-1	-2	-1
Georgia	0	0	0	0	0	0	0	0
Germany	17	12	26	-7	-10	-13	-22	-14
Ghana	0	0	0	0	-1	-2	0	-1
Gibraltar	0	0	0	0	0	0	0	0
Greece	1	3	4	7	8	8	19	0
Greenland	0	0	0	0	0	0	0	0
Grenada	0	0	0	0	0	-1	-2	-1
Guadeloupe	0	0	0	0	0	0	0	0
Guam	0	0	0	0	0	0	0	0
Guatemala	0	0	0	0	0	0	-1	0
Guernsey	21	24	35	54	69	91	126	69
Guinea	0	0	0	0	0	0	-1	0
Guinea-Bissau	0	0	0	0	0	0	-1	0
Guyana	0	0	0	0	0	0	0	0
Haiti	0	0	0	0	0	0	0	0
Honduras	0	0	0	0	0	0	-1	0
Hong Kong SAR of China	14	10	5	17	15	1	72	24
Hungary	-1	-1	-2	-2	-2	-3	-6	-1
Iceland	-2	-3	-2	-2	2	4	1	-1
India	2	-3	-1	-4	-7	-8	-11	-8
Indonesia	0	-2	-1	-4	-5	8	36	-5
Iran, Islamic Republic of	0	0	0	0	0	-1	-1	-1
Iraq	0	0	0	0	0	0	0	0
Ireland	175	226	316	386	441	524	706	637
Isle of Man	0	0	0	0	0	0	0	0
Israel	3	1	3	5	3	4	7	3
Italy	-2	-2	-3	-20	-6	-4	-1	6
Jamaica	0	0	0	-1	0	0	-1	0
Japan	37	27	53	72	135	125	150	50
Jersey	55	32	32	24	40	52	90	36
Jordan	2	1	2	3	7	5	7	5
Kazakhstan	0	0	0	0	0	3	7	2
Kenya	0	0	0	-1	-1	-1	-3	-1
Kiribati	0	0	0	0	0	-1	-1	-1
Korea, Democratic People's Republic of	0	0	0	0	0	0	0	0
Korea, Republic of	11	6	5	12	31	41	34	-11
Kuwait	0	0	0	0	-1	-1	-1	-1
Kyrgyz Republic	0	0	0	0	0	0	-1	0
Lao People's Democratic Republic	0	0	0	0	0	0	0	0
Latvia	0	-1	0	0	0	0	0	0
Lebanon	-1	0	0	0	1	2	2	1
Lesotho	0	0	0	0	0	-1	-2	-1
Liberia	-1	0	-1	-1	-2	-1	-1	-1
Libya	0	-1	0	0	0	0	0	-1
Liechtenstein	5	2	12	16	23	27	22	21
Lithuania	0	0	0	0	0	-1	0	0
Luxembourg	311	368	476	582	747	781	1,060	930
Macao SAR of China	0	0	0	0	0	-1	-2	-1
Macedonia, FYR	0	0	0	0	0	0	0	0
Madagascar	0	0	0	0	0	0	-1	0
Malawi	0	0	0	0	-1	-1	-2	-1
Malaysia	-2	-1	1	3	1	6	5	-4
Maldives	0	0	0	0	0	-1	-1	-1
Mali	0	0	0	0	0	0	0	0
Malta	-2	-2	-2	-3	-4	0	-1	0
Marshall Islands	0	0	0	0	0	0	0	0
Martinique	0	0	0	0	0	0	0	0
Mauritania	0	0	0	0	0	-1	-1	0
Mauritius	-1	-1	-1	-1	-3	-2	-2	-1
Mayotte	0	0	0	0	0	0	0	0
Mexico	12	10	12	16	23	36	28	76
Micronesia, Federated States of	0	0	0	0	0	0	0	0
Moldova	0	0	0	0	0	0	-1	0
Monaco	0	0	0	0	0	0	0	0
Mongolia	0	0	0	0	0	0	0	0
Montenegro, Republic of	0	0	0	0	0	0	0	0
Montserrat	0	0	0	0	0	0	0	0
Morocco	-1	-1	-1	0	0	0	-1	0
Mozambique	0	0	0	0	0	0	-1	0
Myanmar	0	0	0	0	0	-1	-1	-1
Namibia	0	0	0	0	0	0	0	0
Nauru	0	0	0	0	0	0	0	0
Nepal	0	0	0	0	0	0	-1	0
Netherlands	-2	27	-1	-8	179	229	258	136

Netherlands Antilles	5	2	0	0	3	2	2	7
New Caledonia	0	0	0	0	0	0	0	0
New Zealand	0	0	2	2	0	-1	-1	-1
Nicaragua	0	0	0	0	0	0	-1	0
Niger	0	0	0	0	0	0	-1	0
Nigeria	-1	0	0	-1	2	4	7	4
Niue	0	0	0	0	0	0	0	0
Norfolk Island	0	0	0	0	0	0	0	0
Norway	-1	-1	-2	-2	1	11	7	-10
Oman	0	0	0	0	0	1	3	2
Pakistan	0	0	1	1	2	2	2	0
Palau	0	0	0	0	0	0	0	0
Panama	-1	-1	-2	-2	-2	-3	-4	-3
Papua New Guinea	-1	-1	-1	-1	-2	-1	-2	-2
Paraguay	0	0	0	0	0	0	0	0
Peru	1	2	1	1	4	5	14	6
Philippines	-1	0	0	0	0	3	4	-1
Pitcairn	0	0	0	0	0	0	0	0
Poland	-1	-1	-2	0	0	-5	-2	-2
Portugal	2	5	17	26	27	8	-2	-2
Puerto Rico	0	0	0	0	0	0	0	0
Qatar	-1	-1	-1	0	-1	-1	-1	-1
Romania	-1	0	0	0	1	2	0	-1
Russian Federation	13	17	25	54	50	82	110	25
Rwanda	0	0	0	0	0	-1	-1	-1
Réunion	0	0	0	0	0	0	0	0
Samoa	0	0	0	0	0	0	-1	0
San Marino	0	0	0	0	0	0	0	0
Saudi Arabia	-1	-3	-1	-1	-1	-3	-1	-2
Senegal	0	0	0	0	0	0	-1	0
Serbia, Republic of	0	-1	0	0	-1	-1	-1	0
Seychelles	0	0	0	0	0	-1	0	0
Sierra Leone	0	0	0	0	0	-1	-2	-1
Singapore	-4	-2	0	3	5	7	11	11
Slovak Republic	1	1	2	3	4	4	4	-1
Slovenia	0	0	0	0	0	1	2	0
Solomon Islands	0	0	0	0	0	-1	-1	-1
Somalia	0	0	0	0	0	0	0	0
South Africa	2	3	4	3	1	14	22	-3
Spain	12	22	39	38	30	56	102	40
Sri Lanka	0	0	0	0	0	0	0	0
St. Helena	0	0	0	0	0	0	0	0
St. Kitts and Nevis	0	0	0	0	-1	-1	-2	-1
St. Lucia	0	0	0	0	0	-1	-2	-1
St. Pierre and Miquelon	0	0	0	0	0	0	0	0
St. Vincent and the Grenadines	0	0	0	0	0	-1	-2	-1
Sudan	0	0	0	0	0	-1	-2	-1
Suriname	0	0	0	0	0	0	0	0
Swaziland	0	0	0	0	-1	-1	-2	0
Sweden	2	1	4	-1	9	19	9	7
Switzerland	116	106	117	122	117	111	101	94
Syrian Arab Republic	0	-1	0	0	0	0	-1	0
São Tomé and Príncipe	0	0	0	0	0	0	-1	0
Taiwan Province of China	-1	12	14	13	16	24	29	29
Tajikistan	0	0	0	0	0	0	-1	0
Tanzania	0	0	0	0	0	-1	-2	-1
Thailand	0	1	-1	1	0	1	3	-4
Timor-Leste	0	0	0	0	0	0	-1	0
Togo	0	0	0	0	0	0	-1	0
Tokelau	0	0	0	0	0	0	0	0
Tonga	0	0	0	0	0	-1	0	-1
Trinidad and Tobago	0	0	0	0	0	-1	-2	-1
Tunisia	0	0	0	0	0	1	0	1
Turkey	1	-1	0	1	4	3	13	-1
Turkmenistan	0	0	0	0	0	0	-1	0
Turks and Caicos Islands	0	0	0	0	0	0	0	0
Tuvalu	0	0	0	0	0	0	0	0
Uganda	0	0	0	0	0	-1	-2	-1
Ukraine	0	0	0	0	0	0	-1	0
United Arab Emirates	-1	-1	-1	-2	-1	-1	-1	-1
United Kingdom	113	34	14	31	-49	-64	-105	-60
United States	411	299	341	382	279	187	192	177
United States Minor Outlying Islands	0	0	0	0	0	0	0	0
Uruguay	0	0	0	0	0	0	0	0
Uzbekistan	0	0	0	0	0	0	-1	0
Vanuatu	0	0	0	0	0	-1	-1	-1
Vatican City State	0	0	0	0	0	0	0	0

Venezuela, República Bolivariana de	1	2	3	4	3	4	3	0
Vietnam	0	0	0	0	-1	0	3	2
Virgin Islands, British	0	0	0	0	0	0	0	0
Virgin Islands, U.S.	0	0	0	0	0	0	0	0
Wallis and Futuna Islands	0	0	0	0	0	0	0	0
West Bank and Gaza Strip	0	0	0	0	0	0	0	0
Western Sahara	0	0	0	0	0	0	0	0
Yemen, Republic of	0	0	0	0	0	-1	-1	-1
Zambia	0	0	0	0	-1	-1	0	0
Zimbabwe	0	0	0	-1	0	-1	-1	-1
International Organizations	0	-4	-1	-8	0	-1	0	-1

Table A14: Reported debt liabilities minus creditor-derived liabilities (bn of USD)

	2001	2002	2003	2004	2005	2006	2007	2008
Afghanistan, Islamic State of	0	0	0	0	0	0	0	0
Albania	0	0	0	0	0	0	-2	-3
Algeria	0	0	0	0	0	0	0	0
American Samoa	0	0	0	0	0	0	0	0
Andorra	0	0	0	0	0	0	0	0
Angola	0	0	0	0	-1	0	-1	-1
Anguilla	0	0	0	0	0	0	0	0
Antigua and Barbuda	0	0	0	0	0	0	0	0
Argentina	10	6	10	7	5	7	7	-1
Armenia	0	0	0	0	0	-1	-1	-1
Aruba	-1	-1	-1	-1	-1	-1	-1	-3
Australia	47	48	65	63	69	83	101	81
Austria	40	52	56	68	55	54	73	60
Azerbaijan	0	0	0	0	0	-1	-1	-1
Bahamas, The	0	0	0	0	0	0	0	0
Bahrain	0	0	0	0	-1	0	0	3
Bangladesh	0	0	0	0	-1	-1	-1	0
Barbados	0	0	0	0	0	0	0	0
Belarus	0	0	0	0	0	-1	-1	-1
Belgium	-4	-5	-8	-12	-13	-21	22	42
Belize	0	0	0	0	0	0	0	0
Benin	0	0	0	0	-1	-1	-2	-1
Bermuda	9	7	7	2	0	0	4	11
Bhutan	0	0	0	0	0	0	0	0
Bolivia	0	0	0	0	0	-1	-1	-1
Bosnia and Herzegovina	0	0	0	-1	-2	-2	-2	-3
Botswana	0	0	0	0	-1	-1	-2	-2
Brazil	69	67	51	42	38	37	62	56
British Indian Ocean Territory	0	0	0	0	0	0	0	0
Brunei Darussalam	0	0	0	0	0	0	0	0
Bulgaria	1	1	0	-1	-2	-1	-1	-1
Burkina Faso	0	0	0	0	0	0	-2	-1
Burundi	0	0	0	0	0	0	0	0
Cambodia	0	0	0	0	0	-1	-1	-1
Cameroon	0	0	0	0	0	0	0	0
Canada	65	36	34	49	33	20	-8	-36
Cape Verde	0	0	0	0	0	0	-2	-2
Cayman Islands	62	22	0	0	0	0	59	241
Central African Republic	0	0	0	0	0	0	0	0
Chad	0	0	0	0	0	0	0	0
Chile	0	1	0	-2	-2	-2	-4	-1
China, P.R.	0	0	0	0	-2	-3	-4	-3
Christmas Island	0	0	0	0	0	0	0	0
Cocos (Keeling) Islands	0	0	0	0	0	0	0	0
Colombia	6	5	4	3	1	1	0	0
Comoros	0	0	0	0	0	0	0	0
Congo, Dem. Rep. of	0	0	0	0	0	0	0	0
Congo, Rep. of	0	0	0	0	0	0	0	0
Cook Islands	0	0	0	0	0	0	0	0
Costa Rica	0	0	0	-1	-1	-1	-2	-1
Croatia	0	0	0	-1	-1	-2	-2	-1
Cuba	0	0	0	0	0	0	0	0
Cyprus	-1	-2	-3	-2	-1	-2	-3	-3
Czech Republic	-1	0	-1	0	-1	0	0	1
Côte d'Ivoire	0	0	-1	-1	-2	-2	-4	-4
Denmark	28	17	23	23	11	26	37	64
Djibouti	0	0	0	0	0	0	0	0
Dominica	0	0	0	0	0	0	0	0
Dominican Republic	0	0	0	0	-1	-1	-3	-2
Ecuador	2	2	2	1	1	0	-1	0
Egypt	0	0	-1	-1	-2	-2	-3	-3
El Salvador	0	0	0	-1	-2	-2	-3	-2
Equatorial Guinea	0	0	0	0	0	0	0	0
Eritrea	0	0	0	0	0	0	0	0
Estonia	0	0	-1	0	-1	-1	-1	-1
Ethiopia	0	0	0	0	0	0	0	0
Falkland Islands (Malvinas)	0	0	0	0	0	0	0	0
Faroe Islands	0	0	0	0	0	0	0	0
Fiji	0	0	0	0	0	0	0	0
Finland	6	10	17	19	20	19	15	20
France	158	169	174	282	304	259	262	342
French Guiana	0	0	0	0	0	0	0	0
French Polynesia	0	0	0	0	0	0	0	0

French Southern Territories	0	0	0	0	0	0	0	0
Gabon	0	0	0	0	0	0	0	0
Gambia, The	0	0	0	0	0	0	0	0
Georgia	0	0	0	0	-1	-1	-1	-1
Germany	-58	-71	-110	-147	-110	-241	-125	-6
Ghana	0	0	0	0	0	0	0	0
Gibraltar	0	0	0	0	0	0	0	0
Greece	-2	-19	-8	-13	-8	-27	3	16
Greenland	0	0	0	0	0	0	0	0
Grenada	0	0	0	0	0	0	0	0
Guadeloupe	0	0	0	0	0	0	0	0
Guam	0	0	0	0	0	0	0	0
Guatemala	0	0	0	0	-1	-1	-2	-1
Guernsey	0	0	0	0	0	0	0	0
Guinea	0	0	0	0	0	0	0	0
Guinea-Bissau	0	0	0	0	0	0	0	0
Guyana	0	0	0	0	0	0	0	0
Haiti	0	0	0	0	-1	-1	-2	-1
Honduras	0	0	0	0	0	0	0	0
Hong Kong SAR of China	-1	5	-2	-3	-4	-4	19	-5
Hungary	0	0	-1	-4	0	-3	2	4
Iceland	0	-17	-15	-20	-3	6	-3	24
India	9	9	3	2	-5	-2	-2	-3
Indonesia	5	4	1	0	3	7	7	11
Iran, Islamic Republic of	0	0	0	0	0	0	0	0
Iraq	0	0	0	0	0	0	0	0
Ireland	-10	-6	-2	47	74	3	-25	-33
Isle of Man	0	0	0	0	0	0	0	0
Israel	7	4	3	2	3	5	4	4
Italy	39	34	19	-35	0	73	146	241
Jamaica	0	0	0	0	-1	-1	-1	-1
Japan	57	43	41	78	53	106	210	241
Jersey	0	0	0	0	0	0	0	0
Jordan	0	0	0	-1	-1	-1	-1	-1
Kazakhstan	-1	-1	-1	0	-1	-1	-1	-4
Kenya	0	0	0	0	0	0	0	0
Kiribati	0	0	0	0	0	0	0	0
Korea, Democratic People's Republic of	0	0	0	0	0	0	0	0
Korea, Republic of	8	8	10	5	6	8	23	17
Kuwait	-1	0	0	-1	-2	-2	-1	2
Kyrgyz Republic	0	0	0	0	-1	-1	-2	-1
Lao People's Democratic Republic	0	0	0	0	0	0	0	0
Latvia	0	0	0	-1	-1	-1	-1	-4
Lebanon	0	0	0	0	0	0	0	0
Lesotho	0	0	0	0	0	0	0	0
Liberia	0	0	0	0	0	0	0	0
Libya	0	0	0	0	0	0	0	0
Liechtenstein	0	0	0	0	0	0	0	0
Lithuania	0	0	-1	-1	-2	-1	0	0
Luxembourg	-6	-7	-11	-12	-13	-14	-21	-18
Macao SAR of China	0	0	0	0	0	0	0	0
Macedonia, FYR	0	0	0	0	-1	-1	-1	-1
Madagascar	0	0	0	0	0	0	0	0
Malawi	0	0	0	0	0	0	0	0
Malaysia	-2	-2	-3	-3	-4	-4	-5	7
Maldives	0	0	0	0	0	0	0	0
Mali	0	0	0	0	-1	-1	-1	-1
Malta	-1	-1	-2	-3	-7	-7	-24	-6
Marshall Islands	0	0	0	0	0	0	0	0
Martinique	0	0	0	0	0	0	0	0
Mauritania	0	0	0	0	0	0	0	0
Mauritius	0	0	0	-1	-1	-1	-2	-1
Mayotte	0	0	0	0	0	0	0	0
Mexico	37	35	34	35	32	31	46	63
Micronesia, Federated States of	0	0	0	0	0	0	0	0
Moldova	0	0	0	0	-1	-1	-2	-1
Monaco	0	0	0	0	0	0	0	0
Mongolia	0	0	0	0	0	0	0	0
Montenegro, Republic of	0	0	0	0	0	0	0	0
Montserrat	0	0	0	0	0	0	0	0
Morocco	0	0	-1	0	0	-1	-7	-6
Mozambique	0	0	0	0	0	-1	-2	-1
Myanmar	0	0	0	0	0	-1	0	0
Namibia	0	0	0	0	0	0	-1	-1
Nauru	0	0	0	0	0	0	0	0
Nepal	0	0	0	0	0	0	0	0
Netherlands	93	102	158	172	76	147	163	161

Netherlands Antilles	36	40	43	38	28	13	5	27
New Caledonia	0	0	0	0	0	0	0	0
New Zealand	4	12	14	18	19	16	26	11
Nicaragua	0	0	0	-1	-1	-1	-2	-2
Niger	0	0	0	0	-1	-1	-1	-1
Nigeria	0	0	0	0	1	0	-1	4
Niue	0	0	0	0	0	0	0	0
Norfolk Island	0	0	0	0	0	0	0	0
Norway	13	9	14	13	17	18	37	43
Oman	0	0	0	0	0	0	0	0
Pakistan	0	0	0	0	0	0	0	1
Palau	0	0	0	0	0	0	0	0
Panama	-1	-1	-2	-2	-3	-3	-4	-2
Papua New Guinea	0	0	0	0	0	0	0	0
Paraguay	0	0	0	0	0	0	-1	-1
Peru	1	1	0	0	0	-1	-1	0
Philippines	3	5	3	1	-1	-3	-3	1
Pitcairn	0	0	0	0	0	0	0	0
Poland	3	4	2	3	-2	1	4	8
Portugal	0	-1	-10	-7	-5	-1	2	1
Puerto Rico	0	0	0	0	0	0	0	0
Qatar	0	0	0	0	0	0	0	0
Romania	0	0	1	-1	-1	-1	-2	-1
Russian Federation	8	11	12	11	14	13	17	4
Rwanda	0	0	0	0	0	-1	-2	-1
Réunion	0	0	0	0	0	0	0	0
Samoa	0	0	0	0	0	0	0	0
San Marino	0	0	0	0	0	0	0	0
Saudi Arabia	0	0	0	0	0	0	0	0
Senegal	0	0	0	0	0	0	-1	-1
Serbia, Republic of	0	0	0	0	0	0	0	-3
Seychelles	0	0	0	0	0	0	0	0
Sierra Leone	0	0	0	0	0	0	0	-2
Singapore	-4	-1	-3	-4	-4	-5	-6	-6
Slovak Republic	0	0	-1	0	-2	0	-5	-9
Slovenia	0	-1	-1	-1	-3	-2	-2	-1
Solomon Islands	0	0	0	0	0	0	0	0
Somalia	0	0	0	0	0	0	0	0
South Africa	-6	3	-1	-2	-2	-2	0	-3
Spain	-5	0	-5	14	11	60	96	95
Sri Lanka	0	0	0	0	0	0	0	0
St. Helena	0	0	0	0	0	0	0	0
St. Kitts and Nevis	0	0	0	0	0	0	0	0
St. Lucia	0	0	0	0	0	0	0	0
St. Pierre and Miquelon	0	0	0	0	0	0	0	0
St. Vincent and the Grenadines	0	0	0	0	0	0	0	0
Sudan	0	0	0	0	-1	-1	-1	-2
Suriname	0	0	0	0	0	0	0	0
Swaziland	0	0	-1	0	-1	-1	-2	-2
Sweden	27	14	19	17	12	13	9	11
Switzerland	9	6	15	25	19	25	8	4
Syrian Arab Republic	0	0	0	0	0	0	0	0
São Tomé and Príncipe	0	0	0	0	0	0	0	0
Taiwan Province of China	2	3	7	6	-1	-2	-1	0
Tajikistan	0	0	0	0	0	0	0	0
Tanzania	0	0	0	0	-1	-1	-1	-1
Thailand	2	2	-1	-1	-1	-2	1	2
Timor-Leste	0	0	0	0	0	0	0	0
Togo	0	0	0	0	-1	-1	-2	-1
Tokelau	0	0	0	0	0	0	0	0
Tonga	0	0	0	0	0	0	0	0
Trinidad and Tobago	0	0	0	0	0	0	0	0
Tunisia	-1	-1	-1	-1	-1	-1	-5	-6
Turkey	0	7	3	5	11	3	9	2
Turkmenistan	0	0	0	0	0	0	0	0
Turks and Caicos Islands	0	0	0	0	0	0	0	0
Tuvalu	0	0	0	0	0	0	0	0
Uganda	0	0	0	0	-1	-1	-1	-1
Ukraine	0	0	0	1	1	1	5	8
United Arab Emirates	0	0	0	0	0	0	0	0
United Kingdom	13	24	8	-21	72	4	38	11
United States	98	103	154	157	213	168	72	33
United States Minor Outlying Islands	0	0	0	0	0	0	0	0
Uruguay	1	0	0	0	0	0	0	2
Uzbekistan	0	0	0	0	0	0	0	0
Vanuatu	0	0	0	0	0	0	0	0
Vatican City State	0	0	0	0	0	0	0	0

Venezuela, República Bolivariana de	5	4	5	3	1	-1	0	-3
Vietnam	0	0	0	0	0	0	0	0
Virgin Islands, British	2	1	8	9	0	0	0	0
Virgin Islands, U.S.	0	0	0	0	0	0	0	0
Wallis and Futuna Islands	0	0	0	0	0	0	0	0
West Bank and Gaza Strip	0	0	0	0	0	0	0	0
Western Sahara	0	0	0	0	0	0	0	0
Yemen, Republic of	0	0	0	0	0	-1	0	0
Zambia	0	0	0	0	0	0	0	0
Zimbabwe	0	0	0	0	0	0	0	0
International Organizations	82	90	101	66	-8	-85	-96	-78

Table A15: Allocation of SEFER-SSIO Holdings

	2001	2002	2003	2004	2005	2006	2007	2008
United States	64.7%	58.4%	57.9%	54.4%	54.3%	53.9%	46.6%	50.8%
Japan	3.8%	5.8%	5.0%	4.6%	4.2%	4.0%	3.9%	3.8%
United Kingdom	3.7%	3.2%	3.2%	2.6%	3.0%	3.6%	4.2%	4.2%
Euro Area	20.5%	20.5%	23.2%	27.2%	25.5%	25.3%	26.5%	27.1%
Germany	*15.3%*	*11.4%*	*12.0%*	*12.6%*	*12.7%*	*12.5%*	*12.9%*	*14.6%*
France	*3.1%*	*4.3%*	*6.1%*	*9.6%*	*7.2%*	*7.0%*	*6.3%*	*5.5%*
Spain	*0.2%*	*0.5%*	*0.5%*	*0.7%*	*0.8%*	*0.8%*	*1.3%*	*1.7%*
Netherlands	*0.7%*	*1.3%*	*1.6%*	*1.6%*	*1.7%*	*2.0%*	*2.4%*	*2.0%*
Italy	*0.7%*	*2.0%*	*2.2%*	*1.9%*	*2.0%*	*1.6%*	*1.6%*	*1.2%*
Ireland	*0.0%*	*0.2%*	*0.3%*	*0.2%*	*0.3%*	*0.6%*	*1.0%*	*0.9%*
Belgium	*0.4%*	*0.7%*	*0.6%*	*0.6%*	*0.7%*	*0.8%*	*1.1%*	*1.2%*
International organizations	2.2%	7.1%	6.6%	5.7%	6.4%	8.4%	8.6%	8.5%
Confidential	0.4%	1.3%	0.9%	2.0%	2.7%	1.3%	6.2%	0.8%
Other	4.7%	3.8%	3.2%	3.4%	3.9%	3.6%	3.9%	4.8%
Memo: SEFER+SSIO (bn USD)	1,282	1,429	1,850	2,145	2,221	2,558	3,109	3,643

Table A16: Actual and Predicted Shares of Each Developed Country in the Aggregate Portfolio of CPIS-Participating Countries

	Equity		Debt	
	Actual	Predicted	Actual	Predicted
Austria				
2001	0.6%	0.4%	1.5%	1.5%
2002	0.6%	0.4%	1.7%	1.5%
2003	1.2%	0.3%	1.6%	1.4%
2004	1.7%	0.3%	1.7%	1.4%
2005	2.9%	0.4%	2.2%	1.5%
2006	3.4%	0.4%	2.5%	1.5%
2007	2.4%	0.4%	2.1%	1.4%
2008	1.6%	0.4%	2.3%	1.4%
Belgium				
2001	0.9%	0.6%	1.3%	0.8%
2002	0.8%	0.6%	1.1%	0.8%
2003	0.8%	0.6%	1.1%	0.8%
2004	0.7%	0.5%	1.0%	0.8%
2005	1.0%	0.6%	1.2%	0.8%
2006	1.0%	0.6%	1.0%	0.8%
2007	0.8%	0.6%	1.1%	0.8%
2008	0.9%	0.6%	0.8%	0.8%
Denmark				
2001	0.3%	0.3%	0.7%	0.7%
2002	0.3%	0.3%	0.8%	0.7%
2003	0.3%	0.3%	0.8%	0.7%
2004	0.2%	0.4%	0.8%	0.7%
2005	0.9%	0.3%	1.2%	0.7%
2006	0.8%	0.3%	0.8%	0.7%
2007	0.5%	0.3%	1.0%	0.7%
2008	0.5%	0.3%	0.9%	0.6%
France				
2001	4.6%	4.2%	3.8%	5.0%
2002	4.8%	4.5%	4.6%	5.1%
2003	5.4%	4.2%	5.2%	4.9%
2004	4.7%	3.8%	5.8%	4.6%
2005	3.8%	4.0%	5.3%	4.7%
2006	4.0%	3.9%	5.2%	4.6%
2007	3.8%	3.9%	5.0%	4.7%
2008	3.7%	3.8%	5.4%	4.6%
Germany				
2001	4.9%	3.5%	9.6%	10.2%
2002	5.0%	3.8%	10.1%	10.5%
2003	4.2%	3.3%	10.6%	9.7%
2004	3.5%	3.1%	11.3%	9.4%
2005	3.4%	3.2%	10.5%	9.5%
2006	3.1%	3.3%	9.2%	9.6%
2007	4.0%	3.3%	8.2%	9.5%
2008	3.6%	3.2%	7.6%	9.4%
Italy				
2001	1.9%	1.1%	3.9%	2.2%
2002	2.5%	1.1%	4.1%	2.2%
2003	2.1%	1.0%	3.9%	2.1%
2004	1.6%	1.0%	3.7%	2.1%
2005	1.3%	1.0%	3.9%	2.1%
2006	1.2%	1.1%	3.0%	2.1%
2007	1.0%	1.1%	3.2%	2.1%
2008	1.0%	1.1%	3.1%	2.1%
Luxembourg				
2001	11.3%	10.5%	4.4%	2.5%
2002	11.4%	10.1%	4.2%	2.4%
2003	13.9%	9.3%	4.1%	2.3%
2004	14.2%	8.8%	2.9%	2.2%
2005	14.3%	8.7%	2.3%	2.2%
2006	14.3%	8.5%	3.0%	2.2%
2007	14.3%	8.0%	2.9%	2.0%
2008	14.1%	7.9%	2.6%	2.0%
Netherlands				
2001	3.0%	2.4%	4.8%	6.1%
2002	3.8%	2.2%	6.3%	5.8%
2003	3.2%	2.1%	5.8%	5.6%
2004	3.6%	2.1%	6.2%	5.6%
2005	2.9%	2.2%	5.1%	5.6%
2006	2.3%	2.2%	5.6%	5.7%
2007	2.3%	2.2%	6.7%	5.6%
2008	2.2%	2.2%	5.5%	5.5%
Norway				
2001	0.1%	0.3%	0.6%	0.6%
2002	0.2%	0.3%	0.9%	0.6%
2003	0.2%	0.3%	0.5%	0.6%
2004	0.2%	0.3%	0.5%	0.6%
2005	0.4%	0.3%	0.6%	0.6%
2006	0.5%	0.3%	0.6%	0.5%
2007	0.6%	0.3%	0.8%	0.5%
2008	0.5%	0.3%	0.9%	0.5%
Sweden				
2001	1.6%	0.8%	2.0%	1.1%
2002	1.6%	0.8%	1.4%	1.0%
2003	1.6%	0.7%	1.3%	1.0%
2004	1.4%	0.8%	1.1%	1.0%
2005	1.6%	0.7%	1.3%	1.0%
2006	1.8%	0.8%	1.5%	1.0%
2007	1.4%	0.8%	1.4%	1.0%
2008	0.9%	0.8%	1.7%	1.1%
Switzerland				
2001	2.5%	2.2%	0.5%	0.4%
2002	2.1%	2.0%	0.6%	0.4%
2003	2.0%	2.0%	0.4%	0.4%
2004	1.9%	2.1%	0.5%	0.4%
2005	2.0%	2.2%	0.5%	0.4%
2006	2.3%	2.3%	0.5%	0.5%
2007	1.8%	2.4%	0.6%	0.5%
2008	2.4%	2.2%	0.7%	0.4%
United Kingdom				
2001	10.2%	9.6%	8.4%	11.5%
2002	10.5%	9.0%	8.5%	11.0%
2003	10.2%	9.1%	8.7%	11.1%
2004	10.7%	9.0%	11.0%	11.0%
2005	10.4%	9.4%	9.6%	11.2%
2006	10.2%	9.0%	10.0%	11.0%
2007	9.3%	8.9%	12.2%	10.8%
2008	9.9%	9.1%	12.2%	11.1%
United States				
2001	31.2%	21.7%	35.6%	32.0%
2002	29.3%	21.4%	35.5%	31.8%
2003	28.2%	22.6%	35.1%	33.0%
2004	26.3%	23.4%	30.2%	33.6%
2005	24.7%	23.0%	31.4%	33.2%
2006	23.2%	23.0%	30.9%	33.1%
2007	23.2%	24.3%	28.5%	34.0%
2008	25.2%	24.6%	28.9%	34.4%

Table A17: Reported and Predicted Shares of Each Foreign Country in the U.S., Japanese, and French Portfolios (2001-2008 averages)

	USA				Japan				France			
	Equity recorded	Equity predicted	Debt recorded	Debt predicted	Equity recorded	Equity predicted	Debt recorded	Debt predicted	Equity recorded	Equity predicted	Debt recorded	Debt predicted
United States					47%	51%	32%	55%	14%	19%	10%	20%
United Kingdom	18%	25%	22%	19%	11%	11%	6%	9%	11%	30%	9%	27%
Austria	0%	1%	0%	2%	0%	0%	1%	1%	0%	0%	2%	1%
Belgium	1%	1%	0%	1%	0%	1%	1%	1%	3%	3%	4%	2%
Denmark	1%	0%	1%	1%	0%	0%	1%	0%	0%	0%	0%	0%
France	7%	8%	5%	9%	4%	6%	6%	4%				
Germany	5%	7%	6%	19%	3%	6%	9%	10%	11%	14%	13%	28%
San Marino	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Italy	2%	2%	2%	4%	2%	2%	3%	3%	6%	2%	14%	3%
Luxembourg	0%	10%	2%	3%	2%	6%	4%	1%	14%	14%	2%	3%
Netherlands	5%	4%	5%	10%	2%	3%	4%	5%	8%	4%	12%	8%
Vatican City State	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Norway	1%	1%	1%	1%	0%	0%	1%	0%	0%	0%	0%	0%
Sweden	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%
Switzerland	6%	4%	0%	1%	3%	2%	0%	0%	4%	3%	0%	0%
Canada	7%	6%	14%	9%	2%	1%	2%	1%	0%	1%	1%	1%
Japan	12%	8%	3%	2%					5%	2%	3%	0%
Finland	2%	1%	0%	1%	1%	1%	0%	0%	2%	1%	1%	0%
Greece	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	3%	0%
Iceland	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
Ireland	1%	6%	2%	3%	1%	2%	2%	1%	4%	2%	4%	1%
Malta	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Portugal	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	2%	0%
Spain	2%	2%	1%	3%	1%	1%	1%	1%	5%	1%	9%	1%
Turkey	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Australia	2%	2%	4%	2%	2%	2%	2%	2%	0%	0%	1%	0%
New Zealand	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
South Africa	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Argentina	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolivia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Brazil	2%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chile	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Colombia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Costa Rica	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dominican Republic	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ecuador	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
El Salvador	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guatemala	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Haiti	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Honduras	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mexico	2%	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Nicaragua	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Panama	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Paraguay	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Peru	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Uruguay	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Venezuela, Rep˙blica Bolivariana de	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Antigua and Barbuda	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Anguilla	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bahamas, The	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Aruba	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Barbados	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bermuda	6%	2%	1%	0%	1%	0%	0%	0%	1%	0%	0%	0%
Dominica	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Falkland Islands (Malvinas)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Greenland	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Grenada	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guadeloupe	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
French Guiana	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guyana	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Belize	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Jamaica	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Martinique	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Montserrat	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Netherlands Antilles	1%	0%	0%	0%	0%	0%	1%	0%	1%	0%	3%	0%
St. Kitts and Nevis	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
St. Lucia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
St. Pierre and Miquelon	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
St. Vincent and the Grenadines	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suriname	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trinidad and Tobago	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
British Indian Ocean Territory	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cayman Islands	3%	2%	11%	4%	7%	0%	15%	1%	4%	0%	3%	0%
Turks and Caicos Islands	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bahrain	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cyprus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Iran, Islamic Republic of	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Iraq	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Israel	1%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Jordan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kuwait	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lebanon	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Oman	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Qatar	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Saudi Arabia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Syrian Arab Republic	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
United Arab Emirates	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Egypt	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yemen, Republic of	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
West Bank and Gaza Strip	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Afghanistan, Islamic State of	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bangladesh	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bhutan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Brunei Darussalam	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Myanmar	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cambodia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sri Lanka	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Taiwan Province of China	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Hong Kong SAR of China	2%	0%	0%	0%	2%	0%	0%	0%	1%	0%	0%	0%
India	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Indonesia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Timor-Leste	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Korea, Republic of	2%	0%	1%	0%	1%	1%	0%	0%	1%	0%	0%	0%
Lao People's Democratic Republic	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Macao SAR of China	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Malaysia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maldives	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Nepal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pakistan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Palau	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Philippines	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Singapore	1%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Thailand	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Vietnam	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Djibouti	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Algeria	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Angola	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Botswana	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Burundi	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cameroon	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cape Verde	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Central African Republic	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chad	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Comoros	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Congo, Rep. of	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Congo, Dem. Rep. of	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Benin	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Equatorial Guinea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Eritrea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ethiopia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Gabon	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Gambia, The	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ghana	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guinea-Bissau	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guinea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CÙte d'Ivoire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kenya	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lesotho	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Liberia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Libya	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Madagascar	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Malawi	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mali	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mauritania	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mauritius	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Morocco	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Western Sahara	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mozambique	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Niger	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Nigeria	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RÈunion	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Zimbabwe	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Rwanda	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
S„o TomÈ and PrÌncipe	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Seychelles	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Senegal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sierra Leone	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Somalia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Namibia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sudan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Swaziland	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tanzania	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Togo	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tunisia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Uganda	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Burkina Faso	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Zambia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Solomon Islands	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cook Islands	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Faroe Islands	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Fiji	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Gibraltar	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kiribati	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guam	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Nauru	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
New Caledonia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Vanuatu	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Papua New Guinea	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
St. Helena	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
American Samoa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
United States Minor Outlying Islands	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Samoa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tonga	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Marshall Islands	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Micronesia, Federated States of	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tuvalu	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
French Polynesia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wallis and Futuna Islands	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Armenia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Azerbaijan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Belarus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Albania	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Georgia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kazakhstan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kyrgyz Republic	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bulgaria	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Moldova	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Russian Federation	1%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tajikistan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
China, P.R.	1%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turkmenistan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ukraine	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Uzbekistan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cuba	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Czech Republic	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Slovak Republic	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Estonia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Latvia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Serbia, Republic of	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Montenegro, Republic of	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hungary	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lithuania	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mongolia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Korea, Democratic People's Republic of	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Croatia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Slovenia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Macedonia, FYR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bosnia and Herzegovina	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Poland	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Romania	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Andorra	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Monaco	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mayotte	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Guernsey	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Christmas Island	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cocos (Keeling) Islands	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
French Southern Territories	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Isle of Man	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Jersey	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Niue	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Norfolk Island	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pitcairn	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Puerto Rico	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tokelau	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Virgin Islands, British	0%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%
Virgin Islands, U.S.	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Liechtenstein	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
International Organizations	0%	0%	2%	0%	0%	0%	5%	0%	0%	0%	2%	0%

Table A18a: Unidentified Investments in U.S. Equities through Irish, Luxembourgish and Caymanian Funds, bn U.S.D., 2008

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	Creditor-derived equity liabilities	Reported equity liabilities	Discrepancy	Discrepancy, % of equity liabilities	Share of fund assets invested in U.S. equities	U.S. equities with no identifiable owner	*As a % of U.S. foreign equity liabilities*
j	$\sum_i \hat{A}_{ij}$	L_j	[2]-[1]	([2]-[1])/[2]	$\frac{E_{j,US}}{A_j}$	[3]x[5]	$\frac{[6]}{L_{US}}$
Ireland	253	889	636	72%	6%	35	*2%*
Luxembourg	1,151	2,081	930	45%	7%	61	*3%*
Cayman Islands	506	1,106	600	54%	17%	102	*5%*
Total	**1,910**	**4,076**	**2,166**	**53%**	**9%**	**198**	***9%***

Table A18b: Unidentified Investments in U.S. Equities through Switzerland, bn U.S.D.

	2001	2002	2003	2004	2005	2006	2007	2008
U.S. equity assets of Switzerland	47	40	52	55	56	63	67	47
U.S. equity liabilities "vis-à-vis Switzerland"	122	97	123	135	143	167	179	120
U.S. equities in Swiss banks with unidentifiable owner	74	57	71	80	87	103	112	73
As a fraction of U.S. equity liab. "vis-à-vis Switzerland"	61%	59%	58%	59%	61%	62%	63%	61%
As a fraction of all U.S. equity liabilities	**5%**	**4%**	**4%**	**4%**	**4%**	**4%**	**3%**	**3%**

Table A19 – The World Current Account: Credits

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
	Billions of current USD										
	Memo: number of countries used for estimation	**Current account**	Trade	**Income**	Compensation of employees	Investment income	*FDI income*	***Portfolio and other income***	Current Transfers	**World GDP**	*World exports / world GDP*
1975	62	899	785	78	3	75	25	51	36	5,786	14%
1976	89	1,091	958	86	3	83	29	54	47	6,296	15%
1977	118	1,435	1,264	108	6	103	30	72	63	7,120	18%
1978	124	1,694	1,470	146	8	139	38	101	77	8,396	18%
1979	129	2,193	1,869	225	10	215	62	153	99	9,750	19%
1980	135	2,683	2,267	299	11	288	62	226	117	10,964	21%
1981	138	2,790	2,304	370	11	359	55	304	117	11,242	20%
1982	142	2,679	2,189	374	11	363	46	317	116	11,136	20%
1983	142	2,580	2,132	332	11	320	50	270	117	11,377	19%
1984	144	2,732	2,245	368	11	357	59	298	119	11,813	19%
1985	146	2,752	2,273	357	11	346	53	293	123	12,415	18%
1986	148	3,056	2,519	392	14	378	64	314	145	14,671	17%
1987	149	3,601	2,968	461	17	444	84	359	173	16,670	18%
1988	148	4,171	3,384	585	19	566	112	453	202	18,646	18%
1989	148	4,580	3,648	717	21	697	119	577	215	19,566	19%
1990	147	5,366	4,227	870	25	846	124	722	269	21,848	19%
1991	147	5,562	4,342	890	27	863	114	749	330	22,939	19%
1992	150	5,866	4,663	905	29	877	114	763	298	24,502	19%
1993	156	5,832	4,640	909	28	881	134	747	283	24,861	19%
1994	All	6,519	5,312	914	29	885	170	715	293	26,707	20%
1995	All	7,745	6,329	1,094	36	1,058	209	849	323	29,640	21%
1996	All	8,090	6,674	1,050	34	1,015	241	774	367	30,273	22%
1997	All	8,388	6,927	1,107	42	1,065	272	793	354	30,170	23%
1998	All	8,419	6,842	1,207	43	1,164	278	886	370	30,012	23%
1999	All	8,716	7,076	1,259	41	1,218	341	877	380	31,099	23%
2000	All	9,667	7,870	1,431	41	1,390	390	1,000	365	32,048	25%
2001	All	9,335	7,615	1,331	44	1,288	347	940	389	31,826	24%
2002	All	9,748	8,033	1,279	49	1,229	386	844	436	33,087	24%
2003	All	11,367	9,356	1,499	60	1,439	525	914	512	37,235	25%
2004	All	13,851	11,355	1,891	72	1,819	733	1,086	606	42,167	27%
2005	All	16,049	12,925	2,432	79	2,353	952	1,402	693	45,603	28%
2006	All	18,771	14,882	3,128	86	3,042	1,123	1,919	761	49,408	30%
2007	All	22,218	17,321	4,024	105	3,919	1,333	2,586	872	55,731	31%
2008	All	24,896	19,873	4,048	120	3,927	1,297	2,630	975	61,305	32%

Table A20 – The World Current Account: Debits

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	Billions of current USD								
	Memo: number of countries used for estimation	**Current account**	Trade	Income	Compensation of employees	**Investment income**	*FDI income*	***Portfolio and other income***	Current Transfers
1975	*62*	**893**	769	76	3	**73**	18	55	48
1976	*89*	**1,100**	960	85	3	**82**	22	60	54
1977	*118*	**1,458**	1,276	113	6	**107**	31	76	70
1978	*124*	**1,719**	1,483	149	8	**142**	36	106	87
1979	*129*	**2,223**	1,896	221	8	**212**	47	166	107
1980	*135*	**2,742**	2,304	313	11	**302**	58	243	125
1981	*138*	**2,867**	2,339	402	12	**390**	60	330	126
1982	*142*	**2,768**	2,227	413	13	**399**	46	353	128
1983	*142*	**2,656**	2,170	361	12	**348**	45	303	126
1984	*144*	**2,815**	2,284	403	13	**391**	51	339	128
1985	*146*	**2,839**	2,304	404	14	**390**	49	340	131
1986	*148*	**3,134**	2,540	437	18	**419**	50	369	157
1987	*149*	**3,680**	2,979	514	22	**493**	63	429	186
1988	*148*	**4,237**	3,387	632	23	**609**	81	528	218
1989	*148*	**4,673**	3,673	767	25	**742**	79	663	233
1990	*147*	**5,466**	4,248	929	31	**898**	76	822	289
1991	*147*	**5,686**	4,369	959	34	**925**	63	862	358
1992	*150*	**5,974**	4,662	972	37	**934**	65	869	341
1993	*156*	**5,907**	4,607	972	37	**936**	85	850	328
1994	*All*	**6,578**	5,237	993	37	**956**	121	835	347
1995	*All*	**7,800**	6,245	1,180	43	**1,137**	170	967	375
1996	*All*	**8,128**	6,589	1,139	43	**1,097**	190	907	400
1997	*All*	**8,379**	6,817	1,179	41	**1,138**	216	921	384
1998	*All*	**8,488**	6,779	1,305	44	**1,262**	244	1,017	403
1999	*All*	**8,817**	7,060	1,351	47	**1,303**	298	1,005	407
2000	*All*	**9,816**	7,892	1,522	48	**1,475**	362	1,112	402
2001	*All*	**9,484**	7,658	1,405	51	**1,354**	288	1,066	420
2002	*All*	**9,846**	8,019	1,373	57	**1,316**	348	968	454
2003	*All*	**11,387**	9,290	1,576	68	**1,508**	476	1,032	521
2004	*All*	**13,796**	11,265	1,907	78	**1,829**	622	1,207	624
2005	*All*	**15,946**	12,787	2,444	87	**2,358**	828	1,529	714
2006	*All*	**18,517**	14,621	3,152	96	**3,056**	1,017	2,039	744
2007	*All*	**21,814**	16,917	4,044	114	**3,929**	1,238	2,692	854
2008	*All*	**24,598**	19,507	4,147	136	**4,011**	1,225	2,786	944

Table A21 – The World Current Account: Discrepancies

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]
		Billions of current USD									Billions of 2008 USD							
	Memo: number of countries used for estimation	**Current account**	Trade	Income	Compensation of employees	Investment income	FDI income	**Portfolio and other income**	Current Transfers	Memo: Portfolio & other income balance / debits	Cumulative current account balance	**Cumulative investment income balance (ex-FDI)**	Cumulative C.A. minus non-DI inv income balance	Cumulative trade	Cumulateive FDI income	Cumulative trade + FDI income	Cumulative transfers + employee income	U.S. CPI-U (annual average)
1975	62	**5**	15	2	0	2	7	**-5**	-12	-8%	21	**-18**	40	61	28	89	-49	53.8
1976	89	**-9**	-2	1	0	2	7	**-5**	-8	-9%	-14	**-38**	24	49	52	101	-78	56.9
1977	118	**-23**	-12	-5	0	-4	-1	**-3**	-7	-5%	-96	**-48**	-48	4	46	50	-98	60.6
1978	124	**-25**	-12	-3	0	-3	2	**-5**	-10	-5%	-173	**-60**	-112	-38	49	11	-123	65.2
1979	129	**-31**	-27	4	2	3	15	**-13**	-8	-8%	-246	**-91**	-155	-113	88	-25	-130	72.6
1980	135	**-58**	-37	-13	1	-14	3	**-17**	-8	-7%	-369	**-125**	-244	-197	87	-110	-134	82.4
1981	138	**-77**	-36	-32	-1	-31	-5	**-26**	-9	-8%	-516	**-175**	-341	-263	67	-196	-145	90.9
1982	142	**-88**	-38	-39	-2	-37	0	**-37**	-12	-10%	-683	**-246**	-437	-331	63	-268	-169	96.5
1983	142	**-76**	-38	-29	-1	-28	5	**-33**	-9	-11%	-826	**-310**	-517	-402	72	-330	-186	99.6
1984	144	**-83**	-39	-35	-2	-33	7	**-41**	-9	-12%	-965	**-382**	-583	-466	84	-382	-201	103.9
1985	146	**-87**	-32	-47	-3	-44	4	**-48**	-8	-14%	-1,106	**-464**	-642	-513	89	-424	-218	107.6
1986	148	**-78**	-21	-44	-4	-41	14	**-54**	-13	-15%	-1,239	**-563**	-676	-545	114	-431	-245	109.6
1987	149	**-78**	-11	-53	-5	-49	21	**-70**	-14	-16%	-1,343	**-675**	-668	-547	150	-397	-271	113.6
1988	148	**-67**	-3	-47	-4	-43	32	**-75**	-16	-14%	-1,411	**-785**	-626	-530	202	-329	-298	118.3
1989	148	**-93**	-25	-50	-4	-46	40	**-86**	-18	-13%	-1,507	**-899**	-609	-550	262	-287	-321	124.0
1990	147	**-99**	-21	-59	-6	-52	48	**-100**	-20	-12%	-1,594	**-1,018**	-576	-556	328	-228	-348	130.7
1991	147	**-124**	-27	-69	-7	-62	51	**-113**	-28	-13%	-1,726	**-1,155**	-570	-576	395	-181	-389	136.2
1992	150	**-108**	1	-66	-9	-58	49	**-106**	-43	-12%	-1,841	**-1,285**	-557	-558	458	-99	-457	140.3
1993	156	**-75**	33	-63	-8	-55	48	**-103**	-45	-12%	-1,900	**-1,401**	-499	-492	517	25	-523	144.5
1994	All	**-58**	75	-79	-8	-71	49	**-121**	-54	-14%	-1,937	**-1,541**	-396	-371	575	204	-600	148.2
1995	All	**-55**	84	-87	-7	-79	39	**-118**	-52	-12%	-1,962	**-1,666**	-297	-243	614	371	-668	152.4
1996	All	**-38**	85	-90	-8	-81	51	**-132**	-33	-15%	-1,958	**-1,800**	-158	-119	666	548	-706	156.9
1997	All	**9**	110	-71	1	-73	55	**-128**	-30	-14%	-1,901	**-1,931**	30	32	726	758	-728	160.5
1998	All	**-68**	64	-98	0	-98	34	**-132**	-33	-13%	-1,962	**-2,075**	113	115	759	875	-762	163.0
1999	All	**-102**	17	-92	-6	-86	42	**-128**	-27	-13%	-2,051	**-2,196**	145	134	798	932	-788	166.6
2000	All	**-150**	-22	-91	-6	-84	28	**-113**	-36	-10%	-2,172	**-2,266**	94	102	807	909	-815	172.2
2001	All	**-149**	-44	-74	-8	-66	60	**-126**	-31	-12%	-2,293	**-2,356**	63	46	857	903	-840	177.1
2002	All	**-98**	15	-95	-8	-87	37	**-124**	-18	-13%	-2,374	**-2,467**	93	63	889	951	-858	179.9
2003	All	**-20**	66	-77	-8	-69	49	**-118**	-9	-11%	-2,345	**-2,551**	206	138	927	1,065	-859	184.0
2004	All	**55**	89	-16	-6	-10	111	**-121**	-18	-10%	-2,221	**-2,622**	401	237	1,029	1,265	-864	188.9
2005	All	**103**	137	-12	-8	-4	123	**-128**	-21	-8%	-2,034	**-2,677**	643	380	1,131	1,511	-868	195.3
2006	All	**254**	261	-24	-10	-14	107	**-121**	16	-6%	-1,700	**-2,722**	1,023	647	1,210	1,857	-834	201.6
2007	All	**403**	404	-19	-9	-11	95	**-106**	18	-4%	-1,234	**-2,757**	1,523	1,049	1,275	2,324	-801	207.3
2008	All	**298**	366	-99	-16	-83	73	**-156**	31	-6%	-890	**-2,811**	1,920	1,377	1,300	2,677	-757	215.3

Table A22 – Yield on Global Cross-Border Bank Deposits and Portfolio Claims

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
	Billions of current USD										
	Liabilities and debits							Missing flows and stocks			
	Memo: Cross-Border Bank Liabilities	Cross-Border Bank Accounts	Cross Border Portfolios	*Memo: EWNII debt + equity*	Deposits & portfolio, stocks	Deposits & portfolio, income	**Yield**	Missing deposits & portfolio income	Missing portfolio wealth	**Yield**	Memo: Capitalized missing wealth
1975				*1,055*	*1,038*	55	**5%**	-5			87
1976				*1,289*	*1,268*	60	**5%**	-5			114
1977	*672*	640		*1,576*	*1,551*	76	**5%**	-3			70
1978	*857*	817		*1,978*	*1,946*	106	**5%**	-5			89
1979	*1,120*	1,068		*2,411*	*2,372*	166	**7%**	-13			179
1980	*1,335*	1,273		*2,862*	*2,816*	243	**9%**	-17			200
1981	*1,532*	1,461		*3,258*	*3,205*	330	**10%**	-26			250
1982	*1,627*	1,552		*3,549*	*3,492*	353	**10%**	-37			362
1983	*2,038*	1,943		*3,842*	*3,780*	303	**8%**	-33			411
1984	*2,125*	2,026		*4,045*	*3,979*	339	**9%**	-41			479
1985	*2,536*	2,419		*4,804*	*4,726*	340	**7%**	-48			663
1986	*3,234*	3,084		*6,024*	*5,927*	369	**6%**	-54			875
1987	*4,232*	4,035		*7,452*	*7,332*	429	**6%**	-70			1,191
1988	*4,623*	4,409		*8,197*	*8,065*	528	**7%**	-75			1,146
1989	*5,482*	5,228		*9,596*	*9,441*	663	**7%**	-86			1,227
1990	*6,481*	6,180		*11,567*	*11,381*	822	**7%**	-100			1,389
1991	*6,423*	6,124		*12,298*	*12,099*	862	**7%**	-113			1,586
1992	*6,301*	6,008		*12,679*	*12,474*	869	**7%**	-106			1,525
1993	*6,267*	5,976		*14,189*	*13,960*	850	**6%**	-103			1,697
1994	*7,150*	6,818		*15,545*	*15,295*	835	**5%**	-121			2,208
1995	*7,831*	7,467		*17,808*	*17,521*	967	**6%**	-118			2,139
1996	*8,100*	7,673		*19,391*	*19,079*	907	**5%**	-132			2,786
1997	*9,118*	8,454		*21,240*	*20,897*	921	**4%**	-128			2,904
1998	*9,695*	8,943		*24,054*	*23,666*	1,017	**4%**	-132			3,066
1999	*9,611*	8,836		*26,664*	*26,234*	1,005	**4%**	-128			3,340
2000	*10,421*	9,455		*27,475*	*27,031*	1,112	**4%**	-113			2,740
2001	*11,187*	10,021	16,273	*27,910*	27,460	1,066	**4%**	-126	2,532	5%	3,236
2002	*12,803*	11,389	17,754	*31,092*	30,557	968	**3%**	-124	2,392	5%	3,917
2003	*15,464*	13,488	23,638	*38,553*	39,102	1,032	**3%**	-118	2,858	4%	4,479
2004	*18,244*	15,856	28,950	*46,573*	47,194	1,207	**3%**	-121	3,316	4%	4,723
2005	*20,052*	17,223	32,399	*50,699*	52,451	1,529	**3%**	-128	3,676	3%	4,384
2006	*24,602*	21,289	40,732	*63,057*	65,334	2,039	**3%**	-121	3,760	3%	3,866
2007	*31,418*	27,131	49,301	*77,301*	80,719	2,692	**3%**	-106	5,131	2%	3,169
2008	*29,067*	24,342	40,097	*n.a.*	69,165	2,786	**4%**	-156	4,490	3%	3,868

Table A23: Securities in Custody in Swiss Banks, bn of USD

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
									Asset allocation of Swiss offshore portfolio			**Swiss offshore portfolio / Global offshore portfolio**
	All securities	Swiss owned	**Foreign owned**	*Swiss securities*	***Foreign securities (= offshore)***	Equities	*Mutual fund shares*	Bonds	Equities	*Mutual fund shares*	*Bonds*	
1998	**2,139**	987	**1,152**	*361*	***791***	311	*161*	480	39%	*20%*	61%	
1999	**2,145**	984	**1,161**	*361*	***800***	398	*175*	402	50%	*22%*	50%	
2000	**2,247**	1,015	**1,232**	*439*	***794***	405	*184*	389	51%	*23%*	49%	
2001	**2,012**	883	**1,128**	*340*	***789***	402	*206*	387	51%	*26%*	49%	31%
2002	**2,114**	918	**1,196**	*338*	***859***	392	*224*	466	46%	*26%*	54%	36%
2003	**2,652**	1,134	**1,518**	*438*	***1,079***	549	*306*	530	51%	*28%*	49%	38%
2004	**3,121**	1,351	**1,770**	*508*	***1,261***	684	*382*	577	54%	*30%*	46%	38%
2005	**3,357**	1,378	**1,980**	*609*	***1,371***	892	*606*	478	65%	*44%*	35%	37%
2006	**4,112**	1,705	**2,406**	*772*	***1,634***	1,149	*782*	485	70%	*48%*	30%	43%
2007	**4,800**	2,017	**2,782**	*790*	***1,992***	1,465	*1,036*	527	74%	*52%*	26%	39%
2008	**3,772**	1,665	**2,107**	*562*	***1,545***	1,005	*767*	540	65%	*50%*	35%	34%
2009	**4,375**	1,963	**2,412**	*686*	***1,726***	1,102	*755*	624	64%	*44%*	36%	
2010	**4,826**	2,207	**2,618**	*769*	***1,849***	1,221	*823*	628	66%	*45%*	34%	

Table A24: Fiduciary Deposits in Swiss Banks, 1976-2008, mn of USD

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
	Tax havens	Europe	Middle East	Latin and South America	Asia	Africa	North America	Caribbean	Total ex-tax havens	Total	Rich countries	*Of which: Euro area 16*	Developing countries	*Excl. Middle East*
1976	7,536	9,190	3,440	1,266	775	1,076	695	0	16,442	23,978	9,039	*7,666*	7,404	*3,964*
1977	9,620	11,642	3,421	1,498	954	1,337	620	0	19,472	29,092	11,259	*8,970*	8,213	*4,792*
1978	12,004	12,487	4,931	1,843	948	1,925	817	0	22,951	34,955	12,108	*10,235*	10,844	*5,913*
1979	15,744	19,535	7,096	2,730	1,350	2,795	1,328	0	34,834	50,578	18,915	*15,666*	15,918	*8,822*
1980	19,219	29,102	10,121	4,055	2,043	3,484	1,808	0	50,613	69,832	28,107	*22,344*	22,506	*12,385*
1981	22,997	39,495	11,481	6,454	2,476	3,941	2,342	0	66,189	89,186	38,335	*29,529*	27,854	*16,373*
1982	23,622	34,564	15,066	5,790	2,725	3,912	2,337	0	64,394	88,016	33,062	*25,652*	31,333	*16,267*
1983	26,083	31,940	16,740	5,619	3,157	3,868	2,545	0	63,869	89,952	30,183	*22,525*	33,685	*16,945*
1984	31,287	30,573	20,519	6,290	4,408	3,156	3,221	27	68,194	99,481	34,132	*24,513*	34,061	*13,542*
1985	36,054	34,110	22,954	6,773	5,396	3,437	3,527	23	76,220	112,274	38,048	*27,244*	38,173	*15,219*
1986	41,891	37,954	22,495	7,698	6,088	3,756	4,169	27	82,187	124,078	42,638	*30,521*	39,549	*17,054*
1987	54,532	49,199	26,023	9,840	7,323	4,647	5,709	31	102,772	157,304	55,549	*38,484*	47,224	*21,201*
1988	55,527	51,157	26,382	10,825	7,361	4,454	5,894	36	106,109	161,636	57,803	*39,847*	48,306	*21,924*
1989	73,037	63,877	28,649	13,791	7,942	5,462	7,257	21	126,999	200,036	71,947	*52,642*	55,052	*26,403*
1990	95,234	86,870	35,428	19,175	9,134	6,375	9,154	29	166,165	261,399	97,106	*72,110*	69,059	*33,631*
1991	90,378	85,304	36,051	17,818	9,463	6,353	8,733	31	163,753	254,131	94,987	*71,803*	68,766	*32,715*
1992	84,407	84,516	34,032	14,611	9,053	5,746	9,916	42	157,916	242,323	95,206	*72,500*	62,711	*28,679*
1993	78,767	75,297	32,620	11,881	8,466	5,620	7,443	30	141,357	220,124	83,362	*64,204*	57,996	*25,376*
1994	92,095	79,398	34,653	13,853	10,125	6,178	6,523	63	150,793	242,888	86,556	*68,837*	64,237	*29,584*
1995	101,769	84,249	36,385	14,286	11,658	5,879	7,179	71	159,707	261,476	92,089	*73,412*	67,617	*31,232*
1996	108,209	81,342	36,268	14,559	12,852	5,637	7,918	94	158,670	266,879	89,536	*70,040*	69,134	*32,866*
1997	112,745	78,389	35,916	15,556	14,451	5,871	7,598	52	157,833	270,578	86,561	*67,540*	71,273	*35,357*
1998	118,840	82,476	35,774	16,630	15,641	6,355	8,032	65	164,973	283,813	91,533	*69,691*	73,440	*37,666*
1999	113,674	75,736	32,668	17,411	16,423	5,627	7,946	53	155,864	269,538	84,617	*63,688*	71,247	*38,579*
2000	132,723	75,266	33,327	19,570	17,283	5,506	8,584	64	159,600	292,323	84,536	*61,901*	75,064	*41,737*
2001	135,266	76,727	30,564	16,424	17,890	5,736	8,043	64	155,448	290,714	85,578	*61,466*	69,870	*39,306*
2002	142,367	74,435	30,721	18,107	17,533	6,276	8,007	84	155,163	297,530	83,161	*59,463*	72,002	*41,281*
2003	141,122	74,793	30,697	16,406	19,742	6,398	7,903	85	156,024	297,146	83,495	*60,009*	72,527	*41,830*
2004	166,646	81,664	32,591	17,074	19,048	6,676	7,997	70	165,120	331,766	90,719	*64,091*	74,401	*41,810*
2005	207,498	51,982	38,712	19,502	20,993	7,055	8,973	75	147,292	354,790	62,104	*38,856*	85,188	*46,476*
2006	267,932	64,702	44,638	22,611	26,500	7,732	13,055	116	179,354	447,286	77,789	*49,149*	101,565	*56,927*
2007	356,950	84,119	49,419	26,704	29,214	9,345	13,990	169	212,960	569,910	98,719	*66,376*	114,241	*64,822*
2008	293,305	74,898	37,434	21,732	29,824	8,338	11,949	203	184,378	477,683	87,146	*61,707*	97,231	*59,797*

Table A25: Distribution of Fiduciary Deposits in Swiss Banks by Country of Owner, 1976-2008, Uncorrected Shares (% of Total)

	[1] Tax havens	[2] Europe	[3] Middle East	[4] Latin and South America	[5] Asia	[6] Africa	[7] North America	[8] Caribbean	[9] Total ex-tax havens	[10] Total	[11] Rich countries	[12] *Of which: Euro area 16*	[13] Developing countries	[14] *Excl. Middle East*
1976	31%	38%	14%	5%	3%	4%	3%	0%	69%	100%	38%	*32%*	31%	*17%*
1977	33%	40%	12%	5%	3%	5%	2%	0%	67%	100%	39%	*31%*	28%	*16%*
1978	34%	36%	14%	5%	3%	6%	2%	0%	66%	100%	35%	*29%*	31%	*17%*
1979	31%	39%	14%	5%	3%	6%	3%	0%	69%	100%	37%	*31%*	31%	*17%*
1980	28%	42%	14%	6%	3%	5%	3%	0%	72%	100%	40%	*32%*	32%	*18%*
1981	26%	44%	13%	7%	3%	4%	3%	0%	74%	100%	43%	*33%*	31%	*18%*
1982	27%	39%	17%	7%	3%	4%	3%	0%	73%	100%	38%	*29%*	36%	*18%*
1983	29%	36%	19%	6%	4%	4%	3%	0%	71%	100%	34%	*25%*	37%	*19%*
1984	31%	31%	21%	6%	4%	3%	3%	0%	69%	100%	34%	*25%*	34%	*14%*
1985	32%	30%	20%	6%	5%	3%	3%	0%	68%	100%	34%	*24%*	34%	*14%*
1986	34%	31%	18%	6%	5%	3%	3%	0%	66%	100%	34%	*25%*	32%	*14%*
1987	35%	31%	17%	6%	5%	3%	4%	0%	65%	100%	35%	*24%*	30%	*13%*
1988	34%	32%	16%	7%	5%	3%	4%	0%	66%	100%	36%	*25%*	30%	*14%*
1989	37%	32%	14%	7%	4%	3%	4%	0%	63%	100%	36%	*26%*	28%	*13%*
1990	36%	33%	14%	7%	3%	2%	4%	0%	64%	100%	37%	*28%*	26%	*13%*
1991	36%	34%	14%	7%	4%	2%	3%	0%	64%	100%	37%	*28%*	27%	*13%*
1992	35%	35%	14%	6%	4%	2%	4%	0%	65%	100%	39%	*30%*	26%	*12%*
1993	36%	34%	15%	5%	4%	3%	3%	0%	64%	100%	38%	*29%*	26%	*12%*
1994	38%	33%	14%	6%	4%	3%	3%	0%	62%	100%	36%	*28%*	26%	*12%*
1995	39%	32%	14%	5%	4%	2%	3%	0%	61%	100%	35%	*28%*	26%	*12%*
1996	41%	30%	14%	5%	5%	2%	3%	0%	59%	100%	34%	*26%*	26%	*12%*
1997	42%	29%	13%	6%	5%	2%	3%	0%	58%	100%	32%	*25%*	26%	*13%*
1998	42%	29%	13%	6%	6%	2%	3%	0%	58%	100%	32%	*25%*	26%	*13%*
1999	42%	28%	12%	6%	6%	2%	3%	0%	58%	100%	31%	*24%*	26%	*14%*
2000	45%	26%	11%	7%	6%	2%	3%	0%	55%	100%	29%	*21%*	26%	*14%*
2001	47%	26%	11%	6%	6%	2%	3%	0%	53%	100%	29%	*21%*	24%	*14%*
2002	48%	25%	10%	6%	6%	2%	3%	0%	52%	100%	28%	*20%*	24%	*14%*
2003	47%	25%	10%	6%	7%	2%	3%	0%	53%	100%	28%	*20%*	24%	*14%*
2004	50%	25%	10%	5%	6%	2%	2%	0%	50%	100%	27%	*19%*	22%	*13%*
2005	58%	15%	11%	5%	6%	2%	3%	0%	42%	100%	18%	*11%*	24%	*13%*
2006	60%	14%	10%	5%	6%	2%	3%	0%	40%	100%	17%	*11%*	23%	*13%*
2007	63%	15%	9%	5%	5%	2%	2%	0%	37%	100%	17%	*12%*	20%	*11%*
2008	61%	16%	8%	5%	6%	2%	3%	0%	39%	100%	18%	*13%*	20%	*13%*

Table A26: Distribution of Fiduciary Deposits in Swiss Banks by Country of Owner, 1976-2004, Corrected Shares (% of Total)

	[1] Tax havens	[2] Europe	[3] Middle East	[4] Latin and South America	[5] Asia	[6] Africa	[7] North America	[8] Caribbean	[9] Total	[10] Rich countries	[11] *Of which: Euro area 16*	[12] Developing countries	[13] *Excl. Middle East*
1976	0%	61%	14%	8%	5%	7%	5%	0%	100%	60%	*51%*	40%	*26%*
1977	0%	64%	12%	8%	5%	7%	3%	0%	100%	62%	*49%*	38%	*26%*
1978	0%	60%	14%	9%	5%	9%	4%	0%	100%	58%	*49%*	42%	*28%*
1979	0%	61%	14%	8%	4%	9%	4%	0%	100%	59%	*49%*	41%	*27%*
1980	0%	61%	14%	9%	4%	7%	4%	0%	100%	59%	*47%*	41%	*26%*
1981	0%	63%	13%	10%	4%	6%	4%	0%	100%	61%	*47%*	39%	*26%*
1982	0%	58%	17%	10%	5%	7%	4%	0%	100%	56%	*43%*	44%	*27%*
1983	0%	55%	19%	10%	5%	7%	4%	0%	100%	52%	*39%*	48%	*29%*
1984	0%	51%	21%	10%	7%	5%	5%	0%	100%	57%	*41%*	43%	*23%*
1985	0%	51%	20%	10%	8%	5%	5%	0%	100%	57%	*41%*	43%	*23%*
1986	0%	52%	18%	11%	8%	5%	6%	0%	100%	58%	*42%*	42%	*23%*
1987	0%	53%	17%	11%	8%	5%	6%	0%	100%	60%	*42%*	40%	*23%*
1988	0%	54%	16%	11%	8%	5%	6%	0%	100%	61%	*42%*	39%	*23%*
1989	0%	56%	14%	12%	7%	5%	6%	0%	100%	63%	*46%*	37%	*23%*
1990	0%	57%	14%	13%	6%	4%	6%	0%	100%	64%	*48%*	36%	*22%*
1991	0%	57%	14%	12%	6%	4%	6%	0%	100%	64%	*48%*	36%	*22%*
1992	0%	59%	14%	10%	6%	4%	7%	0%	100%	66%	*50%*	34%	*20%*
1993	0%	59%	15%	9%	7%	4%	6%	0%	100%	65%	*50%*	35%	*20%*
1994	0%	59%	14%	10%	7%	5%	5%	0%	100%	64%	*51%*	36%	*22%*
1995	0%	59%	14%	10%	8%	4%	5%	0%	100%	64%	*51%*	36%	*22%*
1996	0%	57%	14%	10%	9%	4%	6%	0%	100%	63%	*49%*	37%	*23%*
1997	0%	56%	13%	11%	10%	4%	5%	0%	100%	62%	*48%*	38%	*25%*
1998	0%	56%	13%	11%	11%	4%	5%	0%	100%	62%	*47%*	38%	*25%*
1999	0%	54%	12%	12%	12%	4%	6%	0%	100%	60%	*45%*	40%	*28%*
2000	0%	53%	11%	14%	12%	4%	6%	0%	100%	59%	*43%*	41%	*29%*
2001	0%	55%	11%	12%	13%	4%	6%	0%	100%	61%	*44%*	39%	*28%*
2002	0%	54%	10%	13%	13%	5%	6%	0%	100%	60%	*43%*	40%	*30%*
2003	0%	54%	10%	12%	14%	5%	6%	0%	100%	60%	*43%*	40%	*30%*
2004	0%	56%	10%	12%	13%	5%	5%	0%	100%	62%	*44%*	38%	*28%*

Table A27: Net Foreign Asset Positions of Rich Countries, As Officially Reported

	Net foreign asset position / World GDP							Net foreign asset position / Country or region GDP						
	Rich countries	USA	Japan	Other rich countries	*Euro area 16*	*Other Europe*	*Canada, Australia, NZ*	**Rich countries**	USA	Japan	Other rich countries	*Euro area 16*	*Other Europe*	*Canada, Australia, NZ*
1985	**0%**	0%	1%	-1%	*-1%*	*1%*	*-2%*	**0%**	1%	10%	-4%	*-3%*	*16%*	*-37%*
1986	**0%**	0%	1%	-1%	*0%*	*1%*	*-2%*	**0%**	-1%	9%	-3%	*-2%*	*16%*	*-41%*
1987	**0%**	0%	1%	-1%	*0%*	*1%*	*-2%*	**0%**	-2%	10%	-2%	*0%*	*14%*	*-44%*
1988	**0%**	-1%	2%	-1%	*0%*	*1%*	*-2%*	**0%**	-3%	10%	-2%	*1%*	*11%*	*-41%*
1989	**-1%**	-1%	1%	-1%	*0%*	*1%*	*-2%*	**-1%**	-5%	10%	-3%	*0%*	*11%*	*-41%*
1990	**-1%**	-1%	1%	-1%	*0%*	*0%*	*-2%*	**-1%**	-4%	11%	-4%	*0%*	*3%*	*-42%*
1991	**-2%**	-1%	2%	-2%	*0%*	*0%*	*-2%*	**-2%**	-5%	11%	-5%	*-1%*	*4%*	*-45%*
1992	**-1%**	-2%	2%	-2%	*-1%*	*0%*	*-2%*	**-2%**	-7%	14%	-5%	*-2%*	*6%*	*-44%*
1993	**-1%**	-1%	2%	-2%	*-1%*	*1%*	*-2%*	**-1%**	-4%	14%	-6%	*-3%*	*8%*	*-49%*
1994	**0%**	-1%	3%	-2%	*-1%*	*0%*	*-2%*	**-1%**	-4%	14%	-6%	*-3%*	*7%*	*-49%*
1995	**-1%**	-1%	3%	-2%	*-1%*	*0%*	*-2%*	**-1%**	-6%	16%	-6%	*-4%*	*5%*	*-48%*
1996	**-1%**	-2%	3%	-2%	*-1%*	*0%*	*-2%*	**-1%**	-6%	19%	-6%	*-3%*	*3%*	*-47%*
1997	**-1%**	-3%	3%	-2%	*0%*	*0%*	*-1%*	**-1%**	-9%	22%	-5%	*-1%*	*2%*	*-40%*
1998	**-2%**	-3%	4%	-3%	*-1%*	*0%*	*-1%*	**-3%**	-10%	30%	-9%	*-6%*	*-4%*	*-41%*
1999	**-3%**	-2%	3%	-3%	*-1%*	*0%*	*-1%*	**-3%**	-8%	19%	-9%	*-6%*	*-3%*	*-37%*
2000	**-3%**	-4%	4%	-2%	*-1%*	*0%*	*-1%*	**-4%**	-14%	25%	-8%	*-7%*	*3%*	*-29%*
2001	**-3%**	-6%	4%	-2%	*-1%*	*0%*	*-1%*	**-4%**	-18%	33%	-6%	*-5%*	*4%*	*-26%*
2002	**-5%**	-6%	4%	-3%	*-2%*	*0%*	*-1%*	**-6%**	-19%	37%	-9%	*-11%*	*7%*	*-33%*
2003	**-5%**	-6%	4%	-3%	*-3%*	*1%*	*-1%*	**-6%**	-19%	38%	-10%	*-11%*	*8%*	*-37%*
2004	**-5%**	-5%	4%	-4%	*-3%*	*0%*	*-1%*	**-7%**	-19%	39%	-11%	*-12%*	*2%*	*-35%*
2005	**-4%**	-4%	3%	-3%	*-2%*	*0%*	*-1%*	**-5%**	-15%	34%	-8%	*-8%*	*4%*	*-29%*
2006	**-5%**	-4%	4%	-4%	*-3%*	*0%*	*-1%*	**-7%**	-16%	41%	-12%	*-12%*	*-3%*	*-25%*
2007	**-3%**	-3%	4%	-4%	*-3%*	*0%*	*-1%*	**-5%**	-13%	50%	-12%	*-15%*	*5%*	*-29%*
2008	**-5%**	-5%	4%	-4%	*-4%*	*1%*	*-1%*	**-8%**	-23%	51%	-11%	*-17%*	*12%*	*-22%*
2001-2008 average	**-4%**	-5%	4%	-3%	-3%	0%	-1%	**-6%**	-18%	40%	-10%	*-11%*	*5%*	*-30%*

Table A28: Euro-Area Net Foreign Asset Position/Euro-Area GDP

		Share of non-Swiss fortunes belonging to euro-area			
		2001			
		0%	**25%**	**50%**	**75%**
	0%	-5%	2%	8%	15%
Share of Swiss fortunes belonging to euro-area	**40%**	0%	7%	13%	20%
	50%	1%	8%	15%	21%
	60%	2%	9%	16%	23%
		2002			
		0%	**25%**	**50%**	**75%**
	0%	-11%	-5%	1%	6%
Share of Swiss fortunes belonging to euro-area	**40%**	-6%	0%	5%	11%
	50%	-4%	1%	7%	12%
	60%	-3%	2%	8%	14%
		2003			
		0%	**25%**	**50%**	**75%**
	0%	-11%	-6%	-1%	4%
Share of Swiss fortunes belonging to euro-area	**40%**	-6%	-1%	4%	9%
	50%	-5%	0%	5%	11%
	60%	-4%	1%	7%	12%
		2004			
		0%	**25%**	**50%**	**75%**
	0%	-12%	-7%	-1%	4%
Share of Swiss fortunes belonging to euro-area	**40%**	-7%	-1%	4%	9%
	50%	-5%	0%	5%	10%
	60%	-4%	1%	6%	12%
		2005			
		0%	**25%**	**50%**	**75%**
	0%	-8%	-3%	3%	9%
Share of Swiss fortunes belonging to euro-area	**40%**	-3%	3%	8%	14%
	50%	-2%	4%	10%	15%
	60%	0%	5%	11%	17%
		2006			
		0%	**25%**	**50%**	**75%**
	0%	-12%	-7%	-3%	2%
Share of Swiss fortunes belonging to euro-area	**40%**	-6%	-1%	4%	8%
	50%	-5%	0%	5%	10%
	60%	-3%	2%	7%	12%
		2007			
		0%	**25%**	**50%**	**75%**
	0%	-15%	-9%	-2%	4%
Share of Swiss fortunes belonging to euro-area	**40%**	-9%	-2%	4%	10%
	50%	-7%	-1%	6%	12%
	60%	-5%	1%	7%	14%
		2008			
		0%	**25%**	**50%**	**75%**
	0%	-17%	-11%	-6%	-1%
Share of Swiss fortunes belonging to euro-area	**40%**	-12%	-7%	-1%	4%
	50%	-11%	-6%	0%	5%
	60%	-10%	-5%	1%	6%
		2001-2008 average			
		0%	**25%**	**50%**	**75%**
	0%	-11%	-6%	0%	6%
Share of Swiss fortunes belonging to euro-area	**40%**	-6%	0%	5%	11%
	50%	-5%	1%	7%	12%
	60%	-3%	2%	8%	13%

Table A29: U.S. Net Foreign Asset Position/U.S. GDP

		Share of non-Swiss fortunes belonging to the U.S.			
		2001			
		0%	**25%**	**50%**	**75%**
Share of Swiss fortunes belonging to the U.S.	**0%**	-18%	-14%	-10%	-6%
	5%	-18%	-14%	-9%	-5%
	10%	-18%	-13%	-9%	-5%
	15%	-17%	-13%	-9%	-4%
		2002			
		0%	**25%**	**50%**	**75%**
Share of Swiss fortunes belonging to the U.S.	**0%**	-19%	-16%	-12%	-8%
	5%	-19%	-15%	-12%	-8%
	10%	-18%	-15%	-11%	-8%
	15%	-18%	-14%	-11%	-7%
		2003			
		0%	**25%**	**50%**	**75%**
Share of Swiss fortunes belonging to the U.S.	**0%**	-19%	-15%	-11%	-7%
	5%	-18%	-14%	-10%	-6%
	10%	-18%	-14%	-10%	-6%
	15%	-17%	-13%	-9%	-5%
		2004			
		0%	**25%**	**50%**	**75%**
Share of Swiss fortunes belonging to the U.S.	**0%**	-19%	-15%	-10%	-6%
	5%	-19%	-14%	-10%	-5%
	10%	-18%	-14%	-9%	-5%
	15%	-17%	-13%	-9%	-4%
		2005			
		0%	**25%**	**50%**	**75%**
Share of Swiss fortunes belonging to the U.S.	**0%**	-15%	-11%	-6%	-2%
	5%	-15%	-10%	-6%	-1%
	10%	-14%	-10%	-5%	-1%
	15%	-14%	-9%	-5%	0%
		2006			
		0%	**25%**	**50%**	**75%**
Share of Swiss fortunes belonging to the U.S.	**0%**	-16%	-12%	-8%	-4%
	5%	-16%	-12%	-8%	-4%
	10%	-15%	-11%	-7%	-3%
	15%	-15%	-11%	-7%	-3%
		2007			
		0%	**25%**	**50%**	**75%**
Share of Swiss fortunes belonging to the U.S.	**0%**	-13%	-7%	-2%	4%
	5%	-12%	-6%	-1%	5%
	10%	-11%	-6%	0%	5%
	15%	-11%	-5%	1%	6%
		2008			
		0%	**25%**	**50%**	**75%**
Share of Swiss fortunes belonging to the U.S.	**0%**	-23%	-18%	-12%	-7%
	5%	-22%	-17%	-12%	-7%
	10%	-22%	-16%	-11%	-6%
	15%	-21%	-16%	-11%	-6%
		2001-2008 average			
		0%	**25%**	**50%**	**75%**
Share of Swiss fortunes belonging to the U.S.	**0%**	-18%	-13%	-9%	-5%
	5%	-17%	-13%	-8%	-4%
	10%	-17%	-12%	-8%	-3%
	15%	-16%	-12%	-7%	-3%

Table A30: Households' Unrecorded Offshore Assets vs. Net Debt of the World (bn USD)

		2001	2002	2003	2004	2005	2006	2007	2008
[1]	**My estimate of households' unrecorded assets Ω**	**2,532**	**2,392**	**2,858**	**3,316**	**3,676**	**3,760**	**5,131**	**4,490**
[2]	*Minus: FDI discrepancy (EWNII)*	*340*	*374*	*381*	*469*	*330*	*159*	*97*	*n.a.*
[3]	*Minus: Derivative discrepancy (EWNII)*	*17*	*-3*	*-32*	*-45*	*38*	*24*	*-47*	*n.a.*
[4]	*Minus: Middle East oil exporters' offshore holdings incl. in EWNII (est.)*	*188*	*209*	*263*	*287*	*369*	*452*	*570*	*n.a.*
[5]	*Minus: Correction to portfolio liability data reported in EWNII*	*242*	*198*	*269*	*225*	*456*	*430*	*619*	*523*
[6]	*Minus: Cumulated trade discrepancy after 2004*				*89*	*227*	*488*	*892*	*1,259*
[7]	*Minus: Other*	*108*	*-192*	*107*	*315*	*793*	*460*	*1,325*	*n.a.*
[8]	**Equals = World net debt (EWNII)**	**1,637**	**1,805**	**1,871**	**1,975**	**1,463**	**1,746**	**1,674**	**n.a.**
[9]	*Memo: World net debt (IMF, July 2011)*	*1,724*	*2,016*	*1,994*	*2,180*	*1,547*	*1,403*	*1,084*	*645*

Table A31: Euro-Area Net Foreign Asset Position/Euro-Area GDP, World IIP balanced

		Share of non-Swiss fortunes belonging to euro-area			
		2001			
		0%	**25%**	**50%**	**75%**
	0%	-10%	-3%	4%	10%
Share of Swiss fortunes belonging to euro-area	**40%**	-5%	2%	9%	15%
	50%	-4%	3%	10%	17%
	60%	-3%	4%	11%	18%
		2002			
		0%	**25%**	**50%**	**75%**
	0%	-13%	-8%	-2%	3%
Share of Swiss fortunes belonging to euro-area	**40%**	-9%	-3%	3%	8%
	50%	-7%	-2%	4%	9%
	60%	-6%	0%	5%	11%
		2003			
		0%	**25%**	**50%**	**75%**
	0%	-15%	-10%	-5%	1%
Share of Swiss fortunes belonging to euro-area	**40%**	-10%	-5%	1%	6%
	50%	-9%	-3%	2%	7%
	60%	-7%	-2%	3%	8%
		2004			
		0%	**25%**	**50%**	**75%**
	0%	-16%	-10%	-5%	0%
Share of Swiss fortunes belonging to euro-area	**40%**	-10%	-5%	0%	5%
	50%	-9%	-4%	1%	7%
	60%	-8%	-3%	3%	8%
		2005			
		0%	**25%**	**50%**	**75%**
	0%	-14%	-8%	-2%	3%
Share of Swiss fortunes belonging to euro-area	**40%**	-8%	-3%	3%	9%
	50%	-7%	-1%	4%	10%
	60%	-6%	0%	6%	11%
		2006			
		0%	**25%**	**50%**	**75%**
	0%	-17%	-12%	-7%	-2%
Share of Swiss fortunes belonging to euro-area	**40%**	-11%	-6%	-1%	4%
	50%	-10%	-5%	0%	5%
	60%	-8%	-3%	2%	7%
		2007			
		0%	**25%**	**50%**	**75%**
	0%	-22%	-16%	-9%	-3%
Share of Swiss fortunes belonging to euro-area	**40%**	-16%	-9%	-3%	3%
	50%	-14%	-8%	-1%	5%
	60%	-12%	-6%	0%	7%
		2001-2007 average			
		0%	**25%**	**50%**	**75%**
	0%	-13%	-8%	-3%	2%
Share of Swiss fortunes belonging to euro-area	**40%**	-9%	-4%	1%	6%
	50%	-7%	-2%	2%	7%
	60%	-6%	-1%	4%	9%

Table A32: Rich World Net Foreign Asset Position/Rich World GDP, World IIP balanced

		Share of non-Swiss fortunes belonging to rich world			
		2001			
		0%	**30%**	**60%**	**90%**
Share of Swiss fortunes belonging to rich world	**0%**	-6%	-4%	-2%	0%
	50%	-5%	-2%	0%	2%
	60%	-4%	-2%	0%	2%
	70%	-4%	-2%	0%	3%
		2002			
		0%	**30%**	**60%**	**90%**
Share of Swiss fortunes belonging to rich world	**0%**	-7%	-5%	-3%	-2%
	50%	-5%	-4%	-2%	0%
	60%	-5%	-3%	-1%	0%
	70%	-5%	-3%	-1%	1%
		2003			
		0%	**30%**	**60%**	**90%**
Share of Swiss fortunes belonging to rich world	**0%**	-8%	-6%	-4%	-2%
	50%	-6%	-4%	-2%	0%
	60%	-5%	-3%	-2%	0%
	70%	-5%	-3%	-1%	1%
		2004			
		0%	**30%**	**60%**	**90%**
Share of Swiss fortunes belonging to rich world	**0%**	-9%	-7%	-5%	-3%
	50%	-7%	-5%	-3%	-1%
	60%	-6%	-4%	-2%	0%
	70%	-6%	-4%	-2%	0%
		2005			
		0%	**30%**	**60%**	**90%**
Share of Swiss fortunes belonging to rich world	**0%**	-8%	-6%	-4%	-2%
	50%	-6%	-4%	-2%	0%
	60%	-6%	-4%	-2%	1%
	70%	-5%	-3%	-1%	1%
		2006			
		0%	**30%**	**60%**	**90%**
Share of Swiss fortunes belonging to rich world	**0%**	-9%	-8%	-6%	-4%
	50%	-7%	-5%	-3%	-1%
	60%	-7%	-5%	-3%	-1%
	70%	-6%	-4%	-2%	-1%
		2007			
		0%	**30%**	**60%**	**90%**
Share of Swiss fortunes belonging to rich world	**0%**	-9%	-7%	-4%	-2%
	50%	-7%	-4%	-2%	1%
	60%	-6%	-4%	-1%	1%
	70%	-6%	-3%	-1%	2%
		2001-2007 average			
		0%	**30%**	**60%**	**90%**
Share of Swiss fortunes belonging to rich world	**0%**	-7%	-5%	-4%	-2%
	50%	-5%	-4%	-2%	0%
	60%	-5%	-3%	-1%	0%
	70%	-5%	-3%	-1%	1%

Figure A1: Cumulated Discrepancies in the World Current Account

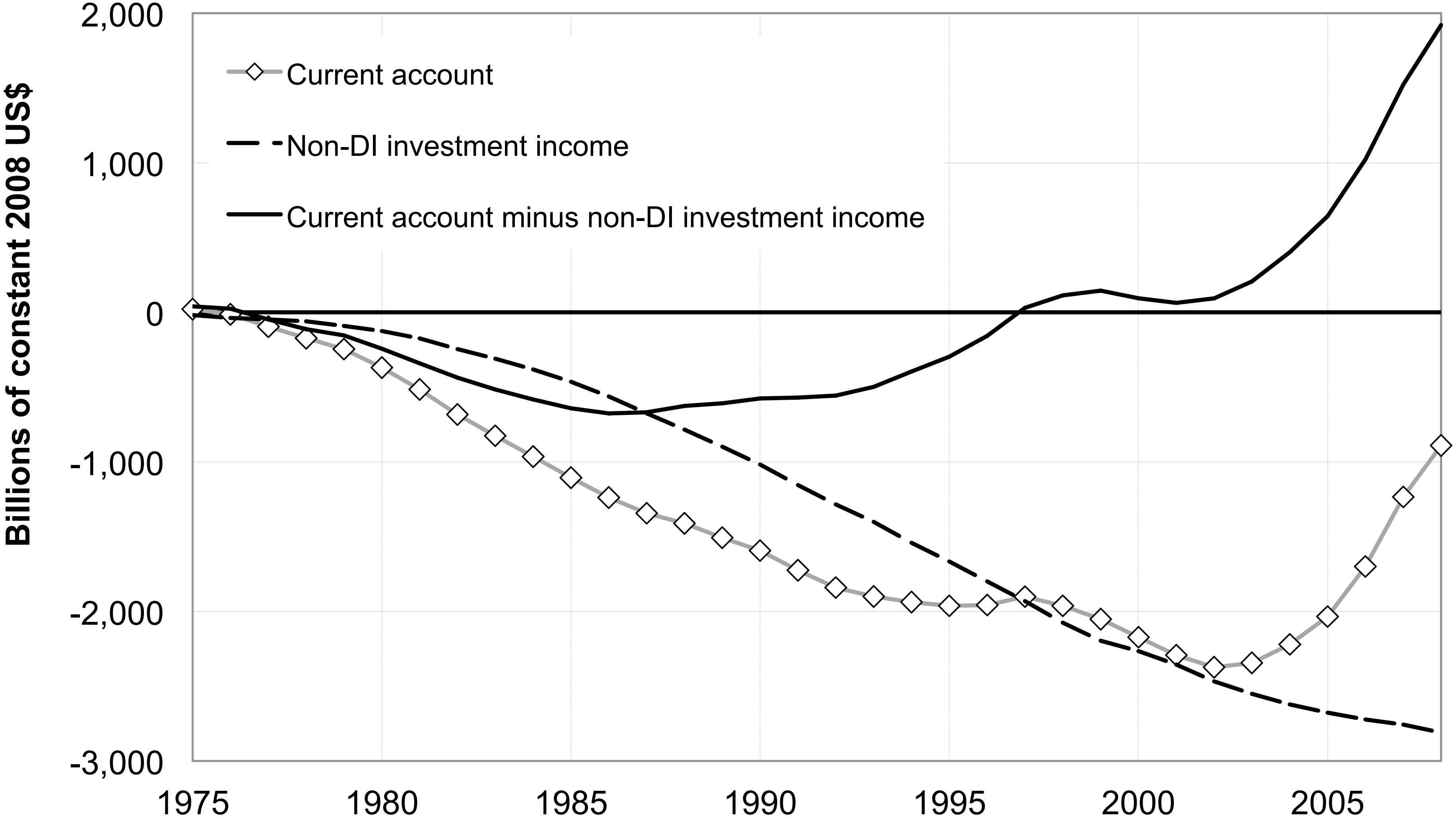


Figure A2: Share of Each Foreign Country in the U.S. Equity Portfolio, 2001-2008 average

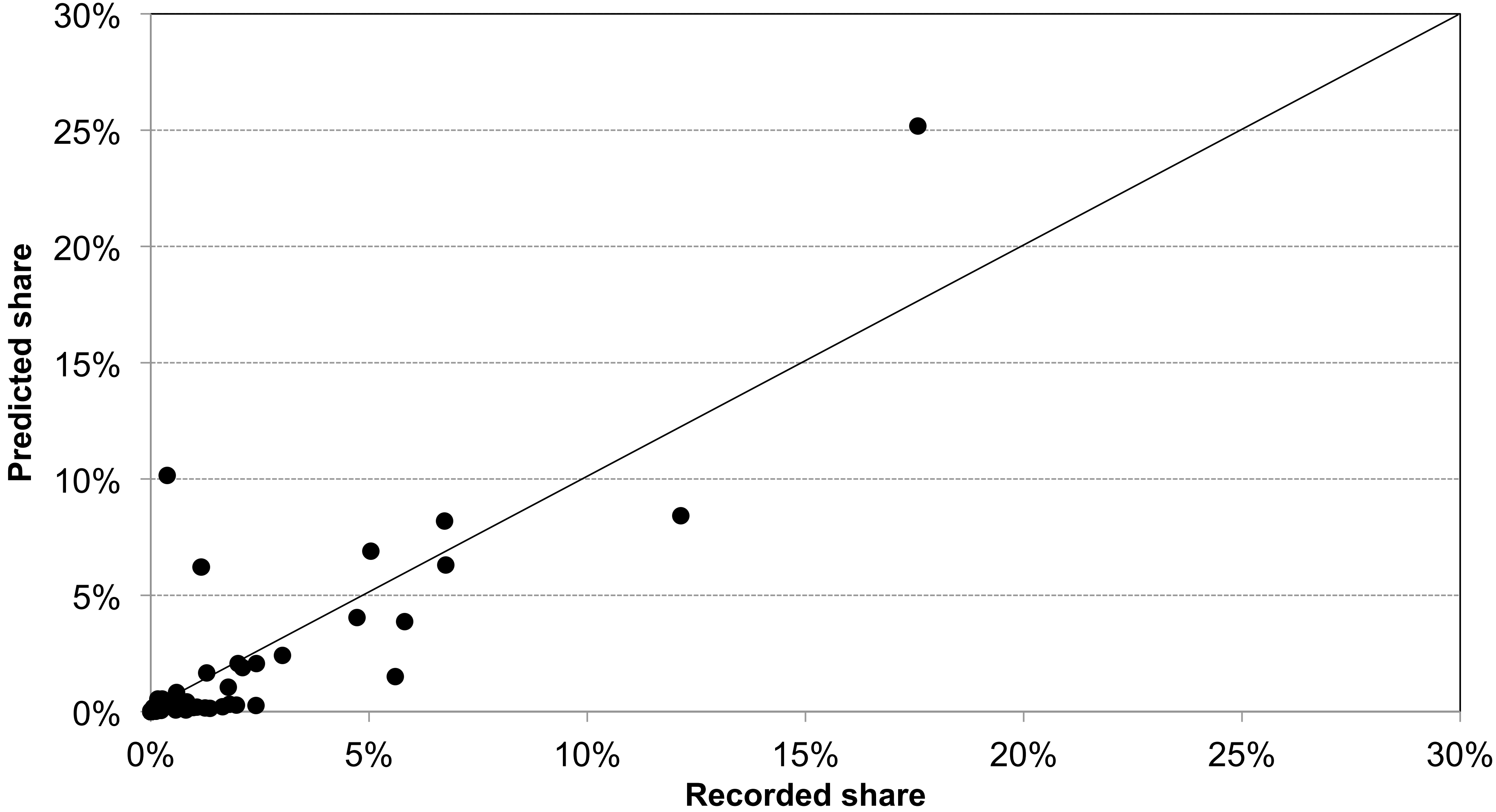


Figure A3: Share of Each Foreign Country in the U.S. Debt Portfolio

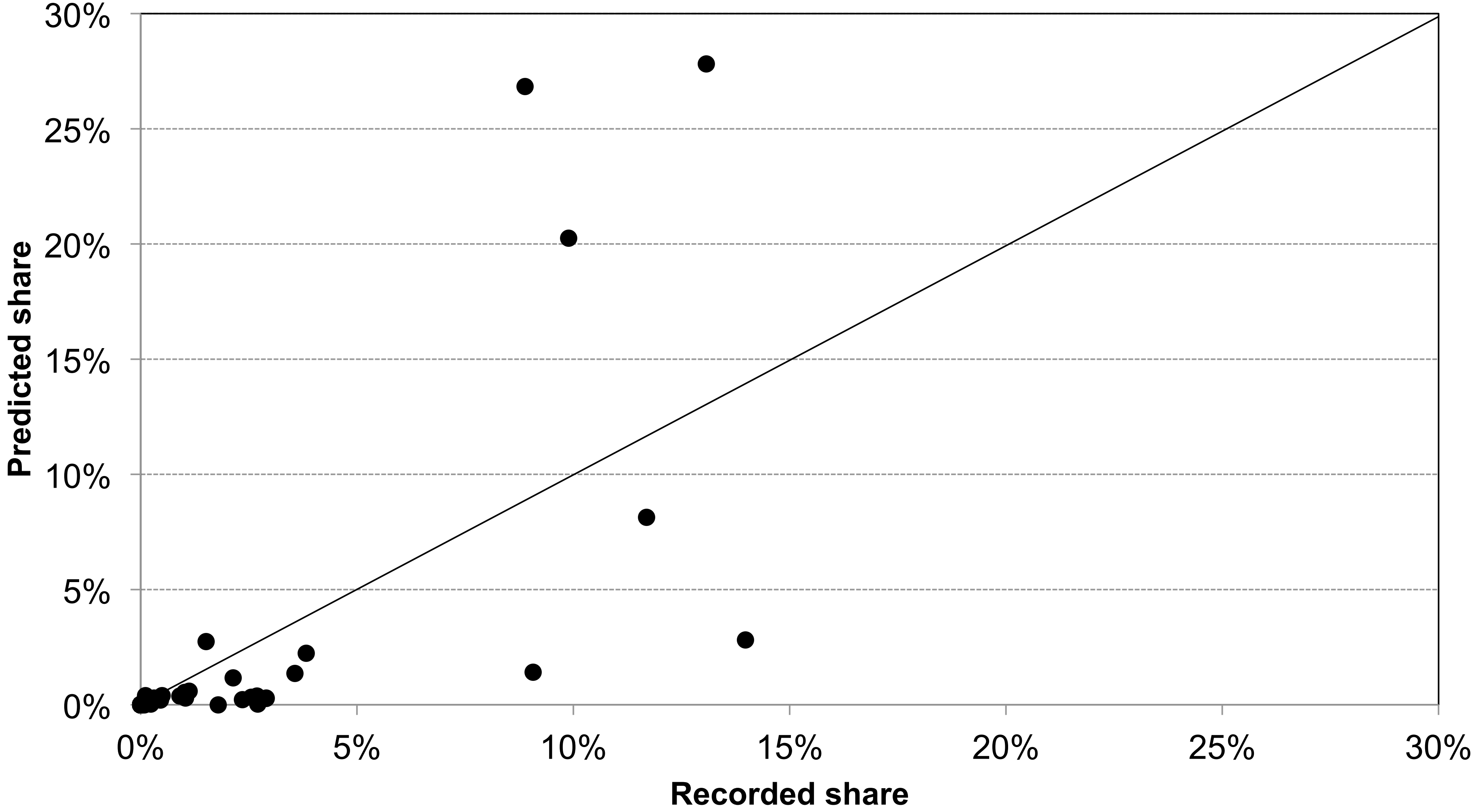


Figure A4: Share of Each Foreign Country in Japan's Equity Portfolio

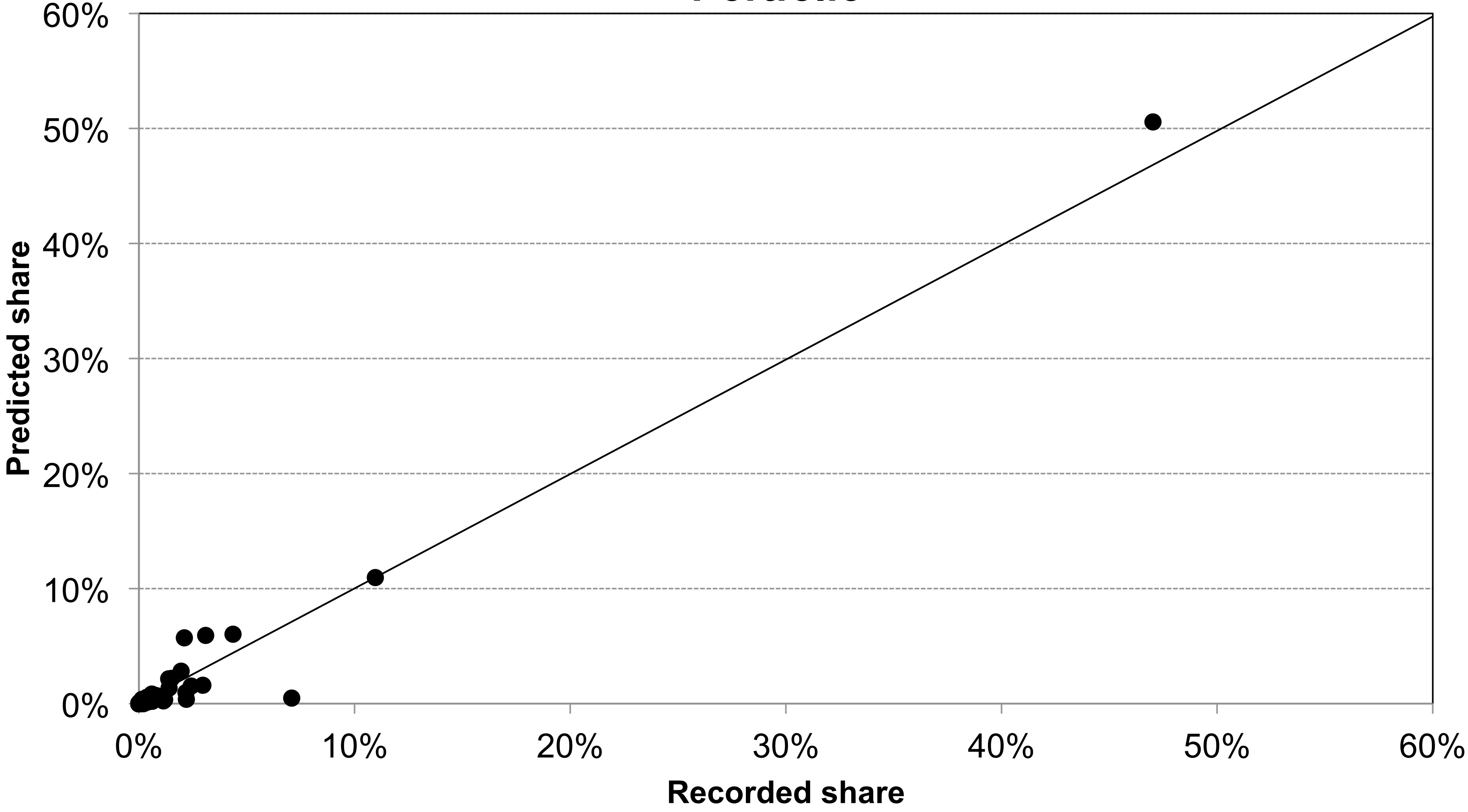


Figure A5: Share of Each Foreign Country in Japan's Debt Portfolio

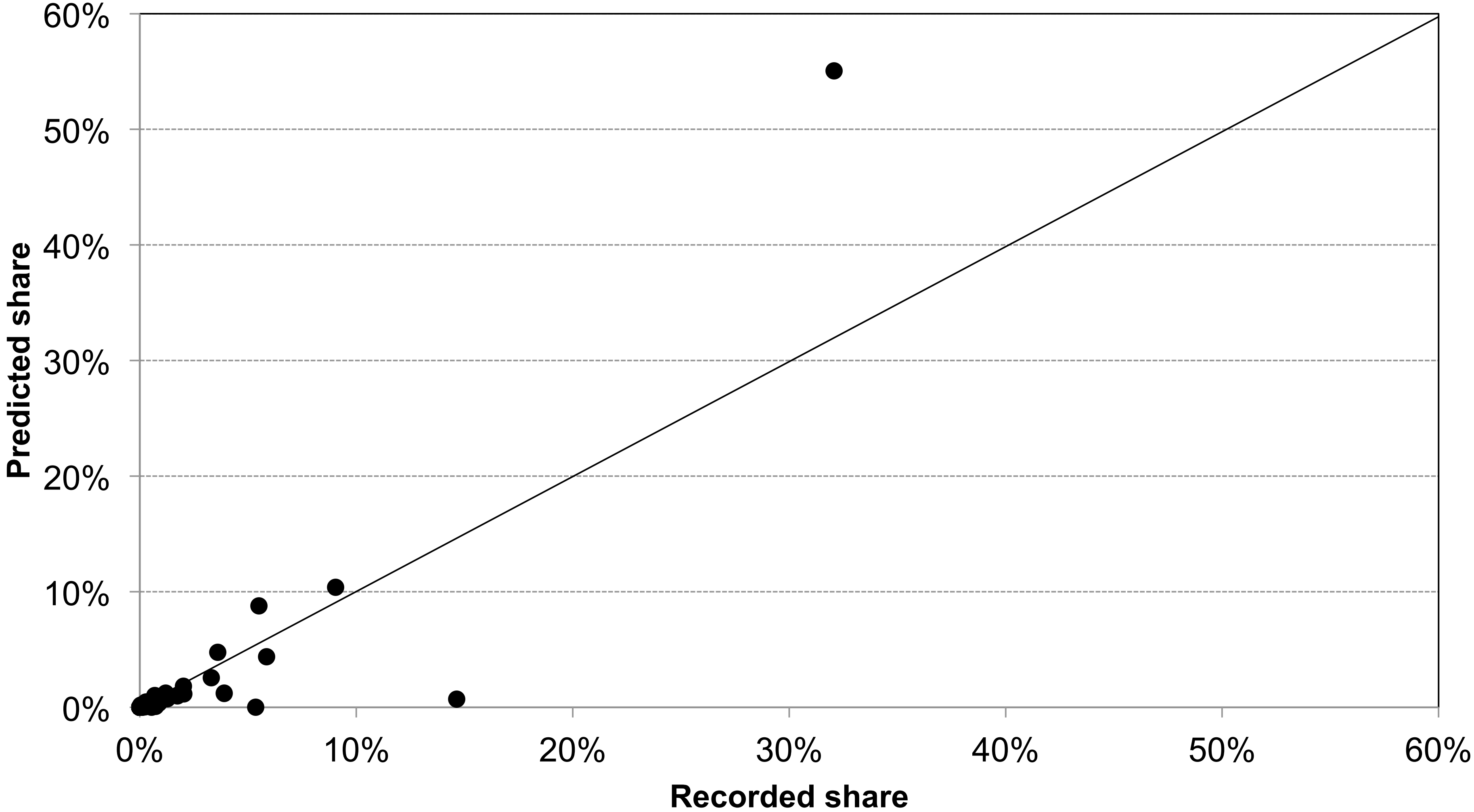


Figure A6: Share of Each Foreign Country in France's Equity Portfolio

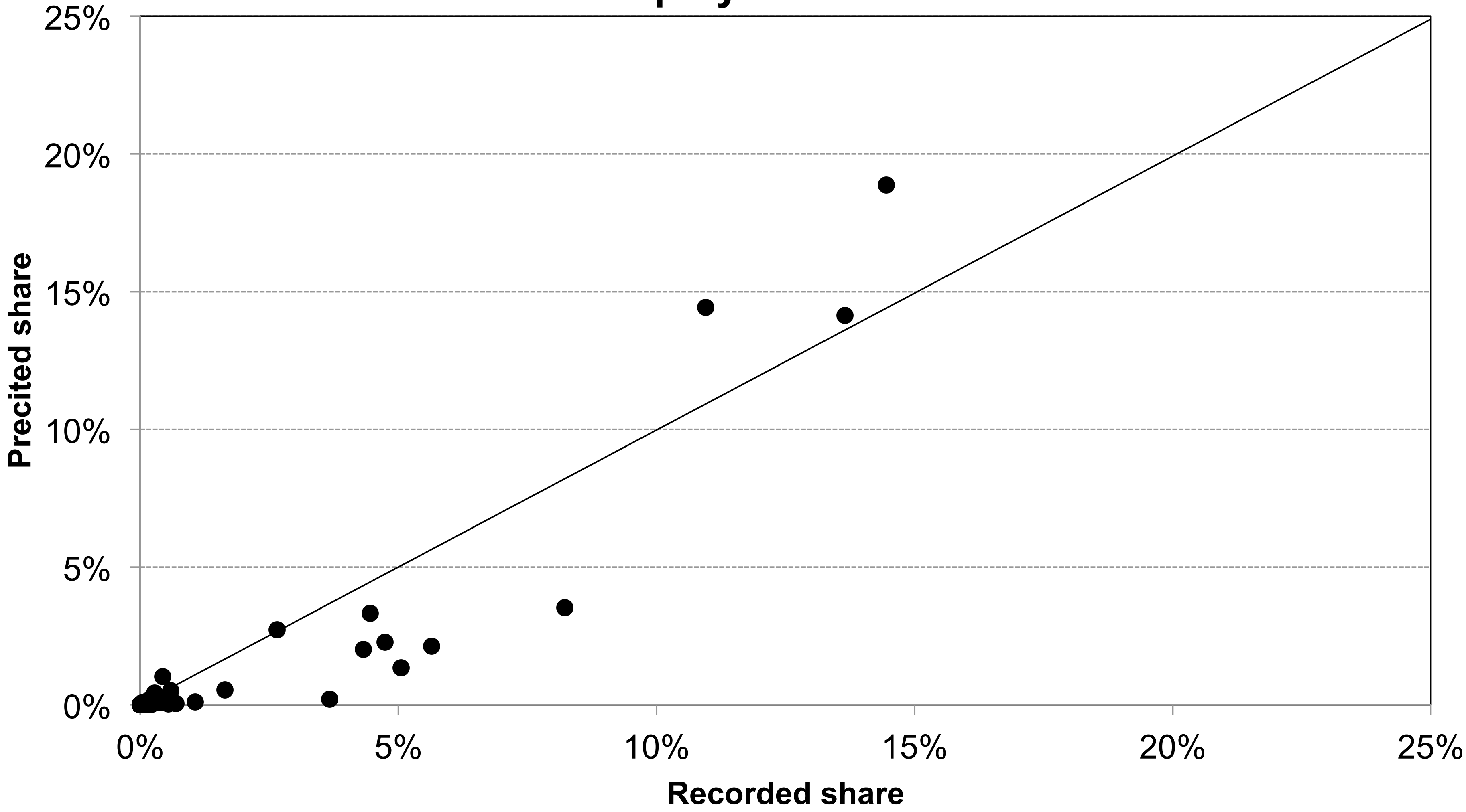
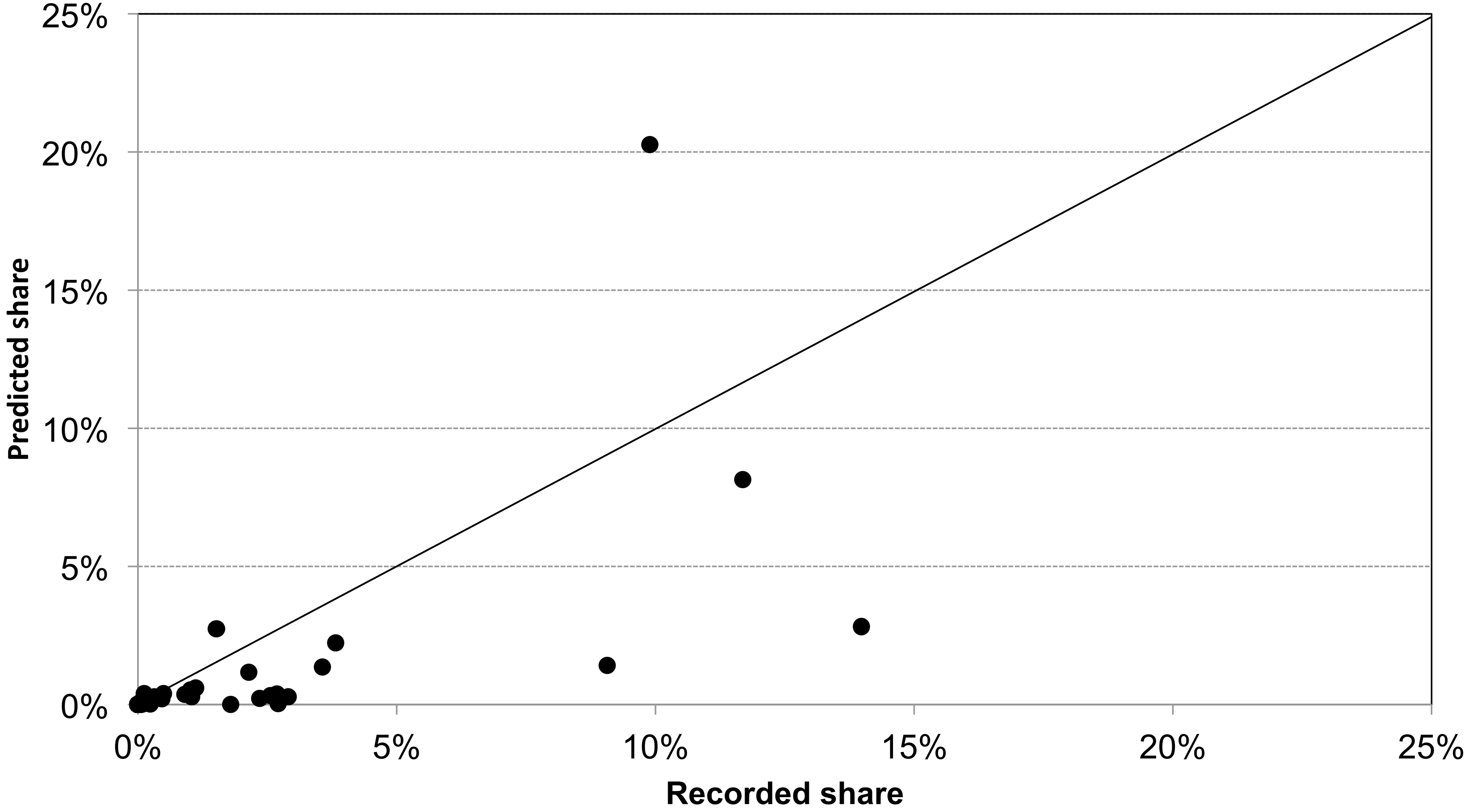


Figure A7: Share of Each Foreign Country in France's Debt Portfolio



Appendix B

Capital is Back: Data Appendix

This Data Appendix has two main purposes: to provide all relevant details on the data sources we use in this research, and to provide additional wealth accumulation decompositions that supplement the main results provided in the paper.

The Appendix is organized as follows. In Section A, we discuss general general methodological principles that apply to all countries. We provide a detailed discussion of what is included in published balance sheets and of how assets and liabilities are measured, following the U.N. System of National Accounts (SNA). Then in Sections B to J we provide country-specific information about sources and methods for each of the 8 countries in our database: the U.S., Japan, Germany, France, the U.K., Italy, Canada, and Australia.[1] The information provided there is detailed enough to enable the reader to reproduce each of our result from readily available published sources. Last, in Section K, we discuss supplementary results on wealth accumulation excluded from the main text for the sake of conciseness.

This Appendix is supported by a series of Excel and PDF files that contain our complete wealth-income dataset. The database is organized as follows. First, there is for each country a separate Excel file USA.xls, Japan.xls, etc., that contains all the raw series on the country's income and wealth, with precise references to the raw sources, and that organizes the raw data according to a 30-tables common template.[2]

From these country-specific files, we have then constructed two Excel files – AppendixTables.xls and AppendixFigures.xls – which contain 170 summary cross-country tables and 157 figures on wealth-income ratios, the structure of household, corporate, government, foreign, and national wealth, the structure of national income, saving flows, wealth accumulation, capital returns, prices, population, and exchange rates, covering the 1870-2010 period for the U.S., U.K., France, and Germany, and the 1970-2010 period for the other countries. The tables and figures presented in the main paper are contained in two separate Excel files – Tables.xls and Figures.xls. Last, all figures from the main text and the Appendix were exported in PDF format into a Chartbook. Similarly, all tables were exported into a Databook.

Finally, we also make available online a large number of raw Excel files collected from each country's official data providers and authors, upon which we have relied to construct our wealth and income database.

A General methodological principles and data sources

A Definition and measurement of assets and liabilities

Measuring capital is notoriously difficult. In this research we systematically follow the most recent international guidelines, as set forth in the 2008 System of National Accounts (SNA).[3] In our online database we often refer to classification codes from

[1] In Section J we briefly discuss the available data for Spain, which are not as comprehensive as in the other rich countries, and therefore are not included in the core database.

[2] The raw data are gathered in the sheets DataUS, DataJapan, at the end of each file US.xls, Japan.xls, etc.

[3] The 2008 SNA, jointly adopted by the UN, the OECD, the World Bank, the IMF and the European Commission, supersedes the 1993 SNA, which was the first set of international guidelines

the European System of Accounts. ESA is the European Union implementation of the SNA; both are virtually identical.[4]

The SNA defines economic assets as "entities over which ownership rights are enforced by institutional units and from which economic benefits may be derived by their owners." Because ownership rights cannot be enforced on human beings, this definition excludes human capital. Including human capital would raise major conceptual difficulties, and we believe its exclusion is justified. In particular, treating human capital as an asset would call for treating education and health services as investment. But these services are largely viewed as having a consumption value per se, independently of the accumulation of any asset, so that the most basic distinction upon which national accounts are built – consumption vs. investment – would collapse.

All assets are to be measured at the market price prevailing at the date of the accounts. Official wealth estimates are usually as at December 31st. In our database, from these raw data we construct mid-year estimates by averaging end-of-year values.

There are two broad ways to measure national wealth: (i) by taking a census of wealth, whereby economic units in the nation have to report on the current value of their assets and liabilities; (ii) by cumulating past investment or saving flows, with adjustments made for depreciation and changes in prices – what is known as the perpetual inventory method.[5] In SNA accounts, for household, government, and foreign balance sheets, statisticians essentially rely on census-like methods. For corporate balance sheets, they rely on both methods: non-financial wealth is mostly measured by cumulating past investment flows, while financial wealth is measured by census-like methods. We begin with a brief discussion of census-like vs. perpetual inventory methods.

A.1 Censuses of wealth

In official national balance sheets, census-like methods are used to measure all financial assets and liabilities, and they are also used for real estate – the two main components of private wealth, hence of national wealth.

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including strict rules and concepts for national wealth accounts and balance sheets (and not only for national income). Changes from the 1993 SNA to the 2008 SNA were relatively modest and we mention them in the text below when appropriate. At the time we conducted this research, all the countries in our database followed the 1993 SNA with the exception of Australia which had already adopted the 2008 SNA. Most countries were expected to adopt the 2008 SNA by 2014 (2013 in the U.S.) For a detailed history of national accounts normalization since World War 2, and particularly of the debates and negotiations leading to the 1993 SNA, see Vanoli (2002, particularly pp.381-464).

[4] ESA 95 is the European implementation of the 1993 SNA and ESA 2010 of the 2008 SNA. The ESA 1995 manual is available on-line at http://circa.europa.eu/irc/dsis/nfaccount/info/data/ESA95/en/esa95en.htm.

[5] A third and more seldom used way to value an asset is to take the discounted value of its future economic benefits. This method is used for some natural resources (subsoil assets, and sometimes forests). Yet a fourth method relies on asset values as reported to insurance companies (e.g., fire or theft insurance). This method was used in the past (e.g., in early twentieth century Germany) and is sometimes used today for estimating valuables such as works of art (SNA 2008, 13.43). We discuss below these estimation methods in more details when necessary.

To establish the current market value of the whole stock of financial claims and liabilities of all sectors of the economy, statisticians typically rely on a broad range of sources. First, they rely on the balance sheets of individual financial institutions such as banks, insurance companies, investment funds, and the like. By drawing on the balance sheets of banks, for instance, it is possible to know the amount of deposits held domestically by the various sectors the economy. Using the balance sheets of insurance companies, one knows the amount of life-insurance claims held by households. And so on.

Statisticians also heavily rely on reports about the off-balance sheet positions of banks. One important off-balance sheet element is the portfolio securities managed by banks on behalf of third-parties. Essentially, all portfolio securities (equities, bonds, mutual fund shares) are entrusted by their owners to custodian banks. By asking banks to report on these portfolios, statisticians can measure the amount of equities held by households, of bonds held by non-financial companies, etc.[6]

Overall, by systematically drawing on the balance sheets and off-balance sheet reports of individual financial institutions, it is fairly easy to obtain accurate market values for the amount of financial claims held by the various sectors of the economy. The main issue is that in the current reporting systems, it is not not possible to measure the portfolio securities entrusted by households to offshore custodian banks (in Switzerland, Singapore, etc.), because there is no automatic exchange of information between banks in tax havens and foreign authorities. Zucman (2013) estimates that these securities amount to about 6% of households' financial wealth globally. So ideally it would be desirable to upgrade by about 6% the net financial claims of households recorded in the balance sheets of rich countries. One problem, however, is that the 6% estimate is a global figure which may conceal significant heterogeneity across countries. The figure may well be significantly higher for a number of European countries, but might be lower for Japan and the U.S. So in this research we have not attempted to upgrade the official balance sheets to account for the tax haven holdings of households. Improving the covering of tax haven wealth at the country level is an important challenge that we leave for future research.

Regarding real estate, the general practice is that its value is based on censuses of built areas (in order to establish the total surface of dwellings) and observed real estate transaction prices. In some countries, statisticians attempt to disentangle the value of real estate in two components: dwellings and land underlying dwellings. Typically, the value of dwellings is obtained by the perpetual inventory method (i.e., by cumulating past residential investment and adjusting for some construction price index), and land values are obtained as a residual (real estate at market values from censuses, minus PIM-estimated dwelling values).

A.2 The perpetual inventory method

The assets other than financial claims and real estate – i.e., essentially corporate tangible assets: machines, structures, etc. – are usually measured by the perpetual inventory method. The goal of the perpetual inventory method (PIM) is to approximate the current market value of a number of capital assets when it cannot be directly observed. The general idea is that this value can be approximated by

[6]See Zucman (2013, Section II) for more details on the custodial activities of banks.

cumulating past investment flows and making suitable price adjustments. Although important effort has been devoted into improving it, the PIM continues to raise a number of important theoretical and practical difficulties (see, e.g., Hulten, 1991). For our study these difficulties are largely irrelevant, because in our benchmark measure of national wealth – market value national wealth – we measure the net wealth of corporation by setting it equal to the market value of their equities. By doing so, we in effect choose not to rely on PIM estimates of corporate capital.[7] It is important, however, to have some ideas of the pitfalls of the PIM.

First, capital stocks derived from the PIM obviously rely on the quality of the underlying investment data. Very long run data are needed when depreciation is low, otherwise benchmark historical estimates are required, which are often of dubious quality. More worryingly, the PIM implicitly assumes that the assets of firms going out of business are bought back by domestic corporations. When this is not the case – which frequently happens in practice, either because assets are scraped at the time of bankruptcy or sold to foreign corporations – assets that do not exist anymore continue to be counted in the capital stock until their estimated depreciation reaches 100%. In the U.K., Mayes and Young (1994, p. 95) consider that "the major reason for mis-measurement of the [corporate] capital stock is because capital scrapped by firms going out of business remains in the measured stock." Another implicit assumption of the PIM is that statisticians are able to identify the sales of fixed assets by firms going out of business to domestic firms. When they fail to do so, investment flows are counted twice, and the PIM again over-estimates corporate capital stocks. In France, Picart (2004, p. 99) concludes that for these two reasons the PIM may over-estimate the stock of corporate fixed assets by up to 20%. This might explain why in many countries, Tobin's Q is structurally below 1 (see below).

The price component of the PIM also raises formidable difficulties. In private company accounts, assets are valued at the prices at which they were originally acquired – what is known as the "book value" or "historical cost" of assets. This method has the advantage of simplicity (historical prices can be easily verified) but tends to under-estimate the value of the capital stock when there is inflation. By contrast, with the perpetual inventory method assets are to be valued at the prices of a reference period.[8] This requires being able to observe the evolution of the market prices of all corporate fixed assets, which is impossible given the enormous variety of assets of different vintages and the lack of centralized markets for many of them. Thus, in practice, price changes are not observed but estimated – a task which is fraught with difficulties.

One reason why the market price of any fixed asset changes is the fact that as time passes, the asset's future income stream shortens. This economic depre-

[7]By contrast, in our alternative measure of national wealth – book-value national wealth – the net wealth of corporation is equal to corporations' non-financial assets plus net financial assets. This measure relies on PIM-estimates of corporate nonfinacial assets.

[8]When the reference period is the current period, assets are said to be valued at "replacement cost" or "current cost." But assets can also be valued at the constant prices of a past period, in which case they are simply at "constant costs." One should be careful with these expressions: while flows can be measured at "current prices" (no deflator required) or "constant prices" (deflator required), for stock data, both "current costs" and "constant costs" estimates require the use of price deflators.

ciation is exactly what national accounts attempt to measure with the concept of "consumption of fixed capital." Depreciation is measured on the basis of estimated age-price profiles for various types of assets.[9] There is a whole literature dealing with what are the most appropriate functional forms for this profile.[10] But the 2008 SNA does not include strict guidelines and leaves the choice of specific functional forms to statisticians (SNA 2008, 20.22), so that some heterogeneity remains across countries.[11] Further, virtually all computations of economic depreciation face important data constraints. Statisticians would ideally like to use age-price profiles that vary over the business cycle as plants open and close, and that change with obsolescence – but the raw data to estimate are scant and do not allow for much sophistication.

The price of fixed assets also changes for many reasons unrelated to depreciation. Ideally, these price changes should be measured at the level of each individual asset vintage category (e.g., computers with 200Mhz micro-processors, 48MB of RAM, etc.). In practice this is of course impossible and statisticians only compute a limited number of prices for pseudo-homogeneous capital goods such as commercial real estate and computers. To estimate these prices, it is essential to properly account for quality improvement and technical change – otherwise computers of say the early 2000s will continue being counted as part of the capital stock above their true market value. While much progress has been done thanks to the greater use of hedonic price indexes following Hall (1971) and Gordon (1989), measures of price changes in industries with very fast rates of quality improvement remains a subject of both theoretical and practical difficulties, and eventually statisticians must often

[9] Economic depreciation (a price effect) should be distinguished from efficiency decay (a quantity effect), which is equal to the decline in an asset's contribution to production caused by the fact that as time passes, the asset becomes less efficient. Efficiency decay is what productivity studies are usually interested in, and is measured using age-efficiency profiles. Depreciation and efficiency decay are not the same thing: for a light bulb with a duration life of 10 years, the efficiency decay between year 8 and 9 is zero but the economic depreciation is not zero. The two concepts, however, are closely related: under the assumption of competitive markets, depreciation is the present value of rental income loss due to the efficiency decay occurring in each year in the future (Hulten, 1991, p.129). From a quantity perspective, the other component of depreciation beyond efficiency decay is retirement. Not all capital goods of the same cohort retire at the same moment, so statisticians also estimate retirement profiles. To one age-price profile corresponds one and only one age-efficiency/retirement profile. Age-price and age-efficiency/retirement profiles are identical if and only if the two are geometric.

[10] Although there is a two-way correspondence between age-efficiency and age-price profiles, in practice there are arguments for basing estimates on assumptions about efficiency rather than price patterns (see SNA 2008, 20.18-20.20 for an intuitive exposition). For efficiency patterns, the most popular functional forms are: (i) One-hoss: assets retain full efficiency until they completely fall apart (as a light bulb does). In this case the pattern of efficiency decay is completely characterized by one parameter, the useful life of the asset. (ii) Straight-line efficiency, in which efficiency decays in equal increments every year (which is popular because in private accounts assets are often amortized in equal increments). The useful life again fully determines the efficiency decay pattern. (iii) Geometric decay, in which efficiency decays at a constant rate, which implies rapid losses of efficiency in the early years of an asset, and also that assets are never fully retired. See the discussion in Hulten (1991, pp.124-127) and the classic study by Hulten and Wykoff (1981) for tests of the three above patterns of depreciation.

[11] The OECD, however, recommends the use of geometric patterns for depreciation, because the combined age-efficiency and retirement profile of asset cohorts often resemble a geometric pattern. See OECD (2009), *Measuring Capital*, 2nd edition.

rely on ad-hoc techniques.[12]

It is worth stressing again that for our measure of market-value national wealth, the many shortcomings of the PIM are irrelevant, because we measure the value of corporations by their current equity values, and not by the PIM-estimated value of their capital goods.

We now turn to a more detailed discussion of the different components of SNA balance sheets. A balance sheet is established for each sector of the economy: households (including non-profit institutions serving households), corporations (financial and non-financial),[13] government, and the rest of the world. For each sector there are two broad types of assets in SNA balance sheets: non-financial assets and financial assets and liabilities.[14] Below we describe the main techniques used to measure the value of these assets, we provide details on various data limitations and the way we have dealt with them. The discussion closely follows the classification of the System of National Accounts.

B Nonfinancial assets

Nonfinancial assets (labelled AN in the SNA classification) include produced tangible capital, non-produced tangible capital (i.e., natural resources), and intangible capital. We deal with each of them in turn.[15] Coverage of tangible capital is usually excellent in published balance sheets, while coverage of intangible capital varies. In Tables A169 and A170, for each sector of each economy in our database, we precisely indicate what assets are included in the balance sheets that we have used in this research.

B.1 Produced tangible capital

Produced tangible capital is what economists are most familiar with. In fact, available estimates of countries' capital stocks usually restrict themselves to this type of wealth. This is the case for the vast majority of all "source of growth" exercises in the spirit of Solow (1957), Kendrick (1961), Denison (1962), and Jorgenson and Griliches (1967).[16] There are three types of produced tangible capital: fixed as-

[12] For a discussion of the issues raised in addressing technical change with hedonic price index, with specific application to computers, see Triplett (1989).

[13] For simplicity in our analysis we group all corporations in a single sector, but the raw sources we provide in the country-specific Excel files disentangle financial from non-financial companies.

[14] For the rest of the world sector, only financial claims and liabilities are recorded. If a Qatari investor owns a hotel in Paris, what is recorded is that a French quasi-corporation owns the hotel, and that the quasi-corporation is wholly owned by a foreign investor – an equity liability for France.

[15] Strictly speaking, there is no distinction between "tangible" and "intangible" capital in the 2008 SNA (the distinction existed in the 1993 but was removed). Rather, there are two types of nonfinancial assets: produced non-financial assets (AN.1), and non-produced non-financial assets (AN.2). Produced non-financial assets (AN.1) includes both tangible and intangible produced assets. Non-produced non-financial assets (AN.2) includes natural resources (AN.21) and intangible non-produced assets (AN.22). However, the distinction between "produced intangible assets" and "non-produced intangible assets" is particularly fuzzy, so we discuss intangible capital in a single section.

[16] Some of these studies try to include some intangible capital such as software in their capital stocks estimates, data permitting. But many also exclude residential real estate, a very large

sets, inventories, and valuables. Estimates do not generally rely on comprehensive wealth censuses.

Tangible fixed assets

Tangible fixed assets are the most important category of produced tangible capital. They include dwellings, other buildings and structures, machinery and equipment, cultivated biological resources, and weapon systems. They are usually estimated by the perpetual inventory method (PIM), i.e. on the basis of past investment flows and estimated changes in the prices of capital goods.

As we have seen, the PIM raises a number of issues. Another traditional issue with the valuation of fixed assets has to do with ownership transfer costs, such as housing stamp duties paid by purchasers of houses, and real estate agents commissions paid by sellers.[17] When a house is purchased for a total price (including commissions) of 105 and sold for a net-of-stamp-duties price of 90, the SNA indicates that the the whole of the ownership transfer costs should be included in gross fixed capital formation and an asset worth 105 recorded in the buyer's balance sheet. Ownership transfer costs, after all, are incurred in order to receive benefits in the future, and so they are investment expenditures. Like other fixed assets, they are then to be gradually depreciated, so that they contribute to a positive net formation of fixed capital during the year of purchase and to a negative net formation of capital afterwards.

The 1993 SNA recommended to depreciate ownership transfer costs over the whole life of the associated asset. This procedure raises issues when existing assets can be sold. If houses often change hands, depreciating transfer costs over the whole life of dwellings results in too much ownership transfer costs being recorded in the balance sheets, and eventually in too large stocks of dwellings. Thus in the U.S., "BEA's estimates of residential fixed assets have been overstated (because the transfer costs from multiple owners remain embedded in the capital stock estimates), and consumption of fixed capital has been understated."[18] The 2008 SNA now indicates that ownership transfer costs should be depreciated over the period during which the acquirer expects to hold the associated asset rather than during its whole life, so this issue should be addressed in the years ahead. It does not matter for our estimates of private wealth because the value of household real estate (which is composed of both dwellings and the land underlying) is not based on PIM dwelling values, but obtained through censuses of real estate market transactions. National accountants then use the PIM estimates of dwellings to break down real estate between dwellings and land.[19]

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fraction of produced tangible capital. This is the case for instance of the KapW variable of the Penn World Table Mark 5 (Summers and Heston, 1991, p.347). The large literature on productivity also usually focuses on the corporate sector, disregarding the often large public assets, i.e. this literature is typically interested in private fixed nonresidential capital (including intangibles when possible).

[17] See Goldsmith (1955) and the review by Paish (1956, p. 337) for early discussions of the issues raised by transfer costs in the measurement of savings.

[18] BEA, 2013, Preview of the 2013 Comprehensive Revision of the NIPAs.

[19] The issue of ownership transfer costs does not arise for for financial assets because ownership transfer costs for this type of wealth are not treated as investment but as intermediate consumption (in the case of purchases by corporations and government), final consumption (in the case of purchases by households) or exports of services (in the case of purchases by foreigners). Ownership

Last, monuments are to be included under "other buildings and structures" in SNA balance sheets. But estimating their value is obviously complicated. Ideally one would want to use comparable sales price. In the absence of such prices, statisticians rely on the perpetual inventory method. The value of an old monument, however, cannot easily be estimated by cumulating investment flows when no such flow was recorded at the time it was built. When already included in the balance sheets, application of the PIM means that monuments get depreciated over time and eventually fully written off, unless specific depreciation patterns are applied. To deal with this issue, the 2008 SNA recommends that from time to time statisticians adjust upwards the value of monuments – an adjustment which should be recorded as a positive "other volume change" (SNA 2008, 12.15). In practice, it seems that in most countries old monuments are not recorded in the balance sheets at all, while relatively recent monuments – for which investment series are observable – seem to be.[20]

Consumer durables and military assets

There is usually little controversy on what is to be counted as tangible fixed asset. Two exceptions are consumer durables and military assets.

First, the SNA excludes consumer durables from balance sheets, and all countries in our sample follow this convention with the notable exception of the U.S.[21] In the SNA, investments in durables are to be treated as current consumption despite the fact that they yield a flow of benefits over time. There is no sound economic reason for excluding durables from the scope of asset,[22] but a practical one: including them would ask for including an additional flow of capital income to the household sector. This would require having data on the rental prices of durables goods, which in practice rarely exist because of the lack of leasing markets.[23] In this research we

transfer costs for non-produced assets are treated quite oddly in the SNA (SNA 2008, 10.97). By convention, at the flow level, they are to be recorded as fixed capital formation (under "land improvements" for land, and under a separate heading, "ownership transfer costs on non-produced assets" for the other natal resources). At the stock level, they are to be incorporated in the value of the asset to which they relate. There are no costs of ownership transfers shown separately in the balance sheets.

[20]For instance in France, the buildings of the Louvre museum are not recorded in the balance sheet of the government (only the value of the land underlying the buildings is recorded). However, the museum's pyramid, constructed in 1989, is recorded as an asset, and valued based on what was paid to build it (Baron, 2008, pp.22-23).

[21]Estimates for durables are usually presented as a memo item in published accounts.

[22]Worse, this exclusion causes a certain inconsistency in the accounts: if a vehicle is rented by a household from a lease company, the vehicle is treated as investment by the leasing company in the year it is purchased and then yields a flow of rental payments that adds to GDP. In contrast, cars purchased by household are treated as consumption in the year they are purchased and there is no flow of capital income over the life of the car.

[23]In the U.S., durables are included in produced tangible assets but the BEA does not include the services from durables in GDP. Consumer durables amount to about 35-40% of national income. Jorgenson and Landefeld (2006, p. 45) propose to include the services yielded by durables in GDP, on the basis, for instance, of their rental prices imputed by BLS for its productivity accounts. They find that this would increase U.S. GDP by about 10% (Jorgenson and Landefeld, 2006, Table 1.5 p. 51). The reason why the impact on GDP is so large despite the modest amount of stock of durables is because durables typically depreciate very quickly (the depreciation rate retained by Jorgenson and Landefeld is 20%, see Table 1.22 p. 73), thus the rental price of durables and the gross flow of capital services is high. The net flow (to be included in national income) is of course

stick to SNA guidelines and always exclude durables from assets (and income).

Second, in the 1993 SNA, only those military assets that could be used for civilian purposes, such as buildings, airports, roads, and hospitals, were included in the balance sheets. The 2008 SNA now includes military weapons, which are seen as being used continuously in the production of defense services (deterrence in peacetime). In practice, some countries (e.g., the U.S.) have included military weapons in the government's balance sheet for a long time, while other still do not (e.g., France). We have not tried to correct the raw data to improve comparability in this area: as far as defense spending is concerned, the distinction between consumption and investment is particularly fuzzy. This problem is unlikely to matter much: even in the U.S., which has the highest amount of defense spending relative to national income in our sample, estimated federal government defense fixed assets (including weapons, buildings, etc.) barely amount to 10% of national income in 2010.

Inventories and valuables

Beyond fixed assets, the second type of produced tangible capital in SNA balance sheets is inventories (AN.12) and valuable (AN.13). These assets are small and do not raise practical difficulties.[24] They are typically estimated by combining both census-like method[25] and cumulated flows.

B.2 Non-produced tangible capital (natural resources)

One key advantage of SNA balance sheets compared to traditional estimates of the capital stock is that they include estimates for non-produced tangible capital (that is, natural resources) which cannot be obtained by applying the perpetual inventory method, and therefore are lacking in virtually all cross-country databases and have been widely disregarded in growth accounting exercises.[26] Here we discuss which natural resources are covered and how their value is estimated.

There are three broad types of natural resources in the SNA: land (AN.211), subsoil assets (AN.212), and other natural assets (AN.213, AN.214, and AN.215).[27] In principle, must be recorded in the balance sheets all natural resources "that are subject to effective ownership and are capable of bringing economic benefits to their owners, given the existing technology, knowledge, economic opportunities, available resources, and set of relative prices" (SNA 1993, 13.18). This means that environmental assets over which there are no ownership rights, e.g., seas and air,

much smaller, typically the equivalent of $5\% \times 40\% = 2\%$ of national income.

[24]One minor problem is that trees grown for timber (by opposition to trees that yield repeat products (e.g. fruits, etc.) are to be counted as inventories, but it seems that not all countries follow this convention (the distinction between fixed asset and inventory can sometimes be a bit obscure). See discussion below of natural resources. Further, the U.K. does not currently include valuables in its balance sheet but plans to do so with the adoption of the 2010 ESA, and Germany does not measure yet inventories and valuables..

[25]See Baron, (2008, p. 54-55) for the data sources used in the estimation of the stock of forests in France.

[26]One notable exception is Caselli and Feyrer (2007) who attempt to account for natural resources in their computation of the marginal product of capital, based on the natural resources data gathered by the World Bank for its "Wealth of Nations" database, available at http://data.worldbank.org/data-catalog/wealth-of-nations.

[27]Together, they formed the category of "tangible non-produced assets" in the 1993 SNA, which has been relabeled "natural resources" in the 2008 SNA (AN.21).

are not measured. Similarly, wild land and virgin forest over which there is no commercial exploitation are not economic assets for the SNA, and thus will not be included in balance sheets. But land put to an economic use by a well-identified owner will, as well as forests harvested on a large scale for timber. Lastly, natural resources exclude assets whose growth is the result of human cultivation, such as livestock and vineyards, which are produced tangible capital.

How should natural resources be valued? The general rule is that all assets must be valued at market prices based on observed transactions. In many cases however, there are no such prices (e.g., for natural resources which are the property of the government and never sold). In these cases, statisticians should aim at computing a present value of future returns (SNA 1993, 13.28).[28] Each of the three broad types of natural resources raises specific difficulties and recording practices remain somewhat heterogeneous across countries.

Land

There are three types of land: (i) land underlying residential buildings, (ii) land underlying non-residential buildings,[29] and (iii) other land.[30] For all types, recorded values should exclude the value of all buildings, cultivated crops, etc.[31] In practice, it is often difficult to separate the values of buildings and of the land underlying. In this case, the SNA indicates that land values should be obtained by subtracting the replacement cost value of the buildings (obtained by the perpetual inventory method) from the value on the market of the combined land and buildings (SNA 1993, 13.57). One consequence is that, by construction, increases in real estate prices, to the extent that they do not reflect increases in construction costs, are attributed to land rather buildings in the balance sheets.

The balance sheets of the countries in our database all cover land. Coverage is very good: all types of lands are usually included for all sectors. The exceptions are as follows: in the U.S., U.K., and Germany, "other land" is not measured,[32] and in the U.S., land underlying buildings is not measured for the government and financial corporations sectors. In the country-specific sections, we precisely describe how we correct for these inconsistencies. In effect, our series include all forms of

[28]This method raises many issues, in particular the choice of the discount factor. The SNA 1993 indicates that "the rate of discount and the capitalization factors should be derived from information based on transactions in the particular type of assets under consideration – forest lands, mines and quarries – rather than using a general rate of interest, such as one derived from the yield on government bonds." (SNA 1993, 13.34).

[29]In ESA accounts, both are included under AN.2111, "land underlying buildings and structures."

[30]This includes land under cultivation (AN.2112); recreational land and associated surface waters (AN.2113); and other land and associated surface water (AN.2119).

[31]In particular, major improvements to land are to be treated as gross fixed capital formation, and the resulting asset separated from the land itself. To this end, the 2008 SNA introduces a new "land improvement" asset under "buildings and structures." When it is impossible to separate the value of the land before improvement and the value of the improvements, the 2008 SNA states that the land should be allocated to the category that represents the greater part of the value (while the 1993 SNA used to include improvements with land itself). In a similar vein, ESA 1995 guidelines recommend that for forests, trees should be distinguished from the underlying land and recorded as part of national inventories (AN.12), see e.g., Baron (2008, p. 54) for the case of France. This convention is retained in the 2008 SNA (13.51).

[32]With the exception of agricultural land (AN.2112) which is measured in the U.K. and U.S.

land (as defined by SNA) for all countries, including "other land". Over the 1970-2010 period, the corrections are quantitatively inessential, because agricultural land has become a relatively minor asset. When one makes comparisons over longer time periods, however, it is critical to ensure that all forms of land are included.

As we stress in the main text of the paper, it should also be emphasized that land values include the cumulated value of all land improvment made in the past, and that it is fairly complicated to isolate the "pure" non-produced component out of the total. To a large extent, this also applies to other natural ressources.

Subsoil assets

Subsoil assets, labeled mineral and energy reserves in the 2008 SNA, include coal, oil, natural gas, and minerals that are economically exploitable given current technology and prices. One difficult question is which sector they should be attributed to. In some countries, subsoil assets legally belong to the owner of the ground, but in others they always belong to the government, which in turn grants extraction rights. The 2008 SNA generally makes a clear distinction between legal and economic ownership but indicates that in this specific case legal ownership should always be followed (SNA 2008, 13.50) and thus subsoil assets legally owned by the government should be recorded as assets for the government, even when they are extracted and eventually exhausted by private sector companies. When the government grants extraction rights to the private sector, a flow of "rents on subsoil assets" should then be written.[33]

The choice to attribute subsoil assets to the government when it is the legal owner is not innocuous: it potentially raises a double-counting issue. Government-owned subsoil assets exploited by private corporations are arguably capitalized in the corporations' equity prices. So they risk being counted twice in national wealth: both as government wealth (directly) and as private wealth (indirectly through equities).

In practice, in our sample of countries, the U.S., U.K., Germany and Italy do not estimate yet the value of subsoil assets. Australia, Japan, France, and Canada do. Australia and France attribute all subsoil assets to the government, while Japan attributes them to non-financial corporations. Canada does not attribute subsoil assets to any particular sector and reports them in separate memo accounts. To ensure consistency, we chose to always report subsoil assets as a "memo item" excluded from our market-value national wealth, just like in Canada.[34] This way we avoid any risk form of double counting and we are consistent across our sample countries.[35] When information on the value of subsoil assets is not available from

[33]Note that subsoil assets, just like land and any immovable assets, can never directly belong to the rest of the world: in the SNA all domestic non-financial assets belong to resident units. Foreign holdings of non-financial assets are recorded as foreign holdings of equities in artificial domestic corporations, called notional residents units, which are the owners of the non-financial assets. See SNA 2008, 4.49.

[34]There is no double counting issue when national wealth is measured at book-value, i.e. when corporations' net assets are measured by the perpetual inventory method rather than through equity prices. So when sufficiently detailed series are available (i.e., in the case of Australia and Canada), we include subsoil assets in book-value national wealth.

[35]In practice we did not make any correction to the Japanese and French data because subsoil assets are essentially 0. So we simply corrected the Australian data – i.e., removed subsoil assets from the government balance sheet to a memo column, see discussion below of Australian data.

national balance sheets (U.S., U.K., Germany, Italy), we report for comparison purposes estimates provided by the World Bank in its Wealth of Nations database for the years 1995, 2000, and 2005. Subsoil assets appear to be less than 10% of national income in the U.S., Japan, Germany, France, and U.K, but as high as 35% in Australia and 60% in Canada.

Other natural resources

These include "non cultivated biological resources" (AN.213), "water resources," (AN.213), and what the 2008 SNA labels "other natural resources" (AN.215), which includes radio spectra and other assets. Since market prices are typically not available for these kind of natural resources, they are to be valued by the present value of their future expected returns.

There is substantial heterogeneity in how these assets are presently recorded, but this is of no consequences for our purposes given their very limited importance in national wealth. Forests appear to be the only potentially important asset of this kind in our sample of countries, and so we provide estimated values (coming either from official balance sheets or from the World Bank Wealth of Nations) as memo items in the country-specific files.[36] The value of timber forests appear to be negligible in Germany, France, U.K., Italy, and Australia, and more significantly positive in the U.S. (6% of national income), Japan (15%) and Canada (25%). Australia has started reporting estimates of radio spectra but these appear to be negligible[37] and we do not attempt to upgrade other countries' balance sheets.

B.3 Intangible capital

Contrary to a widely held view, national balance sheets do include estimates for intangible capital. Coverage is arguably imperfect, but it is expanding. In particular, a key development in the 2008 SNA was to include R&D as an asset, so that the balance sheets now cover – at least in principle – what is most commonly considered to be part of corporations' intangible capital.[38] There remains, however, some heterogeneity in recording practices.

R&D

The first and most important category of intangible capital is R&D. Up to the 1993 SNA, R&D expenditure used to be treated as intermediate consumption. With the 2008 SNA they are now counted as investment. At the time we conducted

[36] According to SNA guidelines, virgin forests should be recorded as "non-cultivated biological resources," (SNA 2008, 10.182 p.214) while for timber forests, trees should be recorded as inventories (work-in-progress) and the land underlying as land. However the conceptual difference between virgin and timber forests is somewhat obscure, so we report estimates for the overall value of forests.

[37] In 2011 radio spectrum were estimated to be worth A$8.8bn, i.e. less than 1% of national income.

[38] See for instance Corrado, Hulten, and Sichel (2005, pp.24-25) for a classification and estimation of intangible capital in the U.S. Two borderline cases are firm-specific human capital (e.g., cost of developing workforce) and organizational structure, for which there is no consensus in scope. The SNA has always refused – rightly in our view – to include human capital in its balance sheets. As long as third-party markets do not exist for management innovation and intangible assets of the like, it seems justified to exclude them from the balance sheets.

this research, all countries except Australia still applied the 1993 SNA. However, a number of countries, most prominently the U.S., had already started compiling satellite R&D accounts (see Lee and Schmidt, 2010 for results covering the 1959-2007 period) and were planning to include R&D in their main accounts. The OECD also publishes data on R&D expenditure in member countries.

There are two potentially relevant measures or R&D, depending on the question one is interested in: stocks of R&D including and excluding spillover effects, i.e. the benefits of R&D that spill over from the original investor to other actors.[39] From the viewpoint of SNA balance sheets, what matters is what R&D is worth for its owner, and so we focus on R&D stocks excluding spillovers.

According to BEA, U.S. gross investment in R&D is about 3% of GDP and this ratio has been roughly stable since the 1960s. This is a bit higher than the OECD average of about 2.5%. Depreciation in the U.S. is estimated to be about 2% of national income so that net investment in R&D is barely 1%.[40] Net stocks of R&D are estimated to be worth about 15% of national income.[41]

Measuring R&D raises formidable difficulties, and R&D accounts are still in their infancy. Like other produced assets, R&D stocks are obtained by applying the perpetual inventory method, i.e. by cumulating constant dollar measures of research and development expenditures and by allowing for depreciation and other price changes. Many of the difficulties raised by the PIM discussed above are compounded when applied to R&D. Accounting for depreciation (Mead, 2007) and price changes (Copeland et al., 2007) is fraught with difficulties. R&D depreciation rates found in the literature range from 12% to 29% and it is certainly possible that currently published BEA estimates over-estimate depreciation. It is also likely that all R&D expenditure are not well identified yet, so that gross R&D flows may be understated. So in our view, one should probably see a 1% yearly net flow of R&D as a lower bound.

Given the many difficulties in estimating R&D and the lack of reliable data sources for most countries, we have not tried to systematically add R&D expenditure to saving flows in our database. However, when we decompose wealth accumulation between saving and capital gains effects, we provide a number of robustness checks by adding rough estimates for R&D to saving flows, on the basis of the U.S. data.[42] In the U.S., a 1% net flow of R&D cumulated over the 1970-2010 amounts to a R&D stock of about 20% of national income in 2010. We also explore scenarios

[39]In the U.S., BEA presents data on R&D excluding spillovers and the BLS including spillovers (but BLS estimates are restricted to R&D of private firms, in contrast to BEA which includes estimates for government, universities, and other non-profit institutions).

[40]BEA also provides estimates of the "capital services" provided by the stocks of R&D to the government and non-profit sector. In 2007, these services, net of depreciation, were estimated to be worth about $50bn, i.e. less than 0.5% of national income. This means that if the net return on government (and non-profit) capital was to be included in national income (which is currently not the case) accounting for R&D would raise national income by an additional 0.5% (but saving would not be affected).

[41]In Australia, net stocks of R&D are estimated to be worth about 7-8% of national income.

[42]We have not attempted to use individual country data (say from the OECD science, technology, and industry dataset) because estimates of net-of-depreciation R&D flows are not available in most countries yet. Most countries in our sample appear to be relatively close to the U.S. gross level of R&D expenditure (about 2-3% of GDP), with the notable exceptions of Italy and Spain which seem to be closer to 1.5%.

in which the actual net flow of R&D is 2% of national income (which translates into a cumulated 1970-2010 flow of about 50% of national income in 2010), which would be closer to the truth if currently available U.S. data overstate depreciation or understate gross R&D expenditures.

Intellectual property products other than R&D

In addition to R&D, the 2008 SNA includes four other types of intellectual property products:[43] (i) expenditure on "mineral exploration and evaluation," (ii) "computer software and database," (iii) "entertainment, literary or artistic originals," and (iv) "other IP products."

All countries in our database have data for computer software.[44] However, no country except Australia covers yet mineral exploration, artistically originals and other IP products yet. In Australia, these assets appear to be almost negligible (about 5% of national income). Looking forward, the implementation of the 2008 SNA will probably mean significant improvements in this area, although the limitations of the PIM are often compounded when applied to intangibles.

Non-produced intangible capital

The last category of intangible capital consists of a number of "non-produced" intangible assets: on the one hand, contracts, leases, and licences;[45] on the other, goodwill and marketing assets (brand names, trademarks, logos and domain names, etc.). Note that the distinction between "produced" and "non-produced" intangible capital is particularly fuzzy. Marketing assets, for instance, are logically produced assets, but the SNA classified them as non produced (due to the difficulty in measuring their value).

The 2008 SNA includes specific guidelines as to which types of contracts, leases and licences should be counted as assets: only those that enable a party to benefit from an asset or service at advantageous conditions, i.e. "at a price that would differ from the price that would prevail in the absence of the contract, lease, or licence" (SNA 2008, 10.186). Examples include tenants who have fixed rentals but are practically able to sublet their building for a higher price ("marketable operating lease"),[46] licences to use radio spectra granted to mobile phone operators ("permits to use natural resources"),[47] taxi licences when they can be sold ("permit

[43]Intellectual property products" (AN.117) are defined as products that are "the result of research, development, investigation or innovation leading to knowledge that the developers can market or use to their own benefit in production because use of the knowledge is restricted by means of legal or other protection" (SNA 2008, 10.98).

[44]For instance, in the U.S. software is included in the balance sheet since the benchmark revision of the national accounts that took place in 1999. It should be noted however that the SNA does not impute a flow of services from stocks of software – which would raise the same estimation issues as for consumer durables.

[45]These include marketable operating leases, permits to use natural resources, permits to undertake specific activities, and entitlements to future goods.

[46]When such leases are not marketable, they are to be excluded from assets. In the U.K., the ONS used to record a pretty large amount of "non-marketable tenancy rights", but these rights, since they are non-marketable, do not meet the SNA definition of an asset and so have been excluded from wealth in the official UK accounts since 2012 (we have also systematically excluded them from the series we report in our database, see U.K. section below).

[47]Note that in the case of mobile phones, the SNA makes a clear distinction between the spectrum, which constitutes a natural resource (a tangible, non-produced asset), and the license

to undertake specific activities"), and publishers' exclusive rights to publish new works by a famous author ("entitlements to future goods and services").

Goodwill and marketing assets are not recorded for all corporations, but only when their value can be identified through market transactions, i.e. when they are purchased. That is, if a corporation is bought at a price that exceeds the value of its net assets, then in principle statisticians are supposed to record the difference as goodwill and marketing assets. At the time we conducted this research, only Italy did provide estimates of goodwill, and no country except Australia had data for contracts, leases and licences.

C Financial assets and liabilities

In addition to tangible produced assets, natural resources, and intangible capital, financial assets and liabilities are the fourth broad category of wealth included in SNA balance sheets. They play a central role in this research, as gross financial wealth is typically about 50% of gross private wealth.[48] Financial assets and liabilities are typically compiled by central banks and then integrated in the overall balance sheet by the domestic statistical institute. In the U.S. for example, financial balance sheets are produced by the Federal Reserve Board, and then used by the Bureau of Economic Analysis for inclusion in the Integrated Macroeconomic Accounts. The financial positions of the various sectors of the economy are obtained by direct census-like methods, not by cumulating financial investment flows. Inputs include the balance sheets of individual financial institutions (banks, insurance companies, investment funds, etc.) as well as surveys of the off-balance sheets positions of banks (e.g., in order to establish the portfolio holdings of the household and corporate sectors).

Regarding pensions, pay-as-you-go, social security pension wealth is not recorded as assets – and rightfully so in our view. Including unfunded, social security pension wealth in the balance sheets would raise all sorts of difficulties. In particular, it would logically call for the inclusion of the net present value of all other public spendings and taxes. While doing so is certainly useful for some analytical purposes, such computations are inherently fragile, and for the purpose of this comparative

to use the spectrum, which constitutes a separate asset (intangible and non-produced). In general, however, what should exactly be included in "permits to use natural resources" is unclear. Take the case of government-owned fishing waters. The SNA recognizes that there are two options (SNA 2008, 17.333 sqq). The government can grant a fishing quota to the private sector for exploiting the assets during an extended period of time. In this case, a "permit to use natural resources" asset should be recorded. The government can also extend permissions to fish from one year to the next. In this case, no "permit" should be recorded in the balance sheet: the fishing waters are considered to be leased, and the government earns a flow of "rents on natural resources". Of course the frontier between the two situations is particularly fuzzy. As regards mineral resources, the SNA recommends to always record a flow of rents rather than a permit asset (SNA 2008, 17.340 sqq.). Permits to use natural resources were essentially created to account for mobile phone licences and in practice only cover this type of asset.

[48] In our database one can actually distinguish two groups of countries. In the U.S., U.K., and Canada, gross financial wealth / gross private wealth ratios fluctuate around 60% over the 1970-2010 period, while in Germany, France, Italy, and Australia , they fluctuate around 40%. Japan has transitioned from the latter group (34% in 1970) to the former (58% in 2010).

research we prefer to retain a more standard notion of wealth.[49] Claims on private pension funds, however, are included in the balance sheets.[50] Note that while the value of private pension funds and life insurance reserves is counted as financial asset in the household sector balance sheet, the value of public pension funds reserves (if any) is counted as financial asset in the governement sector balance sheet.

C.1 Valuation issues

While market values of financial assets can usually be readily observed, this it not always the case, and obtaining market-value approximations can sometimes prove difficult. There are three main issues. The first relates to shares in unlisted companies. The 1993 SNA recommended that unlisted shares should be estimated on the basis of the prices of listed companies with similar earnings and dividend history and prospects, with, if needed, a downward adjustment to account for inferior liquidity. The 2008 SNA provides somewhat less restrictive guidance; valuation can be based on recent transaction price, net asset value, price to earnings ratios, book values reported by enterprises with macrolevel adjustments, and so on (SNA 2008, 13.71). Practices, however, still differ across countries.

A second valuation issue arises for corporations such as public enterprises, the central bank, and partnerships, that do not issue shares. In this case, what is recorded in SNA balance sheets is an "other equity" line equal to the corporation's net assets (SNA 2008, 13.74).

Lastly, debt securities should always be valued at their current market prices (SNA 2008, 13.59). That is, a bond with a face value of 100 that trades for 70 should be recorded in the debtor's balance sheet as a liabilities of 70.[51] The market price is the one that matters because debtors usually have the possibility to buy-back their own bonds if they so wish. But while most countries in our sample follow market value accounting, the U.S. currently does not: bonds are recorded at par value.[52]

Measuring bonds at market value has the important advantage of making it impossible for governments to manipulate the recorded amounts of public debt. Under face value accounting rules, by contrast, a government can artificially drive down its indebtedness by systematically issuing bonds above par (e.g., bonds with face values of 100 that promise very high coupon payments, such that the market price of the bonds when initially sold is above 100). One also needs public debt series expressed at market prices to compute real returns on government debt (see Hall and Sargent, 2011, for such an exercise on U.S. data).[53]

[49] Note that the 2008 SNA encourages to provide information on implicit liabilities of pay-as-you go social security pension systems in a satellite account.

[50] This is true whatever the nature of the funds – defined benefit or defined contribution. An asset (and a liability for the pension provider) must be recorded regardless of whether the employer has recorded any pension liability in its own balance sheet.

[51] Relatedly, although loans should be recorded in the balance sheets at nominal values, non-performing loans should be reported as a memo item at market values (SNA 2008, 13.67).

[52] Note also that in the European Union, public debt under the Maastricht treaty is also recorded at face value (but at market value in SNA balance sheets).

[53] Interest payment series, in particular are insufficient, because the government can always artificially drive down to 0 its flow of interest payments by issuing and perpetually rolling over zero-coupon bonds. Consider the following example: the government issues a $100 par value zero-coupon 10 year bonds, i.e. promises to pay $100 in 10 years and 0 interest in the meantime.

In normal circumstances there is usually little difference between market and face values. In the U.S., the market/par ratio has always between 90% and 110% over the 1942-2010 period,[54] and so we found it unnecessary to correct the official BEA series.[55] However, in periods of crisis, market and par values can substantially differ. This was the case for a number of European countries in the 1920s-1930s and in the U.K. during Napoleonic wars. Market values can also be much below face values in countries with very poor records on debt commitment. Unfortunately, precisely estimating the total market value of government debt can be quite complicated when numerous types of government debts co-exist. The notion of market value is also problematic when a large chunk of the debt is not tradable, as was the case in 18th century France where a lot of the debt consisted in inalienable life annuities (Weir, 1989; Velde and Weir, 1992). Estimating market values, by contrast, is a fairly manageable task when the public debt takes the form of a single perpetual bond, as was basically the case in the U.K. during the second half of the 18th century and the entire 19th century.[56] In this case, a straightforward comparison of the nominal coupon interest rate (e.g., 3% in the U.K. between 1757 and 1888) with the actual yield (given by market quotes) is enough, provided the total quantity of bonds in circulation is known. We discuss the sources we use for the historical estimates of public debt in the individual country appendices devoted to the U.S., U.K., France, and Germany.

C.2 Central bank balance sheets

Although their output is primarily non-market, in national accounts central banks are not included in general government but in the financial corporation sector. They are treated as public financial companies controlled by government. They make profits, because they pay less on their liabilities than on their assets (seignorage income), which they fully remit to governments in the form of dividends. The control exercised by the government on the central bank is reflected in an "other equity" asset in the government's balance sheet.[57] How this "other equity" should

Assuming a constant 4% interest rate r, the price of the bond on the market when issued is $100 \times (1+r)^{-10}$, i.e. 67.5. One year after, the market price of the bond is $100 \times (1+r)^{-9}$, i.e. 70.2. The government re-purchases the bond at a price of 70.2, bondholders make a capital gain of 2.7 and no interest is formally paid. The government then issues a new 10-years 0 coupon bond, etc.

[54] To compute this ratio we use Cox and Hirschhorn (1983) who provide market values for government bonds for 1942-1980, and the subsequent update of this work conducted at the Dallas Fed (which was published on the Dallas Fed website until 2012 but did not appear to be available online anymore in April 2013). See Hall and Sargent (2011, p. 199) for references on the other attempts at measuring the market value of U.S. federal debt.

[55] One practical difficulty with using market values is the lack of estimates for State and local government debt.

[56] In 1752, all U.K. government bonds were consolidated in a single perpetual bond, the consol. The original interest was 3.5%, later reduced to 3% (in 1757), 2.75% (in 1888, Goeschen's conversion) and 2.5% (in 1903).

[57] The U.S. is an exception: the shares of the Federal Reserve Banks are not held by the government but by the 3,000 or so private banks which are members of the Federal Reserve System (all national banks have to be member while state banks are free to join). Holding shares of a Federal Reserve Bank is a condition for being part of the System. However, these shares do not carry with them any control right or claim on profits: shareholders are given a 6% divi-

be valued is largely a matter of convention, since the central bank is not a typical for-profit company whose shares can be traded. The SNA indicates that the central bank's equity should be set equal to its net assets, i.e. the difference between its total holdings (foreign exchange reserves, domestic bonds, etc.) and its non-equity liabilities (banknotes, deposits held by commercial banks, etc.).

If bonds are recorded at book value, the central bank's net assets are typically very small and largely invariant to the scale of its operations: if a central bank wants to increase its assets by \$X, it also has to create \$X in new liabilities,[58] leaving its net assets (hence government gross and net wealth) constant. This is true whatever the nature of the central bank's assets, i.e. even if it mostly holds foreign claims.[59] Net assets will temporarily vary in the unlikely event where the central bank realizes losses on its holdings. In principle, one can imagine losses high enough such that the central bank's net assets become temporarily negative, i.e. the central bank is technically insolvent. This does not raise any particular issue, however: since the central bank makes profits from seigniorage, it can always build up its equity capital by stoping dividend payments to the Treasury for some time, until its net assets recover.[60]

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dend and all profits are paid to the Treasury. See Board of Governor of the Federal System, "The Federal System: Purposes and Functions", 9th edition, June 2005, p.12, available online at http://www.federalreserve.gov/pf/pdf/pf_complete.pdf.

[58]The central bank has two different types of liabilities: (i) monetary liabilities, such as banknotes, that do not pay interest but provide some services (e.g., means of payments); (ii) non-monetary liabilities, such as fixed term deposits, that pay some return attractive enough for banks to hold them. When the central bank finances its asset purchases by increasing its non-monetary liabilities (which is typically what has occurred since 2008-200), the expansion of the balance sheet is sometimes said to be "sterilized". But since the central bank commits to exchanging deposits for banknotes upon request, increasing the monetary or non-monetary liabilities eventually has the same inflation implications. See Reis (2013) for an analysis of central banks' balance sheets.

[59]In China for example, the PBOC had about 20 trillion yuans in foreign assets (about US\$3,200bn) at end 2011, but about the same in liabilities (reserve deposits, bonds, and other). The PBOC, like any central bank, can directly purchase foreign assets if it so wishes, but it has to give foreigners newly created yuans or deposits in exchange. In practice the PBOC purchases dollar assets from the banks of Chinese exporting firms (which have plenty), and gives them deposits in exchange (so that the PBOC liabilities belong to residents, not foreigners). In effect, there is a transfer of foreign claims from the corporate sector to the central bank in order to enable the PBOC to implement its exchange rate policy. The central bank attempts to "sterilize" the inflationary consequences of the increase in Chinese bank assets by offering them bonds and fixed term deposits in exchange of their dollars, rather than currency and liquid deposits. Other countries where the central bank monopolizes a large fraction of the country's foreign assets in order to control the exchange rate – prompting fears of "currency wars" – include Switzerland and Japan. In Switzerland, the foreign claims of the SNB increased from 15% of GDP in 2008 to more than 50% in 2011, as the SNB committed to maintaining a floor on the Swiss franc/euro exchange rate. At the same time, Swiss corporations' net foreign assets decreased and their claims on the SNB increased, so that the overall net foreign assets of Switzerland and net worth of the SNB remained roughly unchanged. In Japan, official reserve assets are not held by the central bank but by the Ministry of Finance, which is part of general government, but the mechanisms are the same (the Bank of Japan acts as agent for the government and is not independent in this respect).

[60]It can also ask the government to recapitalize it, which will happen automatically if the dividend rule is such that the dividend payment is always equal to net central bank profit, be it positive or negative. See Hall and Reis (2013) for an analysis of central banks' dividend rule payments.

If assets are recorded at market value, as the SNA indicates they should, then the central bank's net assets vary from year-to-year along with the market valuation of its bond holdings. In practice, most countries appear uneasy with the idea of recording sizable fluctuations and potentially negative value for the central bank's equity. Consequently they chose to keep recorded central bank equities fixed at their book value, i.e. at the amount of capital paid up by the shareholders.[61] So for instance the Fed's equity capital in U.S. balance sheets is equal to the capital paid up by the Federal Reserve System member banks, which totaled about $25bn in 2010.[62] The same goes in Japan, where the BoJ is valued at a mere 100 million yens (about 1 million US dollars) and in the U.K., where the BoE capital has been worth £14.6 million for centuries. In France, by contrast, the equity of the Bank of France seems to reflect the difference between the market value of its assets and its liabilities, consistent with SNA guidelines.[63] More harmonization would be desirable in this area. An alternative way to measure the central bank's equity would be to take the present discounted value of seignorage income. Practically this would not make a lot of difference with currently recorded values, but it would probably be somewhat more consistent.[64]

D Private and national wealth and capital

D.1 Definition of private and government wealth

There are four domestic sectors in the SNA: households, non-profit institutions serving households (NPISH), corporations, and the general government. In the balance sheets, each sector has a net wealth equal to its non financial assets plus financial assets minus liabilities.[65]

[61]Note that this can be done while maintaining market valuation of assets by adding in the liability side of the balance sheet a line equal to the unrealized capital gains/losses on the central bank's portfolio (so that losses show as negative liabilities). This is what the ECB does: its equity capital is basically fixed (it only increases when new central banks join the Eurosystem or the EU), and unrealized trading losses/gains appear as "revaluation accounts" in the ECB balance sheet.

[62]In the balance sheet, the Fed's assets are also at book value. Equity only increases when new capital is paid up by member banks. Earnings accumulated by the Fed but not yet paid to Treasury are recorded in the liability side of the Fed's balance sheet as "interest on Federal Reserve notes due to the U.S. Treasury." If the Fed makes operating losses (e.g., in case it realizes losses on its portfolio), the equity capital of the Fed does not decrease, but the Fed records negative "interest on Federal Reserve notes due to the U.S. Treasury" and dividends payments are stopped until the losses are offset. See Carpenter et al. (2013, p. 11).

[63]Bank of France equity was worth about $100bn euros in 2010 (5% of national income). From 1994 to 2007 it was worth 30-40bn, then 65bn in 2009 and 91bn in 2010. This increase explains the increase in the "other equity" assets of the general government, from about 100bn before the crisis to 160bn in 2011.

[64]Before the crisis, Fed dividend payments to the U.S. Treasury amounted to $20-30bn per year. They increased to about 80bn during the crisis, but are projected to diminish in the years ahead, and come back to about 30bn around 2020 (Carpenter et al., 2013). Capitalized at 5%, this would put the Fed's equity at about $600bn, i.e. about 5% of national income – which is comparable to the currently recorded "market" value of the Bank of France.

[65]By convention, in SNA balance sheets equities are included in liabilities; so unless we specifically mention otherwise, the term "liabilities" must be understood including equities. The corporate sector is always broken down between nonfinancial and financial corporations, but for

In this research, we define private wealth as the net wealth of the households and NPISH sectors. In addition to individuals, the households sector includes most unincorporated enterprises.[66] The NPISH sector includes all non-profit institutions that are neither controlled by government nor market producers. It therefore excludes institutions like private hospitals and schools that charge fees high enough to cover the majority of their production costs – those are market producers and thus part of the corporate sector.[67] The frontier between households and NPISH is often blurred, and we see this fact as one key argument for including NPISH in private rather than government wealth. For instance, when charitable givings are tax deductible and foundations are laxly regulated there are incentives for wealthy individuals to create shell foundations to shelter assets and avoid taxes (see Landais and Fack, 2011). In this case including NPISH with households is clearly the right thing to do.[68] From a more practical point of view, it is also the right thing to do for the purpose of our comparative research because in some countries NPISH are not isolated as a separate sector but indistinguishably included with households. Overall, NPISH net wealth is usually small, and always less than 10% of private wealth: about 7% in the U.S., 4% in Japan, 1% in France.

Next, we define government wealth as the net wealth of the general government sector, which includes central, state, and local governments, as well as social security administrations. Government units that are engaged in market production and keep a complete set of separate accounts are not in general government but in the corporate sector – which of course includes all government-controlled companies.

simplicity we report results that aggregate both types of companies. Detailed separate series are available in the Excel files.

[66]Specifically, it includes all unincorporated enterprises owned by households except those that have sufficiently detailed accounts and behave in the same way as corporations, which are in the corporate sector ("quasi-corporations"). In practice, the frontier between quasi-corporation and other unincorporated enterprises is hard to draw, and a number of "quasi-corporations" are probably not recorded as such. Differences in the recording of quasi-corporations is problematic since it can affect the comparison of the structure of production across countries, the computation of labor and capital shares, and the analysis of the structure of household wealth. Take for instance an unincorporated enterprise that has 100 in nonfinancial assets, and 0 in financial assets and liabilities. If it is recorded as a quasi-corporation, the household sector will have 100 in equity assets, otherwise it will have 100 in nonfinancial assets. For our purposes in this research, however, such problems are largely irrelevant.

[67]In the SNA, the key criterion to determine whether a unit belongs to the corporate sector is whether the unit is a market producer or not. A market producer is an entity that offers the majority of its production at "economically significant prices," which usually means that sales cover more than half the costs.

[68]Note that while foundations are to be included in the non-profit sector, family trusts, which are also a common vehicle for avoiding taxes, are to be treated as quasi-corporations (SNA, 2008, 24.75). That is, trusts are in principle financial companies, and households are supposed to own equities equal to the net worth of the trusts they own. Given that a great number of trusts are set up in offshore tax havens, this means that U.S. and U.K. statisticians should record a sizable amount of foreign "other equity" on the asset side of the household sector balance sheet (even though the trusts may mostly own domestic assets). What happens in practice is a bit unclear. Even if statisticians correctly identify the assets of the trust (e.g., because the trust uses a domestic bank for the custody of its portfolio), they might still fail to record an asset for household sector (e.g., if they fail to recognize that the trust is owned by a wealthy family) and too little household wealth would tend to be recorded. And of course if the assets of the trust itself are not captured (e.g., because they are deposited with an offshore custodian) then the nation's financial assets are under-estimated (Zucman, 2013).

The SNA isolates public from private corporations, but not all countries provide this breakdown.

From these definitions of private and national wealth, we consider two measures of national wealth.

D.2 Corporate wealth and the two measures of national wealth

The first measure, what we call "market value national wealth", simply sums private and government wealth. The capital stock of corporations is included in national wealth through the equity holdings of households and the government.

The second measure, what we call "book-value national wealth", sums all the nonfinancial assets (produced tangible capital, non-produced tangible capital, and intangible capital) of all domestic sectors and adds the net foreign asset position. This total is what is sometimes referred to as "national wealth" in the SNA (2008, 13.4) or as the "net worth of the total economy" (ESA 1995, 8.99). By definition, book-value national wealth is also equal to market-value national plus the net wealth of the corporate sector. So the two measures coincide when the net wealth of the corporate sector is zero, or, equivalently, when Tobin's Q is equal to 1.[69]

In 2010, net corporate wealth is close to 0 in the the anglo-saxon countries included in our dataset (U.S., U.K., Canada, and Australia) so using market or book-value national wealth does not make much difference. U.S. national wealth, for example, is 431% of national income if we use the concept of market value national wealth, and 445% if we use the concept of book-value – that is, net corporate wealth is only 14% of national income, and Tobin's Q is equal to 0.98. Most of the time, however, net corporate wealth significantly differs from zero. In Japan, Germany, and France, it is about +150% of national income today. In the anglo-saxon countries it was also significantly positive before the 1990s. In the 1970s, for instance, net corporate wealth was about 54% of national income in the U.S., and as high as 128% of national income in the U.K. – just like in Japan and Germany. As a result, when one uses book-value rather than market-value national wealth, then the national wealth-income ratio is (i) consistently higher in Japan, Germany, and France over the 1970-2010 period; (ii) initially higher in anglo-saxon countries but increases less over time.

What is the most appropriate measure of national wealth? We certainly do not pretend to have a definitive answer to this difficult question, and that is why whenever possible we provide all our results on 1970-2010 wealth accumulation using the two definitions.

From a historical perspective, however, we tend to have a preference for market-value national wealth, because it is a concept closer to the one used by the economists of the 18th, 19th, and early 20th centuries. Historical estimates of national wealth were indeed largely based upon censuses of wealth at market value rather than perpetual inventory method-based estimates of tangible assets. Market-value national wealth is also closer to the concept of wealth that one finds in tax returns, since taxpayers are typically supposed to declare the market value of their holdings in

[69] Tobin's Q is traditionally defined as: (market value of equities + non-equity liabilities) / (total assets). Another ratio sometimes used and that we report in our country files is Tobin's "equity" Q: (market value of equities) / (total assets - non equity liabilities).

the estate and other wealth taxes. So if one is interested in comparing wealth in national accounts with wealth in tax returns (e.g., to estimate the flow of inherited wealth, as in Piketty, 2011) then using market-value national wealth seems preferable.

From a relative reliability perspective, if the equity values recorded in the balance sheets are a better measure of the value of corporations' nonfinancial assets than statistician's direct estimates based on the perpetual inventory method, then using the concept of market-value national wealth is also more justified. In practice, both nonfinancial assets and equity value data have pitfalls, but after a careful examination of the strength and weaknesses of available balance sheets, we have come to the conclusion that nonfinancial assets data are probably somewhat more fragile. The main reason is that corporate tangible assets seem to be systematically over-estimated in national balance sheets.

Quite puzzlingly, indeed, in national accounts Tobin's Q appear to be less than 1 most of the time. On average over the 1970-2010 period, it has been less than 1 everywhere. In Japan, Germany and France, Tobin's Q has been less than 1 every single year over the last 40 years, and although in the anglo-saxon countries it has at times exceeded 1 (during equity stock market booms), it appears to have a tendency to revert below unity. This is puzzling for two reasons: first, macro theory would suggest that Tobin's Q should revert to unity, or even above 1, since intangible capital is imperfectly captured in the balance sheets; second, micro studies consistently find Tobin's Q higher than 1. Although numerous factors are at play, it is likely that these two puzzles owe in part to some over-estimation of corporate tangible assets in national accounts.

D.3 Why is Tobin's Q generally less than 1?

The main reason why corporate tangible assets may be over-estimated in the balance sheets is that the data are based on the perpetual inventory method which, as acknowledged by statisticians, suffers from a number of deficiencies. As discussed above in more details, there are three potentially serious issues. First, it is often difficult to properly discard the assets of firms going out of business, and for that reason too much capital may tend to be recorded. Second, it is notoriously difficult to track the price evolution of a number of capital goods. When statisticians fail to properly account for quality improvement, inflation is over-stated and capital stocks at current prices are also over-stated (old computers are included in the capital stock at too high a price). The bias can be large, as Gordon (1990) argued. Lastly, accounting for depreciation is fraught with difficulties, and depreciation might be under-estimated in national accounts (Wright, 2004).

The corporate tangible overpricing story is consistent with the fact that micro studies consistently find Tobin's Q higher than 1. Fernandes et al. (2013, Table 2), for example, find Tobin's Q around 2 in the U.S. and 1.75 in other countries (with the lowest ratio in Italy, 1.44).[70] Micro estimates of the corporate capital stock do

[70]Data cover 90% of the market capitalization of publicly traded firms in 14 countries and are for 2006 (a higher when stock markets were relatively high). They use the standard definition of Tobin's average Q: (market value of equities + non-equity liabilities) / (total assets). Corporate assets include cash, financial investments, loans, investment in unconsolidated subsidiaries, cus-

not face the problem of accounting for the assets of firms going out of business. It is likely, however, that contrary to national balance sheets, corporate accounts somewhat under-estimate tangible assets, so that the true Tobin's Q probably lies somewhere between macro and micro estimates. First, tax rules typically allow for more generous depreciation allowances, and corporations have an incentive to further over-state depreciation in order to pay less in corporate income tax. That is why in general depreciation computed in the national accounts differs from depreciation reported by corporations for tax purposes.[71] Second, assets are usually recorded at book-value in private accounts – i.e., at the price at which they were bought, rather than at current market prices. So while national accounts may have a tendency to over-state investment goods inflation, private accounts have a tendency to under-state it. Third, many micro estimates do not account for intangible capital at all, while national balance sheets increasing try to do so, at least partly.

The main competing explanation as to why Tobin's Q seems to be less than 1 most of the time in macro data is that the equity values recorded in the balance sheets may be in some sense too low.

First, many equities are not listed. Putting a price on unquoted shares is a highly complicated and uncertain business, and statisticians often have to rely on ad-hoc techniques. So it is entirely possible that the value of the shares in closely held firms are under-stated in some countries and time periods. The SNA states that the equities held by governments in public corporations must be set equal to the corporations' net assets – that is, Tobin's Q is in principle equal to 1 for public companies in national accounts (SNA 2008, 13.74). However, some countries such as the U.K. have not been following this principle and used to put too low values on government's stakes in public companies. This might explain why some countries have recorded very low Tobin's Q in the 1970s and 1980s.

A more fundamental reason as to why equity values may tend to be less than the net assets of corporations is the control rights valuation story discussed by Piketty (2010, Appendix A, pp. 34-35). Equity market prices reflect marginal transactions. But investors who wish to take control of a corporation typically have to pay a large premium to obtain majority ownership. This mechanism might explain why Tobin's Q tends to be structurally below 1. It can also provide an explanation for some of the cross-country variation that we observe in our dataset: the higher Tobin's Q in anglo-saxon countries might be related to the fact that shareholders have more control on corporations than in Germany, France, and Japan. This would be consistent with the results of Gompers, Ishii and Metrick (2003), who find that firms with stronger shareholders rights have higher Tobin's Q. Relatedly, the control rights valuation story may explain part of the rising trend in Tobin's Q in rich countries.

As we explain in the paper, the "control right" or "stakeholder" view of the firm can in principle explain why the market value of corporations is particularly low

tomer liabilities, real estate, property, plant and equipment, other assets; they seem to exclude intangible capital.

[71] In the U.S., the NIPA Table 7.13 provides a reconciliation between depreciation reported to the IRS and recorded in the national accounts. On average over the 1970-2010 period, depreciation in tax returns has slightly exceeded depreciation in national accounts (by about 1% on average). Interestingly, however, since the mid-2000s depreciation is much higher in the national accounts than in corporate tax returns, in contrast to the 1980s, 1990s and early 2000s.

in Germany (where worker representatives have voting rights in corporate boards without any equity stake in the company). According to this "stakeholder" view of the firm, the market value of corporations can be interpreted as the value for the owner, while the book value can be interpreted as the value for all stakeholders. In this sense, both definitions have some merit and should be viewed as complementary: they measure the value of corporate wealth from the viewpoint of different agents. However we should again stress that there are many other - less fundamental - reasons why market and book values differ in practice, and why book values might be abnormally high. It would be highly valuable in future research to make progress on these issues and to attempt to isolate the pure "control right" and "stakeholder" of Tobin's Q. This is far beyond the scope of the present paper.

D.4 Foreign wealth and domestic capital

From national wealth (at market-value or book value), we construct domestic capital by subtracting the net foreign asset position.

Foreign assets and liabilities are recorded in two different places in the macro accounts of countries: in SNA balance sheets (liabilities and assets of the rest of the world sector) and in the international investment position (IIP). The IIP, like the balance of payments, relies on accounting concepts that have traditionally slightly differed from those used in the SNA, but there is an ongoing effort to harmonize both sets of statistics. The 2008 SNA and the 6th edition of the IMF Balance of Payments Manual have in particular fully harmonized both the coverage and accounting rules. Classification still differs, as the IIP uses functional categories (portfolio investments, direct investments, etc.) while the SNA uses instrument categories (equities, bonds, deposits, etc.). And in practice there are still at times some inconsistencies between the data reported in the IIP and in SNA balance sheets. In the country-specific Sections below we explain how we have dealt with these discrepancies.

E Definition and measurement of saving flows

E.1 What we include in saving

In addition to wealth and capital stock data, the main ingredient needed to estimate the capital accumulation equations is of course saving data.

Our saving series directly come from counties' national accounts, and we follow the SNA guidelines in determining what is to be included in saving and what is not. The guidelines are consistent at the flow and stock levels. So in particular, consumer durables are not treated as investment since they are not assets; contributions to social security pay-as-you go pension schemes are not counted as saving, but contributions to private pension funds are. We always measure saving net-of-depreciation, since wealth is also net-of-depreciation in the balance sheets.

We add net capital transfers to reported saving flows. The main capital transfers are capital taxes (D91 in ESA95 classification) and investment grants (D92). In both cases, including net capital transfers in saving is justified, because these transfers add (or subtract) to the amount of resources that can be used to accumulate wealth. Capital taxes are mostly estate and gift taxes received by the government and paid by households. Failure to add them to saving would lead us to over-estimate the personal saving flow (hence record slightly too low residual capital gains), and under-estimate the government saving flow. Investment grants are mostly paid out by the government and received by corporations. Again, they help corporations accumulate capital, so including them in corporate saving is justified. A third category of capital transfers, "other capital transfers" (D99), includes cases in which the ownership of an asset is transferred from one sector to the other, and debt cancelled by mutual agreement between the creditor and the debtor. We also include them in our concept of saving for simplicity – an alternative would have been to include them in "other volume changes" (see discussion below), but practically this does not make any noticeable difference.[72]

Since we are interested in estimating the relative importance of capital gains and saving flows, we do not include any identified capital gain in our measure of saving. For some questions, it might make sense to include some form of capital gains in saving flows. Auerbach (1985), for example, argues that capital gains should conceptually be included if an asset has become more productive, because in this case the capital gain reflects a gain in future production, but should not be included if the price change results for instance from a shift in tastes (e.g., change in the rate of time preference or risk aversion that affects the price of land). Practically, however, identifying the source of capital gains is fraught with difficulties, and in this research we do not attempt to make such distinction. Note, however, that in principle we would like to include in saving flows all those capital gains those are caused by the imperfect measurement of saving and investment (e.g., un-measured investment in intangibles). We cannot do this in our baseline decompositions that rely on published saving and investment series, but when we decompose wealth accumulation we provide a number of supplementary results in which we add rough estimates for the amount of unmeasured saving and investment, in order to check the robustness of our findings.

Lastly, we measure saving in nominal terms. That is, if the flow of national saving is 10 and national income 100, the national saving rate of 10%, whatever the inflation rate. For some purposes (e.g., if one is interested in understanding the determinants of personal saving rates), it is better to measure saving in real terms (see Gale and Sabelhaus 1999 pp. 187-188 and the reference therein). The decrease in personal saving from the 1970s to the 1990s, in particular, may partly owe to the drop in inflation. For our wealth decomposition analysis, however, nominal saving is the correct concept, since our key objective is precisely to estimate the role of capital gains and losses in wealth accumulation.

E.2 How we account for R&D

As explained in Section A.2.3., in the 2008 SNA R&D is to be included in saving flows. However, only Australia so far applies the 2008 SNA. In our baseline decompositions results, therefore, we use saving flows that exclude R&D. But we also

[72]The SNA makes a subtle distinction between debt debt cancellation by mutual agreement (which is to be recorded as a capital transfer) and debt write-off (which is to be included in other volume changes). Debt cancellations seems to mostly concern international debts (e.g., cancellation of poor countries external debt), but the distinction made in the SNA is quite obscure to us.

provide a number of supplementary results that include rough estimates of R&D expenditure in saving.

In particular, in Tables A99 and A104, we decompose the increase of national and private wealth-national income ratios under a number of scenarios on the amount of R&D expenditure.

In the U.S., the BEA reports that cumulated 1970-2010 net R&D expenditure have amounted to about 20% of national income. Given the limitations in the measurement of R&D discussed above, we see this as an extreme lower bound. Under this lower bound scenario, the share of the increase in the national wealth-income ratio in rich countries that can be attributed to saving is about 40-50% on average, and the share of capital gains about 50%-60%.[73] If we now make generous allowance for R&D – cumulated expenditure worth about 50% of 2010 national income on average in rich countries – then the fraction of the increase of the national wealth-income ratio explained by saving is a bit higher than 60% on average, with significant heterogeneity across countries.

We should stress that these computations are merely illustrative. We have not attempted to take into account differences in R&D spending across countries, nor potential trends over the 1970-2010 period. Our point is simply that with reasonable allowance made for R&D, saving explain a large fraction of the 1970-2010 increase of the national wealth-income ratio – at least 40%, and more probably around 60% on average. The average order of magnitude is robust to any plausible assumption (in light of available evidence) one can make on R&D. Conversely, whatever the exact amount of R&D spending in rich countries, we find that capital gains (not caused by R&D) explain on average a non-trivial fraction of the rise in wealth-income ratios over the 1970-2010 (at most 60%, and more likely around 40%). Looking forward, the systematic inclusion of R&D expenditures in saving will make it possible to better isolate the exact role they play in the accumulation of wealth in rich countries.

E.3 Other volume changes

The accounting framework presented in the paper isolates two sources of changes in wealth only: saving and capital gains. National accounts isolate a third source: "other volume changes". Other volume changes capture the effects of war destructions, disaster losses, and the discovery of new assets (e.g., subsoil resources) – and more generally of all changes in wealth that cannot readily be accounted neither by investment nor by identifiable valuation effects.

Other volume changes also include the effects of reclassifications across sectors or instruments, as well as the statistical discrepancy that exists between the two available measures of financial saving in the national accounts: that originating from real accounts (i.e., basically income minus consumption minus fixed capital formation) and the one that originates from financial accounts (the increase in financial claims as reported by financial companies).[74] All of this sounds innocuous enough,

[73]This can be seen in Table A99 by changing the R&D assumption to 20% for instance for the additive decomposition.

[74]This statistical discrepancy is the analogue of the "net error and omissions" line in balance of payments, i.e. the difference between the current and capital account balances (foreign saving

but other volume changes can play a substantial role in the wealth accumulation of some countries, especially for some sectors of the economy where measurement issues are important, such as the foreign sector.[75] They can be quite large: in the U.S., for instance, on average total other volume changes have been +0.4% per year over 1946-2010.[76] So we have paid close attention to them in our analysis.

In the SNA, other volume changes are presented in the accounts that attempt to reconcile the flow side of national accounts (saving) with the stock side (wealth). Those accounts have two parts: "other volume changes" and "revaluation" (i.e., capital gains and losses). Not all countries publish such reconciliation accounts, but for the countries that do, we provide in the country-specific files detailed decompositions of wealth accumulation that isolate saving, capital gains/losses, and other volume changes. By construction, by doing so the capital gains that we compute as a residual are exactly equal to the capital gains/losses series published in the official "revaluation" accounts. When we summarize our results (e.g., in the main text of the working paper), unless otherwise noted we include other volume changes with saving flows – so that in effect those flows measure all identifiable volume changes, either coming from saving or from other sources.

F Price deflators

Wealth-income ratios do not rely in any way on price indexes: the wealth-income ratio β_t is simply the ratio of nominal wealth in year t by nominal income in year t. But to compute real growth rates and to decompose wealth accumulation between a volume component and a real capital gains component, one needs price indexes.[77] What is the best price index to use is a complicated question for which we do not claim to have a definitive answer. Ultimately for the purpose of this comparative research we chose to retain the GDP deflator, because it is the one price index for which cross-country harmonization and statistical progress have been more important.

Remember that there are three key issues in the comparison of prices over time: How to account for new goods, such as the iPhone (the "new goods bias")? How to deal with quality improvements (the "quality bias")? And how to account for the fact that consumer choices change when prices change (the "substitution bias")?

from the real side) and the financial account balance (foreign saving from the financial side).

[75] Other volume changes, for instance, are at the heart of the debate on the exact magnitude of the "exorbitant privilege" that the U.S. enjoys by being able to earn higher total returns on its assets than on its liabilities. See Gourinchas and Rey (2007) and Curcuru, Dvorak and Warnock (2008).

[76] The bulk of those come from the statistical discrepancy between the two measures of saving (+0.3%), the rest (discovery of new assets, etc.) accounts for +0.1% per year on average over 1946-2010.

[77] To compute decennial averages of wealth-income ratios, price deflators can matter a little bit. There are three different methods to compute decennial averages of wealth-income ratios $\beta = W/Y$. First we can take the average of the annual $\beta = W/Y$; second we can divide decennial averages of W and Y expressed in 2010 values; third we can divide decennial averages of W and Y expressed in current values. The three definitions yield almost identical estimates when there is limited inflation, but there can be non-trivial gaps during war and high inflation decades. To avoid the issue, in this research decennial averages of wealth-income ratios are always computed, unless otherwise noted, by taking the average of the annual ratios.

The consumer price indexes and GDP deflators of most countries have both done a great deal of progress in addressing the new goods bias and the quality bias. Regarding the substitution bias, however, progress has been faster for the GDP deflator. The standard way to address the substation bias is to use chain-weighting techniques. Under the impetus of the OECD, chain-weighting has been generalized for the GDP deflator, but it is still not used everywhere for the CPI.

As we document in our database, the GDP deflator and CPI usually evolve similarly in the medium and long-run, but in the short run the discrepancy can be sizable. It is useful to keep in mind that there are four broad reasons as to why the evolution of the GDP deflator and the CPI can differ:

(i) *Terms of trade effects*: when the price of imports grows more than the price of domestically-produced goods (e.g., during oil shocks), the CPI increases more than the GDP deflator.

(ii) *Investment goods effect*: when the price of capital goods grows less than the price of consumption goods (which is typically the case for computers once quality improvements are well accounted for), then both the CPI and the personal consumption expenditure (PCE) deflator increase more than the GDP deflator. This investment goods effect explains a significant fraction of the divergence between GDP and consumption deflators in Japan and Germany over the last 15 years. In Germany for instance, from 2000 to 2010, GDP price inflation has averaged 1% per year, but the CPI has grown 1.6% whereas the investment deflator has actually decreased (-0.3% per year).

(iii) *Public consumption effects.* When the price of the goods and services consumed by the government increase less than the price of private goods, the CPI grows more than the GDP deflator. In the U.S. and in 1950s-1960s France, the opposite has apparently happened: the price of public goods seems to have grown a bit more than the price of private goods. (Of course, indexes for public consumption expenditure face the formidable problem of how to properly account for quality improvements in education, defense, police, and so on[78]).

(iv) *Methodological differences in the construction of price indexes* In principle, the CPI and PCE deflators should closely follow each other. But there are at times significant discrepancies. These discrepancies have been the key driver of the divergence between the CPI and the GDP deflator in the U.S. The main difference between the CPI and the PCE deflator is that they usually rely on different index formulas. In the U.S, the CPI-U is a Laspeyres index, i.e. an index in which quantities weights are fixed at the base year level. Laspeyres indexes in effect assume that consumers do not react to relative price changes, therefore tend to overstate inflation – the "substitution bias."[79] By contrast, the U.S. GDP deflator relies on more appropriate chain-weighted Fisher indices. In the latter half of the 1990s, the Boskin commission concluded that the CPI tended to overstate inflation (see Boskin et al., 1998). As a response, BEA introduced the C-CPI-U, a chained-

[78]One standard solution to the quality bias is the use hedonic price techniques, but this is usually of little help for public expenditure.

[79]In Paasche indexes, quantities are fixed at their end-of-sample level. Paasche indexes in effect assume full reactions to relative price changes, therefore tend to understate inflation. To avoid substitution bias, one needs to use "superlative indexes", such as the The Fisher Ideal index – a geometric average of Paasche and Laspeyres indexes – or the Törnqvist index.

weighted Törnqvist index (C stands for chained). Over the 2000-2010 period, the C-CPI-U and the PCE have closely followed each other (the C-CPI-U is not available for earlier periods). Minor methodological differences still remain, however. The PCE is somewhat broader in scope (it includes, for instance, spending on behalf of consumers by employers and government health agencies); it uses a different set of weights (coming from the NIPA rather than from Consumer Expenditure Survey), and it sometimes relies on price series other than those used in the CPI.

G Factor shares and returns

In the country-specific files we provide detailed decomposition of corporate product and national income into labor and capital components. The analysis of factor shares in the corporate sector is standard and does not raise any particular difficulty. At the national level, however, there are a number of issues. The main difficulty is how to deal with self-employment. Other issues include whether one should attribute some capital income to the government sector, and difficulties in the measurement of housing capital income. We deal with each of these issues in turn.

G.1 Capital shares in the non-corporate business sector

There are three main ways to estimate factor shares in the non-corporate business sector: (i) assign the self-employed 100% of the average wage of salaried workers; (ii) apply some capital returns to the capital stocks of self-employed individuals; (iii) assume the same factor income decomposition in the non-corporate and corporate business sectors.

Most estimates of the shares of labor and capital in national income try to impute a wage to the self-employed (see Glyn, 2009). This is for instance the method that Ameco retains to compute its own adjusted wage series.[80] One problem, however, is that there is no particular reason why we should attribute 100% of the average wage of salaried workers to the self-employed. The self-employed have historically been concentrated in sectors where average incomes have been much lower than the national average, such as agriculture; today, on the contrary, many of them are in relatively high-paying sectors, such as health. One way to deal with this issue is to use data on income and employment at the sectoral level to assign the self-employed imputed sectoral wages, correcting for part-time work when possible.[81]

The method that consists in applying rates of return to the capital stock of the self-employed is rarely used, as until recently comprehensive balance sheets for the non-corporate sector were not available.

In practice, estimates that apply average wages to the hours worked by self-employed persons (or capital returns to their capital stocks) often result in negative

[80] Series ALCD0 (adjusted wage share in market price GDP) and ALCD2 (adjusted wage share in factor-cost GDP).

[81] This is the what is usually done in productivity studies (see for instance EU KLEMS). This is also the method used by Jorgenson and Landefeld (p. 34) to form their estimate of total capital income in the U.S. economy (Table 1.6, p. 54-55) which also includes imputed values of the services of consumer durables as well as the net rent on government tangible assets.

returns to either capital or labor. As Jorgenson and Landefeld (2006, p. 33) discuss, the reasons for this problem are not entirely clear. Explanations include the possibility that mixed income may be under-estimated in national accounts, and issues in the measurement of the numbers of hours worked by self-employed (or the capital stocks they use). Mixed income can be under-estimated for a number of reasons: the self-employed may underreport income to tax and statistical authorities; some of the earnings of small business owners that should logically be recorded as mixed income are also sometimes treated as corporate dividends in the national accounts. The latter problem occurs when small businesses are included in the corporate sector but the partners are counted as self-employed in labor force surveys (e.g., because they choose to be paid in the form of dividends only). This problem is particularly acute in countries that have a vast network of small and medium enterprises, such as Germany. In this case, too much corporate dividends tend to be recorded, and too little mixed income compared to the the number of self-employed identified in surveys.[82]

In view of the many issues raised by the methods that impute wages or returns to the self-employed, in our database, whenever possible, we have opted for the third method: we assume that the capital share is the same in the non-corporate as in the corporate business sectors.[83] One drawback is that this method cannot always be applied: we need to know the net-product of the non-corporate business sector, and in some cases national accounts are not detailed enough. But one advantage of the method, when the data exist, is that we can check the plausibility of the results by computing the average wage of self-employed individuals which is consistent with identical factor shares in the corporate and non-corporate business sectors.

In the country-specific appendices, we precisely explain how we estimated factor shares in the non-corporate sector given available data, and the robustness checks that we were able to conduct. We also describe on a case-by-case basis the way we have obtained historical estimates of factor shares for the 19th century, at times when all standard methods raise formidable difficulties because of the high share of agriculture in output.[84]

[82]Only non-corporate businesses can be the source of mixed income. But the distinction between corporate and non-corporate activity is far from being always clear. In the 2008 SNA (4.155-4.156), the main criterion is whether the liability of the partners is limited (corporation) or unlimited (un-incorporated enterprise). However, some un-incorporated enterprises are to be treated as "quasi-corporations" in the SNA if they have complete sets of accounts, many partners, and behave like corporations.

[83]Specifically, we compute factor income in the non-corporate sector by multiplying the net product of the non-corporate business sector by the factor shares that prevail in the corporate sector. A number of estimates of factor shares deal with self-employment by applying the corporate sector's factor shares to mixed income (rather than to the overall net product of the non-corporate business sector). This way of doing things necessarily results in higher labor shares in the non-corporate sector than in the corporate sector, since total labor income in the non-corporate sector is then equal to wages paid to non-corporate salaried workers plus the imputed labor component of mixed income. The problem is that there is no clear reason why the labor share should necessarily always be higher in the non-corporate sector, so overall it seems to us that our method is somewhat more consistent.

[84]There are three main issues. First, there is no particular reason why the distribution of factor shares should be the same in agriculture as in the corporate sector, so the method we generally use for 1970-2010 makes relatively little sense before. Second, attributing an average agricultural wage to peasant farmers often faces important data constraint. Lastly, there is the very tricky

G.2 Housing capital income

An important part of the economy's capital income – though one which unfortunately tends to be disregarded in standard measures of factor shares – is housing capital income. However, it is not always straightforward to properly isolate this income in published national accounts.

In principle, things are quite simple: housing capital income is equal to the net product of the housing sector, which by convention is measured in the SNA as the net operating surplus of the household sector.

There are two main issues here. First, home-owners who have contracted mortgages consume financial intermediation services. These services, called "financial intermediation services indirectly measured" (FISIM), are conventionally defined as the margin between mortgage interest rates and a reference rate (such as the rate at which banks can refinance themselves with the central bank). In the national accounts, FISIM consumed by home-owners are treated as intermediate consumption, so that they are excluded from the value added of the household sector, hence from the net product of the housing sector. Because there is substantial cross-country heterogeneity in the way FISIM are measured,[85] comparisons of housing products across countries are rendered somewhat difficult. One solution would be to add FISIM on mortgages to net housing product; however in many countries FISIM on mortgages are not isolated.

The second issue that affects the comparability of housing capital income is the following. By definition, the net operating surplus of the household sector only captures the income generated by households' housing activities. But households do not own 100% of the housing stock, and there is some variation in the share of houses owned by corporations. In Germany and France, households own about 85% of the dwelling stock and non-financial corporations almost all the rest, while in the U.K. the household share is 95%. In the country-specific appendices, we precisely describe how we have estimated housing capital stocks and income given available data, and what scopes the estimates cover.

G.3 Should the government earn capital income?

By convention, in the SNA the net return to government capital is implicitly assumed to be zero. The SNA estimates the value of government (and other non-market producers) output by costs. The only cost measured for the use of capital inputs in the production of government services is depreciation. In principle a financing opportunity cost – i.e., a rate of return on government non-financial assets – should also be included. This rate of return cannot be directly observed, but one natural candidate would be the interest rate that the government pays on its debt. Doing so, however, would raise the issue that GDP would rise when interest rates for government debt increase. And it is also unclear what exact interest rate should

issue of how to deal with unpaid family workers, historically quite important in many countries, in some cases through to the mid-twentieth century. Attributing those workers the average wage often results in labor share exceeding 100% in the whole economy (see Glyn, 2009, p. 109).

[85]In particular, statistical agencies often use ad hoc methods to smooth variations in FISIM that occur when central banks set extremely low refinancing rates (as has been the case since 2008).

be picked – short term, long term, etc. This seems to be the main reasons why the SNA prefers to retain in practice the assumption of zero net return on government assets, although capital income imputations are routinely made for owner-occupied dwellings (a task, however, made easier by the fact that market rents are readily available).[86] In this research we have not attempted to correct the official data and so there is no capital income in the government sector.

G.4 Alternative measure of the capital share: the concept of capital services

In our database, we measure capital income, consistent with standard practice, as the sum of net operating surplus (net corporate profits and housing capital income), the fraction of mixed income that can attributed to capital, and net foreign factor income. However, there is no strong reason why this should always be equal to the contribution made by capital to production. One can for instance imagine that corporate profits are generated by imperfect competitions, so that the net operating surplus of the corporate sector is not strictly speaking a return to capital.

Independently from the SNA, however, there is a rich tradition of productivity analysis that attempts to isolate the contribution to production of capital, labor, and multi-factor productivity at the industry level.[87] A number of statistical agencies are currently devoting substantial effort into integrating these productivity accounts to the standard national accounts and making the two consistent.[88] This is recognized in the 2008 SNA, which proposes that "for those offices interested, a table supplementary to the standard accounts could be prepared to display the implicit services provided by non-financial assets." (SNA 2008, 20.1).

There are two ways to measure the contribution of capital to production, what is known as "capital services": (i) using observed rental prices (to be then multiplied by the quantities of capital used), (ii) imputing those prices. Since in practice rental markets do not exist for a number of capital goods (or relevant rental prices are not collected), in productivity studies, rental prices are routinely imputed on the basis of the famous Hall and Jorgenson (1967) user cost formula. That is, the rental price p_k of a capital good k, also known as the user cost (i.e., the unit cost for the use of k for one period), is computed on the basis of k's estimated price, P^k, a reference rate of return equal to the opportunity cost of money, r, a depreciation rate, δ (estimated from age-efficiency profiles etc.) and asset price inflation, $\hat{P}^k$:

$$p_k = P^k[r - \hat{P}^k + (1 + \hat{P}^k)\delta]$$

[86] Jorgenson and Landefeld (2006) propose to include the net return to government capital in GDP. They find that the gross return is about 3.5% of GDP ("services of durables, structures, land, and inventories held by government": \$340bn in 2002, see Table 1.5 p.51). This gross return includes depreciation which is already counted in GDP (\$178bn) so that the net return is about \$162bn, i.e. a bit less than 2% of national income.

[87] Productivity data are produced by the BLS in the U.S. (http://www.bls.gov/bls/productivity.htm) and the EU-KLEMS consortium in the European Union.

[88] See in the U.S. Jorgenson and Landefeled (2006) and Jorgenson (2009). There are several inconsistencies between the SNA and productivity accounts. E.g., the former value industry and sectoral output at market price while the latter use basic prices, i.e., deduct taxes on products (net of subsidies), such as value-added taxes, excise duties, import taxes, etc. (code D21 for taxes and D31 for subsidies in ESA95 classification).

Neglecting the small $\delta\hat{P}^k$ term, this formula can be simplified as $p_k = P^k(r - \hat{P}^k + \delta)$ and has a straightforward interpretation: the rental price is equal to the real opportunity cost of an investment of value P^k plus the loss in asset value as the asset ages (economic depreciation).[89] In practice, as discussed for instance in Hsieh (2002, pp. 507-508), the literature uses a variety of methods to compute the real interest rate $r - \hat{P}^k$.

When there is a discrepancy between operating surplus and the value of capital services, it can be that not all operating surplus is a payment made to capital (e.g., monopoly rents) or that some assets used in production have not been well identified (e.g., intangible capital) or that their value or depreciation has not been well estimated. Conversely one can compute the discount factor that equates the value of capital services with operating surplus.

As we explain in the main text of the paper, our overall conclusion is that capital shares α are in many ways more difficult to measure than wealth-income and capital-output ratios β. So far the economics literature has mostly focus upon the study of α. We argue in this research that the study of β should rank highly in future research agendas. Ideally one would obviously like to make progress on both fronts.

G.5 Computing the average return on wealth

Using national account data, one can compute the economy-wide average rate of return on wealth r by dividing the capital share α by the wealth-income ratio β: $r = \alpha/\beta$. In practice, there are slightly different ways to proceed.

The simplest way is to set α equal to the share of capital in factor-price national income, i.e. $\alpha = Y_K/(Y - T_p)$, where Y_K is the sum of all capital income earned by domestic residents as identifiable in national accounts (housing capital income, corporate capital income, imputed capital income in the non-corporate business sector, and net foreign investment income), and $Y - T_p$ is factor-price national income (i.e., national income net of production taxes T_p), and to set β equal to the private wealth-national income ratio W/Y. This formulation assumes that product taxes T_p are split between labor and capital in equal proportions and is straightforward to implement. It is the one we use for the computation of the average rate of returns series presented in Table A145 and displayed in Figure 14 of the main paper. This formulation has also the advantage that the capital share and the labor share (defined as the sum of all labor income as identifiable in national accounts: wage and salaries, imputed labor income in the non-corporate business sector, and net foreign labor income) sum to 1.

A problem, however, is that this procedure is slightly inconsistent in the sense that β includes government debt while α excludes government interest payments. So in effect the average rate of return is under-estimated. The consistent formula includes government interest payments (net of government interest receipts) in the capital share. In Table US.11, JP.11, etc., of the country-specific files, we report detailed computations of the standard capital share α and the augmented capital

[89] This formula excludes the treatment of taxes. See for instance Jorgenson and Landefeld (2006, pp. 76 sqq) for an introduction to the user-cost formula, the effect of introducing taxes, the methods use to compute the real interest rate, etc.

share α^* including net government interest payments (the results are summarized in Appendix Table A48 and A48b). One problem is that the sum of α^* and the labor share now exceeds one. The corrected rate of return $r^* = \alpha^*/\beta$ turns out to be qualitatively similar to the return $r = \alpha/\beta$.[90]

Another consistent way to proceed would be to exclude net government interest payments from the numerator, but to include the return earned by government on its assets, and to divide this economy-wide flow of capital income by the national-wealth income ratio $\beta_n = (W + W_g)/Y$. This is probably the most consistent way to proceed – it would deliver the average return on national wealth, as opposed to the average return on private wealth only in the above computations. But as we have seen, government capital income is not measured yet in national accounts, so this procedure cannot be implemented easily.

H International data on countries' income and wealth

For the 1970-2010 period, the usual international data sources are highly incomplete, so we had to return to the raw primary national sources, namely the accounts compiled by national statistical institutes. For instance, OECD wealth accounts exist for a limited number of years; for most countries, complete balance sheets with full details on non-financial and financial assets and liabilities for the various sector (households, government, corporations, rest of the world) are available only for the 1995-2010 period at best. OECD income accounts also only cover the most recent years. UN official series – available on data.un.org – cover only flow accounts, not balance sheets.[91]

As regards historical sources, we choose in most cases to return to the raw available material as well, for both income and wealth. Historical data sets on national accounts such as Maddison (2001, 2007, 2010) include series on GDP and population only, not on wealth or capital. They typically do not include factor shares series either. We did check, however, that all per capita real growth rates and all population growth rates in our database coincide with Maddison in the very long run. The per-capita real income growth rates that we obtain for the U.S., U.K., and France over the periods 1700-1810, 1810-1910, and 1910-2010 are within 0.1% of Maddison's (see Table A157). In the country-specific sections below, we explain the source of the discrepancy when our choices among the available raw sources have differed from Maddison's.

In addition to country-specific historical sources and studies, we also used a number of cross-country historical studies of income and wealth. Key references here include Mulhall (1896, 1899), Gini (1914), Studenski (1958), and Goldsmith (1985, 1991).

[90]The absolute level of the corrected returns r^* is slightly higher, but the trend is roughly similar. In most countries net government interest payments display no clear trend in the 1970-2010 period, because the rise in public debt has largely been compensated by a decrease in nominal interest rate paid by governments.

[91]The main income and population tables are also available at http://unstats.un.org/unsd/snaama/dnlList.asp.

I Overview of the main areas in which progress needs to be made

Our research includes a Chartbook constructed from our wealth-income database. In the Chartbook we present the main evolutions in wealth-income ratios, the structure of national wealth, national income, and so on. Generally speaking, the displayed cross-country and time variations are meaningful. However, we would like to point out a number of cases in which we see important data issues. This is the occasion to precisely pinpoint the areas in which, in our view, national accounts need to make progress.

Looking first at income, the measurement of housing products raises a number of difficulties, as discussed in Section G.2 above. In Figure A57, we provide tentative estimates of the evolution of the share of housing product in domestic product across countries. While the rising trend for each country is definitely robust, the absolute level of housing products – and thus cross-country comparisons – should be taken with a grain of salt. One issue is that data for Japan and Canada only refer to owner-occupied houses, while data for other countries include both owner- and tenant-occupied housing. There are also inconsistencies in the treatment of property taxes across countries. As a general rule, these taxes are excluded from housing products: we measure the share of the net value added of the housing sector (net of depreciation and of production taxes) in the net value added of the domestic economy (net of depreciation and of all production taxes, i.e. factor cost net domestic product). However, in some countries like Canada, property taxes cannot be subtracted from housing product. Given the increasing importance of housing in both income and wealth, we believe that progress is badly needed in this area.

More broadly, decompositions of the domestic product by production sector raise some difficulties. Generally speaking, net domestic product Y_p can be written as the sum of the net product of the housing sector Y_h, net product of non-corporate business sector (including non-profit institutions) Y_{se}, net product of the corporate sector Y_c, net product of the government sector Y_g, and production taxes T_p:

$$Y_p = Y_h + Y_{se} + Y_c + Y_g + T_p$$

It is the decomposition we use for each country in our database in Tables US.9, JP.9, etc. We plot the share of each sector in domestic product in Figures A59, A61, A62, A63, and A64. We stress, however, that cross-country comparisons should be taken with care, because the frontiers of each sector are not always perfectly comparable across countries. What is recorded as non-corporate and corporate activity, in particular, tends to be increasingly affected by tax considerations – which may explain the rising share of non-corporate activity in the U.S. since the mid-1980s (Figure A61). This issue also affects the measurement of distributed corporate profits (i.e., dividends) displayed in Figure A98.

We also caution the reader against trying to infer too much from our estimates of factor shares. As explained in the working paper, and as detailed in Section A.7 above, computations of factor shares at the national level raise all sorts of difficulties. These issues are compounded when we get back through time, because the share of the non-corporate sector – for which measurement issues are the most important – increases. In Figure A66 we present estimates of the capital share over the 1910-2010 period for the three main European countries, Germany, France, and the U.K. We have attempted to provide reasonable estimates of the capital share during the World Wars, but as discussed in the country-specific sections below, the raw available material is limited. The cross-country variations (in particular during World War II) should be taken with a lot of care. In our view, additional historical research is needed in this area. In this research, we have argued that an alternative way to gauge the relative importance of labor and capital in the economy is to look at the evolution of wealth-income and capital-output ratios. We hope that we have shown this to be fruitful approach, although ideally both approach must be combined.

Moving now to wealth, one particularly tricky issue, in which much progress remains to be done, is the measurement of public assets. While we have taken great care to provide plausible estimates on the basis of published balance sheets, making reasonable adjustments when needed (as detailed in the country-specific sections), we are well aware that it is an area in which there are important statistical issues. In particular, it is difficult to provide accurate estimates of the claims held by governments in public corporations in the aftermath of World War II. In principle, as we have seen, these corporations must be recorded under the assumption that Tobin's Q is equal to 1 (i.e., government claims must be set equal to the value of public companies' assets net of non-equity liabilities). However, the extent to which this principle was followed in available historical balance sheets is unclear, and therefore our estimates of government public assets in the 1950s-1970s are surrounded with uncertainties. The cross-country variations presented in Figure A82 should be taken with care. One way to make progress in this area would be to compute fresh estimates of the equivalent market-value of public companies in the 1950, 1960s and 1970s, by getting back to the individual accounts and balance sheets of those companies and applying standard observable financial ratios, such as price/earnings, or price/revenues. Further, we stress that the decomposition of public assets between "financial" and "nonfinancial" assets is very fragile, and in some sense meaningless (Figure A84 to A87). In principle, the rule is that if a unit sells the majority of its output at "economically significant prices", then it is a corporation in the sense of the SNA, and if it owned by the government, this translates into a financial asset for the government. In contrast, if a government-controlled unit sells a minority of its output at economically significant prices, then it is directly included in the government sector, which translates into nonfinancial assets for the government. The frontier between both cases is often thin in practice.

Moving now to historical estimates of the level and nature of wealth, we stress that the raw data for the 18th and 19th centuries do not allow us to very precisely estimate the wealth-income ratio. They only enable us to provide a reasonable order of magnitude for the level of the ratio (600%-800% in Europe) and its dynamics (namely, we find no long run trend before World War I in Europe: in both France and the U.K., the wealth-income ratio appears to stay relatively close to 700%). Similarly, the decompositions of domestic capital between agricultural land, housing, other domestic capital are approximate, and should not be used for fine comparisons across time and countries. The main robust finding is the long run decline of agricultural land. Precise quantifications of the shares of the different assets always face a number of data constraints.[92] The limitation of the raw material should be kept in mind when comparing the share of agriculture (Figure A34) and other domestic capital (Figure A36) in national wealth.

Similarly, in the recent period, estimates of the amount of natural resources reported in Figure A45 are approximate. Most countries do not yet systematically attempt to estimate the value of natural resources, and statistical methods remain heterogeneous.

B United States

A Official national accounts series

Official U.S. accounts are organized in two parts: most of the flow data are in the National Income and Product Accounts (NIPA), published by the Bureau of Economic Analysis, while stocks of assets and flows of financial assets are in the Flow of Funds Accounts (FFA), published by the Federal Reserve Board. These statistics do not directly follow the SNA guidelines.[93] The Bureau of Economic Analysis, however, attempts to integrate the NIPA and FFA in a framework founded on the SNA, the Integrated Macroeconomic Accounts (IMA). In this research, in order to ensure comparability, we always use when available data from BEA's integrated macro accounts.[94] The integrated accounts start in 1960, the flows of funds in 1945, and the NIPA in 1929. We have reconstructed homogeneous 1929-2010 income series by linking the integrated accounts with the NIPA, and homogenous 1945-2010 wealth series by linking the integrated accounts with the Flow of Funds balance sheets. There is usually a perfect continuity in 1960.[95]

A.1 National income, 1929-2010

For the 1929-2010 period we use the official IMA and NIPA data with no modification whatsoever. We simply re-arrange them in a slightly different accounting framework in order to facilitate comparisons with other countries.

Specifically, the IMA isolates a non-financial non-corporate business sector that does not exist in the SNA. This sector includes (i) non-financial partnerships, that the SNA classifies as non-financial corporations; (ii) sole proprietorships, that the

[92] Some houses – and more generally hotels, etc. – can be owned by the corporate and government sector (and thus will be counted as other domestic capital). Further, it is sometimes hard to exclude the value of farm buildings or cattle from agricultural land. The country-specific sections provide all relevant details on how we have attempted to provide separate estimates for each given available sources.

[93] The OECD compiles U.S. national accounts data in the SNA framework, but the series start in 1998.

[94] The IMA series are available from two sources: (i) BEA (http://www.bea.gov/national/nipaweb/Ni_FedBeaSna/Index.asp) and (ii) FRB (http://www.federalreserve.gov/datadownload/Choose.aspx?rel=Z1). The series are mnemonic and identical, but at the time we conducted this research, FRB data were slightly more up-to-date, so we downloaded the raw data from the FRB's website. See our file "IMA_1946_Today.xls".

[95] When this is not the case, our Excel file "USA.xls" precisely describes the very minor adjustments we make.

SNA includes in the household sector; and (iii) the activities associated with tenant-occupied housing, which are also included in SNA's household sector.[96] In order to analyze the sectoral composition of domestic production and to compare it with other countries, we exclude tenant-occupied activities from the non-corporate sector and include them in the housing sector.[97] We find that the share of the non-corporate sector (excluding housing) in domestic production follows a U-shape pattern over the 1960-2010 period, from 24% in 1960 down to 17% in 1983 and then gradually increasing again to 22% in 2010, the highest level in the rich world. This evolution stands in sharp contrast to other rich countries, where the relative importance of non-corporate activities has continuously declined. Potential explanations for the U.S. reversal include tax incentives favorable to non-corporate activities, e.g. following the 1986 Tax Reform Act, and the importance of a number of financial activities (such as hedge funds) that are traditionally unincorporated.[98]

For the factor share analysis reported in Table US.11, we assume that the same factor income decomposition holds in the non-corporate business sector as in the corporate sector.[99] Consistent with a number of studies, we find rising capital shares (net-of-depreciation, excluding government interest), from about 20% in the early 1970s to 25-30% in 2005-2010. This increase has been accompanied by a rise in distributed profits, while retained earnings (net-of-depreciation) appear rather constant, oscillating around 3% of national income. Over a century, the share of distributed profits in national income follows a spectacular U-shape pattern, from 8% in 1929, down to 2% in the mid-1950s, and back to 6% today.

[96] Owner-occupied housing is in the household sector in both SNA and IMA. See the *Survey of Current Business* paper by Bond et al. (2007) for a discussion of the differences between the SNA and the IMA.

[97] Since the integrated macro accounts include tenant-occupied housing activities in a non-corporate sector distinct from the household sector, we cannot compute the housing sector net product as the operating surplus of the household sector. However, the NIPA provide separate data on the housing sector (Table 7.4.5. Housing Sector Output, Gross Value Added, and Net Value Added). Our factor-price net housing product series is NIPA Table 7.4.5 line 13 (net housing value added) - line 15 (taxes on production and imports in the housing sector) + line 16 (subsidies). This housing product is consistent with how we measure housing activity in other countries, except for one minor point: the NIPA data on housing encompass the housing activity of the government and corporations, whereas for most other countries, our housing series only include the housing activity of households. Households usually account for more than 80% of a country's housing activity.

[98] We compute the net product of the non-corporate business sector as the net product of the households + NPISH + non-corporate non-financial business sectors minus the net product of the housing sector. Non-financial partnerships are included in the non-corporate sector in the U.S., while in other countries which follow the SNA they are in the corporate sector. This might explain part of the relatively high U.S. share of non-corporate activities. Note however that financial partnerships are included in the financial corporate sector, so they cannot account for the rising share of non-corporate activities.

[99] Our capital share differs from the one that can be computed from Jorgenson and Landefeld (2006, Table 1.8 p. 56) for four reasons: (i) Jorgenson and Landefeld include imputed rents on durables in income (net of depreciation, they amount to about 2% of national income); as well as (ii) net rents on government tangible capital (an additional 2%, net of depreciation). (iii) They attribute property taxes and some other product taxes to capital, while we (somewhat simplistically) assume an equal split of all product taxes between labor and capital. (iv) They impute wages to the self-employed in order to estimate the capital share in the non-corporate sectors sector, while we assume the same factor income breakdown in the non-corporate and corporate sectors.

A.2 National wealth, 1945-2010

Private wealth, 1945-2010

Our net household wealth is the one provided by the integrated macro accounts, with two minor modifications as to ensure consistency with other countries. First, we exclude consumer durables from assets. There are good arguments to treat durables as assets, as U.S. statisticians do, but for the purpose of this comparative research, we stick to the international guidelines.[100] Second, at the time we conducted this research, IMA balance sheets excluded the value of farm land; we add it back.[101]

The data we report on the composition of private wealth differ from the official data in one additional way. In the official U.S. balance sheets, residential real estate owned by the household sector only include owner-occupied dwellings; landlords formally own equities on non-corportate businesses, which is inconsistent with what other countries do. To improve comparability, we add tenant-occupied dwellings to households' real estate and decrease households' equities in non-corporate businesses in proportion.[102] We do not further consolidate the household and non-corporate business sectors.[103] Just like for other countries, our private wealth series include non-profit institutions serving households. BEA's integrated accounts do not isolate non-profit institutions from households, but we report FRB data on non-profit net wealth in Table US.6c.[104] In 2000 the net wealth of non-profit organizations was

[100]Note that the BEA classifies consumer durables as assets but currently excludes them from saving and investment flows. Purchases of durables are recorded as "other volume changes" in the flow-stock reconciliation accounts. For the sake of consistency, we subtract the investment in consumer durables from all "other volume changes" series, and so in effect we treat durables as private consumption expenditures, as other countries do.

[101]After we finished our U.S. computations, BEA started including farm land in its balance sheets. Part of it is included in the non-corporate sector, the other part in the non-corporate business sector. In the SNA non-corporate farms would be included in the household sector, but corporate farms would be in the corporate sector. So by including all farm land in the household sector, we slightly over-estimate household wealth. On the other hand, "other land" (recreational – code AN.2113 in SNA – and other – AN.2119) is not measured in U.S. balance sheets and including it would raise U.S. household wealth. These issues are negligible for our purposes since farm land is only 10% of national income today and household "other land" is typically very small as well (7% of national income in France, for example).

[102]Specifically, we transfer all of the non-corporate business sector's residential real estate assets to the household sector; we do the same for mortgage liabilities; and we decrease the value of the equity claims held by households on the non-corporate sector in proportion. See detailed computations and explanations in "USA.xls." This has no impact on the net wealth of households but simply modifies its composition. Note that the non-corporate business sector also has non-residential real estate, that we do not transfer to the household sector.

[103]To provide meaningful comparisons of the structure of private wealth across countries, one should deal with the fact that in the U.S., sole proprietorships are excluded from the household sector and included in the non-corporate sector. As a result, households own equities on non-corporate businesses, including on sole proprietorships. Relative to other countries, this tends to inflate the share of equities in households' portfolios. In effect the real assets of partnerships are recorded as equity assets of households in the U.S., but as real assets in most other counties. This explains why non-housing real assets of households are low in Table U.S.6c as compared to other countries. This accounting difference, however, is irrelevant for the purpose of the present study.

[104]Table B.100 of the FFA gives the tangible assets of NPISH over the 1945-2009 period, namely non-profit organizations' real estate at market value plus equipment and software at current cost. The supplementary Table L.100 of the FFA y also provide information on the financial assets and

about 30% of national income, or 7% of the combined households plus NPISH net wealth.

Note that while most of the countries in our database provide separate statistics for the values of constructions and of the land underlying these constructions, this is not the case in the U.S. Instead, BEA reports statistics on the market value of "real estates," which include the market value of both land and structures.[105]

Government wealth, 1945-2010

We only make one correction to the government balance sheets reported in the macroeconomic accounts: we add estimates for the government's land holdings. At the time we conducted this research, the BEA balance sheets only included public structures and equipments. Government real estate was estimated on the basis of the current-cost of the structures and underlying land values were set to zero. We upgrade the balance sheets by drawing on a number of official and non-official estimates.[106]

We also report as a memo item excluded from wealth estimates for the government's subsoil assets, which are currently lacking in the BEA accounts. In 1994 BEA did compile an integrated economic and environmental satellite account for the year 1987, including estimates of oil, gas, coal, metals and other minerals, forests, etc.[107] But shortly after its publication, Congress asked the Commerce Department to suspend work in this area. An expert panel was charged to examine whether the NIPA should be permanently broadened to include activities involving natural resources and the environment. The panel concluded positively (Nordhaus and Kokkelenberg, 1999) but so far the recommendations have not been followed and the last official environmental accounts are for 1987.

At end 1987, natural resources other than land were estimated by BEA to be worth between 23% and 40% of national income, with timber worth \$336bn (8%), non-timber forests \$315bn (8%) and subsoil assets in the \$300bn-950bn range (i.e., 7%-24% of national income). There is obviously a great deal of uncertainty surrounding these figures, but for information we report in Table US.6a the central estimate of 15% of national income for subsoil assets. Subsequent estimates provided by the World Bank in its Wealth of Nations database give a similar order of magnitude, if a bit lower. In 2005 the World Bank puts subsoil assets at about 9% of national income, and forest at 3%.[108] The OMB also provides estimates of the

liabilities of NPISH, but the series only cover the end-1987 to end-2000 period. Accordingly we only report the net wealth of NPISH over the 1988-2000 period.

[105]There is a further distinction between residential real estates (that is, houses) and non-residential real estates (e.g., offices).

[106]Specifically, for the 1953-1969 period we use the Historical Statistics of the United States series F364 p. 252 (these data are based on a study by Milgram, 1973). For the 1970-1985 period we use the estimates of Boskin et al. (1985, Table 7 p.933) and Boskin, Robinson and Huber (1989, p. 327). From 1986 on, we rely on the federal land values provided in the Office of Management and Budget's Analytical Perspectives for fiscal year 2012 (Table 31-2 p. 479) and we assume that the value of state and local land is a constant multiple of federal land. The OMB attempts to measure federal land at market value based on the price dynamics of private land. Hence estimated federal land holdings were particularly high in 2006-2007 (close to \$1tr) and decreased to about \$400bn in 2010 (see detailed series in DataUS2).

[107]See BEA (1994), "Integrated Economic and Environmental Satellite Accounts," *Survey of Current Business,* April, pp.33-49.

[108]The World Bank estimates that the overall U.S. total natural capital stock is worth \$4.1tr,

federal government's proved reserves of oil and natural gas which appear to be an even more modest 3% of national income in 2010.[109]

Corporate wealth, 1945-2010

We report official data on corporations' assets and liabilities with no modification whatsoever. The main issue is that the assets of financial companies are under-estimated because they exclude land.[110] This problem is probably not very important, however, as the non-financial assets of financial companies appear relatively small (13% of national income excluding land in 2010), and so we have not attempted to address it. We find that the ratio between the equity liabilities of corporations and their assets net of non-equity liabilities (that is, Tobin's Q) appears to be usually below unity, the exception being the 1995-2007 period. This result suggests that BEA's corporate capital stocks may have tended to be historically over-estimated (as argued by Wright, 2004). Alternatively, one can imagine that non-listed equities are somewhat under-estimated.[111]

Foreign wealth, 1945-2010

We use the rest of the world balance sheet reported in the integrated macro accounts, which come straight from the Flow of Funds (table L.106). Some of the data differ from the more widely used international investment position compiled by the BEA. A few words on the main discrepancies is in order.

The main difference is that in the Flow of Funds accounts, interbank claims and liabilities are netted out and derivatives are excluded, so that gross positions are substantially lower. At end 2011, in the IIP gross foreign assets were \$21.1tr, gross liabilities \$25.1tr, and the net position -\$4.0tr. In the Flow of Funds, gross assets were \$14.2tr, gross liabilities \$18.8tr and the net position -\$4.6tr. Both sets of statistics have foreign direct investments at current cost.[112] Of the 6.5-7 trillion gap in gross positions, about 4.5 trillion comes from derivatives, and the rest largely

i.e. 36% of national income. This figure can be decomposed as follows: subsoil assets (\$1.0tr) + timber and non-timber forests (\$0.4tr) + protected areas (\$1.1tr) + crop and pasture land, i.e. agricultural land (\$1.6tr, a figure a bit higher than the 1.25tr of farm land at market value reported in the Flow of Funds for end 2005.). None of these assets are currently included in BEA balance sheets, except for agricultural land. Subsoil assets, timber and non-timber forests should in principle be included in assets (while protected areas should not since they are not economic assets in the sense of the SNA) so we report the value of subsoil assets on one hand, and timber + non-timber forests on the other as memo items in Table US.6a.

[109] OMB Analytical Perspectives for fiscal year 2012, Table 32-2, "mineral rights".

[110] They only include the current-cost value of structures (including dwellings) and equipment and software. This deficiency appears to be the reason why the FRB does not currently publish any balance sheet for the financial sector (those are only reported in the integrated accounts).

[111] In the U.S. balance sheets there is no distinction between the value of listed and unlisted equities. The Federal Reserve Board estimates the value of unlisted corporations from estate tax returns with estate multiplier techniques. Computing the proper multiplier for the specific population of private-equity holders is not straightforward, and it is not impossible that the multiplier used by the IRS has tended to be somewhat too low. As Moskowitz and Vissing report (2002, p. 745-746 and Table 3 p. 752), until the 1990s the total value of private equities exceed that of listed equities, so this might be a rather important issue.

[112] BEA has three valuation methods for foreign direct investments: historical costs, current costs (whereby produced capital is estimated at its current cost by the perpetual inventory method, and current land values are estimated using general price indexes), and market value (i.e., based on indexes of stock-market prices).

from the consolidation of inter-bank claims. Why the net position differs, however, is unclear, as net derivative positions are roughly zero.[113]

Interestingly enough, while gross positions are lower in the integrated accounts than in BEA's international investment position, gross income flows are higher than in BEA's balance of payments. In 2011 for instance, gross foreign income inflows amounted to \$716.5bn in the integrated accounts (the same figure as in the NIPA) but to only \$676.3bn in the balance of payments. NIPA Table 4.3B provides a reconciliation and shows that the bulk of the discrepancy comes from differences in territorial coverage.[114] Lower positions but higher income flows in the integrated accounts translate into substantially higher yields than those that can be inferred from BEA's international accounts. Specifically, we find that the arithmetic average yield on U.S. foreign assets has been 7.6% over the 1990-2010 period; the yield on liabilities 5.1% and the differential a sizable +2.5%. Using comparable figures from BEA's international accounts, respective figures are 5.5%, 4.1% and +1.4%.[115]

We certainly do not pretend that any set of series is more consistent than the other. We simply point that Federal Reserve series deliver a substantially higher yield differential than the large literature on returns differentials has found so far using BEA data (see Curcuru, Thomas, Warnock 2013 for a comparison of the different waves of results). Whether this reflects deficiencies in the (supposedly internally consistent) integrated or international macro-accounts (such as inconsistencies in netting rules at the flow and stock levels), or more substantial economic differences would need careful examination. We also leave to future research a proper comparison of the overall return differential between the two sets of accounts (yield plus capital gains, by asset class).

B Historical national accounts

Historical estimates of U.S. income and wealth are plentiful, and usually of reasonably high quality for the post-Civil war period.

B.1 National income, 1870-1929

We use the 1869-1929 national income series of Balke and Gordon (1989), which improve upon previous estimates, in particular by Kendrick (1961) and Kuznets

[113]Note that there is a slight difference in the scope of foreign vs. domestic entities between the two sets of accounts. In the FRB/integrated macro accounts, international banking facilities (IBFs) are treated as non-resident while in BEA's international accounts they are resident. IBFs are separate accounts or branches of U.S. banks, operating on the U.S. territory, that mostly have foreign customers and are free of certain regulations. However, although the inclusion of IBFs can affect the gross positions, there is no particular reason why it should affect the U.S. net foreign asset position.

[114]In BEA's international accounts, Puerto Rico and other small U.S. territories are treated as part of the United States, while in the NIPA / FRB / integrated accounts, they are part of the rest of the world.

[115]Identical yield estimates based on BEA's data are provided by Curcuru, Thomas and Warnock (2013, Table 4, right-hand panel). Note that all those yields rely on FDI positions at current costs (FDI positions are identical in the integrated accounts and BEA international accounts). Note also that we compute yields as year's t flow divided by beginning of year t position, and that the income flow figures quoted above contain a labor income component that we of course subtract to compute yields.

(1941, 1946, 1961). Balke and Gordon (1989) do not provide any decomposition of national income into consumption and saving, so we had to compute our own saving flow. We take national saving as the sum of net domestic private and public capital formation reported by Kuznets (1961) and of net foreign investments.[116] We compute government saving as the sum of net public capital formation and net government lending/borrowing, which we obtain as the first difference of the net financial position of the government.[117]

B.2 National wealth, 1870-1945

Private wealth, 1870-1945

For the 1916-1945 period, we use the mid-year household wealth estimate carefully computed by Kopczuk and Saez (2004) on the basis of the balance sheets of Goldsmith (1952) and Wolff (1989). We make two corrections to the Kopczuk-Saez data: we exclude consumer durables,[118] and we multiply household net wealth ex-durables by 1.07 in order to ensure consistency with the official post 1945 data.[119] Our wealth series very closely tracks Wolff's (1989) W3 concept which is total household wealth minus durables.[120]

For the 1870-1916 period, we first try to obtain reliable national wealth data points for 1870, 1880, 1900, and 1912 – reported in Table US.6f – based on the balance sheets constructed by Goldsmith (1952, 1962, 1985).[121] Specifically, for the years 1900 and 1912, we use Goldsmith's (1952, 1962) data as printed in the Historical Statistics of the U.S, 1976, vol.1, p.255, series F422-445. The data are based on the perpetual inventory method with allowance made for land. They are of relatively good quality so we do not make any correction except for the exclusion of

[116]Specifically, we compute the ratio of domestic investment to national income from Kuznets' data, as printed in the Historical statistics of the U.S vol. 1 p.231 series F71-F97, and we apply this ratio to Balke and Gordon's (1989) national income. We then add the net outflow of U.S. capital abroad, computed from the balance of payments statistics reported in the Historical Statistics vol. 2 pp. 866-868 series U1-U25. Note that Kuznets' investment data are quinquennial averages whereas in the balance of payments we have yearly estimates, so in effect our national saving series is a mix of quinquennial averages and yearly data points. This slight inconsistency, however, is irrelevant for our purposes. See Table US.12b and US.12c for all details.

[117]In Table US.4e we provide a further decomposition of government deficits into net interest payments and primary deficits. Before 1929, the net interest payment series we use is actually equal to the gross interest paid by the Federal government (from the Historical Statistics series Y461). See Table US.5c for detailed computations.

[118]The BEA provides consumer durable series starting in December 31st, 1925. Before 1925, we use the estimate of Goldsmith (1962, p. 118) for January 1901, 1913, 1923, and linear interpolation to fill in the gaps. In 1900 and before, we assume that durables are a constant fraction of national income (33%, the 1901 value).

[119]There are two reasons why the estimate of Kopczuk and Saez is slitghly below the official data in mid-1946. First we have upgraded the official data to account for farm land. Second, Kopczuk and Saez exclude non-transmissible wealth and there was a small but positive amount of pension fund wealth at the time.

[120]As Kopczuk and Saez (2004) focus upon transmissible wealth, they use Wolff's W2 wealth concept, i.e. W3 minus annuitized pension wealth. For detailed comparisons between the various series, see Excel file "USA.xls."

[121]The balance sheets appear in a number of publications by Goldsmith, with sometimes minor differences, but the bulk of the original work dates back to Goldsmith (1952) – see in particular Goldsmith 1952 p. 306 for the original figures on the reproducible tangible wealth of the U.S.

consumer durables. All relevant methodological details can be found in Goldsmith's original publications. For 1880, we report data adapted from Goldsmith (1985, p. 297). Pre-1900 U.S. balance sheets are based on the regular wealth censuses that were conducted at the time. However, they suffer from a number of deficiencies which led us to upgrade Goldsmith's 1880 data point by 20%.[122] Lastly for the year 1870 we use the balance sheet reported by Hoenack (1964, p. 197) with minor adjustments as to ensure continuity with Goldsmith's data.[123] We find that national wealth increases from about 413% of national income in 1870 to 490% of national income in 1912.

From these national wealth figures, we subtract the estimated net wealth of the government in order to obtain the net wealth of the private sector in 1870, 1880, 1900, and 1912. To obtain yearly household wealth series, we fill in the gaps using available private saving flows (from Kuznets 1961, see above) and assuming constant rates of real capital gains in 1870-1880, 1880-1900, 1900-1912, and 1912-1916. Given available private saving and wealth data, in Table US.5a we find that we need to assume a positive yearly rate of capital gains on private wealth $q = +1.8\%$ in 1870-1880, $q = +1.0\%$ in 1880-1900, $q = +0.7\%$ in 1900-1912 and $q = +1.0\%$ in 1912-1916. Overall we need a small residual capital gain $q = +1.1\%$ in order to account for the evolution of private wealth in 1870-1910.

There are obviously some margins of errors involved here, as both saving and wealth series have some uncertainties. However, it is reassuring to observe that the bulk of the 1870-1910 accumulation of private U.S. capital seems to be well accounted for by saving flows: as we report in Tables US.4a and US.4b, savings explain more than 70% of wealth accumulation. This result is consistent with available equity price indexes. Shiller (2005) computes a real yearly geometric average rate of capital gains on U.S. equities equal to 2.6% in 1870-1910, lending support to our finding that there were relatively small but nonetheless positive capital gains in this period. The time pattern of the residual real capital gain q we find before World War I is also consistent with Shiller's series, as capital gains on equities are particularly strong in the 1870s (+3.7% per year) and smaller afterwards.[124]

Government wealth, 1870-1945

While there are numerous series on government debt, they usually do not properly account for the liabilities of the States and municipalities. So we returned to the raw sources in order to construct annual 1870-1945 government liabilities data.

[122] See the detailed discussion below of the raw sources and adjustments made for the 1770-1870 period.

[123] Specifically, we adjust Hoenack's "total national tangible wealth" upward (by 15%) in order to account for under-valuation in census statistics. We also make an allowance for gold and silver (about $0.45bn in 1870) which are not included in Hoenack's tangible wealth statistics. Lastly, we subtract consumer durables (that we estimate to be worth about 20% of national income) and add the net foreign asset position, about $-1.4bn or -18% of national income (this figure comes from Lewis, 1938; see our discussion below of foreign assets data).

[124] That is, the real equity capital gains is +2.9% in 1880-1900 and +2.2% in 1900-1912. However between 1912 and 1916 real equity prices drop -2.6% per year, which is inconsistent with our estimate of positive residual capital gain $q = 1.0\%$ during this time period. One possible explanation is that we may under-estimate the flow of private saving, which is quite hard to estimate during World War I.

Overall we find that government liabilities first decrease through to World War I, from 40% of national income in the 1870s to about 20% on the eve of the war. The U.S. then comes out of Wold War I with about 50% of public debt, and of World War II with about 130%. Federal government liabilities data are from Treasury Direct (http://www.treasurydirect.gov). State and local government debts are from the Historical Statistics of the U.S., 1976, vol.2 pp.1127 series Y680 and Wallis (2000, Table 2 p. 66).[125] State debts are negligible in the post 1870 period (less than 10% of total public debt) but municipal debts do matter: in the early twentieth century they were as large as the federal debt – and almost as large during the Great Depression.[126] Table US.5c provides a decomposition of total public liabilities by government level.

Measuring the government's assets is somewhat more complicated. In this research we try to make some progress by providing estimates across countries and over time as homogeneous as possible. Our definition of public assets includes all the government's produced fixed assets – equipment and structures, including military assets – financial assets (currency and deposits, loans, securities, etc.) and land. We exclude other non produced assets such as energy and mineral resources, timber, spectrum rights, and the like.

Historical fixed assets estimates, based on the perpetual inventory method, are plentiful. From 1925-on we use the official BEA series. For the 1870-1925 period we rely on Goldsmith (1952, p. 306).[127] Government fixed assets are small and grow slowly until World War I (from about 10% in the 1870s to about 25% in 1913), in line with quite modest public investment rates (about 0.7% in 1870-1910). They grow faster in the interwar, reaching 60-70% of national income on the eve of World War II. Government land adds about 20% of national income throughout the period.[128] Regarding government's financial assets, the evidence is somewhat scarce, as official flow of funds statistics start in 1945, and we rely on Copeland (1961, Table 1 p.7).[129] Financial claims appear to be small until the Great Depression (less than 10% of national income) and then rise to about 20-30% in the 1930s and 1940s, the same level as today.

Net foreign assets, 1870-1945

There are numerous historical estimates of U.S. foreign assets and liabilities, as U.S. authorities have long been interested in measuring foreign investments.

[125] These figures are consistent with the census data reported by (Copeland, 1961, p. 7).

[126] In 1933 for instance, Federal debt is 46% of national income, State debt 6% and municipal debt 33%, so that overall public debt is 85% – a level more significant than what Federal data alone would suggest. Before the Civil War, most of the public debt was State debt. Many States defaulted in the 1870s and 1880s. See Reinahrt and Rogoff's chart book, Figure 66a.

[127] Goldsmith's data are reproduced in the Historical Statistics of the U.S. vol.2 p.255 series F428 and F429. One problem here is that Goldsmith disregards military and naval equipments, but this is a minor shortcoming before World War 1, so we do not attempt correct for it and simply paste Goldsmith's series to the BEA fixed assets statistics.

[128] Data for land are from Goldsmith (1952), as printed in the Historical Statistics of the U.S., vol. 1, p. 255, series F444.

[129] We compute government financial assets as the difference between Copeland's gross and net debts; see Copeland (1961, p.182) for details on what the difference exactly recoups. Copeland provides data for 1890, 1913, 1929, 1939, and 1950. We fill in the gaps by linear interpolation. We also assume that public financial assets are a constant fraction of national income in 1870-1890.

Treasury conducted its first benchmark survey of foreign holdings of U.S. securities in 1853.[130] The Department of Commerce published the first official balance of payment in 1922. Until 1937, only flow data were released on a regular basis, but Commerce did estimate cross-border positions at irregular intervals. Though not always published at the time, some of these estimates were subsequently released in a number of Commerce reports and refined by scholars. In June 1941, Treasury conducted a comprehensive census of foreign investments in the U.S., whose results were published in 1945. Available figure suffer from different shortcomings (e.g., the use of par rather than market values, the lack of data on short-term investments, etc.) but all show the same pattern. Through to World War I, the U.S. was a small net debtor, with net foreign liabilities in the vicinity of 10%-20% of national income. Then it turned into a small net creditor in the aftermath of World War I, with a net position of 0%-20% until 1986. For the whole 1870-1945 period, our foreign assets and liabilities data are based on Lewis (1938) and Department of Commerce publications, as reported in the Historical Statistics of the U.S. vol. 2 p. 869.[131]

C National income and wealth, 1770-1870

As is well known, macroeconomic data for the pre-Civil War period have many deficiencies, and therefore we have not attempted to construct yearly estimates of national income and wealth before 1870. Rather, we provide in Table US.6f estimates for 1770, 1810, 1850, and 1860.

C.1 Population and national income, 1770-1870

We have relied on the reference sources with minor adjustments. For 1810 and 1850, we take national income to be equal to 90% of the current dollars GNP estimates given by Goldsmith (1985). We use the population series provided by the Historical statistics of the U.S. and construct a composite price index from the same source. We assume that real income growth per capita is fixed over 1770-1810 (0.7% per year), 1810-1850 (1.5%) and 1850-1870 (1.6%). The resulting profile for national income is very close to the one obtained by Maddison.[132]

C.2 Private and national wealth series, 1770-1870

1770

[130] See Griever, Lee and Warnock (2001, p.636) for a history of the U.S. system for measuring cross-border securities holdings.

[131] These series are consistent with the figures reported by Mira Wilkins (1989, 2004), in her two monumental books on the history of foreign investments in the U.S. We use Wilkins (1989, p. 147) for the 1880s. In Table US.6f we also report net foreign asset positions from Goldsmith (1952, 1962) as printed in the Historical Statistics of the U.S. vol. 2 p. 255 series F445. These estimates are broadly consistent with the Lewis/Commerce figures – if anything Goldsmith seems to report slightly too high NFAs in the late nineteenth/early twentieth century and in 1922.

[132] Although they were computed independently, our estimates of national income also come reasonably close to those of Lindert and Williamson (2011, Tables 3-5 for 1774 and 1800). The growth pattern is also broadly consistent with the index of industrial production constructed by Davis (2004) for the 1790-1915 period.

We start from the per capita average wealth estimates computed by Alice Hanson Jones for year 1774 on the basis of a large sample of probate records (wealth at death). We make no modification whatsoever, except for the two following points: (i) we convert Jones' estimates from current pounds to current dollars (using the conversion 1 pound sterling = 4.44 US dollar) so as to make the estimates comparable to post-independence estimates; (ii) we convert Jones "per free capita" estimates into "per capita" estimates using the appropriate fraction of free vs. unfree population (slaves made up about 20% of the total population of the Thirteen American Colonies in 1774, most of them in the South – where the fraction was close to 40% –, and very few in the North).[133] So for instance Jones reports an average per free capita wealth for the Thirteen Colonies equal to 47.5 pounds in 1774 (excluding slaves and durables),[134] which we convert into an average per capita wealth equal to 169 dollars.[135] We report on Table US.6f the detailed results separately for each broad asset category, and separately for the South and the North so as to illustrate the very large disparities due to the slavery system. According to our computations, for the Thirteen Colonies taken as a whole, the total market value of slaves represents the equivalent of 147% of national income, but most of it comes from the South (268% of national income) and very little from the North (5% of national income).[136] If we exclude slaves and durables (which we do in our baseline definition of private wealth), then private wealth appears to be very close in the South and in the North (about 310%-320% of national income). Although there is obviously a lot of uncertainty about these 1774 estimates, the broad conclusions appear to be robust.[137]

[133]We report detailed population figures – taken from the Historical Statistics of the U.S., 1976 edition, vol.2, p.1168, series Z1-19 – in Table US.3b. "Negro" population made up 21.4% of the total population of the American colonies in 1770 and 20.7% in 1780 (we take 20% for simplicity, and also to take into account the tiny fraction of free "negroes", as shown by post-1790 data). In the "South" – all colonies from Delaware to Tennessee, including Maryland, Virginia, North and South Carolina, Georgia, Kentucky – the proportion was 39.5% in 1770 and 37.7% in 1780 (we take 37% for simplicity), while in the "North" – all other colonies, from New England to the Middle Colonies, including New York, New Jersey and Pennsylvania – the proportion was 4.3% in 1770 and 3.7% in 1780 (we take 3% for simplicity). At that time the total population of the American Colonies was divided almost equally between the "South" (48.7% in 1770, 50.0% in 1780) and the "North" (we take 50% for simplicity).

[134]47.5 = 74.1 - 21.3 (slaves) - 5.3 (consumer durables and perishables). We exclude both slaves and durables from our baseline definition of private wealth but keep them as memo items in Table US.6f. We use Jones' per free capita estimates published in Historical statistics of the US, 1976, vol. 2, p.1175, series Z169-191. Land values include residential real estate, which on the basis of available estimates we estimate to be worth one third of the total. For a complete description of her methods and results, see Jones (1977).

[135]4.44 x 0.8 x 47.5 = 168.7. Detailed formulas and results are available on the Excel file.

[136]We upgrade our 1770 per capita national income by 5% so as to take into account real and nominal growth between 1770 and 1774. We assume that per capita income is equal to 110% of the overall average in the South and 90% in the North. According to Lindert and Williamson (2011, Table 6), the South/average income ratio might have been as large as 120%-125% in 1774 but only 107% in 1780. We take 110% as an average value (this has limited implication for our purposes here).

[137]Jones put a lot of care at converting her wealth-at-death estimates into wealth-of-the-living estimates via mortality multiplier techniques. In particular she tried hard to correct for the upward bias due to the fact wealthy decedents use probate records more often than poor decedents. This is very difficult though, and Lindert and Willamson (2011) – while recognizing the very high

Finally, we take the ratios from Jones' 1774 estimates for the Thirteen Colonies and apply them to 1770 national income in order to obtain our 1770 estimates (see excel file).

1810, 1850, 1860 and 1880

For these years we use a corrected version of the national balance sheets presented by Goldsmith (1952).[138] These balance sheets are mostly based upon US wealth censuses for 1850-1880 (and upon Blodget (1806) for the 1805-1810 estimate) and suffer from a number of deficiencies. U.S. wealth censuses were conduced approximately every 10 years over the 1850-1922 period. In principle they provide estimates of market value of all real and personal wealth (including slaves in 1850 and 1860). However the raw values reported in census documents are generally closer to assessed tax values, and as such are often substantially lower than market values and need to be upgraded. In practice it is difficult to know with precision the required size of the upgrade, and there are good reasons to believe that most published estimates tend to be too low (particularly for the early censuses of 1850-1880).[139] This also explains why they were eventually abandoned and later replaced by national balance sheets (see Hoenack, 1964).[140] On the basis of the discussion by the various authors, we choose to upgrade all raw published tangible wealth estimates given by early censuses by 20%, which seems relatively conservative.[141]

The other major problem with Goldsmith's estimates for this early period has to do with slaves. There are good reasons to believe that Goldsmith (1952, pp.317-318) vastly underestimates the market value of slaves. He uses assessed tax values for slaves, which have always been severely downward biased, both in 1850-1860 wealth censuses and in 1790-1810 tax data. The market values of slaves that are implicit in Goldsmith's estimates (see Goldsmith 1952, pp.317-318) seem implausibly low, both as compared to the probate estimates due to Jones (1977), and to modern research on the slave economy by Vogel and Engermann (1976, 2006) and subsequent authors (see, e.g., Kotlikoff, 1979 and Wahl, 2008). So we compute the total market value of

quality of Jones' work, on which they rely a lot – have recently argued that Jones' average per capita wealth might be somewhat overestimated, possibly by as much as 30%. They make this downward correction and find corrected, implicit wealth-income ratios – including slaves – around 247%-260% for 1774 and 378%-409% for 1800 (depending on whether they set the rate of return to 6% or 8%, they find capital shares around 16%-20% in 1774 and 25%-30% in 1880; see Lindert and Williamson, 2011 Table 5). Given the very high value of the slaves stock (which Lindert and Williamson, 2011 p.16 note xix believe to be correct), this would however put the non-slave wealth-income ratio at an unusually low level in 1774 (well below 200%). So we choose not to correct downwards Jones' estimates and take them as they were published. In any case, our estimate for 1770/1774 is very close to what Lindert-Williamson adopt for 1800, and most importantly all estimates find non-slave wealth-income ratios at relatively low levels by historical standards (around 200%-350%), and very high values for slaves (around 150% of national income, and as much as twice this amount for the South). Given our very long term perspective in this paper, this is well enough for our purposes.

[138] Goldsmith did not present estimates for 1860, and the numbers reported here use census estimates presented by Hoenack (1964 p.197) and in Historical statistics of the US, 1976, vol.1, p.457 series K10-13.

[139] Balance sheets computed by Goldsmith for 1900-1939 are based upon a lot more data (and postwar estimates on even more data, and finally became the official US balance sheets).

[140] See also the discussions of US wealth censuses by King (1915) and Giffen (1889).

[141] See detailed formulas and computations in the Excel file.

slaves for 1810, 1850 and 1860 by multiplying the numbers of slaves (from population censuses) by average prices given by modern research (namely, 500$ for 1810, 800$ for 1850 and 1,000$ for 1860). The resulting estimates are consistent with those derived by Jones for the year 1774 and with the current consensus on the total slave value at the eve of the Civil war (namely, about 4 billions current dollars in 1860; see Wahl, 2008).[142]

Finally, government debt figures come from the Historical statistics of the US, 1976, vol.2, pp.1117-1118, series Y493. These figures are for the federal government only, and we have made rough allowances for for State and local debt as follows.[143] Regarding government assets, we assume that they amount to 10% of national income in 1770 and 1810, and 20% in 1850 and 1860.

C Japan

A Official national accounts series

Our national account series for Japan come from the Economic and Social Research Institute of Japan's Cabinet Office, which disseminates both flow and stock series complying with SNA guidelines.[144] We start with the most up-to-date series available in July 2012, which are those included in the 2012 Annual Report on National Accounts (national accounts for 2010). The report provides complete flow and stock data based on 1993 SNA concepts and uses 2005 as benchmark year. Japanese statisticians do not fully revise previous statistics to make them consistent with the most recent ones, so we had to get back to previous editions of the Annual Report to compute our own homogenous 1955-2010 income and 1970-2010 wealth series. We provide below the main steps of this reconstruction; the interested reader will find all the details in our file "Japan.xls."

A.1 National income, 1955-2011

The Japanese Cabinet office provides series on both calendar and fiscal year basis; we systematically use calendar-year data. The 2012 Annual Report on National

[142] Slave prices vary with age, and average prices (including children slaves) have risen from 300-400 in 1800 to 1,000$ in 1860, and from 500-700 to 1,500$-2,000$ for prime age slaves. See, e.g., Fogel and Engerman (1976, 2006), Kotlikoff (1979), Wahl (2008). Annual earnings of free farm laborers rose from about 80-100$ in 1800 to about 170-200 in 1860 (see Historical statistics of the US, vol.1 p.163 series D705-717.) That is, slave prices were about 5-10 years of low skill labor income, probably closer to 7-8. To put it differently, the rate of return was closer to 15% than to 10% (in any case, certainly not 5%). This is consistent with the fact that Kotlikoff finds very high implicit interest rates in slaves sales contract with delayed payments (about 15%-20%). Lindert and Williamson (2011) prefer 8%. According to Historical statistics vol.2 p.1174 series Z166, slave prices were about £40-50 per slave in the 1770s, i.e. about 200$.

[143] Wilkins (1989, p. 32) reports that State debts amounted to $25 million at end 1789, and we use this figure for 1810 (Federal debt appears to have been constant over this period of time, from 54mn in end 1789 – of which 21.6% held by foreigners – to 53mn in 1810). In 1841, Wallis (2000, Table 2 p. 66) reports that State and local debts amounted respectively to 193mn and 25mn, and we use these figures for 1850 and 1860. In 1770 we assume that the overall public debt is 10% of national income.

[144] http://www.esri.cao.go.jp/en/sna/menu.html.

Accounts covers the 2001-2010 period for all series and the 1994-2010 period for the expenditure approach of GDP (private final consumption expenditure, government final consumption expenditure, gross capital formation, and net exports).[145] We report these raw series in the sheet "DataJapan" of "Japan.xls." We extend them to 1980 by drawing on the 2011 Annual Report (national accounts for 2009), which also complies with SNA93 but uses 2000 as benchmark year.[146] For the 1955-1980 sub-period, we use data from the Annual Report of 2000 (national accounts for 1998), which was the last vintage of accounts based on SNA68 (benchmark year 1990). We simply splice the old series onto the most recent ones with appropriate adjustment to ensure continuity.[147]

We include non-profit institutions serving households in the household sector. (As Table JP.6d shows, NPISH account for about 4% of Japan's private wealth). In the housing sector, we only include owner-occupied housing activities, because the data at our disposal do not allow us to add tenant-occupied activities.[148] There are no data on wages paid in the corporate and non-corporate business sectors separately, so we cannot isolate these two sectors in our analysis of the structure of national income.[149] The share of the overall business sector has declined from about 90% of factor-price national income in 1970 to about 80% in 2010, as the housing and foreign sector shares increased.

The three strands of data we use (SNA93 2005 benchmark, SNA93 2000 benchmark, and SNA68 1990 benchmark) are not fully consistent. In particular, there are conceptual differences between SNA68 and SNA93 (e.g., related to the scope of public vs. private entities, the treatment of financial intermediation services, etc.) that introduce a margin of error in our reconstruction of Japan's national accounts. But these errors are mostly irrelevant for the purposes of the present paper. What matter most to us are the saving data, the reconstruction of which deserves a few words.

Though Japanese saving data have often been criticized, and rightly so, we benefit from a great deal of progress made in recent years. The key issue with Japan's saving statistics was that depreciation tended to be under-estimated because it used to be partly based on historical prices (i.e., not adjusted for inflation) rather than current prices (see Hayashi, 1986, p. 150; Dekle, 1991, p. 5). This problem has been addressed: starting with the 2012 Annual National Accounts, the evaluation of the consumption of fixed capital is wholly changed to current prices. In our database, depreciation is actually higher in Japan than in other countries, with depreciation

[145] See file "Income_2001_Today.xls".

[146] See file "Income_1980_2009.xls".

[147] Prior to 1955, there exist official income data starting in 1930, see Japan Statistics Bureau, Historical Statistics of Japan (bilingual), 1989, volume 3, Section 13-5, for official flow data covering the 1930-1976 period. As there are no similar data for wealth, we have not used these series in the present research.

[148] National accounts state that households' operating surplus covers imputed services of owner-occupied dwellings. Arai (2005, Table 12 p. 19) provides statistics suggesting that imputed rents account for about 80% of all gross rents. Though we have been unable to find any explicit mention of this in official documents, it seems that tenant-occupied housing is included in mixed income.

[149] But there are statistics on compensation of employees, operating surplus, depreciation, etc., by kind of economic activity, see our files "GDPByActivity". These are the data we use for our series on compensation of employees in the government and NPISH sectors (no data before 1970).

/ GDP ratios gradually rising from 15% in 1970s to 20% in the 2000s.[150] Our private sector saving series show a gradual decrease in the private saving rate from about 26% of national income in 1970 to 10% in 2010. Though some inconsistencies remain between the different waves of national accounts (see for instance Horioka, 2008, Figure 1 p. 40), relative to this broad trend, the margin of error is fairly modest.[151]

We also pay special attention to deflators. As Table JP3 shows, there has been a large divergence in the evolution of the GDP deflator, the personal consumption expenditure deflator, and the CPI. Koga (2003) discusses the sources of the discrepancies between the GDP deflator and the CPI. The two key factors are: (i) the relative decline in the price of investment goods (in particular due to quality improvements); and (ii) the differences in index formulas used: the CPI is a fixed-based Laspeyres index (quantities weights are fixed at the base year level), whereas the GDP and the PCE deflators are chain-weighted indexes.[152]

A.2 National wealth, 1960-2011

We follow the same procedure for our national wealth series as for national income. We start with the most recent vintage of data, the SNA93 (2005-benchmark) statistics which cover the period 2001-2010, and carefully reconstruct homogenous 1970-2010 series by drawing on SNA93 (2000) and SNA68 (1990) data. Japan has a long tradition of wealth accounting, with complete sectoral balance sheets available from 1970 onward, and national wealth data as far back as 1955 (but with no sectoral breakdown for the 1955-1970 sub-period).

Private wealth

Just like for saving flows, there are old issues with Japan's balance sheets, but a fair number of them have been addressed recently. Dekle (1991, p. 4) mentions one key problem: the under-valuation of households' equities. Non-publicly traded stocks used to be valued at par, hence substantially under-estimated. But this has changed following the adoption of SNA93: unquoted shares are now valued on the basis of the market-to-book ratios, dividend yields, and price-to-earnings ratios observed for comparable quoted corporations, with a 70% illiquidity discount. This method is consistent with those used in most other OECD countries.[153]

[150] This higher level of depreciation is consistent with Japan's high wealth-income ratio. Expressed as a fraction of book-value domestic wealth, depreciation fluctuates between 2% and 4%, with a U-shaped pattern over the 1970-2010 period. Japanese accounts also use to disregard a considerable fraction of the government's consumption of fixed capital (Hayashi, 1986, p. 151) but this problem has been addressed with the adoption of SNA93.

[151] Note that to minimize errors, we reconstruct pre-2001 corporate retained earnings as the residual of national, government, and personal saving, rather than from data on corporate profits and distributed earnings, which are potentially affected by changes in what statisticians include in the corporate sector.

[152] In 2003, Japanese statisticians still used fixed-based Paasche indexes (quantities weights fixed at the current year level) for the GDP and PCE deflators, but afterwards moved to chain-weighted deflators as other OECD countries. A set of retrospective chain-weighed GDP deflator series was released, starting in 1980. These are the deflators we use.

[153] See in particular Japan's answer to the OECD's "Questionnaire on the Valuation of Equity in Financial Accounts", available online at http://www.oecd.org/dataoecd/16/23/34661062.pdf.

Japan is one of the few countries in our sample that provide separate balance sheets for households and non-profit institutions serving households (NPISH). We include NPISH in private wealth. These institutions have a small positive net wealth, which has remained roughly stable as a fraction of national income since 1970 (16% in 1970 vs. 21% in 2010). Including or excluding NPISH has no significant effect on the analysis of private wealth accumulation.

Government and national wealth

We use the same sources for our government and national wealth series as for private wealth. For book-value national wealth, we are able to extend the analysis to 1955 using SNA68 (base-year 1980) national balance sheets. These balance sheets give the value of the various non-financial assets of the domestic economy (as well as the net foreign asset position), but without isolating the different institutional sectors. In contrast to many other countries, detailed estimates of land values available as far back as 1955 (see our files "Land.xls"), in additional to the more common data on fixed assets such as dwellings, equipment, etc. (see our file "FixedAssets.xls").

The balance sheet of the government sector stands out among our sample of countries. While government financial assets usually do not exceed 50% of national income, in Japan they reach 125% in 2010. Non-financial assets are also particularly high (150% of national income, vs. 50-100% in other countries). And on the other side of the balance sheet, gross liabilities amount to more than 250% of national income, again much more than elsewhere (about 100% in most other countries). Why are Japan's public debts and assets so high?

Starting with financial assets and liabilities, four factors matter a great deal. First, gross government asset and liability figures are inflated because foreign exchange reserves are on the government balance sheet rather than on the central bank's. In 2010, the government's foreign assets were about 30% of national income. Typically, when the Ministry of Finance wants to increase its foreign exchange holdings by X, it issues X in new debt that will be held by the Bank of Japan, and uses the newly created yens to purchase X in foreign assets.[154] In other countries such as Switzerland and China, the central bank is the holder of the reserve portfolio and official purchases of foreign assets only affect the gross positions of the central bank, not that of the government.

Second, in Japan a large part of government intervention in the economy takes the form of borrowing and lending ("fiscal loans") rather than taxation and spending. In particular, the government runs a large program of lending to small and medium corporations, public companies, and local government, known as the fiscal investment and loan program (FILP).[155] The loans are granted by the Fiscal

[154] So the liabilities of the government (to the BoJ) increase by X (newly government bond issued), the government's assets increase by X (foreign assets), the BoJ's assets increase by X (government bonds), and the BoJ's liabilities increase by X (money created to finance the asset purchase). In practice the foreign assets are purchased from domestic banks, so the BoJ's liabilities are mostly held by domestic residents (foreign banks hold about 10% of the current account balances at the BoJ, see "BoJ current account balances by sector", https://www.boj.or.jp/en/statistics/boj/other/cabs/index.htm).

[155] Similar programs in other countries are much smaller and include Oseo and Caisse des Depots et Consignations in France, the Small Business Administration in the U.S., Kreditanstalt für

loan fund, a public financial company (not part of the government sector) but the fund contributes to increasing the government's financial assets and liabilities, because the government borrows to finance it.[156] Third, a sizable fraction of government bonds are held by social security funds and other government entities.[157] Fourth, the government owns a fairly large amount of shares in public corporations (114 trillion yens in 2010, i.e. about 30% of national income). Foreign exchange reserves, fiscal-loans-related claims, intra-governmental holdings of public bonds, and equities in public companies each amount to about 30% of national income in 2010, and together account for virtually all of the government's financial asset. Intra-governmental and central bank holdings of public debt also account for about one-fourth of the overall public debt (i.e. 60% of national income out of 250% in 2010).

Another fourth of the total public debt is held by public financial companies, such as Japan Post. As a result, the public debt held by the private sector is only half the total public debt.[158] Of course public financial companies in turn have large liabilities towards the private sector (i.e., household deposit at the Post), so consolidating them with the government sector would not significantly improve the net position of the government. But the large holdings of government debt by public companies arguably make it easier for the government to borrow; they also explain the many controversies surrounding the project of privatizing Japan Post.

As regards the high level of non-financial assets, they are in line with the large public investment rates recorded over 1970-2010 (3.4% of national income on average), which are two to three times higher than in other rich countries. In the end, the net position of the Japanese government is close to 0, which is comparable to most of the other countries in our database.

B Historical national accounts

Official national income data start in 1930.[159] The first non-official estimates of income appear to data back to 1900 (see Studenski, 1958, p. 497 for references). However, prior to the beginning of the official balance sheets in 1955, we have not been able to find reliable estimates of national wealth.

Wiederaufbau (KfW) in Germany, etc.

[156]The two major funding source of the Fiscal loan fund are FILP bonds issued by the fund (not part of the public debt) and government deposits. As of the end of March 2010, the central government held 20 trillion yen in deposits with the Fiscal Loan Fund and social security funds (which are part of general government) an additional 24 trillion. In 2010, fiscal loans amounted to 162 trillion yens (42% of national income, see FILP annual report 2012, p. 37.

[157]Social security funds held 75tr in central government securities as at the end of March 2010 and the central government held close to 25tr in Treasury discount bills, so that overall intra-governmental holdings of public debt securities amounted to about 100 trillion yen, i.e. more than 25% of national income.

[158]Specifically, in round figures, the government had 1,000tr yens in liabilities (about 250% of national income) as of the end of March 2010, of which 200tr were held by the central bank and the government itself (see above discussion). This leaves 800tr of debt "held by the public" (about 200% of national income). Of these, public financial companies held 100tr in loans and about 200tr in bonds.

[159]See Japan Statistics Bureau (1989), *Historical Statistics of Japan*, Volume 3, Section 13-5.

D Germany

A Official national income and wealth series, 1991-2011

National income

Post-1991 series come from the official national accounts compiled by Destatis (the official statistical institute). Regarding national income and its components, we use the 2012 edition of Destatis Annual Sectoral Accounts.[160] This publication contains the full sequence of sectoral accounts in line with the ESA 1995 standard.[161] We use it with no modification whatsoever.

To analyze the distribution of factor income, we assume that the distribution of labor and capital income is the same in the non-corporate business sector as in the corporate sector. The German case is a good illustration of the pitfalls of standard practices for computing capital shares in the non-corporate sector. Since unification, net mixed income has been decreasing (from 10% of national income in 1991 to 7% in 2011) while the number of self-employed has been increasing (from 9% to 11% of the total employed population), so that in 2011 the average mixed income per self-employed is smaller than the average wage of salaried workers. As a result, should one assume that the self-employed earn the economy-wide average wage, then one would obtain negative capital shares (net of depreciation) in the non-corporate sector.[162]

One likely explanation is that the flow of mixed income is under-estimated. As Askenazy, Cette and Sylvain (2011) note, the vast majority of German's corporations (about 80%) are small and medium companies that take the form of partnerships. These partnerships pay dividends to their partners. Some of these dividends include a labor income component – the implicit compensation of small and medium business managers/owners – and so should logically be treated as mixed income. But they are not, because partnerships are included in the corporate sector, not in the household (non-corporate) sector.[163] As a result, the flow of corporate dividend payments is in a sense somewhat over-stated.[164] The same logic is also at play in Italy where the network of small and medium enterprises is also very dense, and probably explains in part why the flow of dividends paid out is so much higher in

[160] Destatis (2012), "National Accounts. Sector accounts, annual results 1991 onwards", released in February 2012. See our file "Income_1991-Today.xls".

[161] Additional yearly series are provided in a publication in German, Destatis (2012), "Volkswirtschaftliche Gesamtrechnungen", Fachserie 18 Reihe 1.4, released March 6, 2012. The raw data are also included in our file "Income_1991-Today.xls".

[162] The problem is only magnified when one tries to attribute sector-specific wages to the self-employed, since the self-employed tend to be in relatively high-wage sectors. Using EU-KLEMS data, we find that attributing sector-specific wages implies a wage bill of 189bn euros for the self employed in 2007, while net mixed income was only 163.5bn that year.

[163] Note that at the same time, partners and proprietors who only earn dividends will be correctly counted as self-employed in labor force surveys, so while mixed income is under-estimated, the number of self-employed is not.

[164] In addition, many of Germany's partnerships opt for the individual rather than the corporate income tax. Compared to a situation in which all corporations pay the corporate income tax and dividends are paid out after payment of the corporate tax, this also tends to inflate the flow of dividend payments in national accounts, as the partners use part of their dividends to pay the taxes of the partnership.

these two countries than elsewhere in our sample.[165]

National wealth, 1991-2011

For national wealth, we use the 2012 edition of the Destatis sectoral balance sheets, which cover the period from January 1st, 1992 to January 1st, 2012.[166] The Bundesbank provides a finer breakdown of each sector's financial assets and liabilities in its quarterly financial accounts. We use the Bundesbank data to provide additional information on the composition of private wealth in Table DE.6c and DE.6d.[167] Since the Bundesbank financial accounts are slightly more up to date than the Destatis balance sheets, there is a very small discrepancy between the two sources for the most recent years.[168] The balance sheets will ultimately be updated to incorporate the revisions made in the financial accounts. Destatis does not yet publish flow-stock reconciliation accounts, so for Germany there are no "other volume change" statistics as in the U.S. and some other countries.

The national balance sheets of Germany are still in their infancy. The first comprehensive balance sheets were released in 2010. (Initial results for the 1991-2005 period were presented in 2008). While they follow the international guidelines, Germany's balance sheets have known shortcomings.[169] This has led us to make two minor modifications to the raw data.

First, inventories (AN.12 in ESA95), valuables (AN.13), land other than underlying buildings and structures,[170] subsoil assets (AN.212), non-cultivated biological resources (AN.213) and water resources (AN.214) are not yet included. These gaps are generally of secondary importance – overall, these assets account for about 7% of national wealth in France. The only non-trivial gap is land under cultivation. We upgrade the balance sheets accordingly.[171]

Second, we have corrected the data for the rest of the world sector. There is a sizable discrepancy between the foreign assets and liabilities reported in Destatis balance sheets and in the Bundesbank international investment position. At end 2011, the balance sheet reports gross foreign assets of 5,858bn € and liabilities of

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[165] In 2010 for example, distributed corporate profits amount to 11-12% of national income in Italy and Germany, vs. 4-5% in France and the U.S. In the 1980s, this flow was as high as 20% in Italy.

[166] Destatis (2012), "Balance sheets for the institutional sectors and the total economy, 1991-2011", released in September 2012 and downloaded in October; see our file "Wealth_1992-Today.xls".

[167] Financial accounts released and downloaded in October 2012. The raw data with the exact series code are also in our file "Wealth_1992-Today.xls".

[168] For the household sector, we replace the financial stock data in the balance sheets by the Bundesbank series, since the latter are slightly more up-to-date. This explains the tiny discrepancy between our wealth figures and the Destatis series.

[169] An article in the January 2008 Bundesbank Monthly Report provides useful methodological details: Deutsche Bundesbank (2008), "Integrated sectoral and overall balance sheets for Germany", Monthly Report, January 2008, vol. 60, no 1, pp.31-45.

[170] i.e., land under cultivation (AN.2112), recreational land and associated surface water (AN.2113), and other land and associated surface water (AN.2119).

[171] Specifically, we assume that cultivated land (both in the corporate and household sector) is worth 9 times the value of cultivated fixed assets (which are recorded as produced fixed assets in the balance sheets), which is approximately the ratio observed for France over this time period. See detailed computations in Data.DE2. We do not try to upgrade corporations' balance sheets to include inventories, which can be large – about 25% of national income in France.

5,420bn €, hence a net foreign asset position of 438bn €. In the Bundesbank's international investment position, gross foreign assets reach 6,555bn €, liabilities 5,710bn €, and the net position is 845bn €, that is, about 20% of national income larger. Although we have not been able to find any clear explanation for this discrepancy, plausible reasons include different valuation methods for non-listed equities (e.g., direct investments at book vs. market value) and the treatment of derivatives. Derivatives have been included in the IIP in 2010, but not yet in the external sector's balance sheet. Looking forward, it seems likely that Destatis balance sheets will be upgraded in order to match the IIP. Accordingly, for the rest of the world sector we use the IIP rather than the balance sheet (one additional advantage of the IIP is that it goes back to 1950). We make no correction to the reported private and government wealth data. The fact that Destatis balance sheets seem to understate Germany's external assets does not imply that they understate private and government wealth.[172]

Some other problems likely exist in the official German national accounts, for which we chose not to modify the official data. We briefly mention three of them below.

First, the value of land underlying buildings and structure is largely based on estimates, rather than detailed, census-like methods as in most other countries. The Bundesbank suggests these estimates may be downwards biased.[173] This might partly explain why the aggregate stock of real estate seems a smaller fraction of national income in Germany as in the other European countries in our sample. There is, however, no simple way to know the magnitude of the potential bias, and so we have not made any correction to the reported figures. We do not believe that the bias is large, as survey data (which do not suffer from the same problems as the balance sheets) also indicate that the real estate capitalization is relatively low in Germany.[174]

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[172]If the whole difference between Destatis' and the Bundesbank's data for the external sector comes from the valuation of foreign direct investments, then the discrepancy does not affect household and government wealth, because households and the government have no (or very little) foreign direct investments. But the discrepancy probably affects our measure of Tobin's Q, as Destatis may understate corporations' gross assets (and to a lesser extent their gross liabilities). If the difference between Destatis' and the Bundesbank's data for the external sector do not only come from valuation of foreign direct investments, then the private and market-value national wealth series we report in Table DE.6a may also be under-estimated – by a maximum of 20% of national income in 2010.

[173]See the Bundesbank monthly bulletin quoted above, p. 41: "the valuation of building land areas are based on price information for new land for building development and therefore ignore possible price differences with regard to land that has already been built on. For this reason, the results with regard to market values are to be seen more as a lower limit." The estimates for building land rely on three key inputs. First are quadrennial census data on the total surface area of land by type of use (building, undeveloped, recreational, agricultural, forest) reported in Destatis' "Land- und Forstwirtschaft, Fischerei" (Fachserie 3 Reihe 5.1). There are no data before 1992. Second are statistics on the purchase values or building land, reported in Destatis' "Preise Kaufwerte für Bauland" (Fachserie 17 Reihe 5), which exist since 1964. Third are statistics on construction prices, reported in Destatis' "Preisindizes für die Bauwirtschaft" (Fachserie 17 Reihe 4). It is not entirely clear from the Bundesbank article how exactly these three data sources are combined to estimate the market value of German real estate.

[174]The relatively low German wealth-income ratio is also found in the Panel survey on Household Finances (PHF). See Kalckreuth et al. (2012) for a presentation of the PHF. A first analysis of

A second issue with Germany's official data is the treatment of capital transfers. On average, capital transfers amount to more than 1% of GDP each year. As in other countries, we systematically include capital transfers in our measure of saving. This augments Germany's private saving flow by about 15%. There is, however, a huge capital transfer from the government to the private sector in 1995, when the government takes over the liabilities of Treuhand, the agency in charge of privatizing the East German enterprises. The government pays €125bn in "other capital transfers" and non-financial corporations receive the same amount. In principle, the liabilities of the government should increase by €125bn, and those of the private sector decrease by the same amount. However, this is not what we observe. The transfer does not apparently affect the financial position of the government.

The Treuhand operation explains why the private saving rate – including capital transfers – reaches 19% in 1995, vs. 10% on average around 1995. Should we use a 10% figure for 1995, the decomposition of capital accumulation into volume and capital gains effect would not change much. Over the 1991-2010 period, saving flows would account for 102% of capital accumulation rather than 107%; see Table DE.5a. Accordingly, even though the recording of capital transfers looks somewhat suspicious in 1995, we do not make any correction to the raw data.

Lastly, there are long standing difficulties with the measurement of "other equity", namely shares in GmBHs, cooperative societies, and other partnerships. These types of corporations are very common in Germany but until the adoption of ESA95 German statisticians did not estimate at all the value of their equity. Today, the Bundesbank still considers that its other equity estimates are "very tentative."[175] So in our view, it is entirely possible that currently published financial accounts substantially under-estimate the market value of the equities of many German companies. This might partly explain why Tobin's Q is so low (about 0.5), and also why the financial wealth of German households appears relatively low.[176]

B How we have dealt with territorial changes, 1870-1991

Constructing homogeneous national income and wealth series before 1991 is complicated by the numerous territorial changes Germany has experienced since 1870. Before describing the sources we use to build our 1870-1990 series, it is useful to clarify how we deal with territorial changes.

A first set of tables (Tables DE.1, DE.2, DE.3) does not make any correction for territorial change. Population and income levels in these tables simply refer to the boundaries of the time. That is, data for 1871 refer to the Reich including Alsace-Lorraine; data for 1923 to the post-Versailles-treaty Germany;[177] data for 1940 to the Reich including annexed territories (Austria, Sudetenland, and part of present-day Poland), data for 1945 to the territory occupied by the Allied Powers and USSR

the survey results was published (in Germany) by the Deutsche Bundesbank in March 2013.

[175] See Deutsche Bundesbank, "Financial Accounts for Germany 1991 to 2009", Special Statistical Publication 4, June 2010, p.12.

[176] In 2010, the financial wealth of households and NPISH was about 210% of national income in Germany, the lowest level in our sample (230% in France; 286% in Italy; about 330% in the U.K. and U.S., and up to 400% in Japan).

[177] Germany lost a number of territories in 1919-1923, see below.

(the same territory as post-1991 Germany); data for 1950 to West Germany only (including Saarland and West Berlin); and data for 1991 to reunified Germany.

Table DE.3b provides basic corrections aimed at purging the evolutions of income and population levels from the effect of territorial change. All subsequent tables rely on these corrections, unless otherwise noted. The goal of the corrections is to construct a hypothetical German territory that is not affected by border changes. Over the sub-periods ranging from 1871 to 1918, 1923 to 1934, 1945 to 1949, 1950 to 1990, and 1991 to 2011, real national income and population growth rates in this hypothetical Germany reflect the trends within the fixed borders of the epoch. Then specific adjustments are made for growth rates in 1871, 1919-1923, 1935-1945, 1950, and 1991 to exclude the effect of territorial change.

More precisely, in 1871 the population of the whole Reich grows 4.5%, but 4.0% are accounted for by the inclusion of Alsace-Lorraine. Excluding Alsace-Lorraine population grows 0.5%. We assume a similar per capita real income growth in Alsace-Lorraine as in the Reich (-0.4%), so that excluding Alsace-Lorraine real national income grows 0.1%.

Population in mid-1923 Germany is 7.6% less than population in mid-1918 Germany. In this period Germany loses Alsace-Lorraine, Memel, Danzig, Eupen and Malmedy, Saarland, North Schleswig, and Eastern Upper Silesia. Maddison (1995, p. 131) reports that these territories had a population of 7,330 thousands in 1918 out of a total of 66,811 thousands within the 1918 borders. So territorial losses cause a 11% population drop relative to 1918. Abstracting from these losses, German population should have grown (1-0.076)/(1-0.11)-1= 3.8% between 1918 and 1923. This is what we report in Table DE.3b.[178] We assume that per-capita income was the same in the truncated territories as in the Reich.[179] Consequently, the real growth rate of national income keeping borders fixed is equal to the real growth rate of per-capita income (within the changing borders of the time) times population growth (keeping borders fixed).

In 1935, the Reich regains Saarland, adding 1.8% to population and income. Abstracting from this, population grows 0.7% (Maddison, 1995) and real national income 10.4%.

For the 1938-1945 period, we report in Table DE.3b population growth rates that disregard the annexation of Austria and Sudetenland in 1938, of Wartheland, Dantzig West-Prussia, East Prussia, and Silesia in 1939, and of Bohemia and Moravia in 1940, as well as the loss of all territories East of the Oder-Neisse line in 1945. For 1938 and 1939, constant-border population growth figures are given by the Statistical Yearbook and reproduced in Hoffmann and Muller (1957). Figures for 1940 (+0.8%) and 1945 (+2.7%) come from Maddison (1995). We assume again that per-capita income is the same all over the Reich.

In 1950, East and West Germany are officially split. In 1949, East Germany had a population of 18,900 thousands (Ritschl and Spoerer 1997, p. 53). West Germany

[178] We use the yearly 1918-1923 population growth figures of Maddison (1995, p. 104). Note that Maddison reports a 3.5% 1918-1923 population growth corrected for territorial change (rather than the 3.8% we compute using the same raw data), so we adjust Maddison's 1922 population growth accordingly (from 0.5% to 0.8%.)

[179] Strictly speaking, this is probably not true. Maddison (1995, p. 131) calculates that in 1913 per capita income was 2.4% higher in the truncated area than in the former Reich. This is negligible difference given our purposes in this research.

had about 49,813 thousands inhabitants including Saarland and West Berlin (46,169 thousands excluding these areas). So the breakup of Germany causes a 27.5% population drop (18,900/(49,813+18,1900)). Population on the West German territory alone grows about 2% (Ritschl and Spoerer 1997, p. 53). Further, we know from the same source that real national income in West Germany grows about 12.5%. This is all we need to make our 1950 adjustment: should borders have remained the same, population would have grown 2% and real income 12.5%.[180] Here we don't have to assume that per capita real income is the same in the East and the West (a blatantly false assumption), since we have separate data on Eastern and Western incomes. Our adjustment implies that the division of Germany causes a mere 16.6% income drop (vs. 27.5% population drop), consistent with available evidence that in 1950 per capita income was already much lower in the East.

The last adjustment is for 1991. In 1990, population in East Germany was 16,111 thousands and population in West Germany 62,254 thousands (Ritschl and Spoerer 1997, p. 53). So unification means a 16,111/62,254=25.5% population increase. But Maddison (1995) reckons that between 1990 and 1991, population in West Germany alone grows 0.8%. Further, the Bundesbank reports that real GDP growth was 5.1% in the West. Because East Germany is poorer than West Germany, unification increases income by 8.1% only.

From Table DE.3b on, all the level data (e.g., population and national income) are corrected to exclude the effect of territorial changes. All the other data we report for Germany – such as saving rates and wealth-income ratios – reflect the economic situation within the boundaries of the time. That is, the 1970 wealth-income ratio we report in all our tables is the ratio observed in West Germany; the 1995 ratio is the one in unified Germany. We do not attempt to estimate saving and wealth in East Germany. Available evidence suggests that the private wealth-income ratio was lower in the East than in the West in 1990,[181] so in effect there is a slight discontinuity in our wealth-income ratio series in 1991. However, this is not a concern for our analysis, because East Germany is very small, in economic terms, compared to West Germany. Unification means a population increase of 25% for West Germany, but a national income gain of about 8%, and a private wealth increase of less than 4%, so that practically there is little discontinuity in 1991. We find that West Germany's wealth-income ratio was about 290% in 1990, that reunified Germany's was 284% in 1991, and we estimate a residual capital loss of -2.1% in 1991. Importantly, (i) unification cannot explain the significant amount of capital losses on German wealth for the 1970-2010 period; (ii) our method to deal with border change is consistent at the flow and stock levels: in 1950-1990, both saving rates and wealth-income ratios reflect the situation in West Germany; from 1991-on both reflect the situation in reunified Germany.[182]

[180] So per capita real income would have grown 10.3%, a bit more than in Barro-Ursua (7.3%) but much less than in Maddison (18.2%).

[181] Table DE.6g reports data from the Bundesbank suggesting that the private β was about 138% in East Germany in January 1991, vs. about 290% in West Germany. See Deutsche Bundesbank (1999), "Changes in households' asset situation since the beginning of the nineties", Monthly Report, January 1999 (see p. 45). Another Bundesbank article provides data for the government and corporations: Deutsche Bundesbank (1998), "Overall financial flows in 1997", Monthly Report, May 1998, p. 33. For more details, see Table DE.6g

[182] An alternative method to deal with unification would have been to compute saving and wealth

C National income and wealth, 1950-1991

For the 1950-1991 period, we use the official national income accounts compiled for West Germany by the Statistiches Bundesamt / Destatis. The two key sources are (i) for the 1970-1991 period, the continuously updated annual accounts in euros published by Destatis (in German) and available online;[183] (ii) for the 1950-1970 period, the retrospective 1950-1991 accounts in Deutsche Marks published in 1991 by the Statistiches Bundesamt.[184] Data for 1950-1970 are not updated anymore. We use these official publications with no modification whatsoever.

There are no official balance sheets covering the 1950-1991 period. But constructing reasonably accurate 1950-1991 wealth series does not pose major difficulties, for one simple reason: comprehensive financial accounts, by sector and by instrument, have been published by the Bundesbank since 1950.[185] In order to obtain complete balance sheets, we only need data on non-financial assets. For the household sector, we use the carefully documented estimates of Baron (1988). Baron put a great deal of effort to estimate current market values for German household wealth, based on wealth tax data. Non-financial assets tended to be taxed below their current market values, as the tax laws used supposedly "intrinsic" values (*Einheitswerte*) to assess wealth – and *Einheitswerte* were seldom updated. Baron provides detailed corrections to deal with the under-valuation of non-financial assets in tax returns, and we use his final estimates with no modification whatsoever (Baron, Table 31 p. 159-160).[186] For the government and the corporate sectors,

series for East Germany in order to explicitly account for the relatively slower growth of private wealth in the East over the 1950-1990 period. However, this is fraught with difficulties given the poor quality of available national accounts data in East Germany (which were based on the material planning system rather than the U.N. System of National Accounts). See Merkel and Wahl (1991) for a tentative reconstruction of East Germany's income in the SNA framework.

[183]Destatis (2012), "Volkwirtschaftliche Gesamtrechnungen. Inlandsproduktsberechnung, Lange Reihen ab 1970", Fachserie 18 Reihe 1.5, released 6 March 2012 – our file "Income_1970-Today.xls". Supplementary series for the 1970-1991 period can be found in Destatis' Fachserie 18 Reihe S. 29, released August 2006 – our file "Income_1970-1991.xls".

[184]Statistiches Bundesamt (1991), "Volkswirtschaftliche Gesamtrechnungen 1950-1990: revidierte Ergebnisse," Facheserie 18 Reihe S. 15. The exact page numbers of the raw series we take from this paper publication are carefully documented in the sheet DataDE1b of "Germany.xls".

[185]Complete flow and stock accounts for the 1950-1959 period are in Deutsche Bundesbank (1983), "Revidierte Ergebnisse der gesamtwirtschaftlichen Finanzierungs- und Geldvermögensrechnung für die Jahre 1950 bis 1959". Complete accounts for the 1960-1992 period are Deutsche Bundesbank (1994), "Ergebnisse der gesamtwirtschaftlichen Finanzierungsrechnung für Westdeutschland 1960 bis 1992". One peculiarity of early German financial accounts is that data published before 1998 used to isolate a separate "real estate" sector. This sector had little financial assets but large liabilities, namely mortgages contracted by households. It is important to always add the real estate sector's liabilities to households' liabilities, which is what the Bundesbank has been doing since 1998. For more details on this methodological point, see: Deutsche Bundesbank (1999), "Changes in households' asset situation since the beginning of the nineties," Monthly Report, January 1999, pp. 33-50. Another issue with the older accounts is that equity in private limited companies (GmbH), cooperative societies, and partnerships, was not recorded. We have upgraded the old accounts accordingly, on the basis of the amount of private equity holdings recorded in the new financial accounts.

[186]Baron reports on the value of households' non-financial assets net of liabilities (agricultural wealth – "Land- und fortswirtschaftliches Vermögen" – and real estate – "Grundvermögen"), financial assets (business assets – "Gewerbliches Reinvermögen" – and other financial assets – "Sonstigen Vermögen"), and liabilities (related to agricultural assets, to real estate, to business

we compute non-financial assets as the sum of fixed assets (machinery and equipment, dwellings, other buildings and structures, cultivated land, and intangible fixed assets) and land underlying buildings and structures. We use data provided by Destatis on the value of fixed assets in the West German economy by sector and by type of asset, net of depreciation.[187] For land, there are no official data before 1991. We assume that land is worth 15% of the government's net-of-depreciation fixed assets throughout the period, the ratio prevailing in 1991. For the corporate sector, we assume that land follows the evolution of the net-of-depreciation value of dwellings. There is some margin of error involved here, so we do not attempt to provide pre-1970 data for the corporate sector.

D National income and wealth, 1870-1950

There are no homogeneous official income statistics prior to 1950. We rely on non-official historical estimates.

D.1 National income and wealth, 1870-1914

National income, 1870-1914

For the period from 1870 to 1914, all our income data come from the 842 pages book by Hoffmann (1965), the reference work on historical German income and wealth, used by Maddison and many other scholars. There are known issues with Hoffmann's sometimes ill-documented series, and a whole literature has tried to improve upon them (e.g., Fremdling 1988). One problem is the large discrepancy between the different measures of national income in 1850-1870.[188] The available

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assets, and other liabilities). To compute households' gross non-financial assets, we add net agricultural wealth, net real estate, agricultural liabilities, and real estate liabilities. In 1953 for instance these items sum to DM 210.2bn, i.e., 107.5bn €. This is the value we report in Table DE.6f, which presents the available raw historical estimates for German wealth, and this is the value that underlies our 1953 wealth-income ratio. Baron provides data for the beginning of 1953, 1957, 1960, 1963, 1966, 1972, 1974, 1977, and 1980. We fill in the gaps by linear interpolation. For the financial part of household wealth, Baron's data are usually fully consistent with the Bundesbank's official accounts, and we use the Bundesbank series. The only notable discrepancy is for debt. In 1980, household liabilities amount to 408bn € as per the Bundesbank, but about 200bn € as per Baron. This discrepancy explains why we find slightly lower total net household wealth than Baron.

[187] 1950-1988 series for the private sector's fixed assets and part of the public sector's are in Statistisches Bundesamt (1991), "Volkswirtschaftliche Gesamtrechnungen. Vermögensrechnung 1950-1991," Fachserie 18, Reihe S. 17, Wiesbaden. 1970-1991 series for the whole economy by type of assets are found in Destatis (2006), "Volkswirtschaftliche Gesamtrechnungen 1970 bis 1991," Fachserie 18, Reihe S. 29. The data in these two publications are gathered in our file "FixedAssets_1950-1991.xls". Additional data for the public sector for the 1950-1991 period are found in Statistiche Bundesamt (1991), "Volkswirtschaftliche Gesamtrechnungen. Revidierte Ergebnisse 1950 bis 1990," Facheserie 18 Reihese S. 15, as well as in various issues of the Statistical Yearbook (e.g., the 1978 Yearbook pp. 503 sq gives reproducible tangible assets by type of asset and sector for the 1970-1977 period). The exact references to the raw series and the minor adjustments made to them are precisely described in the sheets DataDE2 and DataDE2b.

[188] Burhop and Wolff (2005) provide a careful discussion of the various available historical national accounts. One of their key conclusion is that Hoffmann (1965) tends to under-estimate national income in the 1850s-1860s (hence to over-estimate growth over the 1850-1913 period. From 1870-on, the discrepancy between the various sources is more modest (Burhop and Wolff, 2005, Figure 1 p.616).

raw sources for this period are scant, and there is no reason to feel more confident in any specific measure, so we discard pre-1870 data altogether.[189] Then, among the three measures of national income (output-, expenditure-, and income-based), we retain Hoffmann's expenditure-based. Burhop and Wolff attempt to make a number of improvements to this series, but they turn out to be quantitatively minor (see Burhop and Wolff 2005, Figure 6 p.626). In 1870-1913, the three measures of national income in Hoffmann closely track each other.[190]

One advantage of Hoffmann's expenditure-based income series is that they provide a readily usable decomposition of income into consumption, investment, and net exports. We directly use this decomposition with no adjustment whatsoever to compute national saving S in 1870-1913: $S = I + X - M + FY + FT$ (see Table DE.12b).

Regarding factor income shares, we provide a tentative decomposition on the basis of Hoffmann's data. We find that the capital share gradually increase from the 1870s to the eve of World War I, from about 20-25% of national income to 30%.[191]

National wealth, 1870-1914

There have been numerous attempts at estimating Germany's national wealth. The data are relatively reliable, for one key reason: a wealth tax has long been levied in Germany, first by the German States, later on by the Reich and the Weimar Republic. The first study of national wealth appears to be Krug's (1805), followed by Dieterici's (1846). Adolf Wagner (1903) was the first to publish comprehensive statistics on German income and wealth derived from tax data, followed by Steinmann-Bücher (1909). The best-known early work is the well-documented book by Helfferich (1913), then Director of the Deutsche Bank.[192] There was little research on wealth in the interwar; interest in the subject picked up with the work of Hoffmann (1965) and Goldsmith (1976).

The above-mentioned studies have different goals and rely on heterogeneous methods, while we are mainly interested in the market value of national wealth, which includes all the non-financial assets (fixed assets plus land) and the financial assets and liabilities of the household and government sectors. Accordingly, we start with modern concepts and data to compute our own national wealth series, and we then check the consistency of our series with the numerous estimates of the time.

Specifically, we first compute private wealth as the sum of the private sector's

[189] We do, however, report Hoffmann's raw series as far back as 1850 in the sheet DataDE1c.

[190] Maddison (1995) uses Hoffmann's output-based measure of income, which explains why he reports slightly higher growth in per capita income over the 1870-190 period (1.5%) than we do (1.3%). Barro and Ursua (2010) use Burhop and Wolff's compromise estimate of income, obtained by averaging the three Hoffmann series and the income in Hoffmann and Muller (1959), and find 1.4% per capital growth in 1870-1910. It is impossible to know whether the true per capita growth rate was 1.3%, 1.4%, or 1.5%, and this is irrelevant given our long run focus. What matters is that over the entire 1870-2010 period, we find a real growth rate of per capita income of 1.7%, just like Maddison.

[191] Whether the low capital share obtained by Hoffmann in the 1870s-1880s is robust is a bit unclear – Hoffmann, in particular, finds a suspiciously low capital share of agricultural output (10%) in the 1870s, vs. 20-25% just before World War 1. This issue would deserve to be further investigated.

[192] See Stamp (1919) and Eddie (1999) for more details on the early national wealth estimates in Germany.

fixed assets, land, financial claims on the government, and Germany's net foreign assets. Net-of-depreciation fixed asset data come from Hoffmann (1965, Table 40 p.255), and are the sum of agricultural fixed assets, business assets, and houses. Land values are also from Hoffmann (1965, p.234). We assume that the whole public debt is held by the domestic private sector. The amount of public debt outstanding comes from the retrospective 1876-1975 statistical compendium of the Bundesbank, the reference primary source for the financial history of Germany.[193] The net foreign asset position comes from Hoffmann (1965, Table 43). The Reich starts with a roughly 0 position in 1870; by 1913, it has accumulated about 20bn marks in net foreign claims, i.e. about 40% of national income.[194] The resulting private wealth-national income ratio is in the 600-700% range throughout the 1870-1914 period.

To compute national wealth, we add the net wealth of the government. Available evidence suggests that the government gradually accumulated a sizable amount of assets, from about 70% of national income in 1870 to close to 100% on the eve World War I. Unlike most other countries, in particular, most railways were publicly owned; their assets alone amounted to about 40% of national income in 1913.[195] As assets increased so did public debts: using the 1876-1975 compendium of the Bundesbank, we find that government liabilities gradually rose from 20-30% of national income in the 1870s to about 60% of national income on the eve of World War I.[196] This finding is consistent with Abbas et al. (2001) and Reinhart and Rogoff (2011). These authors, however, seem to discard municipal debt, i.e. they seem to only take into account the debts of the Reich and the Länder.[197] In any case

[193] Deutsche Bundesbank, *Deutsche Geld- und Bankwesen in Zahlen 1876-1975*, Frankfurt: Knapp, 1976, 364p. We take the total debt of the public sector, i.e. of the central government, regions, and municipalities. Before 1876, we use the public debt series of Hoffmann (1965, Table 225). For pre-1876 public debt series, see Spoerer (2010), who provides in particular debt ratios for 19th century Prussia. The public debt seems to have followed a U-shape pattern, starting at about 40% of GDP in 1815, down to about 10% in the middle of the century, and back to 40%-50% at the end of the century. See data available online at http://www.esfdb.org/Database.aspx.

[194] There are many estimates of German foreign assets for the pre-World War I period, some of which are slightly higher – i.e., some authors have up to $6.25bn dollars in assets in 1913-1914 (26.25bn marks, 50% of national income). Keynes (1920, ft. 122) discusses the available estimates and considers that the most likely figure is $5bn, or about $20bn marks – which is the figure provided by Helfferich, net of foreign liabilities.

[195] Our data on the government's assets come from Hoffmann (1965, Table 40 p.255). We sum public buildings ("öffentliche Gebäuse"), and public constructions ("öffentlicher Tiefbau"), net of depreciation. We also add the fraction of railways ("Eisenbahnen") owned by the government. As Wengenroth (2000 p. 106) reports, about 50% of railways were publicly owned in the mid-19th century; this fraction rose to 56% in 1870, 82% in 1880, and more than 90% in the early twentieth century. By construction, Hoffmann's series for the government's assets are consistent with his data for public investment, since his assets figures are simply constructed by cumulating net constant-price investments. Hoffmann's average net public investment rate is 2.7% in 1870-1913 – which is similar to the average real national income growth rate, hence consistent with an asset/income ratio s/g of about 100%. Note that government assets were probably even a bit larger than this, as the states owned a sizable fraction of land (about 10-15%, see Wengenroth, 2000, p. 104).

[196] In the early 1870s government debt decreases from about 30% to 20% of national income because of the transfer payments made by France.

[197] The Bundesbank reports that municipal debt (bonds issued by municipalities such as Berlin, Köln, etc.) increased from 5% of national income to about 20% in 1913. This fact explains why

public debt appear to be smaller than the government's assets before World War I, so that the government's net wealth is positive throughout the period (30%-60% of national income).

In the end, by our estimate national wealth is about 640% of national income on the eve of World War I (1910-1913), with private wealth accounting for 95% (610% of national income) and government wealth for the remaining 5% (30% of national income). This is close to the level found for the U.K. and France at the same time. If anything the U.K. and French national wealth-national income ratios seem to be slightly higher (closer to 700%), which could be explained by higher income growth in Germany in the late 19th and early 20th century, itself largely due to faster population growth.

Contemporary pre-World War I estimates of German national wealth

Table DE.6f reports the raw wealth estimates obtained by the economists of the time. We use these figures to check the reliability of our own private and national wealth series and to provide further decomposition of the structure of national wealth. Consistent with our own computations, all contemporary estimates consistently suggest that national wealth was in the vicinity of 650% of national income prior to World War I, with fairly modest variation across authors.

Steinmann Bücher (1909) reports 330-358bn Marks in national wealth for 1909, including consumer durables (see Ronce, 1917, p.362). Excluding durables, national wealth is about 320bn Marks, i.e. about 725% of national income. This is somewhat more than what we find for that year (662%), consistent with the widespread view at the time that this author tended to exaggerate German wealth to some extent.[198]

Helfferich (1913) puts national wealth at 300bn Marks in 1911. Durables, he reckons, are worth 375 Marks per head (p.107). Without durables, national wealth comes to 275bn Marks, or 575% of national income, somewhat less than the 636% we find for 1911. Helfferich's estimate is well documented and widely considered the most reliable of the time, so it is worth taking a serious look at it.

Helfferich starts with the raw data reported in the Prussian wealth tax returns ("Steuerpflicthiges Vermögen", i.e. net taxable assets). Such data exist for the years 1895, 1896, 1899, 1902, 1905, 1908, 1911, 1914, and 1917. For instance, there are 63.6bn Marks in net taxable assets in 1896, 70.0bn in 1899, 75.7bn in 1902, and 104.1bn in 1911 (Hellferich, 1913, p.106).[199] About 3.7% of the Prussian population

we find a total public debt of about 60% of national income in 1913 vs. 40% in Reinart-Rogoff and Abbas et al., and why our public debt series increases somewhat more rapidly in 1880-1913. Both Reinhart and Rogoff (2011) and Abbas et al. (2011) take their date from Flandreau and Zummer (2004) rather than from the retrospective 1876-1975 statistical compendium of the Bundesbank, as we do here.

[198] See the discussion of Steinmann Bücher's estimate in Stamp (1919, pp.469-470) and Ronce (1917).

[199] The figures for 1899 and 1902 are exactly the same as in *Statistisches Jahrbuch für den Preussischen Staat*, 1903, p.191. This Yearbook also reports the wealth of taxpayers with assets above 3,000 Marks, the exemption threshold for the income tax as well as a breakdown between urban and rural taxpayers. There are also breakdowns by size of assets, see Dell (2008) for estimates of the distribution of wealth in Prussia based on the tax statistics.

is subject to the wealth tax, which is 14% of the population when relatives are included.[200] Note that these figures are net of liabilities ("Kapitalwert der Schulden"), and that deductible liabilities are typically as high as 20% of reported gross assets.

Helfferich then makes three corrections to the raw tax data. (i) First, he inflates reported net taxable assets data by 20% in order to account for tax evasion (there is no mandatory wealth declaration) and the under-evaluation of farms (which, in contrast to other assets, are not reported at market value). In 1911 this adds 20.8bn Marks to the 104.1bn reported in Prussian tax returns.[201] (ii) Next, Helfferich estimates the amount of wealth legally exempt. Properties under 6,000 Marks are tax free. Those between 6,000 and 20,000 Marks are also exempt if the owner has less than 900 Marks in income per year. Legally exempt taxpayers, Helfferich reckons, have about 15.5bn Marks in wealth. That is, only 15.5 / (104.1 + 20.8 + 15.5) = 11% of assets are legally tax free. (iii) Lastly, furniture, ustensils, clothing, etc. (about 15bn Marks) and properties in impersonal ownership (5bn) are added.

The total net private wealth comes to 160bn Marks for Prussia, or 4,000 Marks per capita, and on the assumption of a like basis for the other States, 260bn for the Reich, or about 550% of national income. Helfferich then reckons that the government has 50bn in assets and 25bn in liabilities, so that national wealth comes to 260bn + 25bn = 285bn Marks, or 595% of national income, including durables.[202]

Helfferich checks this tax-based assessment against fire-insurance statistics. There are 80bn Marks of insured values in public institutions, 124bn in joint stock companies, and 18bn in mutual associations: overall 220bn Marks of reproducible capital is insured in the Reich. Adding careful estimates for the market value of land and other properties not insured against fire, national wealth reaches 330bn Marks – more than the 285bn obtained from the tax data. Helfferich adopts a compromise estimate of 300bn Marks, which we report in TableDe.16 (275bn excluding durables, i.e. national wealth is 575% of national income).

Stamp (1919). The reasons why Helfferich puts more weight on his tax-based estimate than on fire insurance statistics are not entirely clear. At the very least, Stamp (1919) considers that both estimates should be weighted equally.[203] Stamp upgrades Hellferich's figure accordingly and puts Germany's national wealth at 292bn Marks (durables excluded), or 610% of national income. Stamp's estimate accords well with our own 636% figure obtained by a completely independent method.

A reason why we still find a marginally higher national wealth-national income ratio is that both Helfferich and Stamp assume equal per capita wealth across the

[200] See *Statistisches Jahrbuch für den Preussischen Staat*,1903, p.191. However, Dell (2008, p.66) reckons that the number of potential tax units is about 37% of the population, which suggests that the tax only affects 0.037/0.37=10% of potential tax units.

[201] Note that this procedure is consistent with what is commonly done for estimating national income. Helfferich, for example, also estimates national income based on Prussian income tax returns, and upgrades the raw data by 10% to account for tax evasion. In contrast to wealth, income declaration was mandatory, even for exempt taxpayers.

[202] Helfferich's gross public assets are 10% higher than Hoffmann's, and his gross liabilities are 10% lower than those reported by the Bundesbank, so overall Helfferich's net public wealth is 20% higher than what we find – but both are overall remarkably consistent.

[203] One potential problem with Helfferich's tax-based estimate is that he uses net-of-liabilities data, and that reported liabilities are huge. We are unsure that they should fully be deducted from assets (see below the discussion of the Wehrbeitrag data).

Reich. But Hoffmann and Müller (1959) reckon that per capita relative income was about 3-5% smaller in Prussia. Using the same data and methodology as Helfferich, but assuming constant wealth-income ratios rather than per-capita wealth across Germany, national wealth would be about 10bn Marks higher than what Stamp reports – that is, about 630% of national income.[204] In sum, the Helfferich-Stamp effort at estimating Germany's wealth – widely regarded as the most reliable at the time – strikes us as very consistent with our own measure of national wealth based on the retrospective and independent accounts of Hoffmann (1965) and the Bundesbank (1976).

Wehrbeitrag data (1913). We have conducted a last check of the accuracy of our estimate of German wealth by analyzing the returns of the first German federal wealth tax, the Wehrbeitrag (defense levy). The Wehrbeitrag was enacted in July 1913 with a view to financing the war ahead. It was a comprehensive tax with rates ranging from 0.15% up to 1.5% for assets above 10mn marks. Wealth below 10,000 marks was tax-free, as was wealth below 30,000 marks for taxpayers with income below 4,000, and wealth below 50,000 marks for those with income below 2,000. (There were also exemptions for some stock holdings). The reference date for assessing assets values was December 31st, 1913. Detailed statistics on the wealth declared for the Wehrbeitrag, by German State and type of asset, are found in the 1919 *Statistiches Jahrbuch für das Deutsche Reich*, pp.261-263. The total net wealth declared is 182.4bn marks, of which 29.8bn is not taxable, so net taxable wealth is 152.5bn. This amount of wealth belongs to 1.2 million taxpayers, i.e. about 1.8% of the German population (67mn), and is broken down as follows: 152.5bn = 80.9bn property assets (Grundvermögen) + 25.5bn business assets (Betriebsvermögen) + 88.2bn financial assets (Kapitalvermögen) - 42.1bn liabilities (Schulden). The total net wealth declared (182.4bn) amounts to 360% of Germany's 1913/1914 national income. Following Helfferich it is reasonable to upgrade this figure by 20% in order to account for tax evasion and the under-valuation of rural estates.

What is the wealth of exempt taxpayers? Helfferich reckons that for Prussia's 1911 wealth tax, legally tax-free assets account for 15% of the raw net assets reported. But we know that more wealth is free from the Wehrbeitrag. The threshold is higher (10,000 marks vs. 6,000) and rentiers with up to 10 times the average wealth are exempt.[205] In 1913, Prussian net wealth is about 110bn marks in Prussia's wealth tax returns, but only 92bn in the Wehrbeitrag's returns, i.e. 20% less.[206]

[204] Even the assumption of constant wealth-income ratio might be too conservative. We have evidence from the States' wealth taxes that at least in some States the wealth-income ratio was higher than in Prussia. For example, in Hessen net household assets declared in 1907 are 4.4bn marks (*Statistisches Handbuch für das Gro§herzogtum Hessen*, 1909, p.211). Hoffmann and Müller (1959) have national income of about 717mn in 1909, so the private wealth-national income ratio exceeds 610%, with no allowance whatsoever for tax evasion and tax exempt assets (the wealth tax in Hessen covers about 13% of the population, which is much more than in Prussia.)

[205] Owners of fortunes worth 50,000 marks that yield 4% and that have no labor income are not subject to the tax, since their income is only 2,000 marks.

[206] The same pattern appears for the State of Hesse. For instance in 1907 there are 154,984 persons paying the wealth tax in Hesse. At end 1913, only 86,639 taxpayers from Hesse fill in a Wehrbeitrag return, of which 56,294 pay 0 tax, and only 30,345 pay a positive amount of tax. In other words, although the Wehrbeitrag has the advantage of covering all the German States, within each State it usually covers a smaller fraction of the population than the State-specific

On that basis, the Wehrbeitrag data suggest that the 1913 net wealth of German households is 182.4bn (raw data) + 0.2 × 182.4bn (tax evasion following Hellferich) + 0.2 × 182.4bn (legal Wehrbeitrag-specific exemptions) + 0.15% × 182.4bn (legal non-Wehrbeitrag specific exemptions following Helfferich) = 283bn marks = 555% of national income. We emphasize that this figure is net of liabilities, and that reported liabilities are huge – about 22% of gross assets. Such levels of liabilities are odds with available evidence for other countries on the eve of World War I.[207] We don't have any good explanation for the huge amount of liabilities reported in German wealth tax returns, so we are unsure that they should fully be deducted from reported assets. That is why was see a private wealth/national income ratio $\beta = 555\%$ as a lower bound. Should liabilities not be deducted at all, β would reach 700%.

Although there are some margins of uncertainties, the huge amounts of wealth reported in tax returns mean that German private wealth could not be less than 550% of national income on the eve of World War 1, and was in all likelihood in the 550-650% range.

D.2 World War I and its aftermath: 1914-1949

National income and saving flows, 1914-1949

There is no single study covering in full this chaotic period. Many of the reference sources (such as Hoffman, 1965) do not provide data for the 1914-1924 period. For national income and its components in the interwar, we rely on Ritschl (2002), who provides a detailed reconstruction of Germany's national accounts for the 1925-1938 period.[208] For 1914-1924 and 1939-1950, we use the national income series of Ritschl and Spoerer (1997).[209] Those authors have no data for 1945. The raw statistical material is extremely thin. Based on the change in industrial production and in agricultural production, Barro and Ursua (2010) estimate that real GDP per capita declined 15.8% from 1945 to 1946, and this is the figure we retain. We have checked that the profile of real per capita national income growth we obtain is consistent with the one obtained by Maddison (2007, 2010) and Barro and Ursua (2010).

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wealth taxes. Additional information on wealth taxation in Germany around World War I is found in *Die Deustche Vermögensbesteuerung vor und nach dem Kriege*, Statistik des deutschen Reichs, R. Hobbing, 1927, 271p. (not used in this research).

[207] In France liabilities are less than 5% of reported gross assets in estate tax returns, whatever the age of decedents (Piketty, Postal-Vinay and Rosenthal, 2011, Appendix Table B10).

[208] In 1938, Ritschl's (2002) income data refer to the Reich excluding invaded territories, while the population figure we report in Table DE.1 for that year include Austria and Sudedentland. We upgrade Ritschl's income accordingly. Our 1938 real per capita income growth rate (+7.9%) is consistent with Ritschl (2002), Barro and Ursua (2010), Maddison (1995), and a bit below the (presumably inflated) figures reported in the 1941/1942 Statistical Yearbook (p.604) – namely, the Yearbook reports a 10.1% real growth rate of per capita income between 1837 and 1838 in the "Altes Reichsgebiet." Note that at odds with available evidence, Ritschl and Spoerer (1997, p. 51) report a -1.5% real per capita income growth between 1937 and 1938.

[209] Ritschl and Spoerer (1997) provide statistics on population and income including invaded territories. One difference is with Barro-Ursua who report +17.7% real per capita growth in 1939 and +15.3% in 1940. These rates, however, are much higher than those (presumably inflated) reported in the 1941-1942 Statistical Yearbook (respectively +7.3% and -1.0%), so we stick with Ritschl and Sporer (1997).

We compute national saving as the sum of net domestic investment and net foreign investment (i.e., the current account balance). Ritschl (2002) provides the data for the 1925-1939 period. For the world wars and immediate post-war periods, we have attempted to make careful inferences from the available raw material, which is incomplete and at times quite uncertain.[210] We then compute government saving as the sum of the government's net lending/borrowing and net investment, and obtain private saving as a residual.[211] By construction, our public deficit series are consistent with the explosive dynamics of the public debt during the wars. They are also consistent with the extremely large World War 1 public deficits reported by Ritschl (2003, Table 14) – about 30-40% of national income in 1915-1916-1917.[212]

We carefully account for capital destructions during the wars after reviewing available estimates. During World War I destructions on the domestic territory can largely be neglected.[213] During World War 2, about 50% of dwellings are destroyed (Ritschl, 2003b), and Harrison (2000, Table 1.11 p. 37) reports that 17% of industry fixed assets are destroyed. Given the share of housing and other domestic capital pre-war domestic wealth, this implies a destruction of about 26% of the domestic capital stock.[214]

[210]In 1914-1919 and 1939-1946, we assume that net domestic investment was 0 (depreciation compensates gross investment). We do know that there were extremely large government expenditures, but it is impossible (and in some sense meaningless) to disentangle those into consumption and investment. For the 1920-1924 period, we assume a constant domestic investment rate equal to the 1925-1929 average (9% of national income), and for the 1946-1949 period equal to its 1950 value (16%). Regarding the balance of payments, for 1914-1918 we use the trade balance of Hardach (1973, Table 6, quoted in Ritschl, 2003, Table 7) and set net income payments to zero. In 1919-1924 we set net exports and income to zero, but net transfer payments to -5% of national income (in 1921-1924) consistent with available estimates of the amount of reparations paid by Germany in this period (e.g., Schuker, 1988, Table 12.). In 1940-1946, we assume that the Reich borrows 5% of national income per year to invaded and satellite countries, so the current account balance is -5%. This estimate could probably be refined, but it appears in line with historical evidence on the amount of German clearing debt during World War II (see discussion below of Germany's net foreign asset position during the 1914-1953 period). Lastly, for 1947-1949, we assume that the balance of payments is the same as in 1950.

[211]We compute government net lending/borrowing in year t as the difference between the government's net financial position at the end of t and the government's net financial position at the end of $t-1$. For the hyperinflation years 1922-1923, we set net lending equal to 0: there is no way to meaningfully compute a government deficit/surplus when the public debt is being monetized on such a large scale. We similarly set net lending to 0 during the Allied Control Council administration from 1945 to 1949. As regards net public investment, we rely on Ritschl (2002) for the 1925-1939 period. Consistent with the level of public non-financial assets in 1914, 1924, 1939 and 1950 and war destructions, we assume constant net investment rates $i = -2.4\%$ in 1914-1924 and $i = 1.5\%$ in 1939-1950.

[212]Ritschl's deficits are in the 40-50% range, but our computation of net borrowing as the difference between t and t-1 net financial position amounts to excluding from public deficits the fraction that is immediately monetized through central bank purchases of public bonds, since we include in government financial assets the public bonds held by the Reichsbank (see below). This is the most consistent way to proceed if one wants to compute private net lending as national net lending minus government net lending.

[213]Germany also loses almost all its foreign assets during World War I, a large fraction as payments for its trade deficit during the war, and the rest – which we record as capital losses on the foreign asset portfolio – being confiscated, destroyed, or annihilated by inflation.

[214]The 17% figure reported by Harrison (2000) is for destructions of industry fixed assets in the Anglo-American zone. Because fighting and bombing was more intense on the Eastern front, the figure is only a lower bound for destructions on the entire German territory. To take into account

German national wealth, 1914-1949

We are not aware of any well documented study of national wealth in Germany in the 1914-1949 period. The economists of the time were certainly disheartened by the chaotic evolution of consumer price (the 1923 hyperinflation), asset prices, war destructions, and so on. So we had to return to the raw sources.[215]

Private wealth and the 1927 census: The key fact that makes estimating German wealth in the interwar possible is the existence of a wealth tax, created in the aftermath of the 1924 monetary reform. With the wealth tax comes a comprehensive wealth census conducted to establish the market value of all of Germany's wealth (and not only that of taxpayers) as of the end of 1927. The results of the census are found in the 1930 *Statistisches Jahrbuch für das Deutsche Reich*, pp.534-535. We know the total surface of agricultural land by German State and type of land (agricultural, forestry, vineyards, horticulture) and its value: 36.7bn marks. Similarly, we have information on the number of corporations by State and the value of their capital stock (132.8bn marks), and the number and the value of dwellings and undeveloped land (78.6bn marks, 48.9bn once deducted what belongs to corporations).[216] The total private wealth comes to 37bn (land) + 48bn (housing) + 133bn (other private capital stock) - 9bn (net foreign assets, more on these below) = 210bn marks, or 275% of national income.[217] Compared to the 1911 Stamp-Helfferich data point, the private wealth-national income ratio is halved.

From this data point for 1927, we obtain yearly 1914-1950 private wealth series by cumulating private saving flows and accounting for war destructions. The name of the game is to find the pattern of real rates of capital gains q consistent with the 1913, 1927, and 1950 values of the wealth-income ratio on the one hand, and observed saving flows and war destructions on the other. In order to obtain meaningful cyclical variation in q, we rely on the variations in the equity price index constructed by Gielen (1994).[218] There are four broad phases in equity prices. First, equities lose 70% in real term between mid-1914 and mid-1924.[219] There is then a short but sharp reversal from 1925 to 1927, with the index more than doubling. In the course of the Great Depression, the index is again almost halved: by 1932

the increased severity of destructions in the Russian zone, we assume that 25% of the overall 1939 German stock of "other domestic capital" is destroyed. To annualize the destructions, we assume that 50% of them take place in 1944-1945, and the rest equally from 1940 to 1944 – except for government assets, for which we assume for simplicity that all destructions take place in 1944-1945 (see detailed computations in Table DE.6f, DE.5a, and DE.5c).

[215] Note that Hoffmann (1965) does provide fixed capital stock data (agricultural fixed assets, business assets, houses) for the interwar. But there are two major issues. First, these series do not reflect market values: they are simply built by cumulating net investment flows. This problem can be neglected to some extent for the pre-World War I period (and indeed we neglected it), but it cannot be neglected when there are large swings in stock markets and asset prices are deeply depressed, as during the interwar. Second, there are no data on land.

[216] The corporate sector's liabilities amount to 80bn marks.

[217] Note that ideally we would like to have market values for mid-1927 rather than January 1st, 1928, we neglect this 6 month discrepancy. Our 210bn marks figure is roughly in line with the 232bn obtained by Dell (2008, p.154) using a completely different method (mostly Hoffmann's 1965 data; see Dell 2008 pp.132-134.)

[218] See also Bittlingmayer (1998) for an analysis of these data.

[219] The nadir is reached in 1920, and there is no clear trend but huge volatility from 1920 to 1924, so that in mid-1924 the equity index is still close to its historical low.

it is back to its 1924-1925 level. Lastly, during the nazi regime there is a sharp recovery, with the index multiplied by three between 1933 and 1941: in real terms, by 1940 equities have returned to their 1913 level.[220] Admittedly, one should be cautious in interpreting variation in this type of index, which is sensitive to the sample of corporations included, the measurement of consumer price inflation, and so on. However, we believe it provides a good enough qualitative picture of the pattern of capital gains on private wealth in this chaotic period of time.

We find that we can account for the evolution of the private wealth-income ratio given private saving flows while being consistent with the broad dynamic of equity prices by assuming a constant rate of real capital gains $q = -13.9\%$ in the 1914-1923 period, $q = 10\%$ in 1925-1927, and $q = 3.7\%$ during most of the 1928-1949 period, with allowances made for the crash during the Great Depression and at the end of the war.[221] We have carefully checked that the implied amount of private wealth in the 1920s and 1930s is consistent with what is reported in tax returns. In mid-1924 for instance, we estimate that private wealth amounts to 120bn marks, which corresponds to a wealth-income ratio of about 220%, the nadir of the pre-World War II period, barely a third of the 1913 ratio. Given the population covered by the wealth tax and the tax rules, our estimate for 1924 is well in line with the amount of wealth declared in tax returns, namely 77.93bn marks at end 1923 and 64.07bn marks at end 1924.[222] One should not over-state the quantitive precision of the wealth-income ratio we obtain in the chaotic 1920s, but all available evidence

[220] From 1941 on, German equities are subject to price control so the index loses much of its meaning until 1948.

[221] That is, consistent with Gielen (1994), we set $q = -5.0\%$ in 1930 and 1932 and $q = -10\%$ in 1931. To take into account the economic depression in 1944-1946 (real national income per capita decreases -8.5% in 1944 and -15.8% in 1946) we set $q = -10\%$ in 1944 and $q = -20\%$ in 1946. Lastly, in 1945 there is a de facto default on the entire domestic public debt in addition to a stock market crash. To take this into account, we set $q = -55\%$ in 1945.

[222] See Statistiches Jahrbuch 1926 p. 424 (end-1923 data) and Statistiches Jahrbuch 1928, p. 552. (end-1924 data). The 77.93bn figure for end-1923 includes 30.598bn in agricultural land, 19.30bn in urban dwellings, 0.93bn in agricultural dwellings, 22.38bn in business assets, 6.14bn in financial assets, and 1.41bn in liabilities. The number of taxpayers is approximately the same as for the 1913 Wehrbeitrag (2.78mn in 1913 and 2.55mn in 1924, while total population has decreased from 67 million to 61.7 million) but the net wealth declared has been divided by 2.35 (183.2bn vs 77.93bn). The bulk of the fall owes to financial assets (88bn in 1913 vs. 6bn in 1924 – mitigated by the fall of liabilities from 42.1bn to 1.41bn). In end 1924, the main change is that liabilities now amount to 10.36bn (probably due to the reinstatement of some pre-hyperinflation debts); there is also a change in classification that makes it possible to directly compare the wealth reported in end 1924 to that reported in the 1913 *Wehrbeitrag*, asset class by asset class. Business assets (*Betriebsvermögen*) are down 50%, real estate (*Grundvermögen incl. Landwirtschaft*) down 35%, and financial assets down 90%. Averaging the end-1923 and end-1924 totals, declared wealth in mid-1924 comes to 71bn marks, 2.6 times less than in 1913. Dividing our estimated 1913 private wealth by 2.6 we would obtain a mid-1924 amount of private wealth of 125.0bn, very close to the 120bn we find using a completely different method. Of course, it is likely that the distribution of wealth, tax exemptions, and tax evasions changed between 1913 and 1924, so one should be careful not to draw too much from this kind of evidence. Interestingly, however, the 1927 Statistiches Jahrbuch (p. 477) provides data on the distribution of wealth by tax bracket suggesting that wealth concentration was still very high in end 1923, with inverted Pareto-Lorenz coefficient between 3 and 5. This suggests that the very low amount of reported wealth probably mainly reflects a general drop in aggregate wealth rather than a de-concentration of fortunes during the war and immediate post-war period. With existing data, however, it is impossible to properly separate out the two effects. See Atkinson (2006, pp. 13-16) for an analysis of German wealth tax data.

points to a truly massive reduction in aggregate private wealth compared to 1913, with a private wealth-national income ratio markedly lower than in France and the U.K. in the 1920s (200-300% vs. 300-400% in France, and 400-500% in the U.K.).[223]

Government wealth: Government operated a growing number of businesses in the interwar. The first large publicly-owned company was the Reichsbahn, created in 1919 as a merger of existing railways. It employed close to one million workers, and significantly contributed to reparation payments. By the end of the 1920s the government also owned one of Germany's largest electricity company (Elektrowerke AG). And while the nazi regime generally maintained an appearance of private property as long as private businesses were willing to cooperate, it run a very large conglomerate, Hermann Göring Reichswerke, which included more than 300 companies at its peak in 1941-1942.[224]

To compute the government's assets, we rely on Hoffmann's (1965) public fixed assets data. These series, obtained by cumulating investment flows, give the book value of government's assets. We multiply railways assets by a market-to-book ratio in order to approximate the market value of the government's stake in the Reichsbahn.[225] We find that government assets were high in the interwar, close to 100% of national income up to World War II, at a time when private wealth was low. As a result, while government non-financial assets amounted to about 10-15% of domestic capital in the pre-World War I period, by our estimates they reached 20%-30% in the interwar, peaking at 40% in 1944-1945. This is entirely consistent with available evidence that the nazi regime eventually came to control up to 50% of Germany's capital stock (Wengenroth, 2000, p. 118). The nazi conglomerates were largely destroyed during the war, and the remainder dismantled in the immediate postwar period. The government, however, retained control of a number of large companies, most prominently Volkswagenwerk (whose ownership was transferred to the state of Lower Saxony and to the federal West German government), Saarbergwerke (after the end of French control), and the former holding companies of the states (e.g., VEBA, the former Prussian holding company).

Regarding government debt, our data come from the retrospective accounts of the Bundesbank (1976). As previously, we include the debts of the federal government, states, and municipalities.[226] From 1945 to 1948, Germany is in a state of

[223] In January 1st, 1928, reported wealth is still very low (77.37bn marks of net assets for 2.76 million taxpayers), see Statistiches Jahrbuch 1930 p. 535 sq. In the 1930s, the fraction of taxpayers covered by the wealth tax decreases markedly (1.6% in 1931, 2.5% in 1935; see Dell, 2008, p. 130), making it harder to use tax data to measure the overall amount of private wealth.

[224] For an analysis of private property under nazi rule, see Buchheim and Scherner (2006).

[225] Our market-to-book ratio is equal to 100 in 1913 and then follows the evolution of the general equity price index constructed by Gielen (1994). Another – more data intensive – way to proceed would be to use the accounts of the Reichsbahn and other public companies and apply the financial ratios that prevailed for listed companies. For instance, as Wengenroth (2000, p. 111) reports, the Reichsbahn and Reichspost made 1.1bn in profit in 1929. Assuming a price/earnings ratio of 15, this would put the market value of these two companies at about 16.5bn marks, or about 20% of 1929 national income. Note, however, that the Reichspost made very little profit. Prices were deliberately kept low, in particular to make it impossible for Allied countries to use Reichspost profits for reparation payments.

[226] Data are as at March 31st (end of fiscal year), we linearly interpolate them to December 31st. Linear interpolation is problematic during the 1923 hyperinflation and instead we use for end-1923 the Bundesbank estimate that short term public debt was 192 trillion in November 1923.

default on its public debt. We consider that default takes place progressively in the 1945-1948 period, i.e. from mid-1945 to mid-1948, public debt gradually declines to its 1950 value (33% of national income).[227]

All the data we use on public debts refer to face values. It would be desirable to always use market values (i.e., taking into account the price at which bonds trade on markets) but we are not aware of consistent and comprehensive series on the market value of German public debt. This is not a big issue, however, because contrary to the U.K. and France, government debt in Germany has historically always been quite small. Leaving aside the 1990s and 2000s, there are only two periods during which public debt has exceeded 60% of national income: 1915-1919 and 1941-1945. In order to take into account the fact that public debt traded at large discounts during the wars,[228] i.e. that at market value the net position of the government was in some sense better than what face value indebtedness suggest, we include the fraction of the debt held by the Reichsbank in the government's financial assets. This is equivalent to subtracting from government liabilities the fraction of the public debt that was monetized.[229] We find that about 10-20% of Germany's public debt is monetized during World War 1.[230] In the run-up to the 1923 hyperinflation, the ratio of public debt held by the Reichsbank to total public debt increases to 30-40%. During World War 2, 10-20% of the public debt is again monetized.

Overall, we find that government net wealth was strongly positive in the interwar, as the 1923 hyperinflation wiped out almost all of the public debt.[231] By our estimates, net public wealth accounts for up to 15-20% of national wealth in the 1920s and 1930s, up from 5% or so before World War I. It is only during World War II that the net position of the government turns negative, as public debt reaches close to 200% in 1944-1945. But thanks to the 1945-1948 default, net public wealth immediately turns positive again at the end of the war – just as it did at the end of World War I with inflation. As regards government wealth, Germany stands in

[227]Formally, default on the domestic public debt takes place in 1948 with the currency reform that converts most saving at a rate of 6.5 deutschmarks to 100 reichsmarks and completely wipes out all government securities (see, e.g., Lutz 1949, pp.125-126). Between 1945 and 1948 there is no functioning price system; Germany's economy is mostly characterized by barter and some fixed price transactions (most war controls subsisted until 1948), and government securities are practically worthless. Default on part of the foreign public debt took place at the 1953 London debt agreement – and up to 1953 we include in public debt the amount that was subsequently forgiven by foreign creditors in 1953, which explains why in the late 1940s and early 1950s, government debt is about 30% of national income rather than close to 0.

[228]German government issued in Switzerland traded at large discounts during World War II, typically at only 30-40% of par values; see Frey and Kucher (2000, p. 478).

[229]Reichsbank holdings are reported by the Bundesbank (1976, p. 36) and include Treasury bills and bonds (*Schatzwechsel und unverzinsliche Schatzanweisungen*), and *Darlehnskassenscheine*, i.e. notes of the Loan Bureau, which is how part of the public debt was monetized during World War I (see e.g., Webb 1984, p. 501). We also include in government financial assets the Mefo-bills, a form of public debt issued by nazi Germany to finance rearmament and secretly bought by the Reichsbank. Mefo (Metallurgische Forschungsgesellschaft, m.b.H) was a shell company created by Schacht, the Reichsbank president, which issued bills used as payments for the rearmament to circumvent international oversight which prohibited rearmament.

[230]This finding is fully consistent with the data reported by Ritschl (2003, Table 15).

[231]In 1925, some debts (especially mortgages) were reinstated, but typically at huge discounts – i.e., as low as 2.5% of face value for some government bonds.

sharp contrast to the U.K. and France, where public debts largely exceeded public assets in the 1920s, 1930s, and 1940s (and well into the 1950s for the U.K.).

Foreign wealth 1914-1953: Germany basically loses all its foreign assets during World War I and in the immediate post-war period, as the Allies seize the remaining assets (ships, marine cables, etc.) for reparation payments. In 1924, gross foreign assets and liabilities (excluding Versailles-treaty debts) both appear to be very small – about 10% of national income.[232] Versailles-treaty debt are gigantic, but we chose not to include them in our baseline measure of foreign liabilities for two reasons: first, because exactly quantifying these debts is fraught with difficulties (most actors of the time themselves did not have a clear view of the total amount due as per the Treaty); second, because Germany did rapidly default on those obligations.

We nonetheless report tentative estimates of Versailles-treaty debts as a memo item in Table DE.6b. In London in 1921, the Reparation Commission fixed the reparation bill at 132bn gold marks. That same year, German national income was about 42.5bn gold marks, so the total reparation bill initially amounted to more than 3 times national income. Of the 132bn due as per the Treaty, however, Germany was only expected to service what was known as the "A" bonds – 12bn gold marks, for compensation of the war damages – and the "B" bonds – 38bn Goldmarks for the reimbursement of interallied war credits. "C" bonds (82bn) were contingent upon Germany's capacity to pay, and were never really expected to be serviced at all (Guinnane, 2004, p. 11; Ritschl, 2012, pp. 3-4). The "A" bonds alone amounted to about 25% of 1921 national income, and were comparable in size to the French indemnity of 1871 (5 billion francs, which was just 25% of French 1870 national income). Together, the "A" plus "B" bonds amounted to more than 120% of national income – which was comparable to the public debts incurred by France and the U.K. during the war. In 1929, the Young plan reduced the total reparation bill to 121bn gold marks, and at the Lausanne conference in 1932 they were formally reduced to 3bn that were never paid. In the end, available estimates suggest that Germany paid in total about 23bn marks through to 1932 (Schuker, 1988, quoted in Guinnane, 2004, ft 13).

As is well known, the Weimar Republic went on a borrowing spree, especially the states and municipalities. Even disregarding the reparation bill, Germany turns into a large net debtor in the interwar, with a net foreign position of about -40% in the early 1930s (the equivalent of 10% of national wealth) according to the statistics gathered by the Bundesbank in the 1976 compendium. One caveat is that estimates of foreign assets for the inter-war are probably on the low-end for the same reasons as they are today: they miss the foreign securities held offshore by individuals (Zucman, 2013). It was already well acknowledged by contemporaries that a sizable amount of foreign securities in private hands had left Germany since the end of World War I (see, e.g., Keynes, 1920, chapter 5, III.1). Available Swiss data show a large increase in foreign fortunes managed by Swiss banks in the 1920s, and in all likelihood a sizable fraction of those belonged to German households.

In the early 1930s, Germany stopped interest payments and amortization on all its long-term foreign debts (but still serviced most of its short term debts, which was

[232] Cross-border positions for the interwar are provided by the 1976 Bundesbank compendium, p. 331.

mostly to the U.K.). Germany did borrow a lot during World War II as it imported a huge amount of goods and services from occupied and satellite countries. Trade was structured through bilateral clearing agreements, and from 1941 to 1944 the overall German clearing debt increased at a pace of 5% of national income per year (Ritschl, 2001, Table 4 p. 330). By the end of the war, the clearing debt amounted to 30bn Reichsmark – the bulk of it being vis-a-vis France, the Netherlands, and Belgium. However, this clearing debt was artificially lowered, because the Reich massively overvalued the mark so as to render foreign goods cheap for Germany. Occhino, Oosterlinck and White (2006) for instance, consider that French-German bilateral clearing agreement over-estimated the Reichsmark by 50%. At more realistic prices, Buccheim (1986) estimates that the true clearing debt of Germany by end of the war was three times larger as the official one, i.e. 90bn Reichsmarks, the equivalent of 100% of 1938 national income.

In 1953, the London debt agreement settled the foreign debts of Germany. Great care was devoted to precisely establishing the amounts due by the Federal government. The agreement stated that some pre-World War II debts would be reimbursed in the short term, while other repayments would be delayed until reunification, and yet another part would be cancelled; see Dernburg (1954, p. 549) and Guinnane (2004). Up to 1953 we include in government and foreign liabilities the debts that were subsequently cancelled in 1953. The cancellation of about 8bn marks in foreign debts (as well as sustained trade surpluses) help Germany move from a large net debtor position at the end of the war to a creditor position by the middle of the 1950s.[233]

E France

A Official national accounts series

A.1 National income, 1949-2010

French national accounts are constructed and published by the national statistical institute (Insee, Institut national de la statistique et des études économiques). Detailed series are available online in Excel format at http://www.insee.fr. New series are usually released in July n+1 (or September n+1). We use the 2011 edition of Insee's national accounts, which follow the 1993 SNA and have 2005 as base year. Insee provides a comprehensive, consistent, and homogenous set of income accounts by sector starting in 1949,[234] and we use them with no modification whatsoever.

[233] The London debt agreement also explains why there is a large net capital transfer recorded in 1953 – which we include in our measure of government and national saving.

[234] See our file "Income_1949_Today.xls". In September 2011 Insee switched from the 2000 to the 2005 base: all 1949-2010 series were revised accordingly. The changes are described in French here: http://www.insee.fr/fr/indicateurs/cnat_annu/base_2005/methodologie/comptes-nationaux-base-2005.pdf.

A.2 National wealth, 1970-2010

Insee also provides annual wealth accounts by sector starting in end 1970.[235] These balance sheets follow the 1993 SNA / 1995 ESA standard, and we took our wealth data straight from Insee's website, with no modification whatsoever for the 1978-2010 period.[236] Yearly income and wealth accounts are synthesized in the "Tableau economique d'ensemble" (TEE).[237] All data series cover the current territory of France, defined as French mainland territory and overseas departments (Guadeloupe, Martinique, Guyane, Reunion).[238]

Generally speaking, our wealth and income series for France closely follow those reported in Piketty (2010, 2011), and we refer to this work for additional references and details about French historical national accounts. There are a number of differences, however, some due to the fact that some updated Insee series have become available, and some other due to our attempt to better homogenize definitions and concepts across countries. One important limitation of the database constructed by Piketty (2010, 2011) is that it really focuses on private wealth (because of the focus on the intergenerational transmission of wealth) and pays insufficient attention to government and national wealth.

The main differences between the computations we report in our file France.xls and those reported in Piketty (2010, 2011) are as follows (full details are given in the Excel file):

(i) We include non-profit institutions serving households in the household sector (private wealth) rather than in the government sector, in order to be consistent with what we do for other countries (some of which do not isolate NPISH from households in their own accounts).

(ii) We compute real values using the GDP deflator rather than the CPI. Over the long run, both have evolved quite similarly: average GDP price inflation is 5.9% over the 1870-2010 period and CPI inflation 5.7%. There are short run differences, however. As a consequence, year-to-year real growth rates differ from those reported in Piketty (2010).[239]

(iii) Unless otherwise noted, all our wealth data points are mid-year estimates rather than beginning-of-year estimates.

(iv) In line with what we do for all the other countries, we include net capital transfers into saving flows. This raises private saving rates to some extent over the 1949-2010 period; as a consequence the capital accumulation and the residual

[235] Wealth accounts include both non-financial and financial balance sheets. Financial balance sheets are constructed by the Bank of France, and are also disseminated by the Bank – a complete set of 2005-base financial accounts is being constructed by the Bank of France, with data starting in end 1969.

[236] Post-1978 data are available online (see our file "Wealth_1978_Today.xls"). 1970-1978 data have not been put online by Insee/Banque de France yet. However they can be found in older Insee publications such as "25 ans de Comptes de patrimoines (1969-1993)", *Insee Resultats*, no.348, December 1994, 129p. There is very small discontinuity in 1978 and we made appropriate adjustments to as to ensure continuity (see our file France.xls for details).

[237] See our file "TEE_1949_Today.xls".

[238] Note however that this exclude so-called overseas territories (Nouvelle-Caledonie, Polynesie, Wallis-et-Futuna, etc.) and Monaco.

[239] Differences between GDP and CPI inflation can typically be as large as 2-3% in a given year, which translates into real income growth rates differences of 2-3%.

capital gains effects were re-estimated for the 1924-1954 and 1954-1970 periods, and wealth-income ratios in these years slightly differ from the previous ones. Overall, the changes involved here are minor.

(v) In Table FR.1, ratios of private wealth to disposable income are computed using a modified concept of disposable income as to improve international consistency.[240]

(vi) We use population series covering mainland territory and overseas departements, rather than only the mainland territory. This does not affect the wealth-income ratios and aggregate growth rates, but slightly reduces per capita levels.[241]

B Historical non-official national accounts series

Regarding national income before 1949 and national wealth prior to 1970, we start with Piketty (2010, 2011) and extend this work over time along two dimensions: (i) we provide decennial estimates of income and wealth from 1700 on (vs. 1820 in Piketty, 2010, 2011) and (ii) we report yearly income, saving and population data from 1820 on (vs. 1896). Our comparative and national perspective on wealth also led us to make a few adjustments to some of the income and wealth data previously reported, as we explain below.

B.1 National income and population, 1700-1948

1700-1820 decennial estimates

1700-1820 population data are taken from Maddison (2010).[242] Regarding national income, we assume that real per capita growth is 0.2% per year from 1700 to 1810, and 1.5% from the 1810s to the 1820s, consistent with Maddison (2010). To obtain nominal values, we relied on the price series due to Labrousse (1933). Details are provided in Excel file France.xls.

1820-1896 yearly estimates

Yearly 1820-1896 national income data come from Bourguignon and Lévy-Leboyer (1985). Their 1820-1840 national income data were lowered by 0-10% in order to fit

[240] That is, we include in disposable income pure transfers, whereas the national income series Y_{dt} used in Piketty (2010, 2011) excluded pure transfers.

[241] As of 2010, the population of mainland France was equal to about 97,1% of total French population (62,8 millions out of 64,7 millions inhabitants, vs. 1,9 millions for overseas departement - DOM, *departements d'outre mer* -, including about half for Reunion, and about half for Guadeloupe-Martinique-Guyane). This ratio has been slightly declining over time, due to higher population growth in overseas departement (the ratio was about 98%-99% in the 1950s-1960s). See France.xls for details (see in particular Table FR.8b). Piketty (2010, 2011) wrongly divided income and wealth aggragates including DOM by population series excluding DOM (thereby overstating somewhat per capita levels). This is inessential for our purposes here.

[242] Specifically, Maddison reports population of 21,471mn in 1700, and 0.3% average yearly population growth over the 1700-1820 period; we assume 0.3% growth in 1700-1710, hence an average 1700-1710 population of 21,776mn, and similarly fixed population growth of 0.3% per year until 1810. We assume that adult population is 60% of total population, which is consistent with nineteenth century figures and low population growth of the eighteenth century. Post-1820 population data are from Piketty (2010), who uses a number of French official sources (such as Insee AR 1966, p. 22).

Maddison's per capita 1820-1910 growth rates, i.e. 1.0%-1.1% (rather than 0.8%-0.9%). Thus, by construction our 18th and 19th century national income series are fully consistent with Maddison's.

We also use the data from Bourguignon and Lévy-Leboyer (1985) to provide estimates of national saving (net domestic investment plus net foreign investment). According to Bourguignon and Lévy-Leboyer the national saving rate (weighted by real income) averaged about 9.5% in the 19th century, although one should not over-state the quantitive precision of such estimates. The important point is that since the real income growth rate g was about 1.2% in 1810-1910, a saving rate s of about 9.5% is consistent with a wealth-income ratio around 750%. This is well in line with the many available estimates of national wealth computed completely independently by the authors of the time (see below). Saving appear to be slightly higher in the second half of the century than in the first half – with both domestic and foreign investment on a rising trend.

Last, we compute private saving as national minus government saving. Government saving equals government investment plus government net lending/borrowing. We assumed net public investment rates of 0.5% of national income for the 1820-1896 period, which is in line with available estimates of the government non-financial assets (see below). We carefully reconstructed government net lending/borrowing from government budget data.[243] Overall, government saving was slightly negative (about -1% of national income), so that private saving slightly exceeded national saving (10.5% vs. 9.5%).

1896-1948 yearly estimates

From 1896 on we start with the yearly data reported in Piketty (2010, 2011), which rely on the detailed series constructed by Villa (1994). The key differences are as follows.

First, private saving flows were recomputed from the expenditure side of Villa's accounts, as the difference between national saving (domestic investment plus net foreign investment) and government saving (government investment plus net lending/borrowing), while the estimates reported in Piketty (2010, 2011) relied on the income side. Because there is a discrepancy between the income and expenditure approach in Villa's series, the two measures of private saving differ. The discrepancy is sizable during the wars (when our new private saving seriees is larger than the previous one) and the interwar (when it is smaller). Over the whole century, the discrepancies cancel out and the choice of one particular series makes relatively little difference.[244]

Second, we subtracted the losses on foreign assets during World War I from war

[243] Net lending/borrowing is equal to the government's secondary surplus/deficit plus net capital transfers received. The key data source here is AR 1966, pp.484-485. To compute proper government surplus/deficits, it is important to exclude "extraordinary revenues" from government revenues, because these *ressources extraordinaires* include funds raised through the issuance of perpetuals and long term bonds. We include in government deficits a number of exceptional capital payments made by the French government (in 1825 and 1871-1873, see discussion of the public debt below).

[244] Note that Villa (1994) does not provide data on government investment during World War II (see Villa's file "long.xls", series IG). We assumed gross government investment rates of 0% in 1940-1944 and 10% between 1945 and 1948.

destructions, in order to ensure consistency with other countries. Theses losses now appear as capital losses in our decomposition results.[245]

B.2 National wealth, 1700-1913

1820-1913

The 1820-1913 estimates of national wealth reported in Table FR.6f are a synthesis of many contemporary estimates (see Piketty 2010, 2011 for detailed references). Composition of national wealth 1810-1913 is mostly taken from Lévy-Leboyer 1977 p.396 (compilation of many estimates; see also Foville 1893 pp.604-605), Colson (1903, vol.2, pp.282-283) and Danysz (1934, p.141). The 1780-1900 series on land and housing rental income and corresponding capital stock compiled by Turquan (1901 pp.4-5) and Toutain (1997 p.113) are consistent with the stock estimates reported here, just like the historical national wealth estimates published by Insee in 1958.[246]

For 1913, we use Colson's (1918, p. 365) estimate. According to Colson, national wealth amounts to 302bn francs, and we report this estimate with no modification whatsoever. We use the composition estimates of Lévy-Leboyer (1977, p. 396: 63.8bn for land; 50.3bn in net foreign assets) and Toutain (1997, p. 113: 75.6bn for housing).

We draw on additional data sources for government wealth (see below), which leads us to revise the historical public and national wealth figure given in Piketty (2010, 2011). The main difference is that the series reported by Piketty (2010, 2011) show a moderate upward trend in the private wealth-national income ratio in France during the 1820-1913 period (from 550-600% at the beginning of the period to 650%-700% by the end of the period), while we find basically no trend (with ratios around 650%-700%). This is due to revisions in the numerator and the denominator (in particular, national income denominators used by Piketty 2010, 2011 for the 1820s-1840s were over-estimated). The figures now given in Table FR.6f supersede those given in Piketty (2010, Table A16). Though we view the updated series reported in the present work as more consistent (given available evidence), we should stress that these estimates cannot be used to make fine comparisons across countries or over time: they should be viewed as broad orders of magnitude.

In our view, the two robust findings from historical national wealth estimates for France and the UK are the following. First, all available estimates on wealth levels over the 1700-1913 two-century period show relatively high wealth-income ratios (say, between 600% and 800%), with no evidence of any significant long-run upward or downward trend. Next, all available estimates on wealth composition show that the steady decline in agricultural land was gradually compensated by the rise of housing and other domestic capital assets (and foreign assets, particularly in

[245] As discussed in Piketty (2010, Appendix A, pp.42-43), foreign asset losses during World War I appear to be as large as physical destructions, so we simply divided the total war destruction estimates of Piketty (2010) by 2. Note that we attributed all war destructions to the private sector. Ideally one look like to attribute some destructions to the government, but the available raw material is too limited to make precise decompositions of war destructions. The consequences for our decomposition results are minimal.

[246] See "Quelques données statistiques sur l'imposition en France des fortunes privées", *Bulletin Mensuel de Statistique*, Insee, 1958, p.34.

the UK). These two long-run findings are robust, but there is not much else that is really robust. In particular, the quality of the data does not allow us to analyze short-run or medium-run evolutions, and/or trends of moderate magnitudes.[247]

1700-1820 decennial estimates

For the 1810-1819 decade, we use the corrected Chaptal estimate reported by Lévy-Leboyer (1977, p. 396), namely 63.2bn francs.[248]

For 1780, we use the estimate due to Lavoisier (1789). Lavoisier finds 38 billions livres tournois; his estimates refers to year 1788. Given price inflation in the 1780s, this is equivalent to about 33bn for 1780 (and about 30bn after exclusion of furniture and movables). The shares of land, housing and other domestic capital assets in the revised Lavoisier estimates are given by Mulhall (1899 p.591) and consistent with the 1780 estimate reported in the Insee 1958 compilation.

The 1700 and 1750 data points are rough estimates using computations reported by Boisguillebert (1695), Vauban (1707) and Lavoisier (1789).[249] These are probably the most fragile estimates reported in our entire database. In particular, we should stress that Boisguillebert (1695) and Vauban (1707), unlike their quasi-contemporaries Petty (1664) and King (1696) (see below), and unlike Lavoisier almost a century later, do not provide complete balance sheets. They are mostly interested in estimating the total value of agricultural land. The estimates which they report for other assets are incomplete, and not very well documented. On the basis of their estimates, and of the later estimates by Lavoisier, we find however that the broad orders of magnitude are reasonably consistent. In particular, the general picture for the structure of national wealth for 18^{th} century France is relatively close to the structure obtained by using U.K. estimates. Given that the authors in the two countries use different methods and data sources (and do not seem to be aware of the estimates made at the same time in the other country, or at least do not refer explicitly to one another), we find this reinsuring. In particular, the estimates made by Vauban are well documented and appear to be relatively robust.[250] We again emphasize that these estimates should not be used to make fine comparisons between the two countries, or between the different sub-periods of the 18^{th} century. But the broad long-run picture, and the orders of magnitude regarding national income, national wealth and its various components (in particular total land value), appear to be correct.

[247]Some of the raw estimates reported by Lévy-Leboyer, Foville and other authors sometime display large abrupt changes in wealth composition due to changes in methods or definitions; when such variations appear inconsistent or not well-documented, we choose to report moving averages. See Excel file.

[248]This estimate is for 1815. Chaptal gives 45 billions francs, but this seems too low in view of Lavoisier's estimate for 1788 and the increase in prices during the Revolution.

[249]See also historical estimates reported by Studenski (1958).

[250]Vauban estimates the total national income of France around 1700-1705 to be about 2.3-2.4 billions livres tournois, and the total agricultural income to be about 1.2-1.3 billions livres (including about 600 billions in land rent, corresponding to about 12-13 billions in total land value). We adopt slightly more conservative estimates, with national income around 2,1 billions and total land value around 10 billions (Vauban's main objective is to convince the King that a broad based income tax can raise substantial revenues, and his estimates appear to be somewhat overstated). For a detailed, critical analysis of the estimates of national income and national wealth made by Boisguillebert and Vauban, and an interesting comparison with the estimates of Petty and King, see Studentski (1958, pp.26-60).

B.3 Private wealth

For private wealth, we use the same methods and sources as Piketty (2010, 2011). One minor change is that we draw on available asset price to provide a more realistic dynamics of residual capital gains in the interwar, and especially just before and during the Great Depression.[251]

B.4 Government wealth, 1700-1970

Public debt 1700-1800

No record of the face value of the public debt was kept before the Revolution, contrary to what happened in the U.K., and no government accounts published before the nineteenth century. Against this background, we take the ratio of public debt to GNP reported by Weir (1989, Table 1 p. 98) for 1788, namely 55%.[252] There are of course some uncertainties on this ratio (particularly on the denominator), but two things are clear: government debt was substantially lower in France than in the U.K. where all estimates show public debt exceeding 100% of national income,[253] and France paid a higher interest rate, about 6%-7% vs. 3%-4% in the U.K.[254] We base our estimates of public debt in 1750 – about 40% of national income – on the debt payments reported by Weir (1989, p. 103) for the year 1753.[255] Lastly, there is

[251]That is, consistent with available equity price indexes, we set q = +5% in 1927, +10% in 1928, +5% in 1929, -5% in 1930, -10% in 1931. Also to reflect the collapse of the French economy following the defeat of 1940 we set q=-35% in 1940; and to take into account nationalizations -10% in 1944 and 1945. See Excel file.

[252]Specifically, Weir estimates government debt to be worth 3,878 million livres tournois, a figure that is decomposed as follows: 1,421 million of floating and short-term debt, 1,118 of life annuities (including tontines, i.e. group annuities in which payments to deceased subscribers were redistributed among survivors), and 1,339 million in perpetual bonds. Note that this estimate of France's public debt is not obtained by capitalizing interest payments at coupon interest rates (which would give a face value of the public debt) but on the contrary is as close as possible to the market value of the government debt. In particular, it takes account of the sharp depreciation of a number of perpetual bonds issued during the liquidation of Law's system. See Weir, 1989, ft. 17. Weir's figures are also fully consistent those reported by Sargent and Velde (1995, Table 1 p. 487) for May 1789 (3,764 million livres, i.e. 63% of GNP). As for GNP, Weir retains an estimate of 6,977 million livres tournois, on the basis of Marczewski (1965) and making allowance of output in the service sector. This might be a bit too high. On the basis of the Bourguignon/Levy-Leboyer and Maddison data described above, our estimate of national income in the 1790s is about 5.0bn francs, i.e. about 5.1bn livres tournois (1 franc = 1.0125 livres), which would imply a public debt / national income ratio of 75% rather than 55%.

[253]Our sources for U.K. debt and interest payments are the same as used by Weir (1989, Table 1 p. 98). However, Weir reports face values and has a lower income denominator than us, while we report estimates of market values on the basis of Janssen et al. (2002). This explains why our UK public debt/ national income ratio is about 110% (vs. 180% in Weir's Table 1 – a figure which as Weir himself notes on p. 100 and on ft. 16 is too high).

[254]In the two cases computing yields is complicated by the fact that a substantial fraction of recorded debt charges include some amortization of non-perpetual debt. Amortization was particularly important in France (at least 30% of total debt charges, vs. less than 15% in the U.K.), because annuities were a large fraction of debt. The 6%-7% and 3%-4% yield figure are our best guesses after subtracting non-interest debt charges. See Weir (1989, p. 100) and our discussion of U.K. public finance statistics below.

[255]Total debt payments amounted to 72 million livres tournois (this figure excludes repayments but includes all annuity payments (which include some amortization), so it is a bit higher that the true interest charges). If we capitalize this at 6%, the public debt amounts to 1,2bn livres, i.e.

little information before 1726, as available sources do not consistently record debt charges. On the basis of the various rent payments in the literature discussed by Weir (1989, ft. 21), we put the government debt at 30% of national income in the first decade of the 18th century.[256] What all sources and the literature make clear is that France was able to maintain its debt level at relatively low levels in the course of the 18th century through a series of partial defaults,[257] although at the price of relatively high financing costs.

Public debt 1800-1913

France enters the 19th century with a very low level of public debt, following a large scale default in 1797, the "two-thirds bankruptcy", which was the last outright default by the French government.[258] Napoleon does not issue debt and runs balanced budgets, financing its wars by taxation and in-kind levies on occupied territories. So in 1815 the public debt is a modest 15% of national income, and probably even less in market value.[259] The debt then increases over the course of the 19th century from about 15% in 1815 to about 90% at the end of the century, before declining slightly to 75% on the eve of World War I. As explained by Fontvieille (1976, pp.1860-1868), this increase is partly driven by a number of exceptional capital payments made by the French government: 2 billion francs in 1815-1816 to foreign armies, 1 billion in 1825 to aristocrats supposedly spoiled by the French revolution (*le milliard des emigres*), and 7.5 billions in 1871-1873 to Germany (5 billion of pure transfers and 2.5 billion of *frais d'occupation*). We find that over the 1820-1910 period, government deficit is -1.5% per year on average, which can be decomposed as -2.2% in net interest payments, -0.4% in net capital payments, and +1.1% in primary surplus.[260]

Our public debt series for the 1810-1913 period come from the retrospective statistical compendium of Insee (1966), henceforth AR 1966, pp. 494-495. There are three main forms of public debt, and we include all of them.[261] First, up to the 1880s, almost all the public debt took the form of perpetual bonds – la *rente perpetuelle*, also labelled *dette perpetuelle* or *dette consolidee* (funded debt) in budgetary documents. A second form of debt appears in 1878 with the issuance of the first redeemable bonds (*rente amortissable*) with a maturity of 75 years. Those bonds gradually become quite important: in 1900, they account for about one-third of all government debt.[262] Lastly, when the government's net borrowing

about 40% of national income.

[256]This estimate is consistent, in particular, with the 24 million rent payments reported by Clamageran (1876) for 1699, which capitalized at 6% implies about 400mn livres of debt, i.e. about 20% of national income – a figure that most likely increased substantially in the course of the War of the Spanish Succession (1702-1713).

[257]See, e.g., Sargent and Velde (1995, p. 480) for a history of those defaults.

[258]Two-thirds of the capital on perpetual bonds and life annuities was "reimbursed" to bondholders in the form of worthless *bons du 2/3*, see Sargent and Velde (1995, p. 512).

[259]The government bonds that have survived the two-thirds bankruptcy trade at a significant discount, see for instance Tapies (1845) for statistics on the quarterly prices of 5% *rentes* over 1799-1834.

[260]See Table FR.4e, in which we include net capital payments into the primary surplus.

[261]See TableFR.5c for a decomposition.

[262]Up to 1973, holders of perpetual and long-term bonds (more than 30 years) were nominally identified in the Great Book of the Public Debt (*Grand Livre de la Dette Publique*), which estab-

needs exceed the issuance of new *rentes* (either perpetual or fixed maturity), then the "floating debt" increases.[263] The floating debt does not increase much over the course of the nineteenth century (from 0.1bn francs in 1820 to 1.5bn in 1913). But it skyrockets during World War I, and after the War it becomes more important than the funded debt itself.[264] Up to 1913, AR 1966 only provides public debt estimates for the beginning of each decade. We use data on the government's budget deficits (AR 1966 pp. 484-485) to reconstruct complete yearly debt series.[265] The debt data reported by Insee are face values, but there is no default and almost no inflation in the whole 19th century, so that in practice market and face values are extremely close to each other and we make no correction whatsoever to the AR 1966 figures.[266]

Public debt 1913-1970

The public debt surges during World War I, from 75% of national income in 1913 to close to 180% in 1919. Most of the increase comes from the floating debt, which includes "bond de la désense national". In addition, a fourth type appears in the interwar: the "dommages de guerre" introduced by the Bank of France in 1921 to pay the victims of war destructions. They amount to about 20% of national income in the 1920s and 1930s. From 1914 to 1929, the public debt trades at a large discount, sometimes as low as 50% of par values. Because private wealth estimated of the time include the holding of public debt at market value, it is key to put the government liabilities at market value too.[267] Note also that a number of new new issuers of public debt or quasi-public debt appear in the interwar (in addition to Treasury), such as Créfit national and Caisse autonome d'amortissement (in charge of transforming short term debt – bond de la désense national – into medium or long term debt).

Our estimate of the public debt in 1925 includes all forms of debt ("funded" and "floating", i.e. basically long term and short term), all public debt issuers, and uses market rather than book value. Based on the careful work of Colson (1927),

lished ownership on public claims, and enabled bondholders to benefit from tax breaks on coupon payments. The last perpetual bonds were reimbursed in 1987.

[263]Note that there is a distinction in AR 1966 between "fixed maturity short-term debt" and "floating debt". The former is negligible until World War I, to simplify the exposition we include it in "floating debt".

[264]Holders of short-term bonds and other floating debts were not nominally identified in the Grand Livre.

[265]Note that the "government's surplus/deficit" data reported in AR 1966 (p. 485) are not equal to the government's net borrowing, because the funds obtained through the issuance of perpetual and long-term bonds are recorded as resources (they are "extraordinary resources"). So by construction the "government's surpluses/deficits" reported in AR 1966 pp. 484-485 are equal to the fraction of the government's net borrowing needs which are not financed by the issuance of new *rentes* but by an increase in the floating debt (an increase which was only 1.4bn francs over the whole 19th century). So it is crucial to add the government's "extraordinary" resources to reported surpluses/deficits in order to obtain the true government net borrowing.

[266]Our debt figures are usually close to those reported by Reinhart and Rogoff (2011), Abbas et al. (2011), and Flandreau and Zummer (2004) for the end of the 19t century. All these authors appear to more or less directly use the Insee AR 1966 data, but with sometimes undocumented modification (e.g., in 1880, Insee reports 21.6bn in public debt but Flandreau and Zummer report 24.3bn; in 1890 26.2bn vs. 30.1bn).

[267]Note that already before the war, market values seemed a bit lower than nominal values. Colson reports that the total nominal value of perpetuals was 26bn francs at end 1913, but 22.5bn at market value. We disregard this discrepancy before World War I.

we estimate that the public debt is 295bn francs as at the end of March 1925, i.e. about 124% of national income.[268] This is the same figure as the one used in Piketty (2010, 2011).[269]

During World War II, public debt surged again, mostly because of the huge occupation payments imposed by Germany. Total payments amounted to more than 100% of pre-war GDP.[270] About a third was financed with taxes, and the rest with bonds and money creation (e.g., Occhino, Oosterlinck and Whute, 2006, Table 3). As domestic production collapsed – in 1944, national income reaches its twentieth century trough, about 100bn 2010 euros – the public debt / national income ratio exploded and exceeded 250% by the end of the war. The immediate post-war inflation rapidly brought the debt down. By the end of the 1940s, it is less than 50% of national income

Government non-financial assets, 1700-1970

Before the official balance sheets that start in 1970, there are no official estimates of government assets. For the eighteenth century, we assume that government assets amount to 40% of national income up to 1780, and then rise to 45% in the 1810s. For the 1820-1870 period, we reproduce the decennial government assets/national income ratio of Piketty (2010, pp. 39-40), namely 58% in 1820, gradually rising to 80% in 1870. These estimates rely on a number of publications by the economists of the time. They should be viewed as approximate and illustrative, as the methods upon which they rely are less sophisticated than those used to estimate private wealth. But we feel confident that the order of magnitude is correct: first, it is consistent with the moderate public investment flows of the time (i.e., with a 0.5% net investment rate and a 1.2% growth rate, one is bound to obtain non-financial assets worth about 40% of national income, to which land must be added); second, it is in line with what we find in other countries at the same time.[271]

From 1870 on, we report somewhat more sophisticated estimates for the benchmark years 1896, 1913, 1925, and 1954, and in order to provide yearly series period we fill in the gaps by cumulating government investment flows.[272]

The 1896 data point, 20bn francs, is the one obtained by Colson for 1898-1899. Colson (1903, vol. 2, pp. 276-283) reckons that national wealth in 1898-1899 was 229bn francs (pp. 277-279) and that private wealth was 239bn (p. 282). As he explains, the difference, -10bn francs, measures the net wealth of the government

[268]This figure was obtained as follows. Colson (1927) reports on the total amount of funded debt at both nominal (227bn francs) and market values (172.1 bn: titres d'Etat exempts d'impot: 117.1bn + bons du Tresor et de la Defense national: 55bn). To his market value estimate, we add the amount of floating debt from Villa and Insee AR 1966; see detailed computations in France.xls.

[269]One caveat here is that it is unclear whether this includes foreign public debt or not.

[270]See, e.g., Occhino, Oosterlinck and White (2006). At the 1940 armistice, occupation costs were set to 20 million Reichsmarks a day, i.e. 400 million francs a day, or 146 billion francs a year. In 1940 national income was about 361bn francs, so occupation costs were initially set at about 40% of national income per year. This was later reduced to 300 million francs per day. France also transferred a large amount of goods to the Reich through the imposition of massively distorted exchanges rates, in addition to forced labor.

[271]In 1870 Germany for instance, we find that government non-financial assets also amount to about 75% of national income.

[272]Investment flows are generally consistent with the pattern of nonfinancial assets / national income ratios reported below, see detailed computations in Table FR.5c.

with government bonds at market value. By his estimate the market value of the public debt was 30bn francs (Colon, 1903, vol. 3 p. 256), so that public assets amounted -10+30=20bn, i.e. about 65% of national income. This is smaller than the 110% reported in Piketty (2010, 2011), but more in line with government investment flows and available estimates of public assets in other countries at the same time.[273]

For 1913, we use Colson's estimate of 32.8bn francs, which he obtained by the same method. That is, Colson (1918, vol. 3, pp. 362-378) reckons that national wealth was 303bn francs in 1913, a bit more than private wealth (297). As the market value of the public debt was 26.8bn (p. 344), government assets amounted to 303-297+26.8 = 32.8bn francs, i.e. around 73% of national income.

For 1925 and 1954, we reproduce the estimates reported in Piketty (2010, 2011). The 1925 data point, 192bn francs (81% of national income) comes from Colson (1927, livre 3, pp. 485-483), and the 1954 data point, 28bn euros (124% of national income) from Divisia, Dupin, Roy (1956, vol. 3, pp.65-67). All relevant details can be found in Piketty (2010, Appendix A, pp. 39-45).

Government Financial assets

Up to 1969, financial assets of the government are equal to the central bank's claims on the government (bonds plus loans), and nothing more. From 1970-on we use the official Insee balance sheet. There is a beak in series in 1970, when official balance sheets become available: gross financial assets and liabilities of the government increase a lot. Bu this has no effect on the government's net financial position, which is what matters for our study.

F United Kingdom

A Official national accounts

A.1 National income, 1948-2010

The UK national accounts are currently constructed by the Office for National Statistics (ONS). The reference publication is "The Blue Book – United Kingdom National Accounts" (BB) edited each year by the ONS.[274] For the 1948-2010 period we use the official blue book series with no modification whatsoever.[275] The PDF

[273]At the end of the nineteenth century we find that the German government has about 90% of national income in assets, which is more than Colson's estimate for France (65%). This is consistent with the fact that railways were gradually nationalized in Germany at the end of the nineteenth century, but were not in France.

[274]We used the 2011 edition of the Blue Book, downloaded from the ONS website in April 2012 from http://www.ons.gov.uk/ons/rel/naa1-rd/united-kingdom-national-accounts/2011-edition/index.html. All references to table numbering and variable names are given in the Excel file UK.xls.

[275]The only exception is that we treat financial intermediation services indirectly measured (FISIM) differently than the official accounts. UK statisticians treat FISIM on mortgages as intermediation consumption (which is standard), but they record a lot of FISIM (especially in recent years, because of very low central bank rates). As a result, households earn little net operating surplus (because they consume a lot of FISIM on their mortgages), which biases the net product of the housing sector (hence housing capital income) downward. To improve compara-

version of the Blue Book for year n usually includes series up to about $n - 10$. Longer-run series using identical table numbering are available in the Blue Book on-line database on the ONS website.[276] There are some gaps in the online database, in particular for saving flows. We filled in the gaps by drawing for the most part on the careful work of Martin (2009).

One problem with the Blue Book data is that no estimate of the wage bill in the non-corporate business sector is available before 1987. We made assumptions in order to provide a decomposition of national income by production sector before 1987 in Table UK.9.[277] By construction our series on the share of corporate vs. non-corporate activity are consistent with all available macro indicators (in particular the number of individuals employed in agriculture vs. other sectors), and so they can reliably be used to study the long-run transformation of the UK economy. Given the limitation of the raw national accounts data, however, we caution the reader against using our series for short-run business cycle analysis. For the 1948-2010 period, we compute the shares of labor and capital in national income by assuming that the same factor income distribution holds in the non-corporate as in the corporate business sector (Table UK.11a). Given the uncertainty on the exact share of corporate vs. non-corporate activity, the above caveat also applies to our factor shares series. Given our long-run focus, any error here is irrelevant.

A.2 National wealth, 1975-2010

The online Blue Book database includes complete balance sheets by sector covering the 1987-2010 period. The ONS – and the previous administrative bodies, such as the Central Statistical Office – did construct complete annual balance sheets by sector starting as far back as 1957. Unfortunately, the detailed 1957-1986 balance sheets are not available online yet. One needs to return to earlier Blue Book paper publications, and the resulting series are not fully homogenous to the post-1987 series. Therefore, we proceeded as follows.

For the 1975-2010 period all our private wealth series come from the Blue Book, either directly from the online database, or indirectly through earlier works that rely on official data (Blake and Orszag, 1999; Atkinson, 2012). In addition to the national balance sheets compiled by the ONS, the UK tax administration (HMRC)[278] has been compiling estimates of "identifiable personal wealth" since 1962, on the basis of inheritance tax returns and probate records, using the mortality multiplier technique.[279] By construction, these HMRC personal wealth aggregates are sub-

bility with other countries, we set FISIM on mortgages to zero i.e., we add them to the housing sector's net product, and subtract them from financial companies profits. This has zero impact on GDP or national income, and is a pure transfer between the housing and financial corporations sectors. See detailed formulas and computations in the Excel file.

[276]See e.g. Blue Book 2011 on-line database: http://www.ons.gov.uk/ons/rel/naa1-rd/united-kingdom-national-accounts/2011-edition/tsd---blue-book-2011-dataset.html.

[277]Specifically, we assume that the amount of wages paid in the non-corporate sector follows the evolution of mixed income. Detailed computations and robustness checks are provided in the Excel file.

[278]HM Revenue & Customs since 2005, formerly Inland Revenue and HM Customs & Excise.

[279]That is, HMRC multiplies the number of decedents by the inverse of the mortality rate for this age and gender group, and uses a survey-based correction for differential mortality between the rich and the poor. Mortality multiplier techniques have been used since the 1900s-1910s in

stantially smaller than the aggregate net wealth of the household sector obtained by the ONS.[280] Given our macroeconomic focus in this paper, we only use the national accounts estimates, which are based upon wealth census methods and are therefore more comprehensive and more suitable for our purposes.[281]

For government wealth, 1967-2010 data are from the Blue Book (annual balance sheets of the general government sector). Up to 1988 the official balance sheets severely under-estimate the government's assets, because they measure the government's equities in public non-financial corporations at book value (a few million pounds) rather than market value. In Table UK.6a we therefore present two sets of results. One reproduces the official BB series ("government wealth"). The other ("corrected government wealth") adds to the government's assets the net wealth of public sector corporations (i.e., the book-value of their assets minus their recorded equity liabilities). This correction typically adds 50-80% of national income in assets in 1967-1988, as the government owned a large number of companies from the post war period to the 1980s.[282]

B Non-official national accounts series: Main sources

The UK – together with France – has the longest tradition of national accounts in the world. The first estimates of national income and wealth were published by Petty (1664) and King (1696), and were followed by many others, including Colquhoun (1815), Giffen (1878, 1889, 1890), Bowley (1920), Clark (1937), Campion (1939), Deane and Cole (1962) and Revel (1967).

Regarding national income, the reference historical series are those established by Feinstein and his coauthors (Feinstein, 1972, 1978; Matthews, Feinstein and Odling-Smee, 1982; Feinstein and Pollard, 1988), and we use them intensively. In particular, Feinstein's monumental 1972 book includes detailed annual series on national income and its components covering the 1855-1965 period, using concepts and methods which are reasonably close to official post-1948 blue book series.

Regarding national wealth, however, we choose for the most part to return to the original estimates made by contemporaries such as Petty, King, Colquhoun, Giffen, Campion and others, and to use these estimates in order to construct our own long

order to study the wealth of the living from wealth-at-death data, both in France and in the UK. See the references given in Piketty (2011, section II.D).

[280] All HMRC personal wealth estimates are available on line on the HMRC website: see http://www.hmrc.gov.uk/stats/personal_wealth/menu.htm. See in particular the "reconciliation table" between HMRC and ONS estimates (see "Personal wealth statistics 2001-03 and 2005-07", HMRC, June 2011, Table 13.4). The raw ratio between "identified wealth" and "national accounts wealth" is typically about 50%. Once valuation differences and excluded wealth (e.g. small or joint properties do not require a probate to be transmitted at death) are taken into account, the ratio is typically about 70%-80%. Most of the remaining gap is due to non-transmissible, annuitized pension wealth (funded pensions make about 15%-20% of household wealth as measured by the national accounts).

[281] Estate multiplier techniques are useful not only to estimate aggregate wealth, but most importantly to study the distribution of wealth by age group and by wealth deciles. See e.g. Atkinson and Harrison (1978) and Piketty, Postel-Vinay and Rosenthal (2006).

[282] Non-financial public corporations' assets are bout 40% of national income in assets in 1967, peak to 80% in the mid-1970s, and quickly decrease in the 1980s and 1990s (about 15% of national income since the end of the 1990s.)

run series. In effect, these contemporary estimates are close in spirit to modern, market-value, balance-sheet estimates of national wealth. In contrast, Feinstein and his co-authors are mostly interested in volume (constant-price) estimates of the reproducible capital stock that cannot easily be compared to modern national wealth estimates.[283] The book by Giffen (1889), *The Growth of Capital*, provides a detailed description and comparison of the methods, concepts and results of previous national wealth estimates, and is particularly useful for the earlier periods. For the period going from World War 1 to the 1970s, we heavily rely upon the personal sector balance sheets constructed by Solomou and Weale (1997) and Blake and Orszag (1999).

We provide annual series covering the entire 1855-2010 period, as well as decennial estimates for 1700-1850. All national income and wealth series were adjusted so as to cover the historical UK territory (Great Britain plus Ireland) throughout the 1700-2010 period.[284] Below we briefly describe the main sources we use for national income, as well as for private and government wealth. The following subsection will provide additional details on most of these data.

B.1 National income, 1700-1948

For the 1855-1948 period, we rely on the series constructed by Feinstein (1972), with minor adjustments described in the Excel file UK.xls so as to ensure homogeneity with official blue book series.[285] We provide estimates of the distribution of factor shares at the national level by imputing sectoral wages to the self-employed, drawing in particular on the works of Matthews, Feinstein, and Odling-Smee (1982, especially pp. 168-172) and Allen (2009). Consistent with these authors, the labor share reaches a trough in the early 1870s (the end of Allen's "Engel's pause"), then rises until the end of the 19th century, before declining in the years preceding World War I.[286]

[283]In particularly, Feinstein's estimates raise major difficulties for the measurement of land values. More on this later.

[284]Including Southern Ireland until 1920a, excluding Southern Ireland after 1920b, and excluding all overseas territories throughout the period. Note that the discontinuity in 1920b is rather limited (about 6.6% drop in population, but only 3.2% drop in national income) and is assumed not to affect the wealth-income ratio.

[285]Feinstein (1972) uses the national accounts concepts of the 1960s-1970s, so we made a number of minor adjustments to ensure continuity with the BB 1948-2010 series (which use ESA 1995 concepts). Note that the investment (and capital stock) series released by Feinstein (1972) for the 1855-1938 period were substantially revised upwards in subsequent work by Feinstein and his co-authors (see Matthews, Feinstein, and Odling-Smee, 1982, and Feinstein and Pollard, 1988). The gaps are particularly large for the 1855-1873 period (see Matthews, Feinstein, and Odling-Smee, 1982, p.121, note 2). We always use the latest revised series available. All details are given in the Excel file.

[286]All the details of our factor share computations, including computations of the imputed wage of self-employed individuals in the agricultural and non-agricultural sector, are in the Excel file UK.xls. Note that it is important to impute sector-specific wages to the self-employed (as Matthews, Feinstein, and Odling-Smee do) rather than an economy-average wage because the self-employed are in relatively low paying sectors (e.g., the average agricultural wage is about 60% of the economy-average wage through to World War I). For the pre-1948 period, given available data, this method to compute factor shares is also much preferable to the one that assumes the same factor income decomposition in the non-corporate sector as in the corporate sector (which we use for the post 1948 period).

For the 1700-1850 period, we proceed as follows. 1760-1850 estimates were computed backwards from 1855, using the 1760-1855 real growth rates of Feinstein (1978) and the composite price index series of O'Donoghue, Goulding, and Allen (2004), Gayer, Rostow and Schwartz (1953), and Schumpeter (1938).[287] For the 1700-1760 period, we start with the 1700 estimate due to King (1696), and we assume constant nominal growth between 1700 and 1760. The resulting 1700-1820 growth pattern is very close to Maddison (2007, 2010) and consistent with the 1700-1830 GNP estimates reported by Officer (2011 Table 8 pp.33-34).

B.2 National wealth, 1700-1975

Private wealth, 1700-1975

For the period from 1920 to 1975, we rely on the series constructed by Blake and Orszag (1999) for 1948-1975, and by Solomou and Weale (1997) for 1920-1948.[288] When we decompose wealth accumulation over this period, we take into account war destructions during World War II. Harrison (2000, Table 1.11 p. 37) reports that war destructions amounted to about 5% of domestic wealth; we assume that all destructions are for the private sector, and are equally split over 1940-1944.

For the 1855-1920 period, we use estimates of the stock of private wealth available for the years 1855, 1875, 1885, 1913, and 1920 and we obtain annual figures using the private saving series constructed by Feinstein (1972) and assuming constant real rates of capital gains in each sub-period (1855-1875, 1875-1885, 1885-1913, and 1913-1920). We find that the residual capital gains are usually small, except in the 1913-1920 where real capital losses are about 16% per year.

Lastly, for 1700-1850, private wealth series were similarly interpolated on the basis of the private wealth estimates available for the years 1700, 1750, 1810 and 1855 and private saving flows.

[287]Specifically, we assume real growth rates of national income equal to 1.8% over 1800-1855 and 1.0% over 1760-1800. Overall, the 1700-1850 period was one of zero inflation (+0.1% per year on average), with the moderate price increase during the French Revolution and Napoloeonic wars entirely reversed by 1850. The available inflation series for the eighteenth and nineteenth century all show the same pattern, so the choice of the exact series does not matter a great deal. In the short run there are admittedly some variations across sources. In particular, O'Donoghue, Goulding, and Allen (2004) seem to slightly over-estimate the increase in prices during the Napoleonic wars (+3.3% per year in 1790-1810 by their estimate, vs. 2.6% in both Schumpeter, 1938, and Gayer, Rostow and Schwartz, 1953). So we constructed our price index by taking O'Donoghue, Goulding, and Allen (2004) for 1810-1855, Gayer, Rostow, Schwartz (1953) for 1790-1810, and Schumpeter's (1953) average of consumer and producer prices for 1760-1790. We set inflation rates to 0 over 1700-1760, consistent with available seventeenth century series (see for instance Gilboy, 1936). All details are provided in the Excel file notes and formulas.

[288]We made various minor adjustments so as to ensure continuity (see Excel file for full details). Blake and Orszag (1999) provide detailed, annual personal wealth series covering the 1948-1994 period (their 1975-1994 series follow very closely the official BB series). Solomou and Weale (1997) provide detailed, annual personal wealth series covering the 1920-1956 period and are also very close to the Blake-Orszag and BB series. Note that we attempt to follow throughout the period ESA 1995 definitions of net wealth. In particular our definition of net private wealth excludes non-marketable tenancy rights, which are often included in official ONS-BB UK balance sheets, but which are not considered as assets by the SNA. Non-marketable tenancy rights currently represent the equivalent of about 40% of UK national income (around 600 billions £in 2008-2011) and are scheduled to be eliminated from official UK balance sheets in 2012. See "Improvements to the non-financial balance sheet," ONS, february 2012.

Government wealth, 1700-1967

The Blake-Orszag (1999) and Solomou-Weale (1997) balance sheets only cover the personal sector, so we computed our own yearly public wealth series for the 1855-1967 period. For non-financial assets, we have official data from 1958 on.[289] Prior to 1958, we use two non-official estimates for 1865 (Giffen, 1989) and 1913 (Campion, 1939) and we interpolate using Feinstein's public net investment flows. Just like for the 1967-2010 period, we also compute an extended measure of government wealth which includes the net worth of non-financial public corporations.[290] For public debt, we use the public finance statistics assembled by Mitchell (1988, pp.575-645) for par values[291] and Janssen, Nolan, and Thomas (2002) for the market value of government securities (see discussion below of these two sources). We also try to account for the financial assets of the government, which are not very well documented but appear to have always been quite modest in comparison to public debts.[292]

For the 1700-1850 period, we have carefully reconstructed the public debt history of the U.K. based on the detailed public finance statistics in Mitchell (1988, pp.575-645) and Janssen, Nolan, and Thomas (2002).

C National income and wealth: Detailed Sources

Here we provide additional details about the sources and methods used for our 1700-1950 national income and wealth estimates summarized in Table UK.6f.

C.1 1700

We use the national income and wealth estimates published by King (1696) for England, which we gross up on the basis of population in order to obtain UK estimates (keeping fixed the wealth-income ratio). That is, King's original estimates are $Y =$£43.5 million for national income and $W =$£306.0 million for national wealth, and they refer to an estimated English population of 5.300 million inhabitants (see King 1696, pp.41-49).[293] Given that total population for the UK (Great Britain and Ireland) is estimated to be 8.565 million in 1700,[294] we find a UK national income

[289]BB series are only complete and consistent from 1967-on; for the 1958-1967 period see Revel (1967), Hibbert (1981), and Sbano (2008) for retrospective series on financial assets and liabilities by sector.

[290]Although there are no official balance sheets before 1958, we do have data on net investment rates of non-financial public companies (BB and Feinstein, 1972). These investments really take off in the late 1940s, so the net worth of non-financial public companies is negligible until that time. See Table UK.6g for detailed computations.

[291]See also Reinhart and Rogoff (2011) and Abbas et al. (2011). There are slight variations across sources, but they are negligible for our purposes.

[292]Throughout the 1855-1967 sub-period we include in the government's assets the Gilts held by the Bank of England. The balance sheet of the Bank, presented in TableUK.7, based on Mitchell's data (1988, p. 651-661), shows that these assets peaked at about 20% of national income in 1946.

[293]According to King, this 5.3m total population (including 45% children and 10% servants) corresponds to 1.3m households. King also provides some estimates about long run population growth: according to him, England had 0.4m inhabitants around 1, 2m in 1066 and 5.3m in 1696 (this corresponds to annual growth rates of exactly 0.15% for both sub-periods).

[294]We use the UK population estimates reported by Maddison (2010, population table) for 1700 (8.565 million) and 1820 (21.239 million), and by Feinstein (1972) for 1855-1948 (and official BB

of Y =£70.3 million and a UK national wealth of W =£494.5 million (see Table UK.6f).[295] Needless to say, what matters for our purposes is the order of magnitude for the national wealth-national income ratio (here $\beta = W/Y = 703\%$) and its constituents rather than the precise levels of the numerator and denominator.[296]

Several points are worth mentioning.

(1) First, King's estimate is supposed to refer to year 1688. However King also provides estimates for 1695, which turn out to be lower than his 1688 estimate (due to the war against Holland and France).[297] It is clearly illusory to search for great annual or even decennial precision for this time period. So as a first approximation we choose to attribute King's estimate to the year 1700.

(2) Next, King's national wealth estimate (£306 million for England, 703% of national income) is the sum of three components: land (£180m, 414%), houses (£54m, 124%) and other capital goods (£72m, 166%). We include in the category "other capital goods" (£72m) the following categories used by King: "live stock, cattle, etc." (£25m); "stock in shipping, stores, materials, etc." (£28m); "money, precious metals, jewels, etc." (£14m). In order to follow the modern ESA 1995 definition, we exclude from "other capital goods" – and therefore from national wealth – household durable goods ("furniture, plates, etc.", which King estimates to be worth £14m, i.e. another 32% of national income; see Table UK.6f). King considers that net foreign assets are close to zero and does not give a precise estimate.[298]

(3) It should be noted that the sources and methods used by King (1696) are broadly similar to his predecessor Petty (1664) – but that King's estimates are probably more accurate. In particular, both compute aggregate land value and land rent by multiplying estimates of average rent per acre by estimates of total numbers of acres (obtained from a combination of tax and topographical sources). Both consider that land values are generally equal to 18 years of land rent (i.e. land is "reckoned at 18 years purchase", "capitalisée au denier 18" in French, following the terminology of the time). That is, the rate of return on land is assumed to be 1/18=5.6% per year. For instance, King (1696) estimates that total land rent is £10 million (so that total land value is £180 million), and that total housing

estimates thereafter). We assume constant population growth over each sub-period 1700-1820 and 1820-1855, and an adult population share equal to 55% of total population throughout the period 1700-1855 (this is consistent with King's estimates and post-1855 series). See Table UK.2.

[295] That is, 43.5 x 8.565/5.300 = 70.3, and 306 x 8.565/5.300 = 494.5.

[296] To the extent that income and wealth averages were probably somewhat smaller outside England than in England, our national income and wealth figures are possibly somewhat overestimated. But some authors have argued that the initial King estimate was underestimated, possibly by about 20%-25% (see Lindert and Williamson 1982 p.393 Table 2, who propose to replace the £43.5m estimate by £54.4m). Also the fact that we find the same 1700-1820 real growth as Maddison and other existing estimates (see above) suggests that the overestimate cannot be very large. We use the UK population estimates reported by Maddison (2010, population table) for 1700 (8.565 million) and 1820 (21.239 million), and by Feinstein (1972) for 1855-1948 (and official BB estimates thereafter). We assume constant population growth over each sub-period 1700-1820 and 1820-1855, and an adult population share equal to 55% of total population throughout the period 1700-1855 (this is consistent with King's estimates and post-1855 series). See Table UK.2.

[297] In order to analyze the consequences of the war on each country's wealth and public finances, King (1696, pp.63-69) also provides national income estimates for England vs France vs Holland in 1688 and 1695.

[298] Given the territorial differences, our estimates are quantitatively consistent with the net worth estimates reported by Lindert (1986, Table 3, p.1144).

rent is £3 million (so that total housing value is £54 million). According to King and Petty, the rate of return on other capital goods varies across assets, but is generally higher than for land and for housing, typically 1/12=8.3% rather than 1/18=5.6%. Assuming an average rate of return of 6.0% on other capital goods, total capital income in King's estimates amounts to Y_K =£17.3m (13.0+4.3), the capital share is $\alpha = Y_K/Y = 40\%$ (17.3/43.5), and the aggregate rate of return is $r = Y_K/W = \alpha/\beta = 5.7\%$ (17.3/306).

Petty's estimates of wealth-income ratios and capital shares for year 1664 are broadly similar, but involve a lower wealth-income ratio, due to a lower estimate of aggregate land value. That is, Petty (1664, pp.5-9) estimates that national income in 1664 England is Y =£40.0m, including total capital income Y_K =15.0m£, so that the capital share is $\alpha = Y_K/Y = 37.5\%$ (15/40). Petty breaks down capital income into land rent (£8.0m) and other capital income (including housing rent) (£7.0m). He estimates national wealth to be equal to W =£236.0m (i.e. $\beta = W/Y = 590\%$), including land (£144m, 360%), houses (£30m, 75%) and other capital goods (£62m, 155%),[299] which corresponds to an aggregate rate of return is $r = Y_K/W = \alpha/\beta = 6.4\%$ (15/236). The main difference with King is due to land and to housing. Giffen (1889, pp.72-83) offers a careful comparison of Petty and King and concludes that King is more reliable (in particular, King seems to give higher and more realistic estimates of land rent, while Petty omits to gross up the fiscal values of the time), so we choose to use King's ratios.[300] However it should be clear that both estimates are approximate: the true wealth-income ratio is probably closer to 703% (King) than to 590% (Petty), but given the uncertainties about both the numerator and the denominator, the only really safe conclusion might be that it is somewhere in the 600%-750% range.[301]

(4) Both Petty and King compute some estimates for human wealth, which they do by capitalizing labor income at some given rate of return, typically r =6%.

[299]Petty's other capital goods can be further decomposed into live stock, cattle, etc., stock in shipping, stores, materials, etc., gold and silver. The categories and amounts are broadly similar to King, except that Petty estimates total coined gold and silver in circulation to be only £6m, while King finds £14m, probably because the latter includes bullion and jewels (in any case, both authors rightly stress that gold and silver are a very small part of national wealth). Here we also exclude household durable goods (£14m) from Petty's national wealth estimate (which would otherwise be £250m instead of £236m).

[300]Note that Petty's lower wealth-income ratio is partly compensated by a higher rate of return, so that the capital shares are almost the same in both estimates. Petty's higher rate of return is due to the fact that he chooses to reckon housing values at 12 years' purchase (r =8.3%) rather than 18 years (r =5.6%), while for land values he uses the same 18 years coefficient as King. It is difficult to believe that houses were a so much riskier asset than land, so it is likely that most of gap has to do with a confusion between gross and net returns (houses incur more depreciation than land). Petty and King generally refer to net returns, but they are not always fully precise about this (particularly Petty).

[301]In particular it should be noted that both Petty and King estimate labor income as a difference between national income (which they get by multiplying population by what they view as a reasonable estimate of average income) and capital income (which they obtain via their census type estimates of land and housing rent, acres and other capital goods). They both find a labor share around 60% and a capital share around 40%, but it is clear that there is significant uncertainty about these factor shares. Allen (2005, Table 9, p.36) offers interesting estimates of aggregate income and rents over the 1300-1850 period (showing a large increase of rent share in agricultural income; see also Table 13 p.40, and Table 14 p.41).

For instance, Petty (1664, pp.9-10) proposes to capitalize labor income at 6% so as obtain an estimate of human wealth ("labor stock") equal to £417m (£25m divided by 6%), and a total estimate of human and non-human wealth of £667m.[302] This corresponds to an augmented wealth-national income ratio well above 1500% (667/40=1668%) – a natural consequence of the fact that 100% of national income is now being capitalized at rates of return around 6%. King (1696) provides similar computations. These computations have some similarities with total human and non-human wealth recently published by the World Bank (2006). However modern national accounts guidelines have consistently – and in our view rightfully – refused to include human capital in the list of assets and liabilities, first because humans cannot be sold on a market (to some extent they could at the time of King and Petty), and next because the study of the accumulation of human assets would raise major conceptual difficulties (in particular because the education and health services which serve to accumulate such assets are largely viewed as consumption goods, i.e. goods that have a consumption value per se, independently of the accumulation of an asset; so that the most basic distinction upon which national accounts are built, i.e. consumption goods vs capital goods, would collapse).[303]

(5) Neither Petty nor King decompose national wealth into private and government wealth. The implicit assumption is that the latter is negligible, and we indeed find that government net wealth was probably around zero. Although fully comprehensive public accounts were not made available to Parliament until 1857, archives were kept at the Exchequer and used in the middle of the nineteenth century to publish retrospective accounts starting in 1688.[304] These accounts give the par value of central government debt, about 23% of national income in 1700.[305] Another and more consistent measure is the market value of government debt, which can be obtained by capitalizing the flow of interest payments at the market interest rather than the official issuance rate (Janssen, Nolan, and Thomas, 2002).[306] In the aftermath of the Glorious Revolution and until the end of the War of the Spanish Succession in 1713, the public debt trades at a large discount and for 1700 the market value of the public debt appears to be about half the nominal value, i.e. about 11% of national income (the figure we report in Table UK.6f). On the assets side, we have no direct estimate, but on the basis of the various 18th and 19th

[302] £417m human wealth + £250m non-hunan wealth (including the £14m in durable goods).

[303] For a discussion of these issues, see e.g. Vanoli (2002 pp.385-387).

[304] See Mitchell (1988, pp.570 sqq.)

[305] As at the end of September 1699, the "funded plus unfunded debt" of the central government was £15.4 million (Mitchell, 1988, p.600). This figure excludes terminable annuities (and some residual debt charges which were regarded as outside the permanent charge of the national debt) and needs to be slightly upgraded, by about 7% (see Clark, 2001, Table 4, for statistics on the share of perpetual bonds – "funded debt" –, short term debt – "unfunded debt", i.e. notes issued without an act of Parliament –, annuities – terminable and life –, and other liabilities in government debt.) Applying the 7% correction factor, the par value of public debt in mid-1700 comes to £15.8 million, i.e. 23% of national income. Note that Reinhart and Rogoff (2011) also report a 23% debt figure for 1700, but this similarity masks three differences: (i) they do not try to account for terminable annuities, (ii) they divide Mitchell's "funded plus unfunded debt total" by a GDP estimate from http://www.ukpublicspending.co.uk/ which turns out to be lower than King's national income (£60.5mn vs. £70.3); (iii) their debt figure for 1700 refers to September 29, 1700 whereas ours refers to an average of September 29, 1699 and September 29, 1700.

[306] The data are reported in Hills et al. (2010).

century estimates surveyed by Giffen (1889, pp.72-114), it is reasonable to set the government's non-financial assets to 30% of national income. We neglect financial assets (e.g., Treasury balances). As a consequence net government wealth appears to be slightly positive (+19% of national income), and private wealth appears to be close to national wealth (684% instead of 703%).

(6) Finally, one important additional advantage of King's estimates over Petty's is that King provides some relatively sophisticated computations about saving rates. First, King (1696, pp.48-49) estimates that aggregate saving is equal to £1.8m, which corresponds to an annual saving rate s =4.1% (1.8/43.5). Unfortunately, he does not attempt to relate this saving flow to the wealth stock. But the most impressive part of King's work is his famous "social table", in which he provides the distribution of incomes, expenses, and saving for a large number of social groups, including "temporal lords", "baronets", "knights," "gentlemen", "farmers", "artisans & handcrafts", "cottagers and paupers", etc. King's estimates of saving flows by income group show large positive savings at the top and negative savings at the bottom (expenses larger than incomes) – but unfortunately King offers no discussion as to how this might lead to an equilibrium distribution. (The only convergence force seems to be the larger average family size at the top, but this is not discussed explicitly. One could also think of negative random shocks at the top as an equilibrating force).

(7) The original documents written by Petty and King are short and readable (26 pages for Petty, 45 pages for King). The main results and tables obtained by Petty-King have been reproduced in various forms by several authors, including Giffen (1889, pp.72-80), Feinstein (1978, p.33), Lindert and Williamson (1982, pp.388-393), Stone (1984, pp.116-120). It is worth returning to the original documents, however, so as to gather a better sense of the sources and methods used by these two authors.[307]

C.2 1750 and 1810

We use the national wealth estimates reported by Giffen (1889, pp.110-111). The estimate for year 1750 was computed by Giffen as a synthesis of various existing mid-18th century estimates. In the same way as the 1700 estimate, we grossed up the 1750 figure from its value for England (500.0 £million, including household durable goods) to its value for the UK (£685.6 million, excluding durables) on the basis of population.[308] The estimate for year 1810 was taken by Giffen directly from Colquhoun's 1812 UK data point, and we took it as published by Giffen (again excluding durable goods). These estimates appear to be conceptually and quantitatively comparable to the estimates for 1700 and for 1855-1913, both in

[307]Note that the national income and wealth estimates of King (1696) are extensively quoted by his contemporary Davenant (1698, 1699), who also provides a number of additional, unpublished details about King's computations, e.g. the decomposition of the total land and cattle estimates into different types of land and cattle. Petty (1664) also provides separate estimates about houses in London vs. the rest of the country, etc. Both King and Petty clearly had a policy agenda in mind. In particular Petty's main purpose is to show that with a broad tax base the King of England could easily get ample fiscal resources – up to £4m per year with a 10% tax – in order to fight the war with Holland and France.

[308]That is, 685.6 = (500 × 12,504/8,500) - 50.0. See Table UK.6f.

terms of total level and in terms of composition by asset type (land, housing, other domestic capital goods). Net foreign assets are undistinguishable from 0 in 1750 and 1810.[309]

Regarding public debt, we use again the long-run series on the market value of central government debt constructed by Janssen, Nolan, and Thomas (2002). The explosion of UK public debt during the 18th century and early 19th century is a well-known and nonetheless striking fact (see, e.g., Clark 2001). It is even more striking when one uses nominal values (in which case the debt amounts to 178% of national income in 1810) rather than market values (102% of national income), because the public debt again trades at a large discount during Napoleonic wars.[310] For our purposes, however, it is more meaningful to always use market values. First, for a conceptual reason: when the debt takes the form of perpetuals, as was the norm until Word War I, there is no capital to be reimbursed. If the government wants to decrease the debt, it cannot simply wait for its bonds to mature but has to repurchase perpetuals on the markets (or convert them into terminable annuities) and pay market prices.[311] Second, for a consistency reason: we are interested in the market value of national and private wealth, so it is important that to use the same valuation method for both.[312] The British government did not default once in the 18th century, but it suspended the convertibility of the Bank of England's notes in 1797, before returning to the gold standard at par in 1819.

Regarding government's non-financial assets, we assume that they rise to 40% of national income in 1750, and then to 50% of national income by 1810. There

[309] Brezis (1995) argues that the UK was a net debtor for most of the 18th century. In her central scenario, the 1750s foreign debt is £24.8mn, i.e. about 23% of national income, with a lower bound around zero and an upper bound as high as £47.3mn (44% of national income); see Brezis (1995, Tables 3 and 4, p.53). Her computations rely on an initial 1700 position close to 0 (£2mn, i.e. about 3% of national income) and on current account deficit estimates which were criticized as too high by Nash (1997). So we retain the low-end scenario (0%). All authors agree that the U.K. turns into a net creditor in the late eighteenth century or early nineteenth, thanks to a positive current account balance driven by large positive transfers from the East and West Indies in the 1790s (about 4% of national income per year if we take the average of the studies discussed by Brezis, 1995, p.63) and net exports in the first decades of the nineteenth century. Table UK.12b reports decennial estimates of the balance of payments taken from Tables 2 and Table 5 of Brezis (1995). Table UK.4f shows that these estimates are consistent with a 0 net position in 1700 and 1810 (i.e., the implied residual capital gains / volume changes not accounted for by saving flows are close to 0).

[310] We report both long run market and nominal values in Table UK.5e. Our estimate for par value public debt in 1750 (81% of national income) differs from Reinhart and Rogoff's (107%) because of denominator differences: our national income estimate (£102.8) is substantially higher than their GDP figure (£72.6). Although this is not entirely clear, the ultimate source of Reinhart and Rogoff GDP seems to be the work of Lawrence Officer (2011), as reported on http://www.measuringworth.com/ukgdp/ and http://www.ukpublicspending.co.uk. There is of course a lot of uncertainty on the yearly and even decennial patterns of national income in eighteenth century UK, so short-run discrepancies in debt/GDP ratios across authors for this time period are not surprising. From the 1770s-on, our national income is well in line with Reinhart and Rogoff's GDP.

[311] Just like stocks, the market value of perpetual bonds is determined by the expected flow of future payments. The difference is that the the payments are in principle fixed, so that they are directly reduced by inflation. This (along with maybe fears of default, e.g. because of military defeat) explains the drop in the market value of the public in 1790s and early 19th century.

[312] In particular, the SNA explicitly state that bonds should be recorded at their market value.

does not seem to exist sufficient data to know exactly the magnitude of this rise of government assets, but there are good reasons for assuming that such a rise indeed took place, and that the order of magnitude is about right.[313] In any case, there is no doubt that net government wealth turned strongly negative during the 18th century, from +19% of national income in 1700 to -52% in 1810 according to our estimates.

From the 1750 and 1810 data points for national and net government wealth, we compute private wealth as a residual, and we obtain decennial estimates based on available private saving flows and by assuming constant residual real capital gains in 1700-1750 (0.0% per year), 1750-1790 (-0.1%), 1790-1810 (-1.2%) and 1800-1812 (-0.7%). Private saving is equal to national minus government saving. Thanks to the exhaustive and detailed public finance records kept by Treasury (Mitchell, 1988), government saving rates are very reliable, but there are large uncertainties on domestic and foreign investment rates (hence on national saving).[314] Reassuringly, however, we find that although our saving and wealth series come from independent sources, identifiable saving flows account for virtually 100% of private wealth accumulation over the 1700-1790 period. It is only in 1790-1810 that we need non-zero capital losses, and the overall pattern of residual capital losses we find for the full 1700-1810 period is consistent with the evolution of the price of perpetuals (which are a large asset class for households): the debt trades at par in 1750, but only at an average of 60% during the French revolutionary wars, with the bulk of the losses occurring in the 1790-1800 decade. Over the whole 1710-1810 period, we find that we need small residual capital losses (and/or measurement issues) to account for the wealth dynamics for the private sector: savings account for about 120% of wealth accumulation and valuation losses / measurement issues the remaining 20%.

From the decennial estimates of private wealth we obtain decennial estimates of national wealth by adding the net wealth of the government. Strikingly, we find that as a first order approximation national wealth appears to have been relatively stable around 700% of national income throughout the 1700-1810 period, despite the large drop in net government wealth. That is, the rise of government debt

[313] It is generally the case that periods of large and rising government debt also coincide with smaller but significant rise in government assets – simply because the government compels other public or quasi-public institutions to purchase some of its new debt. We observe this phenomenon in Japan since the 1990s, in today's United States or in 1945 France. Historical balance sheets published by the Bank of England confirm this general pattern. In Table UK.7 we report long-run series on the BoE's balance sheet. In normal time the BoE has about 5% of UK national income in assets and liabilities. The three big exceptions are (i) the 1810s-1830s, where liabilities reach 10%, with about 5% in government securities; (ii) the period from the 1930s to the 1960s, with holdings of public securities in the 10-20% range, both peaking at close to 20% in the aftermath of World War II. And lastly (iii) since 2009 the BoE's balance sheet is back to 1946 level, and about a quarter of the public debt is held by the BoE. Now if the Bank of England alone increased its holdings of public debt by 5% at the end of the eighteenth century and early nineteenth century, then it does not seem unreasonable to assume that the government sector taken as a whole increased its holdings by about 10%. Note that prior to 1855 we do not attempt to isolate government financial and non-financial assets.

[314] Gross domestic investment rates from 1760 to 1855 are from Feinstein (1978 p. 91), and we assume that depreciation is 3% of national income in 1760-1810 and 4% in 1810-1855 (see Table UK.12d). Before 1760 we assume that net domestic investment is constant and equal to its estimated 1760s value (5% of national income). Foreign investment data are from Brezis (1995, Table 2 and Table 5).

appears to have been absorbed by a corresponding rise in private wealth, from about 700% in the early 18th century to about 800% after the Napoleonic wars.[315] This is probably the most important and substantive result of our analysis of 18th century UK wealth accumulation: in effect, the rise of UK public debt during the 18th century was matched by a corresponding increase in private saving (with net private saving rates of about 20% in the 1790s, and 15% in the 1800s and 1810s), as predicted by the Ricardian equivalence theorem (maybe it is not too surprising if the latter was formulated by Ricardo in 1817 UK).[316]

If we relate the change in national wealth to national saving, we find that saving flows can account for virtually 100% of national wealth accumulation (Table UK.4d). Extreme caution is of course required when interpreting this result, given the uncertainties on saving data: in low-growth environment ($g = 1\%$ in the 18th century), small changes in s can have enormous effects on $\beta = s/g$ hence on residual capital gains. What is beyond doubt, given the good quality of public finance statistics, is that the government did make large capital gains: we find that on average government saving was -3.1% of national income over 1700-1810, so that with saving flows alone the government's position should have decreased from 19% of national income in 1700 to -191% in 1810 (see Table UK.4e). It is thanks to +138% of net capital gains (i.e., depreciation of perpetuals) that the 1810 position was a more favorable -52%. These capital gains, though very substantial, do not mean that bondholders earned a negative return on their investments: on net they received a cumulated flow equivalent of 91% of 1810's national income over the 1700-1810 period from their holdings of public bonds: +229% in interest payments minus 138% in real capital losses. The large interest payments (an average of 3.6% of national income per year) were the driving force of the government deficit. In fact, the primary balance was almost exactly 0.[317]

[315]Note that the increase in private wealth would have been even larger if we valued government bonds at par value (e.g. private wealth would be close to 900% of national income in the 1820s). So although the private sector has saved a lot to finance the wars, the increase in wealth has been tempered by real capital losses (and gains for the government).

[316]On the historical UK public debt experience, see also Barro (1987) and Clark (2001).

[317]In order to properly compute government saving and interest payments, it is critical to subtract from both the payments made to terminable annuity holders: these payments are mostly principal repayments rather than interest payments (e.g., in a 10-years annuity, a debt of 100 is settled in 10 yearly payments of 10 (+ interest)). In effect the raw receipts/expenditure data in Mitchell (1988, pp.578 sqq.) substantially under-estimate the government's saving by wrongly counting permanent annuity payments, which are nothing but a form of debt redemption, as current expenditure. On the other hand, one should keep in mind that Mitchell's expenditure series exclude all capital investment – both ordinary investment (about 0.5% of national income on net) and more importantly extraordinary investment made during the wars – and this omission tends to bias upwards the government's net surplus. Extraordinary military investments/expenditure can be backed out by looking at the growth of the nominal value of the public debt during the War of the Spanish Succession (1702-1713), the American War of Independence (1776-183) the French Revolutionary War (1793-1801) and the Napoleonic Wars (1803-1815). As the detailed computations in UK.xls show, with the corrections for permanent annuity payments and extraordinary military expenditure, we are able to perfectly reproduce the dynamics of the 1700-1913 public debt on the basis of the government's receipts and expenditure reported in Mitchell (1988).

C.3 1855, 1865, 1875 and 1885

We use the national wealth estimates reported by Giffen (1889 Table C p.43, and pp.110-111 for 1855). They were directly computed by Giffen using various sources, in particular data from the schedular income tax (income capitalization method). These estimates could probably be improved, but they measure the right concept (namely, the various items of market-value national wealth), and they are reasonably well documented by Giffen.[318] We again exclude household durable goods ("movable property not yielding income") from national wealth. Although the durable goods categories are not fully homogenous over time, the fact that durables always represent around 40%-60% of national income suggests that the changes cannot be too large.

The asset categories used by Giffen allow us to isolate government non-financial assets (about £300mn in 1865, i.e. 34% of national income) but do not allow to fully isolate net foreign assets (they are split between net foreign public funds, other profits and foreign investments, etc.). So we used estimates of net foreign assets from Feinstein (1972, Table 50 p.T110) and Matthews, Feinstein, and Odling-Smee (1982, Table 5.2 p.128), and computed other domestic capital goods as a residual.[319]

In his writings, Giffen (1878, 1889, 1890) repeatedly stresses that the growth of UK capital during the 19th century is particularly remarkable if we compare it to the evolution UK public debt: typically, he (rightly) points out that UK national wealth is around 11-13 times larger than UK nominal public debt in 1875-1885, while it was only 3-4 times larger in 1810-1820. To him this is a more natural reference point than national income (which he almost never uses). Yet it is also interesting to relate debts and income. In the first half of the 19th century, government interest payments average 5.6% of national income – in effect a huge transfer from taxpayers to bondholders, since the primary government surplus is +5.0%. This is the golden era for bondholders, who over the 1810-1855 period receive cumulated payments equivalent to 221% of 1855's national income from their holdings of public debt: +170% of interest payments and +51% in capital gains, driving positive capital gains for the private sector as a whole. That is, we find that capital gains may account for up to 40% of private wealth accumulation over 1810-1855. But we also find that these gains essentially offset past losses, so that over the full 1700-1910 period private saving flows can account for close to 90% of private wealth accumulation.

[318]See in particular Giffen (1889, pp.1-71), as well as Giffen (1878, 1890). In the 19th century UK income tax system, the various forms of capital income (rent, interest, profits etc.) were taxed under various "schedules", thereby producing annual, reliable series on the various tax bases which Giffen could then capitalize using various sources on rates of return. Giffen also used other sources, in particular inheritance tax data, in order to ensure that both fiscal sources delivered the same quantitative growth of UK wealth since the early 19th century (see in particular Giffen, 1878). There seems to be an inconsistency between the growth of wealth reported by Giffen between 1875 and 1885 (+14.7% in nominal terms) and the pattern of national income growth in this time period in Feinstein (1974) – namely, 0 growth. One possibility is that Giffen does not sufficiently take into account the equity bear market in his estimation (-2% per year over this 10 years period). Another possibility is that Feinstein's 1885 national income is too low. With the data we have it is impossible to tell. In light of this issue, in Table UK.6f we divide Giffen's 1885 estimated wealth stocks by Feinstein's estimated 1890 national income.

[319]Full details, formulas and consistency checks are given in the Excel file.

In the second half of the 19th century (1855-1910), against the backdrop of roughly balanced budgets and with growth picking up (+2.1%) the public debt decreases, from 114% of national income in 1855 to 34% in 1910. As yields remain very low (2-3%), interest payments are significantly lower in the 1855-1910 period (1.2% of national income on average) than in the first part of the century.

The opposite dynamics is at play for net foreign interest payments, which increase from 1.2% in 1810-1855 to a staggering +5.0% in 1855-1910, driving a huge current account surplus (+4.1% on average), so large that in the 1880s and in the decade preceding World War I, foreign investments exceed domestic investments. On the basis of identified current account surpluses alone, we find that the net position of the UK should have increased from 39% of national income in 1855 to 153% in 1910, which is slightly lower than what available estimates give (173%). Of course, given the data limitations that we face it is impossible to tell whether this reflects real positive net capital gains for the UK, or measurement issue. The only safe conclusion is that current account balances are broadly in line with the evolution in the net position, which would be consistent with the findings of Meissner and Taylor (2006) that the UK did not enjoy a substantial "privilege" from being the center of the world monetary system.[320]

C.4 1901 and 1913

We use the national wealth estimates reported by Craigie (1902 pp.595-596) and by Campion (1939 pp.65 and 84). These were computed by Craigie and Campion and are broadly homogenous to the Giffen estimates. Regarding government nonfinancial assets for instance, Campion reports a £1.1bn figure for 1913 (46% of national income), which is consistent with Giffen's 1865 figure and public investment flows over 1865-1913. The remarks made above regarding durable goods and net foreign assets also apply here.[321]

C.5 1920 and 1950

The private wealth estimates come from the annual series obtained using Soloumou-Weale, Blake-Orszag and BB series (see above). The market-value government debt figures again come from Janssen, Nolan, and Thomas (2002), and we also report par values from Mitchell (1988), which are consistent with both Reinhart and Rogoff (2011) and Abbas et al. (2011). Regarding government assets, our estimates are based on the 1913 data point due to Campion (1939), the 1957 detailed and rigorous balance sheets of Revel (1967, pp.46-55) and public investment flows in the 1913-1957 period.[322]

[320] Our computations, however, abstract from the question as to whether the UK earned a particularly high yield on its foreign assets.

[321] Campion's estimates refer to Great Britain and were grossed up to apply to the UK. Our resulting estimates for UK national wealth in 1913 are still somewhat below the estimates given Goldsmith (1985). The latter raise a number of difficulties, however. See discussion below.

[322] From 1855-on we also explicitly try to measure the financial assets of the governments (net of non central government debt). Over the 1855-1967 period we set these net financial claims equal to the public bonds held by the Bank of England (see Table UK.7). Other assets appear to be negligible, at least in the early twentieth century, e.g., in 1914 Suez Canal shares and Exchequer balances were valued at £48mn, i.e. 2% of national income. In 1967, other financial assets are

C.6 Differences with earlier series

Our private wealth-national income series have the same general pattern but differ slightly from the 1920-2010 series presented by Atkinson (2012, figure A), because of small definitional differences both for the numerator and denominator. Regarding the numerator, Atkinson includes household durable goods in private wealth but excludes pension wealth (this is justified given his focus on intergenerational wealth transmission, but given our international, macro, capital accumulation perspective, we do the opposite, following SNA guidelines). Regarding the denominator, Atkinson uses factor-cost national income, while we use market-prices national income (again to facilitate international comparisons: the frontier between direct and indirect taxes is somewhat arbitrary).

Our series differ more substantially from the 1855-1965, annual capital-output series reported by Feinstein (1972, Table 20, pp.T51-T53, col. 8), because of more substantial definitional differences. According to the Feinstein series, the capital-output ratio declined from about 450%-500% in the 1850s-1870s to 400%-450% in the 1880s-1930s and 300%-350% in the 1940s-1960s. The denominator is gross domestic product. However the capital concept used at the numerator is very different from our aggregate wealth concept: Feinstein uses the "gross stock of reproducible fixed assets", which he computes by cumulating past flows of gross fixed capital formation, with no allowance for depreciation. In other tables (see Tables 43-46, pp.T96-T105), Feinstein also gives series for the "net stock of reproducible fixed assets" (taking into account depreciation), in which case the numerator and the capital-output ratio would be substantially smaller – typically about 30%-40% smaller (so that the ratio would fall from about 300%-350% to 200%-250% between the 1850s-1870s and the 1940s-1960s). Feinstein's concept of "net stock of reproducible fixed assets" would be equivalent to "fixed assets" (AN11) in the ESA95 classification (in particular, it excludes land value).[323] The starting point of the Feinstein series is very high (with a net reproducible capital stock of 2.45 billions £ in 1855, at a time when national income was slightly above 0.6 billion £), but it was not obtained by a census estimate for 1855 or by cumulating previous flows (no saving or investment flow prior to 1855 is given by Feinstein), but rather by working backwards from estimates of the capital stock for the 1920s and the 1950s. That is, given the limited saving and investment flows observed between the 1850s and the 1920s or 1950s, one needs to assume a very high starting point in the 1950s in order to account for the final point; but of course another possibility is capital gain and/or mis-measured saving or investment flows.

Last, our series substantially differ from those reported by Goldsmith (1985, Table A7, pp.232-236), who finds higher wealth-income ratio than we do in the

valued by the official blue book series at 30% of national income, so in effect there is a break in our government gross financial assets series in 1967. On that same year there is a discontinuity of the same of order of magnitude for liabilities, as in 1967 we also include other government liabilities (i.e., other than central government liabilities) which turn out to be close to 30% of national income as well (e.g., local government debt). So the 1967 discontinuity in the government's gross financial positions does not affect its net financial position and net worth. See Table UK.5c for detailed computations.

[323]In ESA 95, Non-financial assets (AN) = Produced assets (AN.1) + Non-produced assets (AN.2:land, subsoil assets), and Produced assets = Fixed assets (AN.11: dwellings, other buildings and structures, machinery and equipment, etc.) + Inventories (AN.12) + Valuables (AN.13).

mid-18th century (about 850% of national income), and declining ratios through to World War I (about 600% in 1913). Goldmisth's wealth-income ratio for the 1760-1860 period are artificially high because of land. Goldmisth uses Feinstein's (1978) land value estimates expressed in constant prices, and attempts to reflate them. This double-price adjustment introduces important errors because the price index used by Feinstein to deflate land values differs from the one used by Goldmisth to reflate them, so that eventually Goldsmith obtains much too high land values for the mid-18th century and early 19th century. This problem illustrates the pitfalls of Feinstein's and Goldmisth's "volume" perspective on capital and the confusion between market price balance sheets and volume estimates of capital stocks. In this case it is obvious why the market-value estimates of wealth at current price should be preferred.[324] In the end there is nothing robust in the higher wealth-income ratio found by Goldmisth for the 1760-1850.

G Italy

A Official national accounts series

A.1 National income series, 1960-2011

Italy's national income accounts are published by Istat, the Italian National Institute of Statistics. As of July 2012, Istat disseminates two types of series, all complying with ESA95. First is a set of series using 2005 as base year, covering the 1990-2011 period for economy-wide aggregates and 1995-2011 for the different institutional sectors.[325] Second is a set of 2000-base year series, covering the 1970-2010 period for the main aggregates and 1990-2010 for the sectors.[326] We use the most recent series and extend them backward using the 2000-base year data in order to obtain homogenous 1990-2011 accounts. When they exist, discrepancies between the old and the new base are negligible.[327]

Istat does not disseminate anymore pre-1990 sectoral income accounts. However, official pre-1990 series can be retrieved thanks to the the annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs, Ameco.[328] The series in Ameco are fully consistent with the 2000 base-year data available on Istat's website. They go back to 1960 for the main aggregates, and to 1970 or 1980 for the different sectors. These are the series we use, when available, for the 1960-1990 period. All the computations are detailed in the sheet "DataItaly" of Italy.xls, with links to the raw Istat and Ameco files mentioned above.

There are some gaps in Ameco over the 1960-1980 period, in particular for sectoral saving. To fill in these gaps, we turn to the series of Pagliano and Rossi

[324] Goldmisth himself notes (1985, p. 234) that his land values "differ considerably from the contemporary estimates for tall land".

[325] See the file Income_1990_Today.xls

[326] See the file Income_1970_1990.xls

[327] One exception relates to the international accounts (exports, imports, and income flows with the rest of the world), which have been substantially revised following the publication in 2011 of new balance of payments estimates by the Bank of Italy.

[328] See the files Ameco_FullDatabase.xlsx and Ameco_SelectedVars.xlsx.

(1992) who provide a detailed reconstruction of Italy's saving for the 1951-1990 period.[329] Specifically, our 1960-1980 series for net government interest payments, contributions to social insurance plans, total monetary government transfers, government net saving, direct taxes, and net personal saving come from Pagliano and Rossi (1992, Tables 13 and 20) and are spliced (with appropriate scaling) onto the Ameco data.[330] Overall, Italian income accounts strike us as fairly consistent over the 1960-2011 period, and we feel that they are of reasonably high quality.

One fairly minor exception is worth mentioning. As in other countries that follow ESA95, we have information on the value added of households' housing sector: it is, by definition, equal to the operating surplus of the household sector. However, Ameco series (and previous SNA68 accounts) always aggregate households' mixed income and operating surplus, so it is not possible to isolate the value added of the housing sector before 1990. Further, we feel that the 1990-2011 figures for household's operating surplus have some margin of error. The gap between gross and net operating surplus is large, implying a high rate of depreciation, with fixed capital consumption / gross housing product ratios as high as 54% in 1990 (but gradually decreasing to 40% in 2011). One should take the Italian housing product series with some care, especially for the early 1990s.

To compute factor shares in national income, we proceed as follows. For the 1990-2011 period, we assume that the same factor income decomposition holds in the non-corporate business sector as in the corporate sector. Based on this assumption, we can compute the implied labor income of self-employed workers. It is equal to the capital share in the corporate sector times the net product of the non-corporate business sector minus compensations paid by non-corporate businesses. Over the 1990-2000 period, the implied wage of self-employed workers is equal to around 53% of the average wage of salaried workers.

As there is no available data on mixed income before 1990, the only way to break self-employment income into labor and capital for this time period is to attribute an imputed wage to the self-employed. To ensure continuity with our 1990-2011 series, we assign the self-employed 53% of the average compensation of salaried workers. By our estimates, the capital share (excluding government interest) in factor-price national income averages 31% over 1980-2010 vs. 22% in France. This finding is consistent with the high capital share in the Italian corporate sector (34% of the corporate sector's net product against 20% in France).

A.2 National wealth series

Istat does not currently publish comprehensive balance sheets for all institutional sectors of the economy. But the Bank of Italy has compiled complete financial accounts (at both flow and stock levels) since 1950, and it publishes the complete balance sheet (financial plus non-financial wealth) of the household sector, starting

[329] The series in Pagliano and Rossi (1992) are the same as those presented pp.388-400 in the Appendix of the book edited by Ando, Guiso and Visco (1994) devoted to saving and wealth in Italy. They are based on SNA68 concepts, therefore they are in principle not completely comparable to modern ESA95 Istat/Ameco data. In practice, however, there are no major continuity problems; see the detailed computations and checks in Italy.xls.

[330] In a companion paper, Marotta and Pagliano (1992) provide a reconstruction of Italy's sectoral accounts for the 1970-1979 period; we use their data for the 1970-1979 corporate income tax.

in 1995. These series comply with ESA95 guidelines.

Private wealth

To construct homogenous January 1st, 1966 to January 1st, 2011 balance sheets for the household sector, we rely on three key data sources. For the whole period, financial asset and liability figures come straight from the Bank of Italy's financial accounts.[331] 1996-2011 non-financial asset data come from the Supplements to the Bank of Italy's Statistical Bulletin.[332] These official data benefit from a decade of important methodological improvements, described in a 2008 conference volume edited by the Bank of Italy.[333] Lastly, non-financial asset data for the 1966-1995 period come from Brandolini et al. (2007), who devote considerable effort to constructing a homogeneous 1966-2003 balance sheet for the household sector, using unpublished official data.[334] All these raw series, and the minor adjustment made to them, are gathered in the file "Wealth_1966_Today.xls".[335]

There are two minor discontinuities in the resulting 1966-2011 balance sheet. The Bank of Italy's financial accounts include non-profit institutions serving households, while non-financial wealth accounts exclude them.[336] And the financial accounts for the 1951-1994 period have not been fully revised in order to comply with ESA95 guidelines. But these inconsistencies are negligible as compared to the threefold increase in the Italian private wealth to national income ratio (from 222% in 1966 to 666% in 2011).

Contrary to what happens in the U.S., Japan, France, and Australia, the Bank of Italy does not currently publish flow-stock reconciliation accounts. In particular,

[331] 1966-1995 financial accounts come from the Bank of Italy's Historical Tables; 1996-2011 accounts come from the Bank of Italy's Supplements to the Statistical Bulletin. Both are available online at http://bip.bancaditalia.it/. The historical and modern series were spliced with no adjustment.

[332] "Household Wealth in Italy, 2010", Supplements to the Statistical Bulletin, Monetary and Financial Indicators, Year XXI, number 64, 14 December 2011, Table 3A.

[333] See Bank of Italy (2008), papers presented at the conference held in Perugia, 16-17 October 2007, available online.

[334] In particular, Brandolini et al. (2007) estimate dwellings at market value by combining real estate price series (based on semi-annual surveys of real estate agents) with census data which indicate that households own around 91% of the total Italian dwelling stock. The main correction we make is that we exclude consumer durables from household assets in order to be consistent with ESA95 guidelines. Note also that Brandolini et al. (2007) only focus on the assets of "consumer households," and exclude producer households (i.e., sole proprietorships and parternships). Official post 1996 accounts, by contrast, include both consumer and producer households. We upgrade the data from Brandolini et al. (2007) accordingly.

[335] Pagliano and Rossi (1992) provide household balance sheets for the 1951-1990 period (Table 21 p. 39) that we could in principle use to extend our own private wealth series to 1950. But the non-financial stock data in Pagliano and Rossi (1992) are based on the perpetual inventory method, not on modern census-type wealth estimates, which is the reason why Brandolini et al. (2007) discard them. Pagliano and Rossi (1992) find extremely high values for dwellings in the early 1950s: they report a dwelling stock basically constant in current prices over the 1950-1960 decade, which implies a high wealth-income ratio in the early 1950s, sharply decreasing over the 1950s (see Ando, Guiso and Visco, 1994, p. 87). We caution the reader against using these 1950s perpetual inventory method-based balance sheets, which do not give a good picture of the market value of Italian households' wealth.

[336] This inconsistency could be corrected for the 1995-2011 period (and based on this correction, one could also correct the historical 1950-1994 financial accounts). However, given the very small net holdings of NPISH, this did not seem worthwhile to us, and we stuck to the raw official figures.

there are no data on "other volume changes", that is, on the changes in wealth that cannot readily be assigned to capital gains or saving flows. But the Bank of Italy considers that other volume changes are limited. For instance, even "the large earthquake in the Abruzzo region in April 2009 had a limited impact on total household wealth in Italy. The value of all residential property located in the affected areas is estimated to be below 0.1% of total net Italian household wealth".[337]

Government wealth

The main issue with the Bank of Italy's balance sheets is that they only cover the household sector. This means, in particular, that we do not know the value of Italian's corporations non-financial assets (especially land). Accordingly, we are unable to report any result for Italy's Tobin's Q and book-value national wealth.

To estimate the non-financial assets of the government, we rely on a recent paper by Istat that provides estimates for 2006, 2007 and 2008.[338] Istat reports a stock of government non-financial assets worth 52% of national income. We keep this ratio constant over the 1970-2010 period. This assumption is obviously unsatisfactory, and we hope that retrospective non-financial balance sheets will be published in the future to help us improve it. There are four reasons, however, why feel that Istat's estimate is reliable and our assumption justified. First, a 52% ratio is consistent with the observed investment patterns of the Italian government. Over the 1970-2010 period, the government net investment rate has been 1.1% of national income; with a 1.9% real growth rate of national income, and absent real capital gains, this implies a long-run non-financial assets/national income ratio of $1.1/1.9 = 61\%$, close to the figure given by Istat. Second, government net investment has been quite constant over time (at around 1-2% of national income) and there has never been in Italy any active policy to sell real assets in order to improve the government's net position (Fabrizio, 2008). Third, in all countries for which we have complete official balance sheets for the government sector, non-financial assets to national income ratios exhibit a remarkable stability between 1970 and 2010.[339] Lastly, one has to keep in mind that the net financial position of the Italian government has dropped from -33% of national income in 1970 to -122% in 2010. In comparison to this key development, the uncertainty concerning the government's non-financial position is minor: it cannot substantially affect our analysis of government and national wealth accumulation in Italy.

[337] "Household Wealth in Italy, 2010", Supplements to the Statistical Bulletin, Monetary and Financial Indicators, Year XXI, number 64, 14 December 2011, p. 6.

[338] See Table 3.1 p. 31 of Istat (2011), "Compilation of Annual Balance Sheets for Nonfinancial Assets: Methodological Approach, Main Outcomes and Open issues in the Italian Experience," paper presented at the Conference on strengthening sectorial position and flow data in the macroeconomic accounts, jointly organized by the IMF and the OECD, February 28-March 2, 2011.

[339] In the U.S., the ratio of the general government's non-financial assets to national income is exactly the same in 1970 and 2010 (80%); in Canada this ratio equals 62% in 1970 and 51% in 2010; in Australia it is 100% in 1970 and 134% in 2010 (and the increase can be fully accounted for by the discovery of important subsoil assets). The main exception is Japan, where government non-financial assets have increased from 68% in 1970 to 164% in 2010, in line with the exceptionally high rate of government fixed asset investment.

B Historical non-official national accounts series

There is a rich tradition of research on household wealth in Italy. Stamp (1918), Zamagni (1980), and Baffigi (1908) discuss the large body of literature produced between the mid-nineteenth century and the first World War. A first wave was based on estate-multiplier techniques and delivered results that Gini (1914) criticized as much too low, in particular because they under-estimated tax evasion. Carefully combining estate-multiplier, census-type and capitalization techniques, Gini (1914) put the amount of private wealth at about $W = 116$ billion lire in 1914 (4,484 million pound sterling, see Stamp 1918, p. 478). Gini's estimate is widely considered the most reliable for the pre-World War I period. Like other authors of the time, Gini had in mind a concept of wealth very comparable to what we find in modern household balance sheets, namely the market value of all tangible and financial assets in private hands.[340] As national income was about $Y = 20$ billion lire in 1914, the implied wealth-to-income ratio $\beta = W/Y$ is 580%.[341]

A 580% wealth-income ratio is marginally smaller than what we find on the eve of World War I in France, Germany, and the U.K., where β is in the 600-700% range. Whether this slight discrepancy reflects real differences in economic development or merely estimation issues would deserve to be further studied. We leave this task to future research. The important point to note is that the most reliable historical data reveal a broad pattern for the wealth-income ratio which is the same in Italy as in other European countries, with β reaching its pre-World War I level only in the mid-2000s.

H Canada

A Official national accounts series

Canada's national income and wealth accounts are produced by Statistics Canada. Both are based on the 1993 System of National Accounts (SNA93), but are disseminated in a presentation that differs from that retained by many countries and international organization. Most countries present their accounts in the following traditional sequence: production, generation of income, allocation of primary income, secondary distribution of income, use of disposable income, capital account, financial account, other changes in assets, and balance sheet. Statistics Canada, by contrast, currently organizes its accounts in five tables: aggregate income-based GDP and expenditure GDP, income and outlay, capital account, financial flow accounts, and national balance sheet.

[340] In the second edition of his book, published in 1962, Gini made critical comments on the perpetual inventory method that came to dominate wealth-accounting in the post World War II period (see the Appendix of the 1962 edition entitled "Human labour and natural resources in the formation, destruction and reconstruction of wealth").

[341] Baffigi (2011) provides a reconstruction of Italy's income accounts covering the 1860-2011 period. He puts market-price GDP at 22.7 billion lire in 1914 (within the boundaries of the time). Assuming the same capital depreciation / GDP ratio as in France (11%), one gets a a 20.2 billion lire net domestic product. Based on Feis (1961), Goldsmith (1985, p. 250) puts Italy's net foreign liabilities at about 2 billion lire in 1914, which would likely imply a national income marginally below the 20.2 billion net product.

All our series for Canada come directly from the 2012 edition of Canada's economic accounts, which is the last vintage of accounts based on SNA93 and covers the 1960-2011 period.[342] Starting with the 2013 edition, Statistics Canada plans to shift to SNA08, revise its historical series, and adopt the more traditional "sequence of accounts" presentation. The series we report here are likely to be affected by this important revision, but they are the best data available at the time we conducted this research.

A.1 Income accounts, 1960-2011

One implication of the presentation retained by Statistics Canada until 2012 is that GDP from the income approach is not equal to compensation of employees plus operating surplus and mixed income. Rather, net domestic product at factor costs is broken into: (i) wages & social contributions paid by all domestic sectors, (ii) net corporate profits, (iii) interest and miscellaneous investment income (which includes for instance interest paid on corporate debt, which are deductible from corporate profits, as well as mortgage payments), (iv) accrued net income of farm operators from farm production, (v) net income of non-farm unincorporated businesses, including rents; and (vi) an inventory valuation adjustment (the net holding gain or loss incurred by businesses on their inventories as a result of price changes).

In the sheet "DataCanada" of our file "Canada.xls", we first report the official, raw data from Statistics Canada, and then we rearrange them in order to present them in the more conventional framework that breaks domestic product into compensation of employees, operating surplus, and mixed income. More precisely, we construct operating surplus and mixed income as follows:

- Operating surplus = net corporate profits + inventory valuation adjustment + a fraction of interest and miscellaneous investment income;
- Mixed income = accrued net income of farm operators from farm production + net income of non-farm unincorporated businesses including rents + a fraction of interest and miscellaneous investment income.[343]

These rearrangements do not affect the analysis, but allow us to keep a consistent analytical presentation for country's income in our cross-country database. In addition to this, two other minor points about Canada's income accounts are worth mentioning here.

First, the housing sector net product series reported in Table CA.9 only cover owner-occupied dwellings, because in the current presentation of Canada's national accounts it is not possible to exactly isolate the tenant-occupied housing activities

[342] The raw data are gathered in our files "Income_1961_Today.xls" and "Wealth_1970_Today.xls".

[343] More precisely, we allocate "interest and miscellaneous investment income" in proportion to corporate profits on the one hand and to (net income of farm + net income of non-farm unincorporated businesses) on the other. See "Canada.xls" for detailed computations. In principle some of the "inventory valuation adjustment" should also be included into mixed income, but this can be neglected as a first approximation. With the shift to SNA08, interest and miscellaneous investment income, accrued net income of farm operators, net income of unincorporated businesses and inventory valuation adjustment will disappear and will be implicit in the computations of mixed income and operating surplus, just like in other countries.

of households.[344] This means that we tend to under-estimate the true value added of Canadian households' housing activities. On the other hand, we somewhat over-estimate the net product of the owner-occupied housing sector, because the value-added series disseminated by Statistics Canada (which are the ones we report) are gross of some property taxes.[345] So some care is needed when comparing Canada's housing product statistics to those of other countries in our database.

Second, Statistics Canada produces its own estimation of the imputed wage of self-employed workers.[346] So for our computation of the labor share, we simply add this official estimate of labor income in the non-corporate sector to the data on compensations paid by corporations and the government.

A.2 Wealth accounts, 1970-2011

Statistics Canada publishes extremely detailed balance sheets and financial flow accounts, with about 30 distinct sub-sectors.[347] There are two sets of data: a set of book value estimates and a set at market values. We report market values. The raw Canadian balance sheets include consumer durables in assets; to ensure consistency with other countries we exclude them. This is the only modification we make to the stock data. At the time of this study, Statistics Canada does not disseminate flow-stock reconciliation accounts to isolate capital gains from other volume changes. So all our capital gains estimates for Canada de facto include other volume changes. This issue will be addressed with the adoption of SNA08.

In addition to land, Statistics Canada also provides estimates for the value of a number of natural resources: timber, energy, and mineral resources. These assets are not included in published balance sheets, and we do not attempt to include them in national wealth. We report the value of natural resources other than land as a memo item in Table CA.6a. Natural resources appear to have fluctuated between 50% and 120% of national income in 1960-2010, with no clear trend.[348]

[344] Note however that Statistics Canada disseminates data on the economy-wide housing sector. They show that owner-occupied dwellings account for about 70-75% of Canada's housing activity; see the supplementary data on the housing sector in the "DataCanada" sheet of Canada.xls.

[345] The reason is that most sectoral value added figures are presented at basic prices rather than at factor costs. Value added at basic prices is equal to value added at market price minus taxes on products (net of subsidies), such as value-added taxes, excise duties, import taxes, etc. (code D21 for taxes and D31 for subsidies in ESA95 classification). Value added at factor costs deducts, in addition, other taxes on production (net of subsidies), such as a number of property taxes and non-social-contribution payroll taxes (code D29 for taxes and D39 for subsidies in ESA95).

[346] More precisely, we have data on wages and social contributions paid in the business sector. The business sector covers the whole economy less public administration, non-profit institutions and the rental value of owner-occupied dwellings, and one of the business sector wage series disseminated by Statistics Canada includes the imputed labor income of the self-employed.

[347] There are also complete flow-of-funds statistics (including household financial assets and liabilities) as well as fixed assets and agricultural land series since 1960, so that in principle we could start our investigation of Canada's wealth in 1960 rather than in 1970.

[348] The order of magnitude is comparable to the one found by the World Bank (2011). In the World Bank's *Wealth of Nations*, Canadian subsoil assets, forest, and agricultural land are worth about 60% of national income in 1995, 2000, and 2005, vs. about 50%, 70%, and 85% respectively in Statistics Canada's data.

B Pre-1960 income series

Historical official and non-official income and wealth accounts are plentiful. In this research we simply use them to provide wealth-income ratios in 1860, 1895, the 1910s, 1920s, and 1955 in Table CA.6e. We leave the construction of complete yearly income and wealth series to future research, but below we indicate the raw sources that could be used to do so.

The first official estimate of national income dates back to 1920, and was published in the *Canada Year Book* for 1922-23. Revised, detailed estimates and methods for the 1926-1974 period were published in 1975 in a three-volume book edited by Statistics Canada, "National Income and Expenditure Accounts" (volume 1: annual estimates 1926-1974, ; volume 2: quarterly estimates, 1926-1974; volume 3: guide to the national income and expenditure accounts: definitions, concepts, sources and methods). Official series of fixed capital, obtained by applying the perpetual inventory method, similarly exist since 1926.[349] All of these data have subsequently been reproduced in the the second edition of the *Historical statistics of Canada*, jointly produced in 1983 by the Social Science Federation of Canada and Statistics Canada.[350] Section F of this book contains data on national income, expenditure, fixed capital, and related aggregates from 1926; on income produced, by industry, from 1919 to 1926; and on gross capital formation from 1901 to 1930. Other Sections contain detailed information on many other aspects of economic activity in Canada.[351]

Prior to 1926, non-official income accounts covering the 1870-1926 period have been assembled by Urquhart (1986, 1993).[352] Urquhart provides detailed data on gross national product, but no data on depreciation. We assume that national income is 92% of gross national product, consistent with the 8% depreciation rates estimated in other countries at the end of the nineteenth century.

C Pre-1970 non-official national wealth series

Generally speaking, early estimates of national wealth used five different techniques, summed up by Stamp (1922, pp. 9-10) as follows: "(1) Based on data arising through taxation of income—notably the United Kingdom. (2) Based on data arising through the annual taxation of capital—notably United States. (3) Based on data arising through taxation of capital at irregular period—death duties—notably Italy and France. (4) The inventory—an aggregation of various forms of wealth built up from various sources, insurance, etc.—notably France and Germany. (5) The census—notably Australia." Most of the early estimates for Canada's wealth use the inventory method.

[349] See Statistics Canada (1974), "Fixed Capital Flows and Stocks, 1926-1974"

[350] *Historical statistics of Canada*, 2nd edition, F. H. Leacy (ed), Ottawa: Statistics Canada, 1983.

[351] For example, balance of payments and international position in Section G; government finance in Section H, from the start of Confederation in 1867 to the mid-1970s. This book, and all its series, are freely accessible online at http://www.statcan.gc.ca/pub/11-516-x/3000140-eng.htm.

[352] Malcolm Urquhart was also one of the lead editor of the first edition of the *Historical statistics of Canada*, Malcolm C. Urquhart and Kenneth A.H. Buckley (eds.), Cambridge: Cambridge University Press, 1965.

1860 The very first attempt at estimating national wealth seems to be Sir Henry Parnell's, in 1830. Parnell puts the value of farms, urban real estate, industrial and commercial buildings in the then settled parts of Canada at £60 million (see Mulhall, 1896, p. 431). On the basis of 1£=C$4.615, this implies a stock of Canadian real estate worth about C$277 million in 1830. But this estimate does not take into account such capital assets as cattle, farm implements, and shipping, nor the net foreign asset position. Further, there is, to our knowledge, no data on Canada's national income in 1830, so we do not use Parnell's estimate in this research.

We rather start with the first reasonably exhaustive estimate of Canada's national wealth, which appears in the inaugural issue of the statistical yearbook of the Confederation, the *Year Book and Almanac of Canada* for 1867 (p. 18).[353] According to Firestone (1958, p. 372), this estimate can be attributed to Arthur Harvey, the editor of the 1867 *Year Book*. Harvey mostly uses data from the decennial census for 1860, and provides a breakdown of the domestic capital stock K into public and private capital. His C$1,136 bn figure for the "honestly realized property of British America" refers to the private capital stock, and includes C$546 mn (almost 200% of national income) for the value of farms (excluding agricultural implements—25 mn—and horses, cattle, etc.—120 mn—but probably including some agricultural dwellings), as well as 200C$ mn (about 75% of national income) for "real estate in cities, towns and villages." Harvey's "honestly realized property" excludes the value of the railways of the Provinces, though Canada's railways are mostly privately owned. We add them back.[354] We also deduct consumer durables ("other personal property," 75 million), and add -110 million of net foreign assets.[355] The resulting private wealth of Canada comes to C$1,070 million, or about 385% of national income.[356]

According to Harvey, government non-financial assets ("canals, harbors, light houses and public buildings constructed by the Governments") reach about C$35 million in 1860. The 1867 *Year Book* also provides (p. 23) the consolidated balance sheet of the province of Canada, as at June 30th 1865. The public debt ("direct debt funded") is 61 million and, in addition to the canals, harbors and other tangible assets, the government has invested about 27 million in the railways. Overall, assuming that the government balance sheet was the same in 1860 and 1865, available evidence suggests that the Canadian government had in 1860 about 20% of

[353] Available online at http://www.statcan.gc.ca/yearbook-annuaire/index-eng.htm.

[354] Harvey estimates the railways to be worth C$150 million, of which 27 million belong to the government. So we add 123 million to the private sector and 27 million to the public sector

[355] Available estimates of Canada's net foreign asset position start in 1900, but Urquhart (1986) provides comprehensive data on Canada's balance of payments from 1870, including on interest and dividends paid and received. In 1870 net capital income payments amount to C$5.4 million. On the basis of a 4% yield, which is close to the yield observed in the early twentieth century, the implied net liabilities of Canada amount to about 135 million Canadian dollars, or 40% of national income. We assume that the same 40% ratio holds true in 1860, which implies net foreign liabilities of C$110 mn.

[356] To our knowledge there are no data on Canada's national income in 1860, since Urquhart's (1986) series start in 1870. We assume that nominal growth was the same over the 1860s as over the 1870s, i.e., 2.3%. This is consistent with Maddison, who reports average annual real growth rates of 2.7% in the 1860s, at a time when inflation was probably slightly negative (the wholesale price index drops from 80.2 in 1867, the first available year, to 79.8 in 1870).

national income in both assets and liabilities. National wealth is thus equal to private wealth, i.e., 385% of national income.

1895 The second data point we use is Mulhall's (1896) domestic capital stock estimate for 1895. Mulhall reports detailed statistics on both earnings and wealth, drawing mainly on the 1891 census. He puts national income Y at £183 million (C$890 million on the basis of 1£=4.866C$) and domestic capital K at £1,003 million (C$4,881 million), which implies a domestic capital/national income ratio $\beta = K/Y = 548\%$. Domestic capital includes land (about 125% of national income), houses (about 90% of national income), and eight other categories of domestic capital goods (cattle, railways, factories, furniture...). The sharp decrease of agricultural land, from about 200% in 1860 to 125% in 1895, is fully consistent with the evolution of the share of the agricultural sector in national income. Urquhart (1986) estimates that agriculture accounts for 38% of gross national product in 1870—hence probably for more than 40% in 1860. In 1895, the share of agriculture is down to 26%.

The main problem with Mulhall's (1896) estimate is that his national income figure seems to be somewhat over-estimated. Urquhart (1986) reports a gross national product of 633 million Canadian dollars in 1895, which is almost one third less than Urquhart's C$890 mn. We keep all of Mulhall's wealth-income ratios, but scale back his absolute figures to make them consistent with Urquhart's more reliable figures (see the formulas in Tables CA.6e).[357] Just like for all our other national wealth series, we exclude consumer durables ("furniture," about 30% of national income), and add to the domestic capital stock K the net foreign asset position.[358] The resulting national wealth / national income ratio is the same as the one based on Harvey's data for 1860, i.e. about 390%. But one key difference is that the ratio of the domestic capital stock K to national income ratio is now significantly higher (around 520%, against 425% in 1860) owing to the huge inflows of British capital during the last four decades of the nineteenth century. The rising indebtedness of Canada exactly mirrors the rising net asset position of the U.K., which increases from about 40% of national income in 1855 to 100% in 1885.

Mulhall (1896, p. 330) reports a stock of public debt of £64 million, or about 50% of national income, but does not give comparable figures for the government's assets.

1911 and 1918 The third estimate of Canada's national wealth, for 1911, appears in the *Journal of the Canadian Bankers' Association*," Toronto, January 1916, p. 90-92. This is the estimate reproduced by Stamp (1918, p. 487) in his study on the wealth of the chief powers, and one of the few that Stamp considered satisfactorily reliable (it is a "Grade II estimate," i.e. Stamp considers that there is a 10-20% margin of error, while most estimates for other countries have margins of error in excess of 30%). The Canadian Bankers' Association mostly uses data

[357] The only exception is housing, for which we report Mulhall's raw data, as they are based on presumably reliable censuses of urban properties.

[358] Urquhart (1986) reports net foreign capital income payments of C$30 mn for 1895; capitalized at a rate of 4%, the net foreign liabilities come to C$750 million, i.e. 130% of national income. This very high ratio is fully consistent with the international balance sheets constructed by Viner (1924) from the year 1900 onward.

from the 1911 census, and puts the total national wealth at £2,285 mn, that is, C$11,119 mn. Detailed data on wealth composition are provided (farm values, mines and forests, railways, urban real property, etc.). The estimate appears to be net of foreign liabilities,[359] so we only subtract consumer durables (which we assume, based on the available data for 1895 and 1918, to be equal to 30% of national income). The resulting national wealth / national income ratio β is 511%.

In order to have a meaningful data point for the 1910 decade, we average this 1911 figure with the 1918 figures provided by Coats (1919) just after World War I.[360] Just like the CBA, Coats uses the inventory method, and gives detailed figures for land, agricultural buildings, implements, livestock, mines, railways, and so forth. Coats notes that his estimate of a C$19 billion national wealth figure probably involves double-counting; on the other hand, he seems to somewhat under-estimate the rise in prices that took place during World War I. So we simply report Coats's raw domestic capital stock figure, and deduct consumer durables and Canada's net foreign liabilities.

1920-1933 From 1923 to 1936, the Dominion Bureau of Statistics published official national wealth series. The first estimate, for 1920, can be found in the *Canada Year Book, 1922-1923* (p. 806-807). All of the estimates are derived by the inventory method; like previous non-official estimates they include farm and urban land, but exclude undeveloped natural resources. For our 1920s data point, we simply average the estimates given by the Dominion Bureau of Statistics for 1926 (*Canada Year Book, 1929*, p. 828) and for 1929 (revised figure provided in *Canada Year Book, 1936*, p. 879). The Bureau of Statistics does not disentangle agricultural land from agricultural buildings, implements, machinery and livestock, but rather includes all this into "farm values." In order to provide comparable land value figures, we adjust the "farm values" figures provided by the Bureau by assuming that land is 53% of the overall value of farm, the figure reported by Coats (1919). As usual, we simply adjust the Bureau's official statistics by subtracting consumer durables and adding the net foreign asset position. From 1926 on, all our data for the net foreign asset position are from Statistics Canada.

1955 The Dominion Bureau of Statistics discontinued its national wealth series after 1933. So our next data point is for 1955, and comes straight from Goldsmith (1985, p. 202). Specifically, Goldsmith reports a national capital stock K (land plus reproducible tangible assets) worth C$103.7 billion. Subtracting consumer durables and adding the net foreign asset position (from the official Statistics Canada international investment position), national wealth comes to C$83.8 billion, or 332% of national income. This is the figure we report in Table CA.6e.

[359] "We must deduct $3,500 million as the mortgage outside investors hold against us," p. 91-2. But this gross liabilities figure probably refers to 1913-1914 rather than 1911; in order to obtain a homogeneous 1911 estimate, we disregard this 3,500 million figure and retain Viner's (1924) figure of 2,900 million for 1911 instead (note that Viner has 3,529 million in gross liabilities as at 1913).

[360] Coats also provided an estimate for 1915 based on probate returns from Ontario, which he grosses up on the basis of population. Because the raw source is here quite limited, and the estimate not detailed, we do not use Coats's probate return-based figure in this research. Two other estimates of the time that we don't use are Crammond (1912) and Giffen (1903), because both authors simply estimate wealth as a multiple of national income, without trying to draw on available census data.

Overall, Canada's national wealth appears to follow a marked U-shaped pattern over the twentieth century. Although early balance sheets have significant margin of errors, all the estimates of the time suggest that national wealth was in the vicinity of 500-550% from the late nineteenth century to the eve of World War I. Then, available data – the official statistics of the 1920s, Goldsmith's (1985) estimate, and the official 1970-on balance sheets – paint the same picture: the national β appears to continuously decline from the 1920s to the 1970s, when it reaches a through of about 280%. Lastly, from the late 1970s-on, the national wealth-income ratio continuously rises to more than 400% today.

I Australia

A Official national accounts series, 1960-2011

The Australian Bureau of Statistics (ABS) is in charge of compiling Australia's income and wealth accounts. Both currently follow the 2008 System of National Accounts standard (SNA08).[361]

A.1 National income, 1960-2011

All published income accounts are for fiscal years that start July 1st and end June 30th. We keep this convention and do not try to convert official fiscal-year series into calendar-year data. Thus, in our file "Australia.xls" as in the rest of the text below, 2011 refers to the period from July 1st, 2010 to June 30th, 2011. ABS has recomputed all pre-2009 series to comply with the new SNA, so we have official, homogenous SNA08-based statistics that start in 1960.[362] Australia is the only country in our sample that has already adopted SNA08; all other countries use versions of SNA93. This does not raises major comparability issues, as the revisions introduced by SNA08 have been fairly modest.

The only notable issue concerns the treatment of real asset ownership transfer costs (see Section A above for a general discussion of the issues raised by transfer costs).

According to the 2008 SNA, transfer costs should be indistinguishably included in the value of the associated assets (SNA 2008, 13.34) and depreciated over the period during which the acquirer expects to hold the associated asset.

However, ABS statisticians do not currently follow this standard. First, they include all transfer costs on dwellings, construction other than dwelling, and land, as a separate "ownership transfer cost" item in the balance sheets.[363] In addition, it seems that they depreciate these costs at too high a rate. In the mid-2000s for instance, total consumption of fixed capital (including on ownership transfer costs) / gross housing value-added ratios are as high as 60% in the raw Australian data.[364]

[361] The last SNA93-based accounts were published in 2008, and the first SN08 accounts in 2009.

[362] See the file Income_1960_Today.xls.

[363] As at July 2011, for instance, A$ 157 billion of ownership transfer costs were recorded as assets in households' balance sheets, which is around 14% of national income.

[364] Note that in "Australia.xls" we only report series on the housing activity of households. Table 49 of ABS annual national accounts provides a complete analysis of the housing sector, including

It has been long-standing practice in the Australian national accounts to write off the whole of the amount of ownership transfer costs as consumption of fixed capital in the same period as transactions occur. Apparently this practice has not changed with the adoption of the 2008 SNA despite the fact that a positive stock of transfer costs are now recorded in the balance sheets. As a matter of fact, depreciation rates in the housing sector are much too volatile and high during real estate booms, when dwellings often change hands.

Accordingly, we have corrected the Australian data to improve comparability with the other countries in our dataset: we subtract ownership transfer costs from both depreciation and assets. This boils down to treating all ownership transfer costs as current expenditure.

Aside from ownership transfers, the only other point worth mentioning about Australian income accounts relates to factor income shares. ABS does not currently break the wage bill paid by domestic sectors into wages paid by corporations, government, and non-corporate businesses.[365] As a result, we cannot compute the labor and capital share in the corporate sector, nor can we apply the factor income decomposition of the corporate sector to the non-corporate business sector. We deal with self-employment by assuming that 25% of net mixed income is capital income, and the remaining 75% labor income.

A.2 Private, government, national, and foreign wealth

Official ABS balance sheets start in 1989. Data are as at June 30th; as for other countries, we recompute mid-year (in this case mid-fiscal year, i.e. January 1st) wealth series. Below we describe the minor adjustments we have made to the official 1989-2001 balance sheets, and how we have extended the data to 1960 by drawing on a number of official sources.

Private wealth

For the 1989-2011 period, our net private wealth series is the one reported by ABS, with the only difference that we subtract from assets the value of households' "ownership transfer costs," as discussed above. We extend the series to 1960 as follows. Until 2007, the Treasury compiled its own measure of private sector wealth, starting in 1960, using similar concepts and methods as ABS (with assets valued, as far as possible, at current market prices). The Treasury drew on financial assets, liabilities, and housing (dwelling plus underlying land) statistics produced by the Reserve Bank of Australia (RBA), Australia's central bank.[366] By construction,

the housing activity of corporations and government. They turn out to be negligible: in 2010-2011, sectors other than households account for only 2% of the gross value added of the total housing sector.

[365] However, ABS *Government Financial Statistics* provide compensations paid by the general government since the end of the 1990s. There is also data on wages paid in the agricultural sector (available from 1990 only). We use this information to provide an idea of the structure of national income by production sector from 2000 onwards, see "Australia.xls" and the more detailed explanations in the sheet "DataAU."

[366] RBA disseminates quarterly balance sheets for the household sector from 1988 onwards (RBA series 20, http://www.rba.gov.au/statistics/tables/) and simplified household balance sheets (housing assets, financial assets, total assets, and debts) that start in March 1977 (RBA series B21).

from 1989 onward, Treasury/RBA and ABS data are fully consistent. So for the period ranging from 1960 to 1989, we simply splice the Treasury household net worth and housing series (Goldbloom and Craston, 2008, Table 1 p. 56) onto the ABS figures. The household sector always includes non-profit institutions.[367]

Government wealth

For the 1989-2011 period, our government wealth data come from the ABS balance sheets, with one notable modification. Australia is the only country in our sample that includes the value of subsoil assets in the balance sheets. Subsoil assets are assigned to the government, irrespective of who exploits them. (The government also owns timber and spectrum, but the value of these assets is negligible).[368] We exclude all these assets from the government's assets, and report a memo item in Table AU.6a. With the resource boom of the second half of the 2000s, the value of subsoil assets has considerably increased – from about 25% of national income in the 1990s to close to 60% in 2010. So our correction makes a large difference to the net position of the government. [369]

There are two reasons why excluding subsoil assets is the correct way to proceed for our purposes. First, it is necessary to ensure consistency within our database. More fundamentally, failure to exclude subsoil assets would cause double-counting. Since the government grants extraction rights to the private sector in exchange of small fees, subsoil assets are capitalized in the equity values of the corporations in the resource sector. Through this channel, subsoil assets are already included in our measure of private and market-value national wealth. Natural resources push Australian equity prices upward, and there is no need to specifically account for subsoil assets in top of that.

In order to extent the government's balance sheet to 1960, we proceed as follows. There are official data on fixed assets,[370] so all we need is the government's net financial position. We use RBA statistics on the amount of public debt outstanding and on intra-governmental holdings of public debt securities.[371] The net wealth of

[367]ABS provides satellite balance sheets for non-profit institutions for fiscal years 1999-2000 and 2006-2007. As at June 2007, the net worth of non-profit institutions amounted to 101.7 bn A$, that is 2% of household net worth.

[368]The government then grants extraction rights to the private sector and earns royalties ("rents on natural assets" in the SNA classification). The value of the stock of subsoil assets (and of native forest) is estimated by applying net present value techniques which take into account the current level of production, prices, costs, and discount rates (Ryan, Thomson and Sincock, 2003). The royalties earned by the government are small compared to the net present value of Australia's subsoil assets: in effect, the government subsidizes subsoil exploitation (e.g., for regional of industrial development purposes). Gregory and Sheehan (2011) estimate that about 80% of Australia's resource-sector is foreign-owned today, so the subsidy is partly to the rest of the world. Note also that corporations have a "permission to use natural resources assets," but this only corresponds to the right to use spectrum licenses granted to mobile phone operators (these rights were worth A$ 2 billion as at June 2011). Subsoil assets extraction rights granted to private sector companies are counted as resources leases (which translate into a flow of rent payments) rather than licenses (which would translate into an permit asset being recorded in the corporate sector's balance sheet), as recommended by the 2008 SNA (17.340 and sqq).

[369]The recent increase in subsoil assets is mostly a price rather than volume effect. New subsoil assets have been discovered, especially in recent years, but over the medium-run, additions of new resources have been in line with depletion (see the 2012 Statistical Yearbook, pp. 121-126).

[370]For land, see discussion below of book-value national wealth.

[371]Specifically, for the total amount of government securities outstanding we use RBA series

the Australian government follows an inverted U-shaped pattern, starting from 40% of national income in 1960, up to 90% in the early 1980s, and down to 50% in the mid 1990s. Rising net assets over the 1960s and 1970s are well accounted for by the combination of high public investment rates (2-3% of national income) and high inflation rates (which reduces the real value of the public debt). The drop in net government wealth in the 1980-1995s owes to a rising public debt and decreasing investment. Since the mid 1990s, the public debt has decreased, which has a led to a moderate improvement in the government's net position.[372]

Book-value national wealth and foreign wealth

By definition, the book-value of national wealth is the sum of all produced non-financial assets and non-produced non-financial assets. ABS provides capital stock series starting in 1960. These statistics give the value of all produced non-financial assets in the economy by type of asset (e.g., dwellings) and by sector (e.g., households). Non-produced assets are exhaustively covered by the 1989-2011 official balance sheets. For the 1960-1988 period, we proceed as follows. Available RBA/Treasury data enable us to compute the value of the land owned by households (both land underlying dwellings and unbuilt plots of land). We assume that, in other sectors of the economy, land values have followed the same evolution as in the household sector.

To estimate the book-value of national wealth, it is necessary to include subsoil assets – since there are no equity prices involved here, failure to account for subsoil assets would lead us to under-estimate Australia's wealth. This is what we do in TableAU.6b.[373] Subsoil assets and other natural resources amounted to 23.6% of national income in 1989. We keep this ratio constant through to 1960. The margins of error involved are negligible as compared to the magnitude of Australia's book-value national wealth to national income ratio, which ranges from 450% to 700%.

Pre-1989 data on foreign assets and liabilities come from Foster (1996), who provides a reconstruction of Australian national accounts covering the 1950-1995 period. The data are available online on RBA's website.[374] They show that Australia has been a sizable net debtor for a long time, with a net foreign asset position of -16% of national income in 1960, down to about -70% in 2010. There are no other volume change data available for foreign wealth.

E10 for the 1974-1989 period, and then various issues of Australia's statistical yearbook for the 1960-1974 period (these yearbooks are all freely available online on the ABS website starting with the 1908 edition). See the file "Australia.xls" for detailed references and computations.

[372] Should we include subsoil assets in the balance sheet, the increase in net wealth would be spectacular, with net asset reaching 125% in 2010, in sharp contrast to the other countries in our database.

[373] We proceed similarly for Canada, the other country in our database that provides yearly data on subsoil assets – with the key difference that Canada, contrary to Australia, does not yet include subsoil assets in the balance sheets, but simply report those as a memo item.

[374] See http://www.rba.gov.au/statistics/frequency/occ-paper-8.html and our file "DataFoster96.xlsx".

B Historical non-official national accounts series

There appears to be many historical estimates of national income and wealth in Australia. We have gathered some of those,[375] but we have not used them in the present research.

J Spain

At the time we conducted this research, Spain did not have official, comprehensive SNA balance sheets. But there were detailed financial balance sheets on the one hand – following the 1995 ESA / 1993 SNA standard – and official estimates of the market value of household real estate compiled by the Bank of Spain on the other. We draw on these official data sets to provide estimates of the market value of private and national wealth in our file Spain.xls. It should be noted that the Bank of Spain itself published a series on the ratio of household wealth to GDP ("Riqueza total de los hogares. Ratio sobre PIB"). This ratio is fully consistent with the wealth-income ratios we report in Spain.xls.[376]

In the absence of integrated balance sheets, however, the Spanish wealth data are of somewhat lower quality than for the 8 countries included in our core database. In particular, we probably slightly under-estimate the wealth-income ratio – and the Bank of Spain as well – because there is no data on the real assets other than housing held by individuals – in our computations, those are assumed to be equal to 0. Another issue is that the real estate estimates only start in 1987, so it not possible to estimate private wealth data before. In view of these two limitations, we have chosen not to include Spain in our core dataset.

K Detailed decomposition results for wealth accumulation

In this section we start by giving more details on the wealth accumulation equations summarized in section 3 of the paper. We then present the full decomposition results for the 1970-2010 period (summarized in the paper, section 4) and for the 1870-2010 period (summarized in the paper, section 5).

A Additive vs. multiplicative decomposition

A.1 Additive decomposition of wealth accumulation

Wealth or capital accumulation between years t and $t+n$ can generally be decomposed into a volume effect and a relative price effect:

[375] See the "Pre1960Series directory" in the CountryData directory devoted to Australia. Knibbs (1918), for example, gives detailed estimates for 1915 (Stamp considers this as "perhaps the most thorough and complete attempt that has yet been made to ascertain national wealth." (p. 483)).

[376] The Bank of Spain reports that the household wealth / GDP ratio peaked at about 670% at the end of 2007; given that national income is about 82% of GDP according to the official national accounts, this is consistent with private wealth exceeding 8 times national income at the peak of the housing bubble.

$$W_{t+n} = W_t + S_{t,t+n} + KG_{t,t+n}$$

where:

W_t is the amount of wealth (or capital) in year t;

$S_{t,t+n} = S_t + S_{t+1} + ... + S_{t+n-1}$ is the total saving (or investment) flow between year t and $t+n-1$, and captures a volume effect;

$KG_{t,t+n}$ is the total capital gains or losses between year t and $t+n$ and capture a relative price effect.[377]

In this equation, W_{t+n},W_t and S are expressed in constant prices, using some reference price index. The choice of a reference price index is an important issue. One attractive option would be to use the consumer price index, so that KG would measure the excess of asset price inflation over consumer price inflation. But as we discuss below, in most countries GDP deflators are of higher quality and so in this research we mostly use GDP deflators to compute real values.

In a one-sector model with no relative price effect, KG would be equal to 0. That is, wealth in year $t+n$ would simply be equal to wealth in year t plus total savings between years t and $t+n-1$.

We note Y_t national income at time t (in constant prices) and define g the geometric average real income growth rate between years t and $t+n$: $Y_{t+n} = Y_t \cdot (1+g)^n$. We note $\beta_t = W_t/Y_t$ the wealth-income ratio in year t. Lastly, we define define s^* the uniform-growth-weighted average saving rate between year t and $t+n$:

$$s^* = \frac{S_{t,t+n}}{Y_t + (1+g)Y_t + ... + (1+g)^{n-1}Y_t} = \frac{S_{t,t+n}}{\dfrac{(1+g)^n - 1}{g} Y_t}$$

With these definitions in hand, the wealth-income ratio $\beta_{t+n} = \dfrac{W_{t+n}}{Y_{t+n}}$ can be written as the sum of three components.

Additive decomposition of wealth accumulation:

$$\begin{aligned}
\beta_{t+n} &= \beta_{ini} + \beta_{sav} + \beta_{kg} \\
\text{with:} & \\
\beta_{ini} &= \frac{W_t}{Y_{t+n}} = \beta_t \frac{1}{(1+g)^n} = \text{component coming from initial wealth} \\
\beta_{sav} &= \frac{S_{t,t+n}}{Y_{t+n}} = \beta^* \left(1 - \frac{1}{(1+g)^n}\right) = \text{ component coming saving flows} \\
\beta_{kg} &= \frac{KG}{Y_{t+n}} = \text{ component coming from capital gains} \\
\beta^* &= \frac{s^*}{g} = \text{Harrod-Domar-Solow steady-state wealth-income ratio}
\end{aligned}$$

[377]In our database our wealth data points are mid-year estimates (obtained by averaging end of $t-1$ and end of t wealth amounts). By contrast, our saving flows are for year t. So in effect there is slight inconsistency (logically we would like to have mid-year to mid-year saving flows) but given our long-run focus it is completely irrelevant and we disregard it.

In the absence of capital gains, β_{t+n} is simply the weighted average of the initial wealth-income ratio β_t and the Harrod-Domar-Solow wealth-income ratio β^*. Further, as $n \to +\infty$, and in the absence of capital gains (or if capital gains are purely transitory), $\beta_{t+n} \to \beta^*$. In the long run the initial capital stock does not matter any more, and the wealth-income ratio converges towards the Harrod-Domar-Solow steady-state.

As long as n is finite, however, the initial stock does matter. Take $t = 1950$, $t + n = 2010$. With $g = 2\%$, then $(1 + g)^n = 3.28$, and $1/(1 + g)^n = 0.30$. Capital accumulation takes time: even after 60 years, the initial stock matters for 30%, and cumulated savings for 70%. Of course with larger growth the initial stock matters less. That is, if $g = 3\%$, then $(1 + g)^n = 5.89$, and $1/(1 + g)^n = 17\%$.

To estimate the additive decomposition equation of wealth over the 1970-2010 period, we simply need some estimate of the initial and final capital stocks β_t and β_{t+n}, and of total saving flow $S = S_{t,t+n}$ between 1970 and 2010. Total capital gains are estimated as a residual: $KG = W_{t+n} - W_t - S$. It is straightforward to compute the full decomposition $\beta_{t+n} = \beta_{ini} + \beta_{sav} + \beta_{kg}$ and the share of total wealth accumulation coming from each channel.

In practice when we decompose wealth accumulation, rather than using the uniform-growth-weighted average saving rate s^*, we use for convenience the simpler real-income-weighted saving rate s defined by:

$$s = \frac{S_{t,t+n}}{Y_t + Y_{t+1} + ... + Y_{t+n-1}} = \frac{s_t Y_t + s_{t+1} Y_{t+1} + ... + s_{t+n-1} Y_{t+n-1}}{Y_t + Y_{t+1} + ... + Y_{t+n-1}}$$

where s_t is the saving rate in year t. This simple income-weighted average saving rate s slightly differs from the uniform-growth-weighted average saving rate s^* because growth rates g are not constant, but the gap is negligible and irrelevant for our purposes. Using the income-weighted average saving rate, we can compute the extra saving rate Δs necessary to fully account for observed wealth accumulation:

$$\Delta s = \frac{\beta_{kg}}{\beta_{sav}} s = \frac{KG}{S} s$$

A.2 Multiplicative decomposition of wealth accumulation

Multiplicative decomposition with yearly balance sheets

The additive decomposition is fine when capital gains or losses are purely transitory and play no role in long run wealth accumulation. But when there is a permanent rate of capital gain $q > 0$ (or $q < 0$), for instance because there is a permanent mis-measurement of saving or investment flows (e.g., because R&D is counted as intermediate consumption), it is better to adopt the following multiplicative decomposition:

$$W_{t+1} = (1 + q_{t+1})(W_t + s_t Y_t) = (1 + q_{t+1})(1 + g_{wst+1}) W_t \tag{K.1}$$

With: $g_{wst+1} = s_t/\beta_t$ = saving-induced wealth growth rate,
q_{t+1} = capital-gains-induced wealth growth rate.

Alternatively, we could write $W_{t+1} = (1 + q_{t+1})W_t + s_t Y_t$, i.e. saving and investment are made at the end of the period and do not benefit from capital gains.

This makes very little difference given that q is usually small, and the multiplicative form is a bit more convenient to work with so we retain it.

Dividing equation K.1 by Y_{t+1} and noting $g_{t+1} = \frac{Y_{t+1} - Y_t}{Y_t}$ the growth rate of national income we obtain:

$$\beta_{t+1} = \frac{(1+q_{t+1})(1+g_{wst+1})}{1+g_{t+1}}\beta_t$$

Cumulating over n years we get the following **multiplicative decomposition of wealth accumulation:**

$$\begin{aligned}
\beta_{t+n} &= \frac{(1+q)^n(1+g_{ws})^n}{(1+g)^n}\beta_t \\
\text{with:} & \\
(1+g_{ws})^n &= (1+g_{wst+1}) \times ... \times (1+g_{wst+n}) : \text{cumulated saving-induced wealth growth rate} \\
(1+q)^n &= (1+q_{t+1}) \times ... \times (1+q_{t+n}) : \text{cumulated capital-gains-induced wealth growth rate} \\
(1+g)^n &= \frac{Y_{t+n} - Y_t}{Y_t} = \text{cumulated growth rate of national income}
\end{aligned}$$

With annual balance sheets, one compute annual rates $g_{wst+1}, q_{t+1}, ..., g_{wst+n}, q_{t+n}$ and cumulate them in order to compute the average rates g_{ws} and q. From this one can define the share of total wealth growth coming from savings as $g_{ws}/(g_{ws}+q)$, and the share coming from capital gains as $q/(g_{ws}+q)$. Alternatively, one can define the share of total wealth accumulation coming from initial wealth as β_{ini}/β_{t+n} (with $\beta_{ini} = \beta_t/(1+g)^n$), the share coming from saving as $(1-\beta_{ini}/\beta_{t+n}) \times g_{ws}/(g_{ws}+q)$ and the share coming from capital gains as $(1-\beta_{ini}/\beta_{t+n}) \times q/(g_{ws}+q)$. Note that these shares differ from those coming coming from the additive decomposition $\beta_{t+n} = \beta_{ini} + \beta_{sav} + \beta_{kg}$.

Multiplicative decomposition without yearly balance sheets

Assume we do not have annual balance sheet series but that we observe initial and final capital stocks β_t and β_{t+n}. Assuming a uniform rate of capital gains q between years t and $t+n$, as well as a uniform saving rate $s_t = s$ and growth rate $g_t = g$, the dynamic equations can be rewritten as follows:

$W_{t+1} = (1+q)(W_t + sY_t)$

$W_{t+2} = (1+q)(W_{t+1} + sY_{t+1}) = (1+q)^2 W_t + s[(1+q)^2 Y_t + (1+q)(1+g)Y_t]$

$W_{t+n} = (1+q)^n W_t + sY_t[(1+q)^n + (1+q)^{n-1}(1+g) + ... + (1+q)(1+g)^{n-1}]$

That is:

$$W_{t+n} = (1+q)^n \left[W_t + s \cdot Y_t \frac{\left(\frac{1+g}{1+q}\right)^n - 1}{\frac{g-q}{1+q}} \right]$$

Now define the corrected Harrod-Domar-Solow steady-state wealth-income ratio as follows:

$$\beta_q^* = \frac{s(1+q)}{g-q}$$

We have the following equation:

$$\beta_{t+n} = (1+q)^n \left[\beta_t \frac{1}{(1+g)^n} + \beta_q^* \left(\frac{1}{(1+q)^n} - \frac{1}{(1+g)^n}\right)\right] \tag{K.2}$$

For given β_t, β_{t+n}, g and s, there exists a unique q solving equation K.2, with $q > 0$ if and only if $\beta_{t+n} < \beta_t \frac{1}{(1+g)^n} + \beta^*(1 - \frac{1}{(1+g)^n})$ and $q < 0$ if the reverse inequality holds. There is no closed formula for q, but it can easily be computed by numerical methods (in practice a simple tatonnement process works very well). We use equation K.2 many times in this research in order to compute real rates of capital gains in time periods when there is no official yearly balance sheets and fill in the gaps in our wealth series. A few notes are in order here.

First, equation K.2 computes the uniform q corresponding to uniform saving rates s and growth rates g. In practice, even when we do not have annual balance sheets series, we generally have annual series on s_t and g_t, and so we can (and do) make use of these yearly series to compute more accurate estimates of q. That is, if savings happen mostly at the beginning of the period the required capital gain effect $q > 0$ will be smaller than if they are concentrated at the end of the period. In practice however, it makes relatively little difference.

Second, note that with $q = 0$, equation K.2 boils down to:

$$\beta_{t+n} = \beta_t \frac{1}{(1+g)^n} + \beta^* \left(1 - \frac{1}{(1+g)^n}\right)$$

Third, equation K.2 can also be rewritten:

$$\beta_{t+n} = \frac{(1+q)^n (1+g_{ws})^n}{(1+g)^n} \beta_t \quad \text{with} \quad (1+g_{ws})^n = 1 + \frac{\beta_q^*}{\beta_t}\left[\frac{(1+g)^n}{(1+q)^n} - 1\right]$$

Fourth, the corrected Harrod-Domar-Solow formula $\beta_q^* = \frac{s(1+q)}{g-q}$ shows that permanent capital gains per se do not generate capital accumulation. As long as $q < g$, $\beta_q^* = 0$ if $s = 0$. So in the long run saving flows always explain 100% of capital accumulation in the multiplicative framework, including in the presence of capital gains.

Fifth, in this research we always use net-of-depreciation income and saving series, but the corrected Harrod-Domar-Solow formula can be extended to the case where s is the gross-of-depreciation saving rate and δ is the depreciation rate (assumed to be proportional to capital stock, so that in effect it operates like a negative rate of capital gain):

$$\beta_q^* = \frac{s(1+q-\delta)}{g-q+\delta}$$

Lastly, in case we prefer to assume that savings and investment are made at the end of the period and do not benefit from capital gains, i.e., $W_{t+1} = (1+q)W_t + sY_t$, then the corrected Harrod-Domar-Solow formula writes:

$$\beta^*_q = \frac{s}{g-q}$$

B Detailed decomposition results for the 1970-2010 period

The main decomposition results for the 1970-2010 period are presented in the paper (section 4). Here we provide a number of supplementary results (see Appendix Figures A122-A142 and Appendix Tables A99-A107). For the most part, the results are self-contained. Detailed formulas can be found in the corresponding Excel files as well as in the country-specific Excel files. A number of specific issues, however, require particular attention.

B.1 Private saving vs. personal saving

First, we provide separate decomposition results for private wealth accumulation using personal (household) saving rather than total private saving, i.e. excluding corporate retained earnings. In most countries, a substantial fraction of private saving and investment takes place through corporate retained earnings: about 40-50% in the US, Japan, Canada and Australia, and over 60% in the UK. There are exceptions, however. In Germany and France, only about 20% on net private savings took place through retained earnings on average during the 1970-2010 period; in Italy, less than 5%.[378] It is far beyond the scope of the present paper to explore the various explanations for these cross country variations. It is likely that differences in tax rules (e.g., provisions against double taxation of dividends are more common in Germany and France than in the U.S. and the U.K.) and financial intermediation systems play role. Pure accounting differences also probably matter.[379]

When we exclude retained earnings from the private saving flow, then in most countries savings alone are far too small to explain the observed evolution of wealth-income ratios. The residual capital gain is positive everywhere and usually large (accounting for up to 81% of private wealth accumulation in the U.K., for example). But such capital gains are spurious, in the sense that they mostly correspond to the accumulation of retained earnings within corporations in order to finance new investment and new acquisitions (thereby leading to rising stock prices), rather than to a true relative price effect. In particular, they can easily be accounted for in a one sector capital accumulation model (there is no need to introduce relative prices). In effect, instead of distributing more dividends, U.S. corporations choose to re-invest the equivalent of 3.1% of national income in net retained earnings, which according to our estimates generate an extra residual capital gain of 0.8% per year over the the 1970-2010. This corresponds to a stock market real appreciation of about 2%-3% per year. Instead of receiving more dividends, U.S. wealth holders can choose

[378] Note that the share of household vs. corporate saving in total private saving depends on whether one looks at net saving flows (as we do in this research) or gross flows. Because depreciation is higher in the corporate sector, the share of retained earnings is higher when one looks at gross saving flows – over 50% in Germany and France.

[379] For instance, many large firms – and their corresponding retained earnings- - seem to be registered in the personal rather than in the corporate sector in Germany and Italy

to realize their capital gains when they so wish. Presumably corporations do not distribute more dividends because private wealth holders prefer to have some of their wealth accumulation to take place in corporations, either for tax reasons or because they trust corporations to make wiser investment choices than they would on their own.

We observe the same phenomenon in every rich country, but with varying intensities, and that is why we consider it much more meaningful to decompose private wealth accumulation using the total private saving flow (households + corporate). One limitation of our approach, however, is that we attribute all retained earnings of U.S. corporations to the U.S. personal sector (and similarly for other countries). Ideally, one should re-attribute a fraction of retained earnings to foreign shareholders, and part of foreign retained earnings should similarly be re-attributed to domestic shareholders. Part of the retained earnings of domestic corporations should also be attributed to the government. Unfortunately national accounts series – at least in the form they are currently released – do not report such bilateral flows in a systematic manner, so we cannot do that for the time being. Given that the net foreign asset positions of the various countries are not very large (so that each country receives and gives approximately the same quantities of retained earnings), and government ownership in corporations has become fairly small, any errors here can probably be neglected, at least as a first approximation.[380]

B.2 Private wealth vs. national wealth decomposition

Generally speaking, it is worth stressing that the measurement of government wealth raises a number of specific difficulties. In particular, government non-financial assets are mostly made of buildings and equipment used by public administration, schools, public hospitals, etc., most of which are not sold very often, so that their market value can be difficult to determine. In addition, historical monuments are rarely valued.[381] Natural resources – forests, mountains, subsoil assets etc. – are not valued until the time they are exchanged on a market and/or used for economic activity. In practice, the recorded value of government non-financial assets appears to be relatively stable – around 50%-80% of national income – throughout the 1970-2010 in most countries of our sample.[382] The main exception is Japan, where government non-financial assets gradually rose from about 50% of national income in 1970 to around 100% in 1990 and as much as 150% by 2010.[383]

In principle, the market value of government-held financial assets and liabilities (i.e. public debt) is easier to measure, with two caveats. First, countries with large nominal public debt often have a significant fraction of their public debt

[380]Our method is probably more problematic for the 1950s-1960s (and to some extent for the 1970s), when government ownership was more prevalent.

[381]In France for example, historical monuments are valued when there are observable investment series – e.g., when large reparation work is undertaken, or when a new monument is built (such as the Louvre pyramid).

[382]There are limited cross-country variations: in the US, government non-financial assets are stable around 70%-80% on national income; in Germany, the UK, Italy and Canada, they are stable around 50%-60%; in France they are stable around 50%-60% until the early 2000s and then rise up to 80%-90% in the period. See Tables US.6a, DE.6a, FR.6a, etc.

[383]We discuss the patterns in Japanese public assets and debts in Section G devoted to Japan.

held by various public entities (local government debt held by central government, central government debt held by social security funds, etc.). So it is critical to consolidate the balance sheet at the level of the entire government sector (including all government levels: central, local, social security and all forms of public bodies and agencies under public control).[384] This is what SNA international guidelines require to do, and all countries in our sample seem to follow this rule rigorously.

So for instance in 2010 Japan's government sector balance sheet involves very large public debt (264% of national income), but even larger public assets (278% of national income, including 150% in non-financial assets and 128% in financial assets), so Japan's net government wealth appears to be slightly positive (+14%). In contrast, Italy has smaller public debt (156% of national income), but much smaller assets (88%, including 52% non–financial and 36% financial), so that Italy's net government wealth appears to be strongly negative (-68%).[385]

The last difficulty has to do with the valuation of government participation in publicly owned companies, many of which have been privatized in rich countries since the 1970s (particularly in the energy, telecom, transportation and banking sectors). In principle, according to SNA 1993 international guidelines, national accountants should report on the financial asset side of the government balance sheet the fair market value of its equity participation in public companies - on the basis of stock prices observed for publicly traded companies in comparable production sectors (in the same way as for non publicly traded, privately owned businesses). However not all countries have published retrospective balance sheets following these rules for the earlier part of the period. We made a number of corrections to the originally published balance sheets so as to ensure maximum continuity, but it is possible that we still underestimate somewhat the value of publicly owned corporations in the 1970s and early 1980s.[386]

It is possible that we under-estimate the value of government wealth in the 1970s (say by about 50% of national income - probably an upper bound),[387] in which case the decline in government wealth would be even larger.

B.3 Gross vs. net saving

In our view, it is perfectly possible that national accounts under-estimate saving and investment flows by substantial amount, and that this explains some of our findings on the importance of capital gains in 1970-2010 wealth accumulation. In particular, UK official balance sheet series do not include estimates for "other volume changes" (new construction permits, discovery of national resources, etc.), which for other countries we included with saving-induced volume effects – as opposed to residual

[384]Throughout the paper, when we refer to "governement sector" or "government wealth", we always refer to the consolidated government sector in the broadest sense (as defined by SNA guidelines).

[385]See Tables JP.6a and IT.6a.

[386]In particular, we re-attributed the residual book value of public corporations to the UK government. The effect of the correction is substantial for the 1970s and early 1980s, but might still be somewhat under-estimated (see UK section). More on this below.

[387]In particular, public assets for France and Italy seem a bit too low for this period. E.g. according to official balance sheets the government share in national wealth is only 15%-20% in the 1970s and early 1980s in France, vs as much as 25%-30% in Germany and the UK, which does not seem entirely plausible given the size of the public sector in France at that time.

price effects. If “other volume changes” in the UK were of similar magnitude as in countries like the US or France, then the share of wealth growth accounted for by volume effects would rise from 55% to about 65% in the multiplicative decomposition.[388] In case unmeasured saving and investment flows – due in particular to R&D spendings – represent the equivalent of about 3% of national income, then there would be no UK puzzle at all.

It is also worth recalling that statisticians estimate net saving and investment flows first by computing gross flows, and then by deducting estimates of capital depreciation. Because the depreciation provisions and allowances reported in the books of private corporations are not homogenous over time and across countries (and are often severely polluted by tax optimization behavior), statisticians produce their own, homogenous estimates of capital depreciation, on the basis of various assumptions about average depreciation rates for each type of capital good and about the age distribution of these capital goods. National accountants do their best, but it is fair to say that this a complex process which involves many potential measurement errors. This can have serious consequences about the measurement of net saving and investment flows – especially given that capital depreciation generally represent between one half and two thirds of gross flows.

E.g. in the UK, gross private saving flows were on average 21.0% of national income over the 1970-2010 period, but capital depreciation flows were 13.6% of national income, so that net private saving flows were only 7.3% of national income. Capital depreciation flows seem to be fairly similar across countries and display no obvious inconsistency. In particular, countries with lower net savings like the UK or the US do not display higher depreciation rates. But it could be that true capital depreciation rates in the UK are actually lower than in other countries and than currently estimated (say, because of ill-measured differences in composition or age structures of machines and equipments), so that net saving rates are underestimated by a non-negligible amount (say, by the equivalent of 1%-2% of national income). We have no strong reason to suspect that this is the case - but we have no strong reason to exclude it either. The point is that a moderate error on depreciation would be sufficient to explain a significant part of the UK puzzle.

C Detailed decomposition results for the 1870-2010 period

The main decomposition results for the 1870-2010 period are presented in the paper (section 5). A number of additional decomposition results are provided in Appendix Tables A108 to A137. Specifically, we provide detailed additive and multiplicative decomposition results for each sector of the economy (private, government, foreign) in the U.S., Germany, U.K., and France, for each of the main subperiods (1870-1910, 1910-1950, 1950-1980, and 1980-2010). These results are self-contained, and

[388] It is also possible that Australian series under-estimate other volume changes (discovery of new natural resources were very important in Australia over this period, and they are difficult to account for at a proper market value at the time they are made). In the country tables US.4, JP.4, etc., we separately report the results obtained for saving flows strictly speaking and for “other volume changes”. In the US other volume changes represent an average annual flow of 1.0% of national income over the 1970-2010 period, vs 7.7% for private saving (see Table US.4b); in France they represent 0.9% of national income, vs 11.1% for private saving (see Table FR.4b).

the interested reader is referred to AppendixTables.xls and the country-specific Excel files for all details.

D The formula $\beta = s/g$ with bequest taste and lifecycle saving

In the paper (section 3), we show that the saving rate s in the formula $\beta = s/g$ can be interpreted as the intensity of the taste for bequest in a simple model with bequest in the utility function. We also mention the fact in a more general model with lifecycle saving then the equilibrium saving rate $s = s(\lambda)$ would also depend positively on the fraction of lifetime λ that is spent in retirement. I.e. following the Modigliani triangle logic one should see more lifecycle saving when one expects to spend more time in retirement (and/or if one expects larger consumption needs during retirement, e.g. due to health shocks). Here we provide a simple model that can be used to generate such a formula.

Instead of assuming that each generation leaves one period, we now assume that each generation leaves two periods: one period from adulthood to retirement, one period from retirement to death. The fraction λ is given by: $\lambda = (D - R)/(D - A)$ (where A = age at adulthood, R = age at retirement, D = age at death). Say, if $A = 20$, $R = 60$ and $D = 80$, then $\lambda = 1/4$. For simplicity, we model this continuous-time, overlapping generation process as a discrete process where the life of each generation can be broken down into two components (one from age A to R, and one from age R to D), leaves bequest at the end of life, and receives bequests at the beginning of (adult) life.[389]

More precisely, we consider the same exogenous-growth, bequest-in-the-utility-function model as in the paper (section 3.3), and we now assume that each generation t has to divide its lifetime consumption into two components: working-life consumption c_{1t} and retirement-life consumption c_{2t}. We assume that the budget constraint can be written as follows:

$$c_{1t} + c_{2t} + b_{t+1} \leq y_t = y_{Lt} + (1 + r_t)b_t$$

In effect, we are assuming that both types of consumption take place at the end of life, and that the only difference between the two is that retirement-life consumption must be funded into some pension fund or health insurance account, so that it can be interpreted as wealth accumulation.[390] The simplest case is when the utility function is defined directly over consumption levels c_{1t} and c_{2t} and the increase in

[389] In practice, individuals inherit at age $I = D - H$ (where H = age at parenthood), so I is typically between A and R, and often closer to R than to A (e.g. with $D = 80$ and $H = 30$, $I = 50$). In order to have $I = A$, one would need a very large rise in the age at parenthood (i.e. one would need $H = 60$). Inter vivos gifts however tend to bring I closer to A. See Piketty 2010 (section 5, and appendix E) for a continuous time OLG model along those lines (i.e. interacting inheritance and life-cycle forces in a realistic way). The simple discrete model presented here is merely illustrative.

[390] In effect, c_{2t} can be interpreted as the ressources devoted to an old-age insurance fund that is used to finance extra terminal health or consumption spendings that are not well covered by the existing public pension and health insurance system. The corresponding ressources are funded but produce no return because of a strong liquidity requirement. Needless to say, this is a highly simplified model of lifecycle saving.

wealth $\Delta b_t = b_{t+1} - b_t$ and takes a simple Cobb-Douglas form: $V(c_1, c_2, \Delta b) = c_1^{(1-\lambda)(1-s)} c_2^{\lambda(1-s)} \Delta b^s$. We then have: $b_{t+1} = b_t + s \cdot y_t$, $c_{1t} = (1-\lambda) \cdot (1-s) \cdot y_t$ and $c_{2t} = \lambda \cdot (1-s) \cdot y_t$. Defining total wealth accumulation w_{t+1} as the sum of bequest wealth b_{t+1} and pension wealth c_{2t}, we find that $\beta_t = w_t/y_t \to \beta = s(\lambda)/g$, with $s(\lambda) = s + \lambda \cdot (1-s)$. In a more sophisticated model with a realistic continous time structure for consumption and bequest streams, the corrected saving rate $s = s(\lambda, r, ...)$ will be a complex function of the fraction of lifetime that this spent in retirement, the rate of return, etc.[391]

[391]See Piketty, 2010, section 5 and appendix E.

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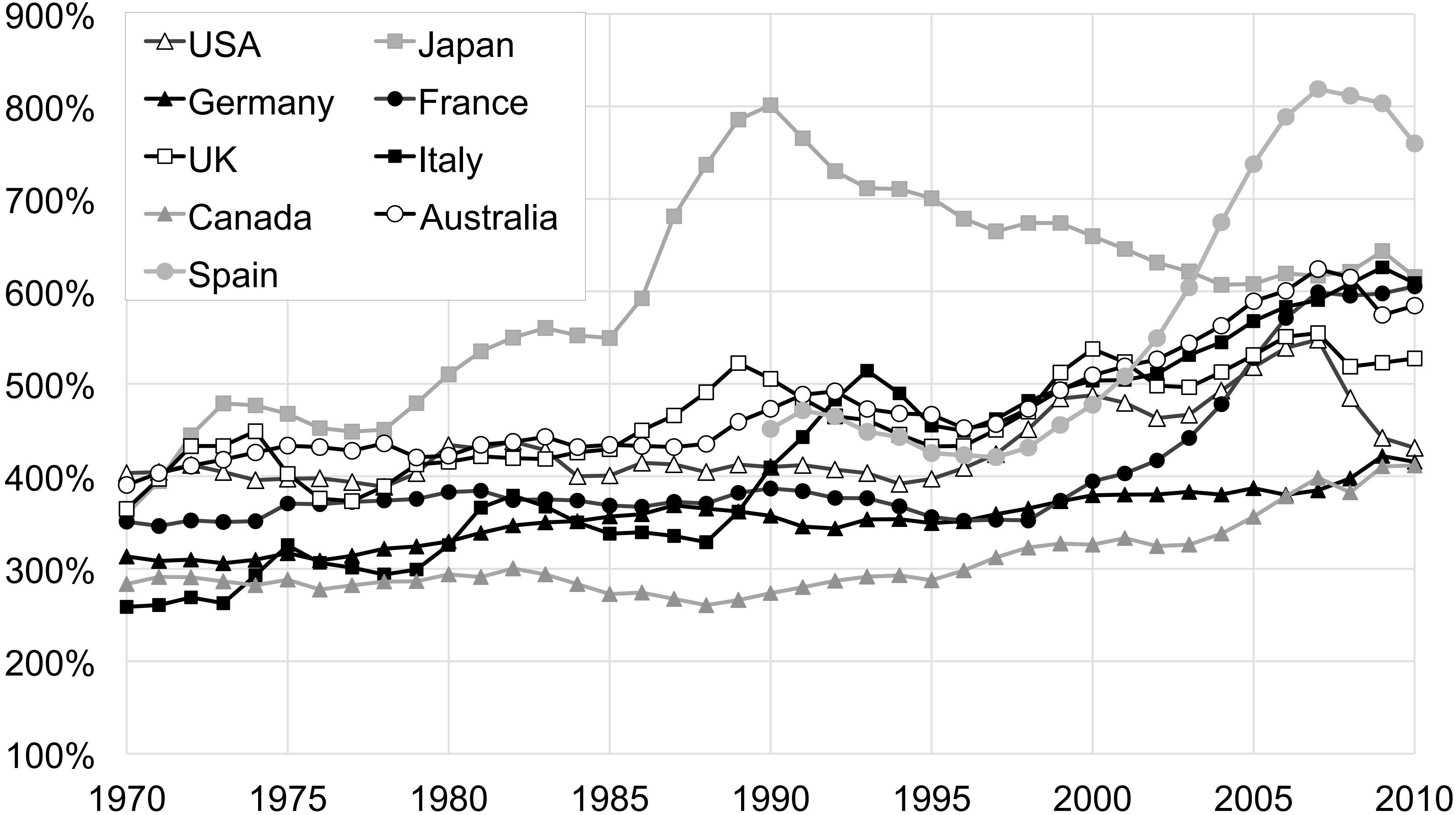
M Appendix Figures and Tables

A Appendix Figures

This Data Appendix is supplemented by 157 Appendix Figures which are reproduced below. These figures are constructed from our wealth-income electronic database, which is available online.

Figure A1: National wealth-national income ratios 1970-2010 (incl. Spain)



Authors' computations using country national accounts. National wealth = private + government wealth

Figure A2: National wealth / national income 1870-2010

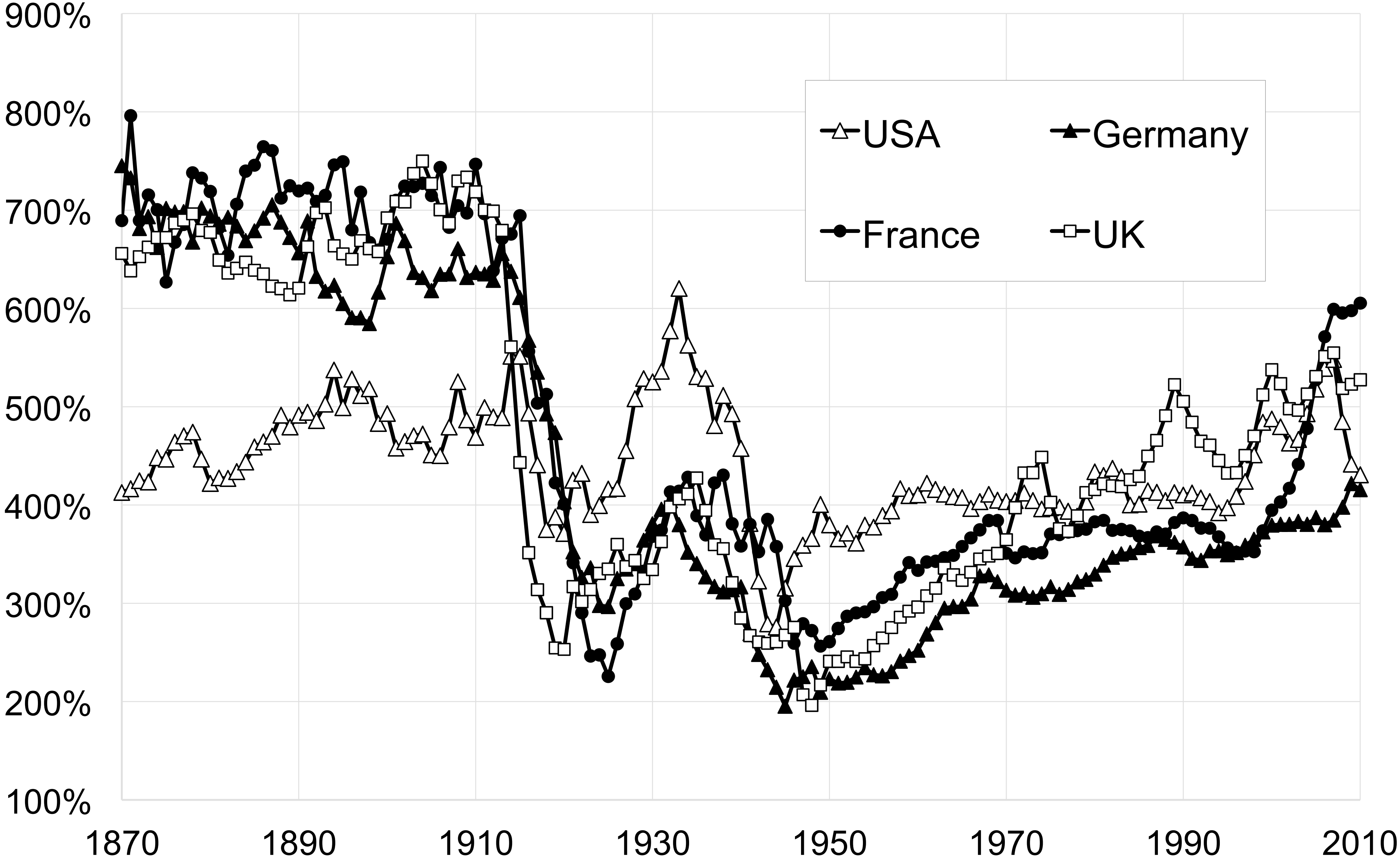


Figure A3: National wealth / national income ratios in Europe 1870-2010 (decennial averages)

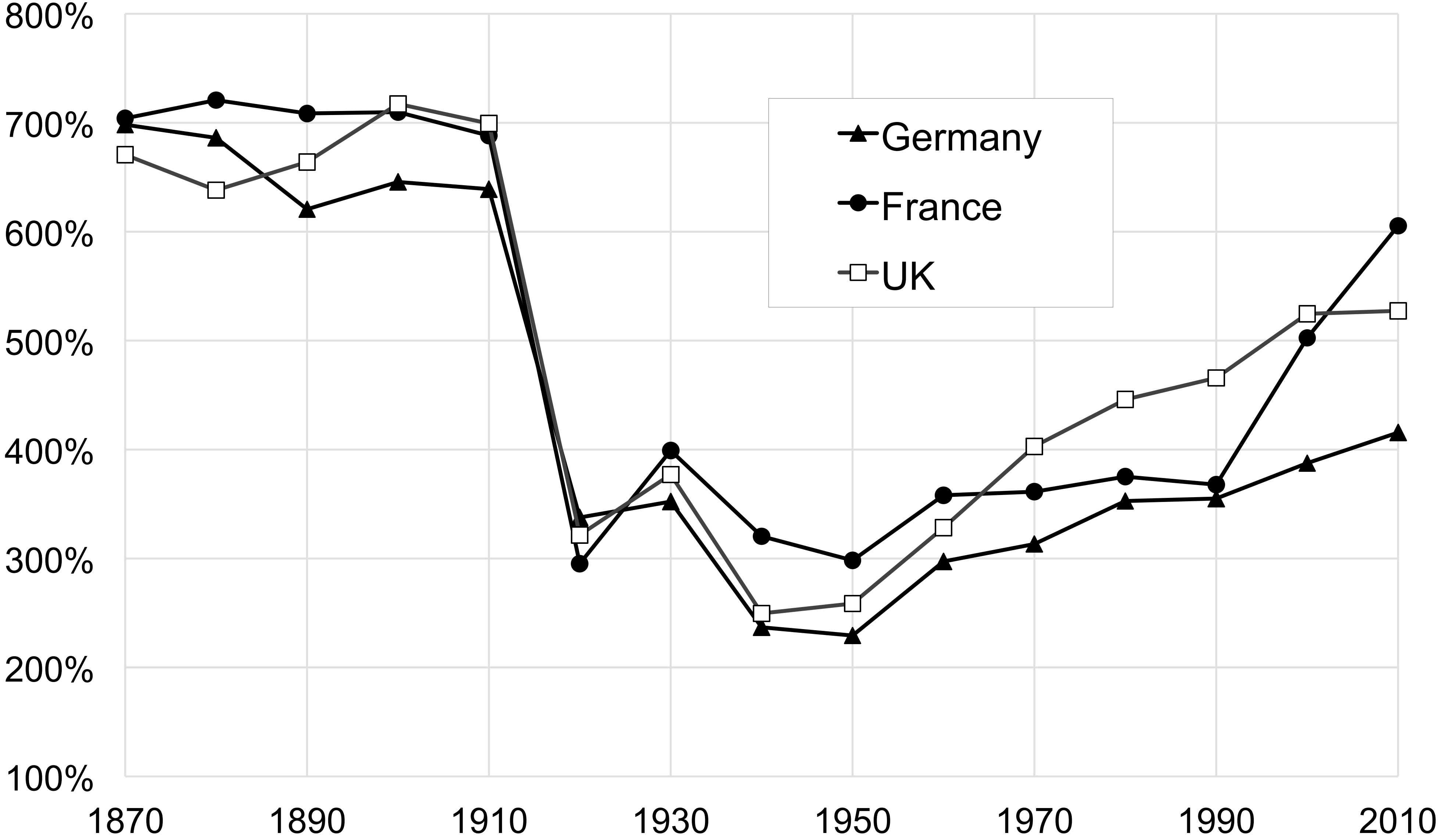


Figure A4: National wealth / national income 1870-2010: Europe vs. USA

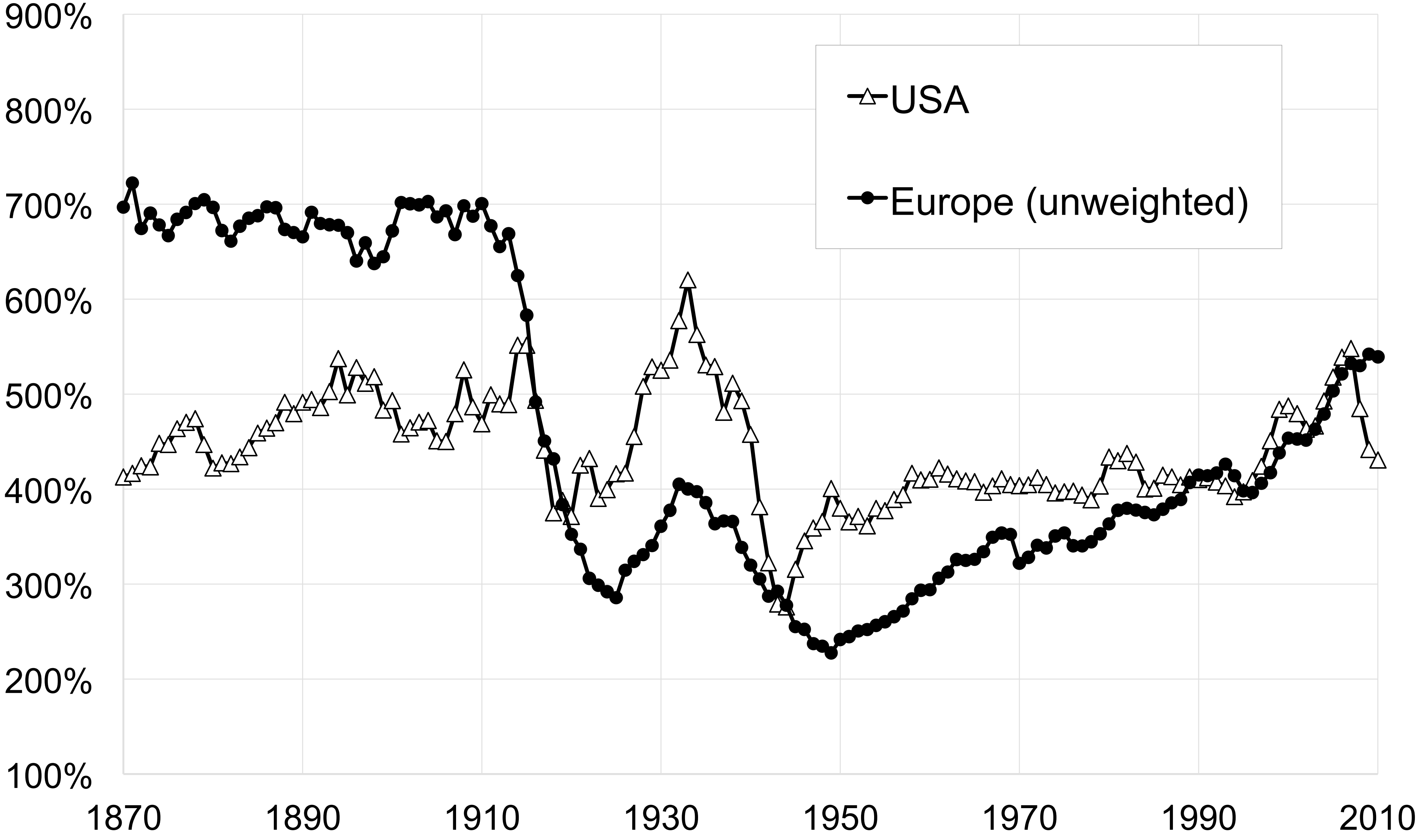
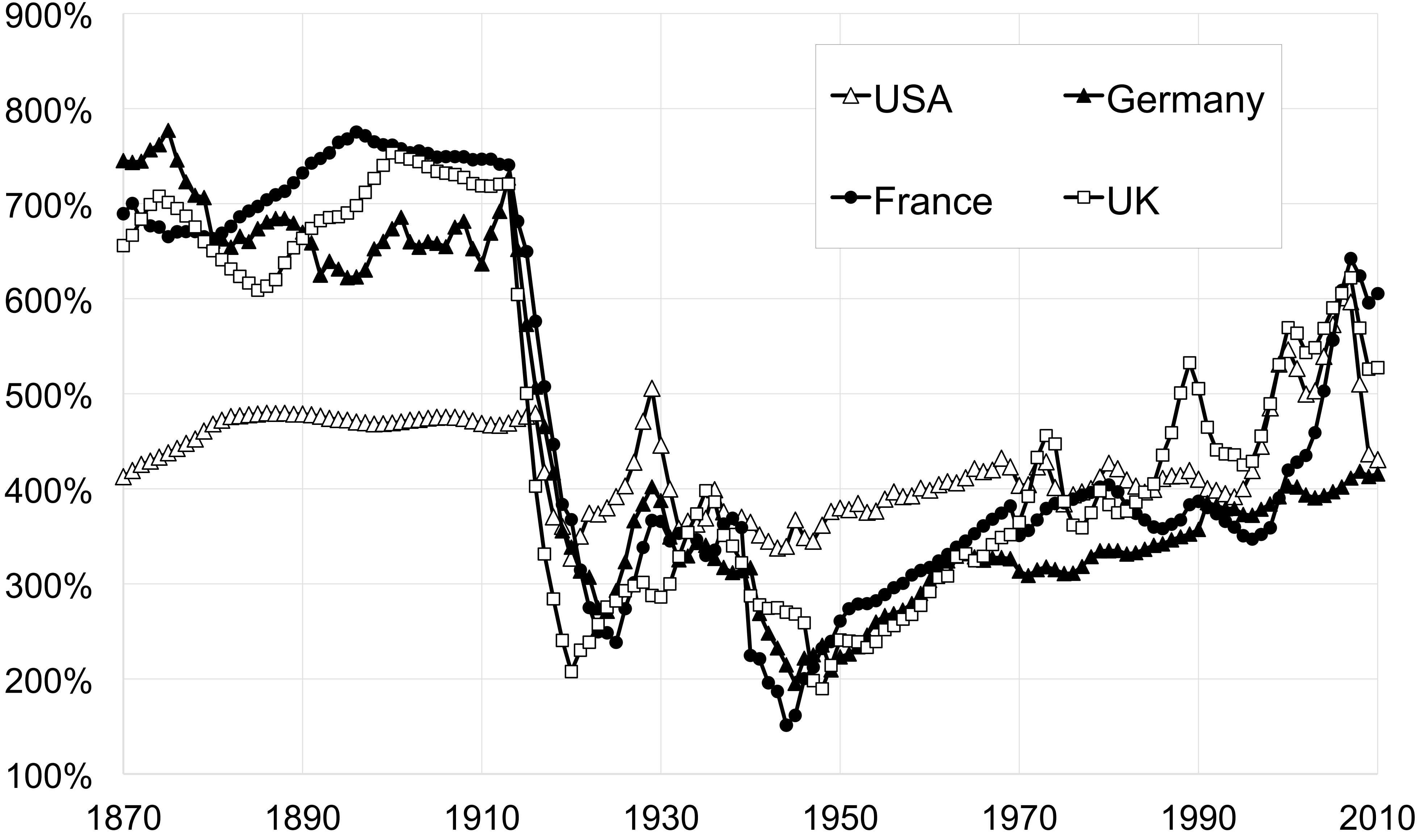


Figure A5: National wealth / potential national income 1870-2010



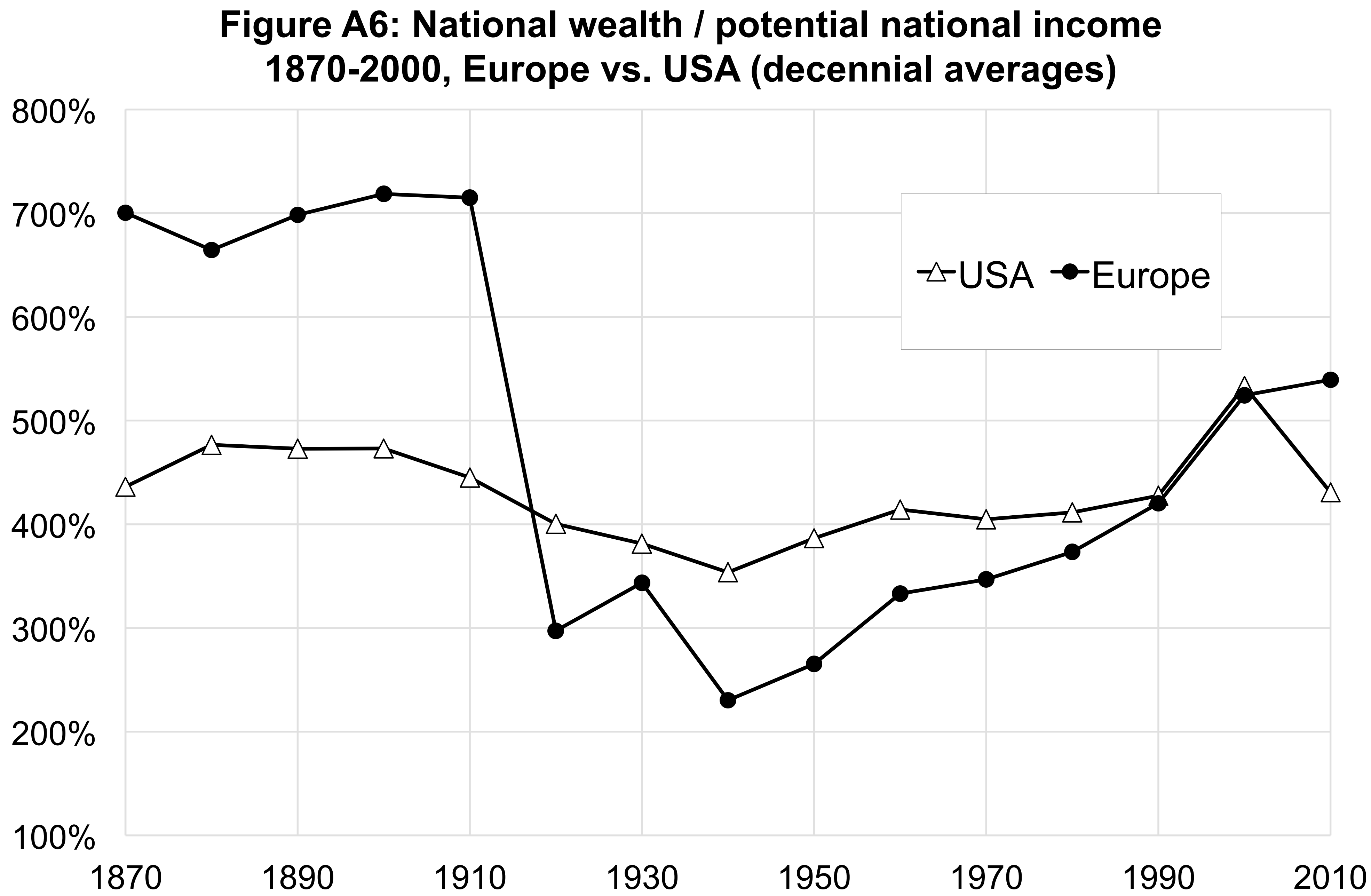


Figure A6: National wealth / potential national income
1870-2000, Europe vs. USA (decennial averages)
800%
700%
600%
500%
400%
300%
200%
100%
1870
1890
1910
1930
1950
1970
1990
2010
USA
Europe

Figure A7: National wealth / national income ratios in the U.K. and France 1810-2010 (decennial averages)

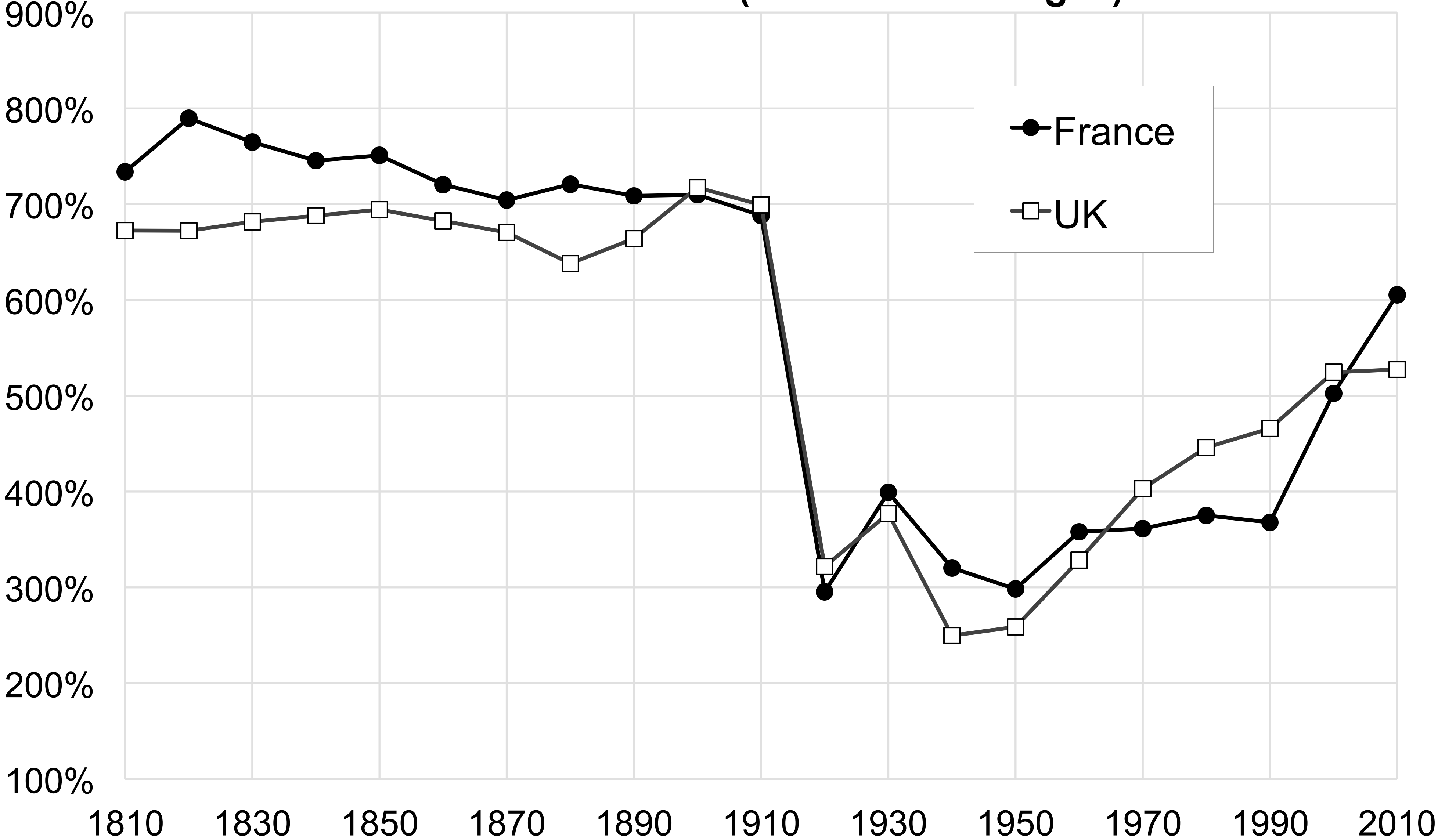
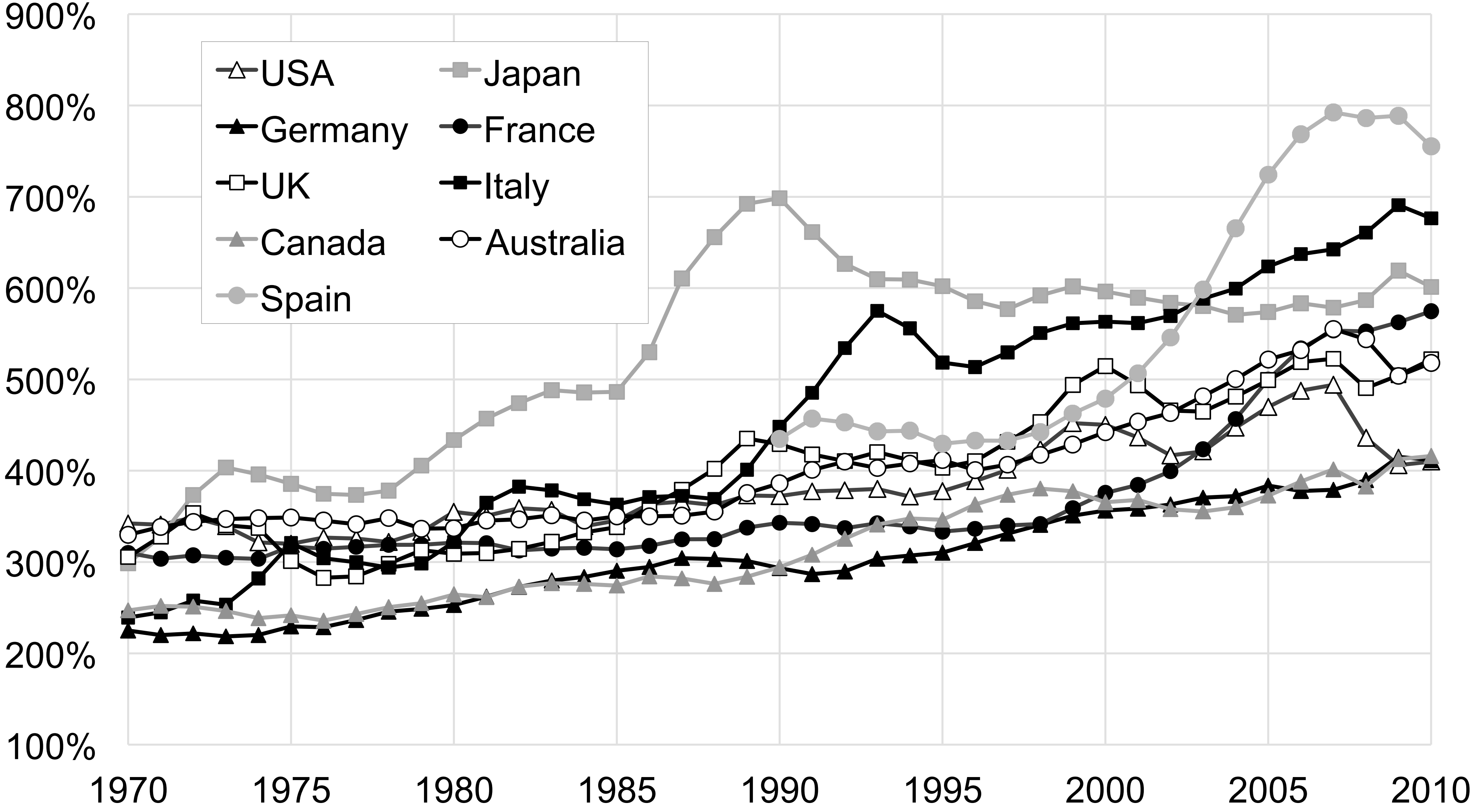
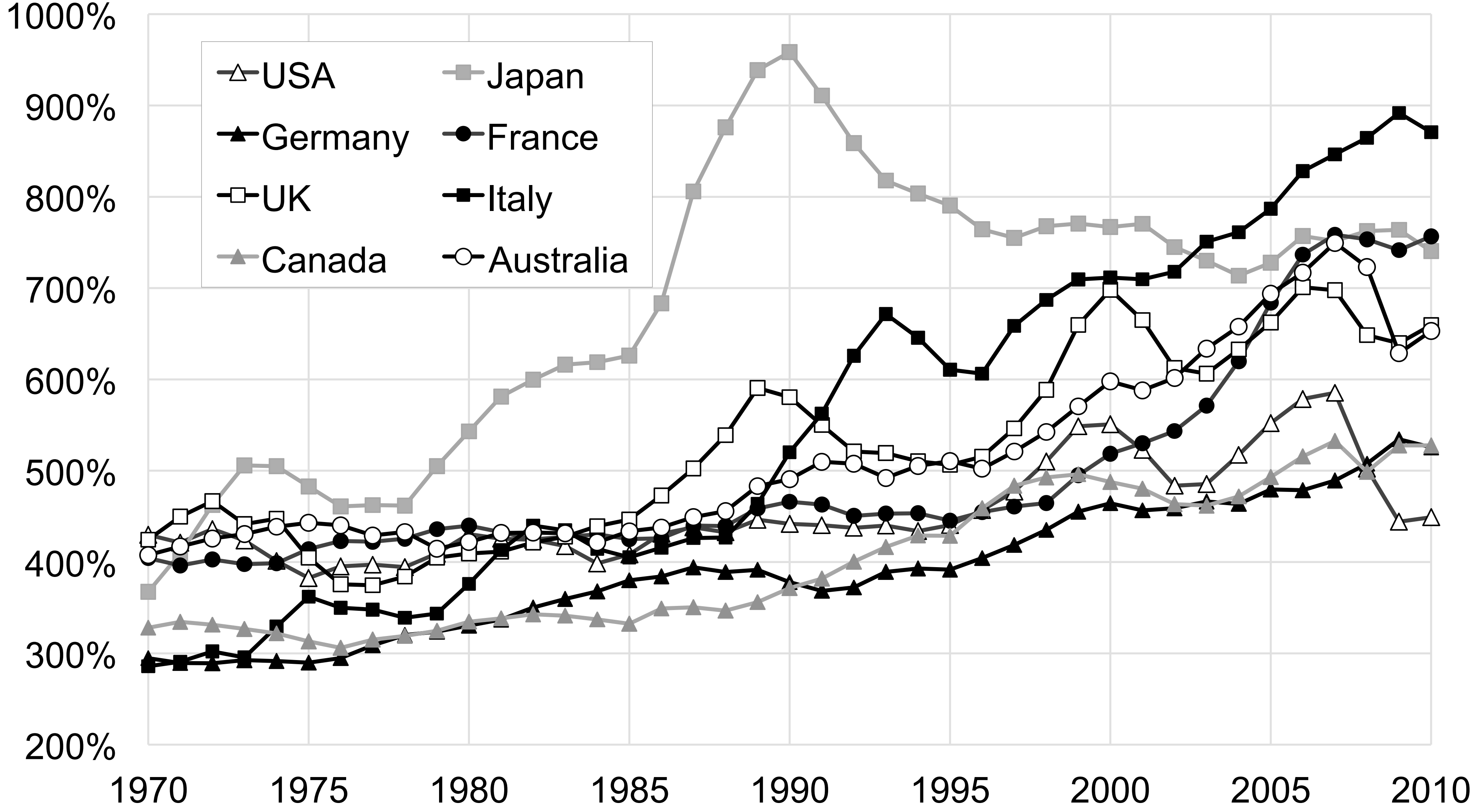


Figure A8: Private wealth / national income 1970-2010 (including Spain)



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

Figure A9: Private wealth / disposable income 1970-2010



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

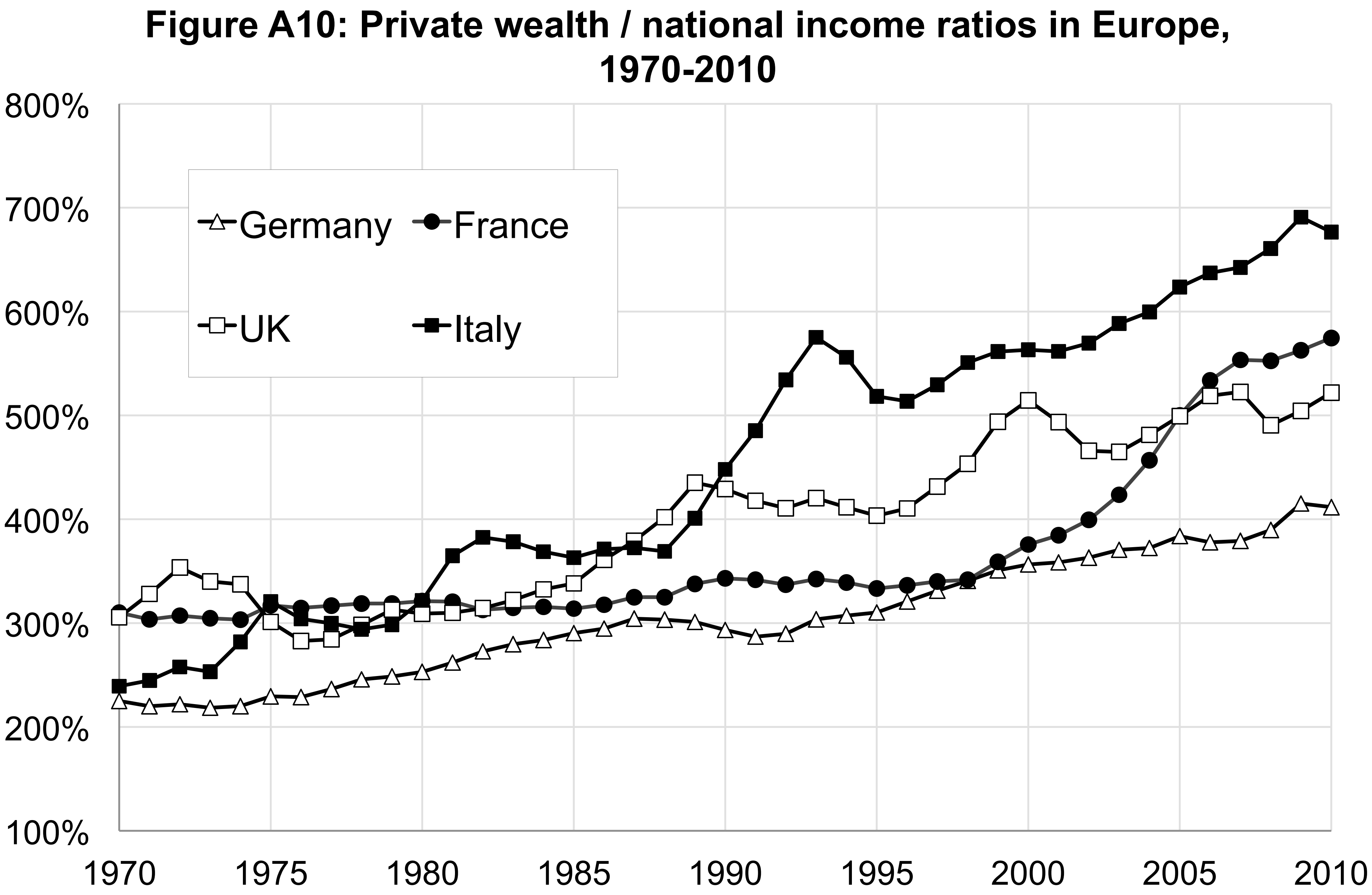


Figure A10: Private wealth / national income ratios in Europe, 1970-2010
800%
700%
600%
500%
400%
300%
200%
100%
1970
1975
1980
1985
1990
1995
2000
2005
2010
Germany
France
UK
Italy

Figure A11: Private wealth / national income ratios in America, Japan & Australia, 1970-2010

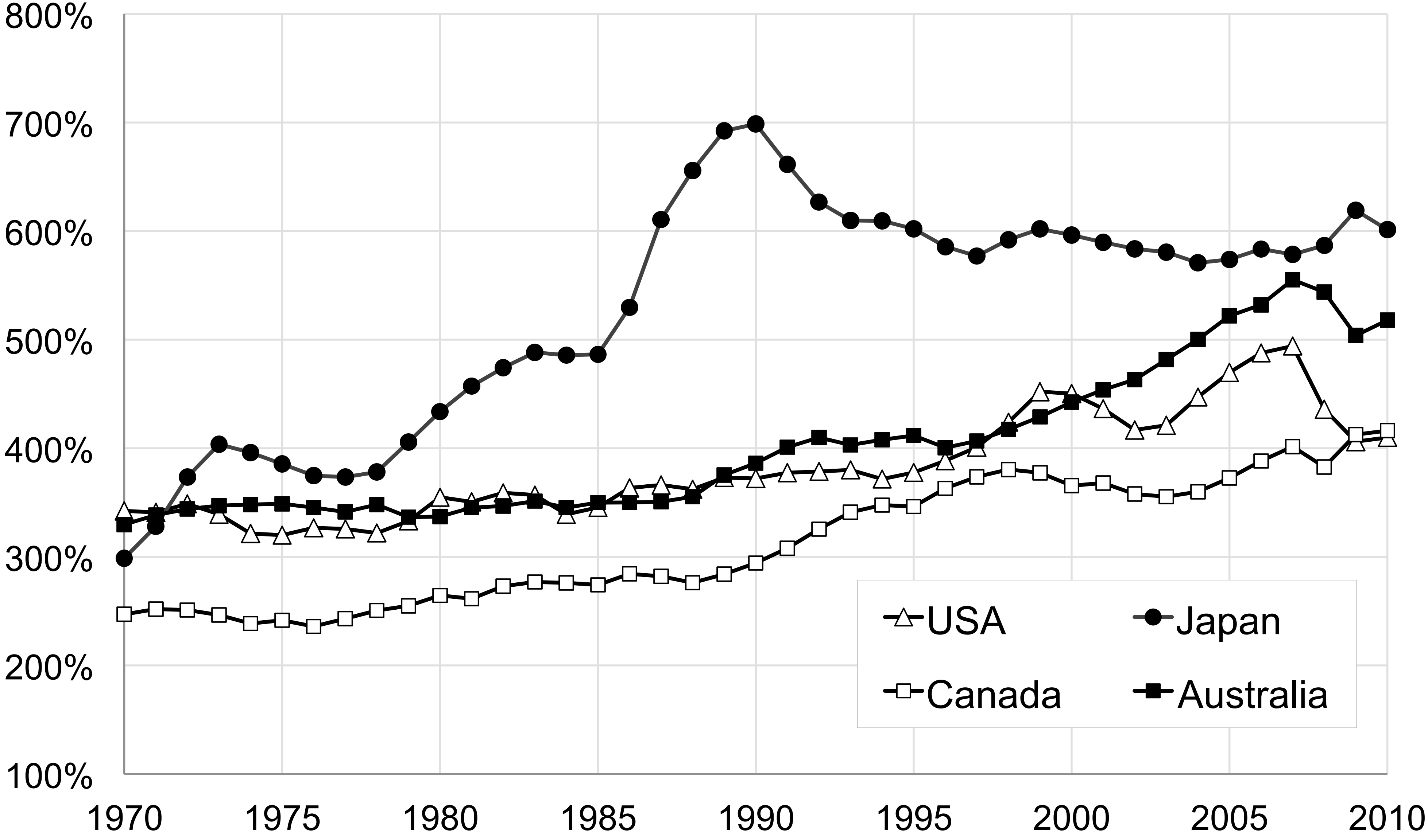


Figure A12: Private wealth / national income 1870-2010

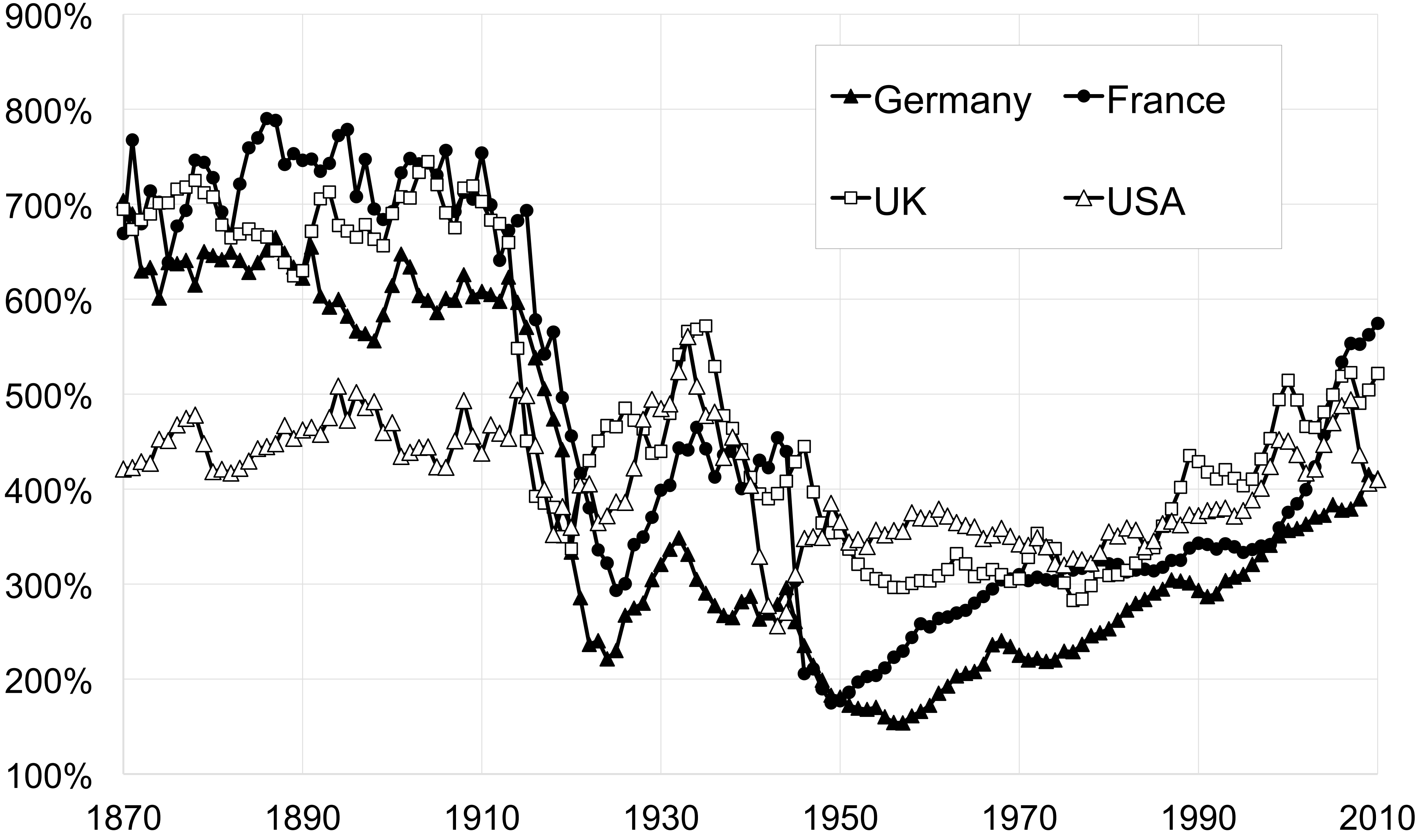


Figure A13: Private wealth / national income: Europe vs. USA 1870-2010

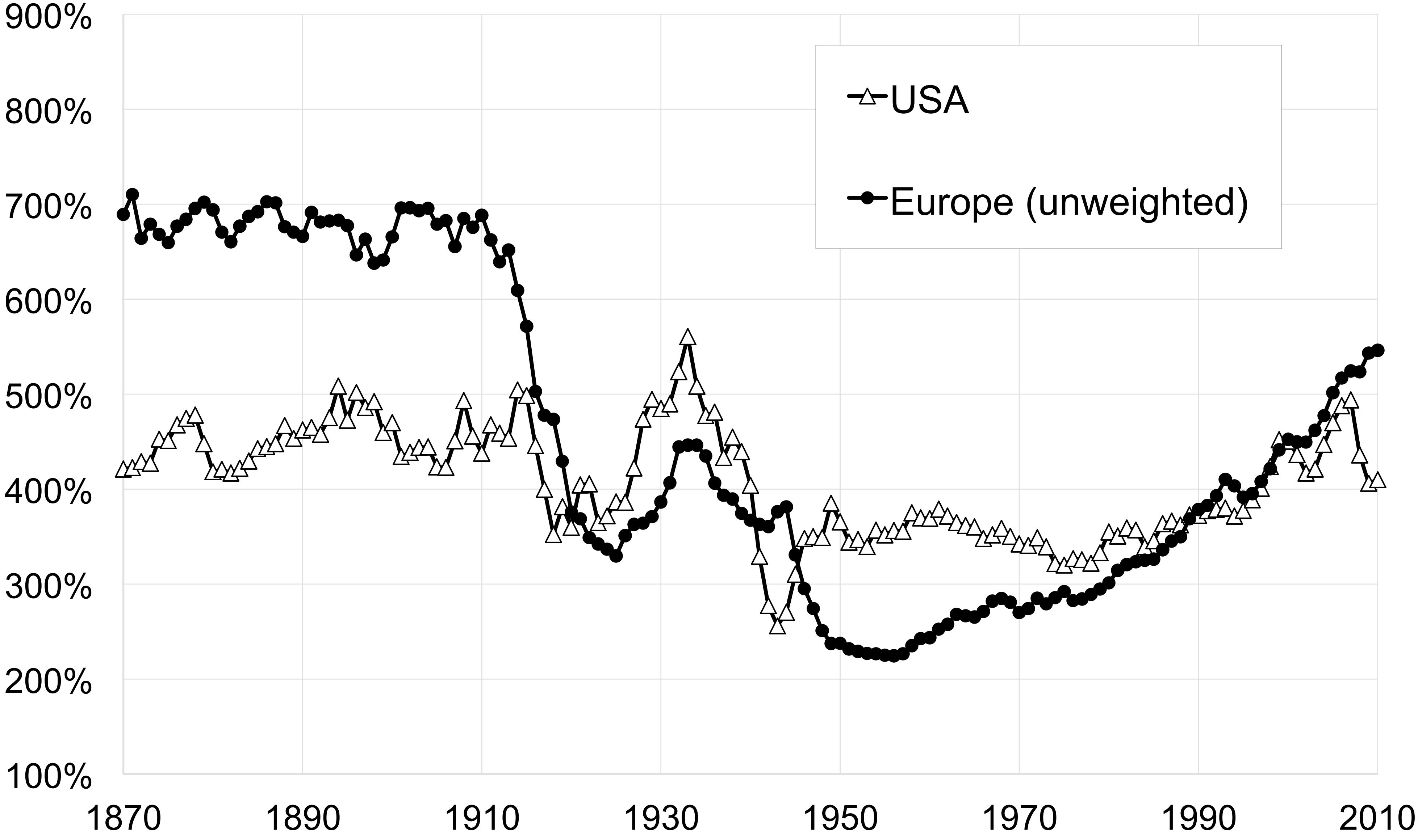
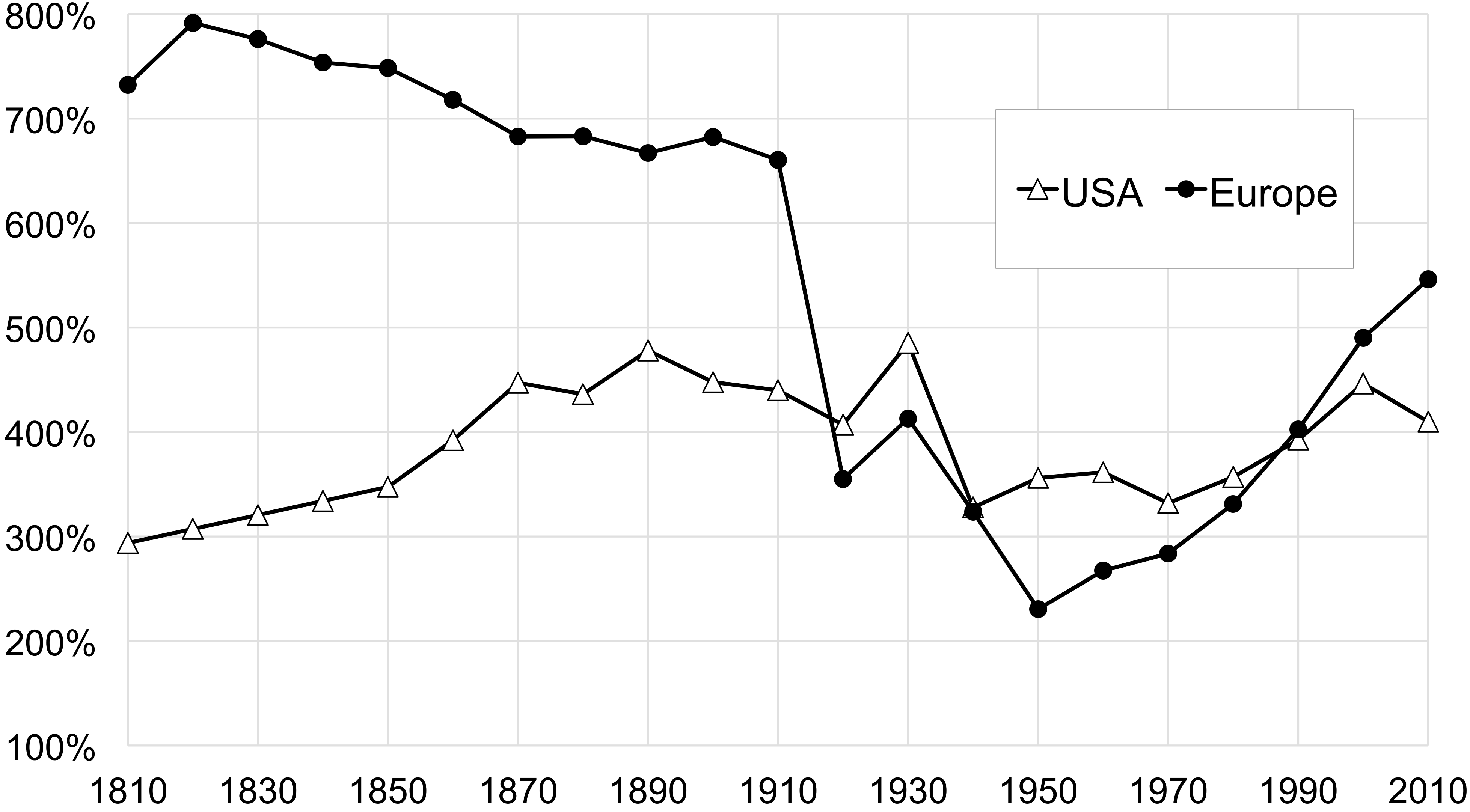


Figure A14: Private wealth / national income ratios: Europe vs. USA 1810-2010 (decennial averages)



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

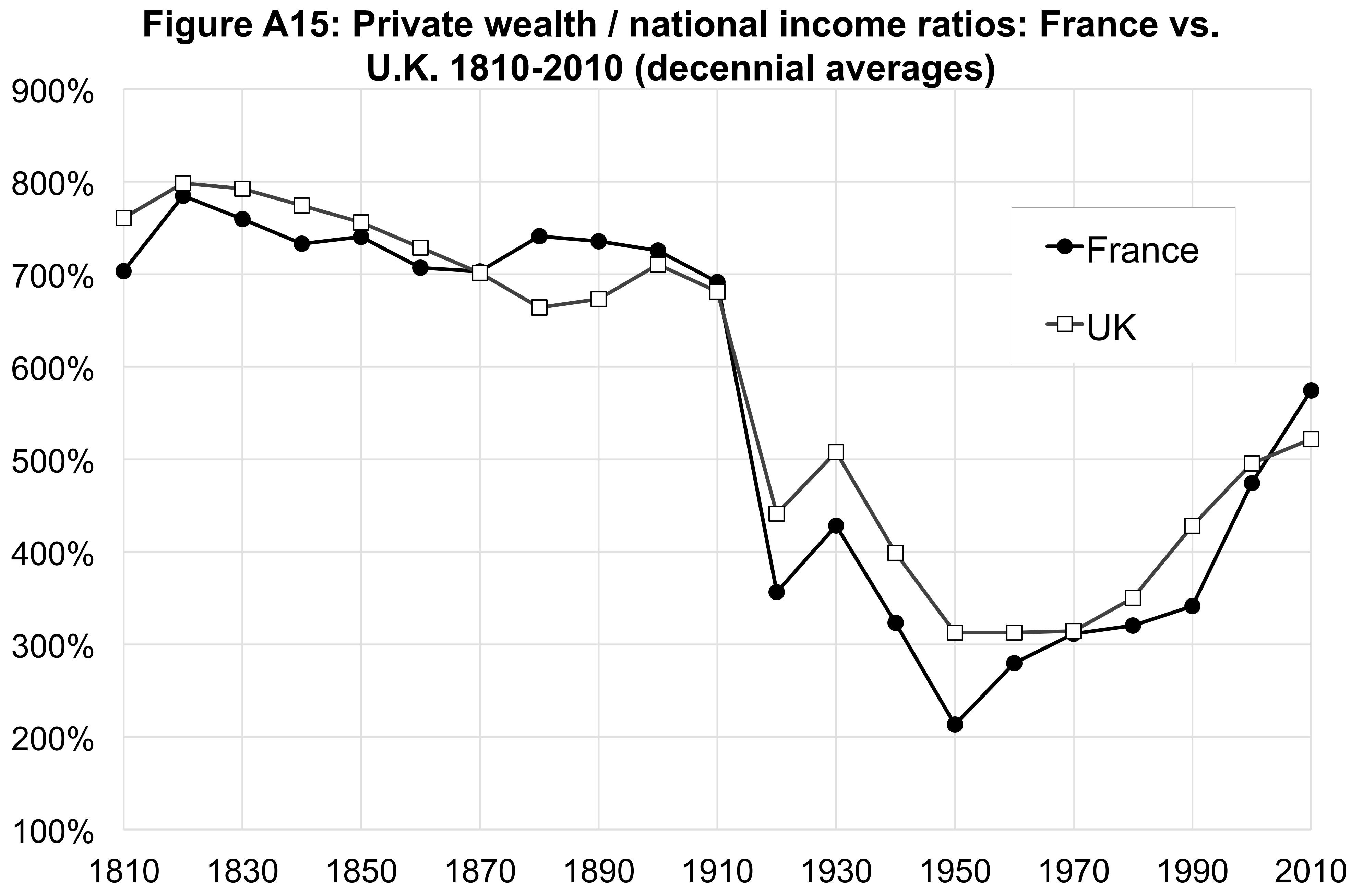
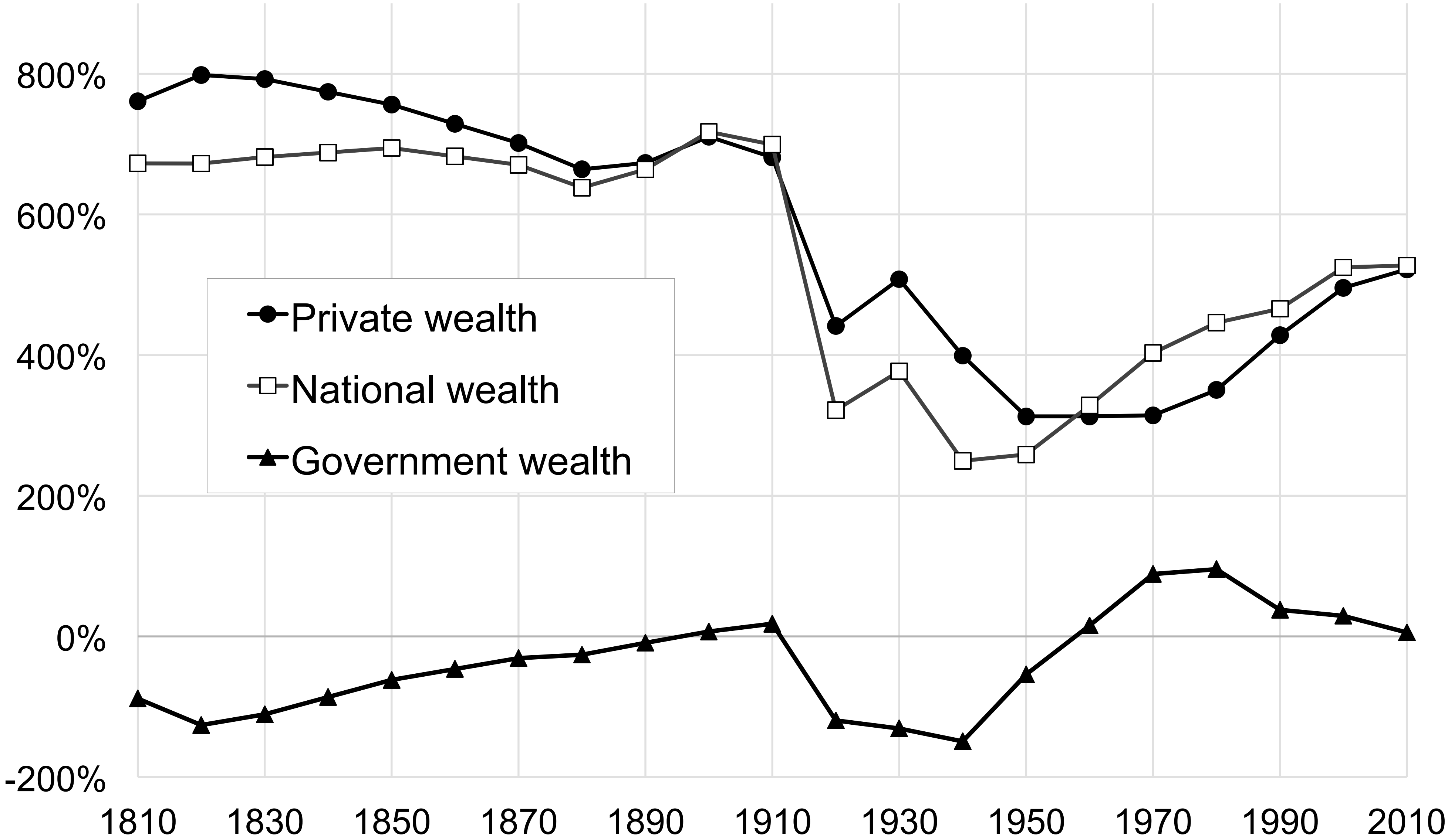


Figure A15: Private wealth / national income ratios: France vs. U.K. 1810-2010 (decennial averages)
900%
800%
700%
600%
500%
400%
300%
200%
100%
1810
1830
1850
1870
1890
1910
1930
1950
1970
1990
2010
France
UK

Figure A16: National and private wealth / income ratios in the UK, 1810-2010 (decennial averages)



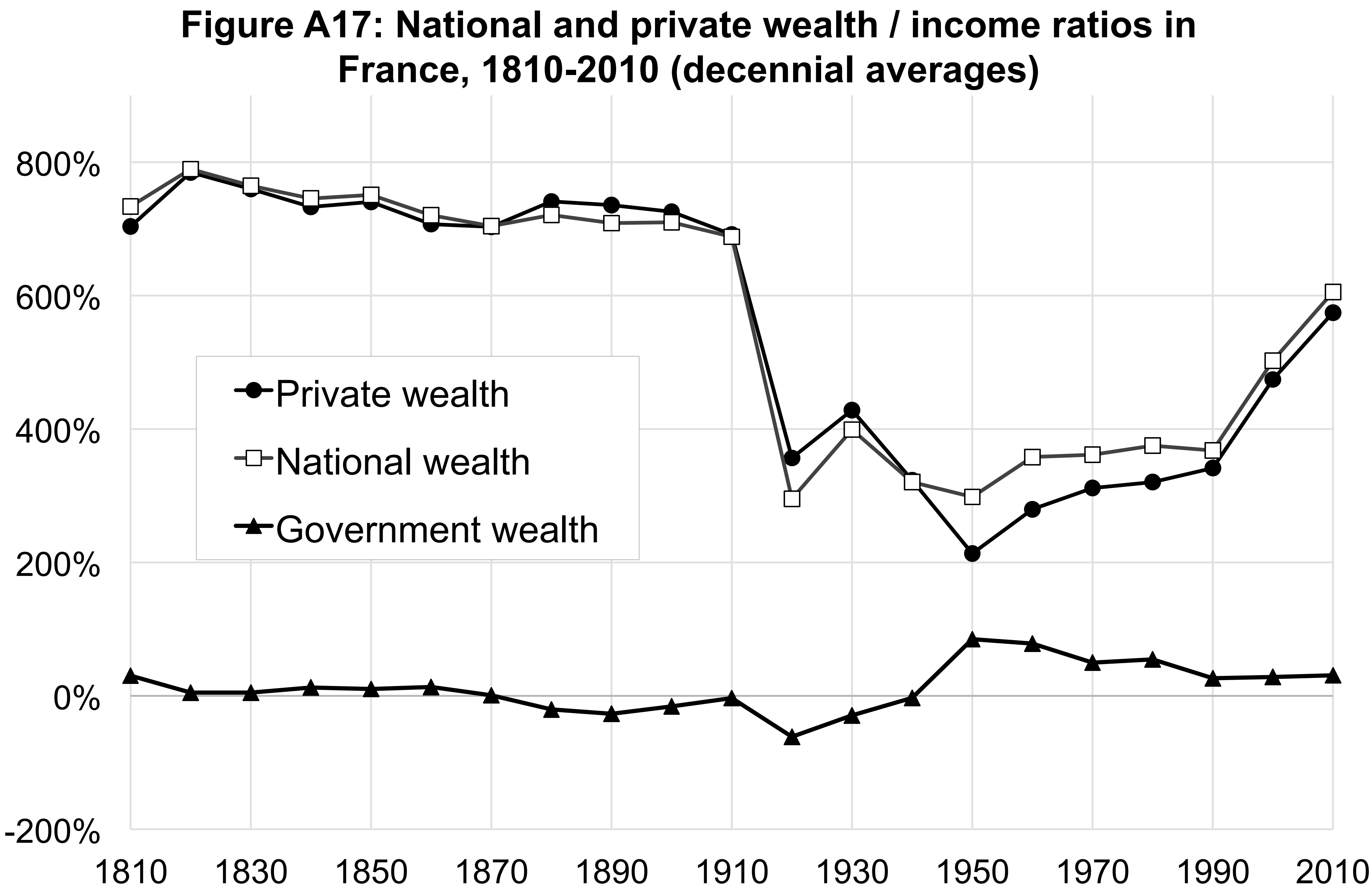
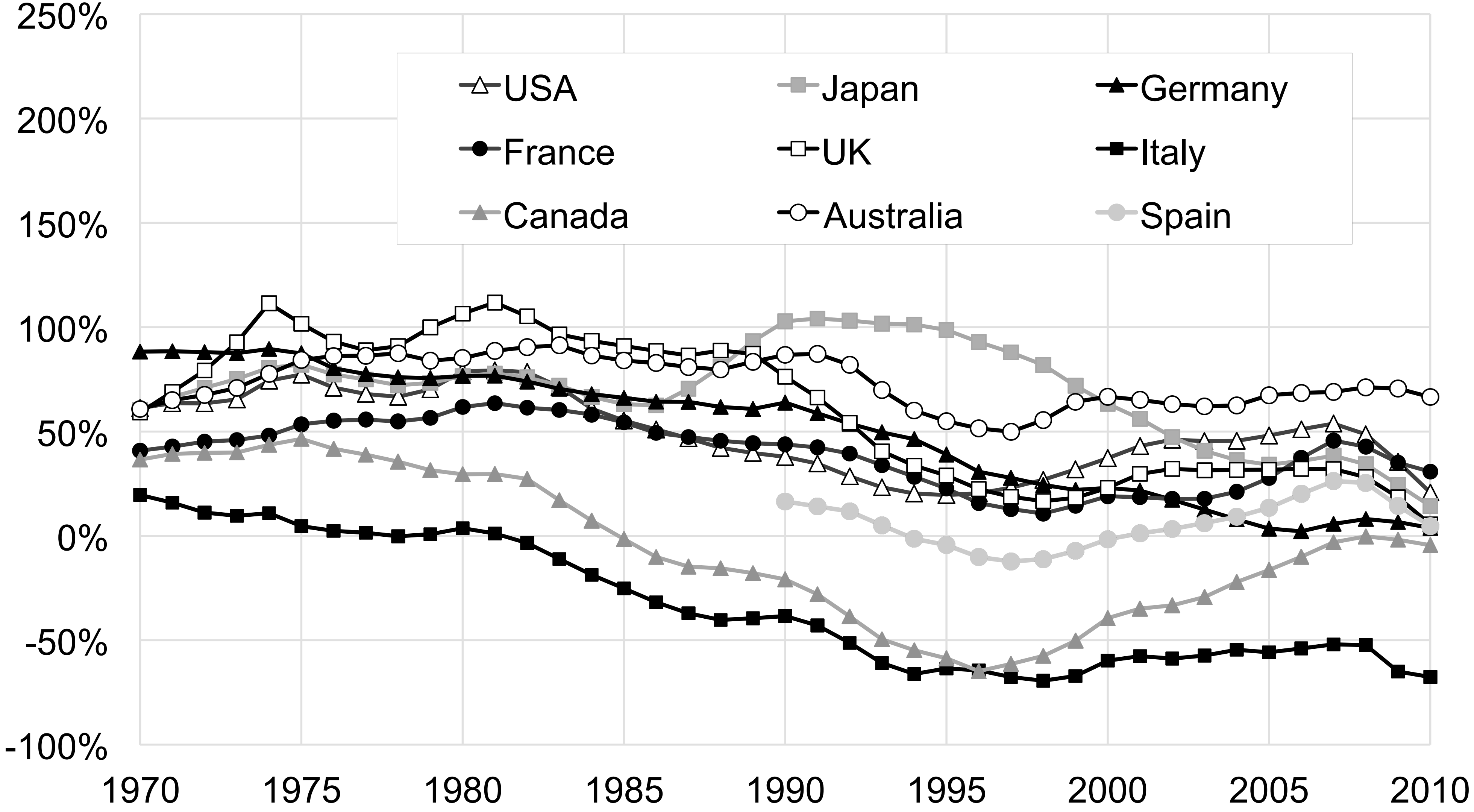


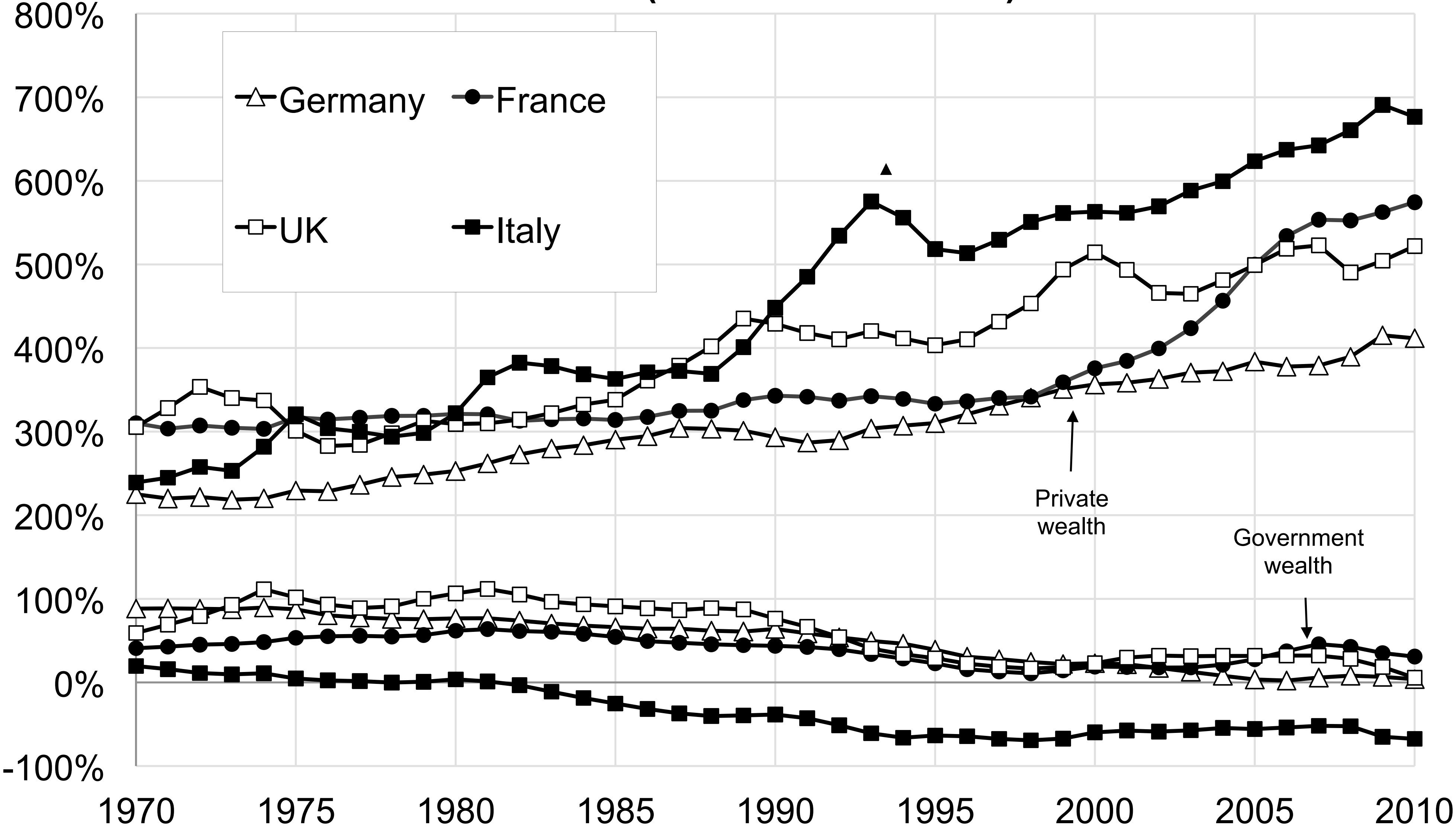
Figure A17: National and private wealth / income ratios in France, 1810-2010 (decennial averages)
800%
600%
400%
200%
0%
-200%
1810
1830
1850
1870
1890
1910
1930
1950
1970
1990
2010
Private wealth
National wealth
Government wealth

Figure A18: Government wealth / national income ratios 1970-2010 (incl. Spain)



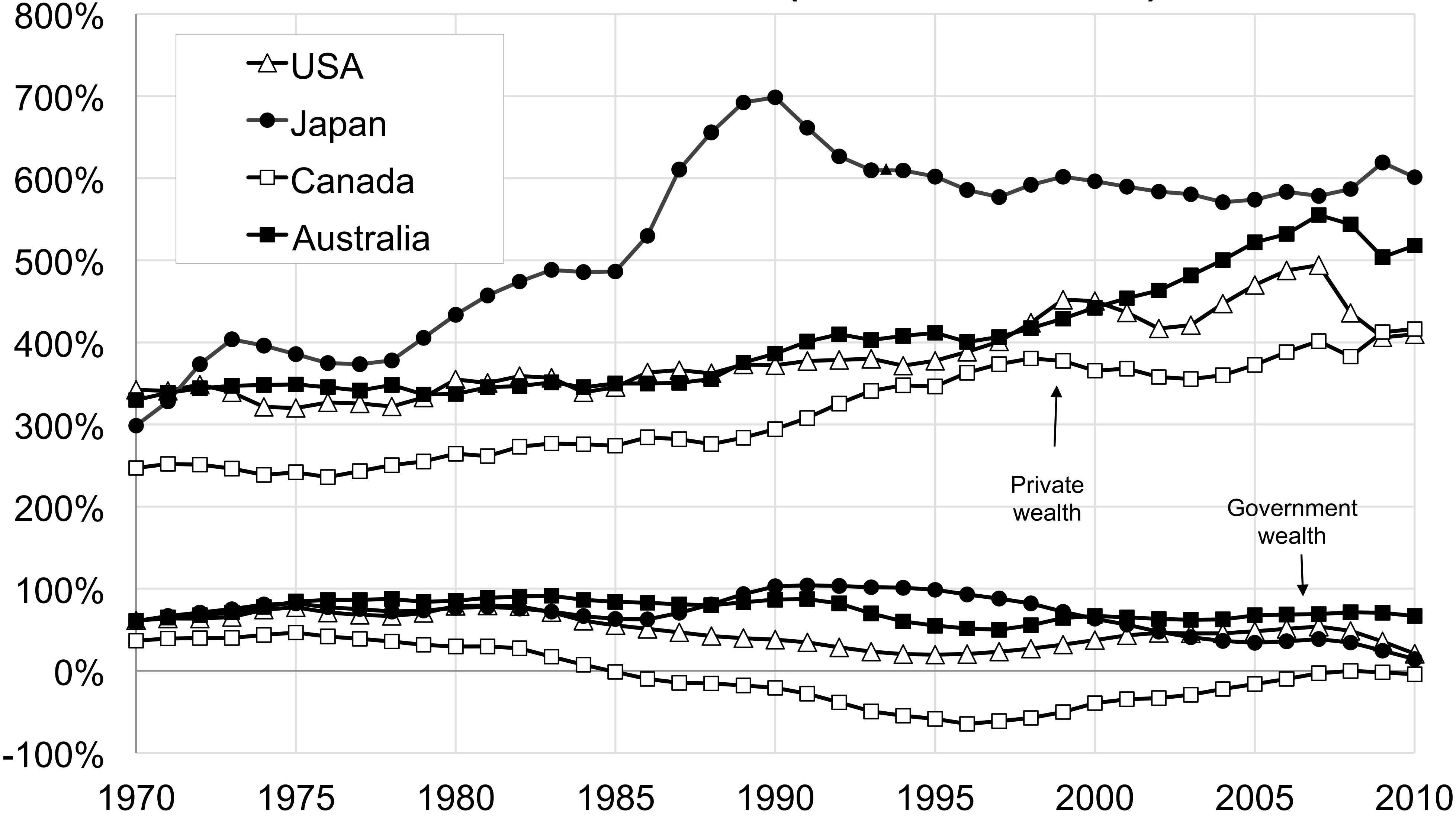
Note: Government wealth = non-financial assets + financial assets - liabilities (government sector)

Figure A19: Private vs governement wealth in Europe, 1970-2010 (% national income)



Authors' computations using country national accounts. Government wealth = non-financial assets + financial assets - financial liabilities (govt sector)

Figure A20: Private vs governement wealth in America, Japan and Australia , 1970-2010 (% national income)



Authors' computations using country national accounts. Government wealth = non-financial assets + financial assets - financial liabilities (govt sector)

Figure A21: Government wealth / national income 1870-2010

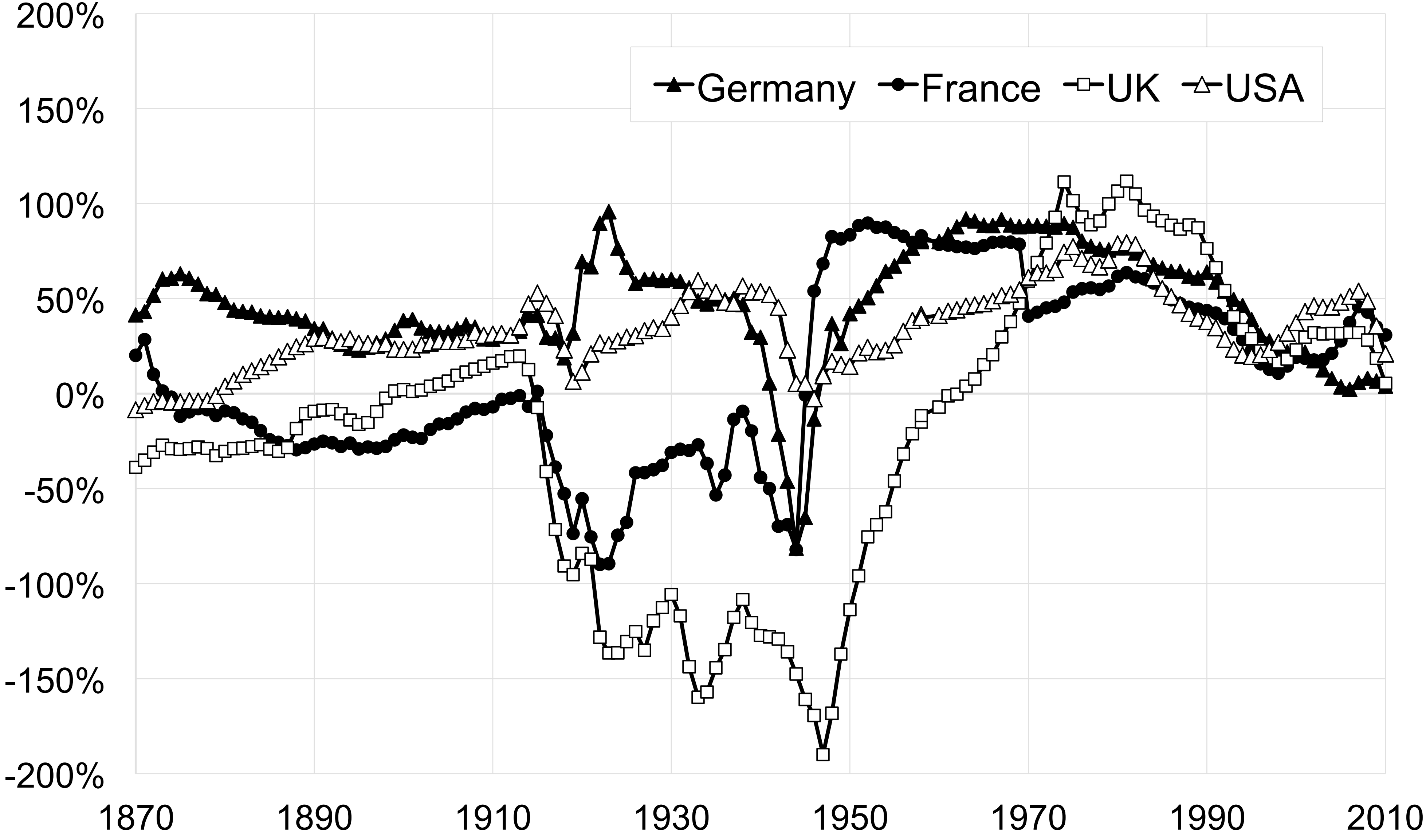


Figure A22: Government net wealth / national income 1870-2010 (decennial averages)

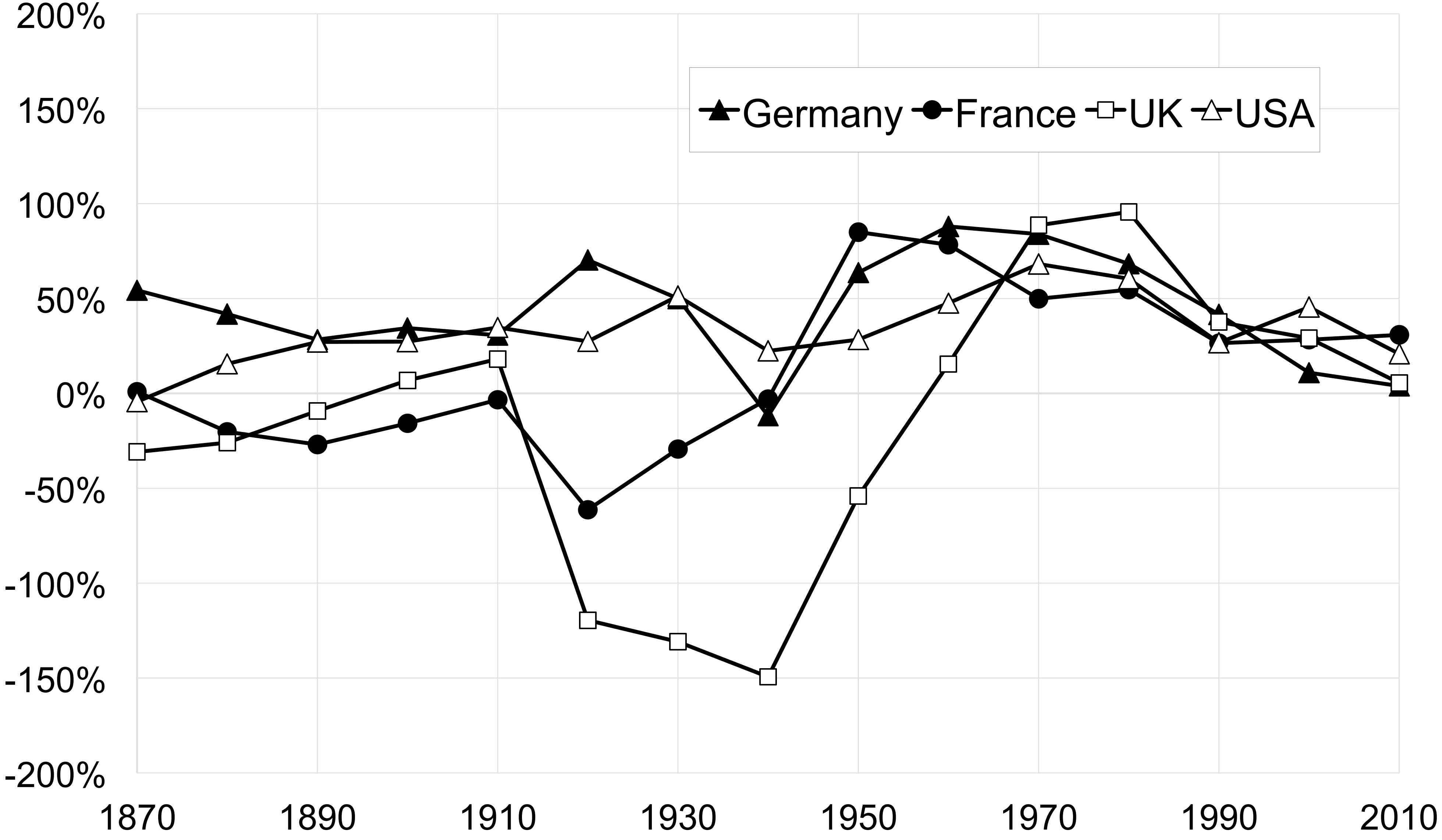


Figure A23: Government net wealth / national income: Europe vs. USA 1870-2010 (decennial averages)

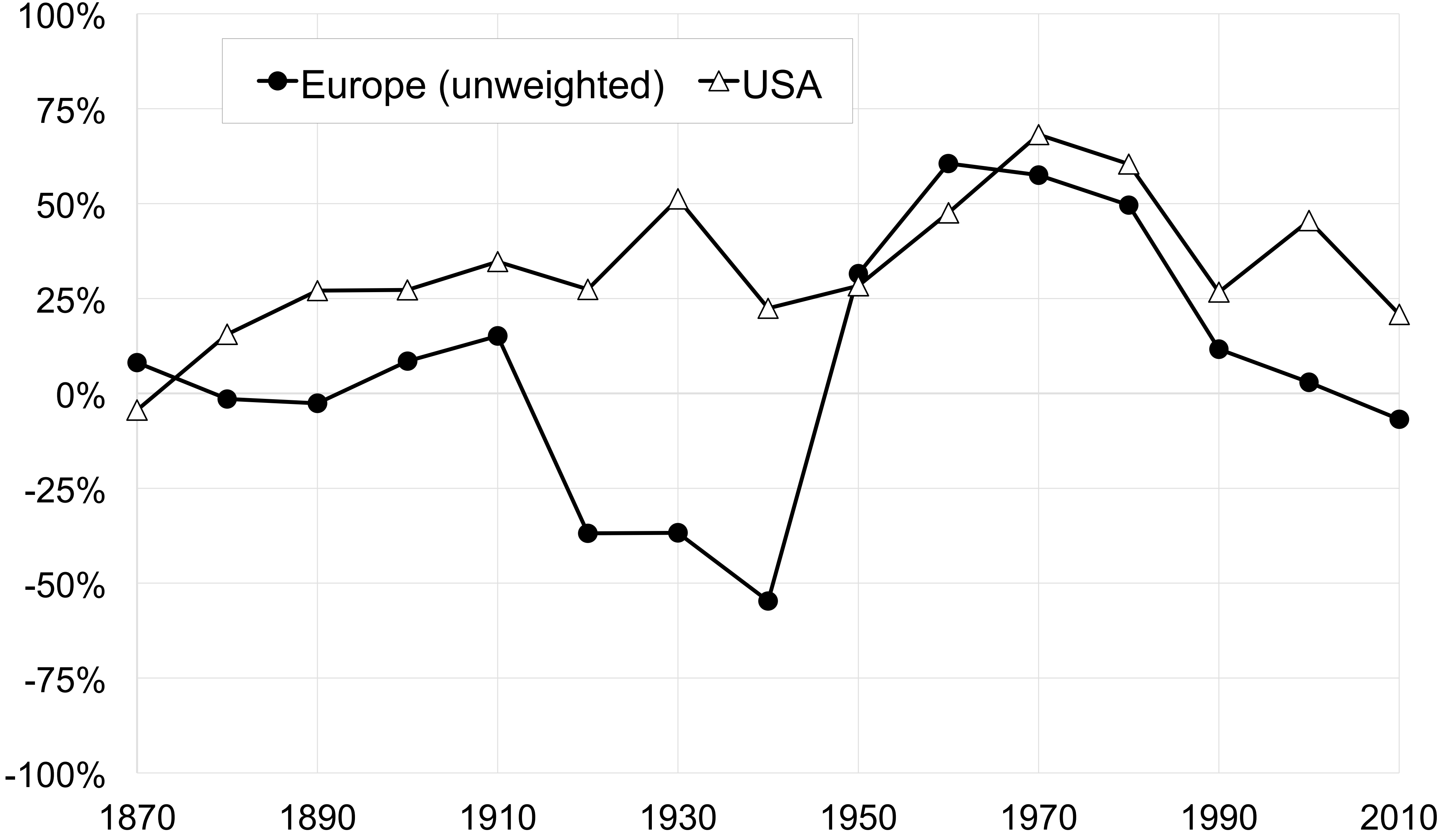
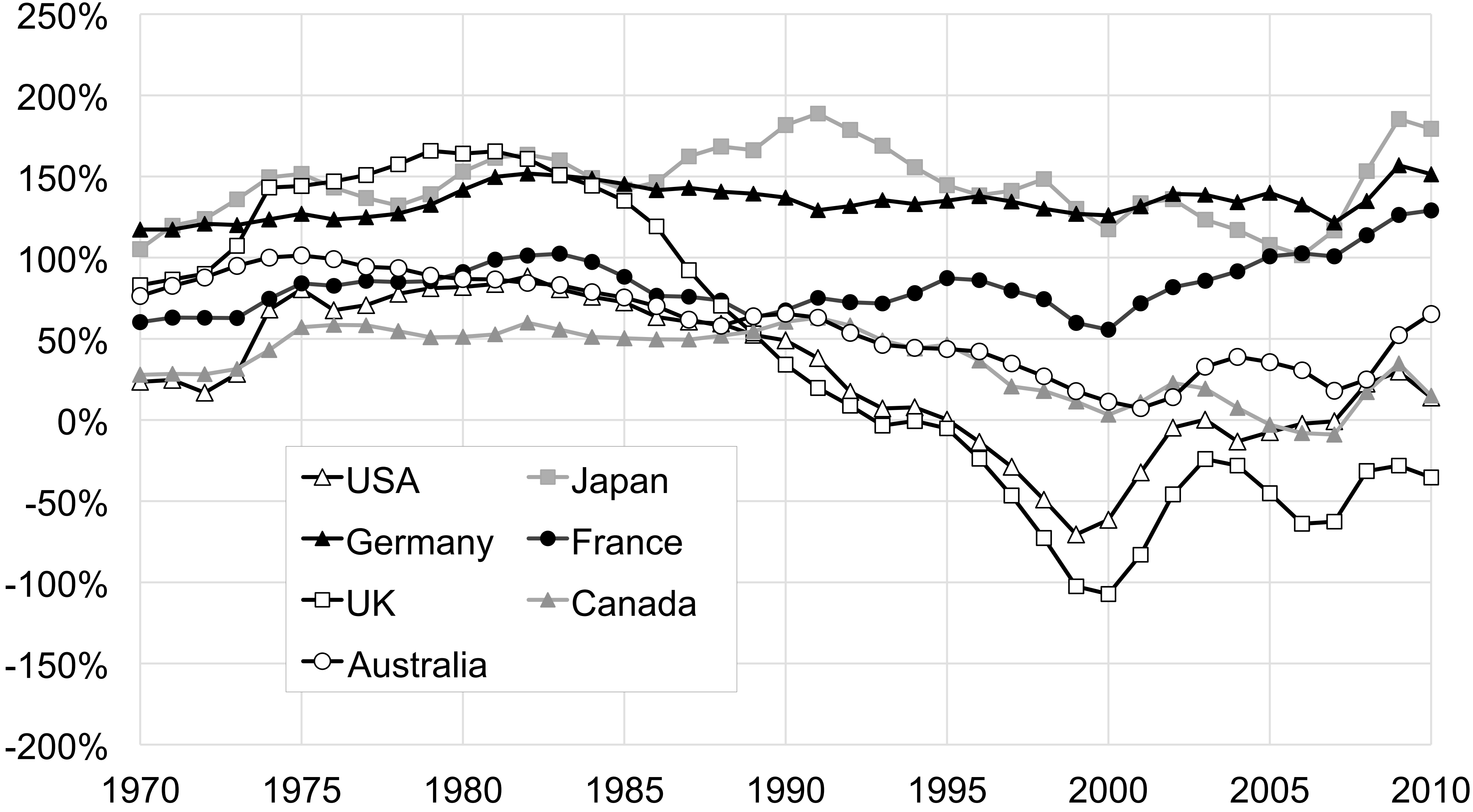
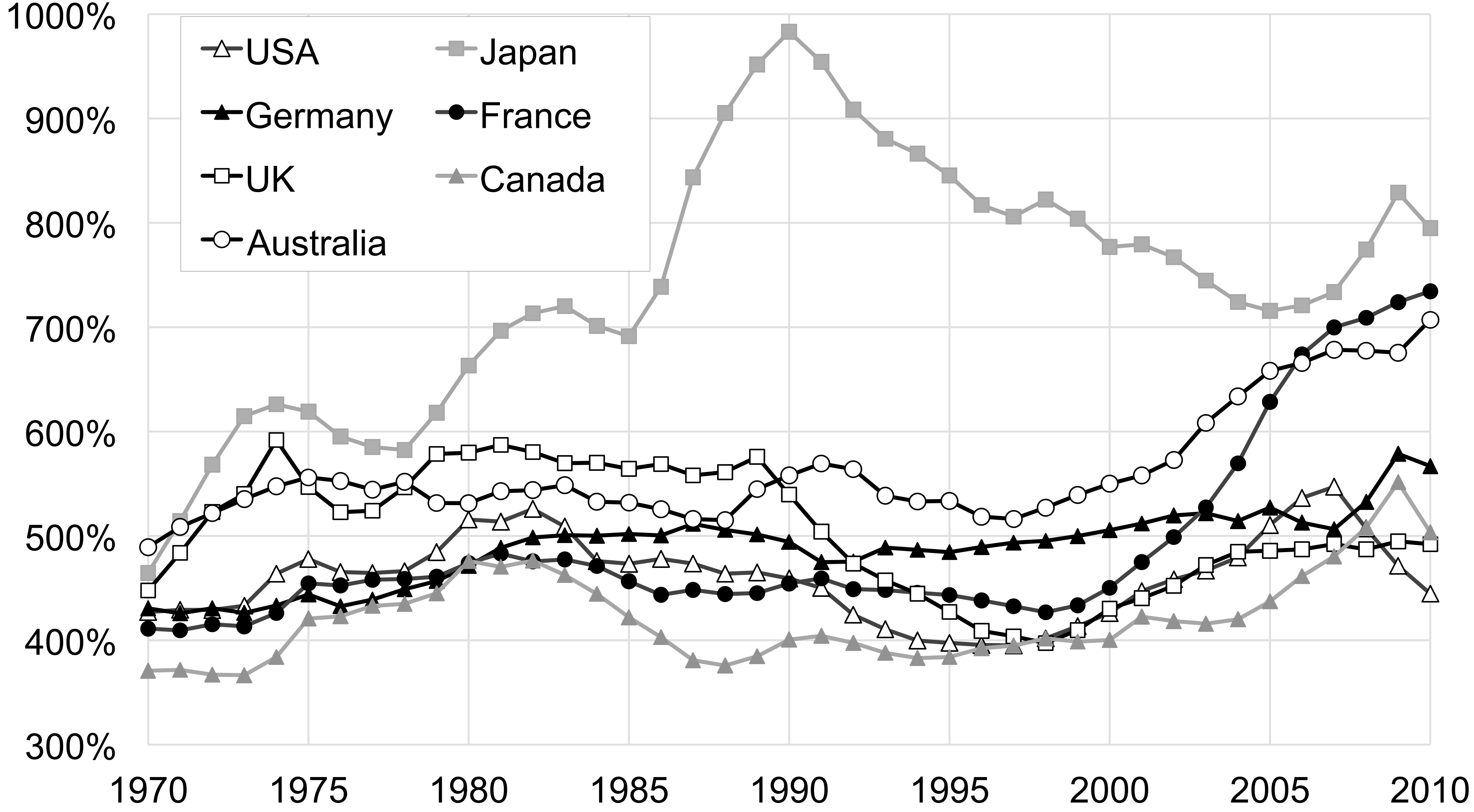


Figure A24: Residual corporate wealth-national income ratios, 1970-2010



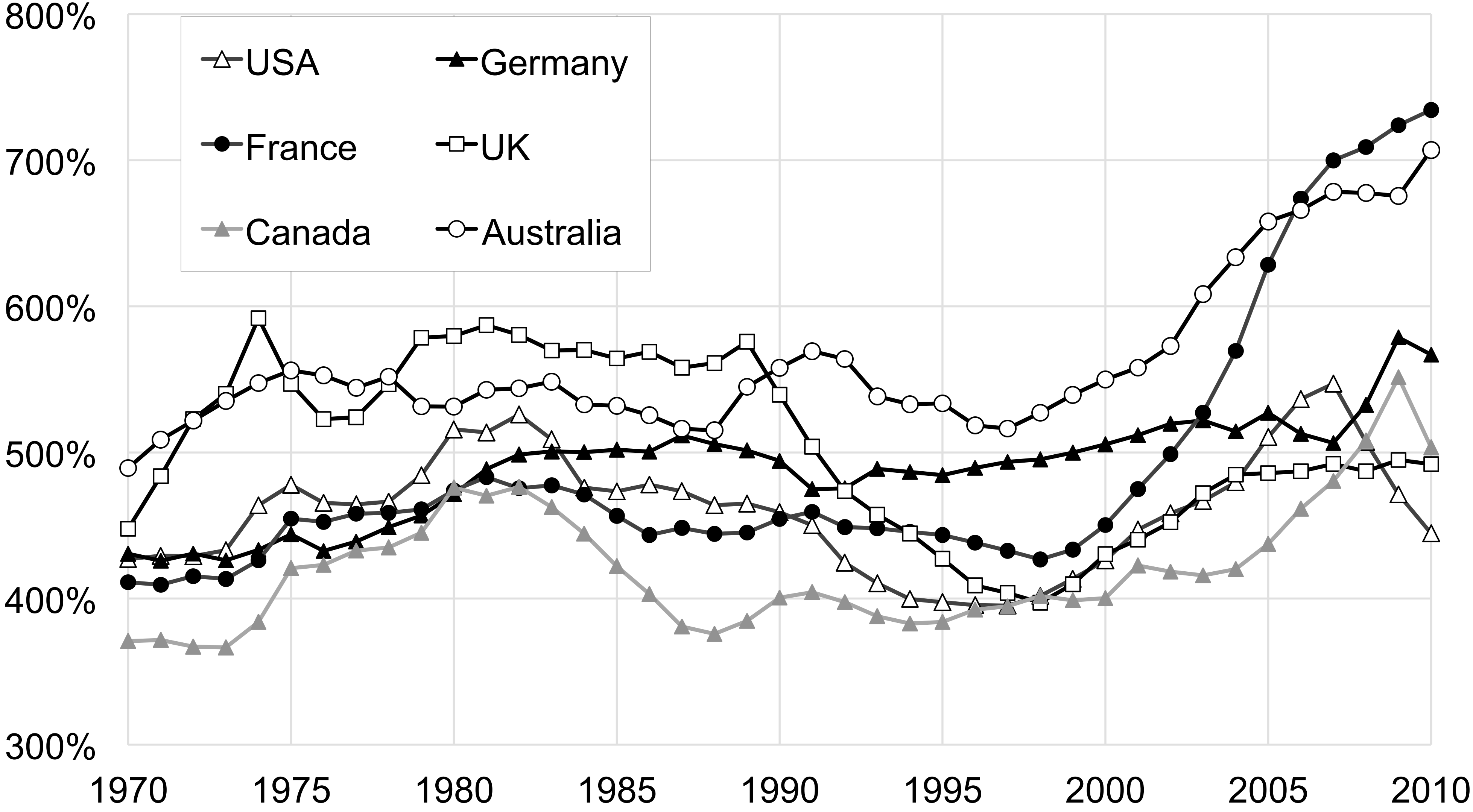
Authors' computations using country national accounts. Residual corporate wealth = non-financial assets + financial assets - equity liabilities of corporations

Figure A25: Book-value national wealth / national income 1970-2010



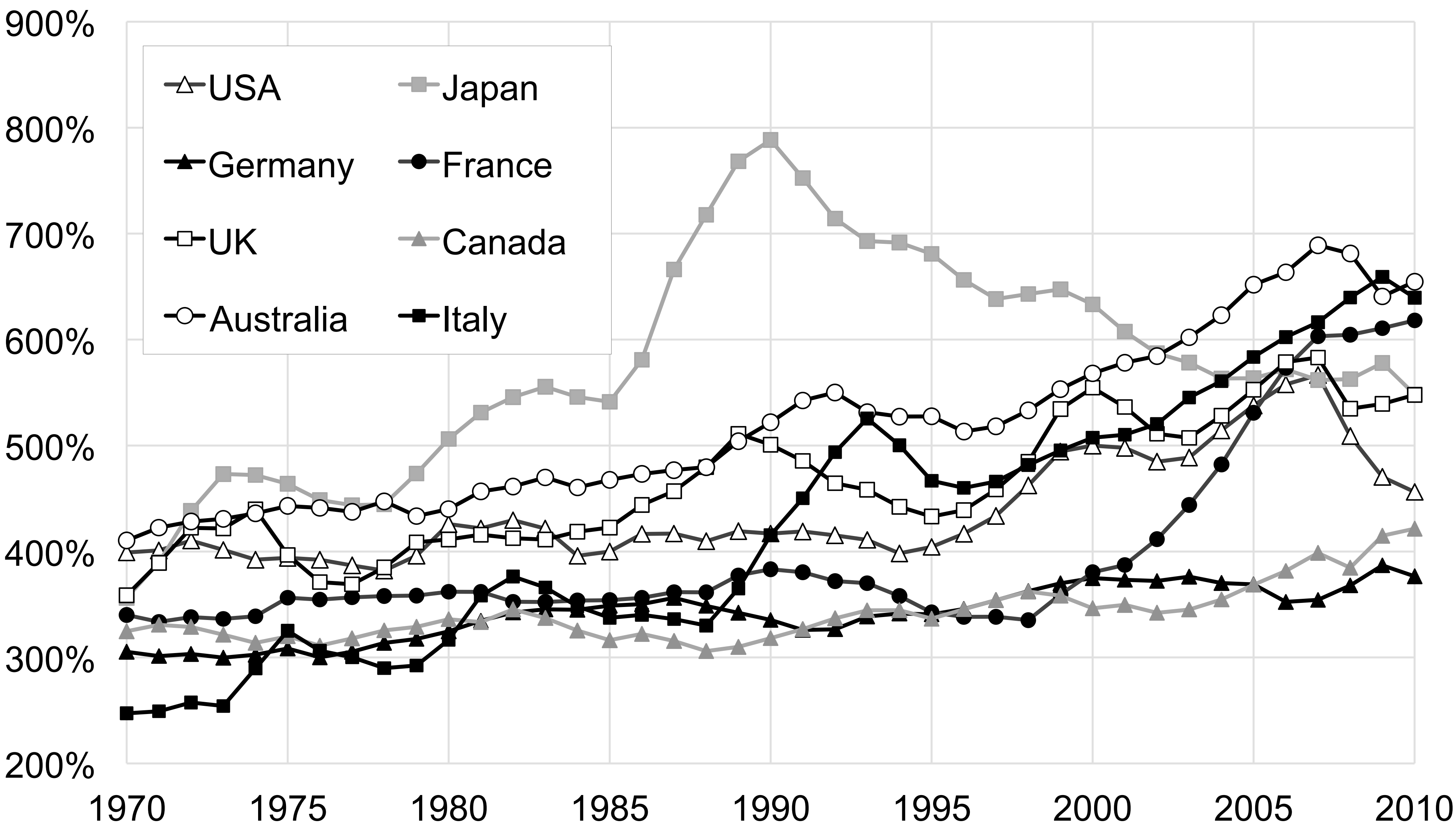
Authors' computations using country national accounts. Book-value national wealth = non-financial assets of all sectors (incl. natural resources) = national wealth + residual corporate wealth + natural resources not-included in national wealth

Figure A26: Book-value national wealth / national income 1970-2010 (excl. Japan)



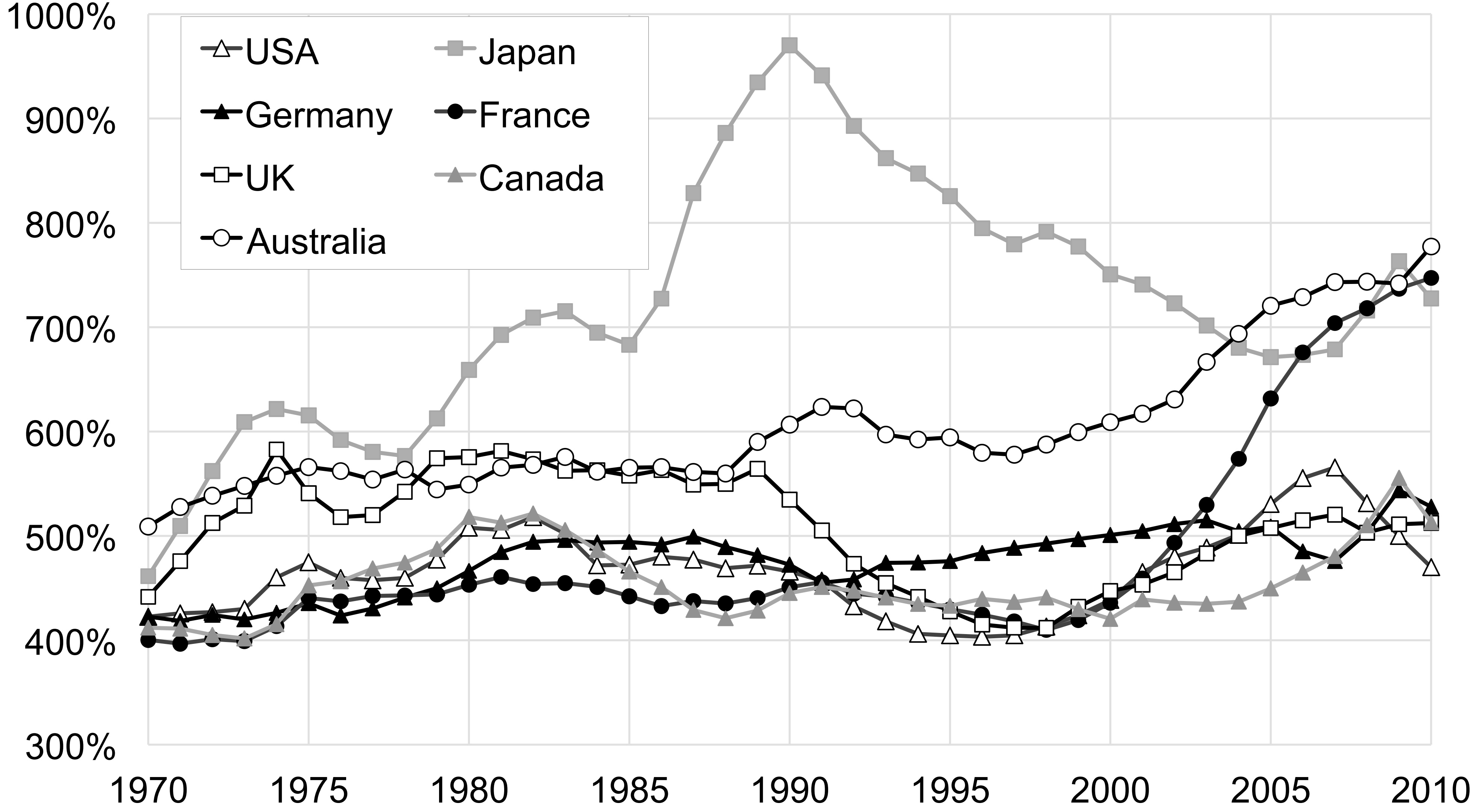
Authors' computations using country national accounts. Book-value national wealth = national wealth + residucal corporate wealth, % of national income

Figure A27: Domestic capital-national income ratio 1970-2010



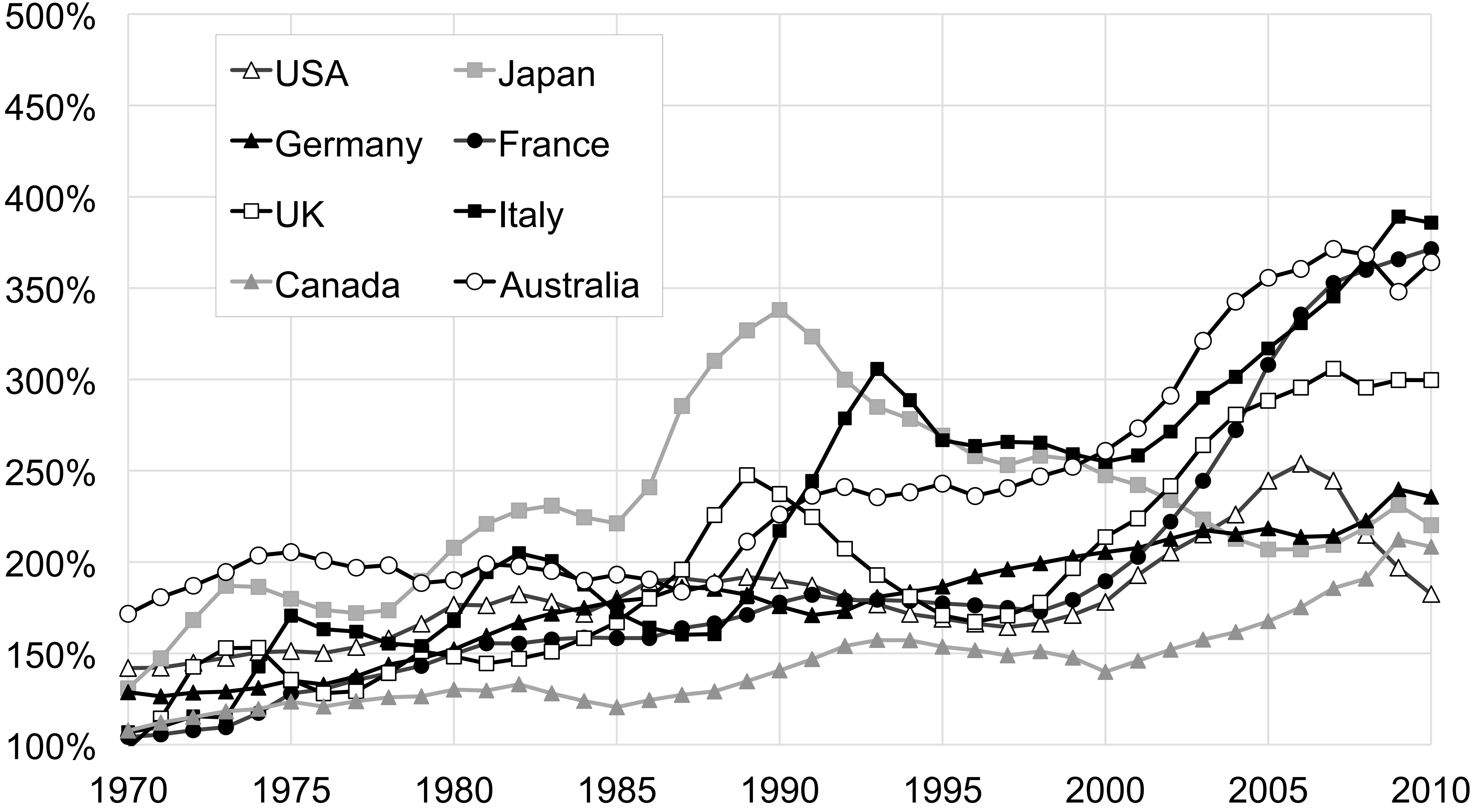
Authors' computations using country national accounts. Domestic capital-national income = national wealth - foreign wealth, % national income

Figure A28: Book-value domestic capital-national income ratio 1970-2010



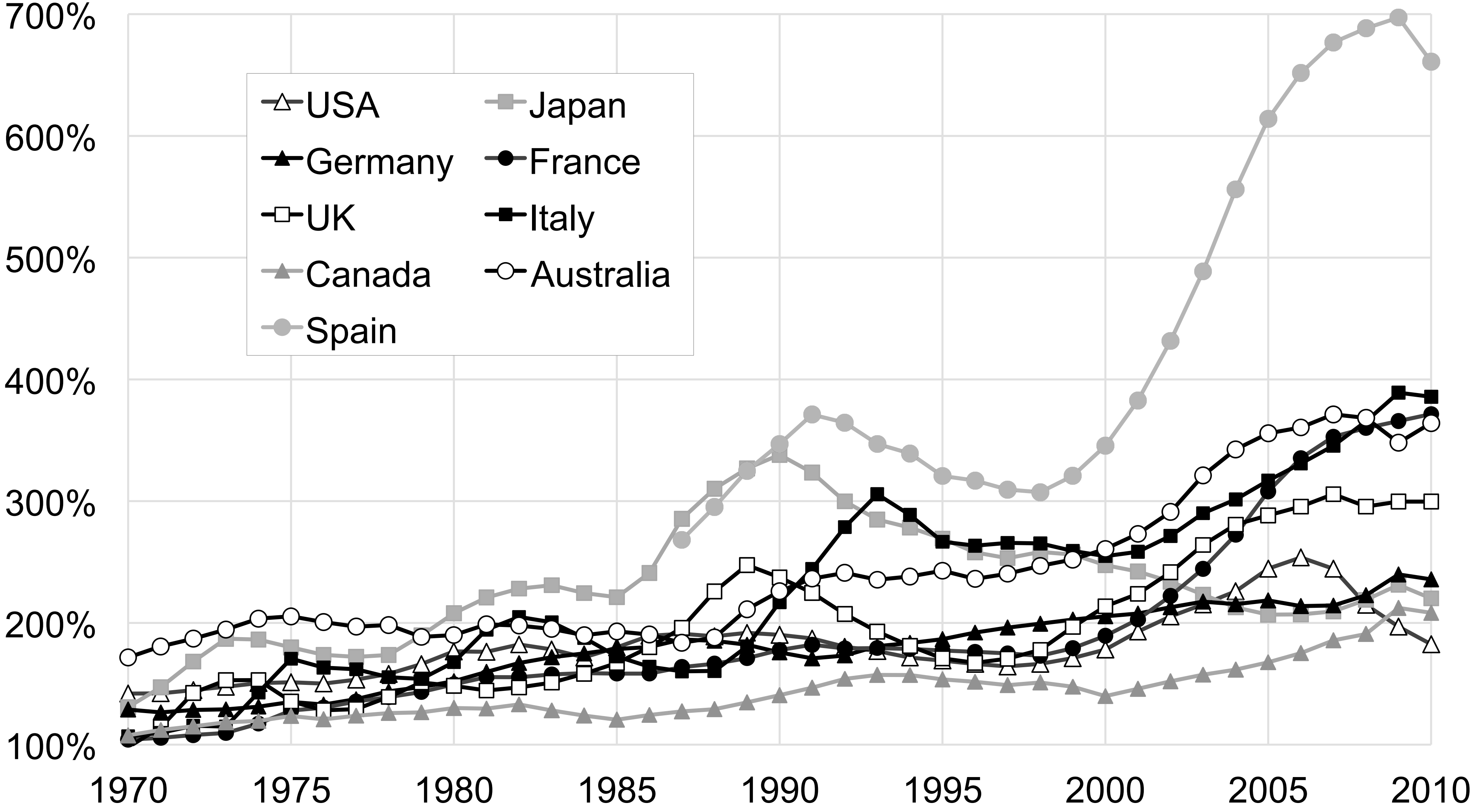
Authors' computations using country national accounts. Book-value domestic capital-national income = book-value national wealth - foreign wealth, % national income

Figure A29: Housing capital / national income ratios, 1970-2010



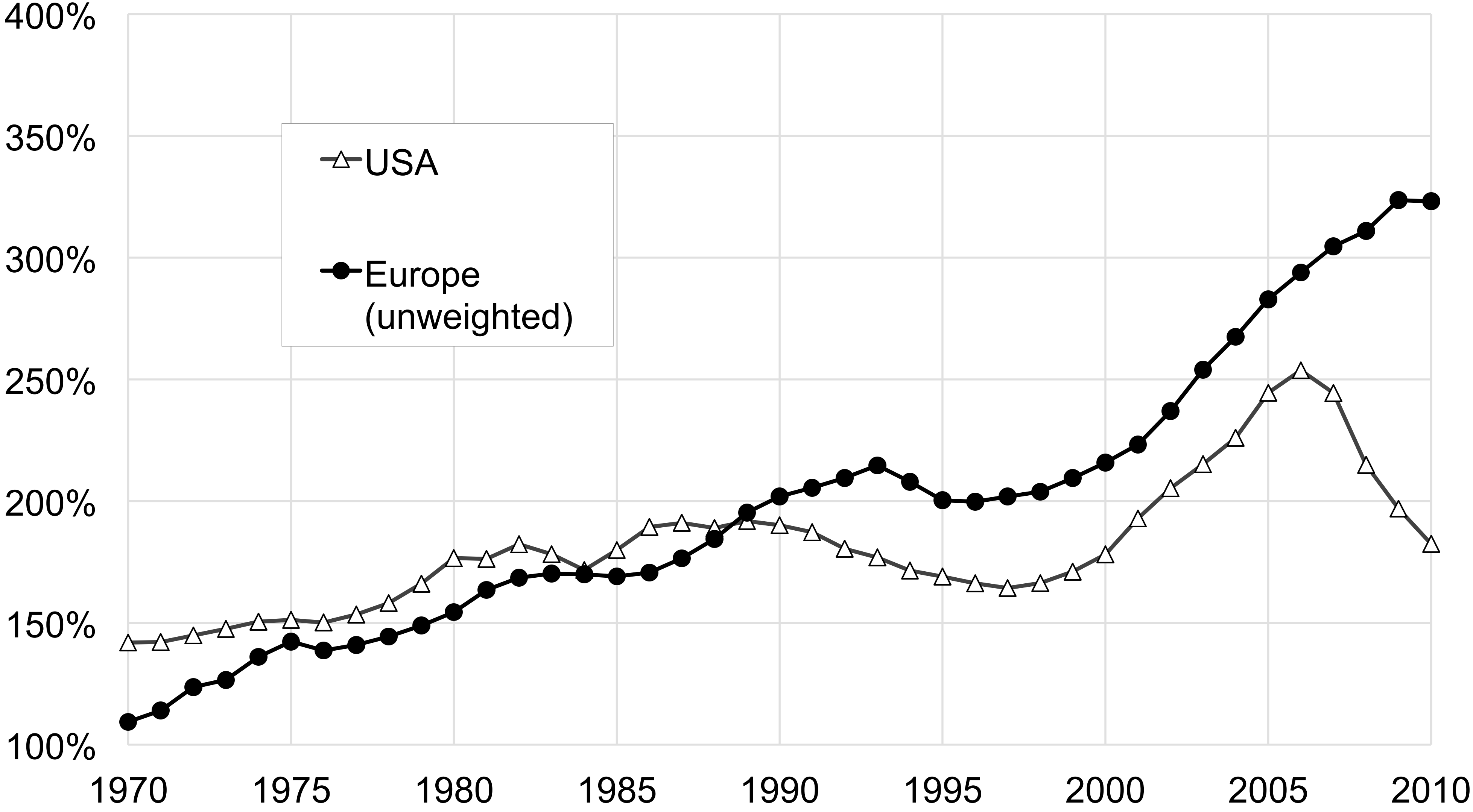
Authors' computations using country national accounts. Housing capital = real estate used for dwelling (personal sector)

Figure A30: Housing capital / national income ratios, 1970-2010 (incl. Spain)



Authors' computations using country national accounts. Housing capital = real estate used for dwelling (personal sector)

Figure A31: Housing capital / national income ratios: Europe vs. USA 1970-2010



Authors' computations using country national accounts. Housing capital = real estate used for dwelling (personal sector)

Figure A32: Housing wealth-national income ratios 1870-2010 (decennial averages)

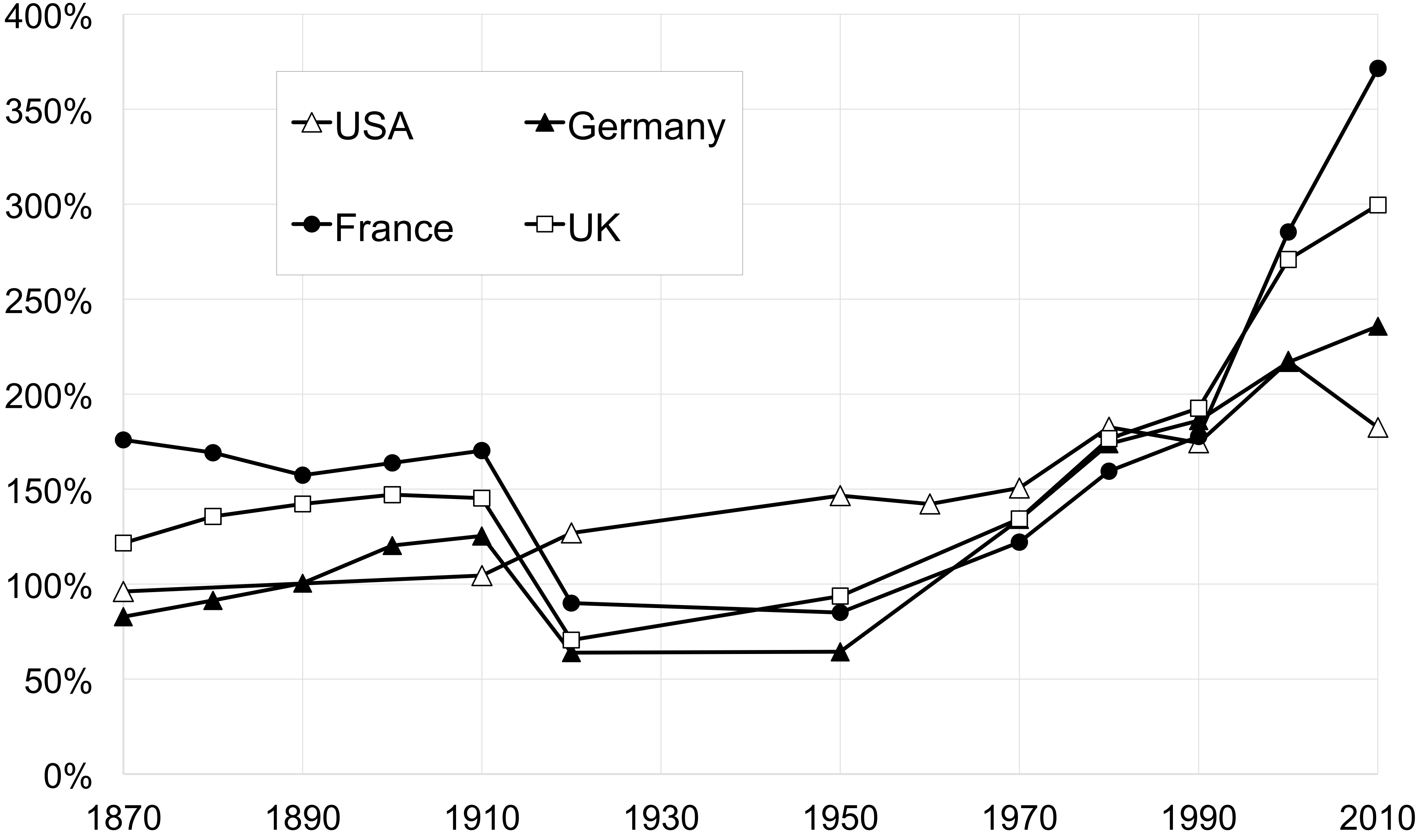
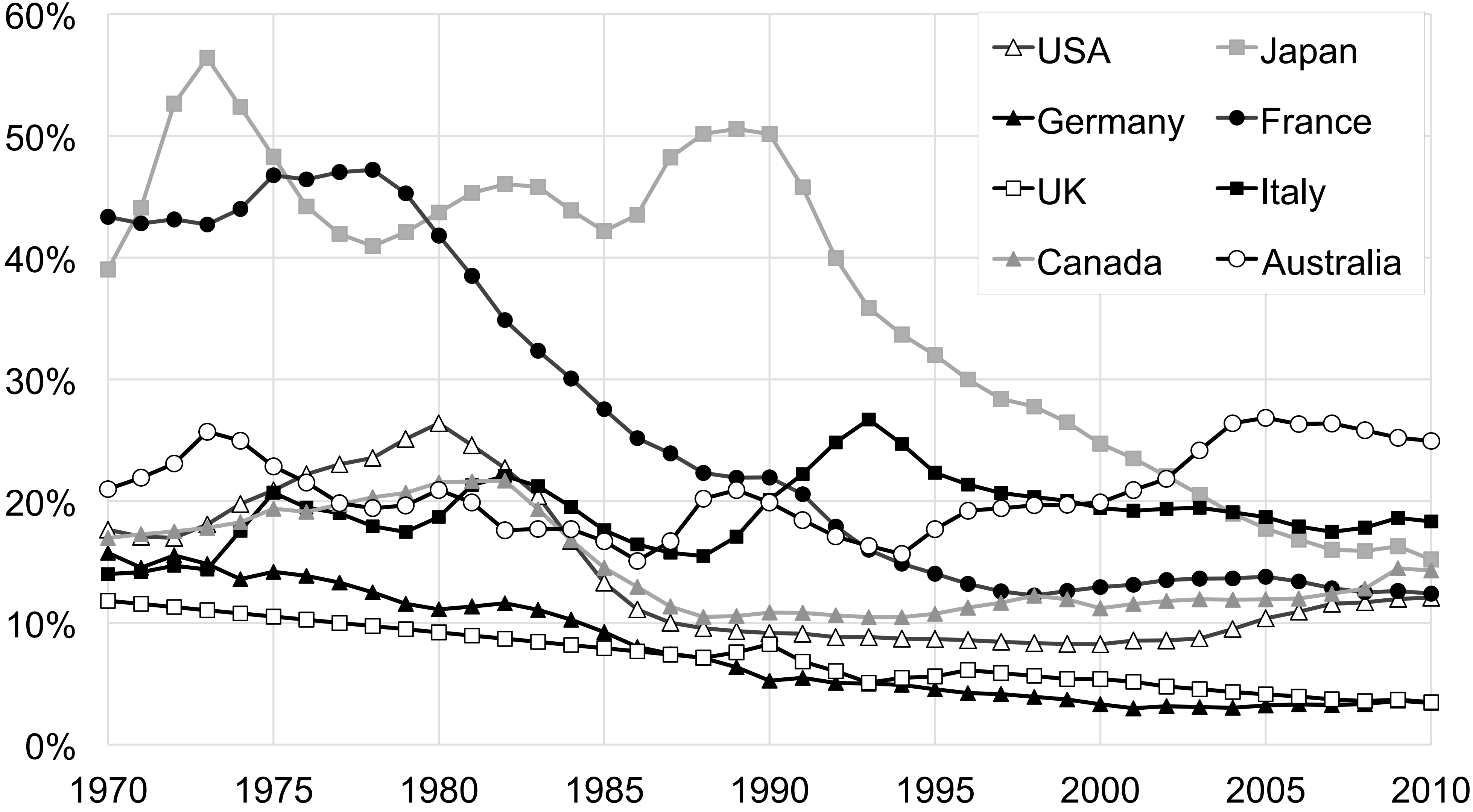


Figure A33: Agricultural land-national income ratios, 1970-2010



Authors' computations using country national accounts. Housing capital = real estate used for dwelling (personal sector)

Figure A34: Agricultural land-national income ratios 1870-2010 (decennial averages)

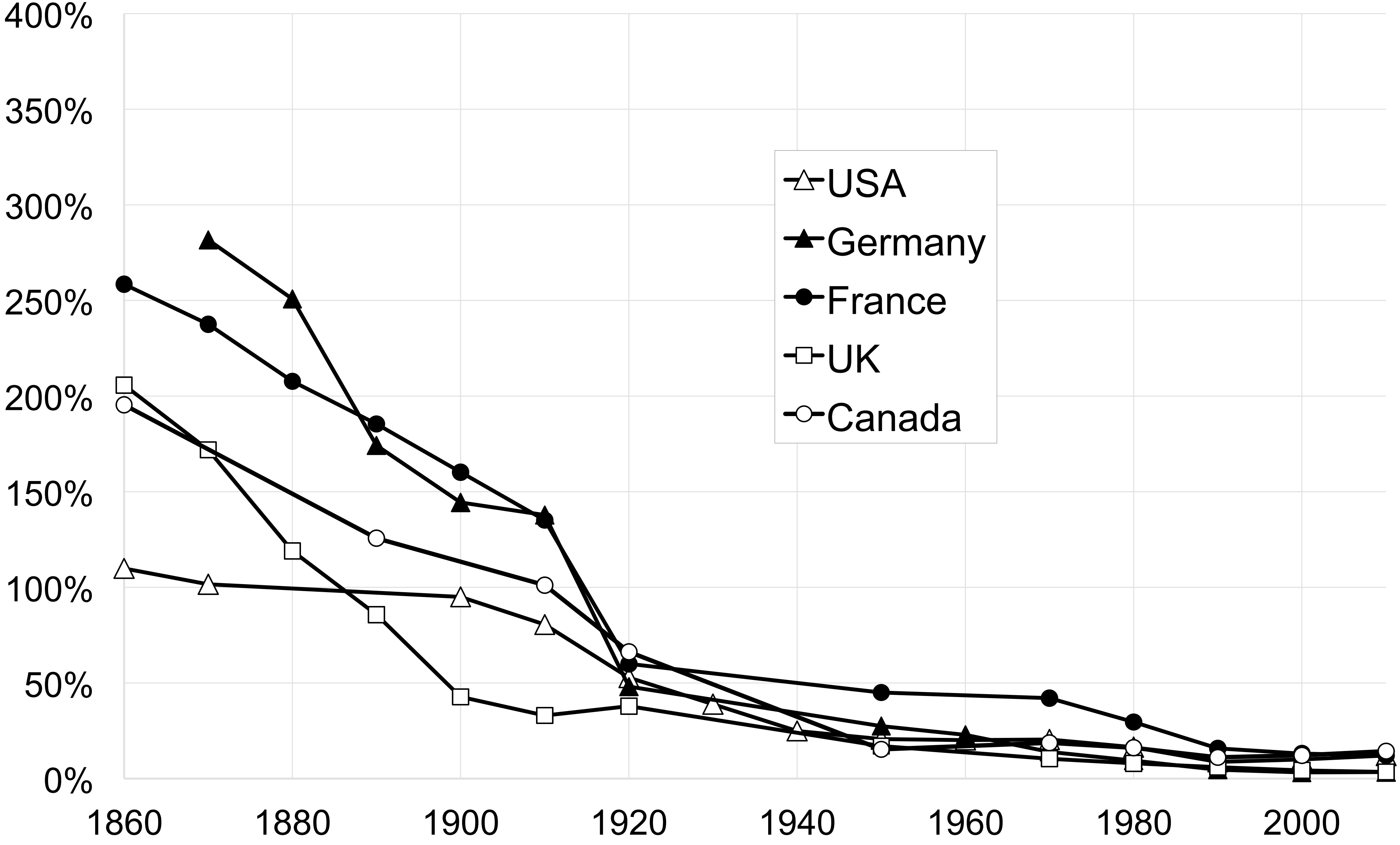


Figure A35: Other domestic capital / national income ratios 1970-2010

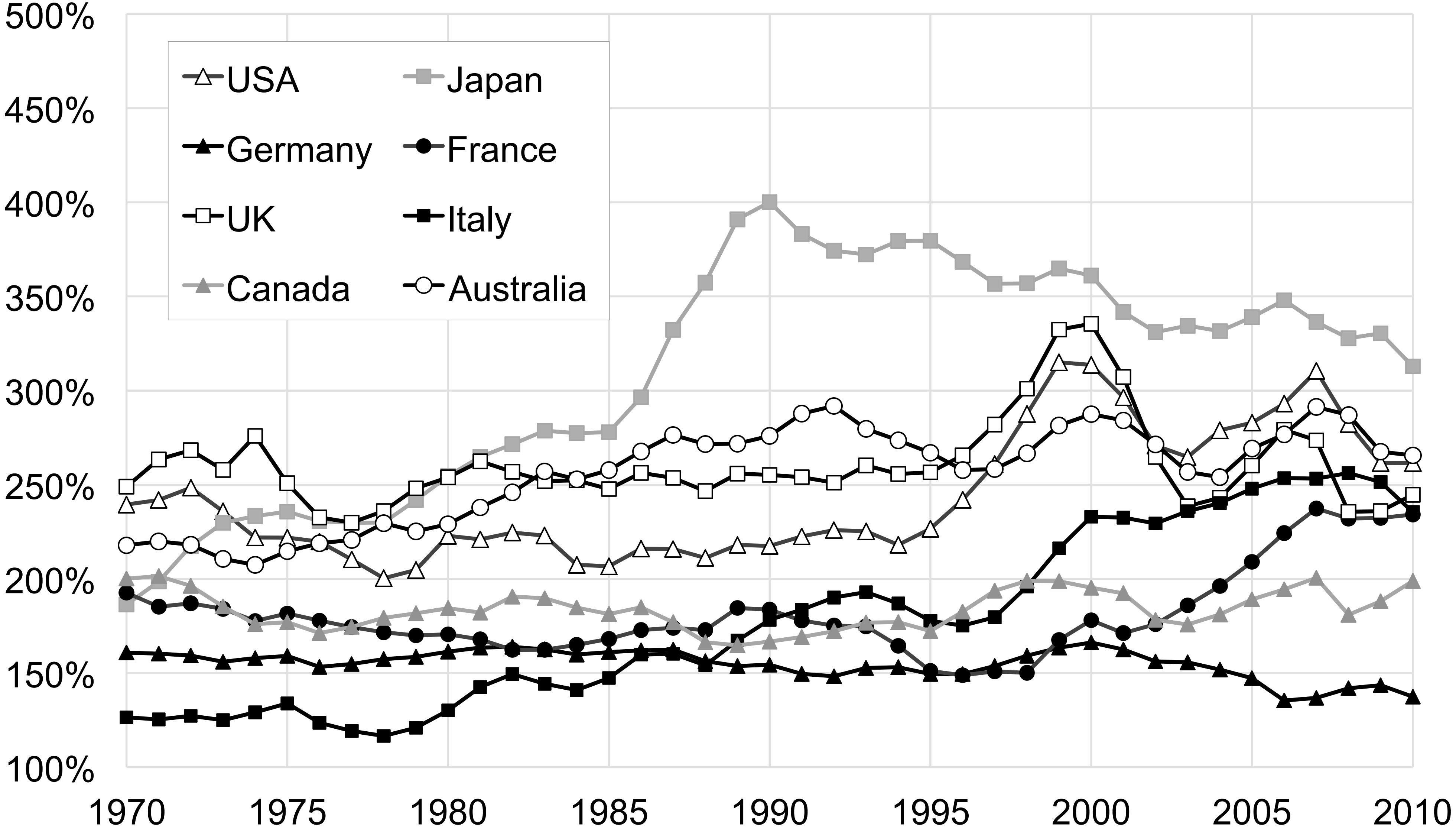


Figure A36: Other domestic capital-national income ratios 1870-2010 (decennial averages)

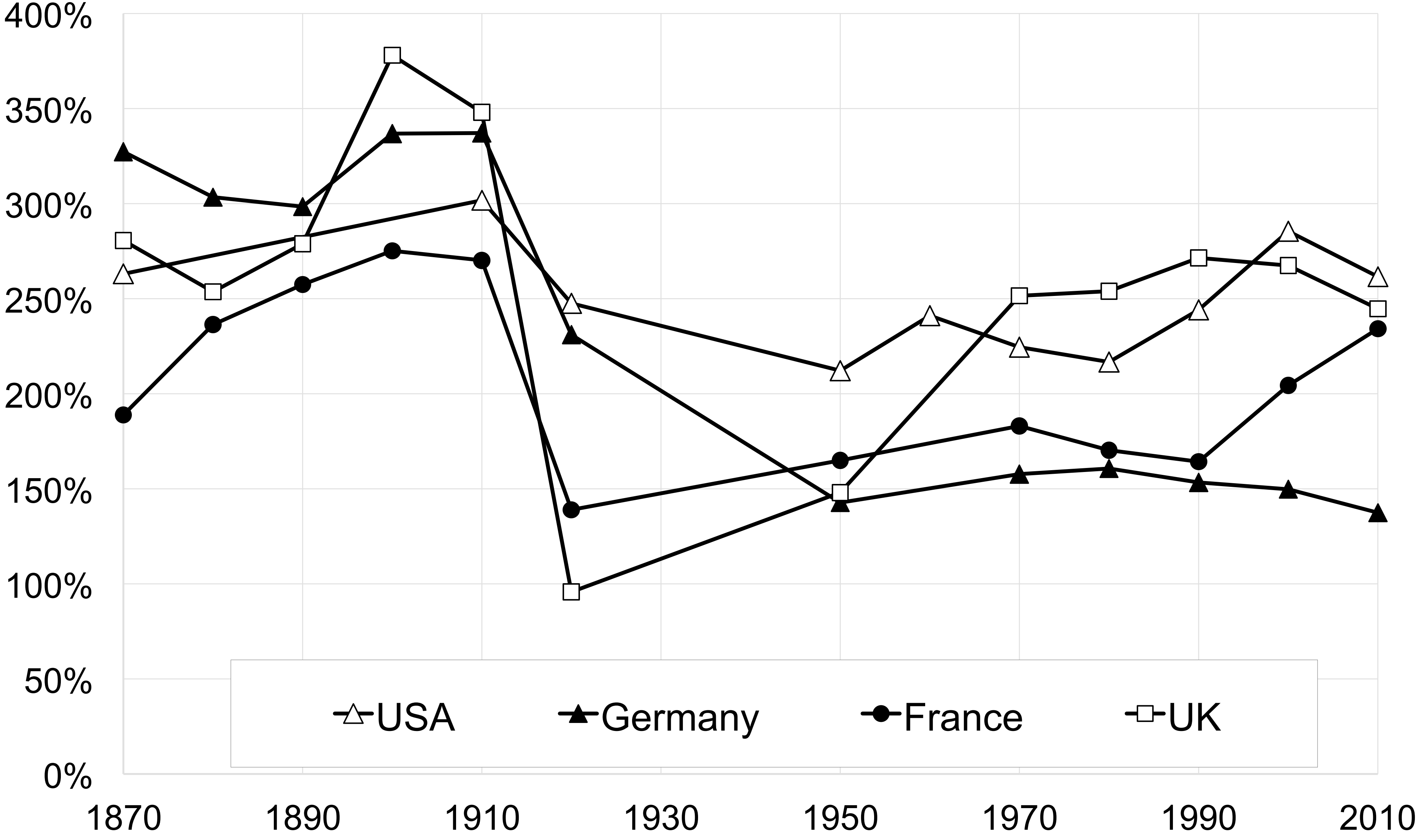


Figure A37: Net foreign assets / national income 1970-2010 (including Spain)

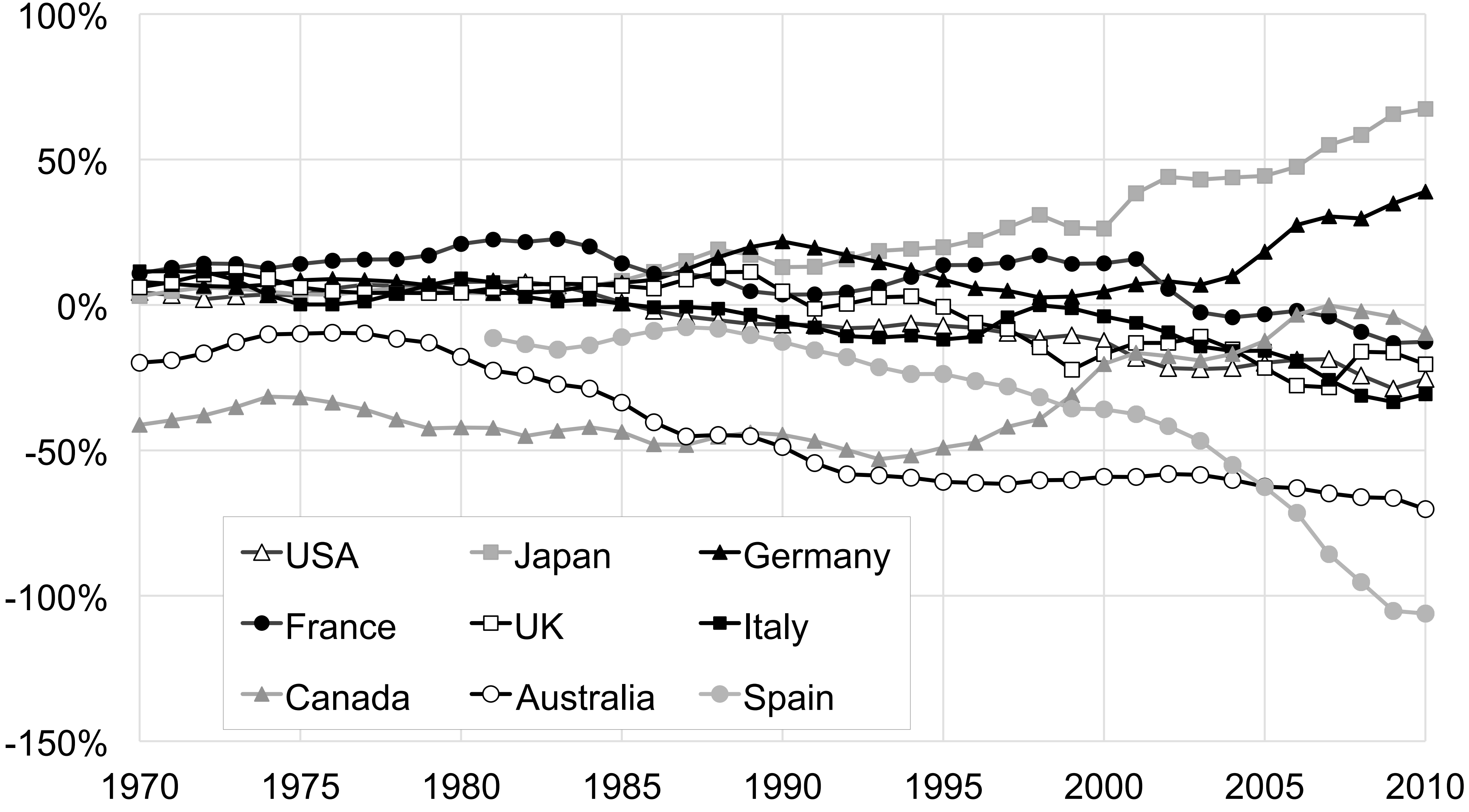


Figure A38: Net foreign assets / national income 1860-2010 (decennial averages)

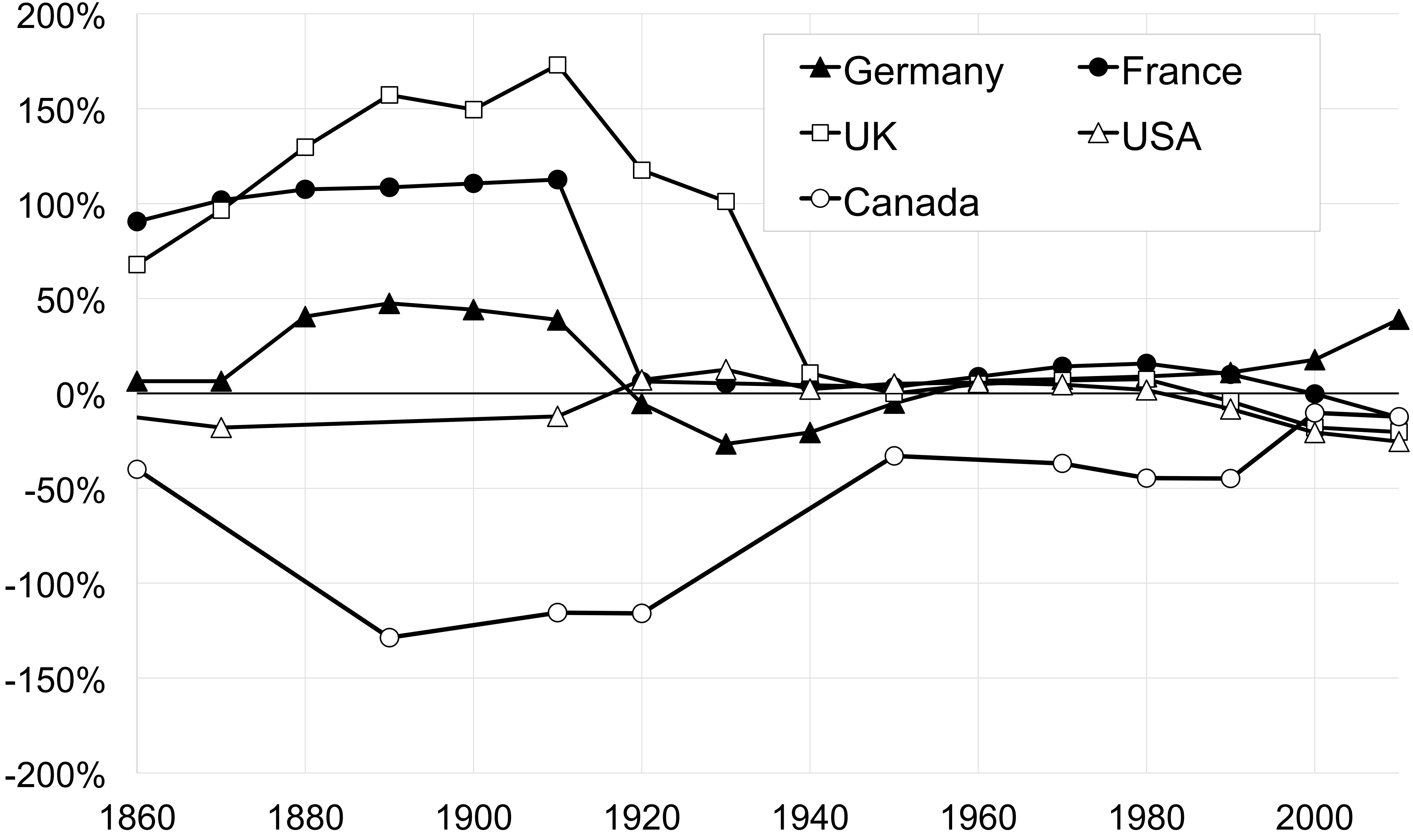


Figure A39: Gross foreign assets-national income ratios 1970-2010

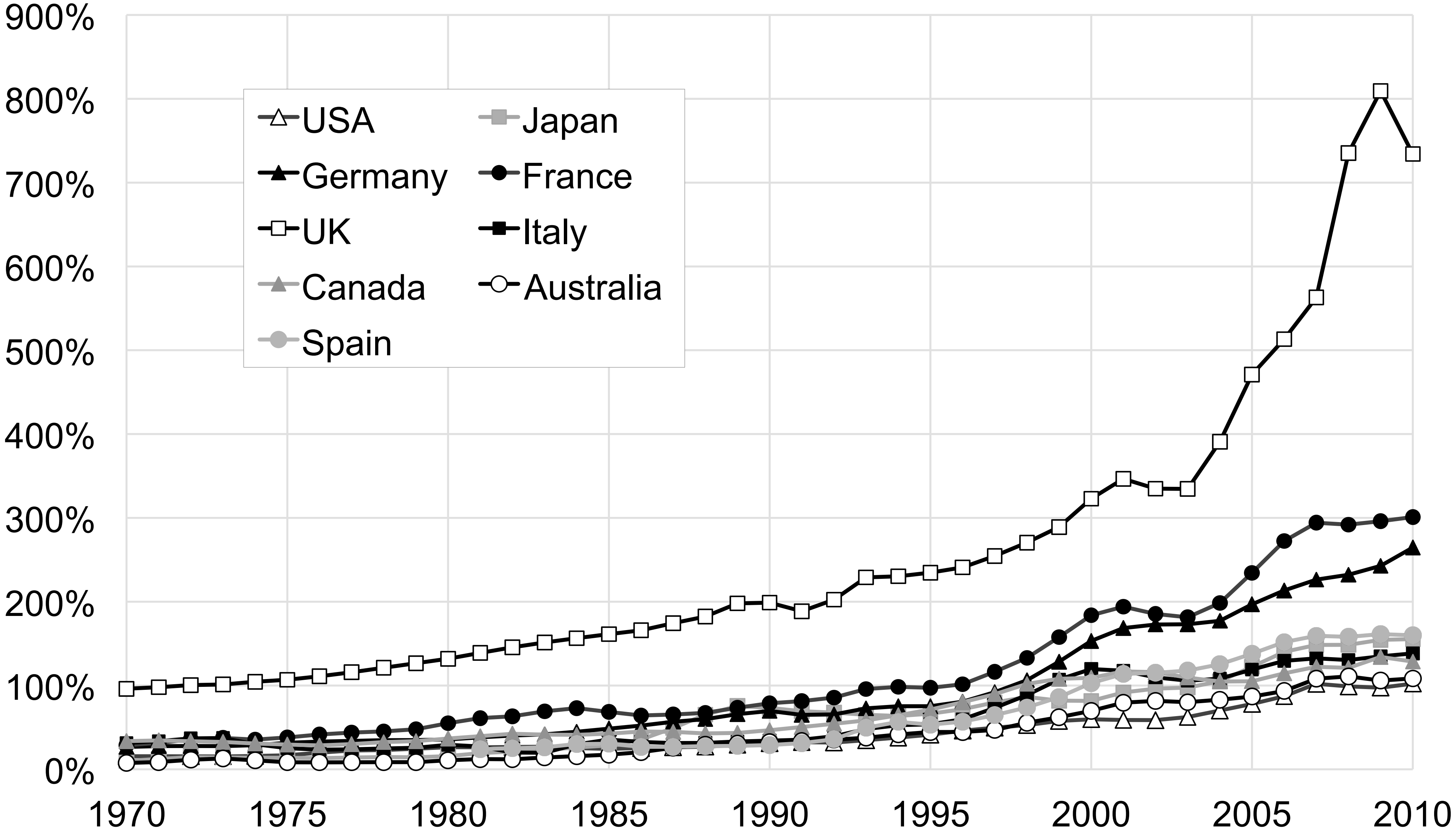


Figure A40: Gross foreign liabilities-national income ratios 1970-2010

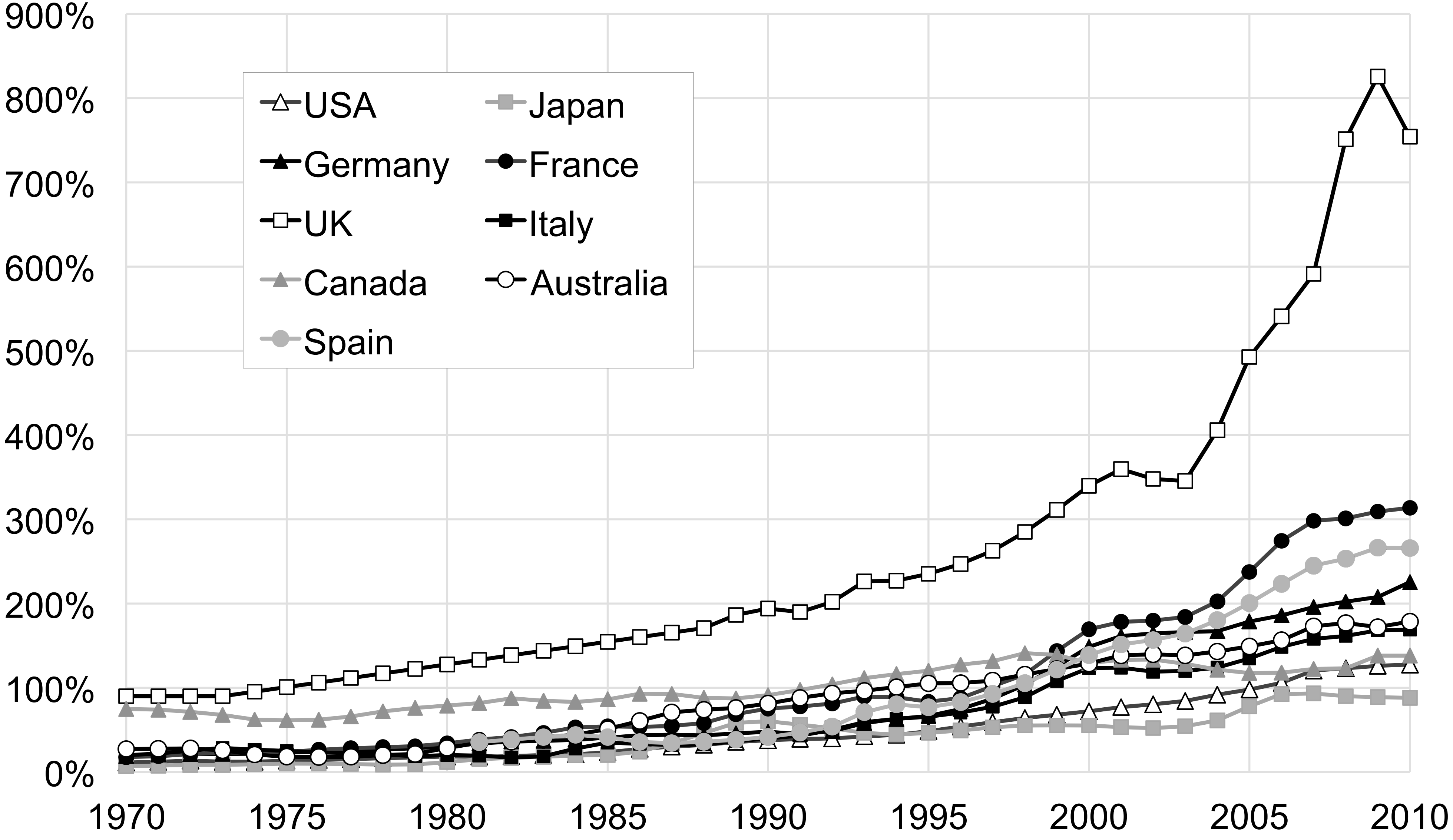


Figure A41: Gross foreign assets-national income ratios, 1970-2010 (excluding UK)

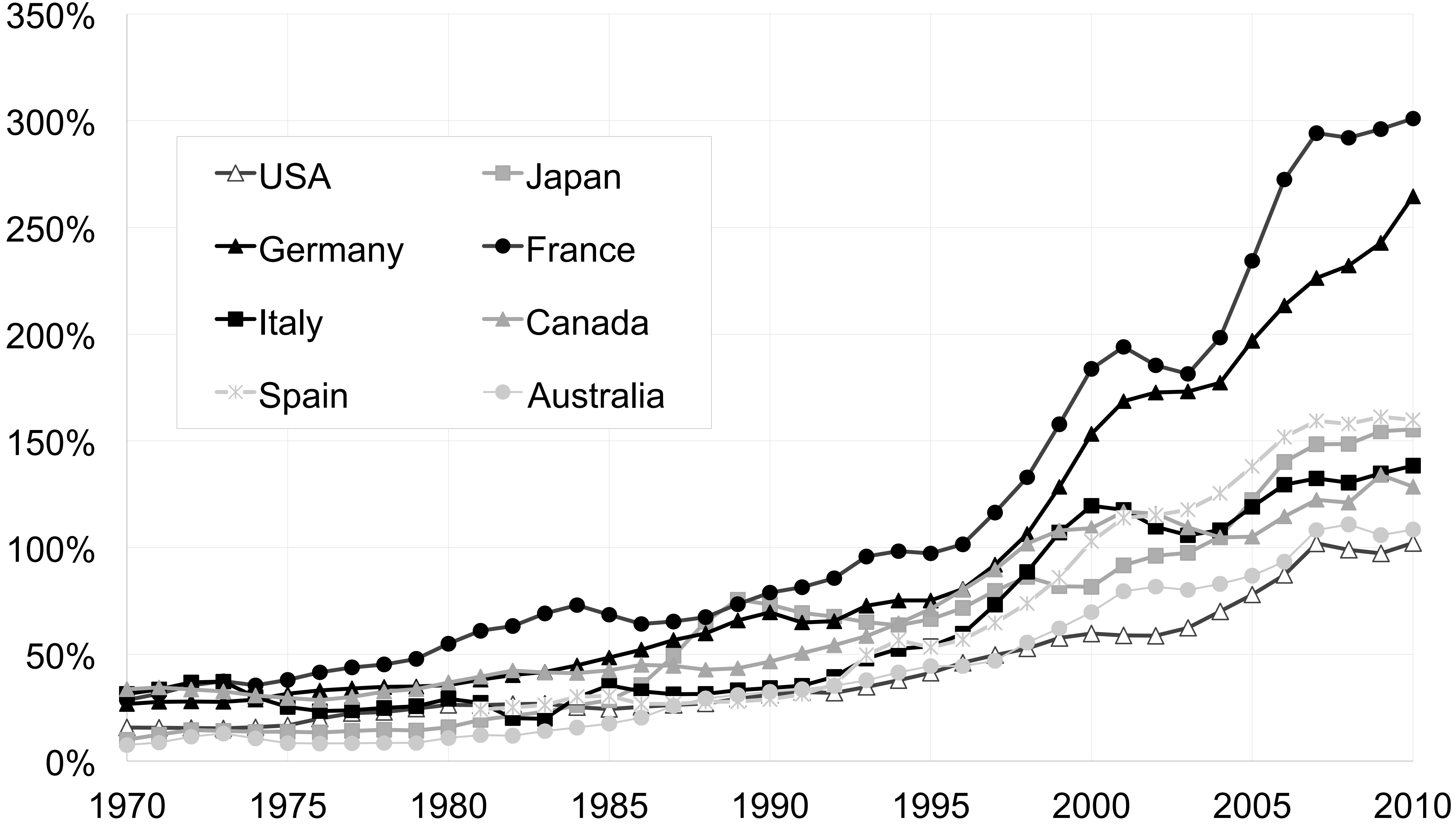


Figure A42: Gross foreign liabilities-national income ratios, 1970-2010 (excluding UK)

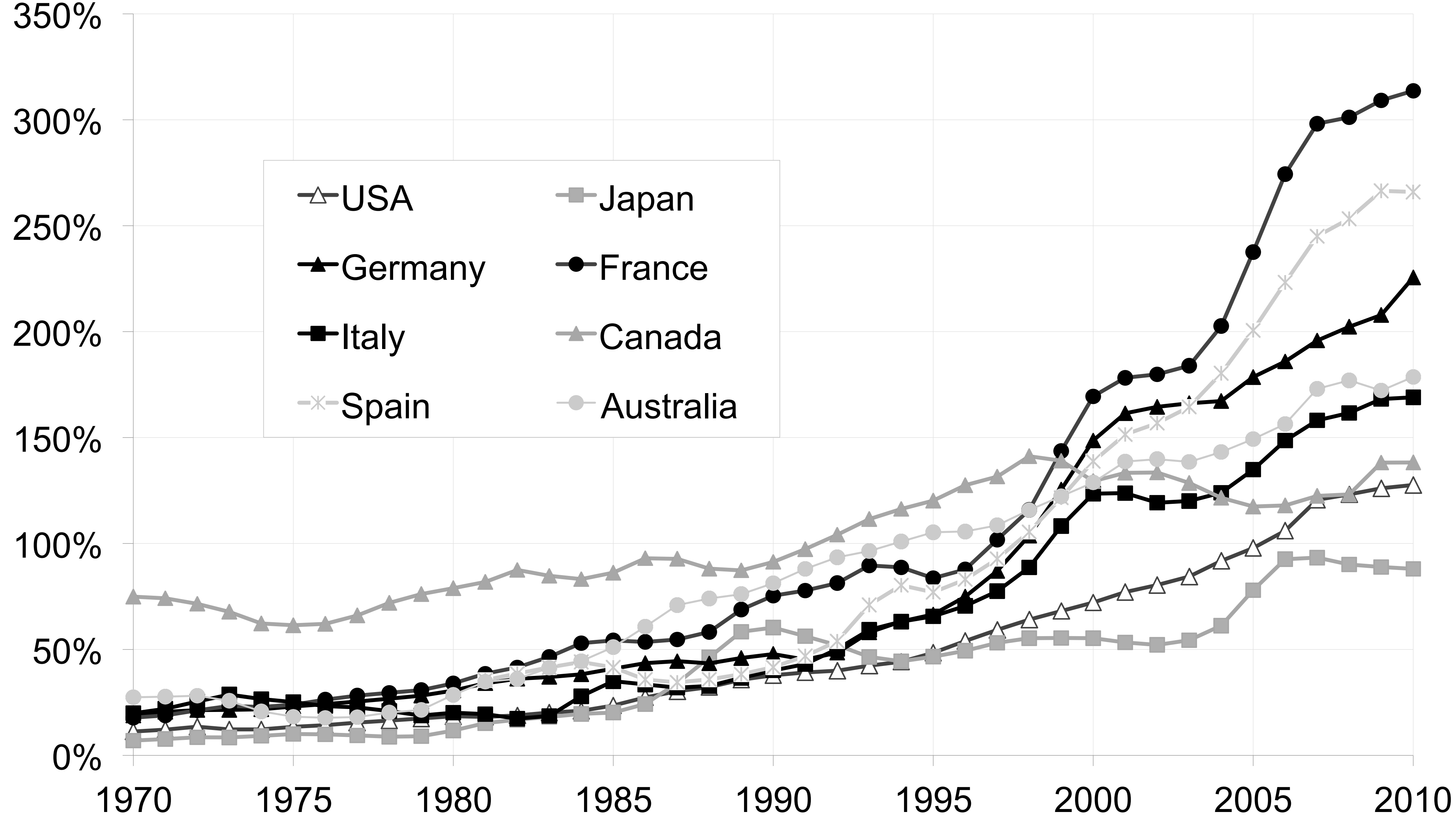


Figure A43: Gross foreign assets / Gross financial assets of all domestic sectors, 1970-2010

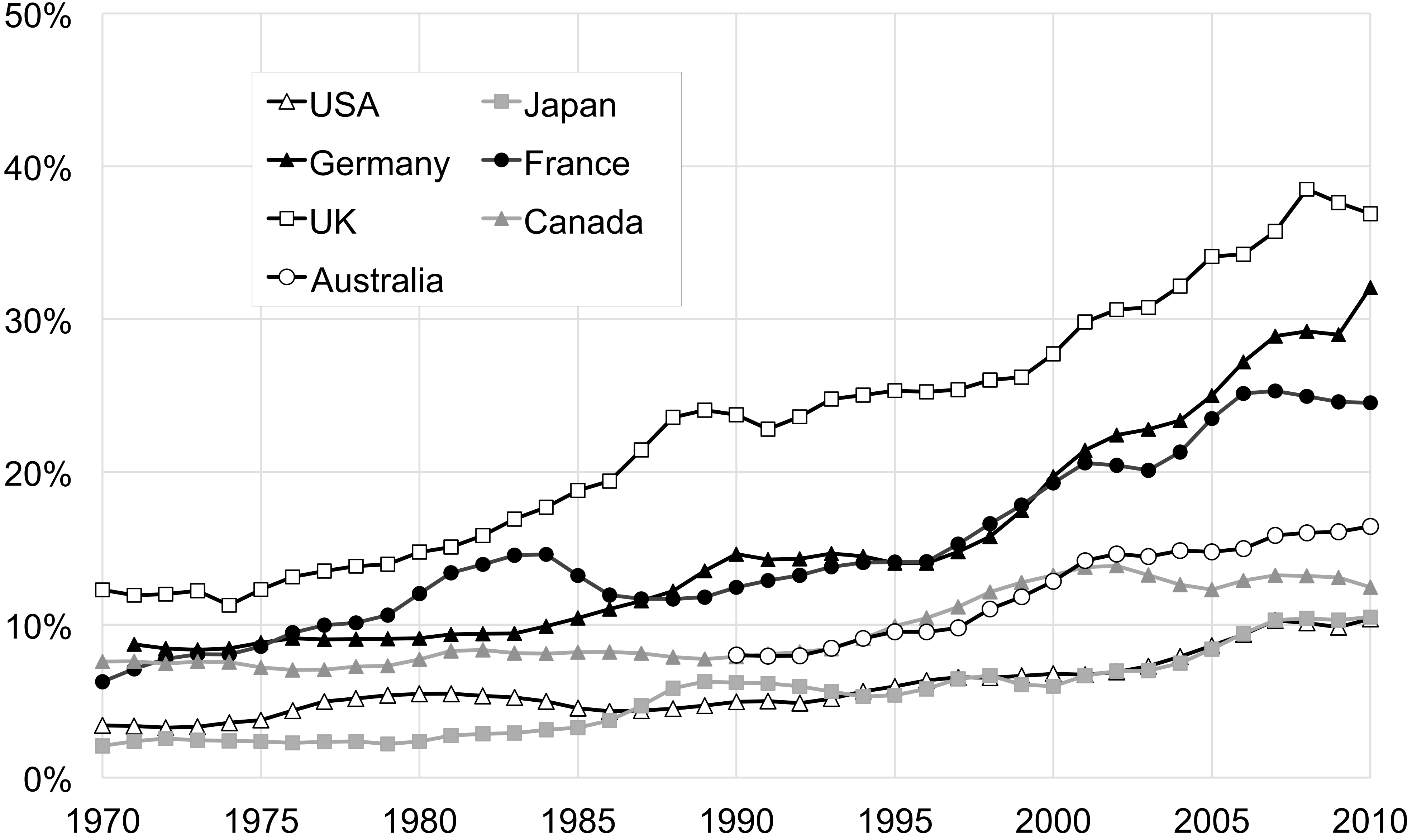


Figure A44: Gross foreign liabilities / Gross financial liabilities of all domestic sectors, 1970-2010

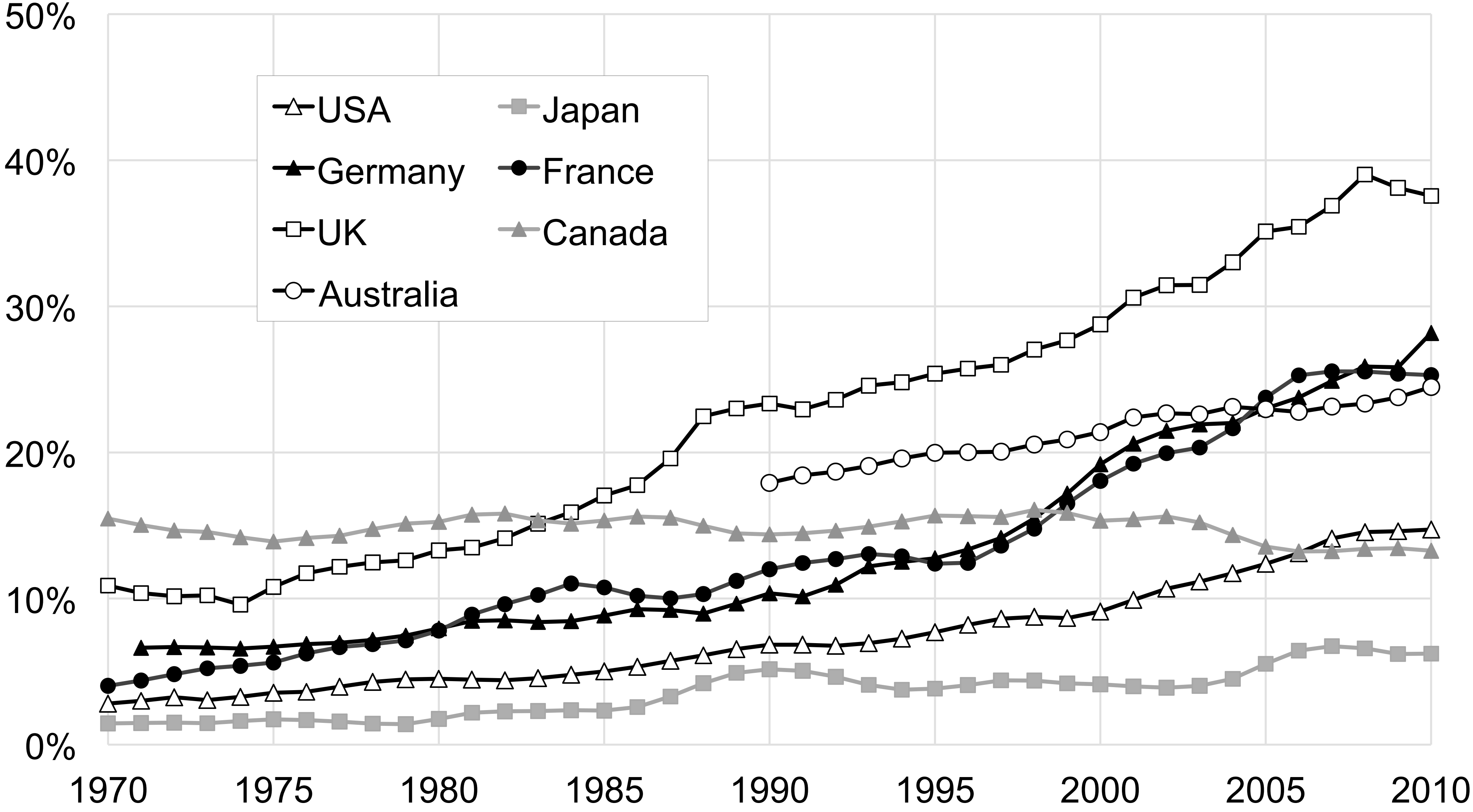


Figure A45: Natural resources in 2000-2010 (% of national income)

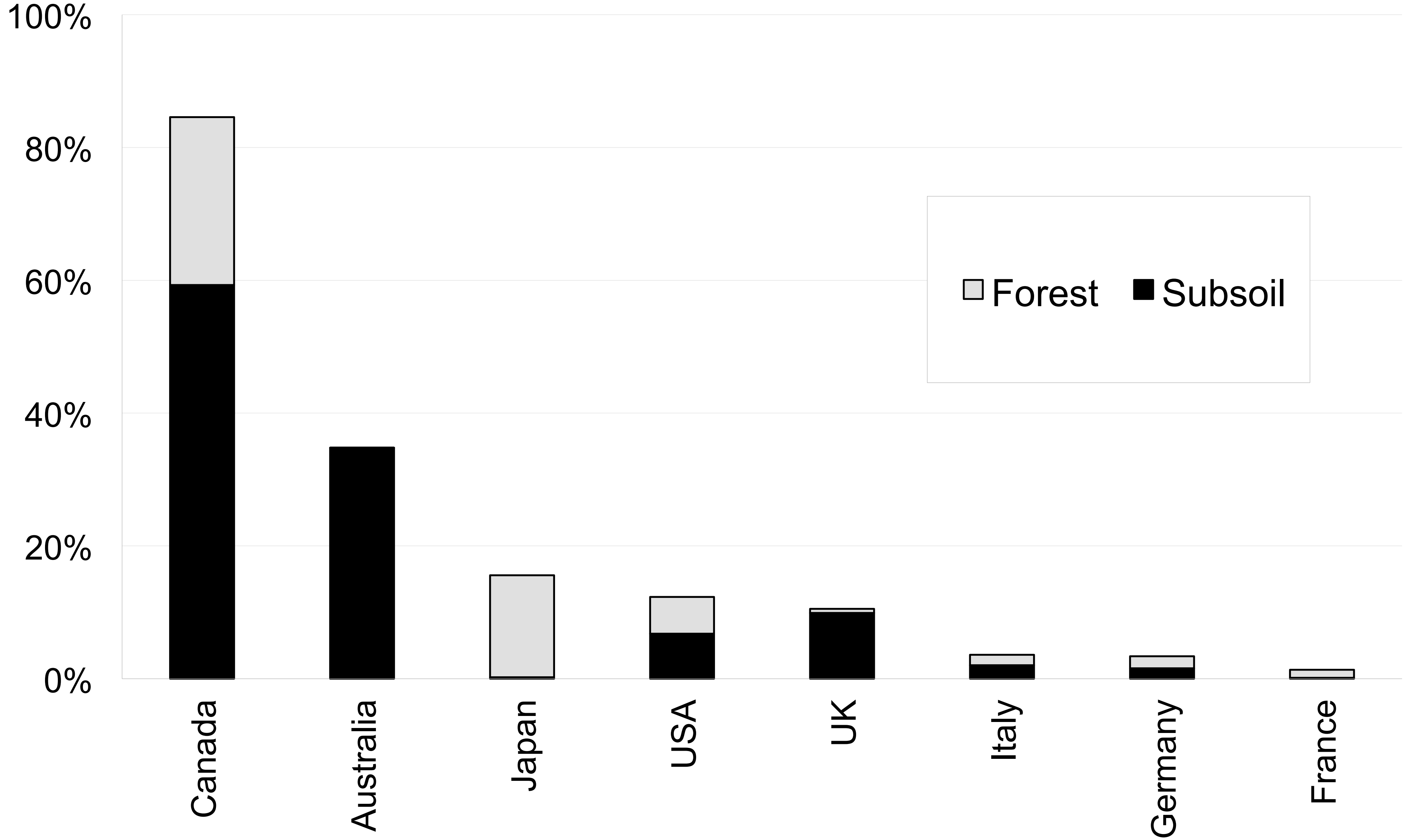
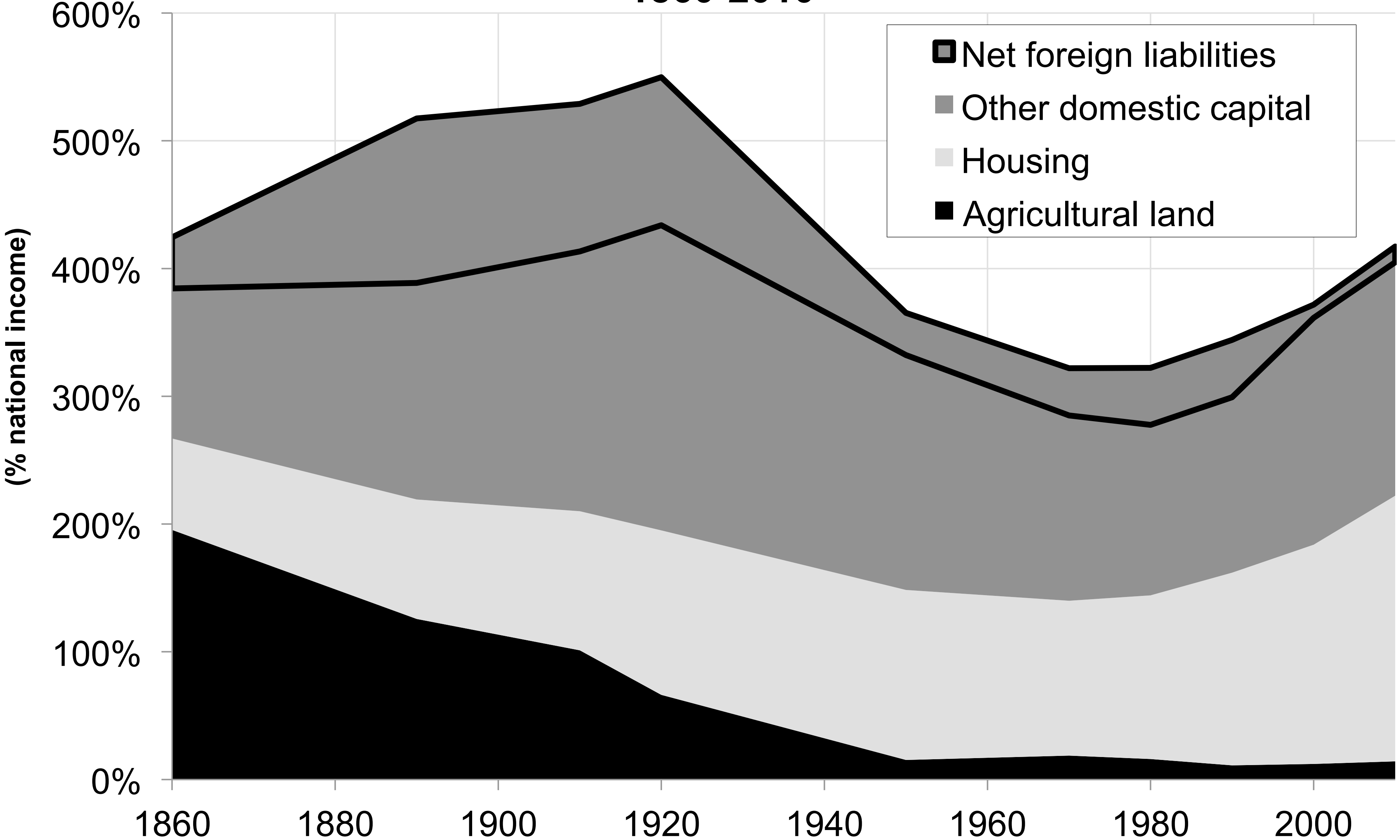
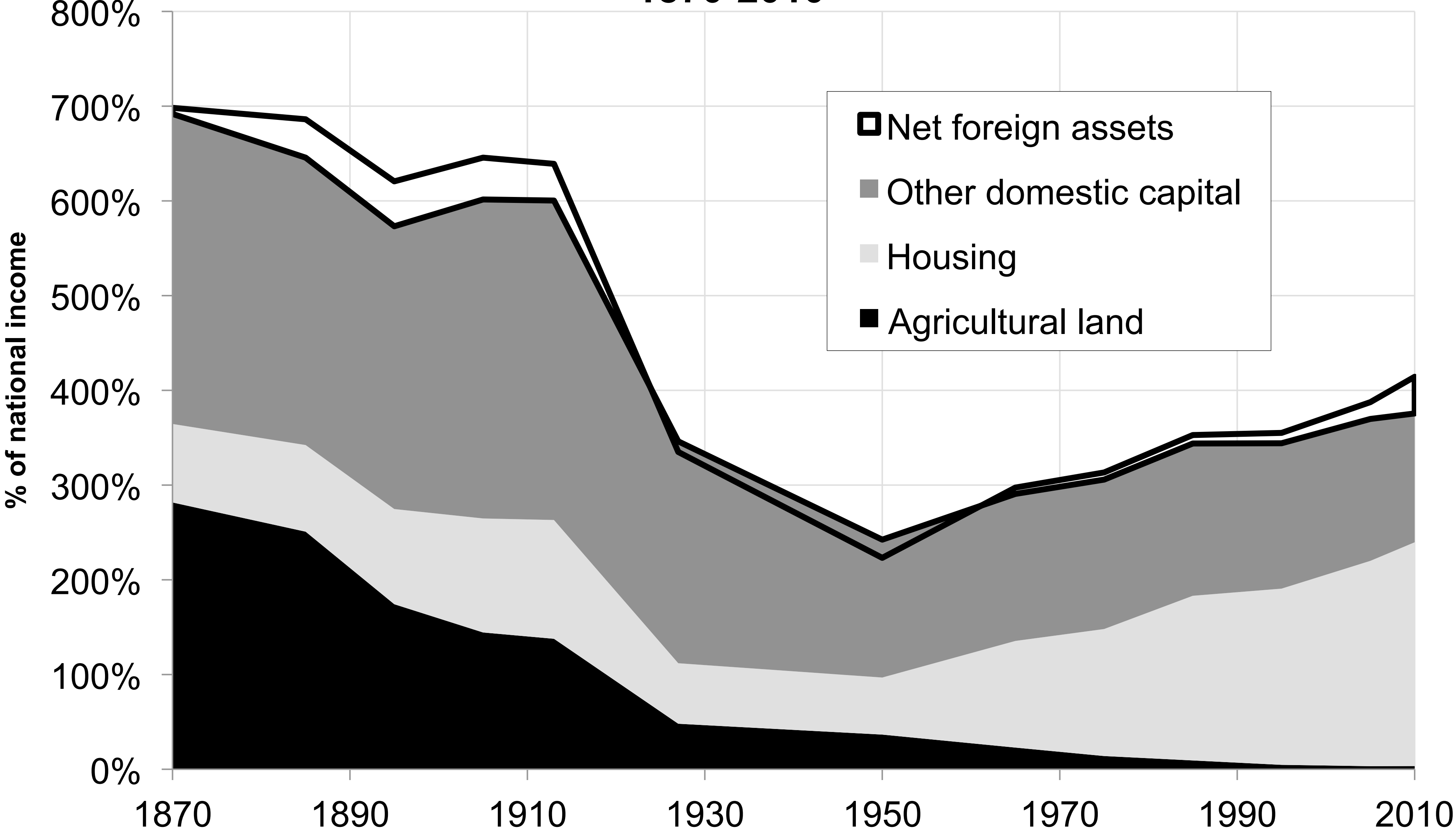


Figure A46: The changing nature of national wealth, Canada 1860-2010



National wealth = agricultural land + housing + other domestic capital - net foreign liabilites

Figure A47: The changing nature of national wealth, Germany 1870-2010



National wealth = agricultural land + housing + other domestic capital + net foreign assets

Figure A48: Private wealth / national wealth 1870-2010

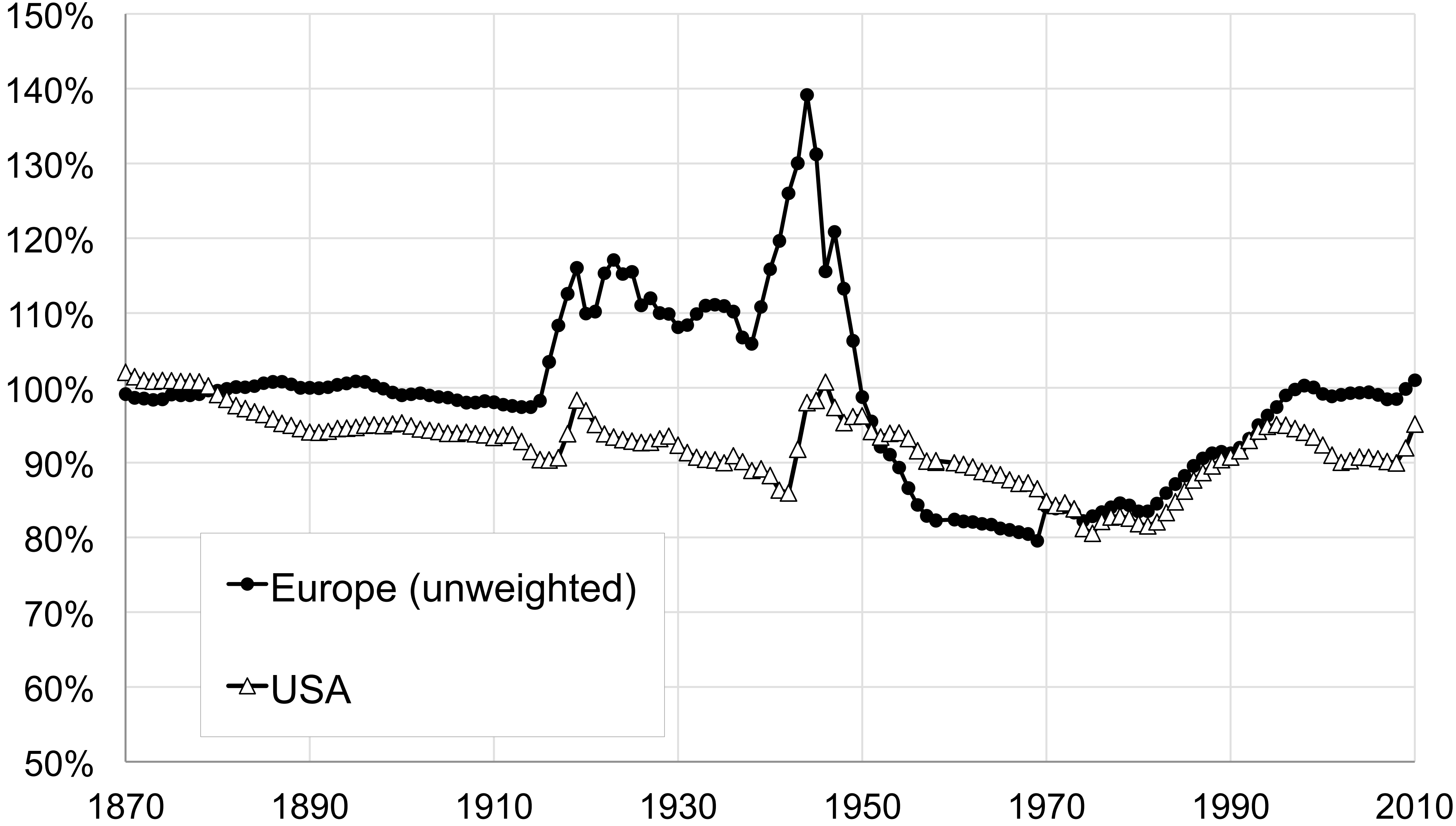
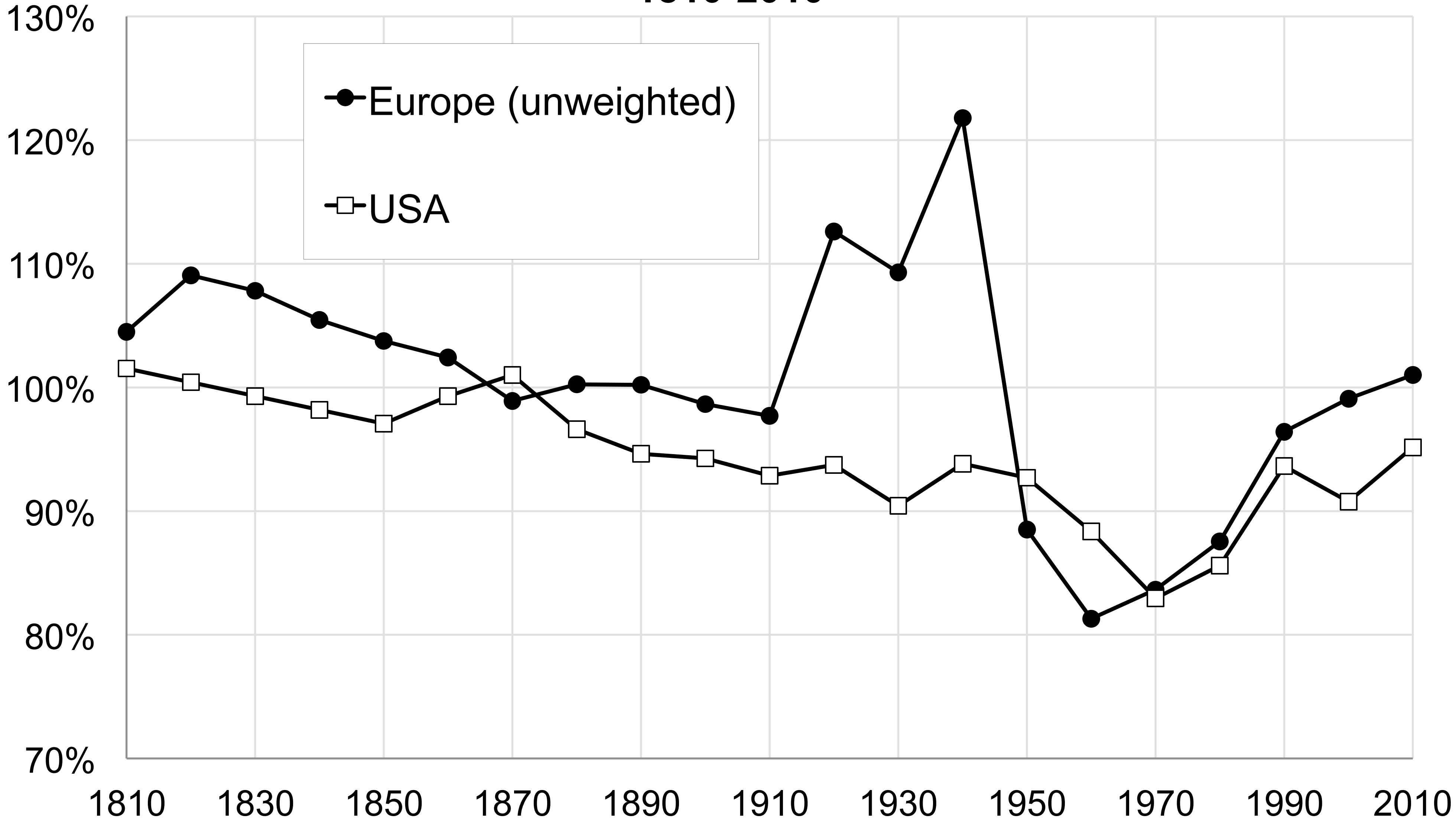


Figure A49: Share of private wealth in national wealth 1810-2010



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

Figure A50: Government wealth / national wealth, 1970-2010

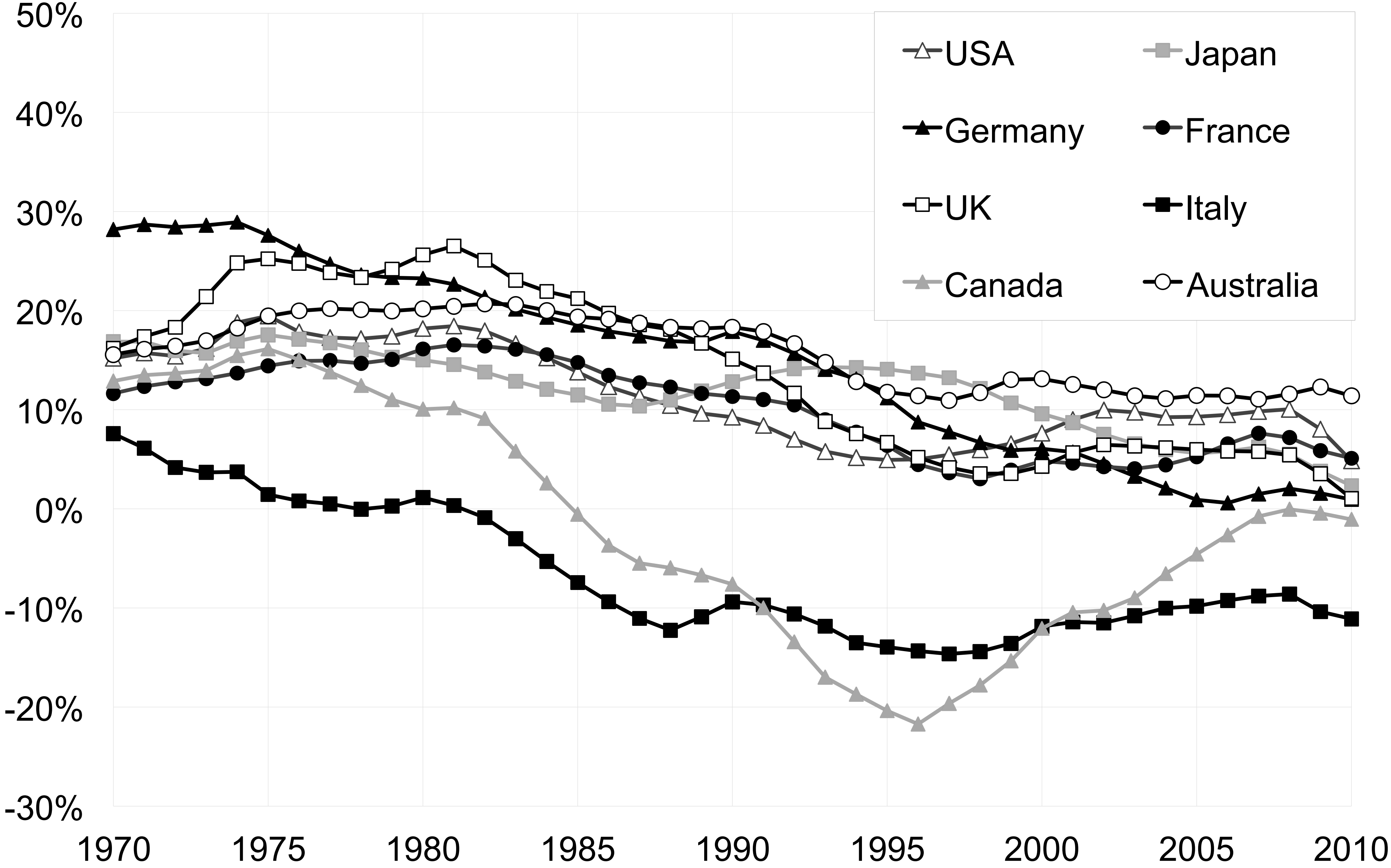


Figure A51: Government net wealth / national wealth 1870-2010

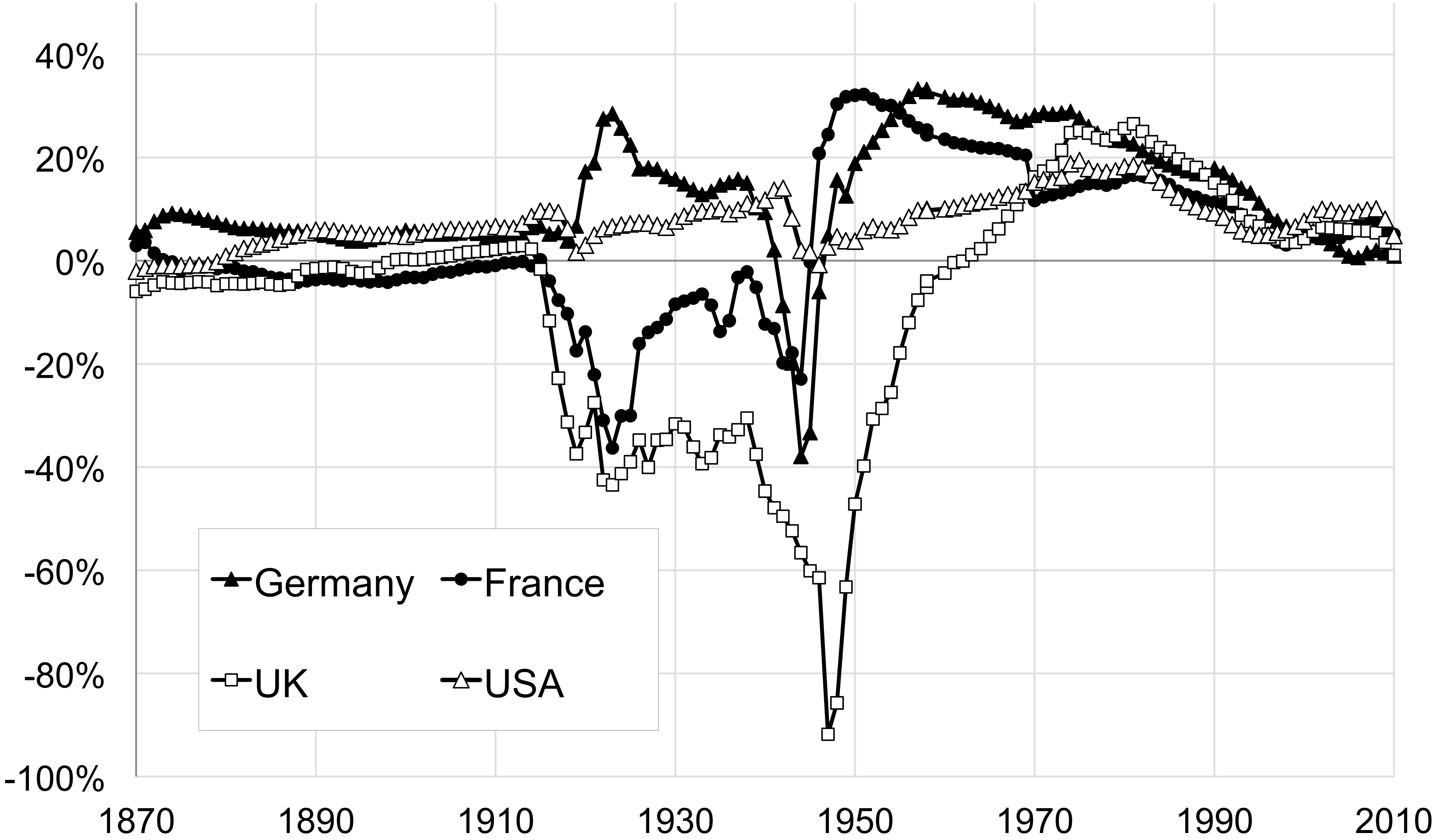


Figure A52: Share of government wealth in national wealth 1810-2010

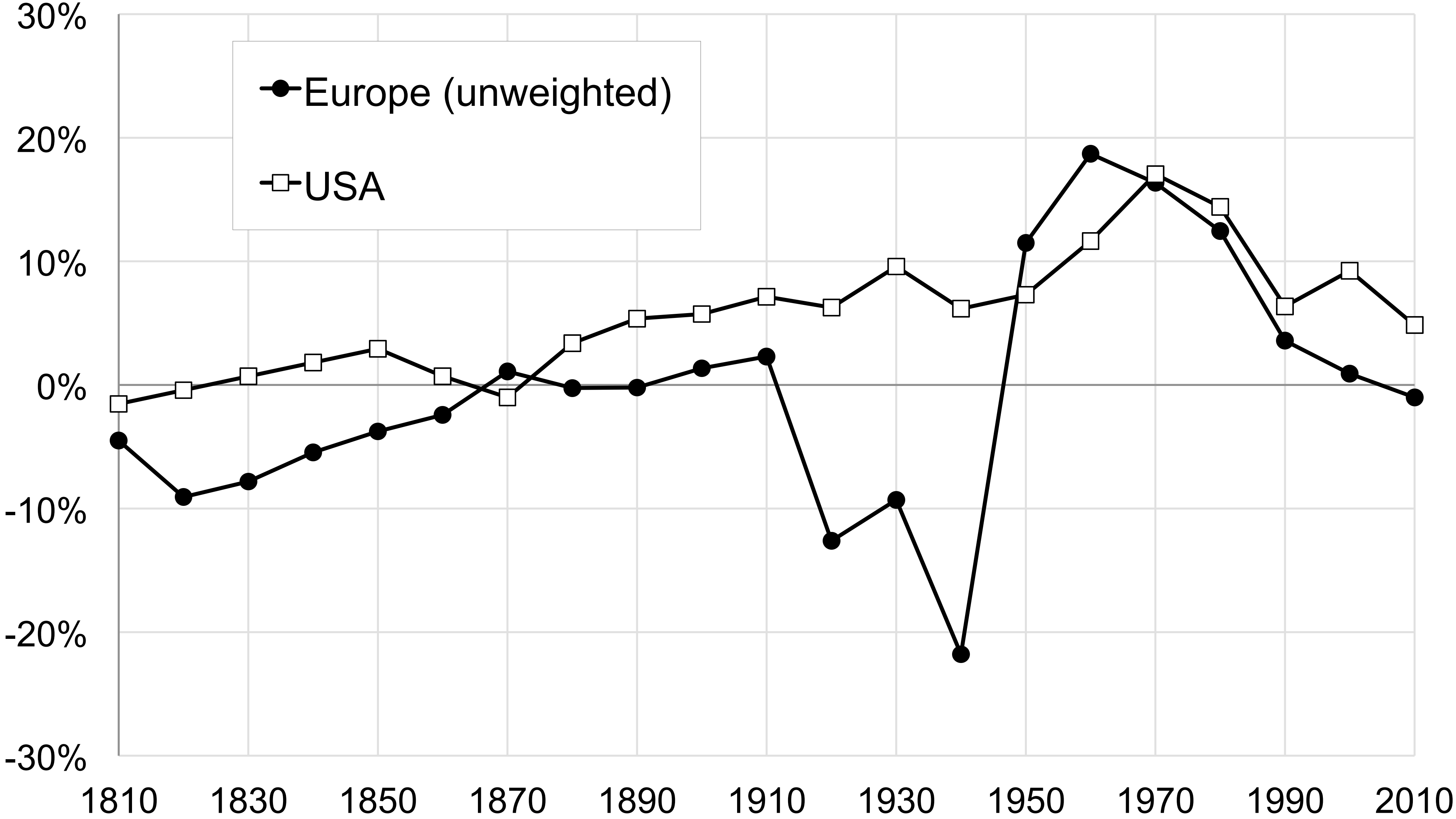


Figure A53: Housing wealth / national wealth 1870-2010 (decennial averages)

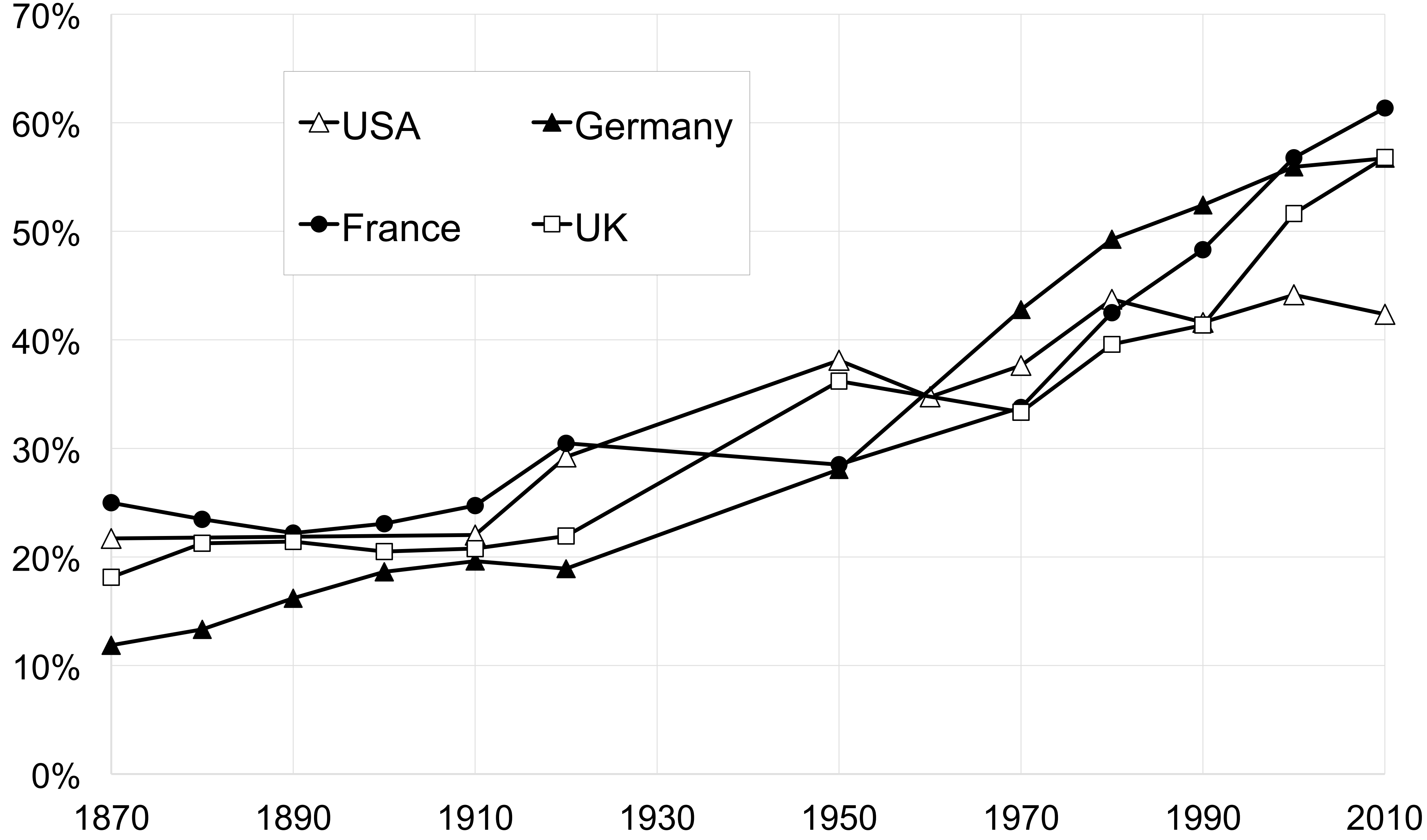
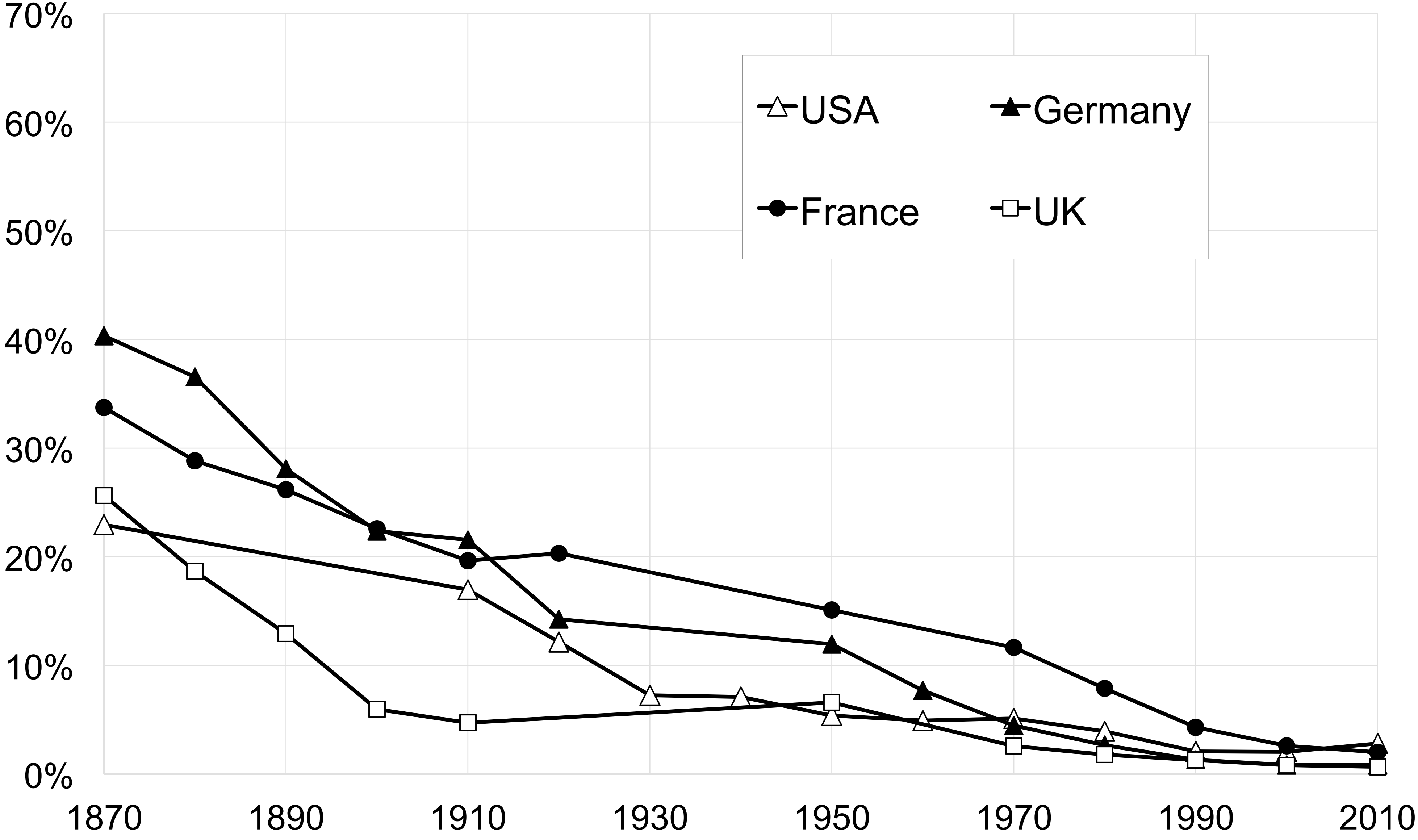


Figure A54: Agricultural wealth / national wealth 1870-2010 (decennial averages)



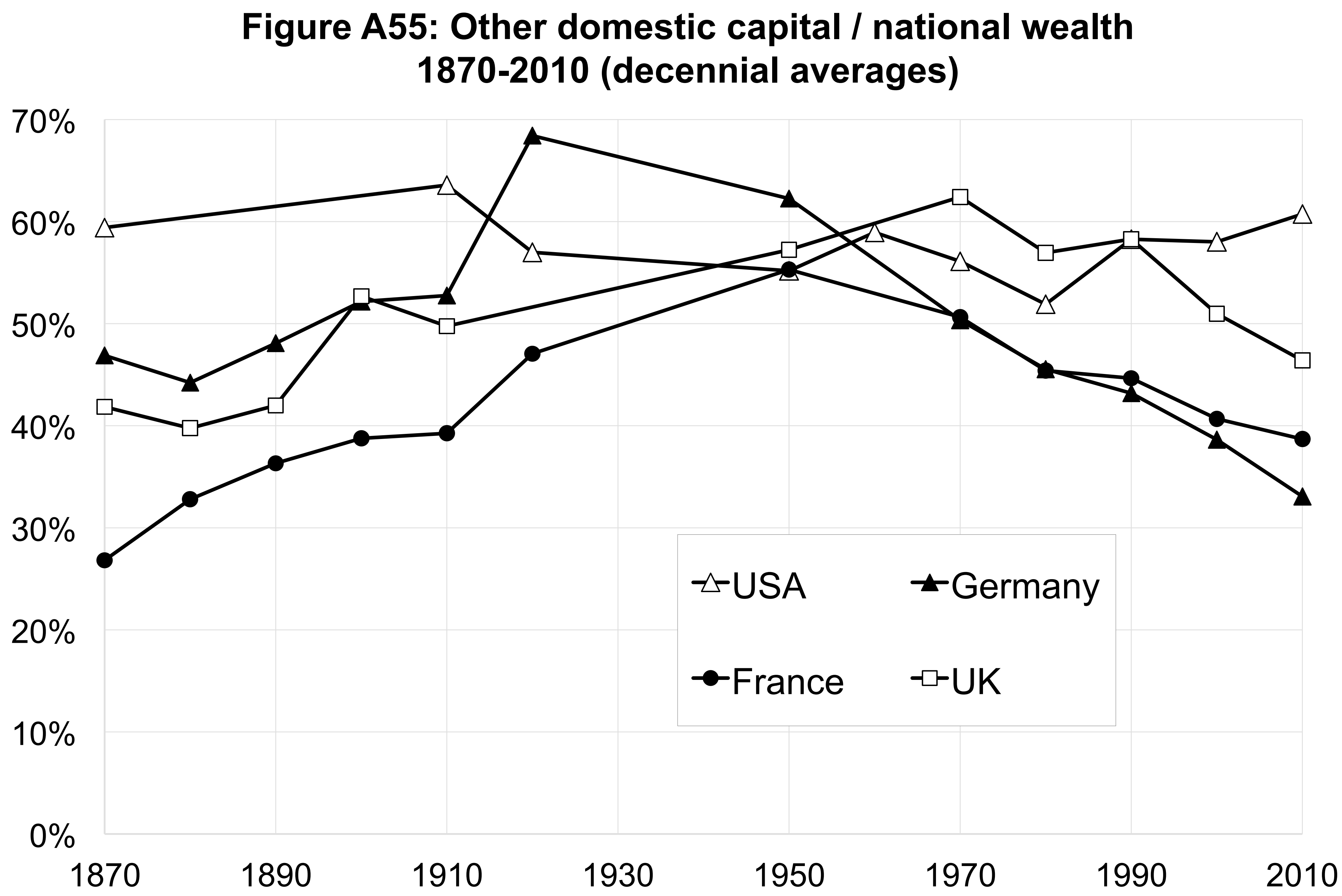


Figure A55: Other domestic capital / national wealth
1870-2010 (decennial averages)
70%
60%
50%
40%
30%
20%
10%
0%
1870
1890
1910
1930
1950
1970
1990
2010
USA
Germany
France
UK

Figure A56: Net foreign wealth / national wealth 1870-2010 (decennial averages)

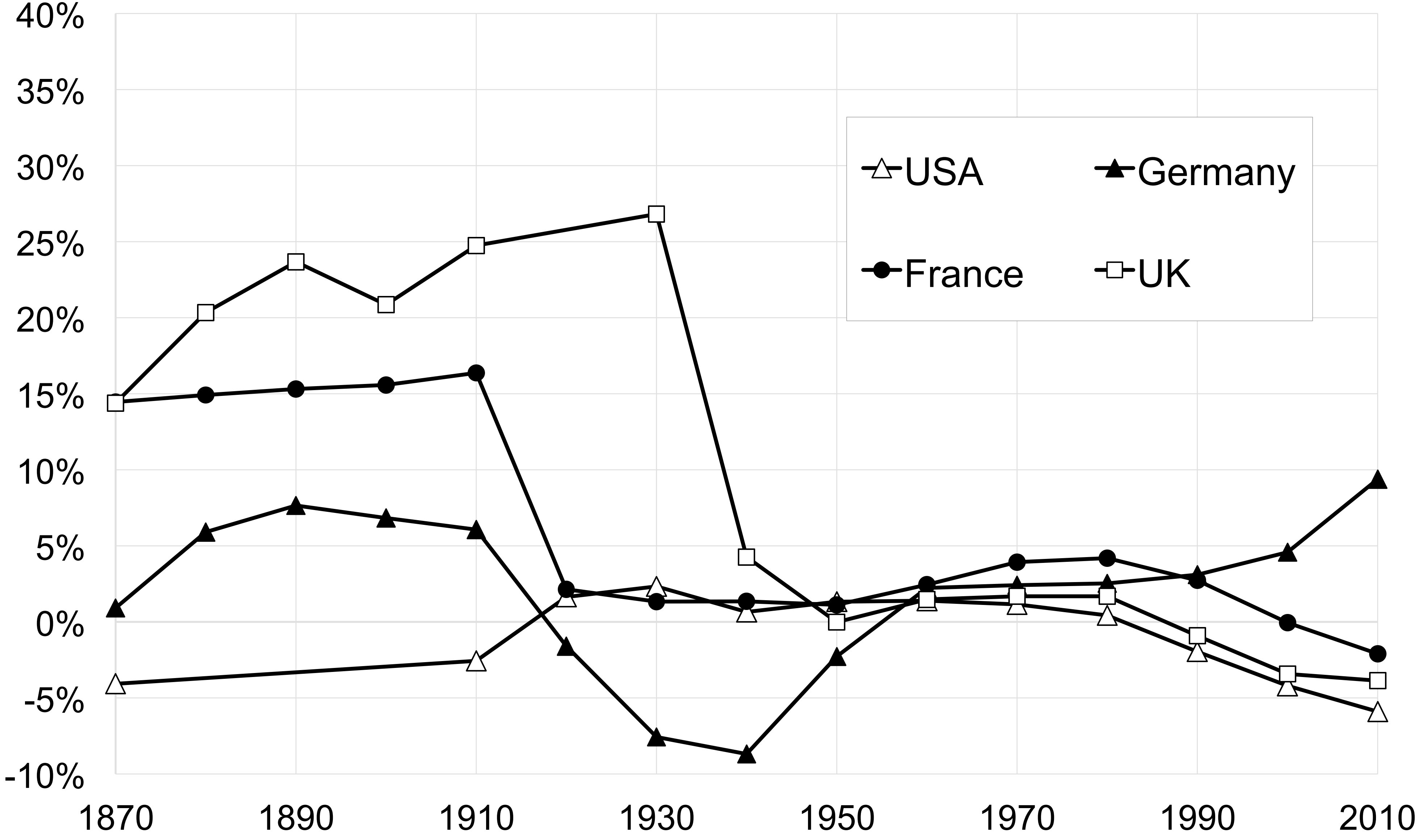
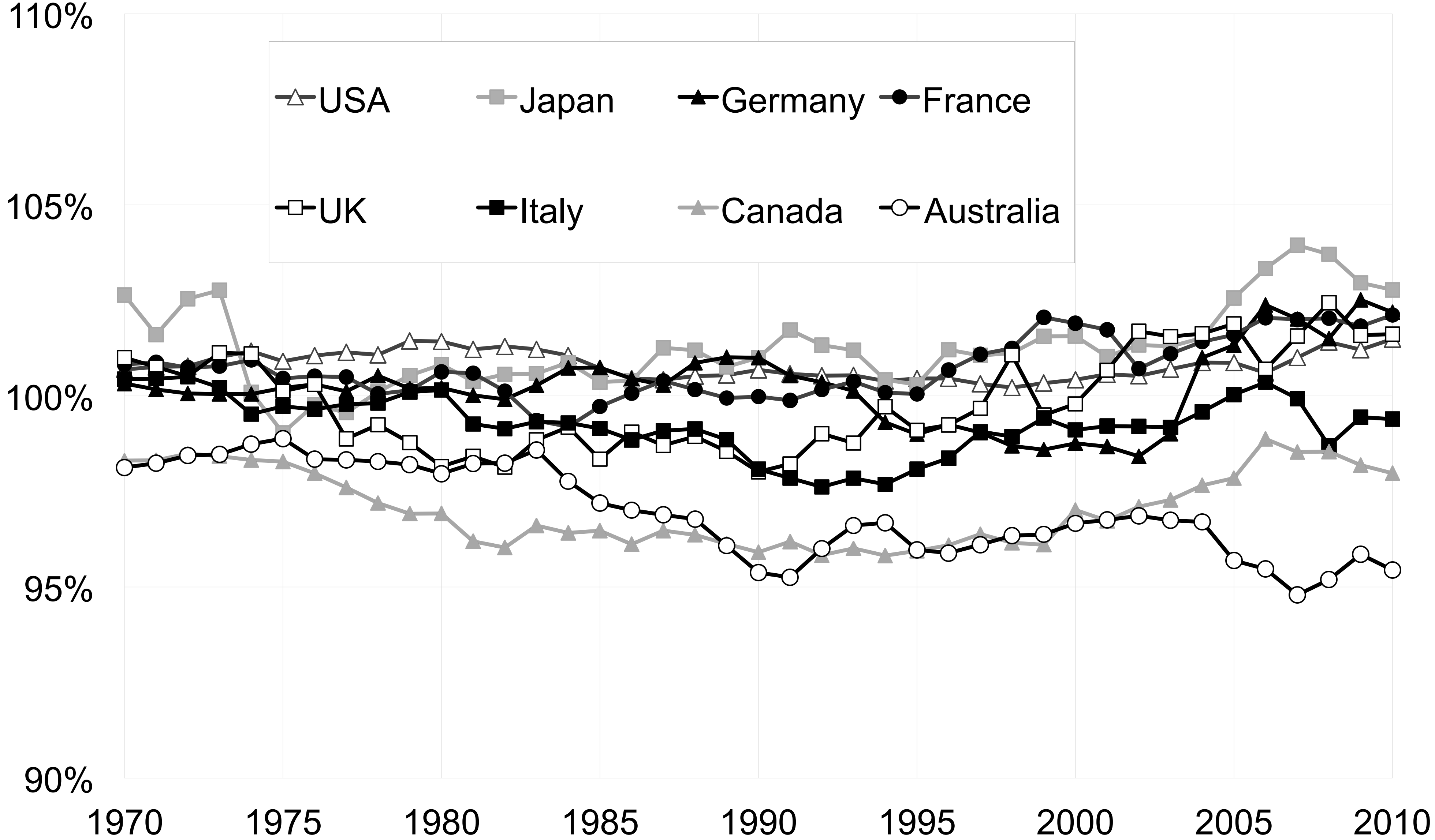


Figure A57: National income / domestic product ratios, 1970-2010



Authors' computations using country national accounts. National income = domestic product + net foreign income

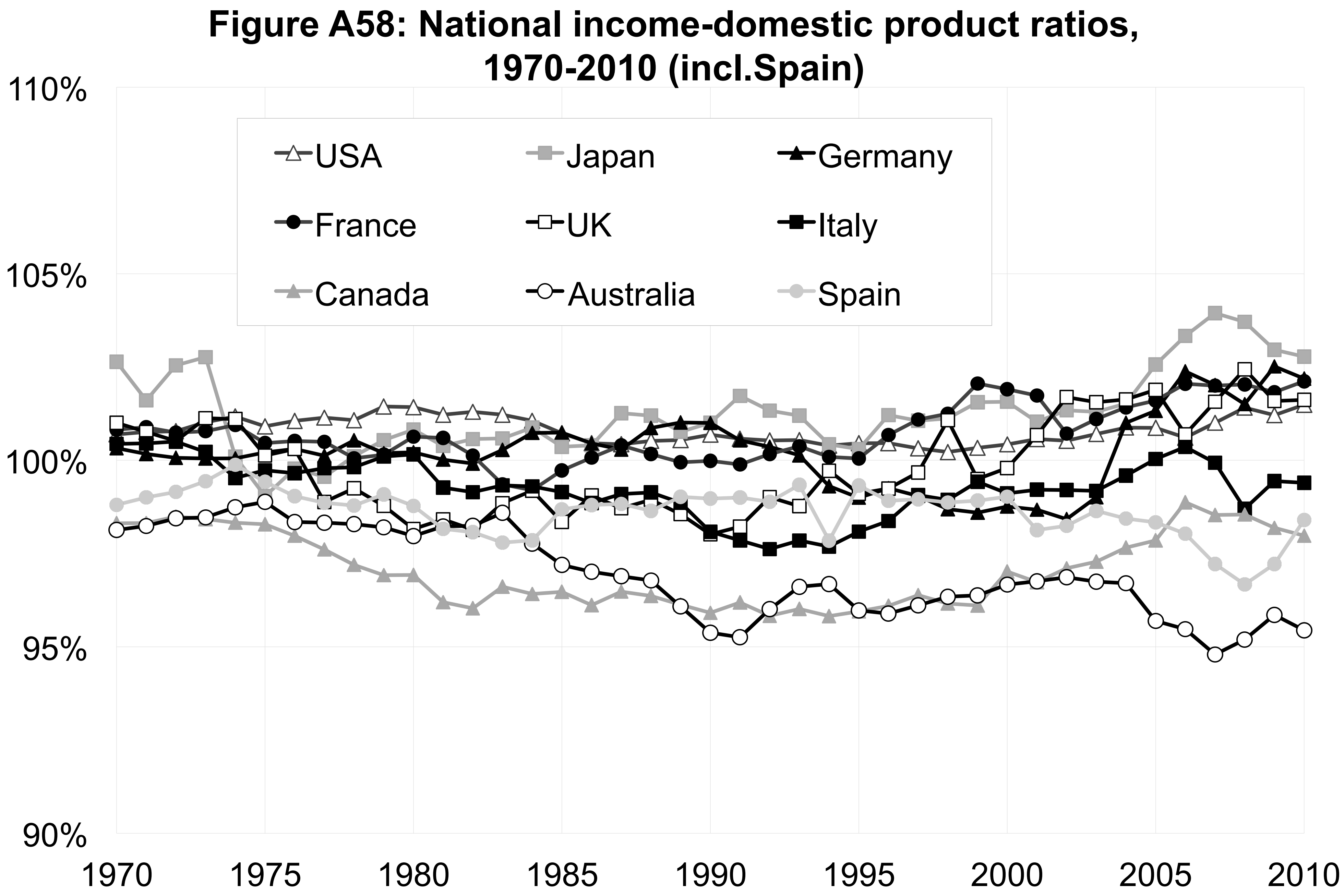
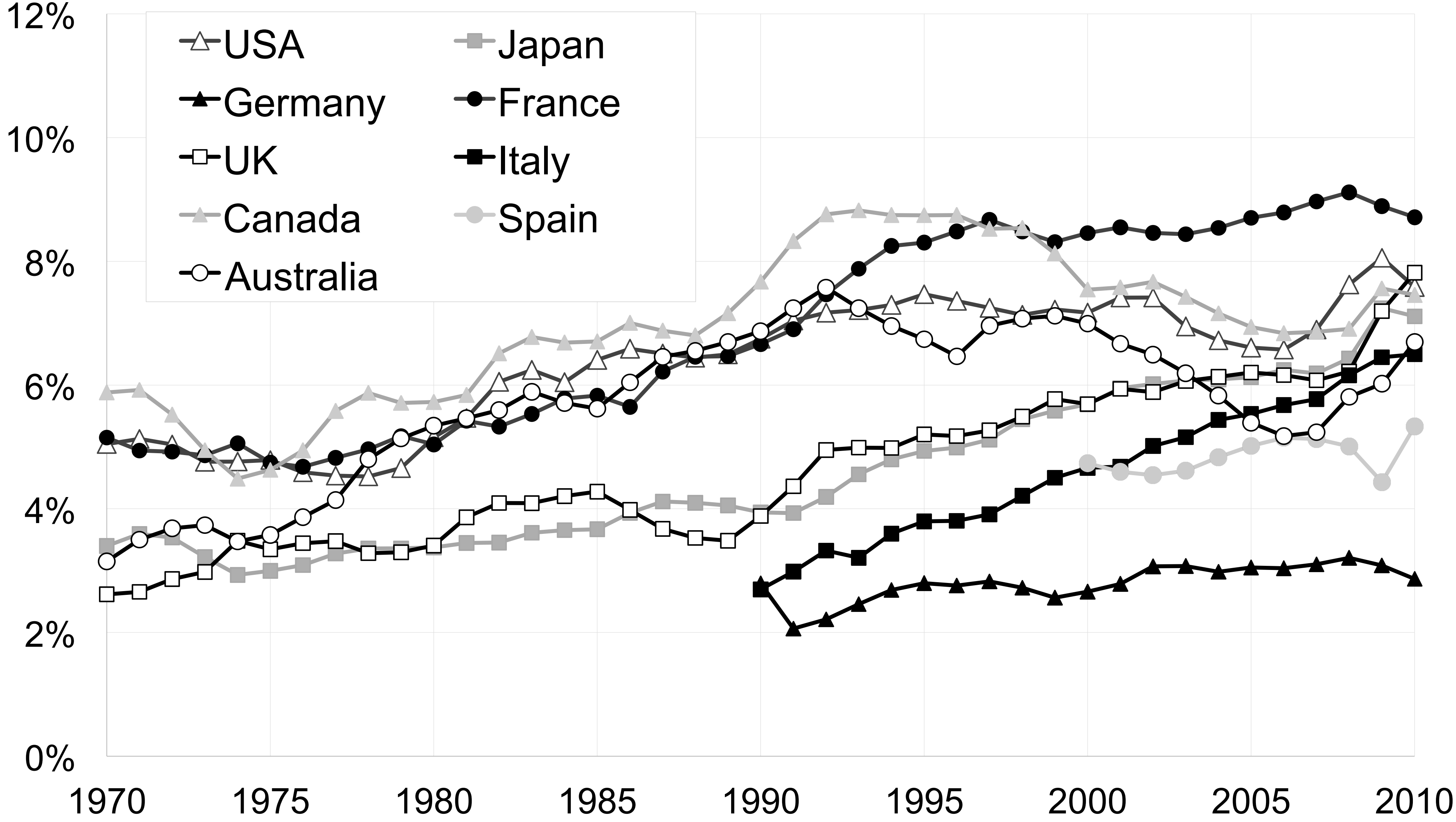


Figure A58: National income-domestic product ratios,
1970-2010 (incl.Spain)
110%
105%
100%
95%
90%
USA
Japan
Germany
France
UK
Italy
Canada
Australia
Spain
1970
1975
1980
1985
1990
1995
2000
2005
2010

Figure A59: Housing product-domestic product ratios, 1970-2010



Note: Domestic product = housing product (rental value of housing) + business product (self-employed + corporate) + government product

Figure A60: Rates of return to housing capital, 1970-2010

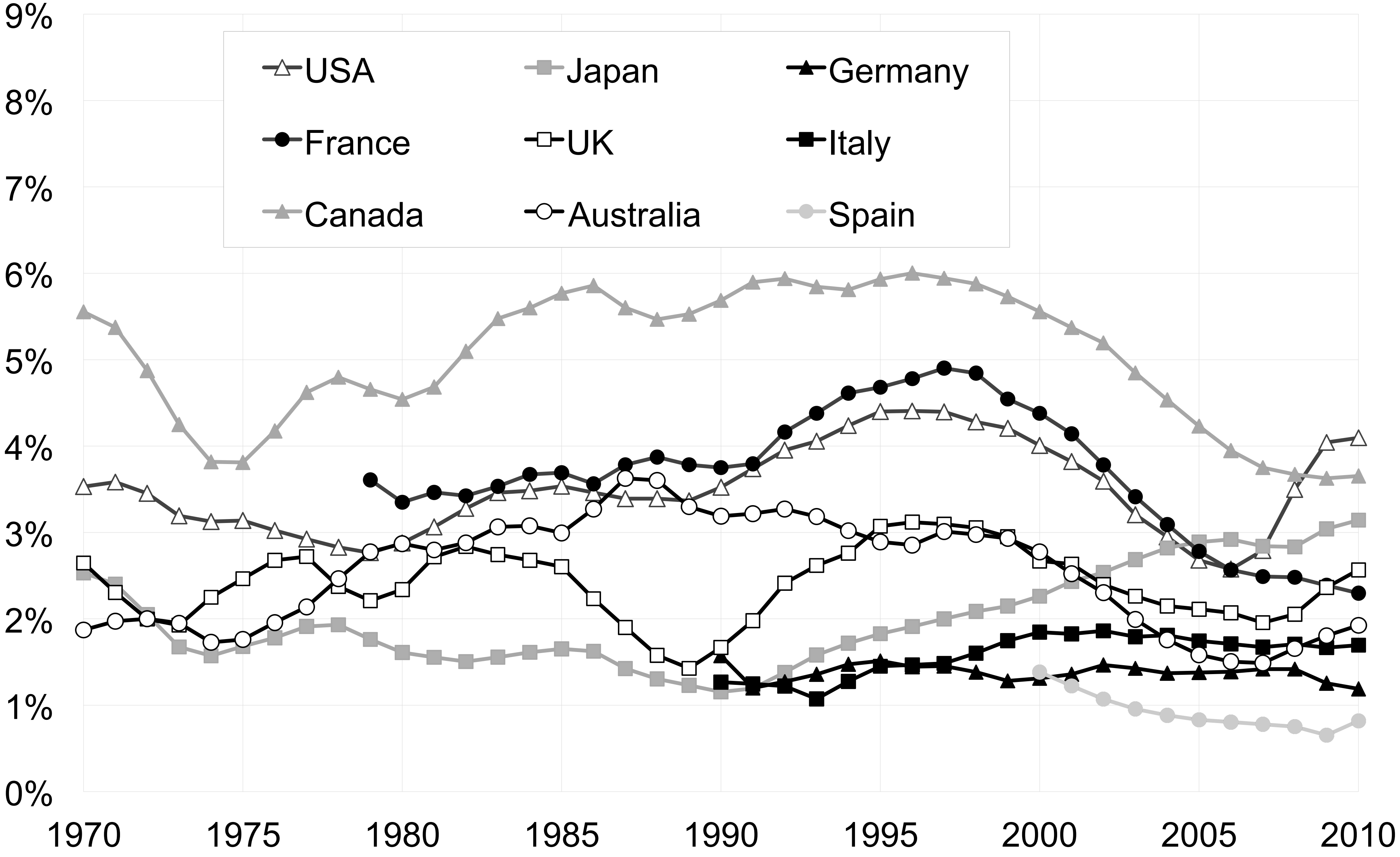


Figure A61: Non-corporate business product / Total domestic product ratios, 1970-2010

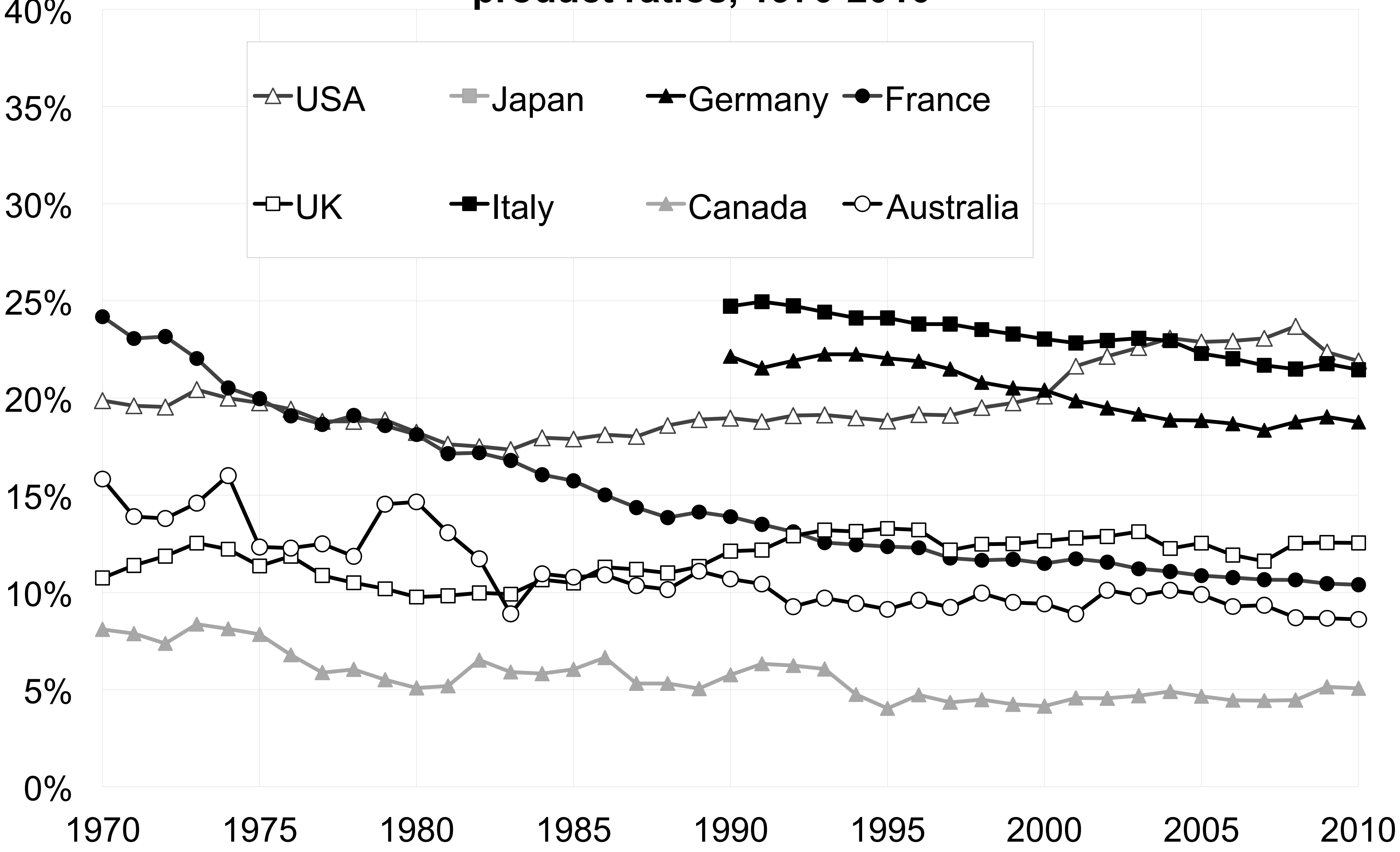


Figure A62: Corporate product-domestic product ratios, 1970-2010

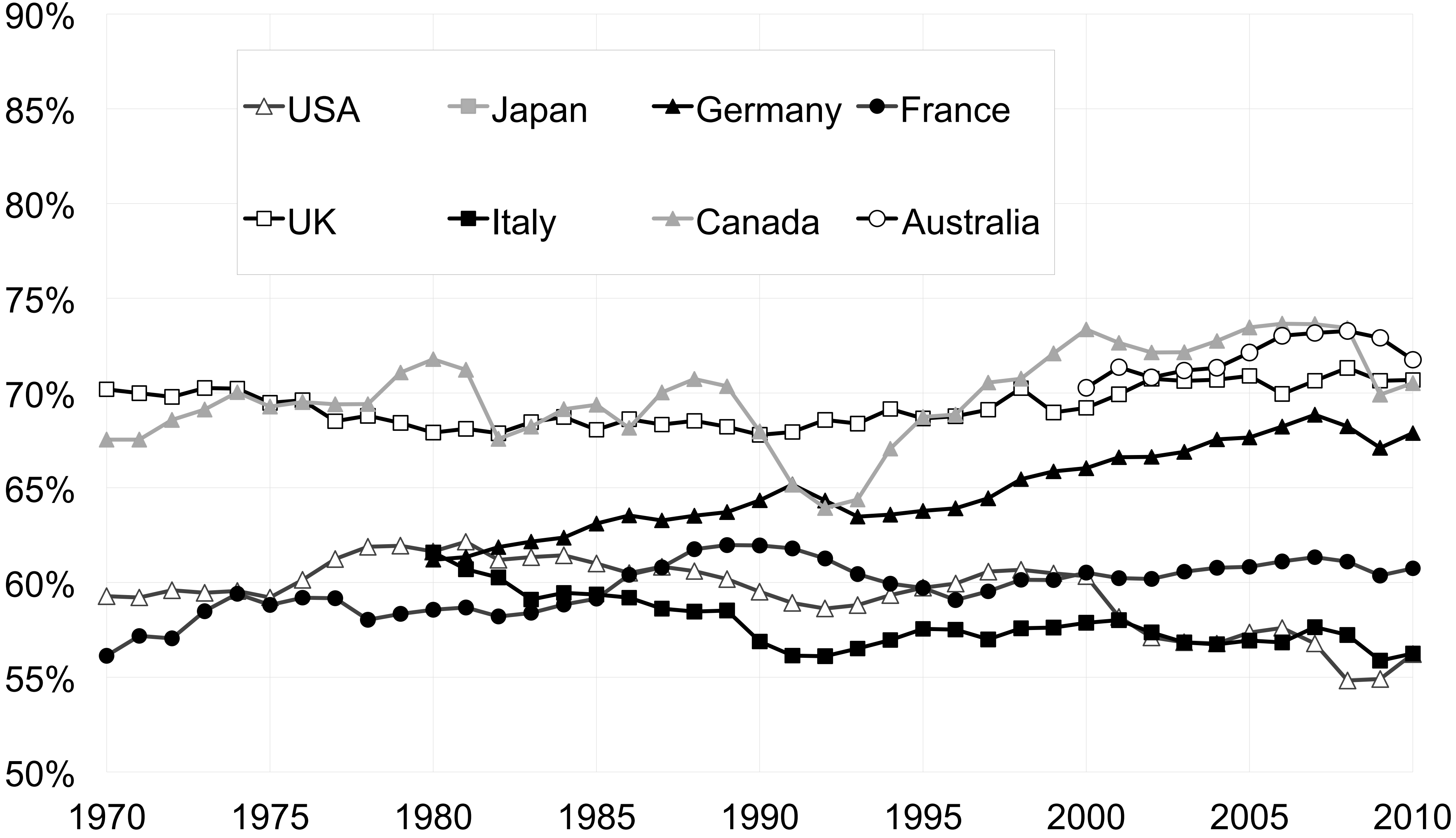
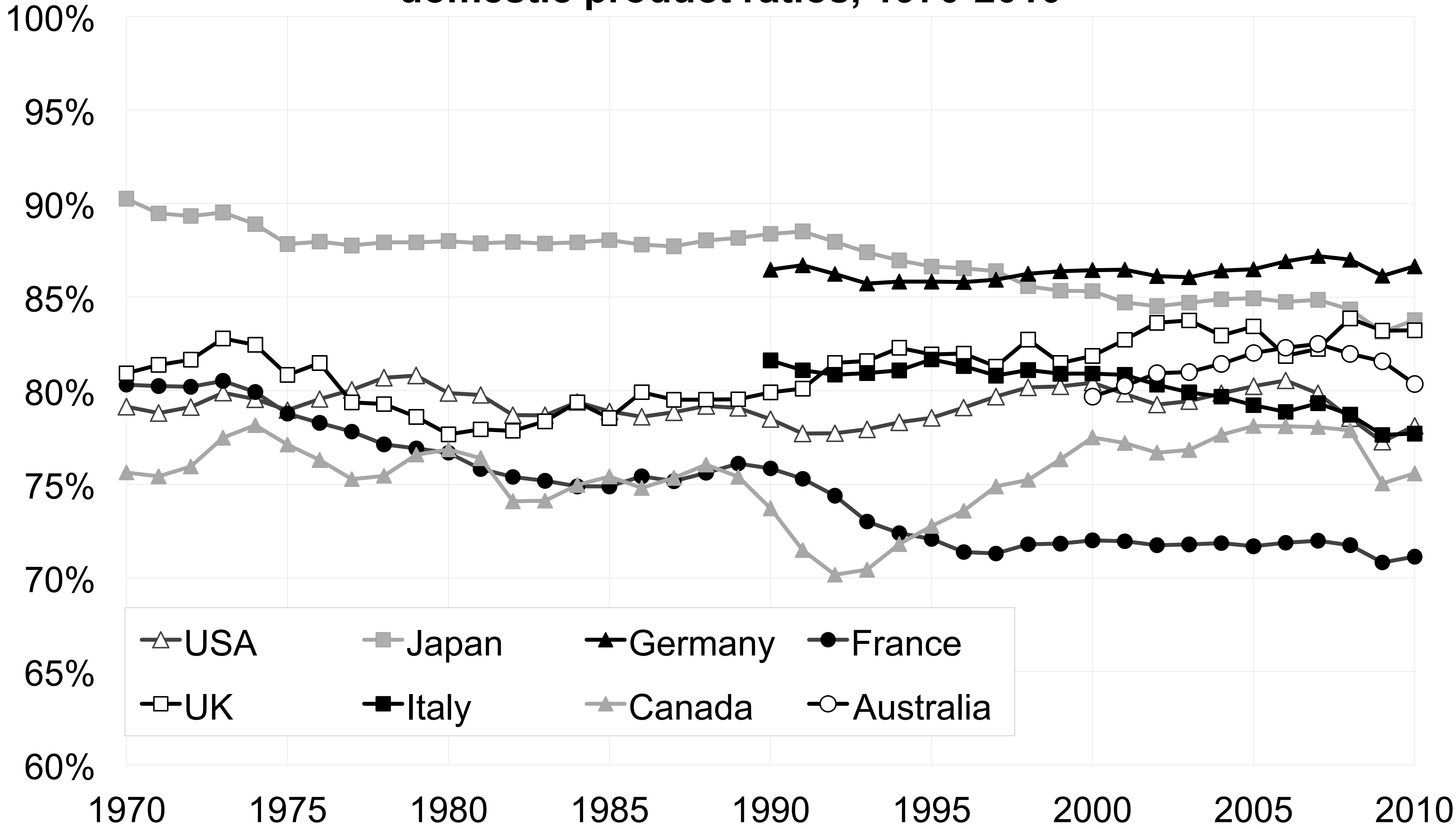
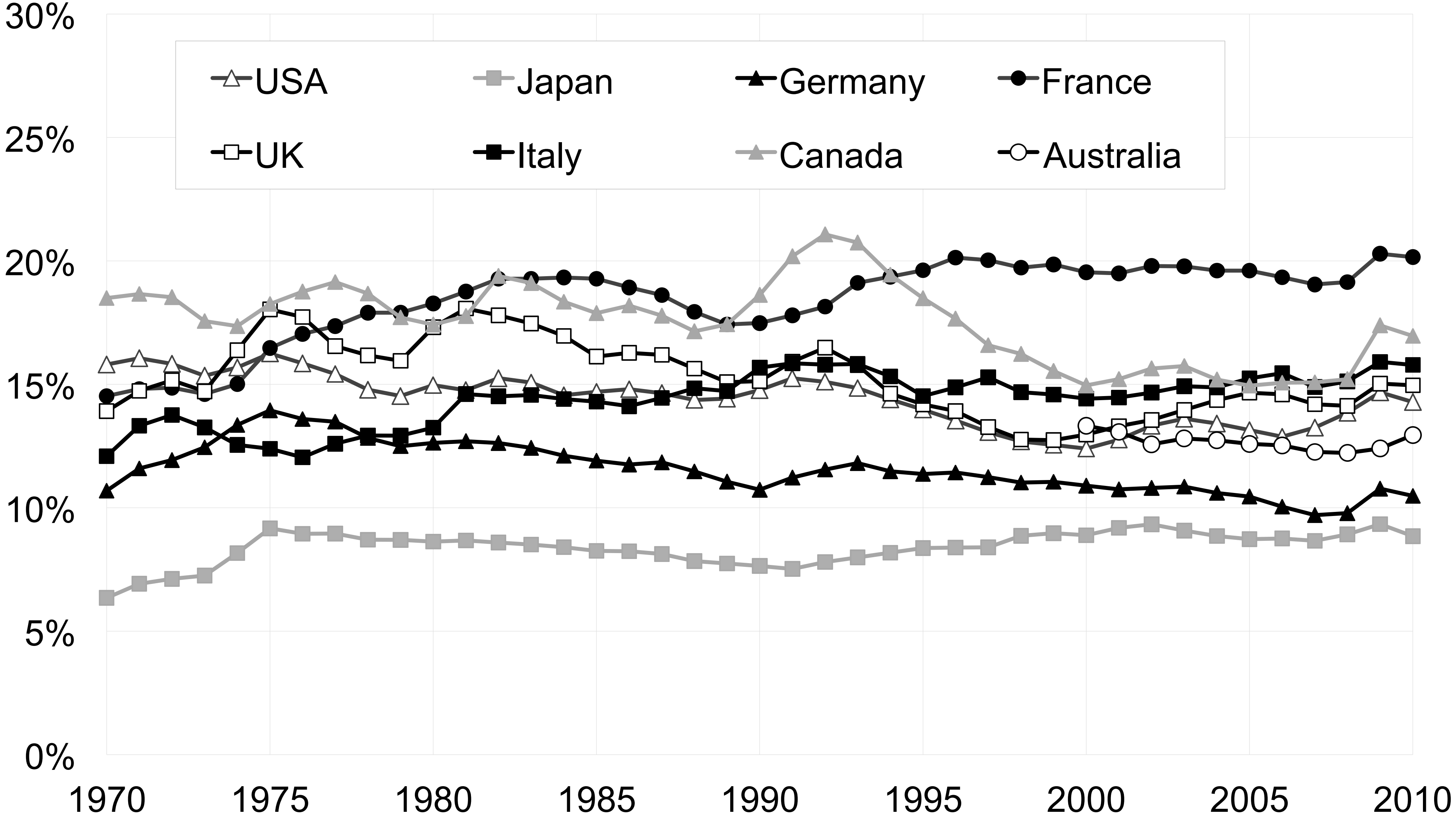


Figure A63: Business (non-corp.+corporate) product-domestic product ratios, 1970-2010



Note: Domestic product = housing product (rental value of housing) + business product (non-corporate + corporate) + government product

Figure A64: Government product-domestic product ratios, 1970-2010



Note: Domestic product = housing product (rental value of housing) + business product (self-employed + corporate) + government product

Figure A65: Disposable income / national income ratios 1970-2010

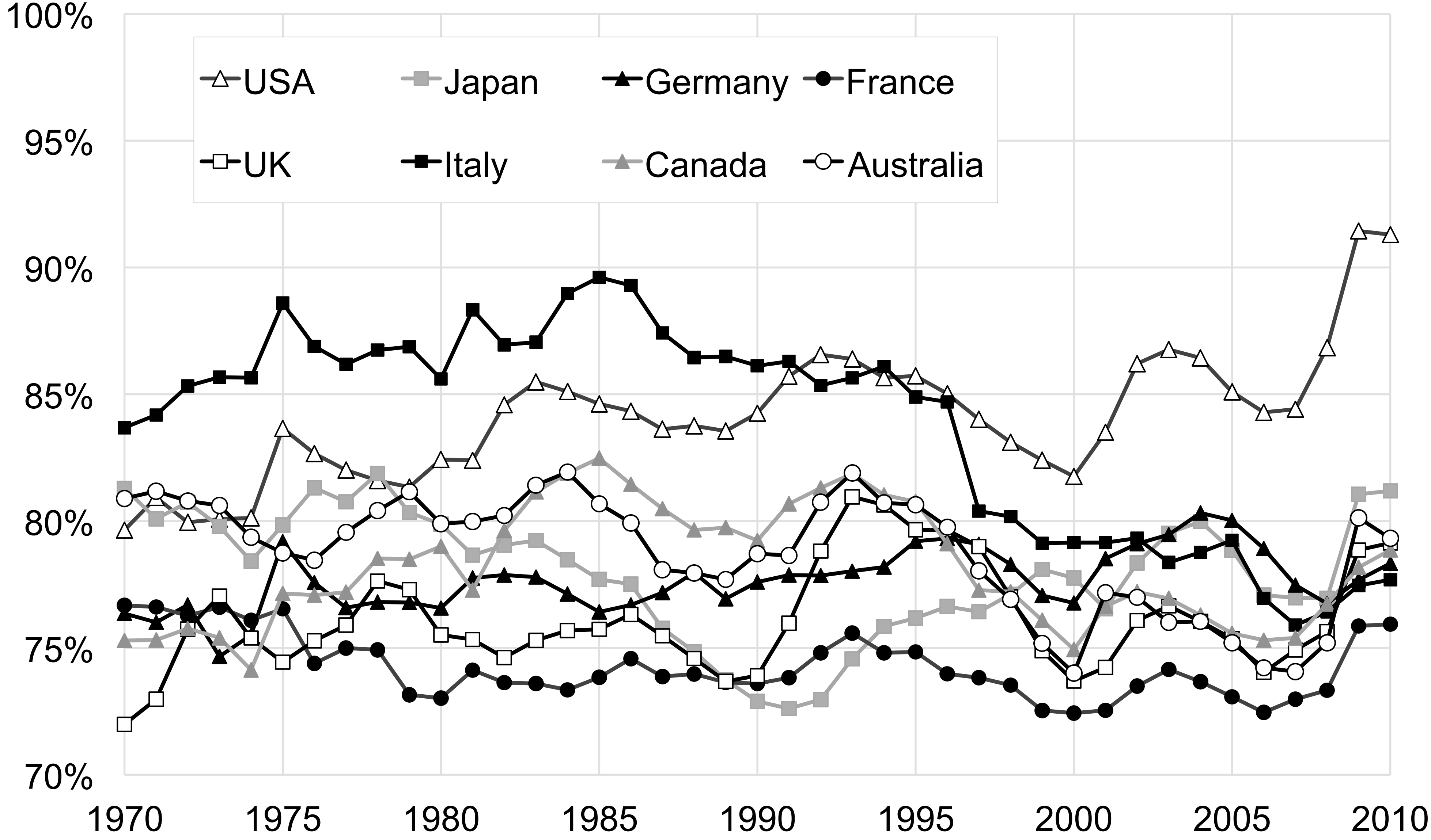


Figure A66: Capital share (excl. gov. interest) in factor-price national income, 1910-2010

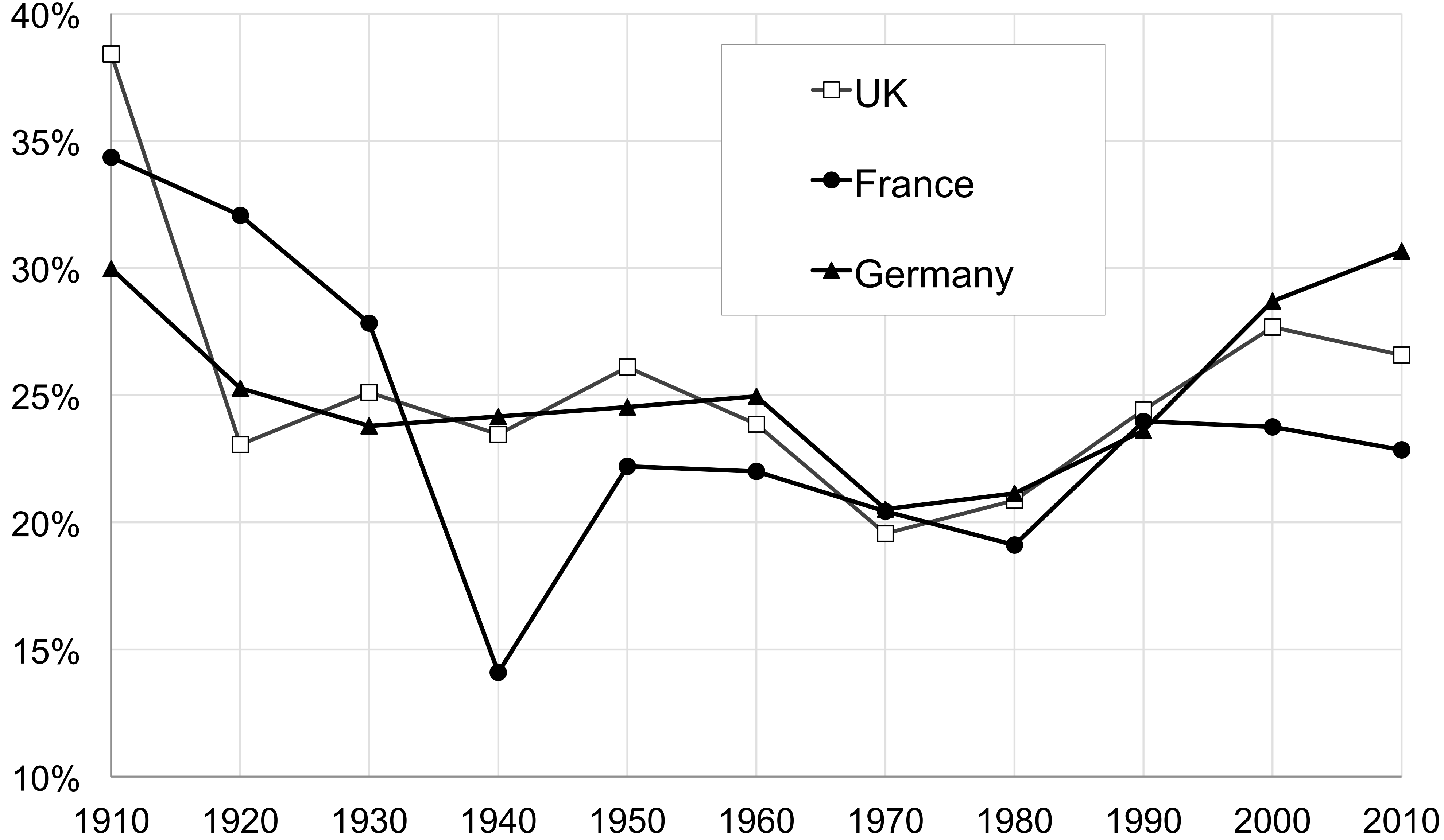
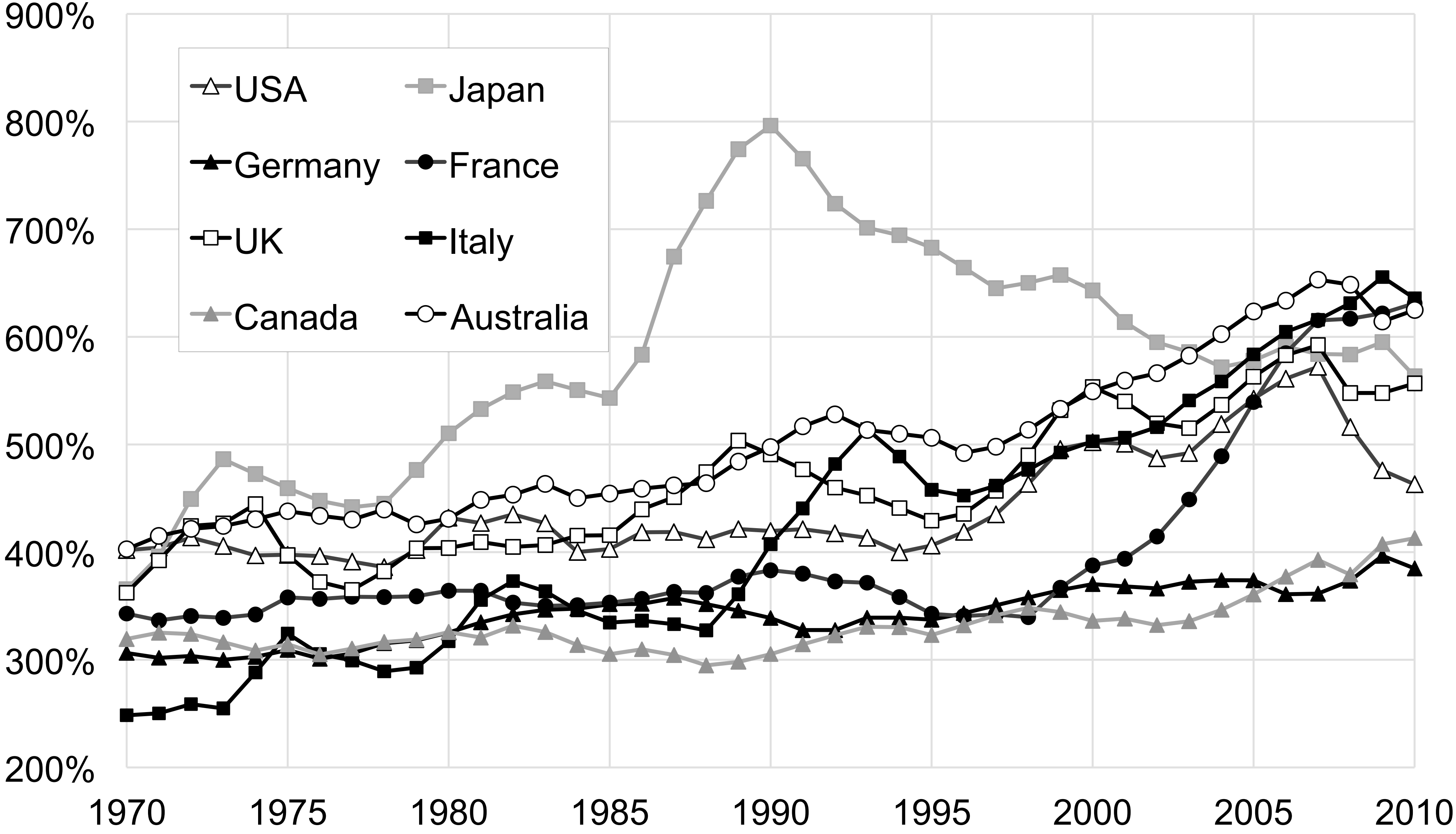
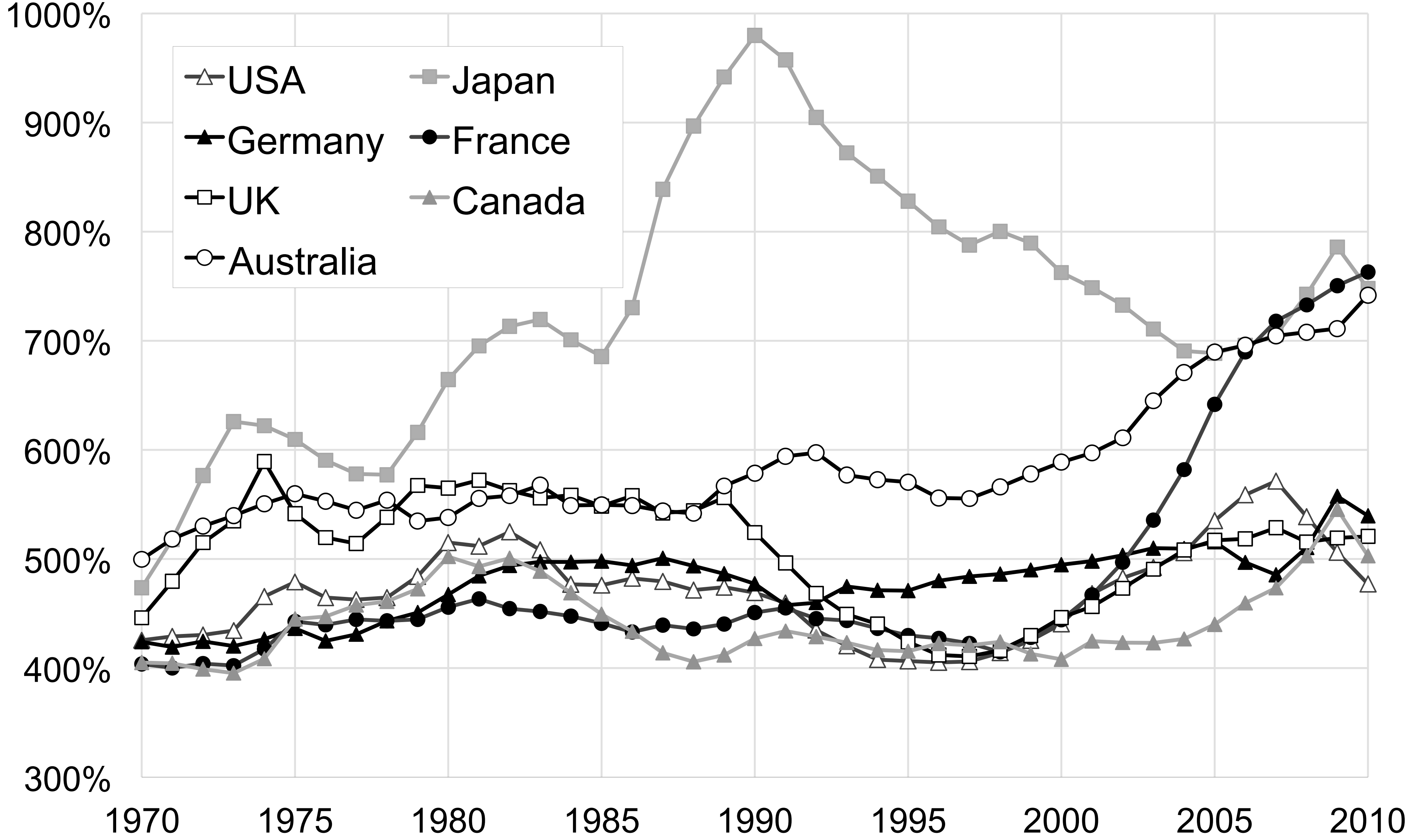


Figure A67: Domestic capital-output ratio 1970-2010



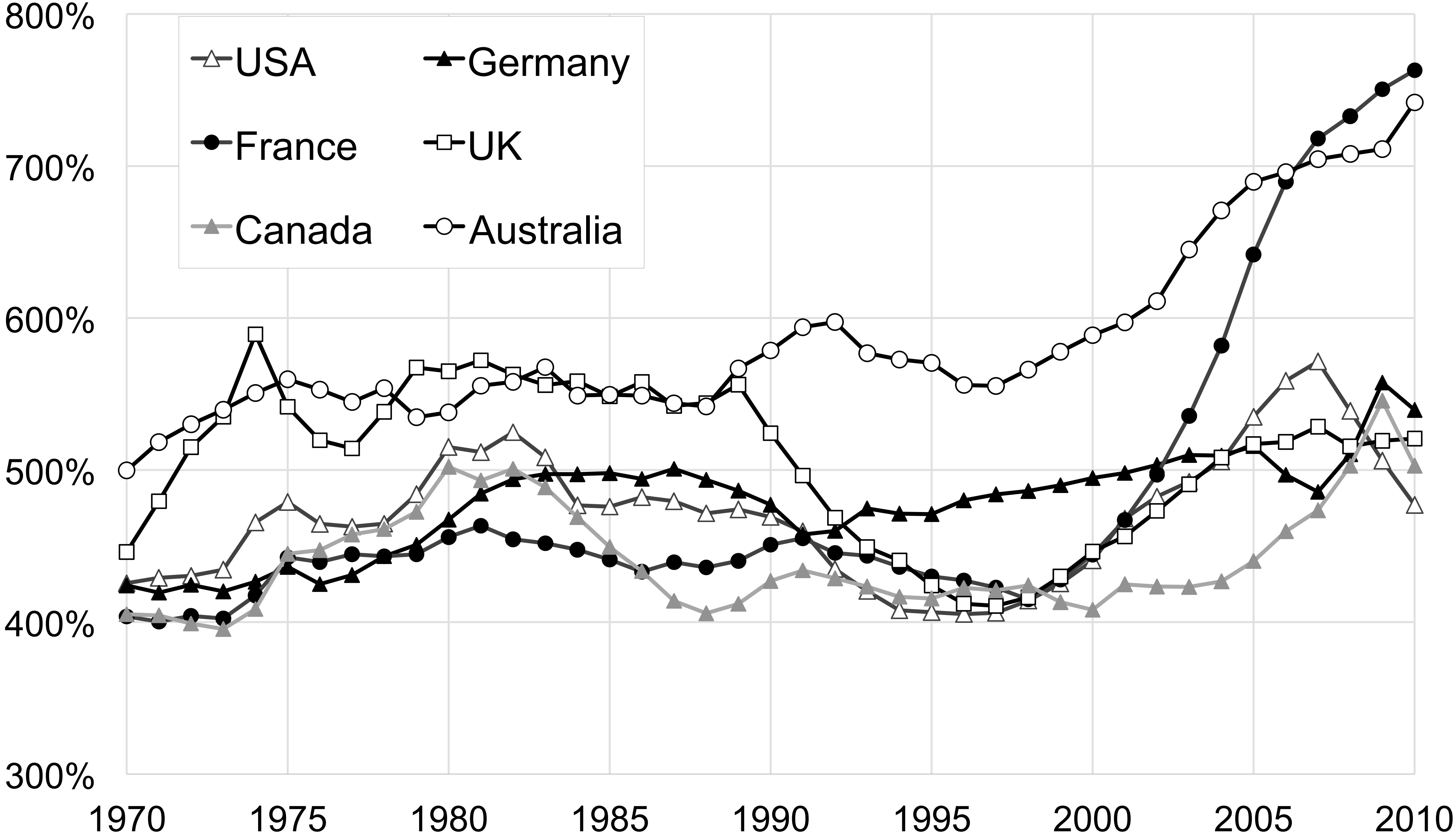
Authors' computations using country national accounts. Domestic capital-output ratio = national wealth - foreign wealth, % domestic product

Figure A68: Book-value domestic capital-output 1970-2010



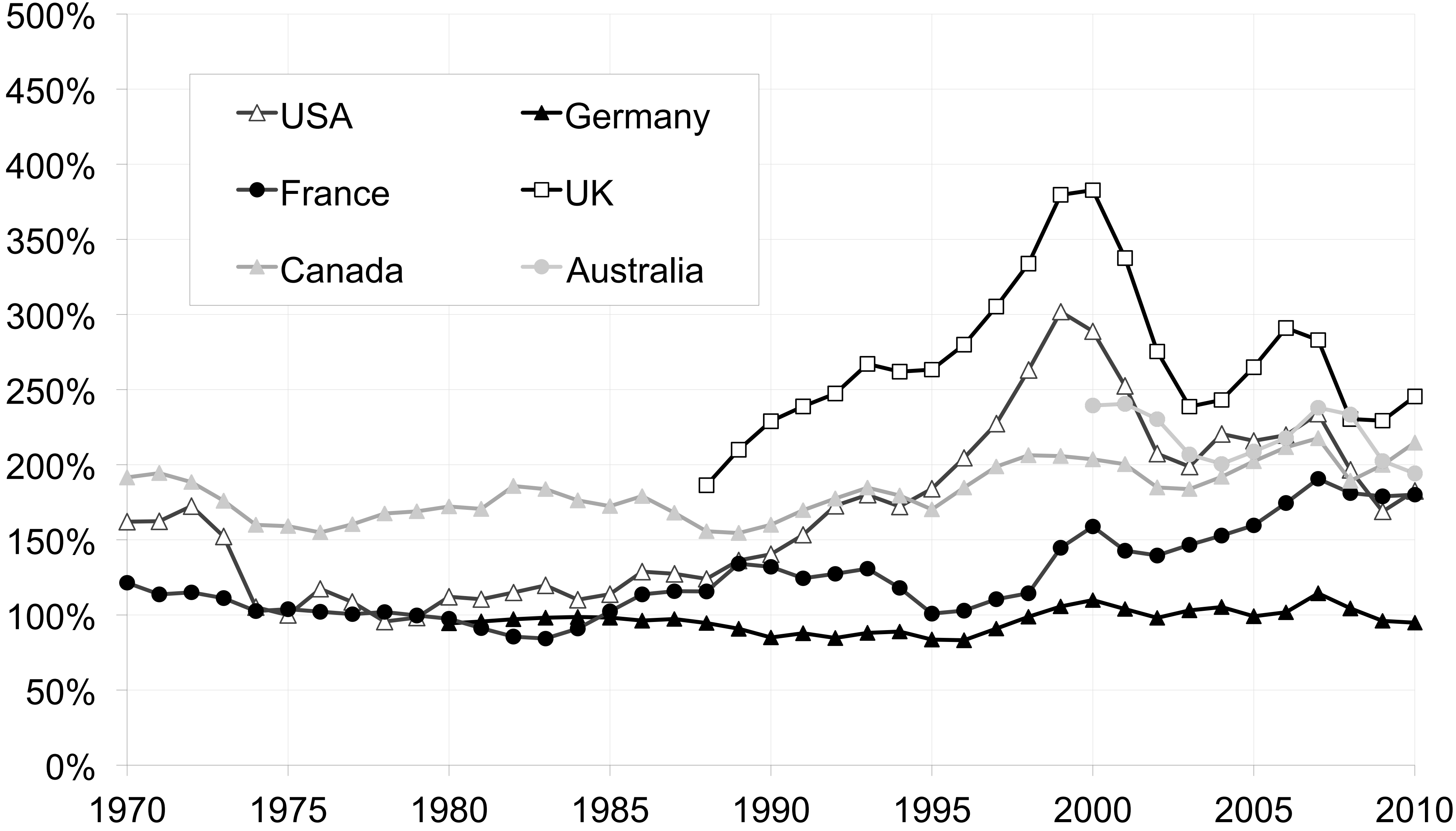
Note: Book-value domestic capital-output ratio = (book-value national wealth - foreign wealth) / domestic product

Figure A69: Book- value domestic capital-output 1970-2010 (excl. Japan)



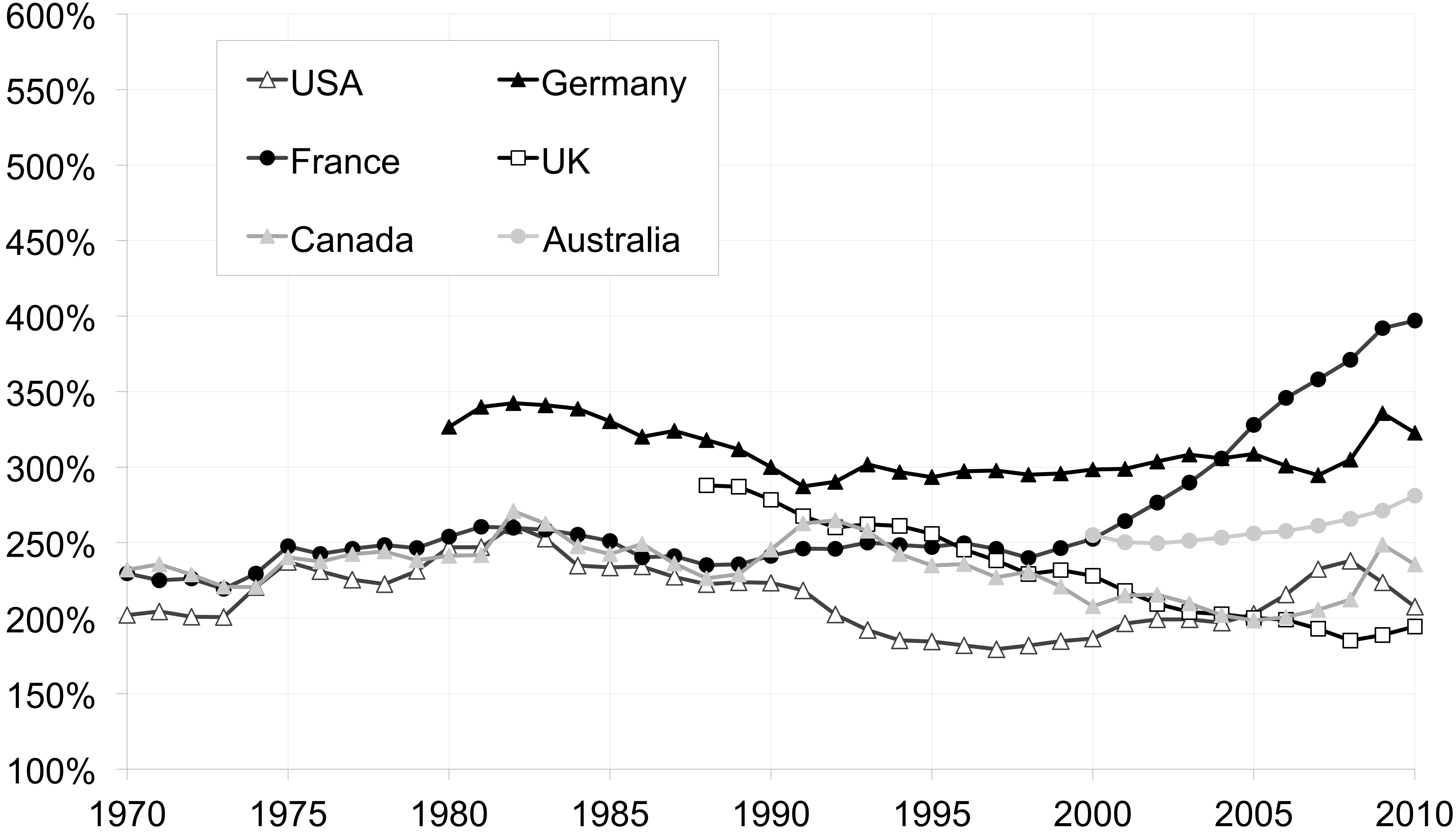
Note: Book-value domestic capital-output ratio = (book-value national wealth - foreign wealth) / domestic product

Figure A70: Corporate capital-output ratios (market value), 1970-2010



Note: Corporate capital-output ratios (market value) = market value of corp. nonfinancial assets/corporate product

Figure A71: Corporate capital-output ratios (book value), 1970-2010



Note: Corporate capital-output ratios (market value) = book value of corp. nonfinancial assets /corporate product

Figure A72: Gross household & NPISH assets / National income 1970-2010

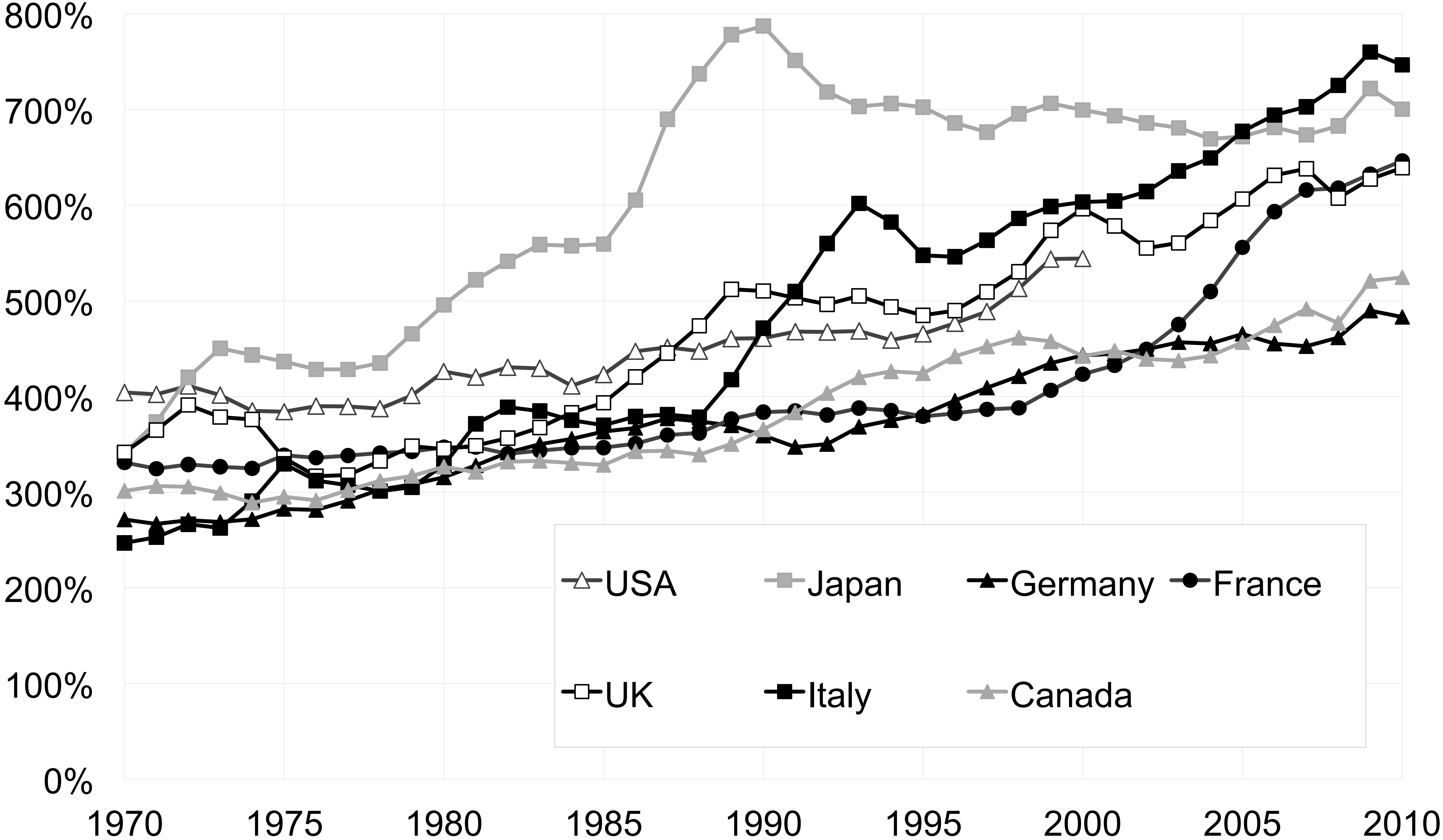


Figure A73: Gross household & NPISH financial assets / National income 1970-2010

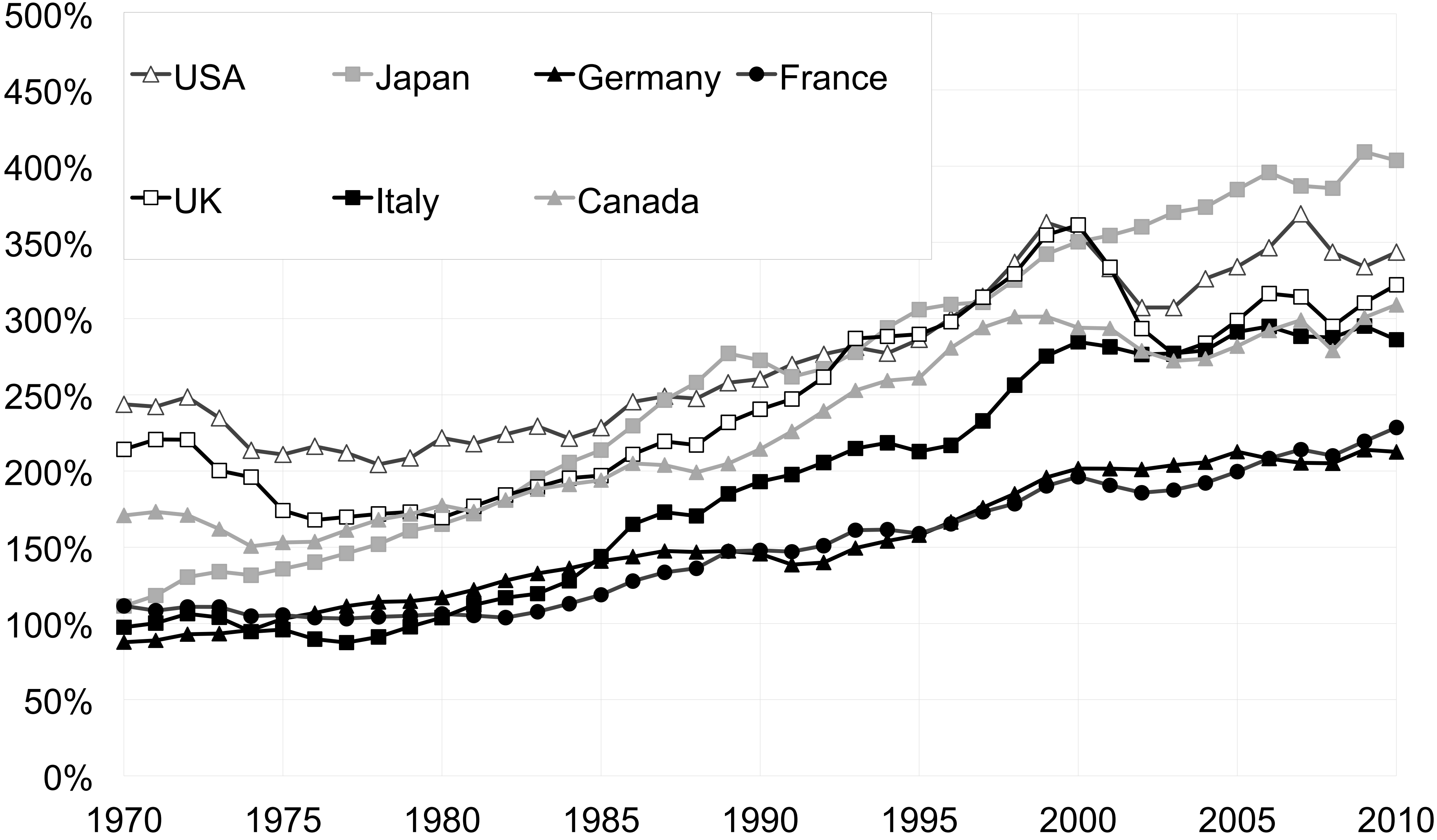


Figure A74: Gross household & NPISH nonfinancial assets / National income 1970-2010

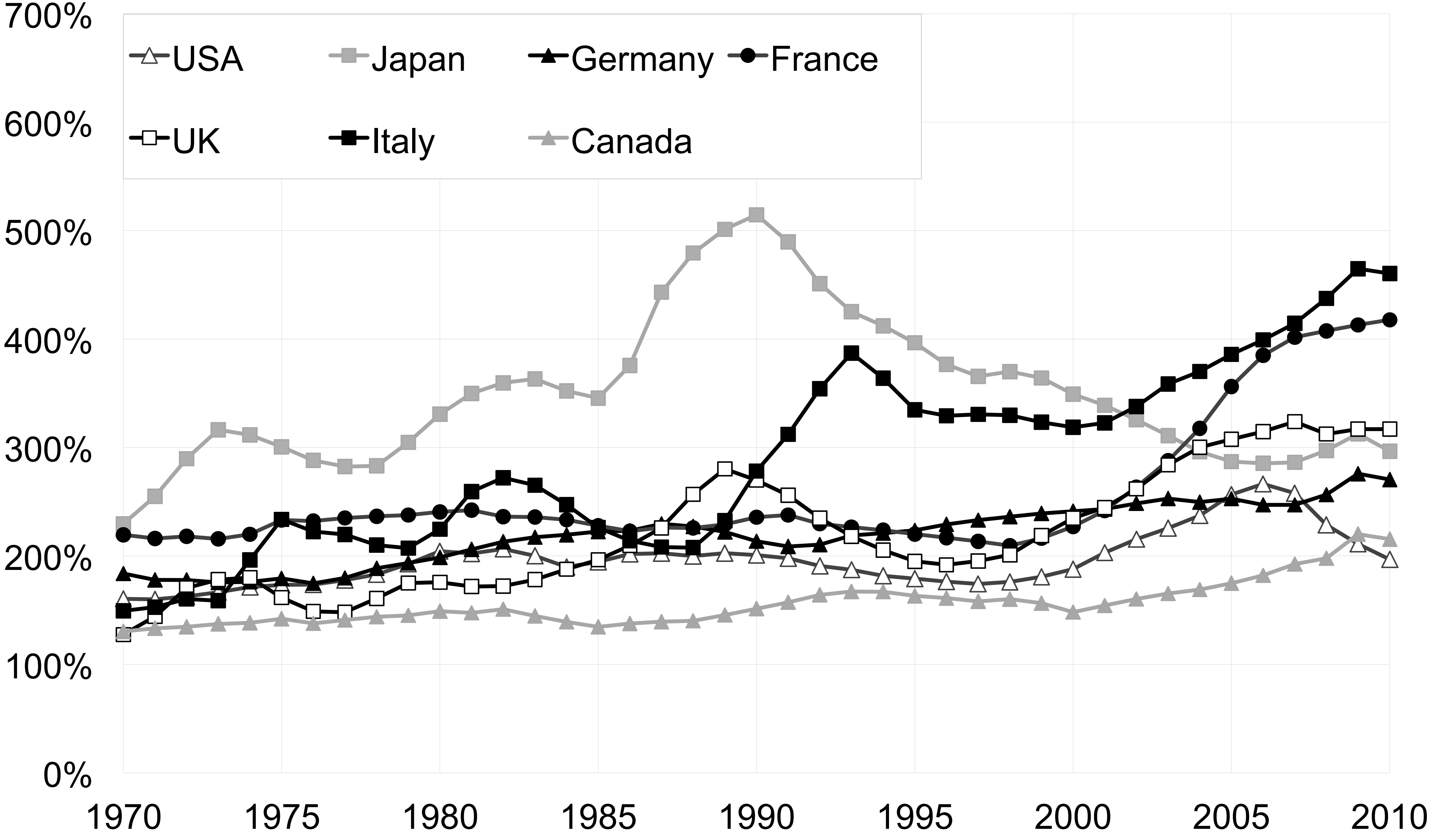


Figure A75: Gross household & NPISH liabilities / National income 1970-2010

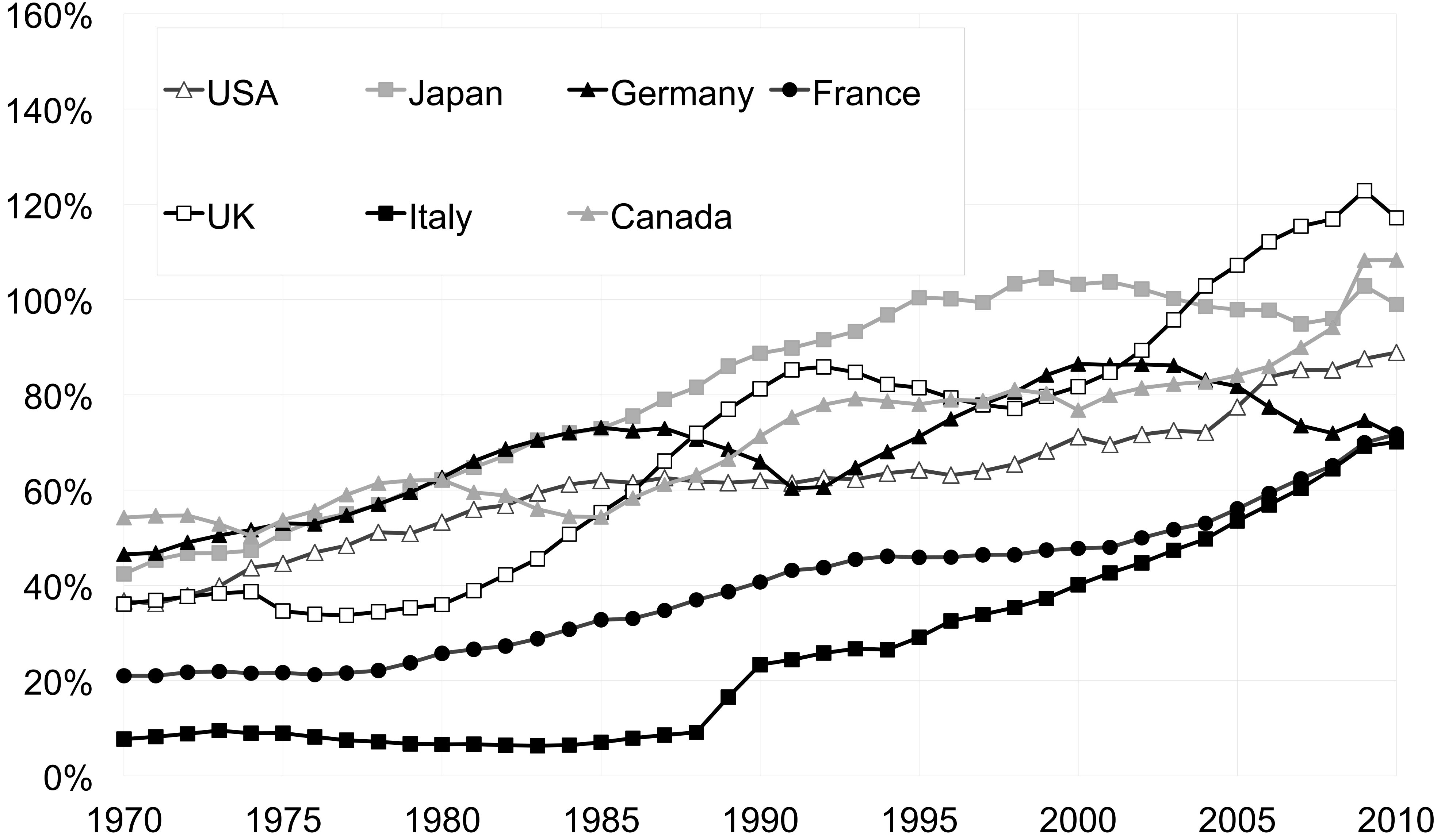


Figure A76: Gross financial wealth / Gross household & NPISH wealth, 1970-2010

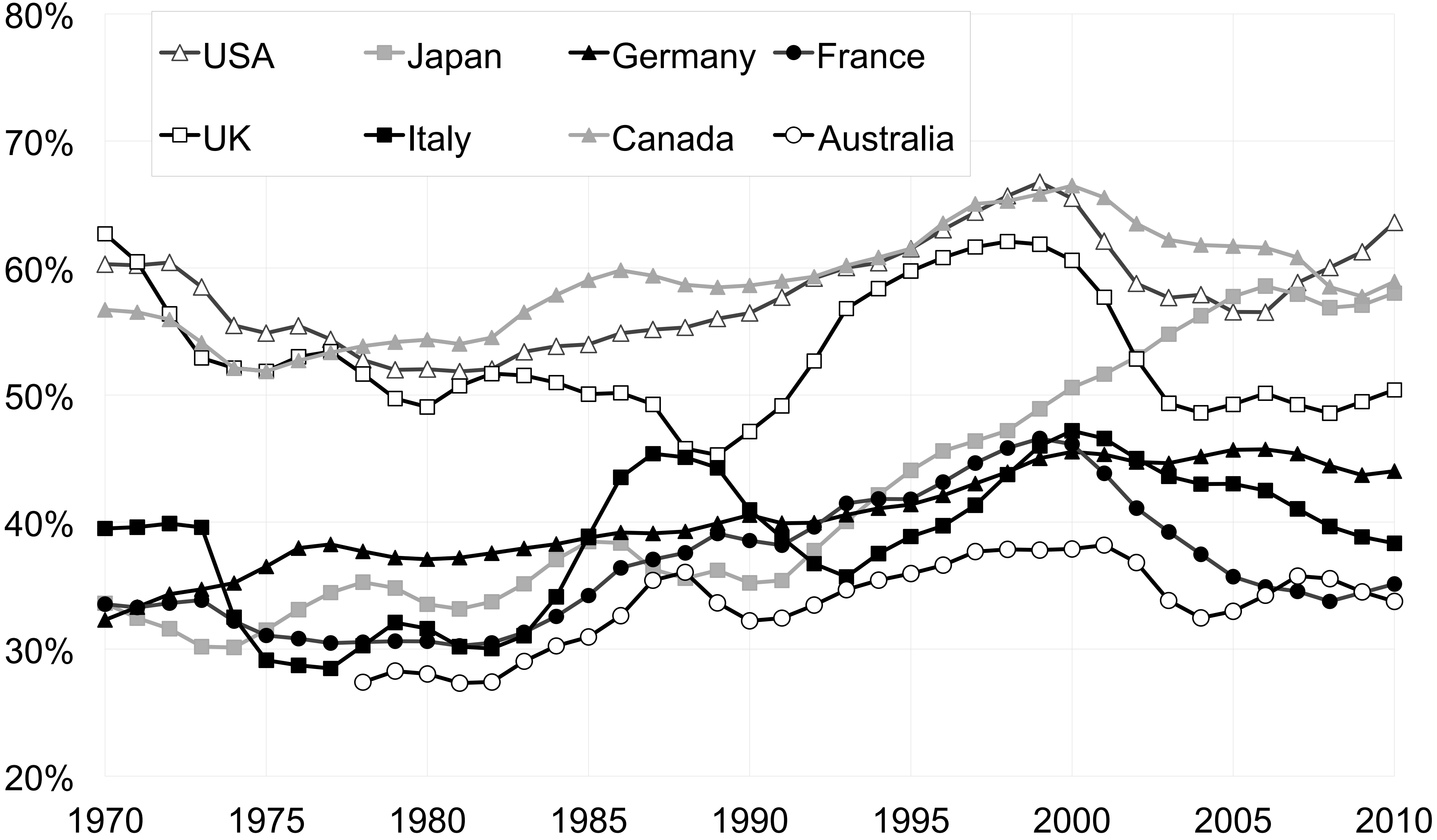


Figure A77: Gross housing wealth / Gross household & NPISH wealth, 1970-2010

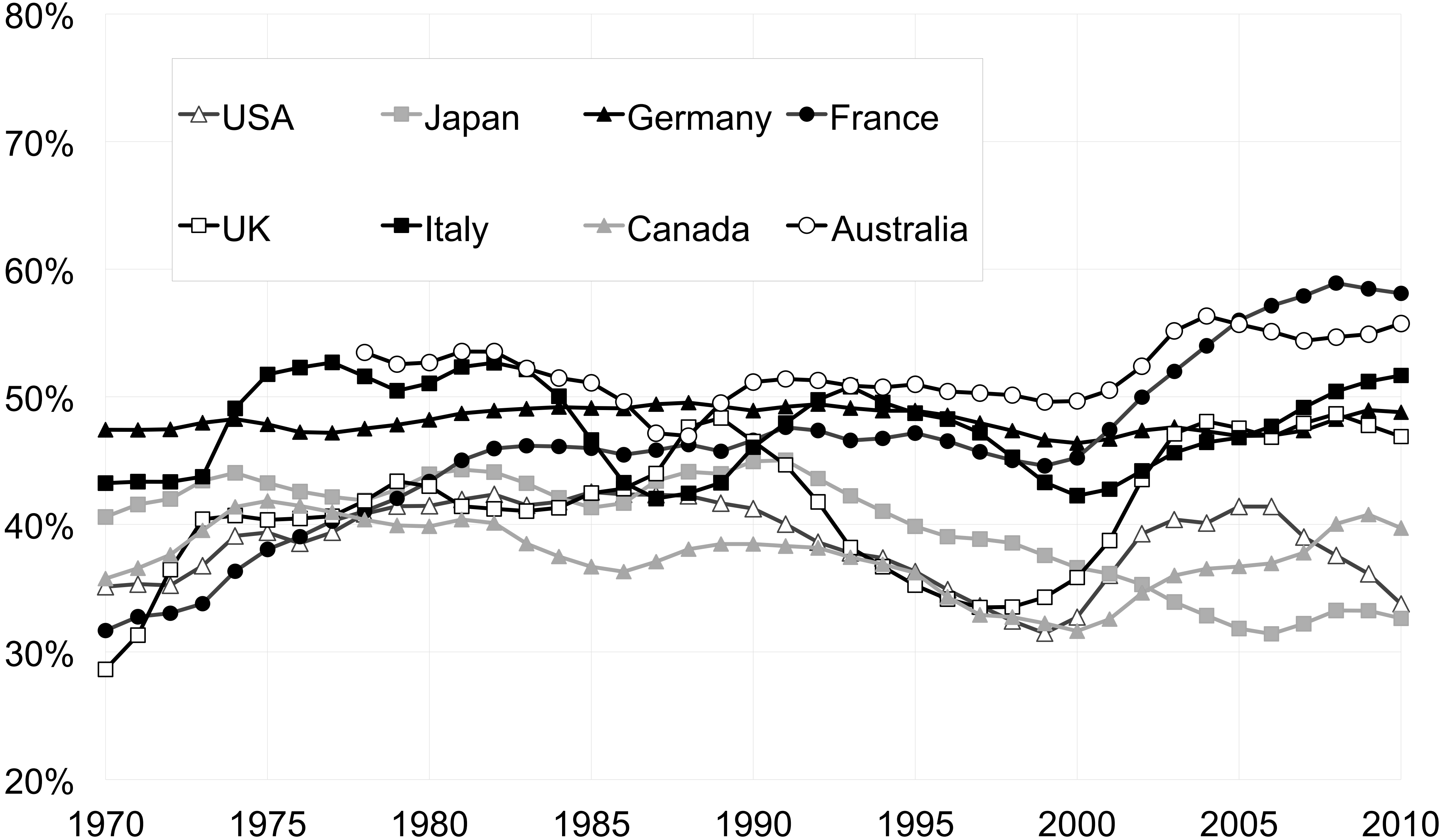


Figure A78: Gross non-housing nonfinancial wealth / Gross household & NPISH wealth, 1970-2010

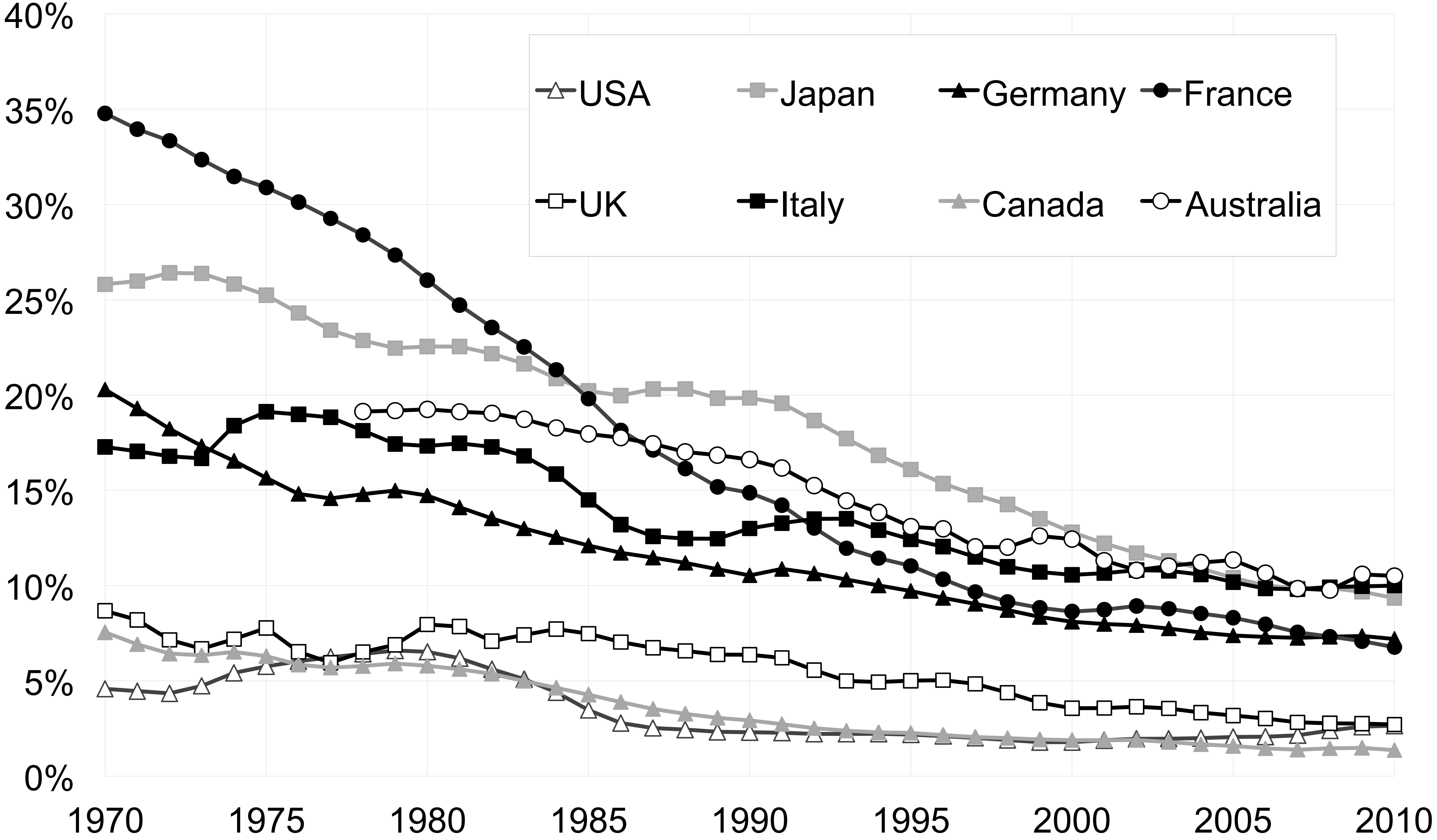
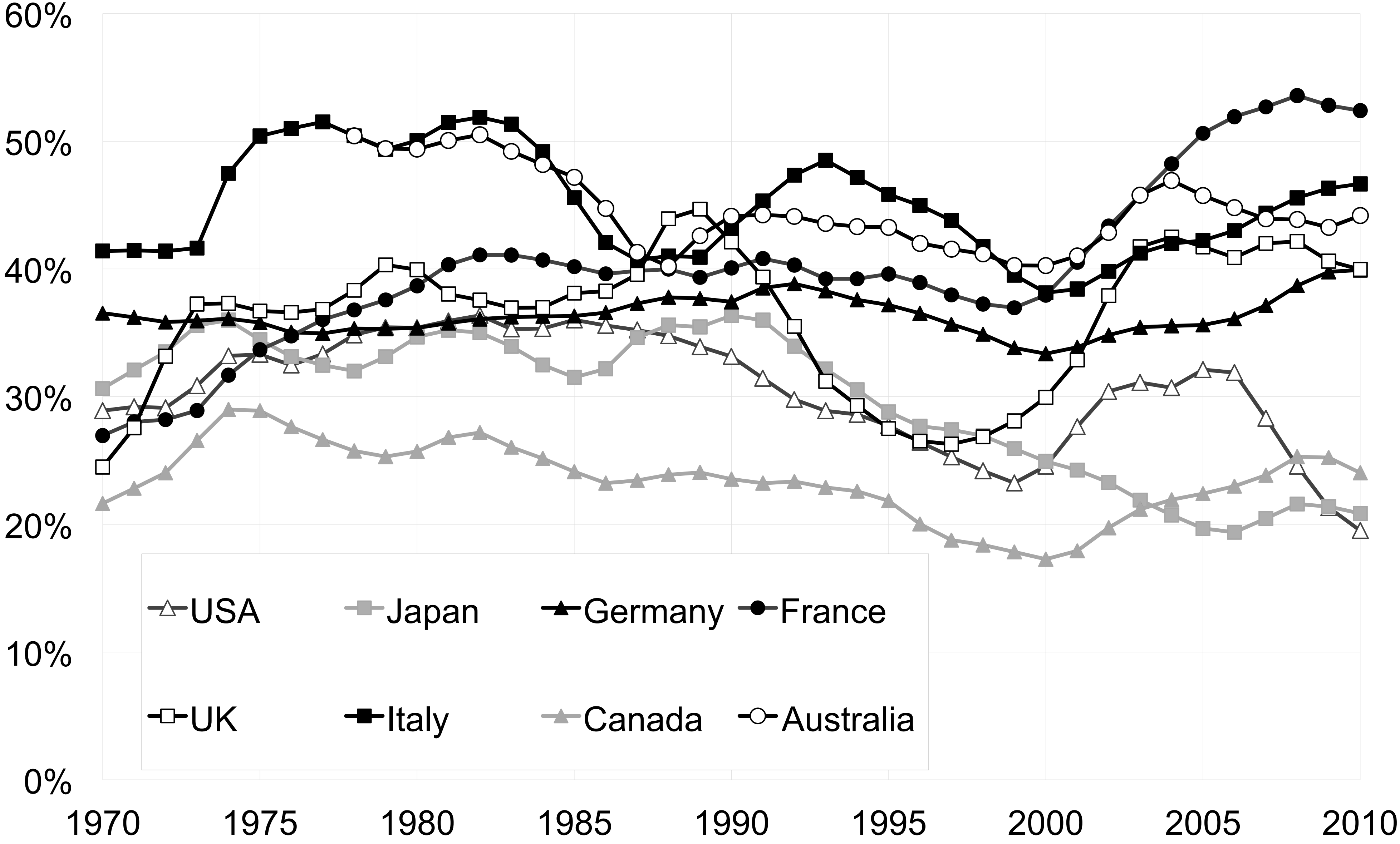


Figure A79: Share of net housing wealth in net private wealth, 1970-2010



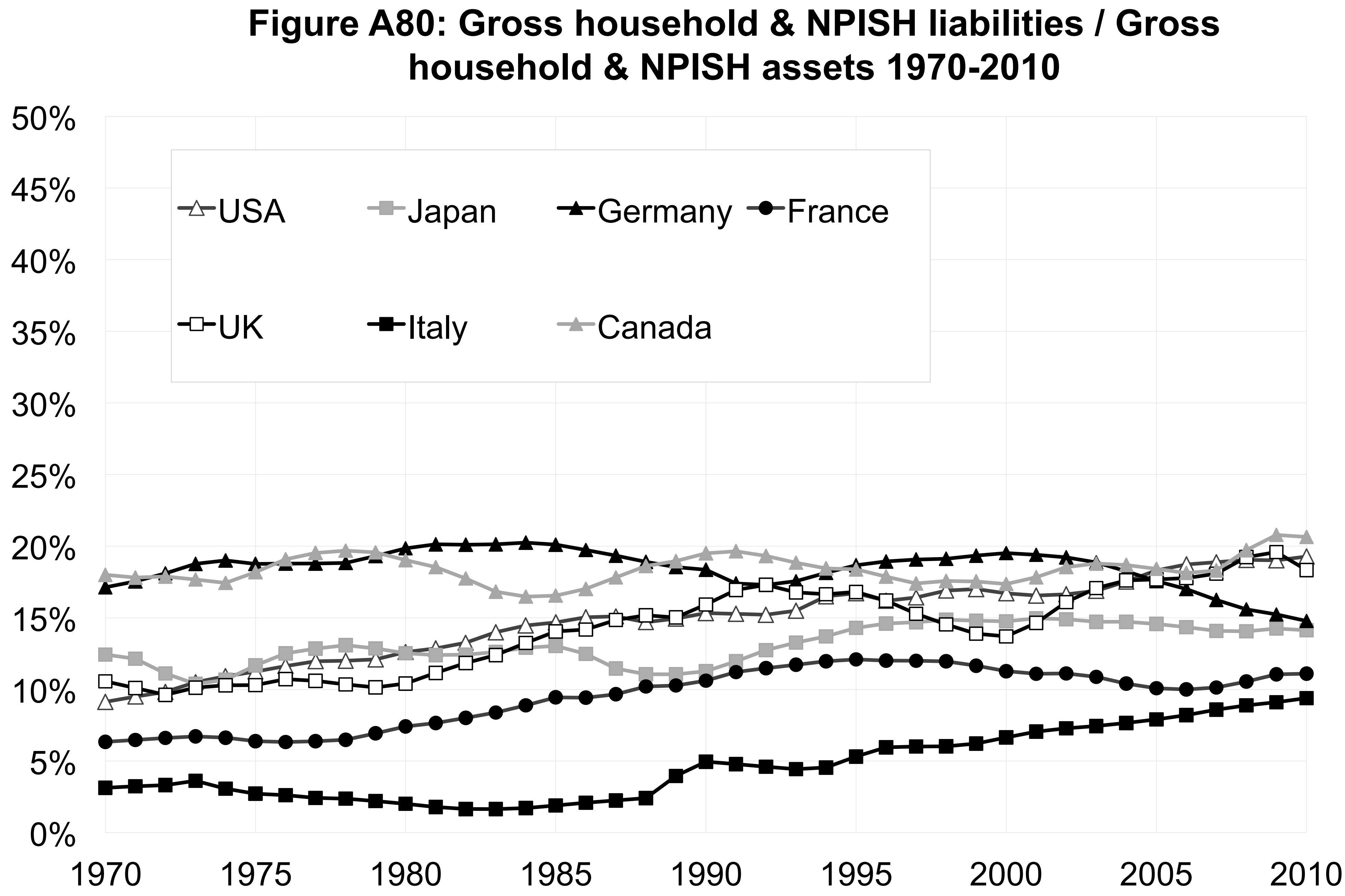


Figure A80: Gross household & NPISH liabilities / Gross household & NPISH assets 1970-2010
USA
Japan
Germany
France
UK
Italy
Canada
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
1970
1975
1980
1985
1990
1995
2000
2005
2010

Figure A81: Government assets / national income, 1870-2010

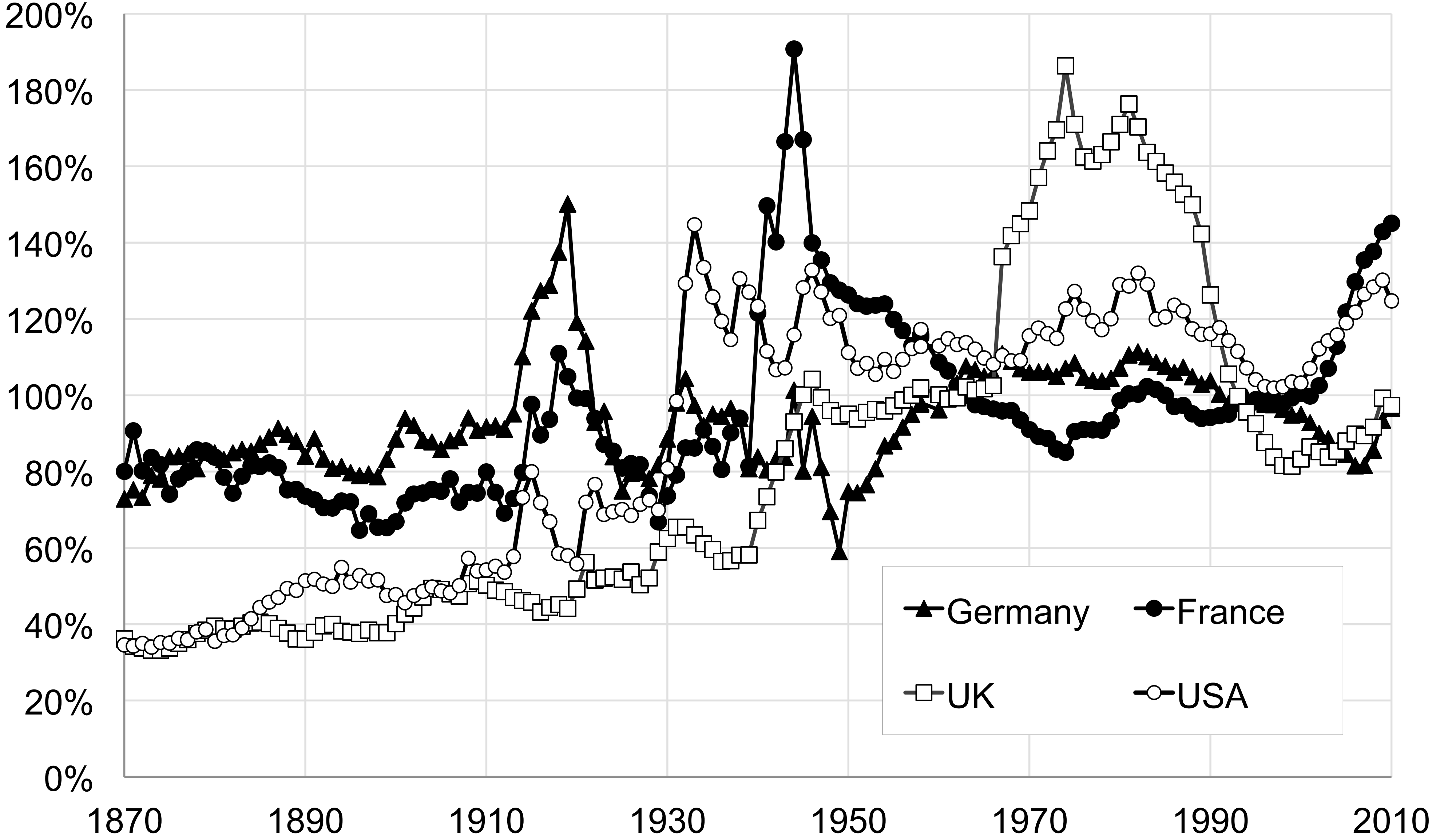


Figure A82: Government assets-national income ratios 1870-2010 (decennial averages)

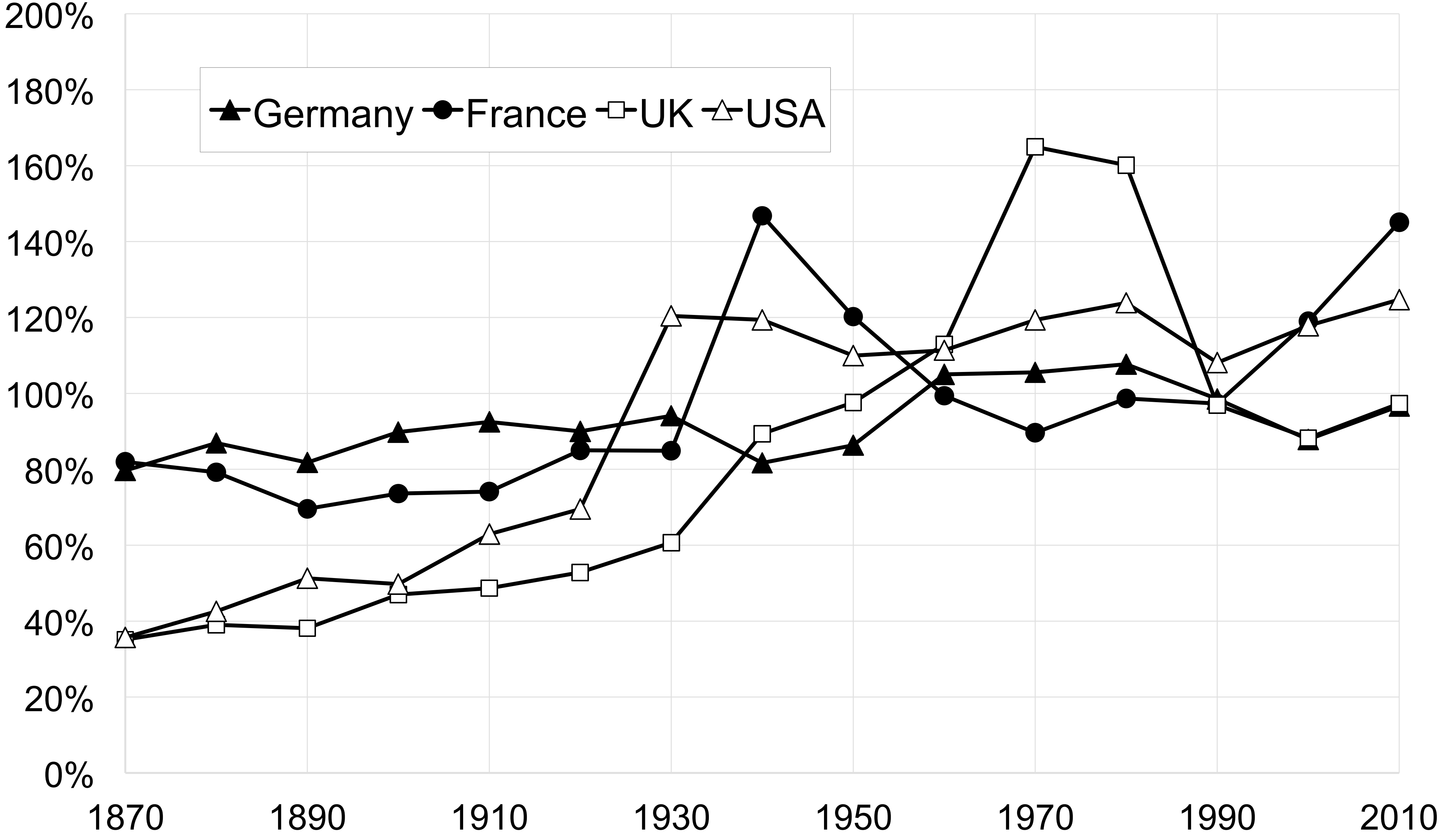
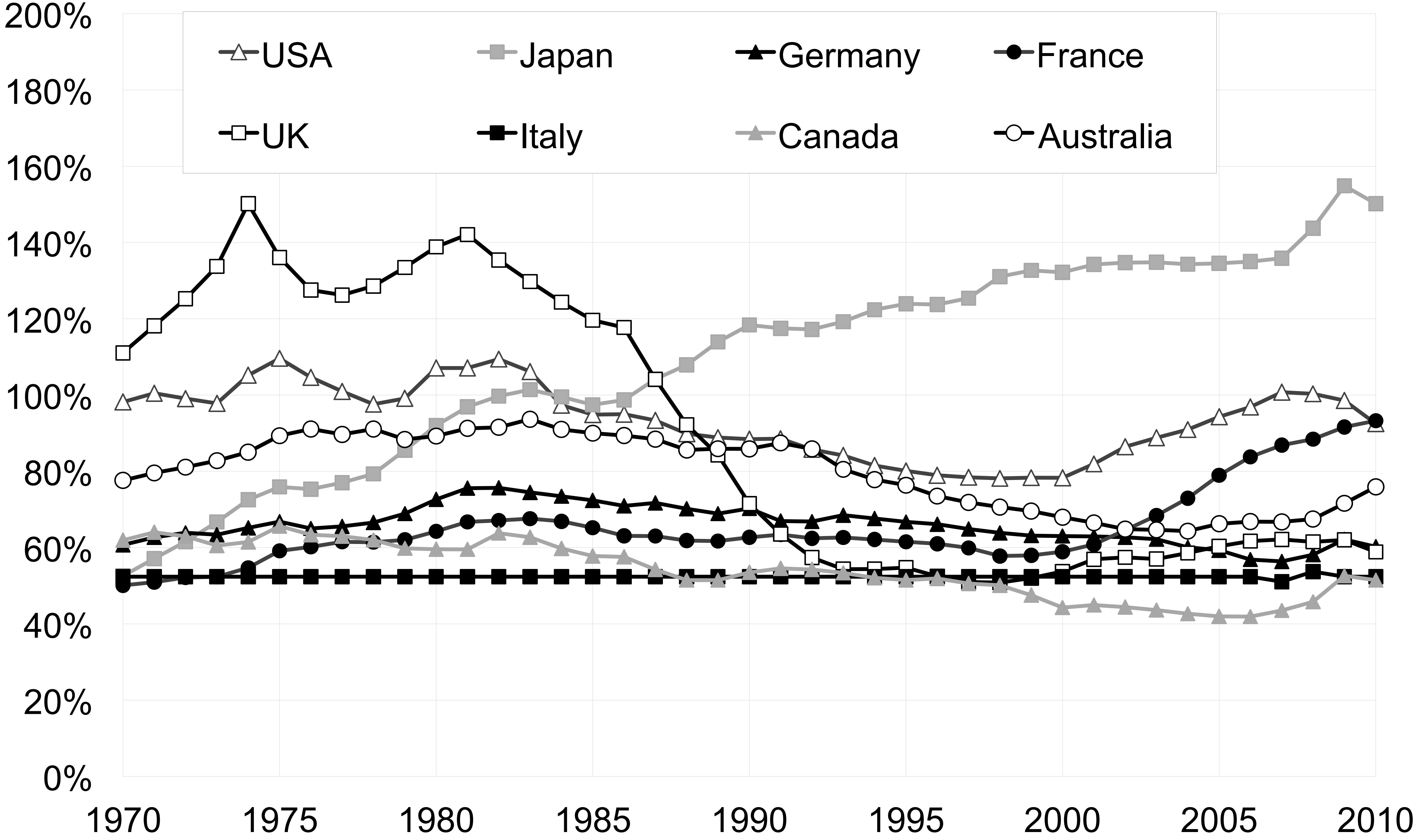


Figure A83: Government non-financial assets, 1970-2010



Government non financial assets: all non financial claims of the general government sector, including land

Figure A84: Government non-financial assets / national income, 1870-2010

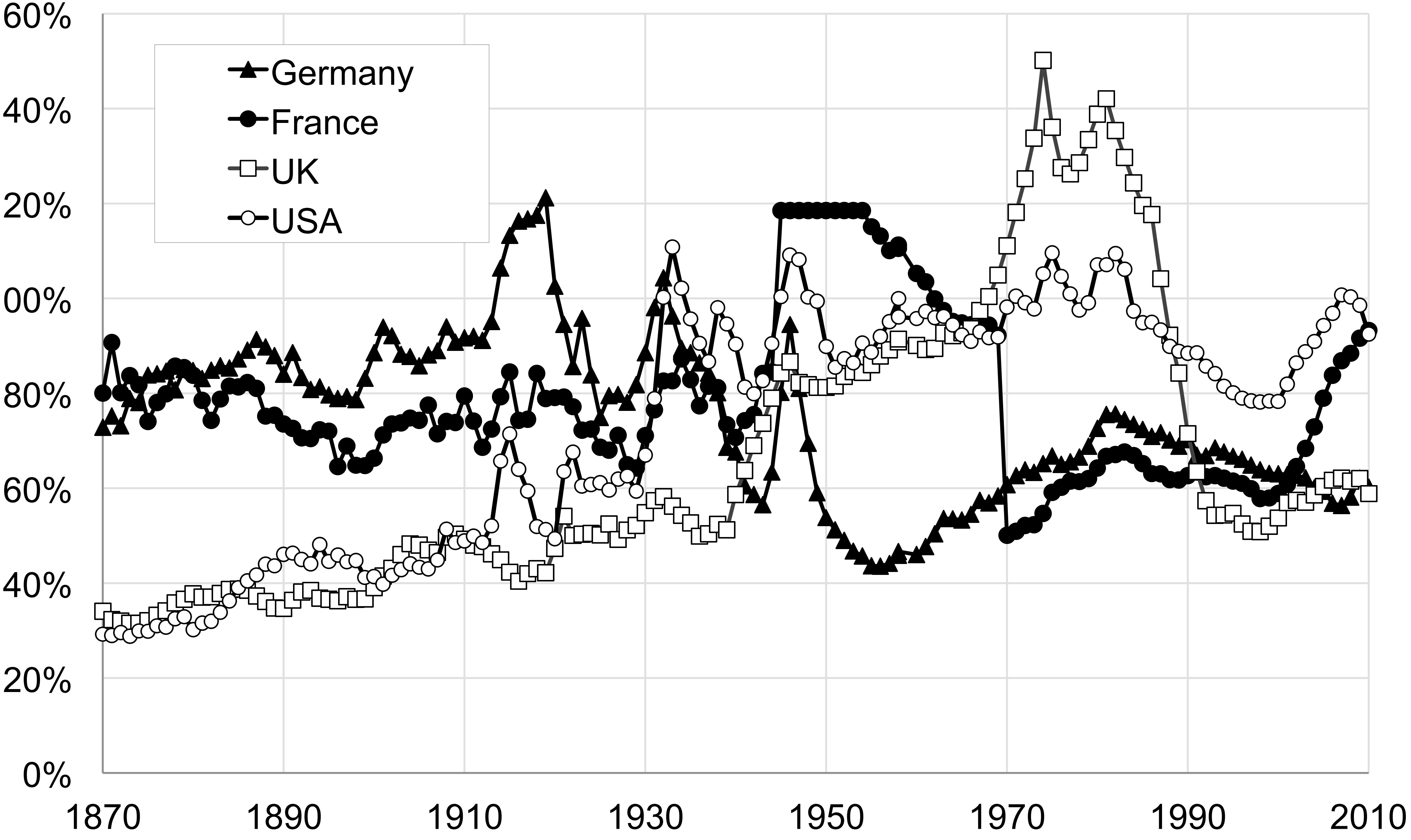


Figure A85: Government nonfinancial assets / national income 1870-2010 (decennial averages)

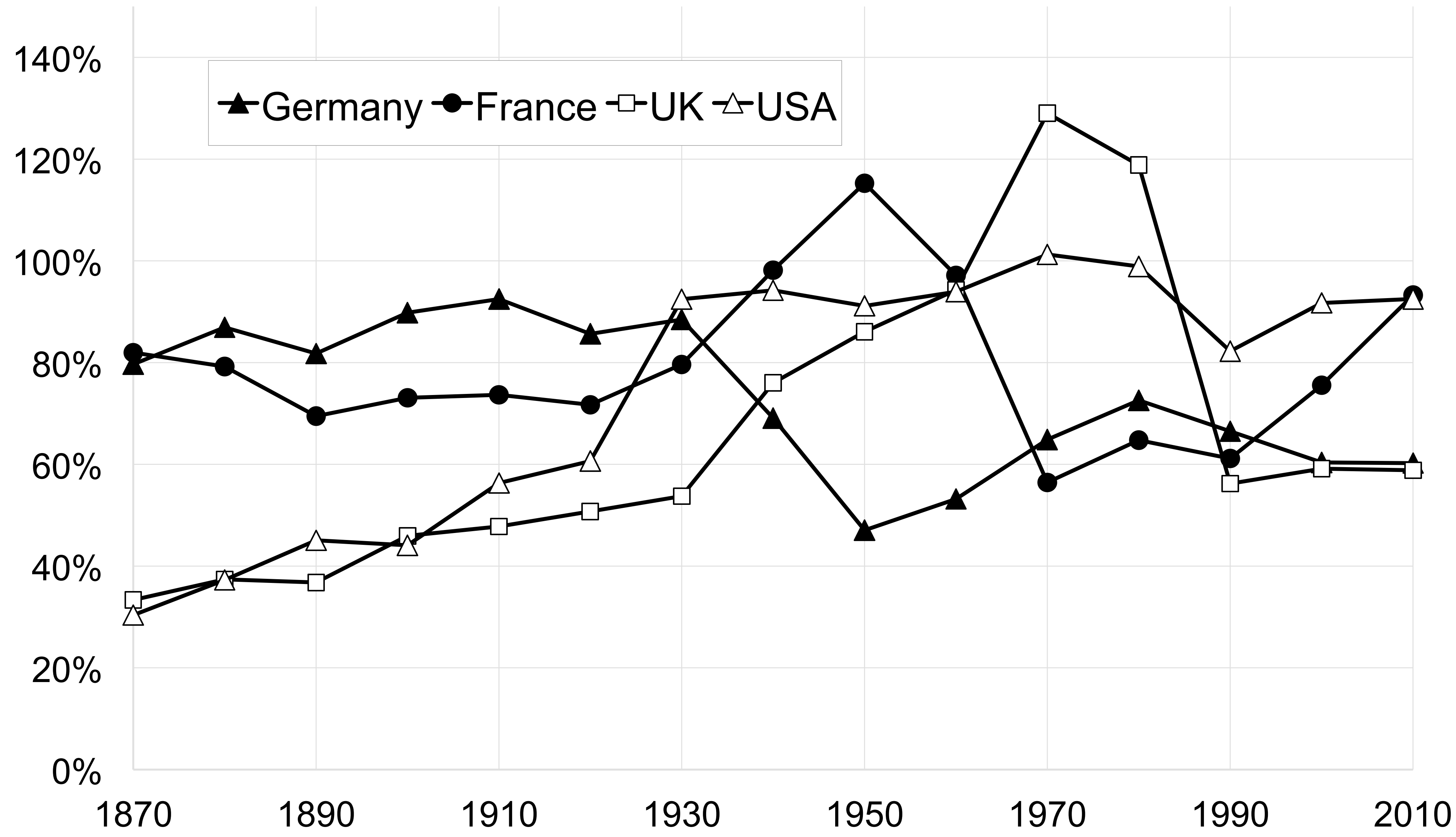
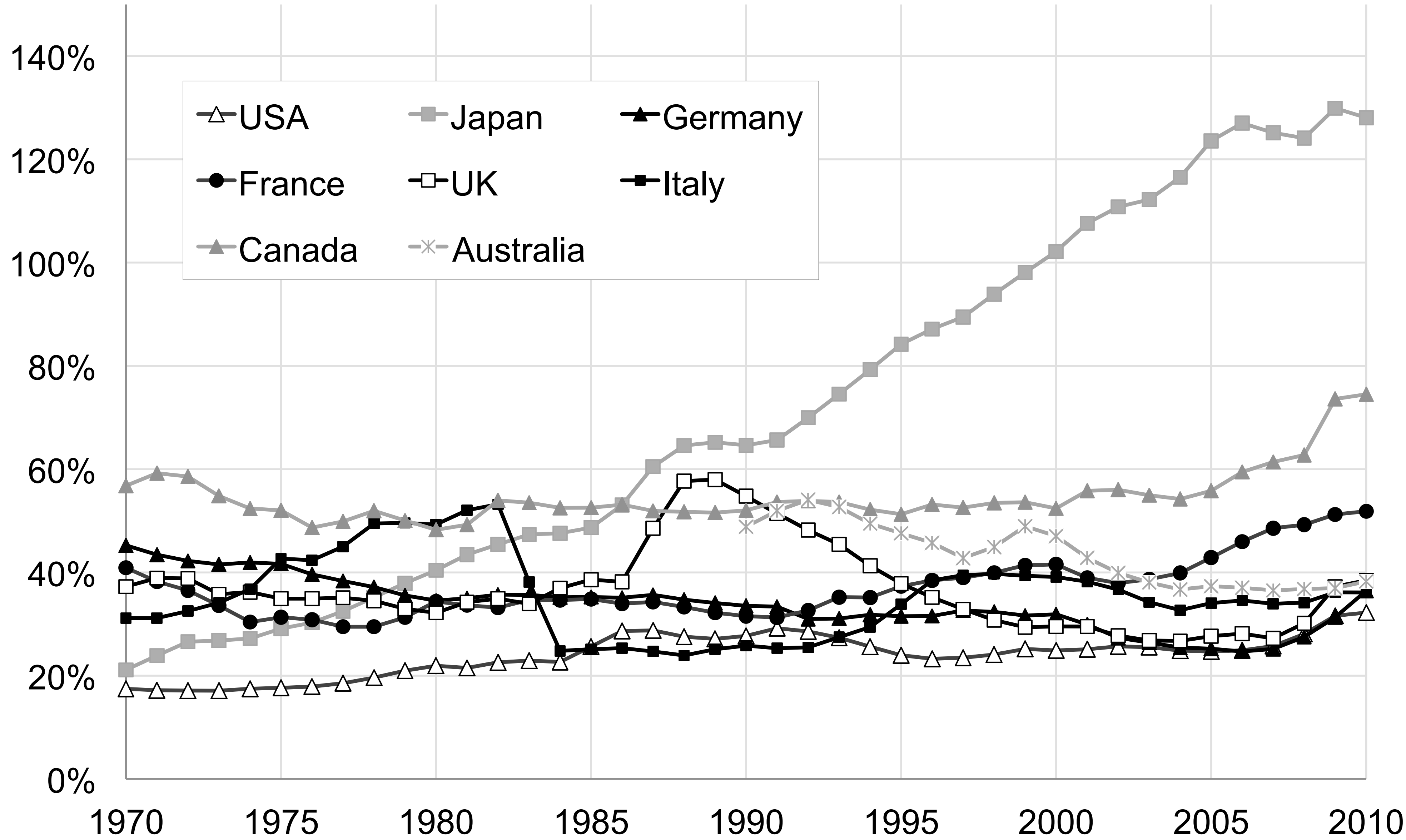


Figure A86: Government financial assets, 1970-2010



Governemnt financial assets: all financial claims of the general government sector

Figure A87: Government financial assets / national income, 1870-2010

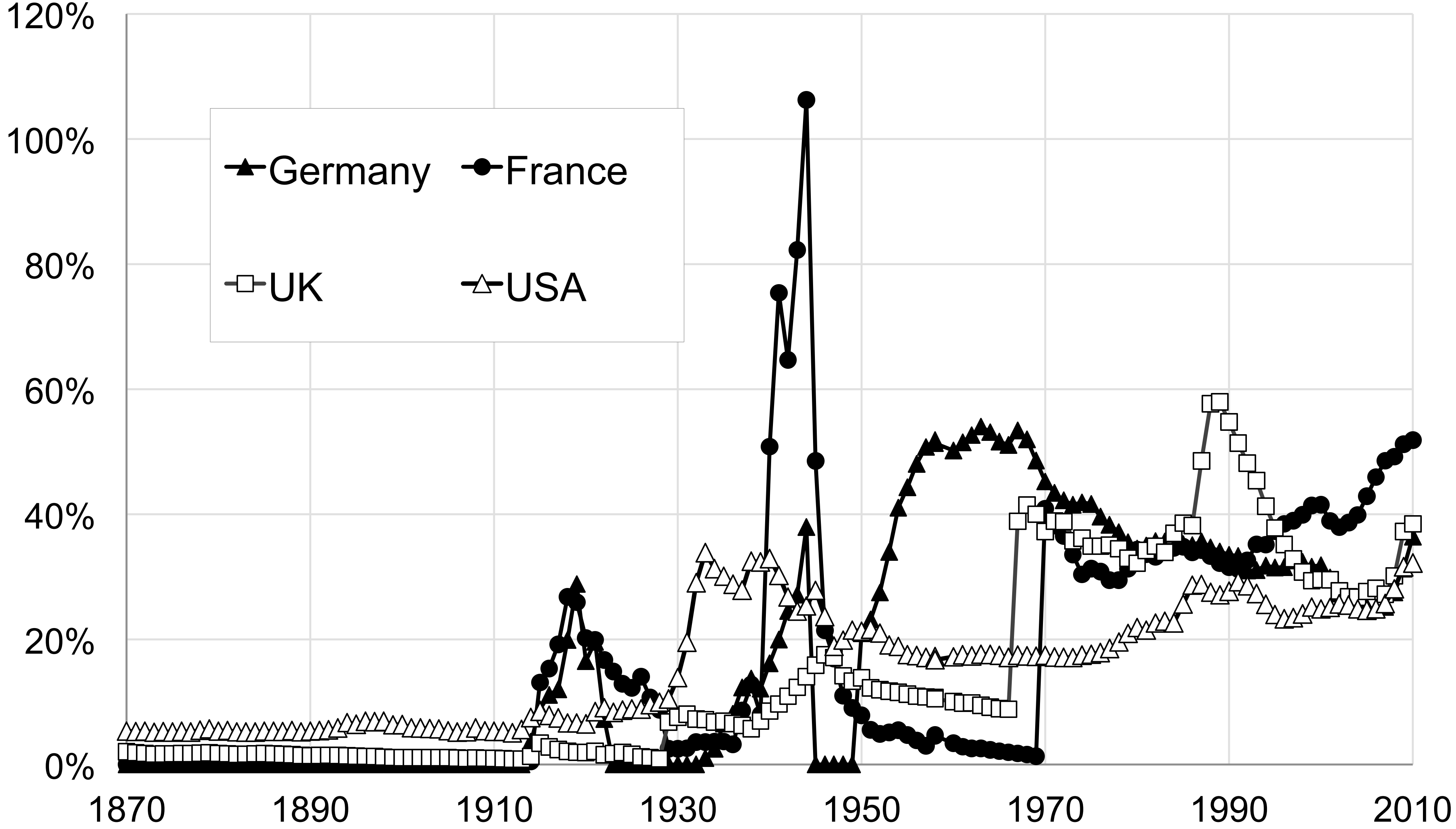


Figure A88: Government liabilities / national income 1970-2010

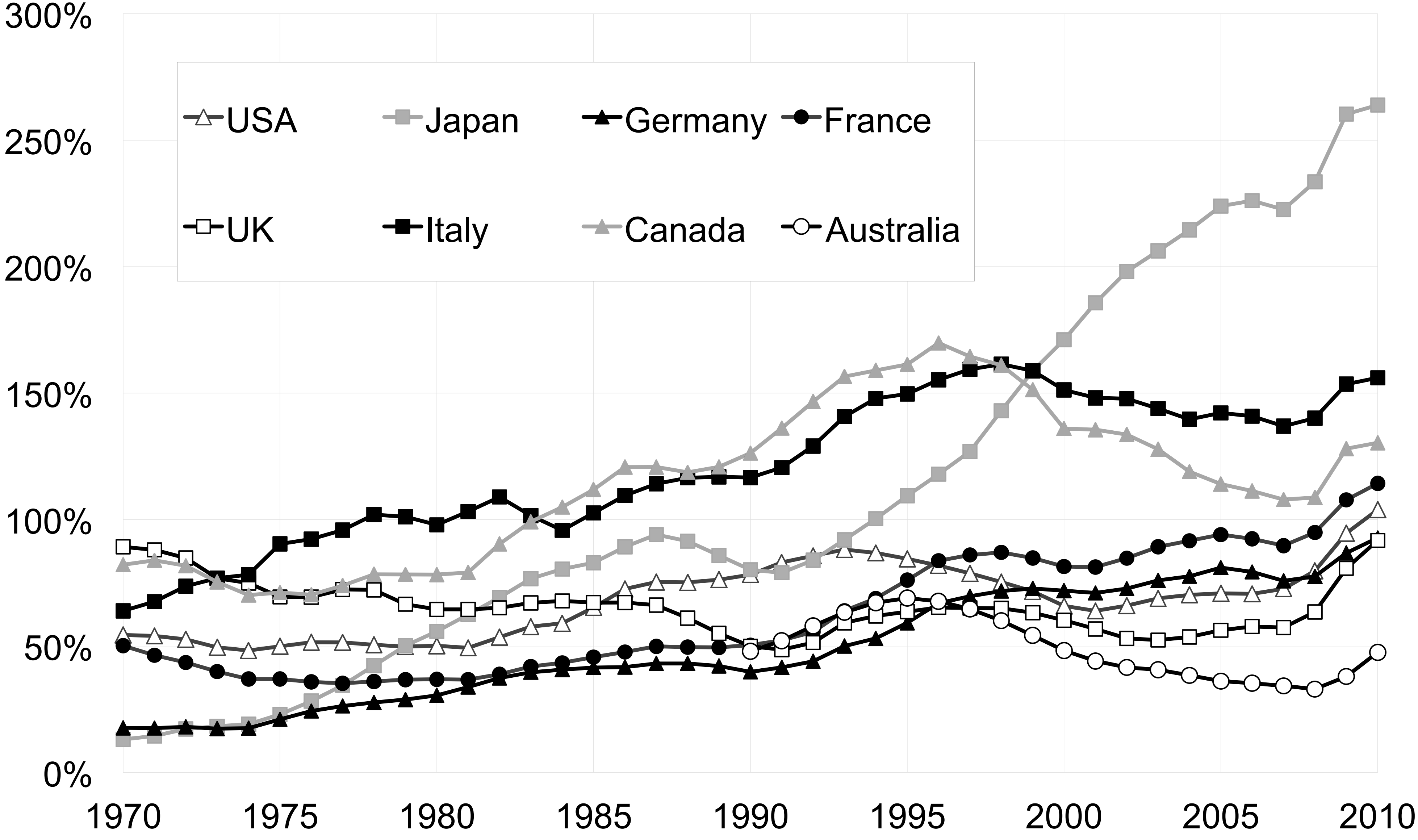


Figure A89: Government liabilities / national income, 1870-2010

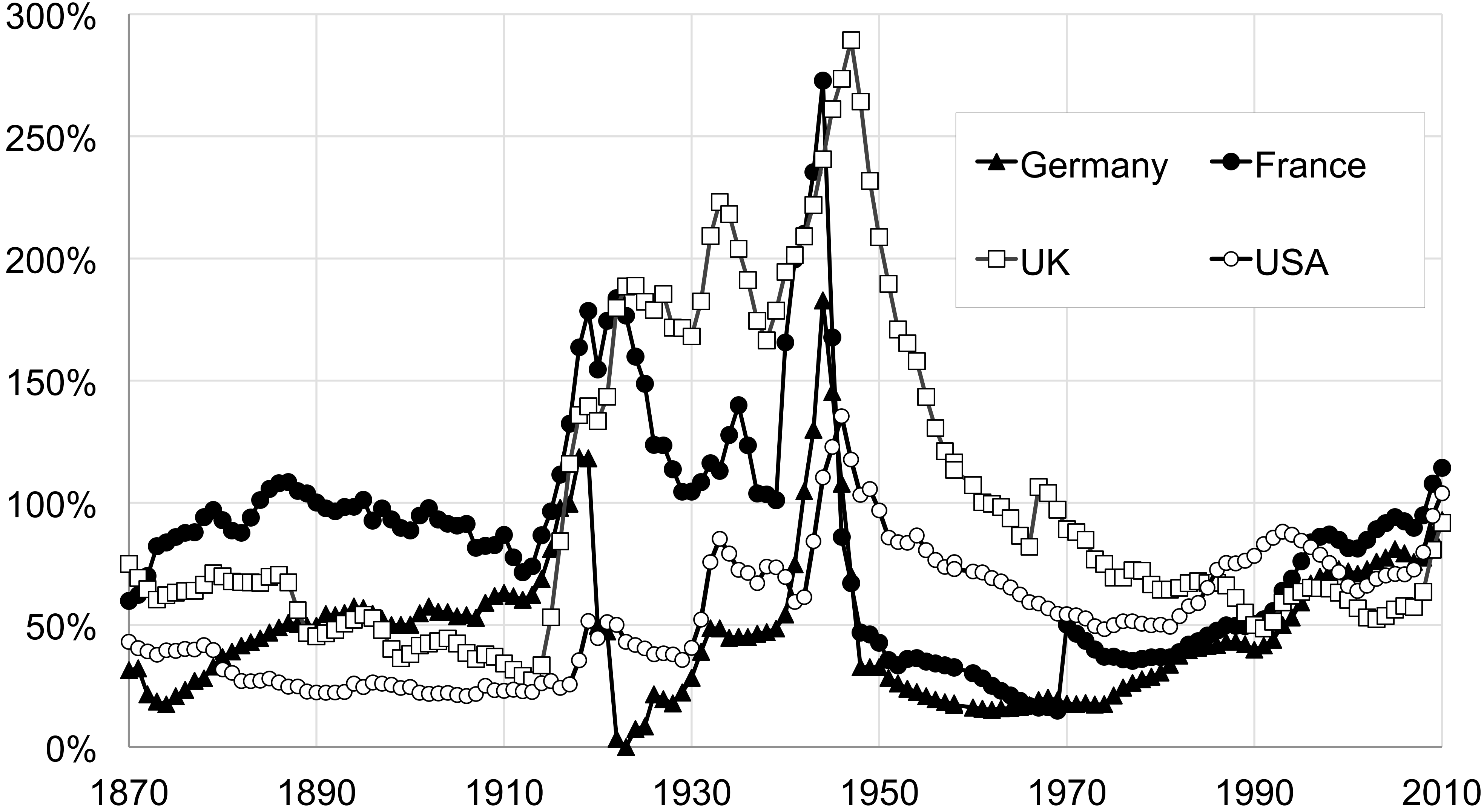


Figure A90: Government liabilities-national income ratios 1870-2010 (decennial averages)

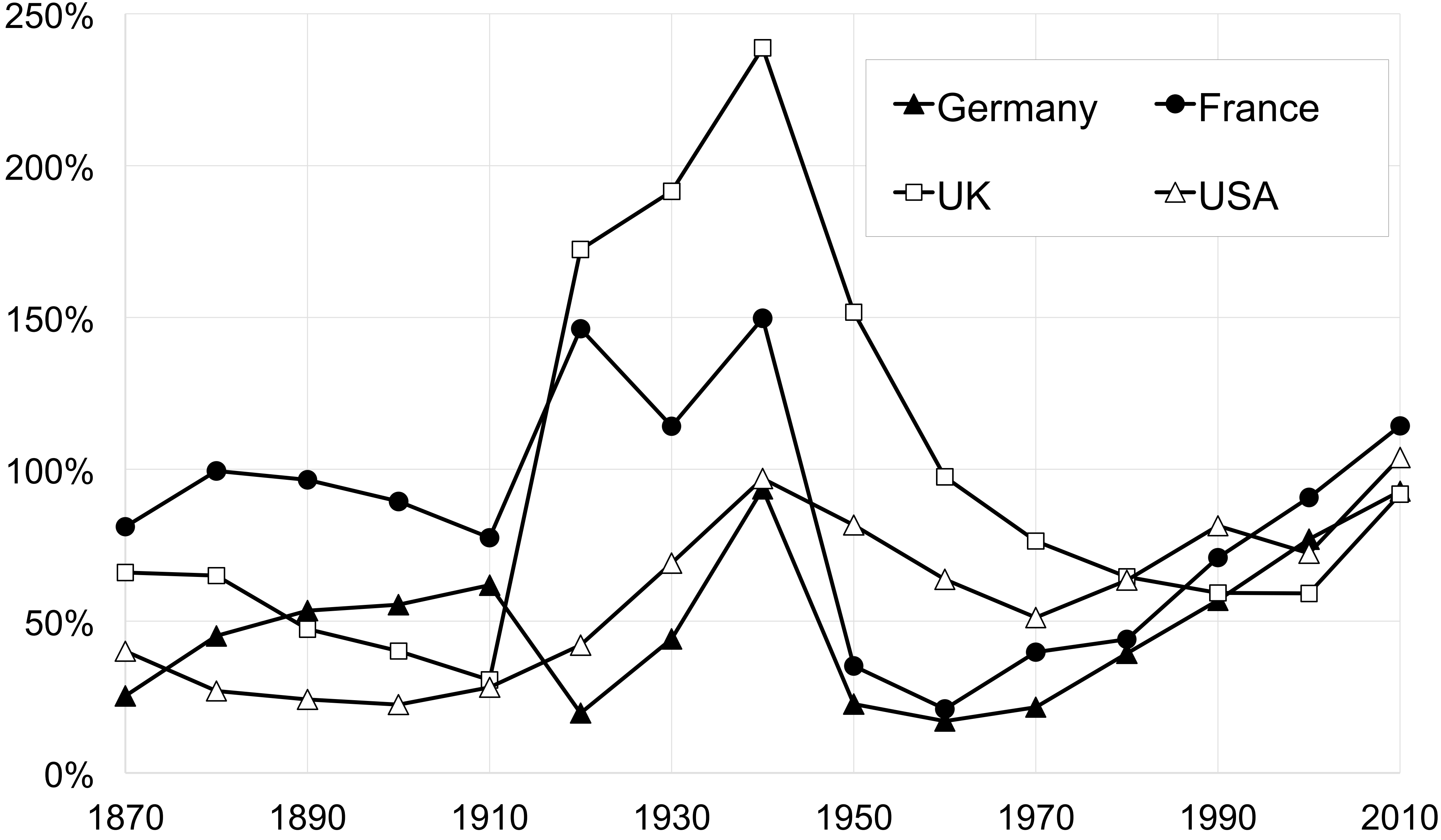
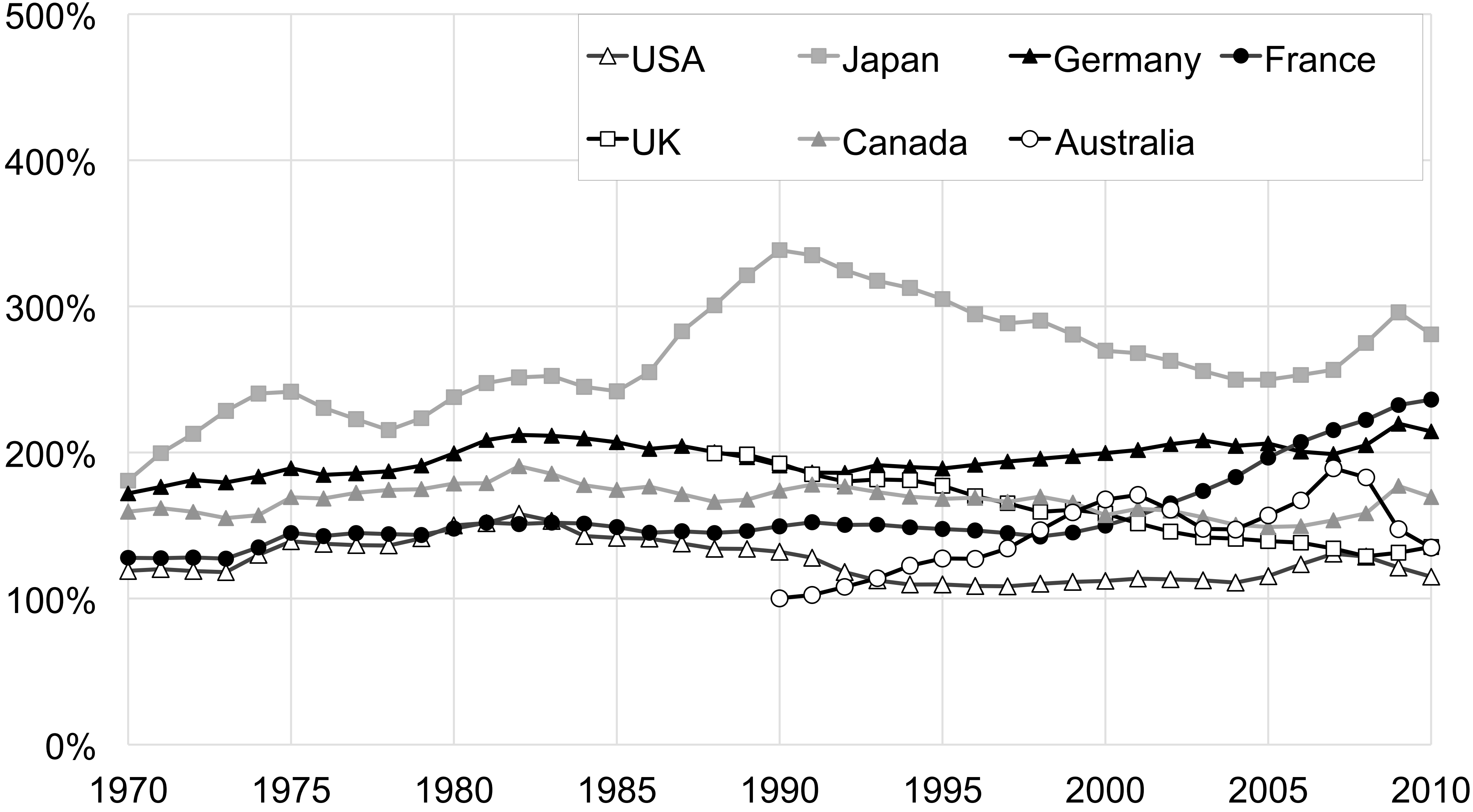
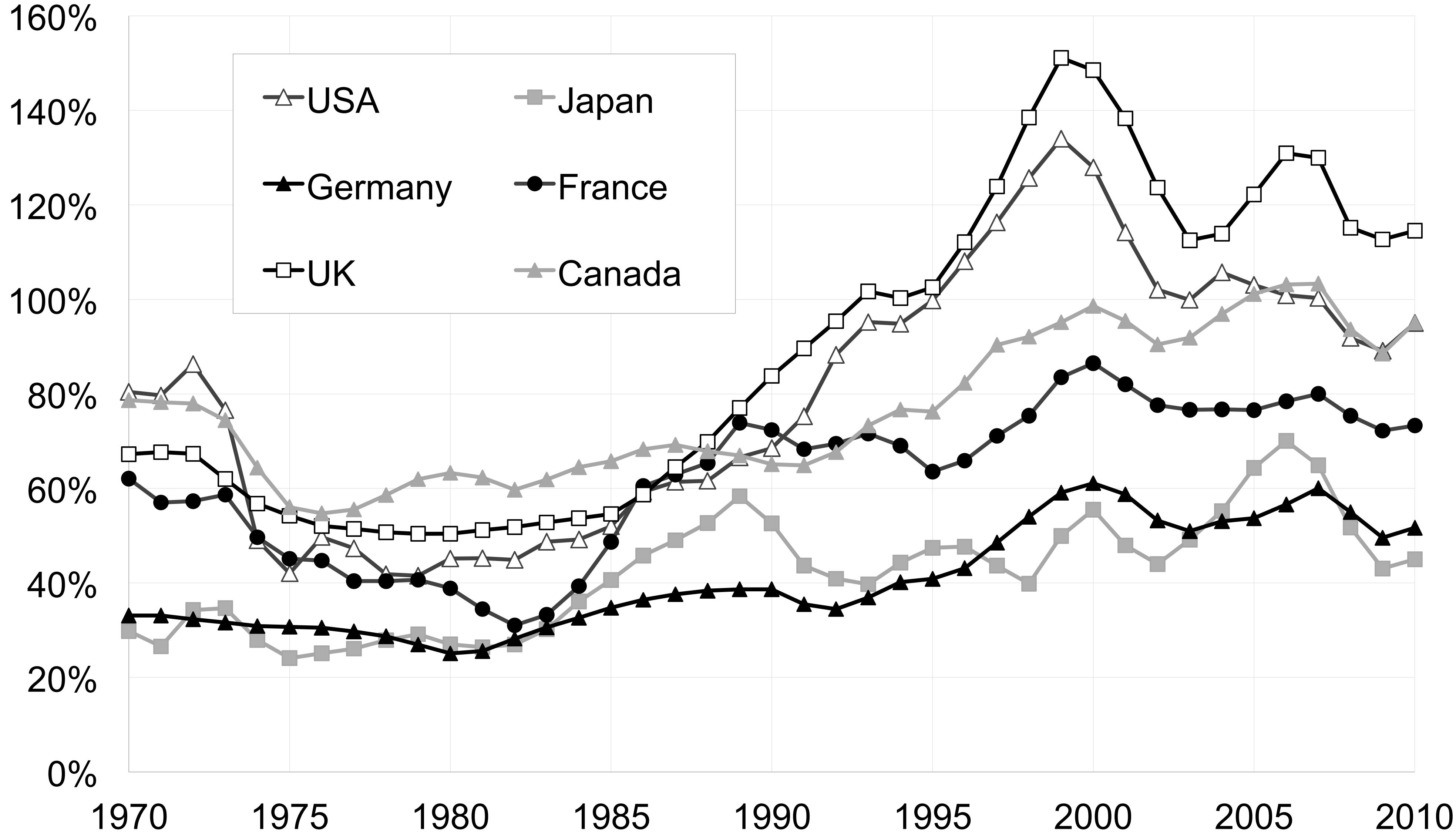


Figure A91: Book-value of corporate capital / national income 1970-2010



Authors' computations using country national accounts. Book-value of corporate capital = nonfinancial assets of the corporate sector

Figure A92: Corporate market value / book value Q-ratios 1970-2010



Authors' computations using country national accounts. Q ratio = market value/book value = equity/(assets - debt) (corporate sector)

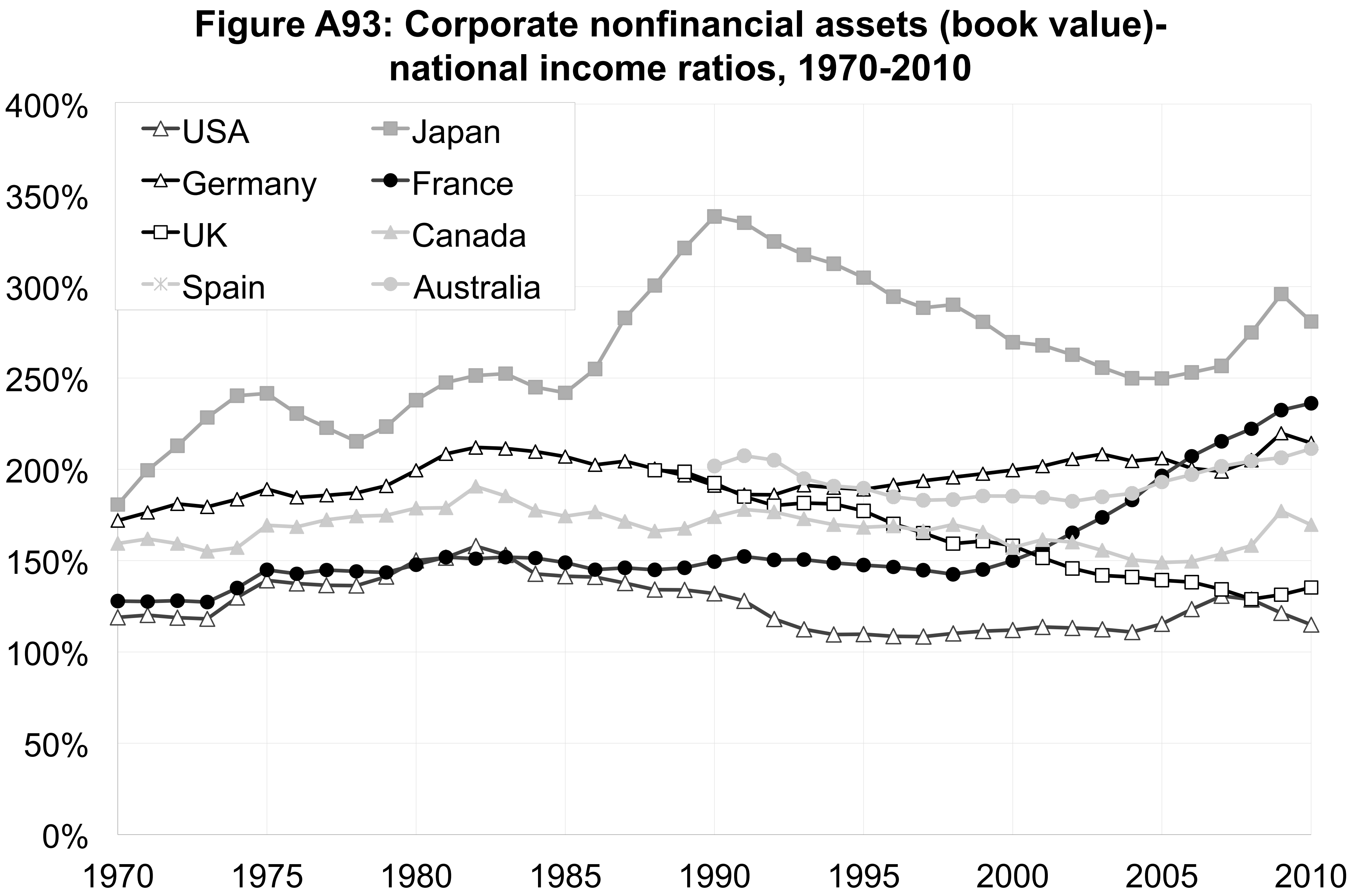
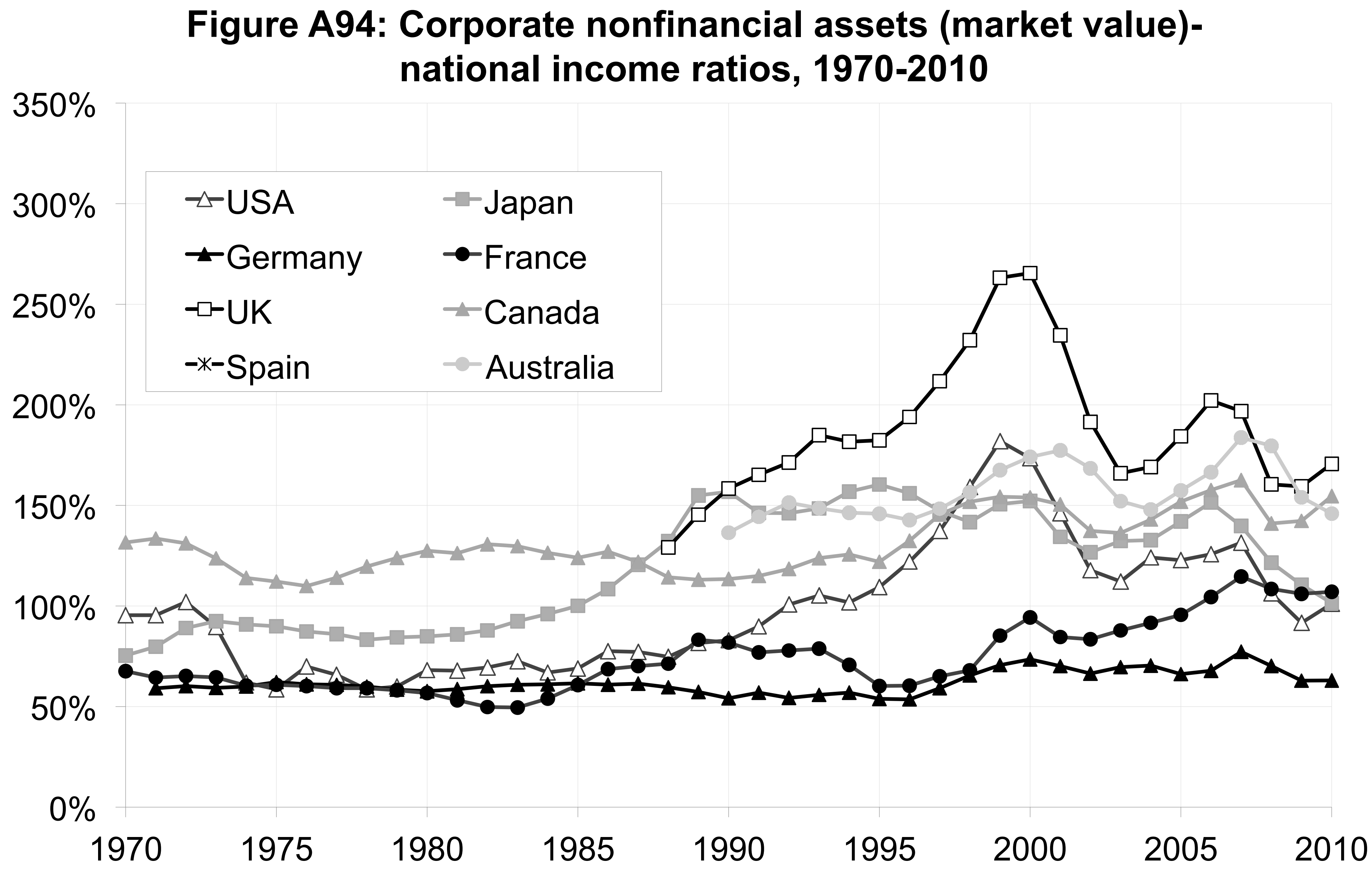
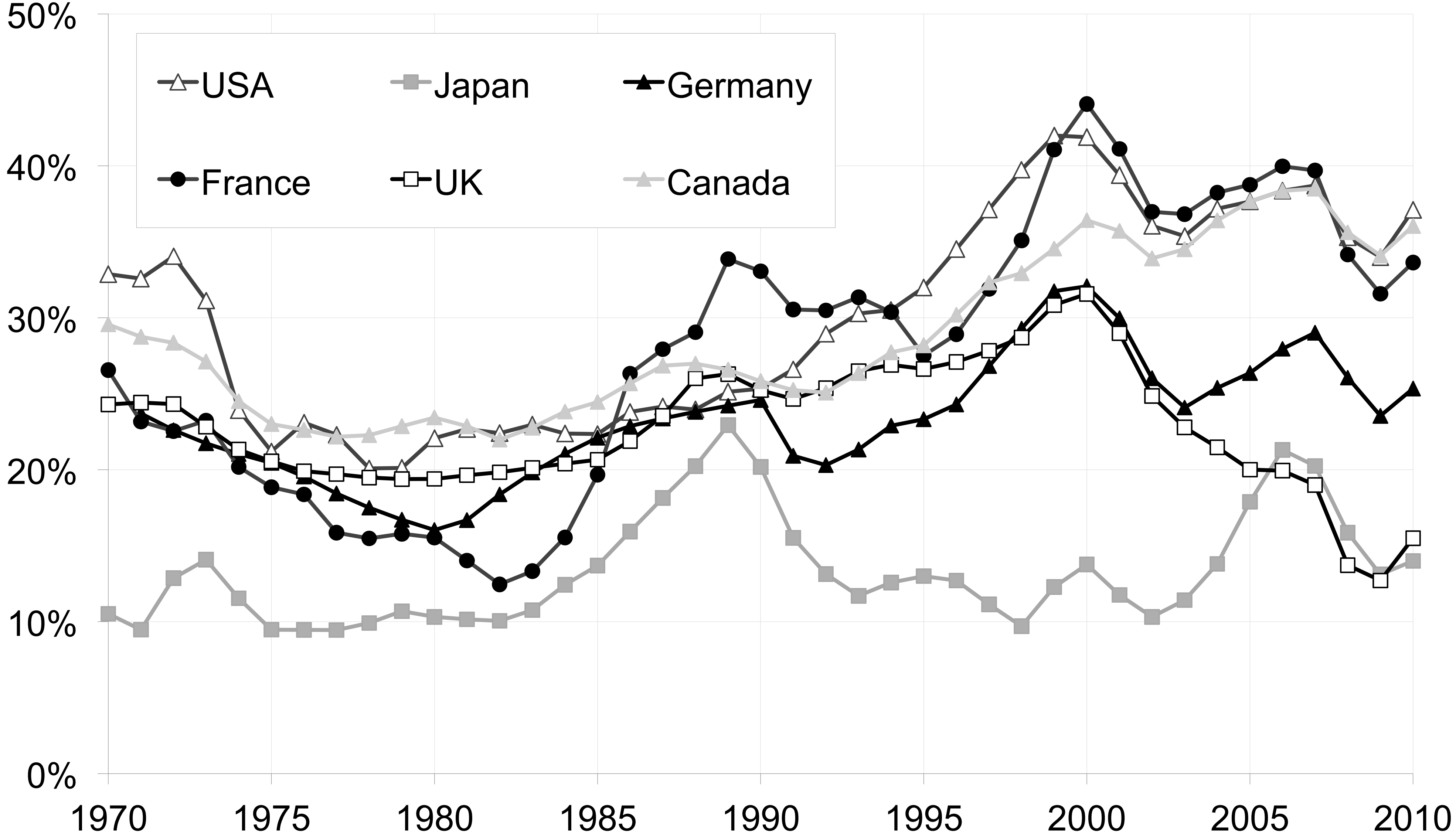


Figure A93: Corporate nonfinancial assets (book value)-national income ratios, 1970-2010
USA
Japan
Germany
France
UK
Canada
Spain
Australia
400%
350%
300%
250%
200%
150%
100%
50%
0%
1970
1975
1980
1985
1990
1995
2000
2005
2010



Note: Market value of corporate tangible assets = book value of corp.tang.assets - residual corp.wealth = net corp. financial liabilities

Figure A95: Share of equities in corporate liabilities, 1970-2010



Note: Share of equity = equity/(equity+debt)

Figure A96: Net national saving rates 1870-2010

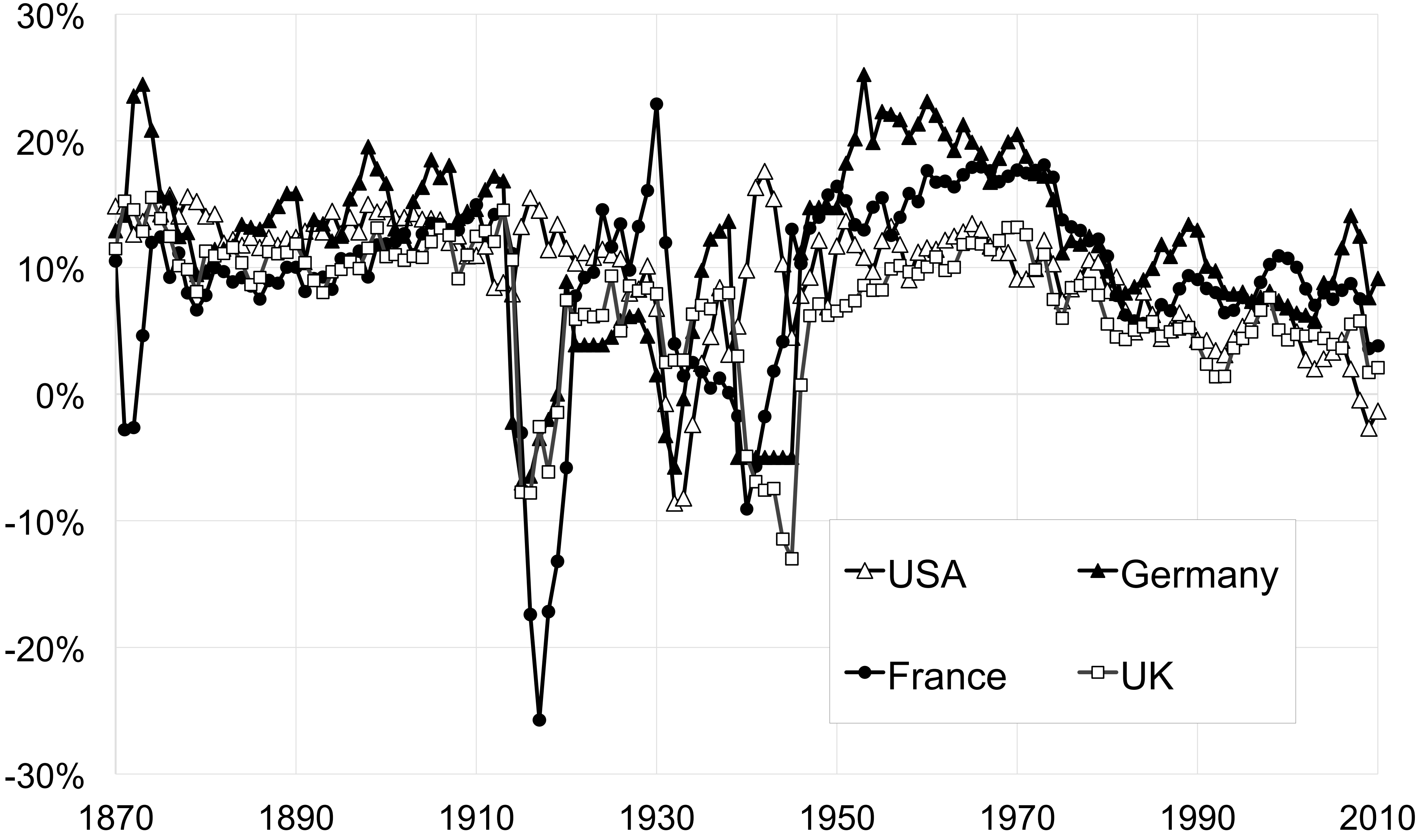


Figure A97: Net national saving rates 1870-2010 (decennial averages)

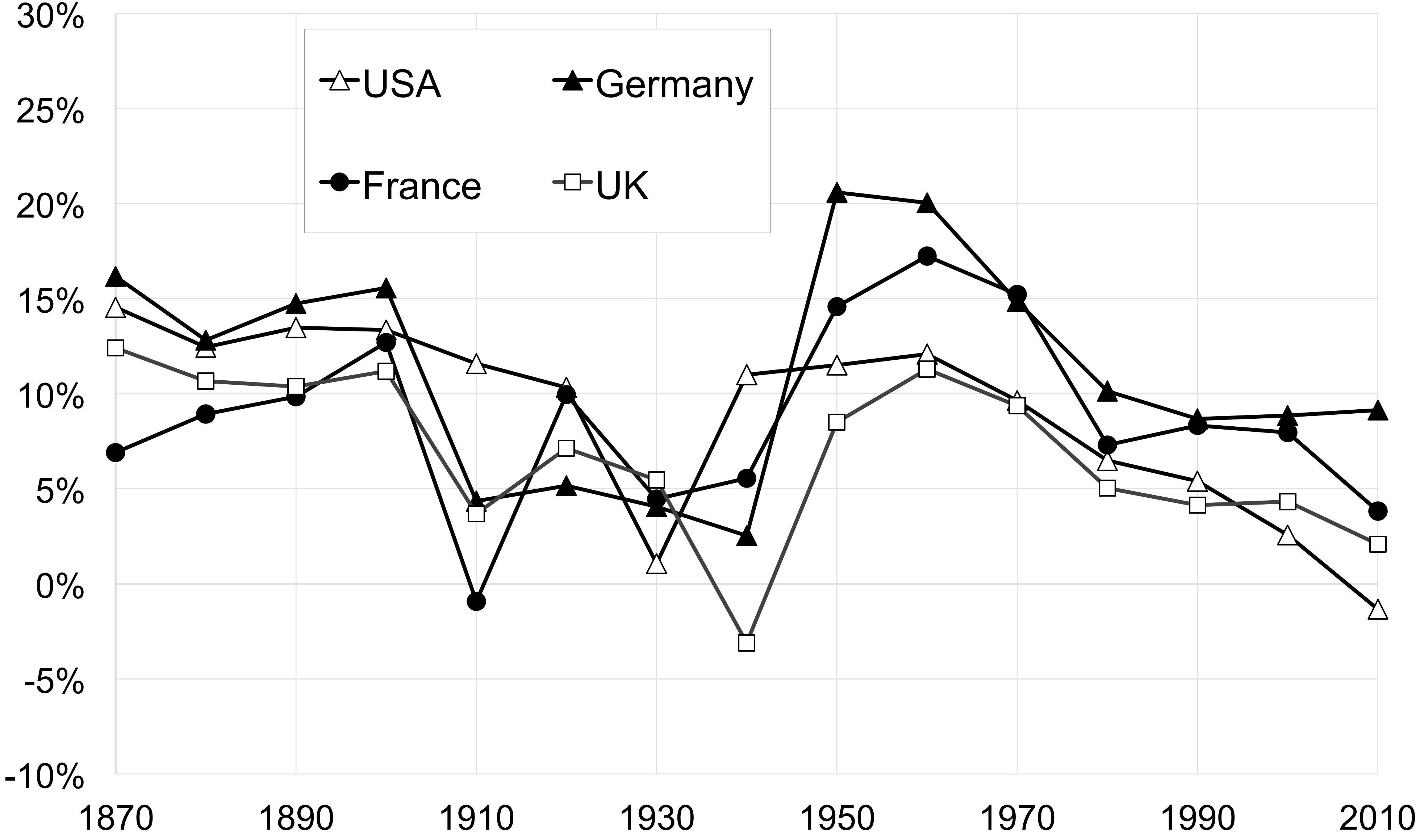


Figure A98: Net national saving rate (% national income) 1970-2010

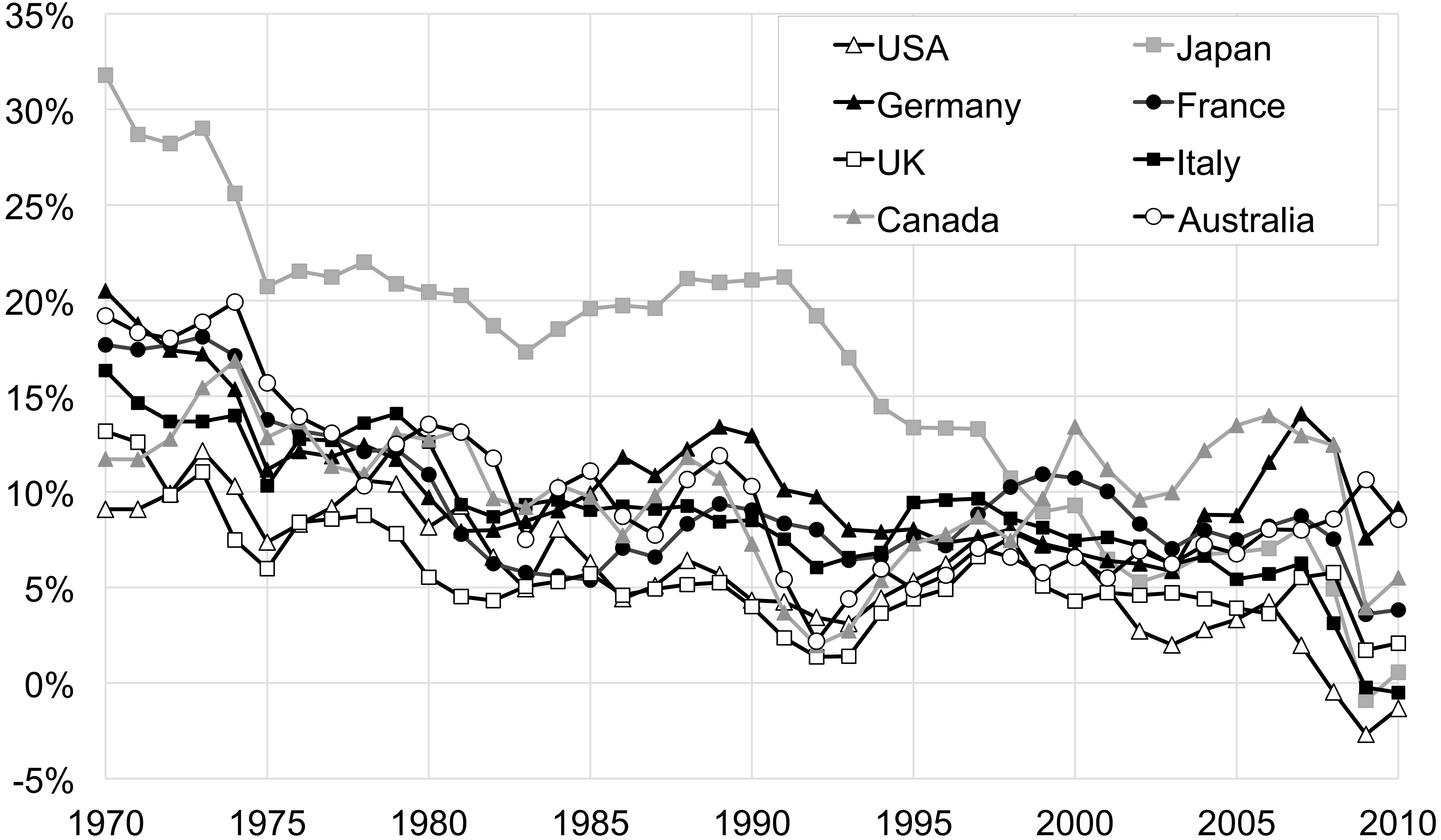


Figure A99: Net national saving rates 1810-2010 (decennial averages)

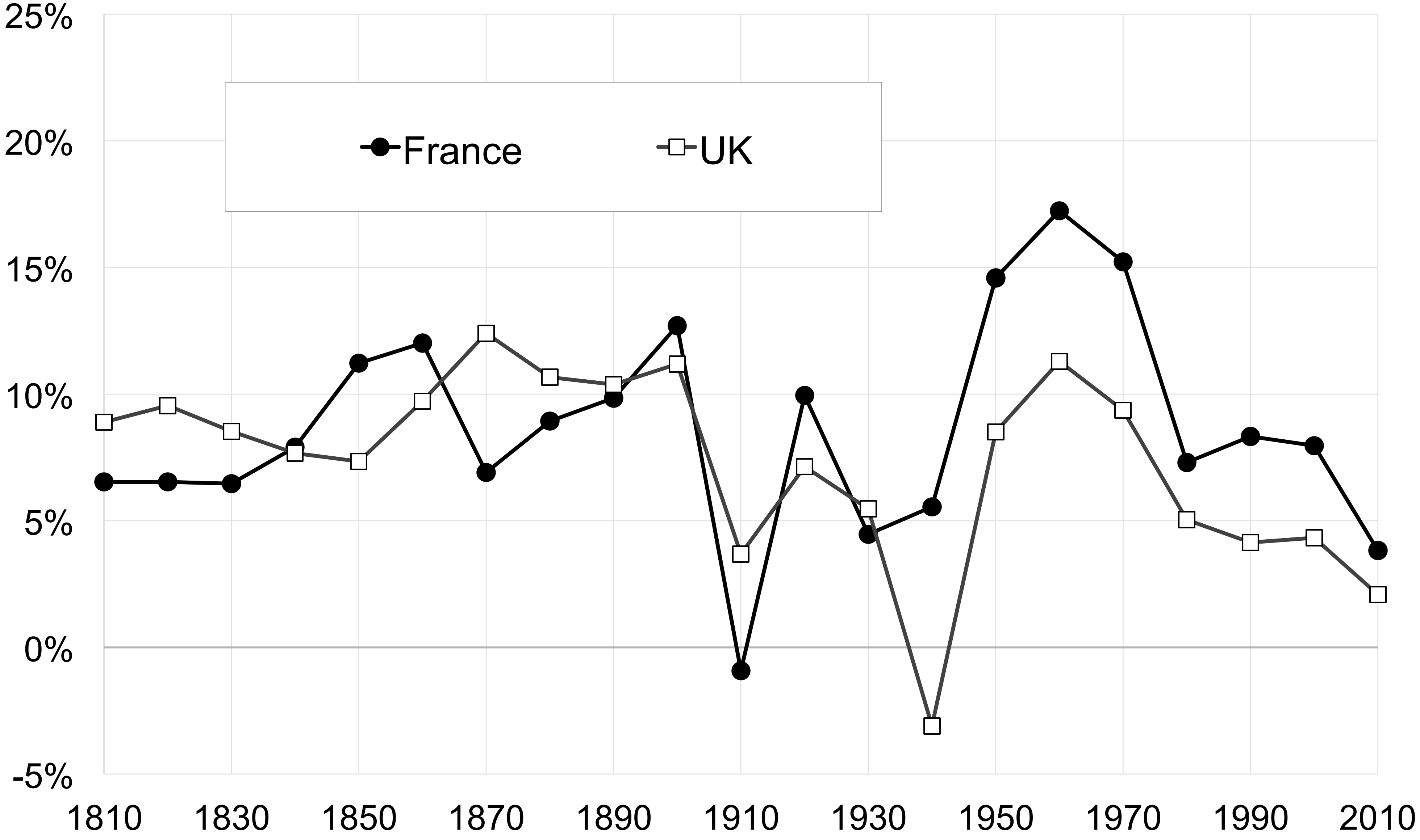


Figure A100: Net private saving rates 1870-2010

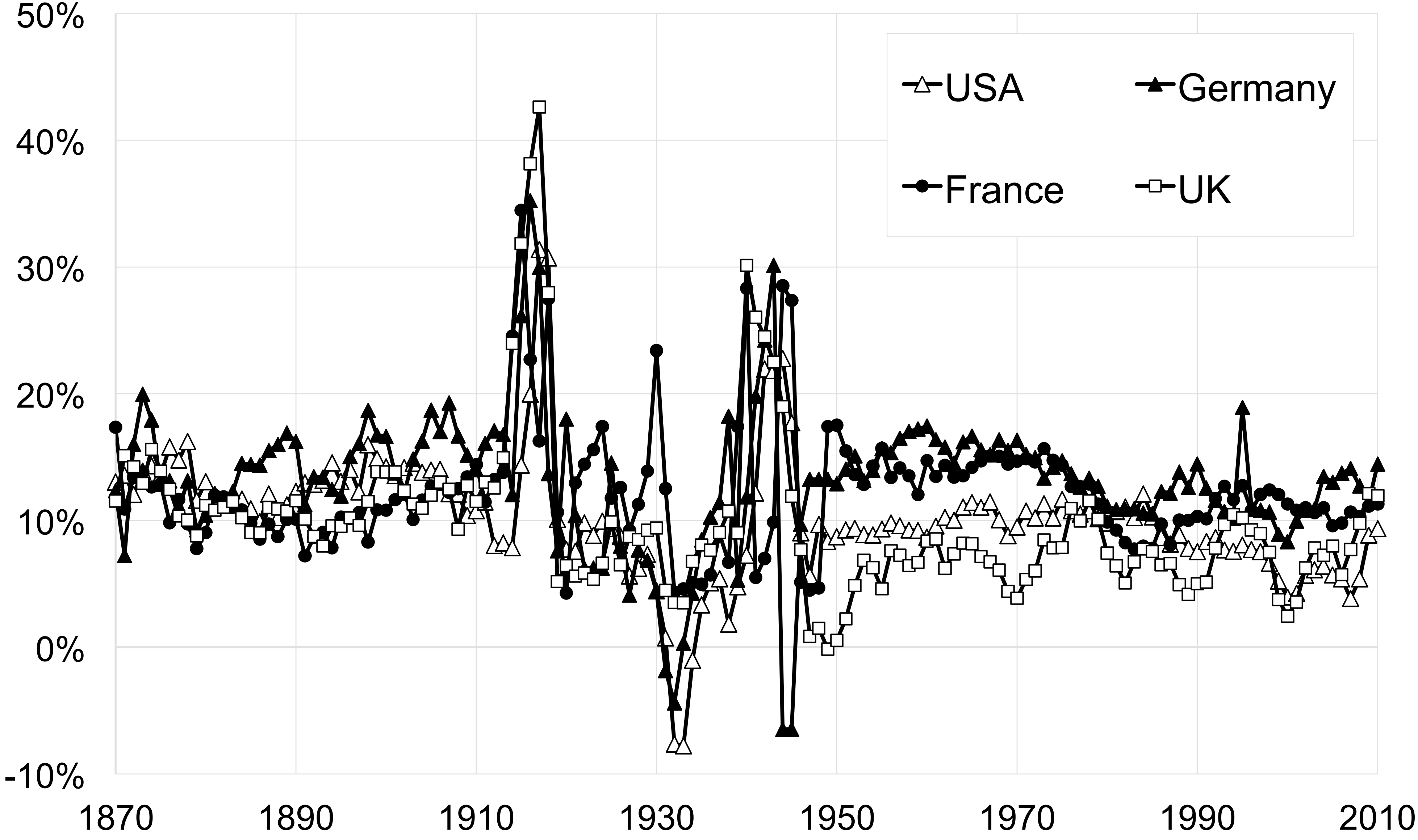


Figure A101: Net private saving rates 1870-2010 (decennial averages)

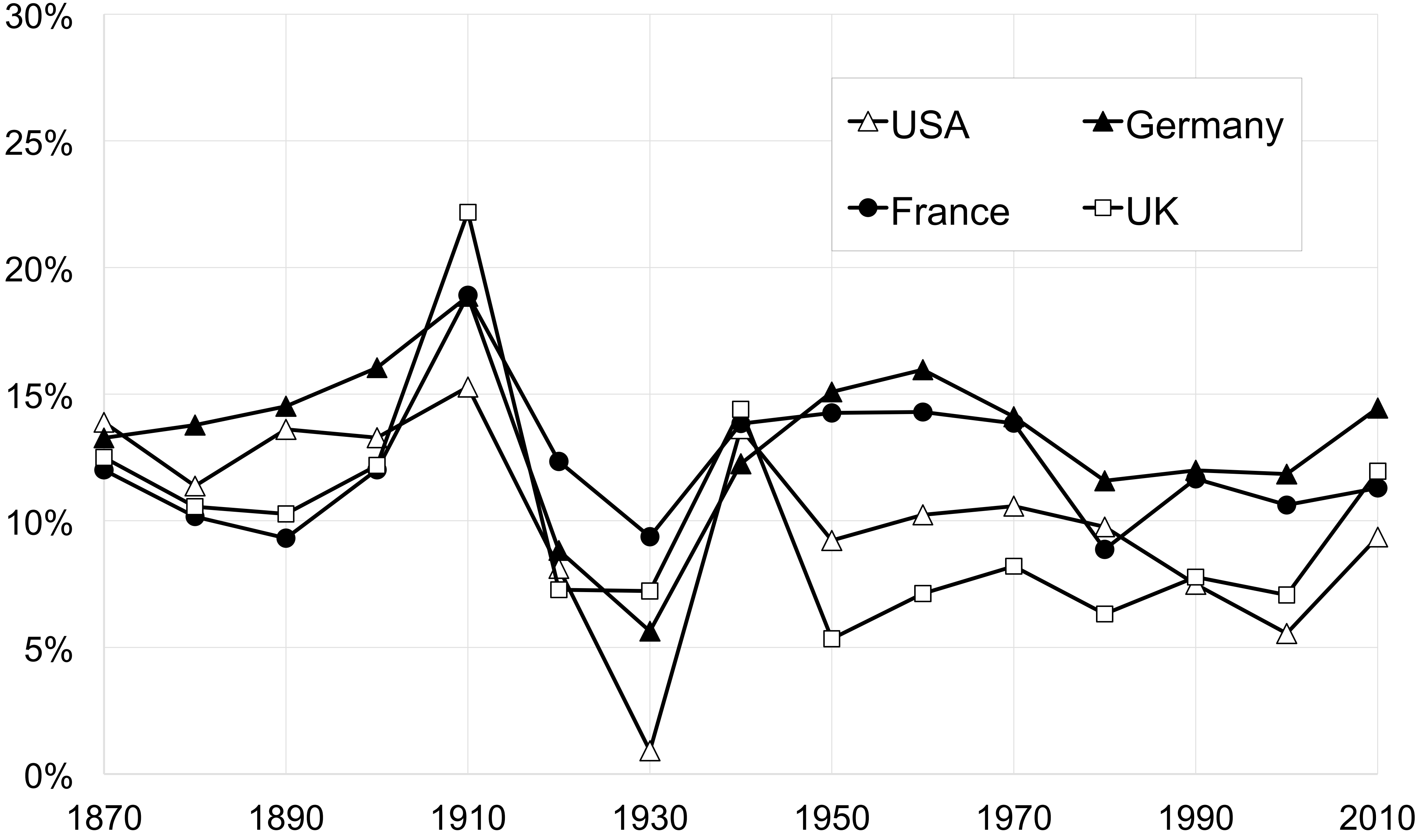


Figure A102: Net private saving rate (% national income) 1970-2010

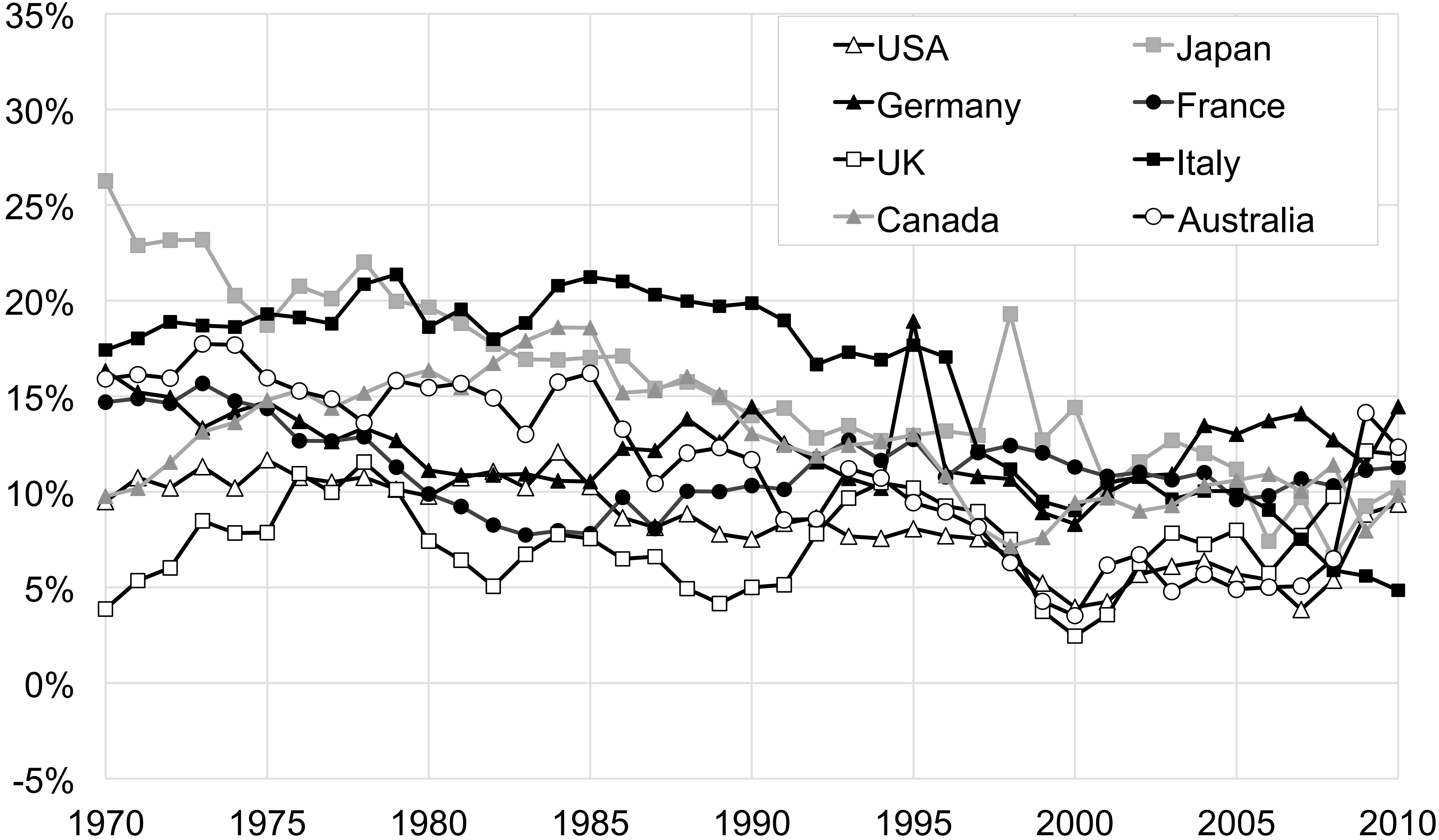


Figure A103: Net private saving rates 1810-2010 (decennial averages)

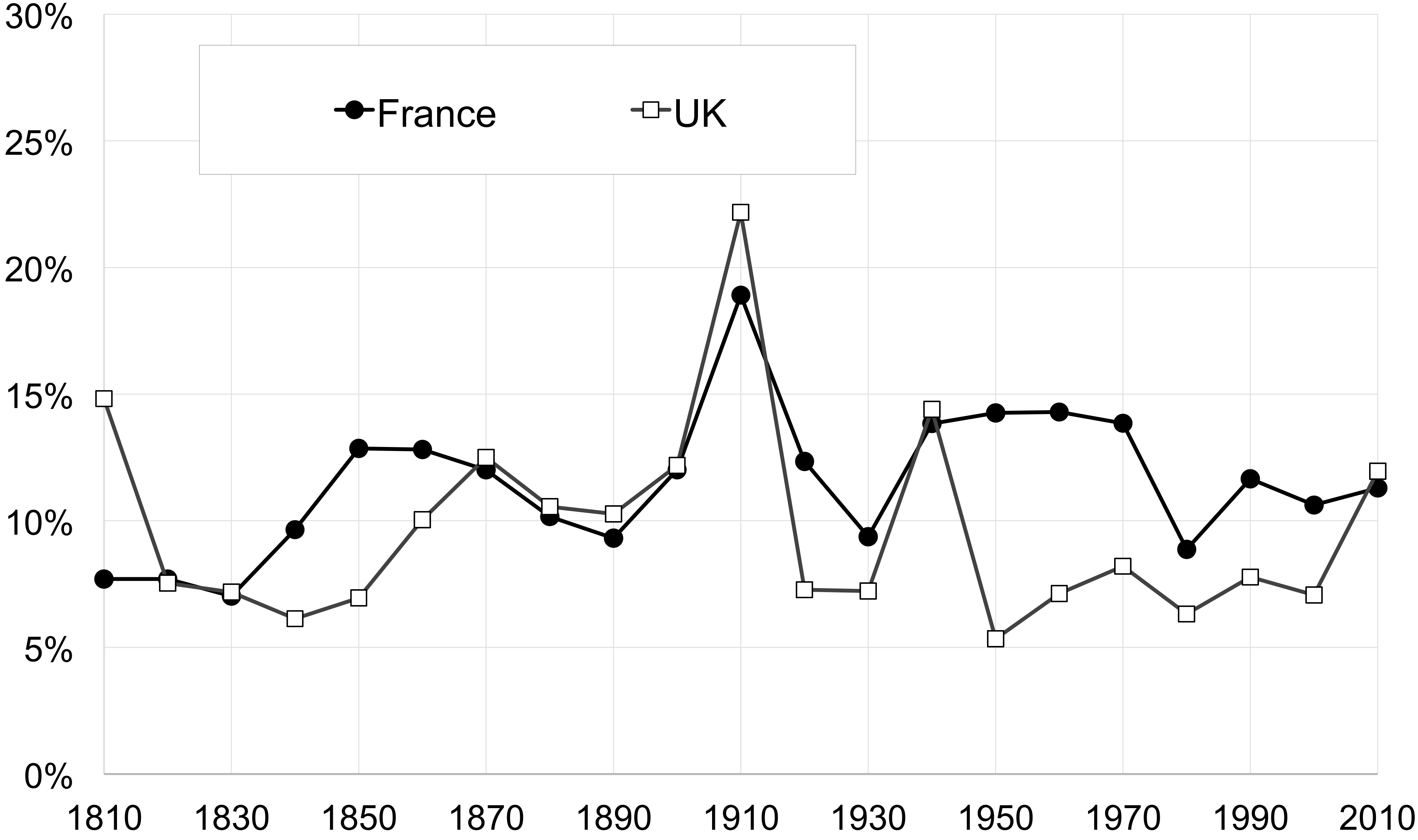


Figure A104: Net government saving rates 1870-2010

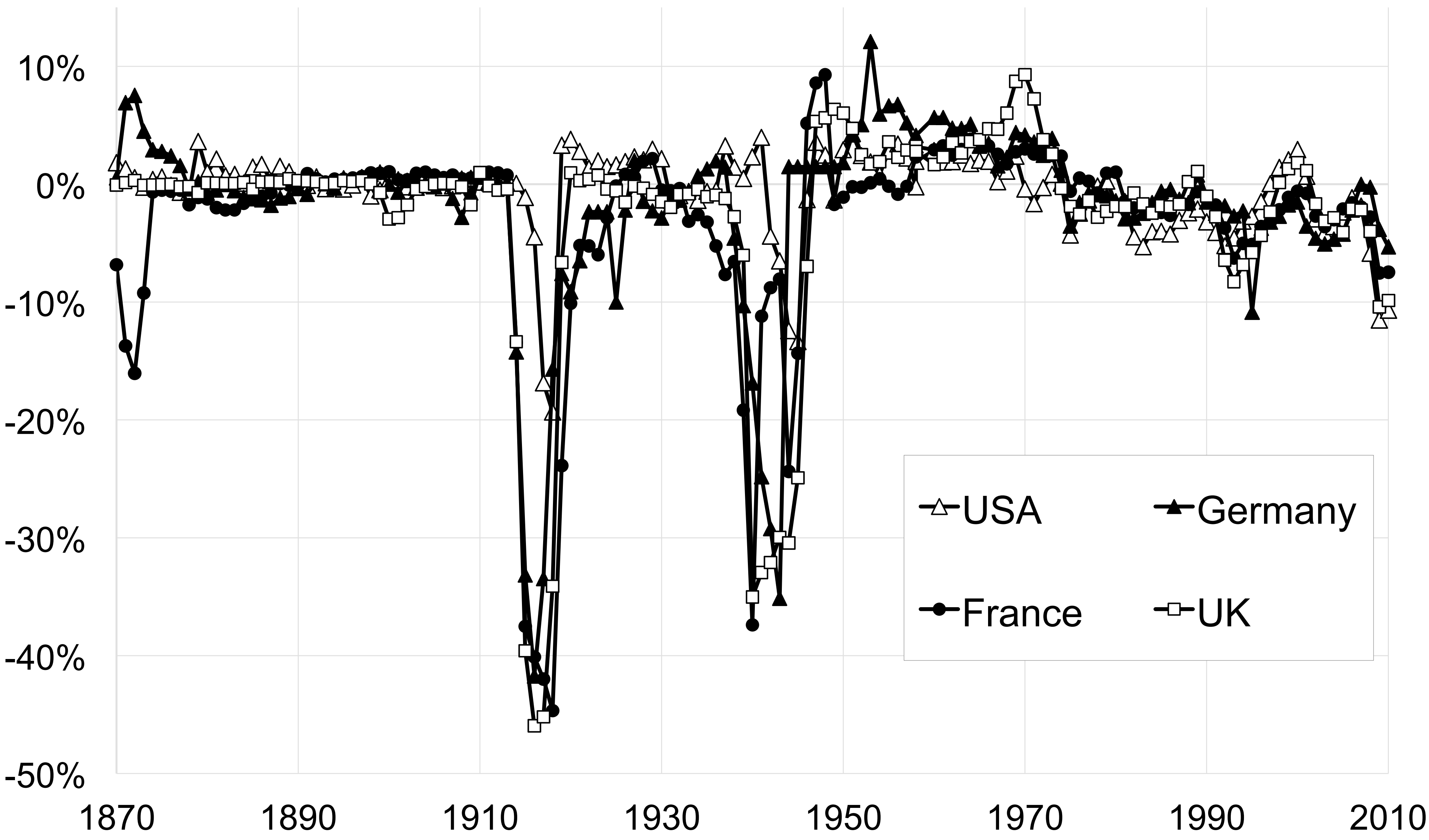


Figure A105: Net government saving rates 1870-2010 (% national income, decennial averages)

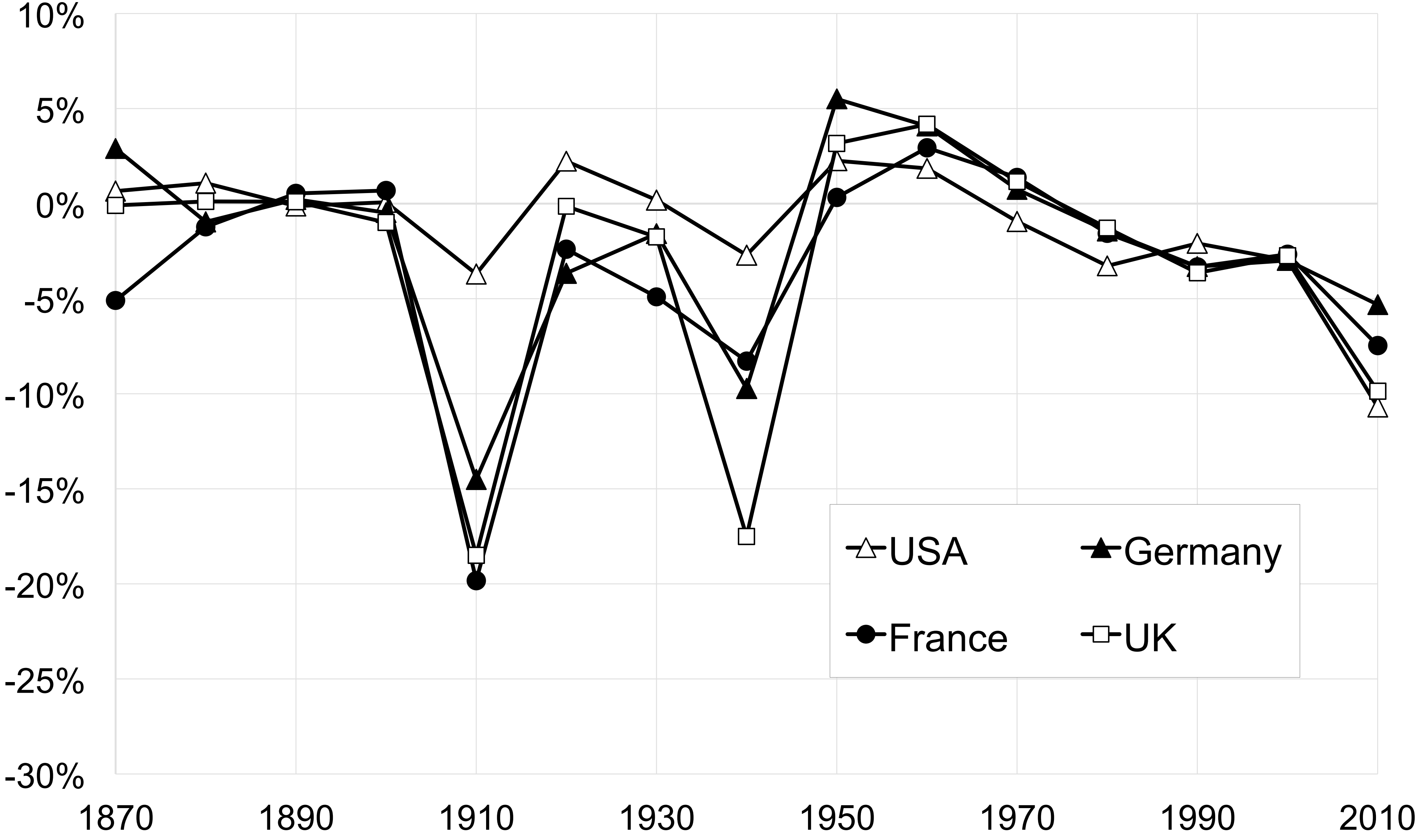


Figure A106: Net government saving rate (% national income) 1970-2010

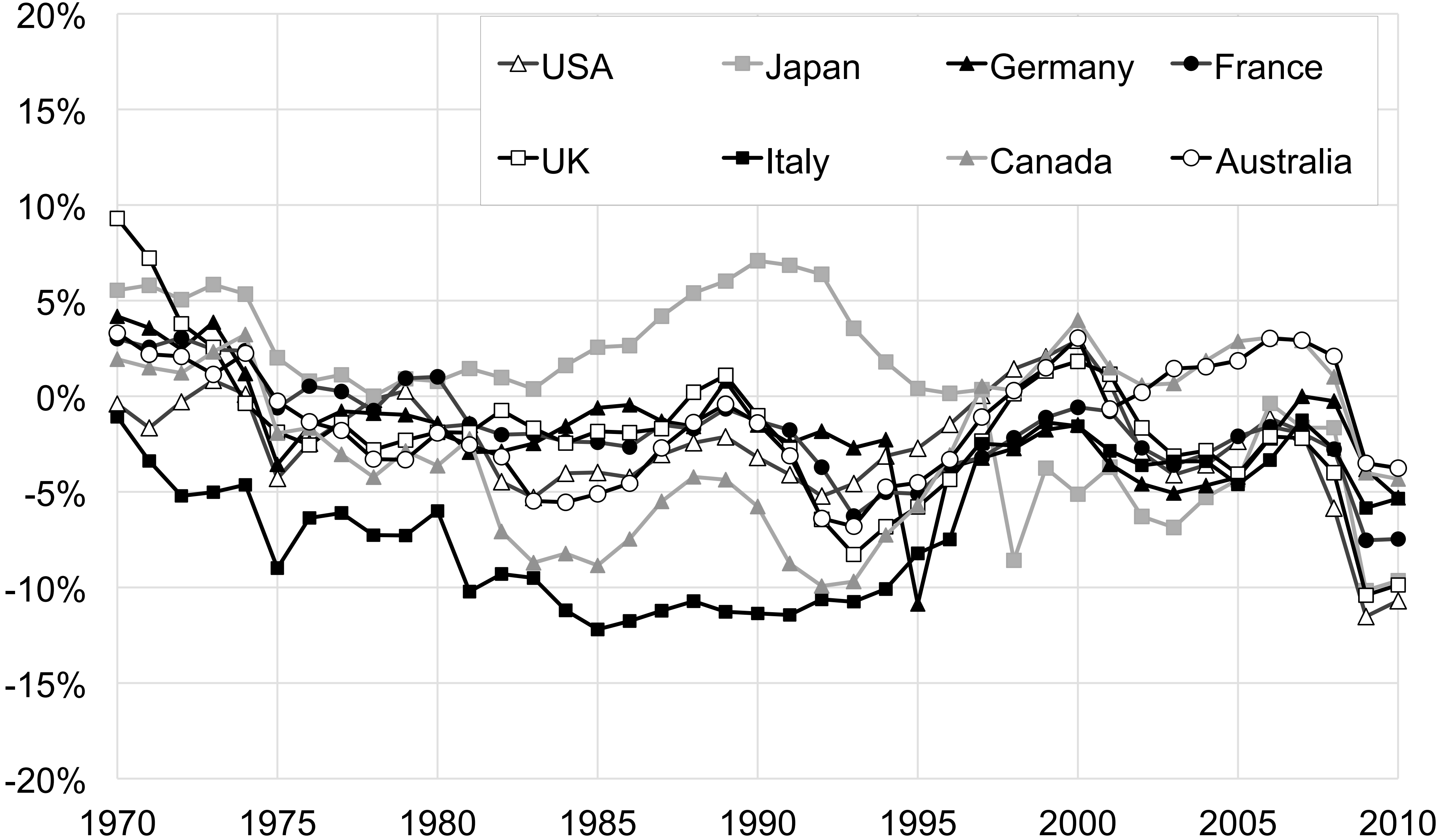


Figure A107: Net household saving rate (% national income) 1970-2010

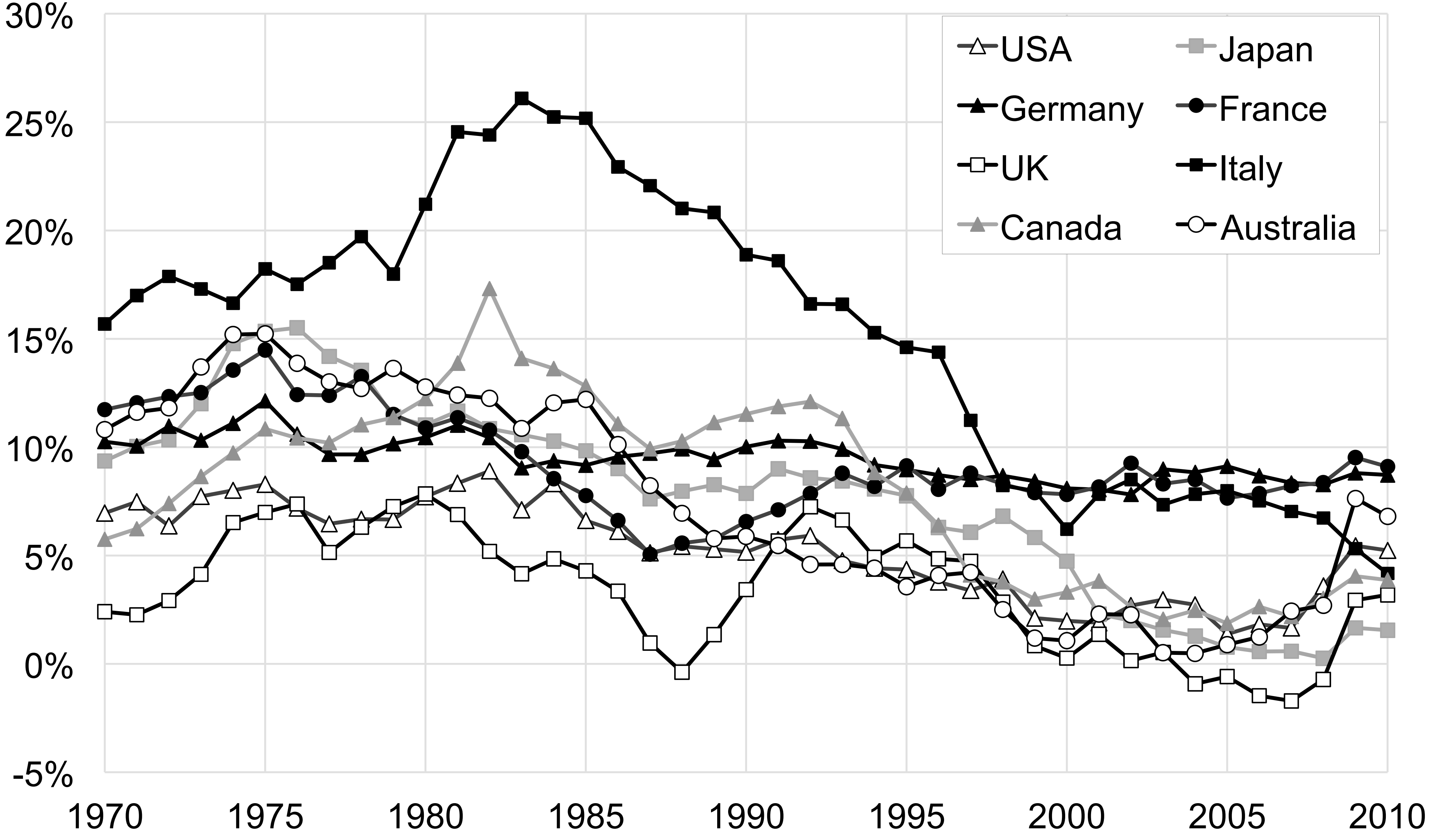
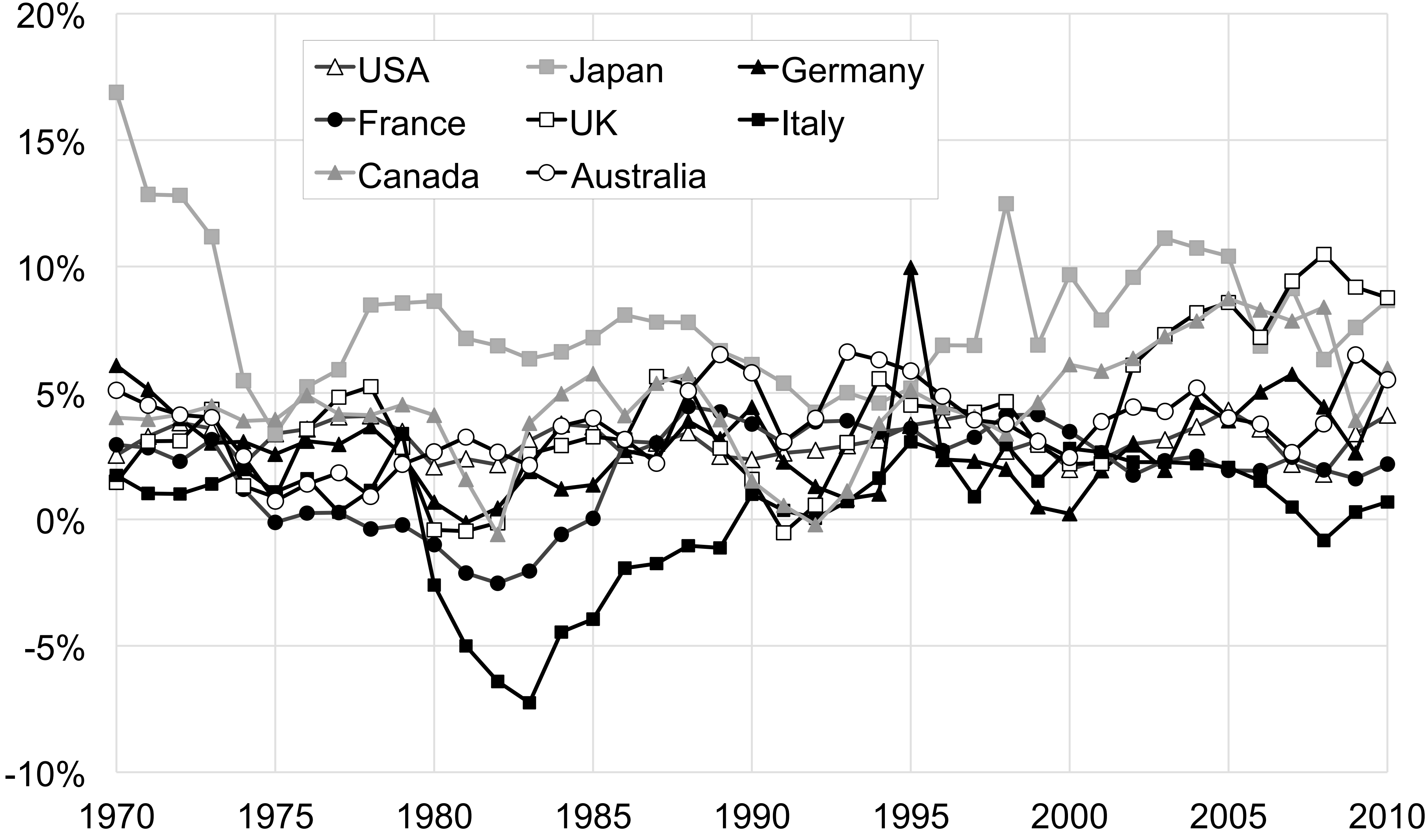


Figure A108: Net corporate saving rate (% national income) 1970-2010



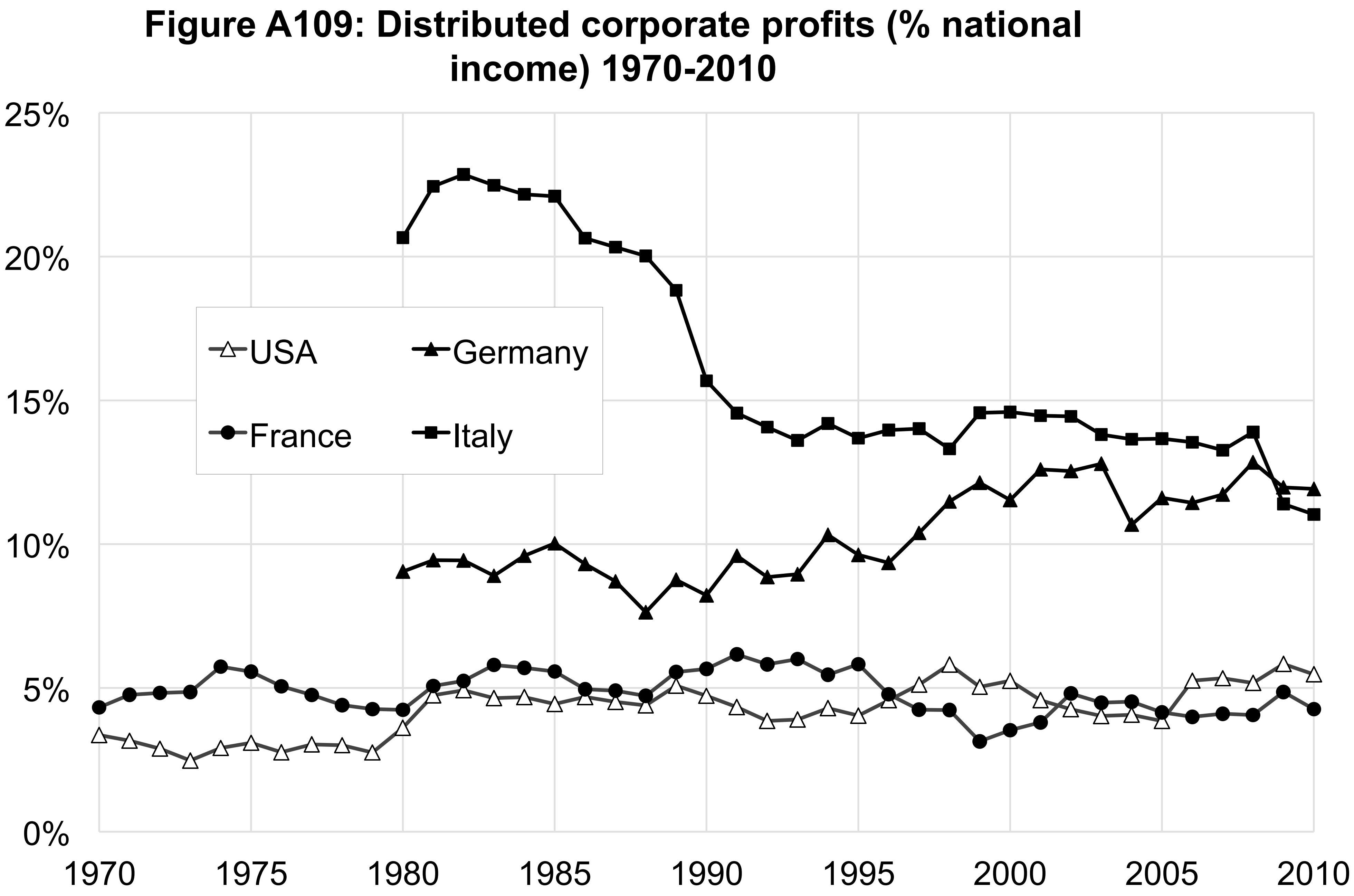


Figure A109: Distributed corporate profits (% national income) 1970-2010
25%
20%
15%
10%
5%
0%
1970
1975
1980
1985
1990
1995
2000
2005
2010
USA
Germany
France
Italy

Figure A110: Net foreign saving rates 1870-2010

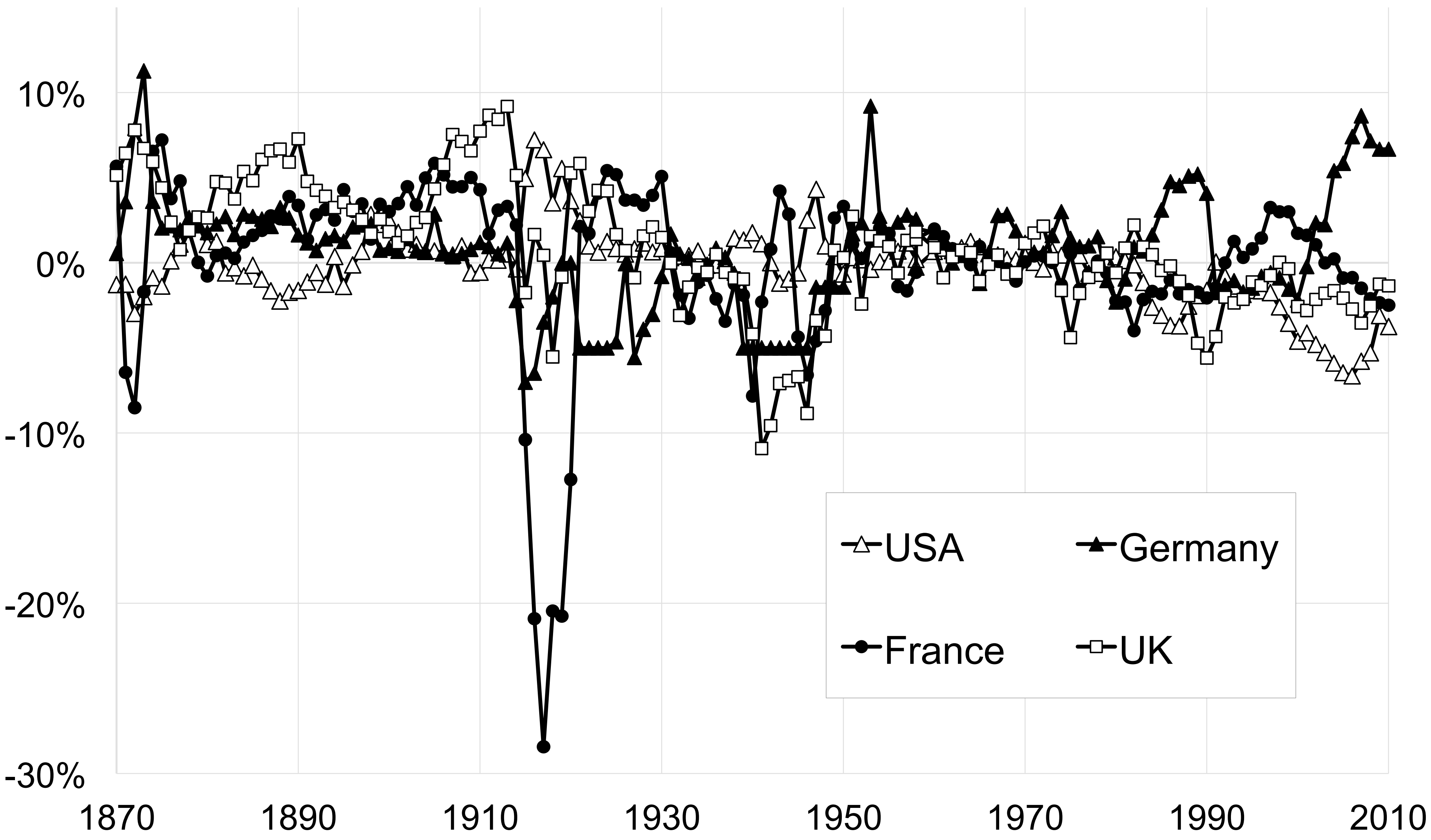


Figure A111: Net foreign saving rates 1870-2010 (% national income, decennial averages)

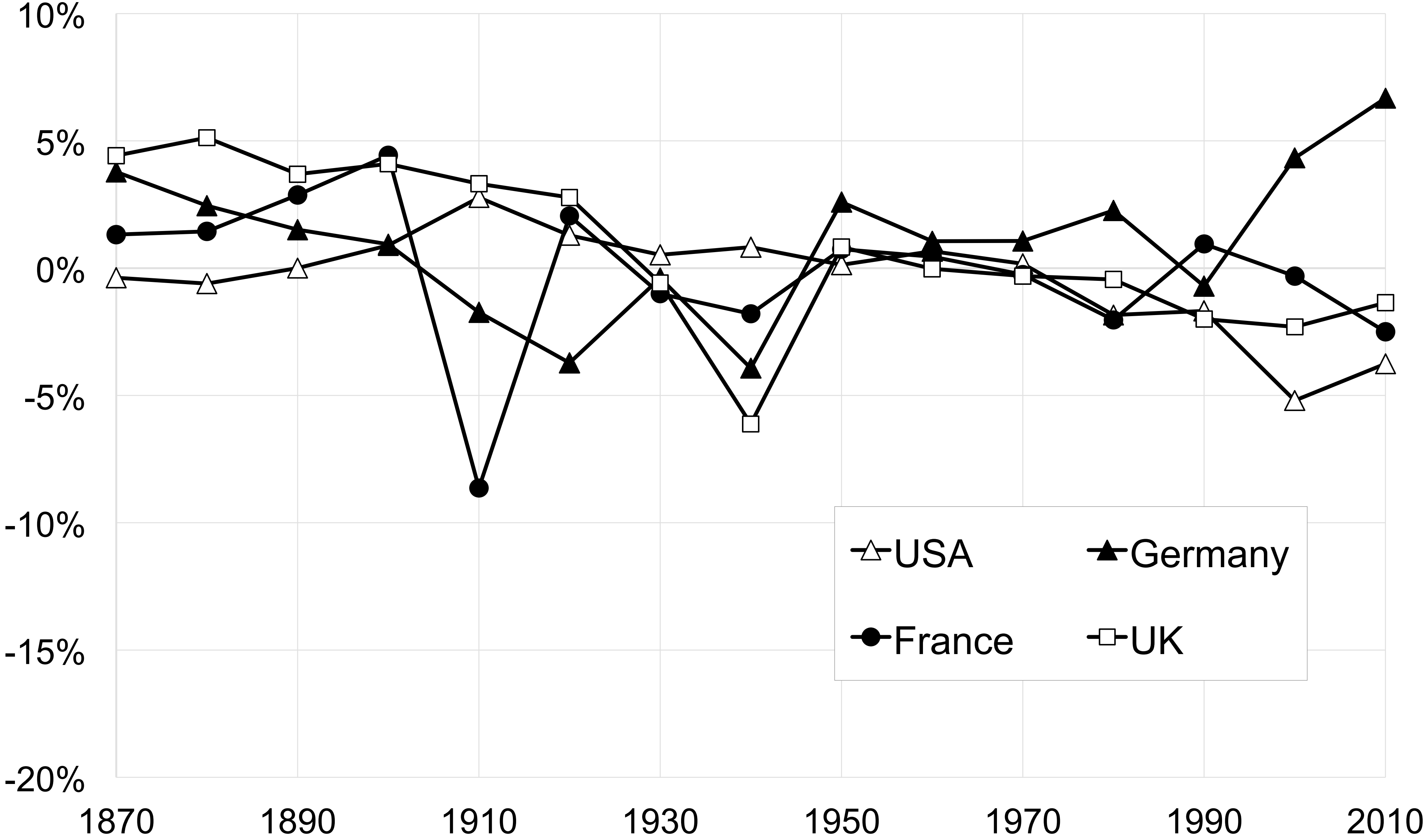


Figure A112: Net domestic investment rates 1870-2010

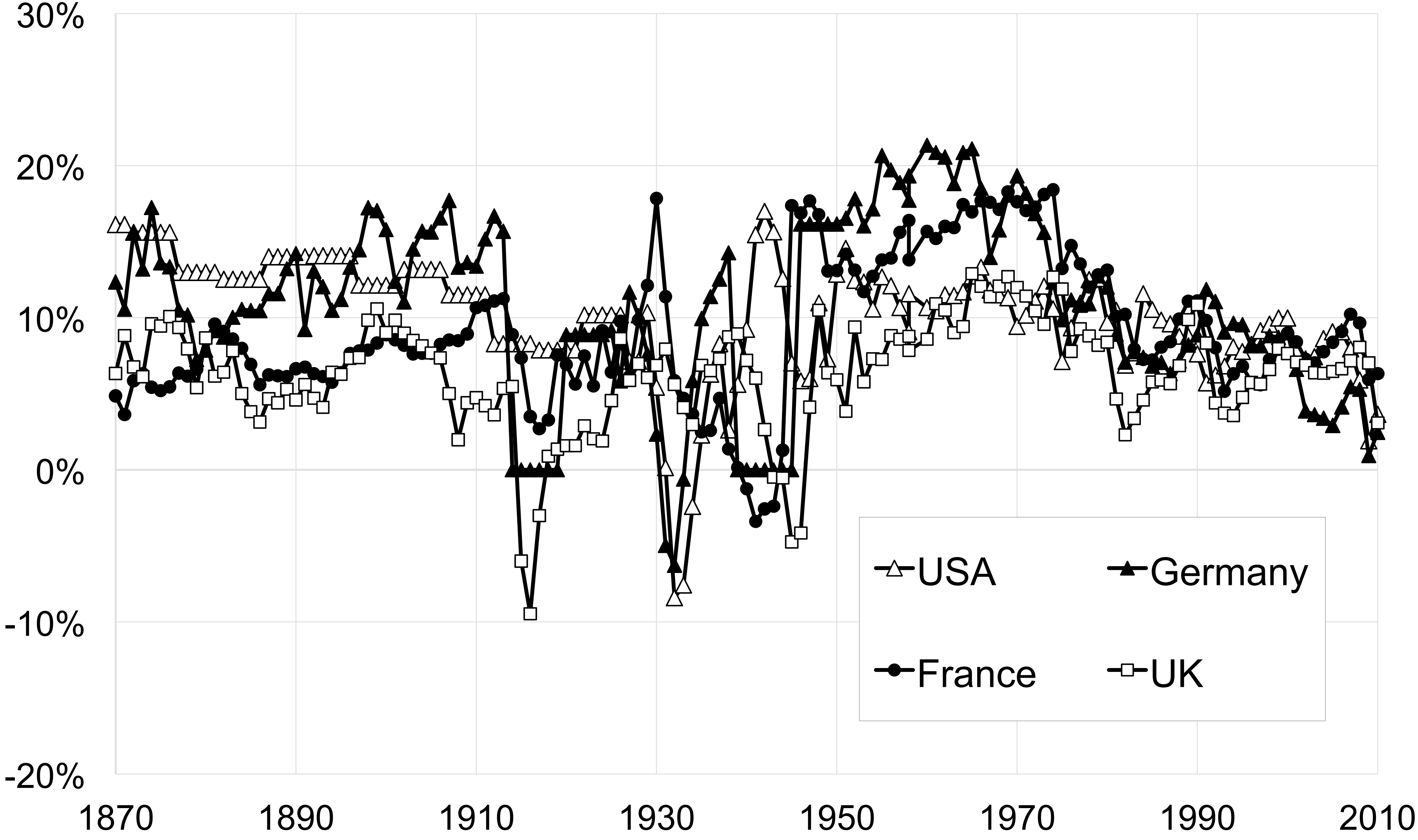


Figure A113: Net domestic investment rates 1870-2010 (% national income, decennial averages)

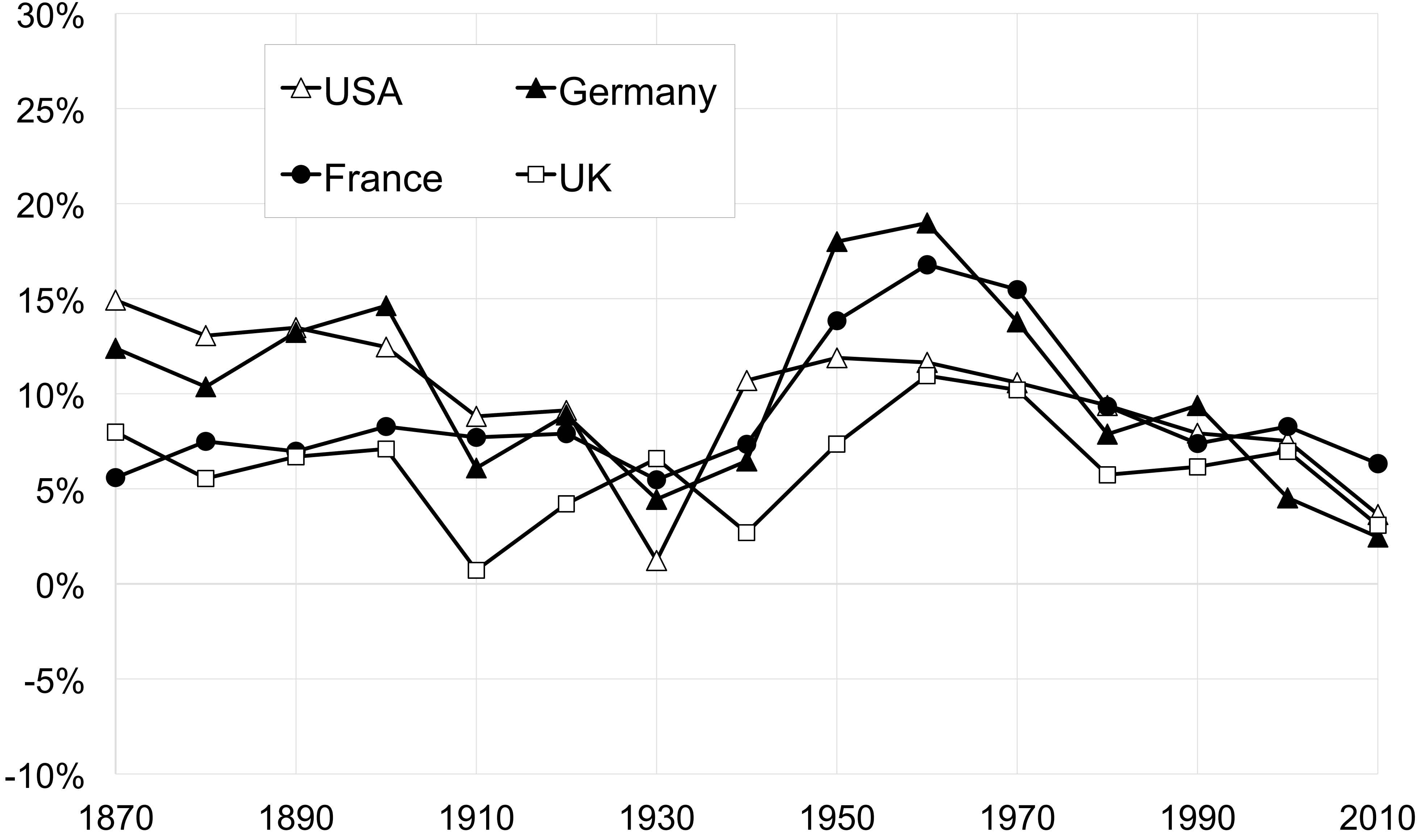


Figure A114: Net domestic vs. foreign investment rates: Germany 1870-2010

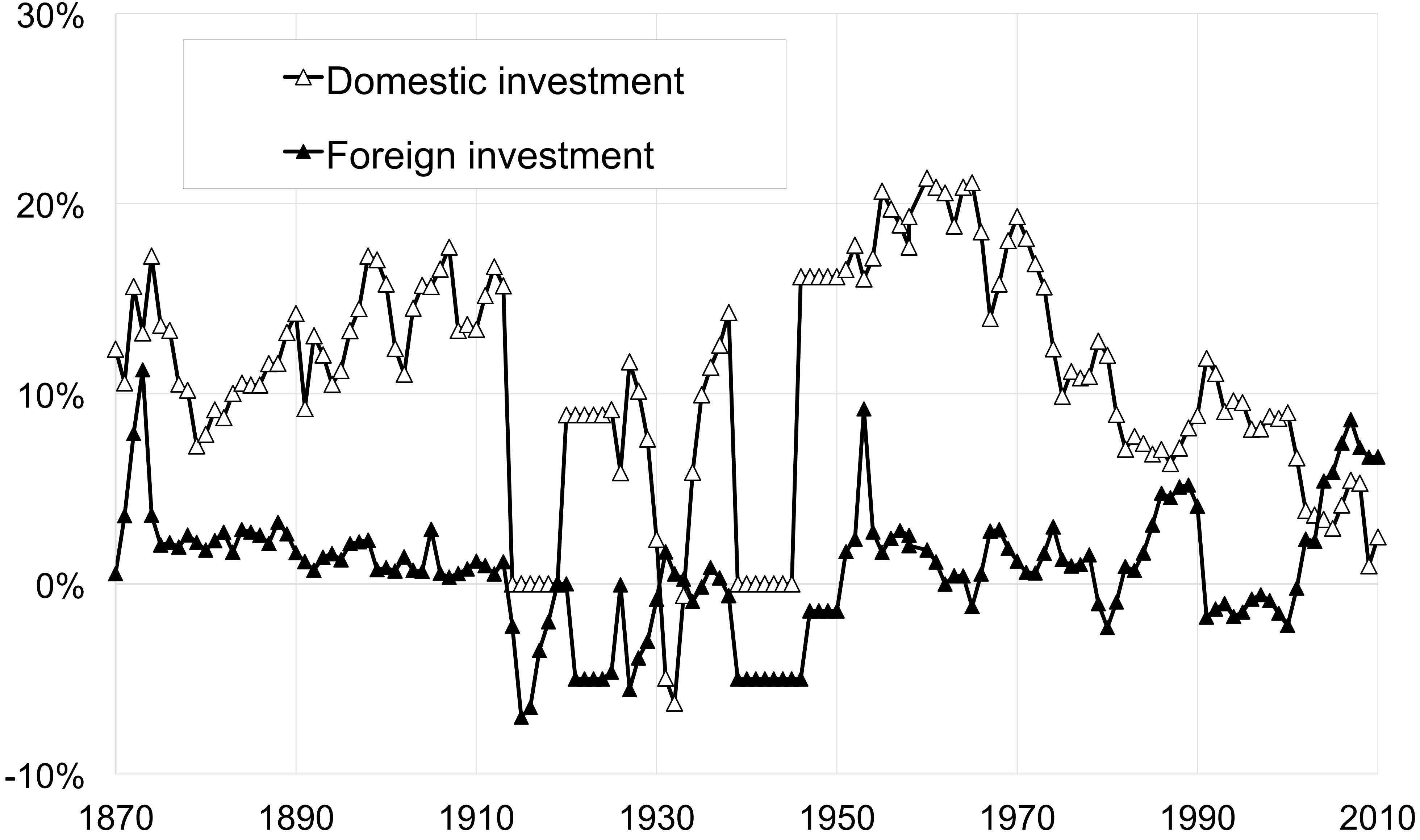


Figure A115: Net domestic vs. foreign investment rates: Germany 1870-2010

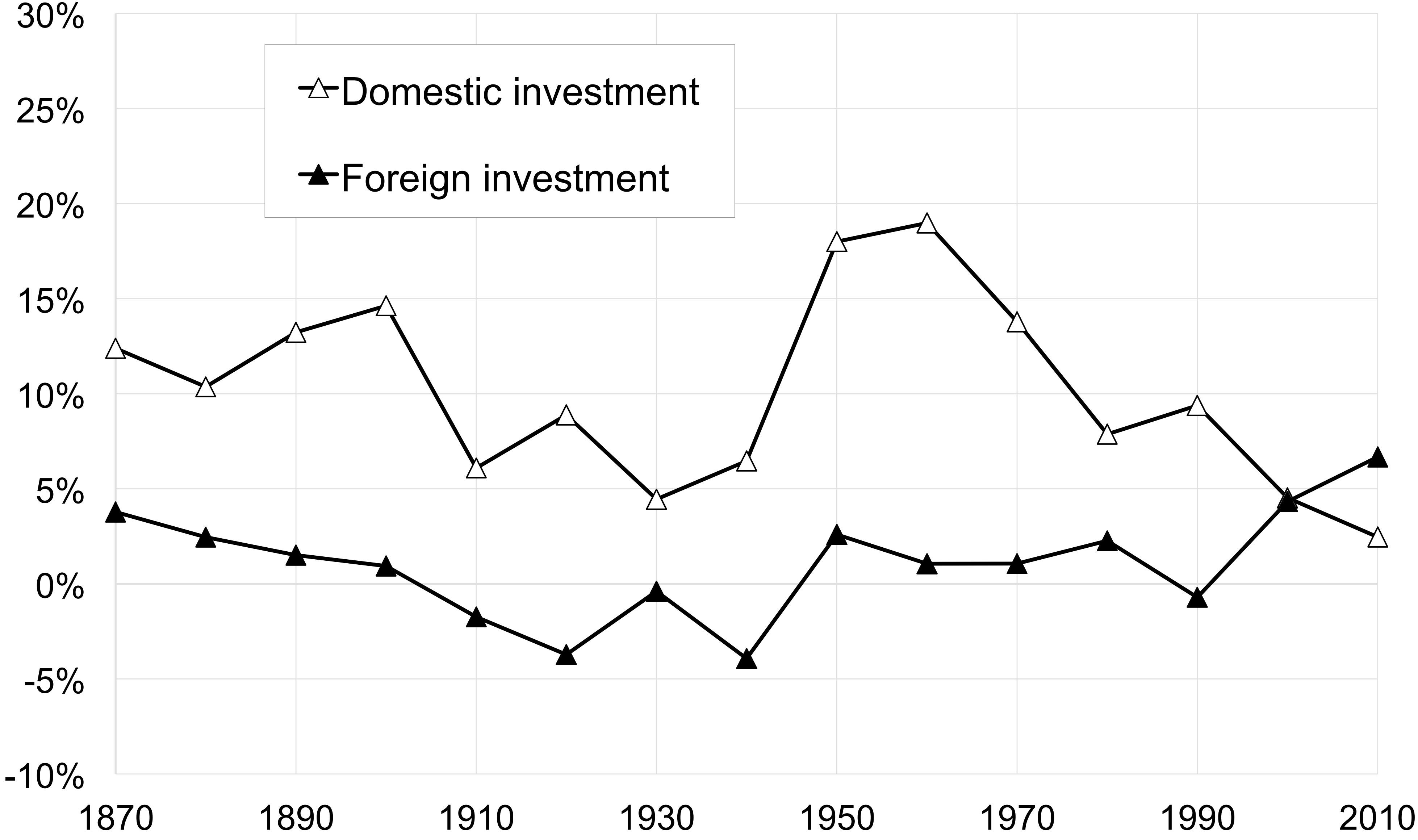
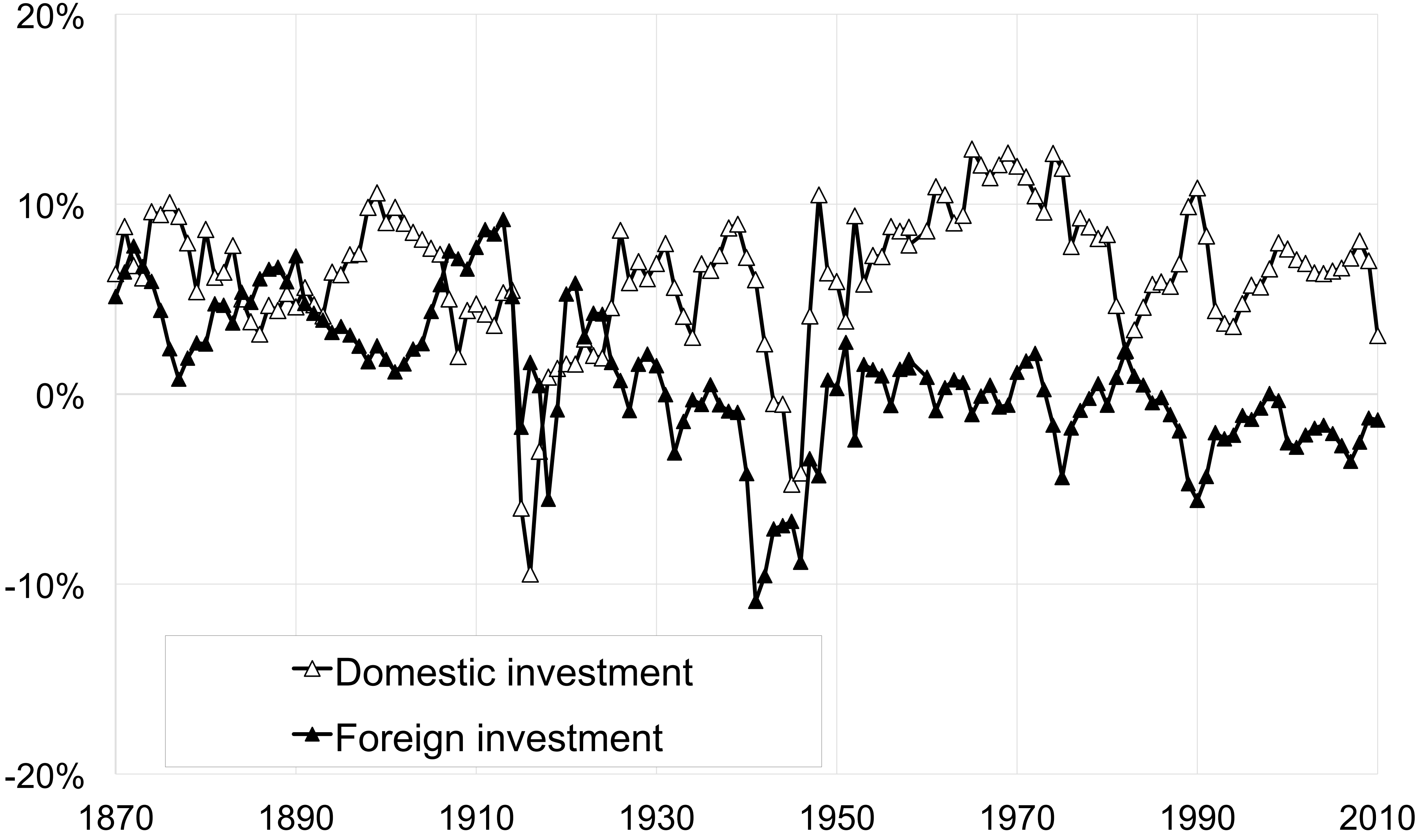


Figure A116: Net domestic vs. foreign investment rates: UK 1870-2010



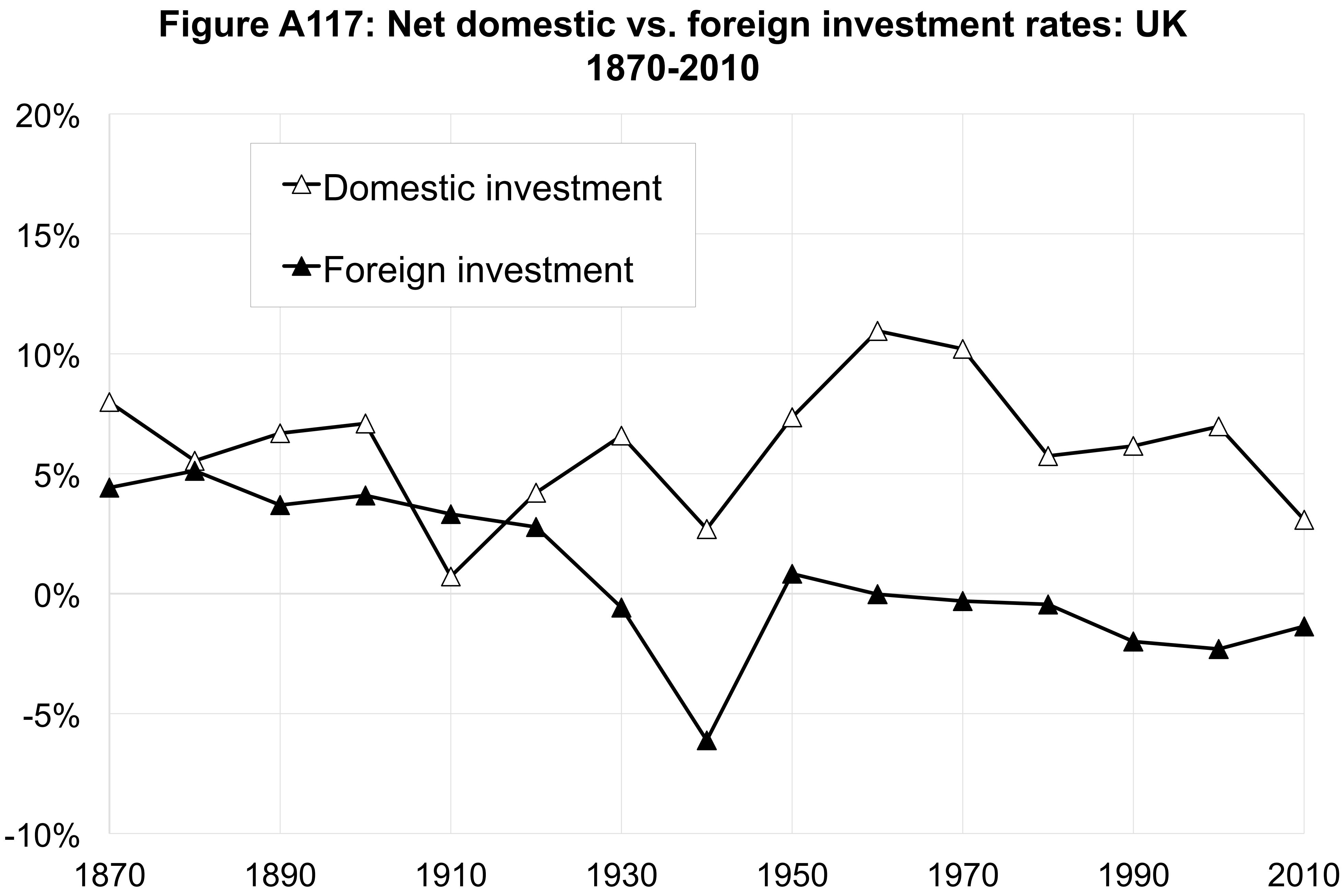


Figure A117: Net domestic vs. foreign investment rates: UK
1870-2010
Domestic investment
Foreign investment
20%
15%
10%
5%
0%
-5%
-10%
1870
1890
1910
1930
1950
1970
1990
2010

Figure A118: Net domestic vs. foreign investment rates: France 1870-2010

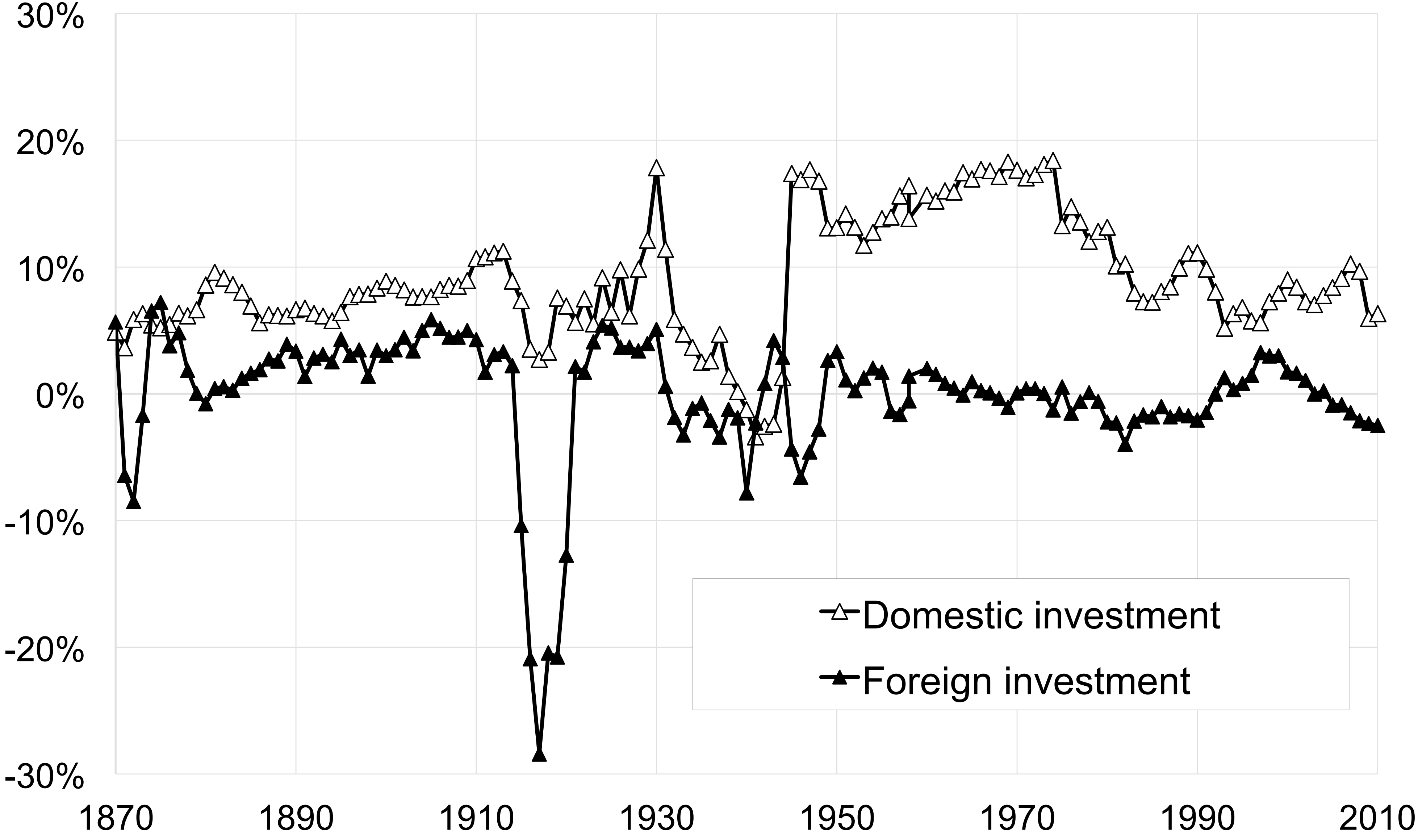


Figure A119: Net domestic vs. foreign investment rates: France 1870-2010

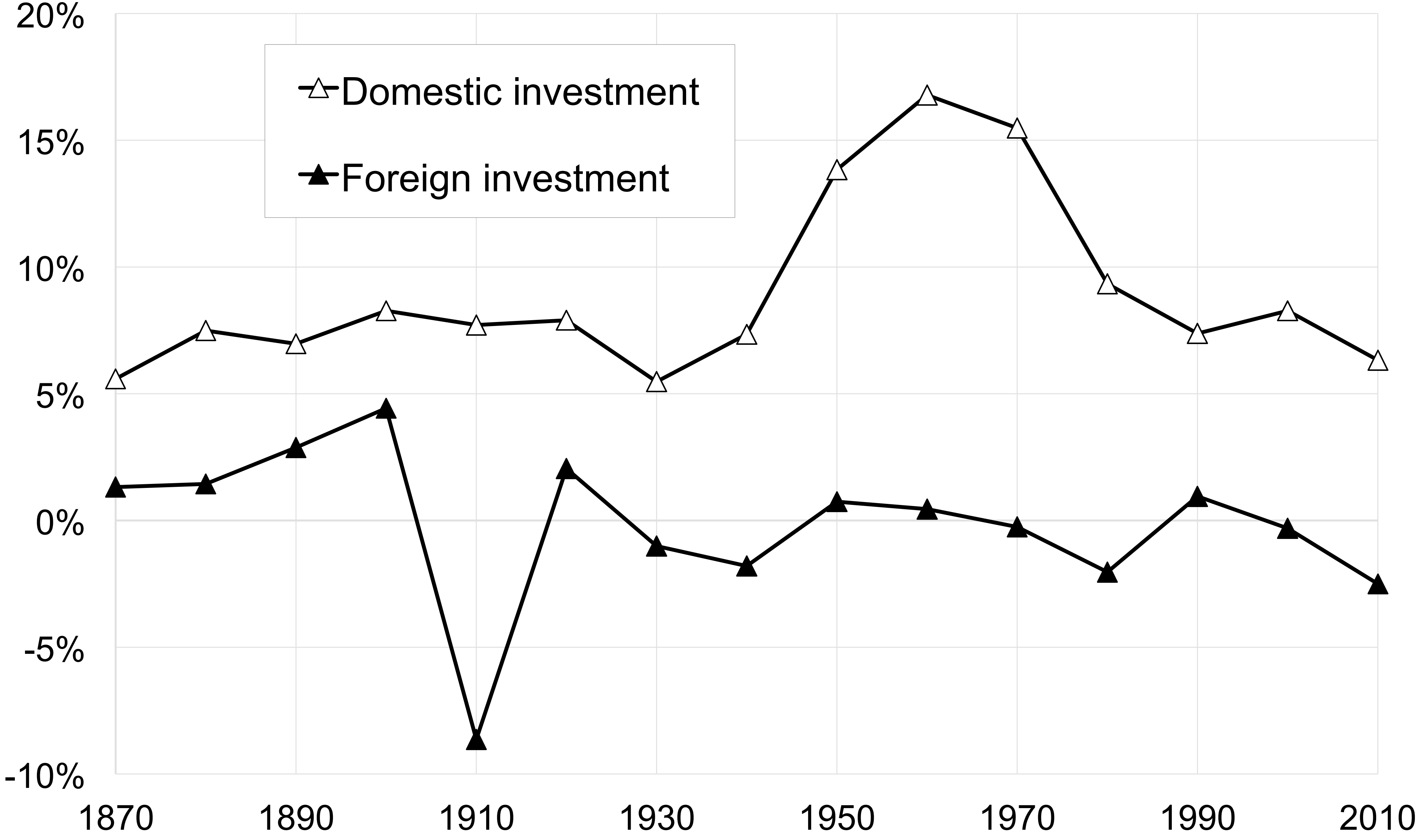


Figure A120: Net domestic vs. foreign investment rates: USA 1870-2010

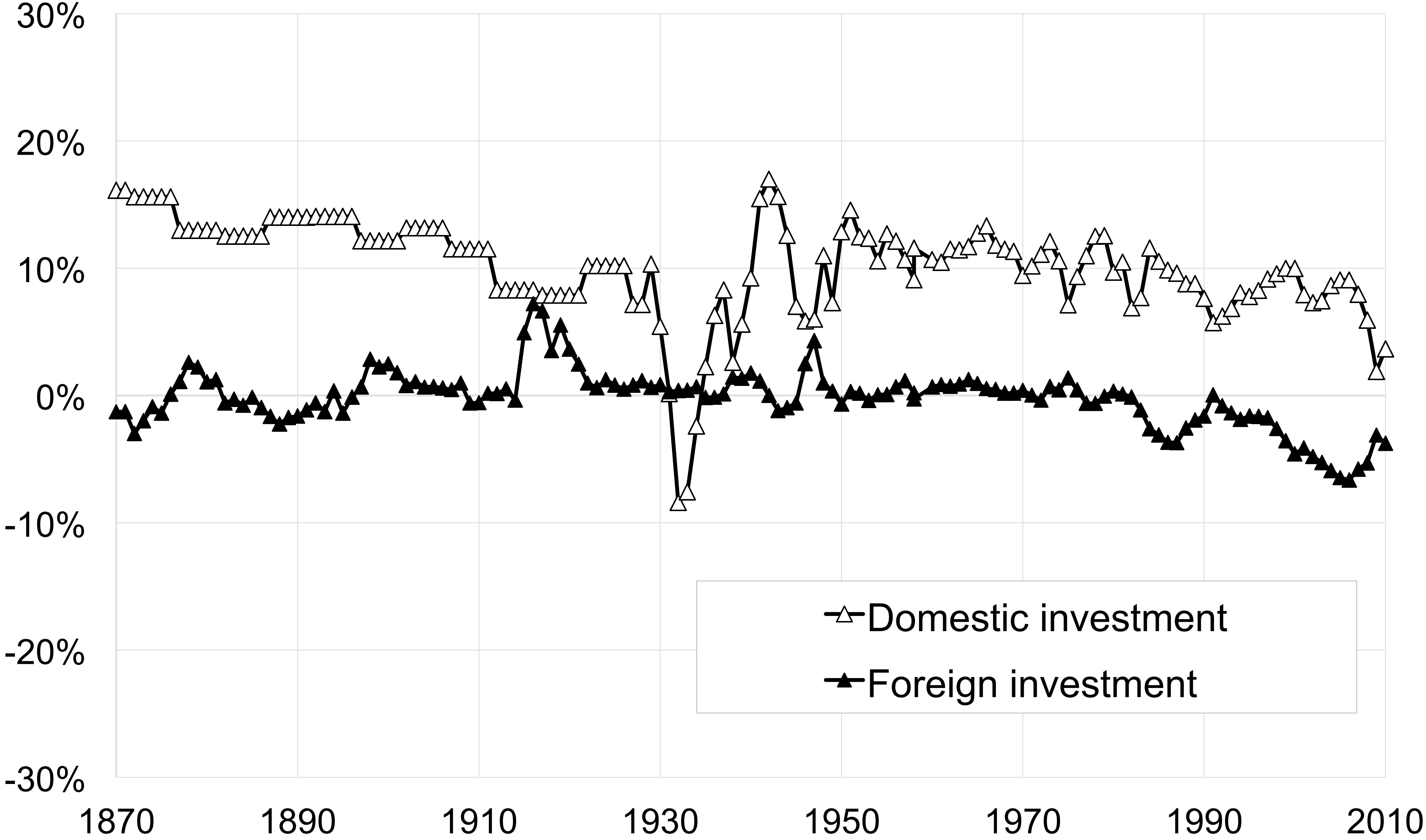


Figure A121: Net domestic vs. foreign investment rates: USA 1870-2010

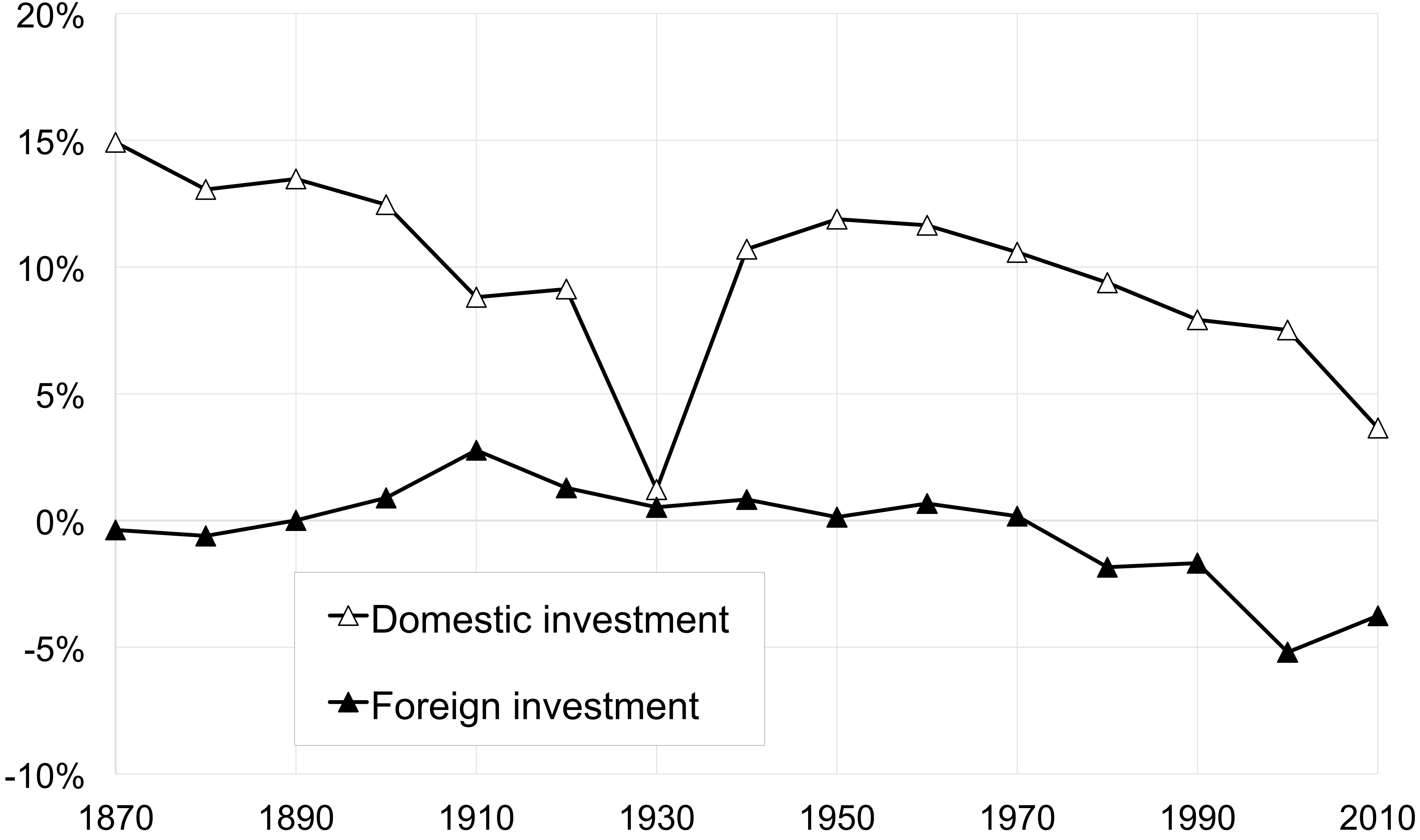


Figure A122: Growth rate vs private saving rate in rich countries 1970-2010

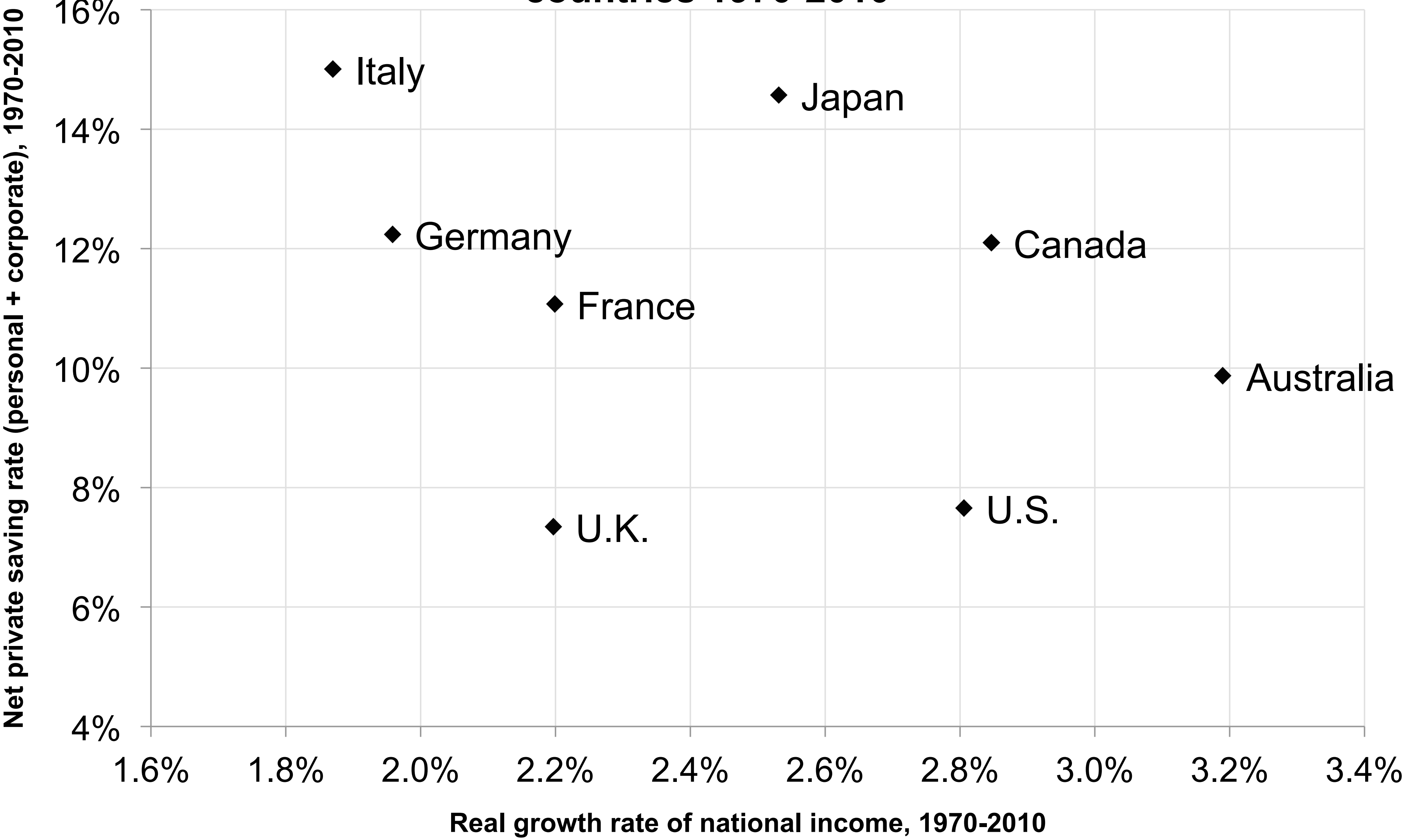


Figure A123: Growth rate vs national saving rate in rich countries 1970-2010

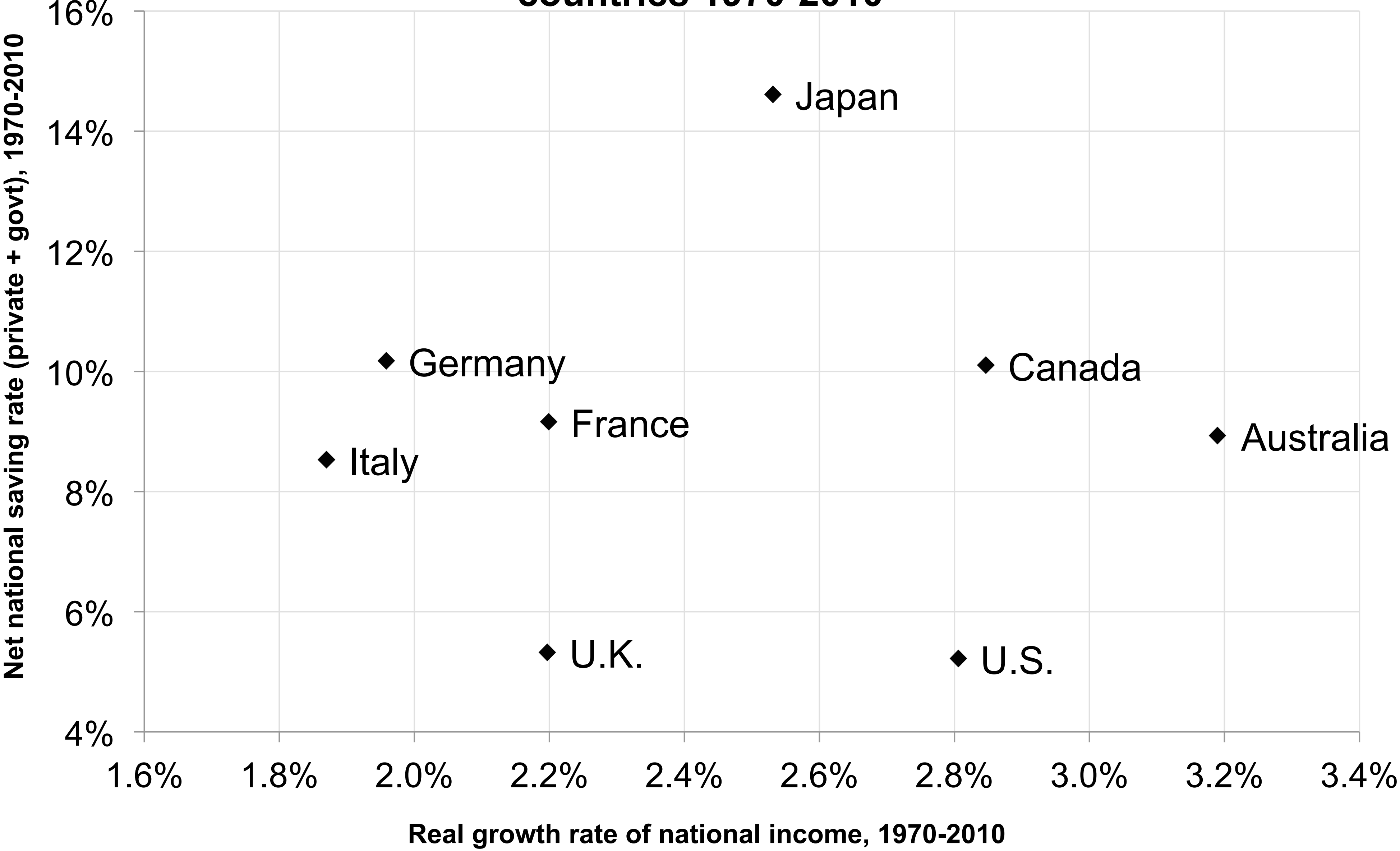
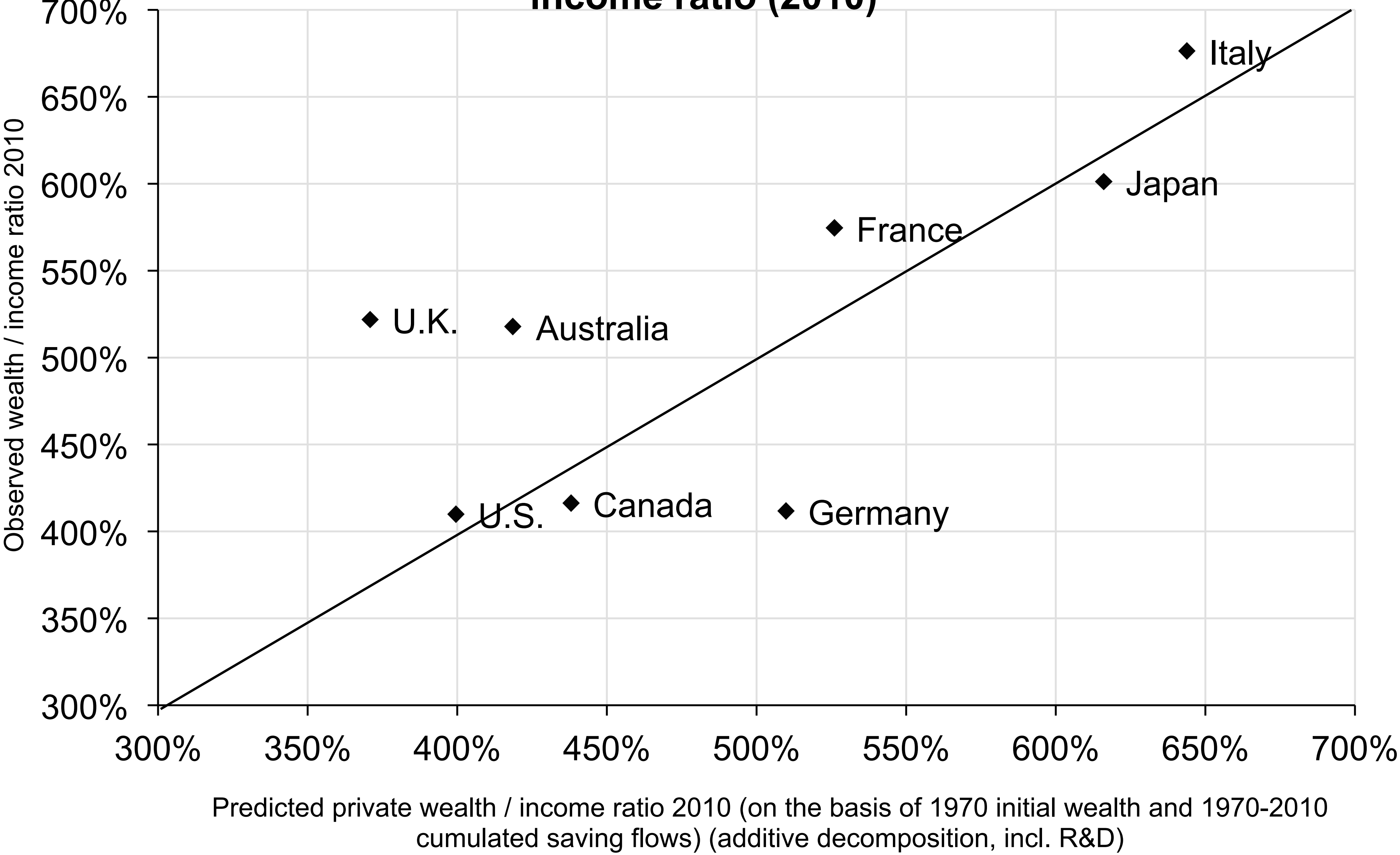


Figure A124: Observed vs predicted private wealth / national income ratio (2010)



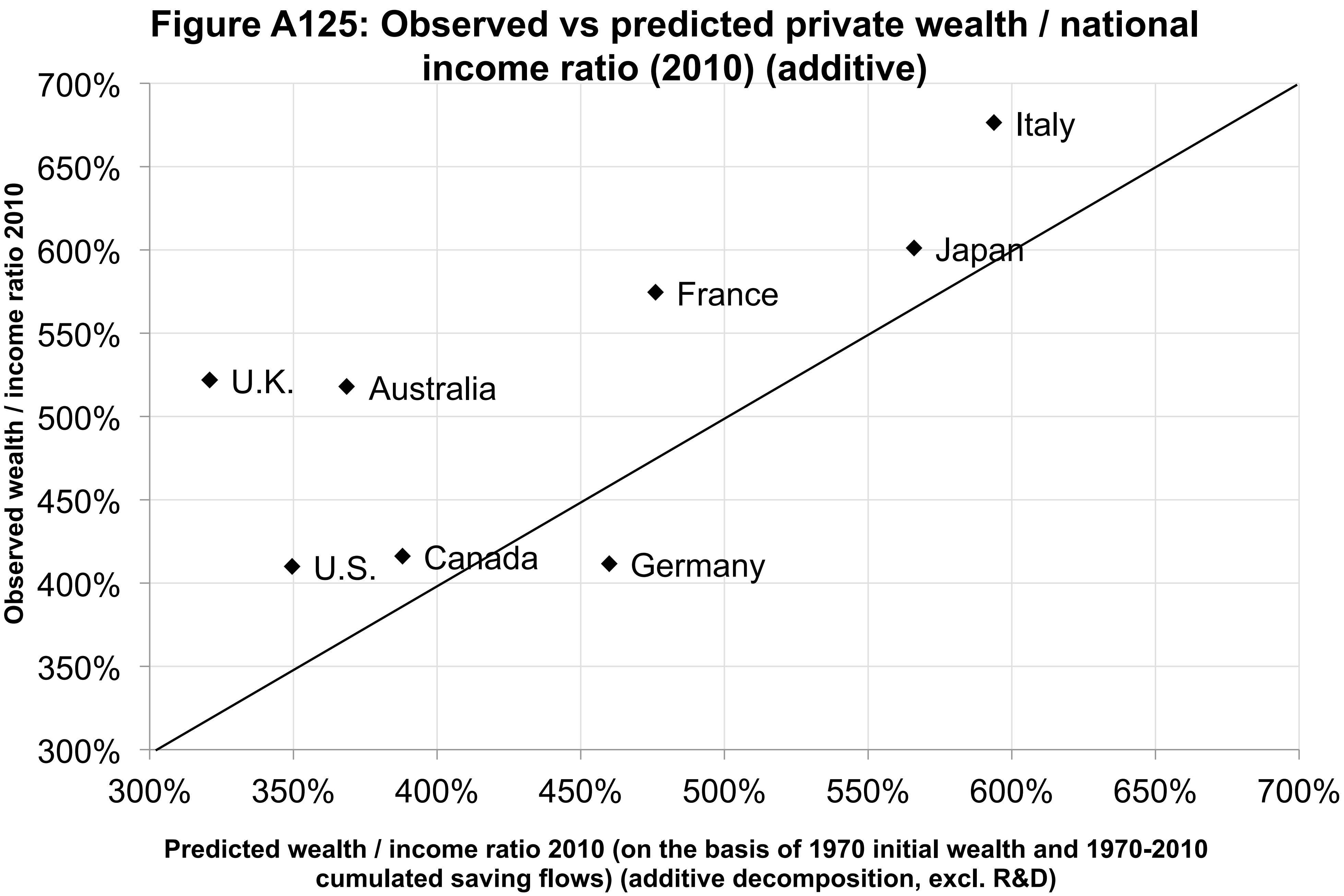
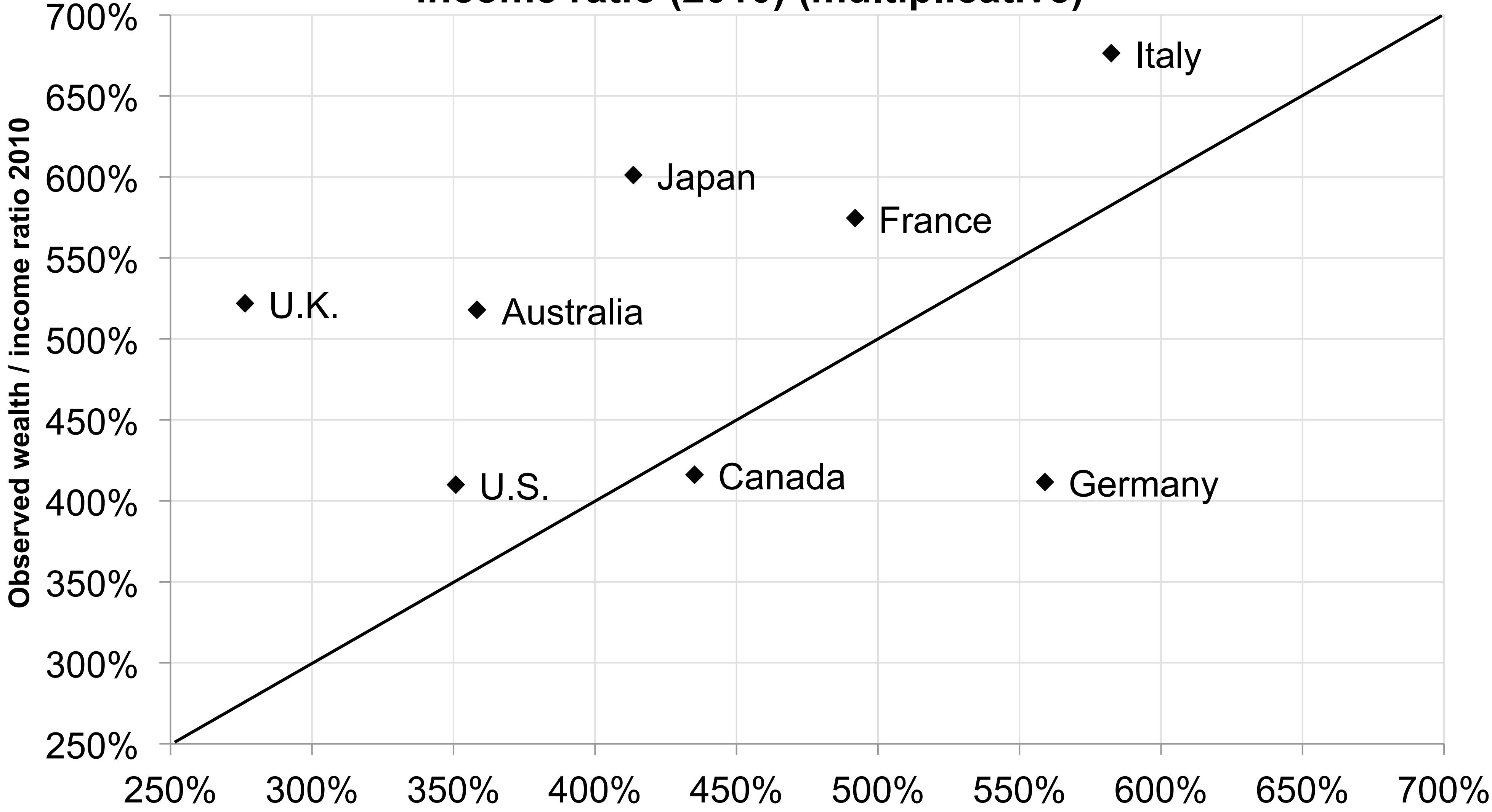


Figure A125: Observed vs predicted private wealth / national income ratio (2010) (additive)
Observed wealth / income ratio 2010
Predicted wealth / income ratio 2010 (on the basis of 1970 initial wealth and 1970-2010 cumulated saving flows) (additive decomposition, excl. R&D)
700%
650%
600%
550%
500%
450%
400%
350%
300%
300%
350%
400%
450%
500%
550%
600%
650%
700%
Italy
Japan
France
U.K.
Australia
Canada
U.S.
Germany

Figure A126: Observed vs predicted private wealth / national income ratio (2010) (multiplicative)



Predicted wealth / income ratio 2010 (on the basis of 1970 initial wealth and 1970-2010 cumulated savings) (private wealth, multip. decomposition, excl. R&D)

Figure A127: Observed vs predicted national wealth / national income ratio (2010)

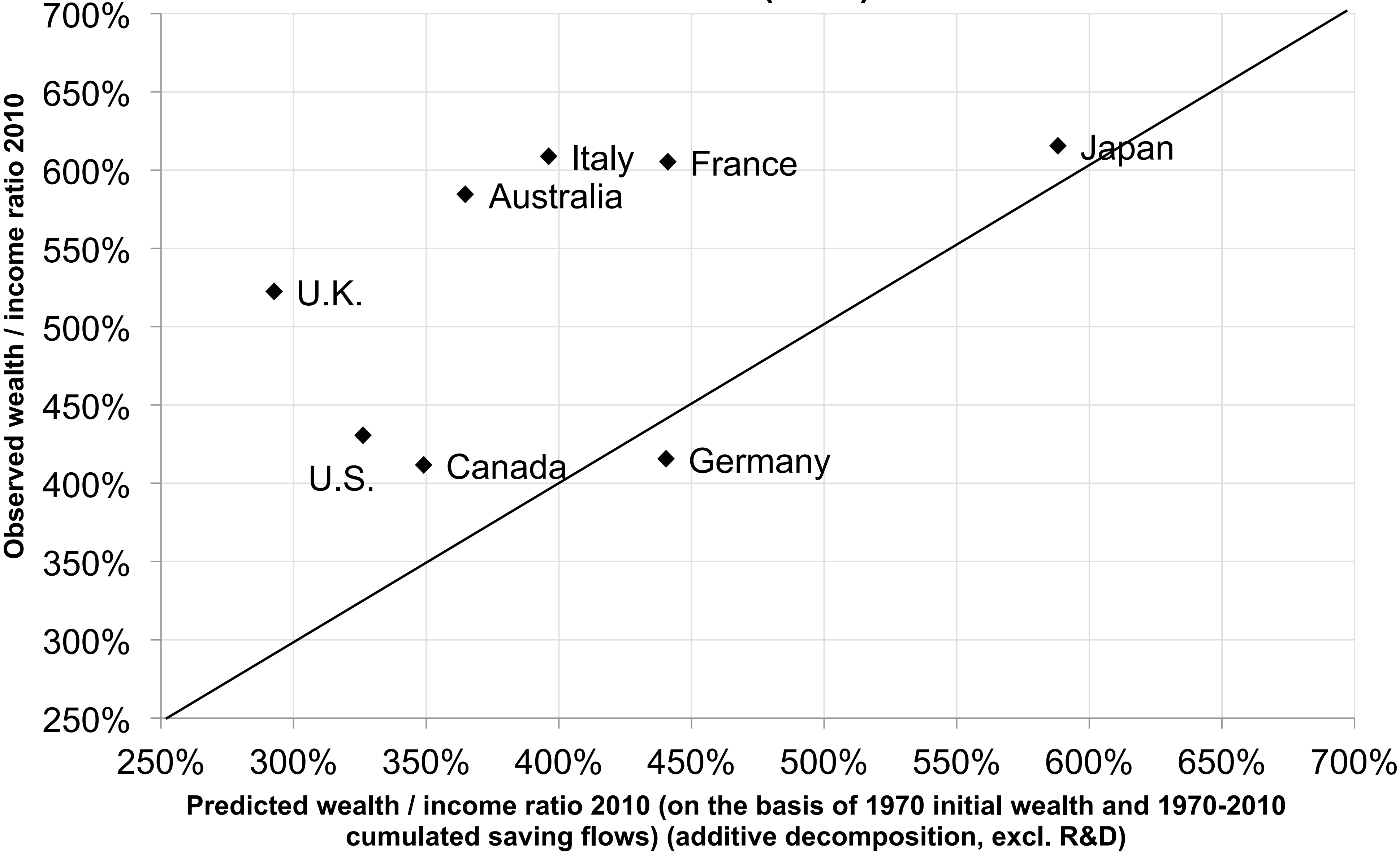


Figure A128: Observed vs predicted national wealth/national income ratio (2010) (multiplicative)

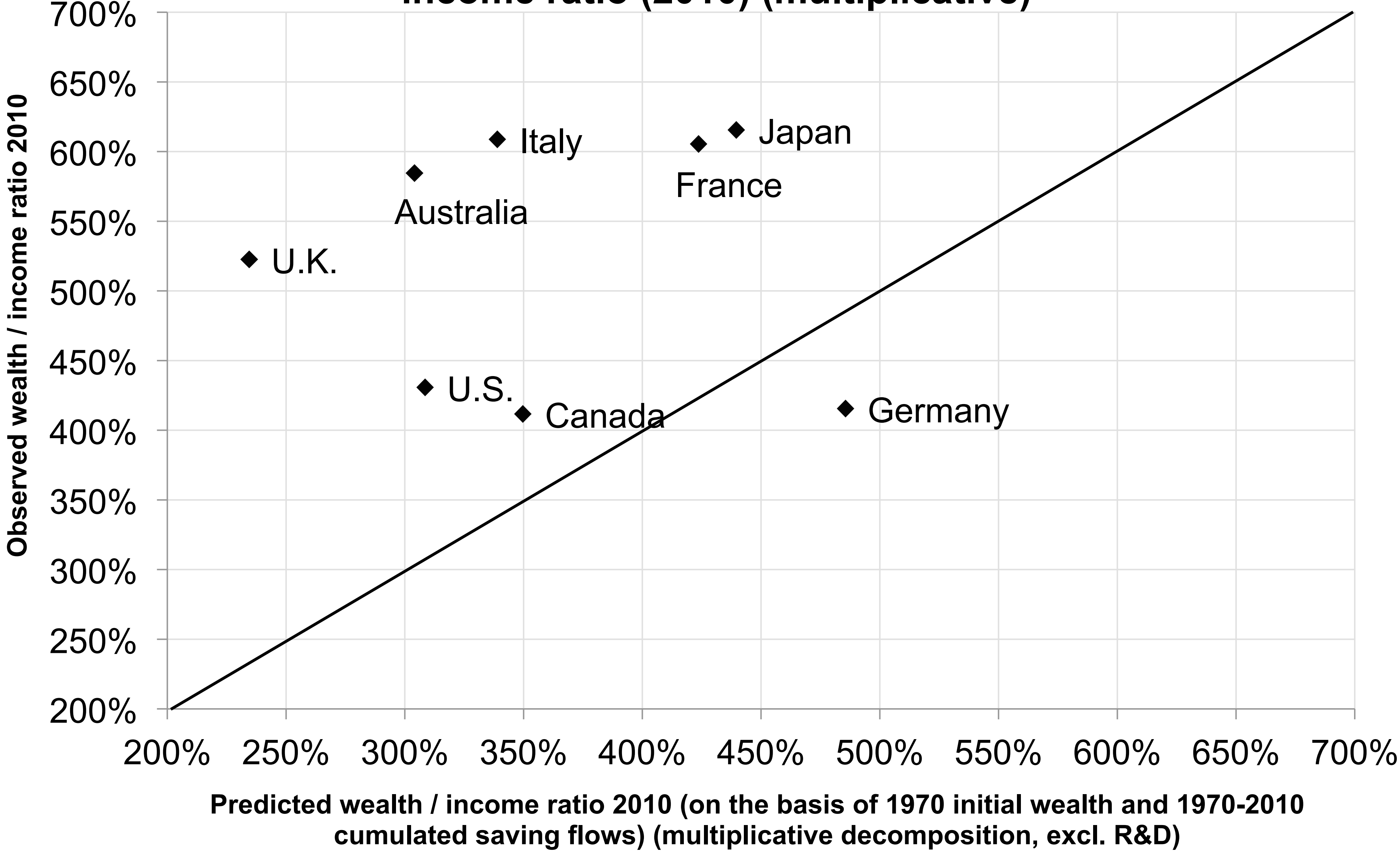
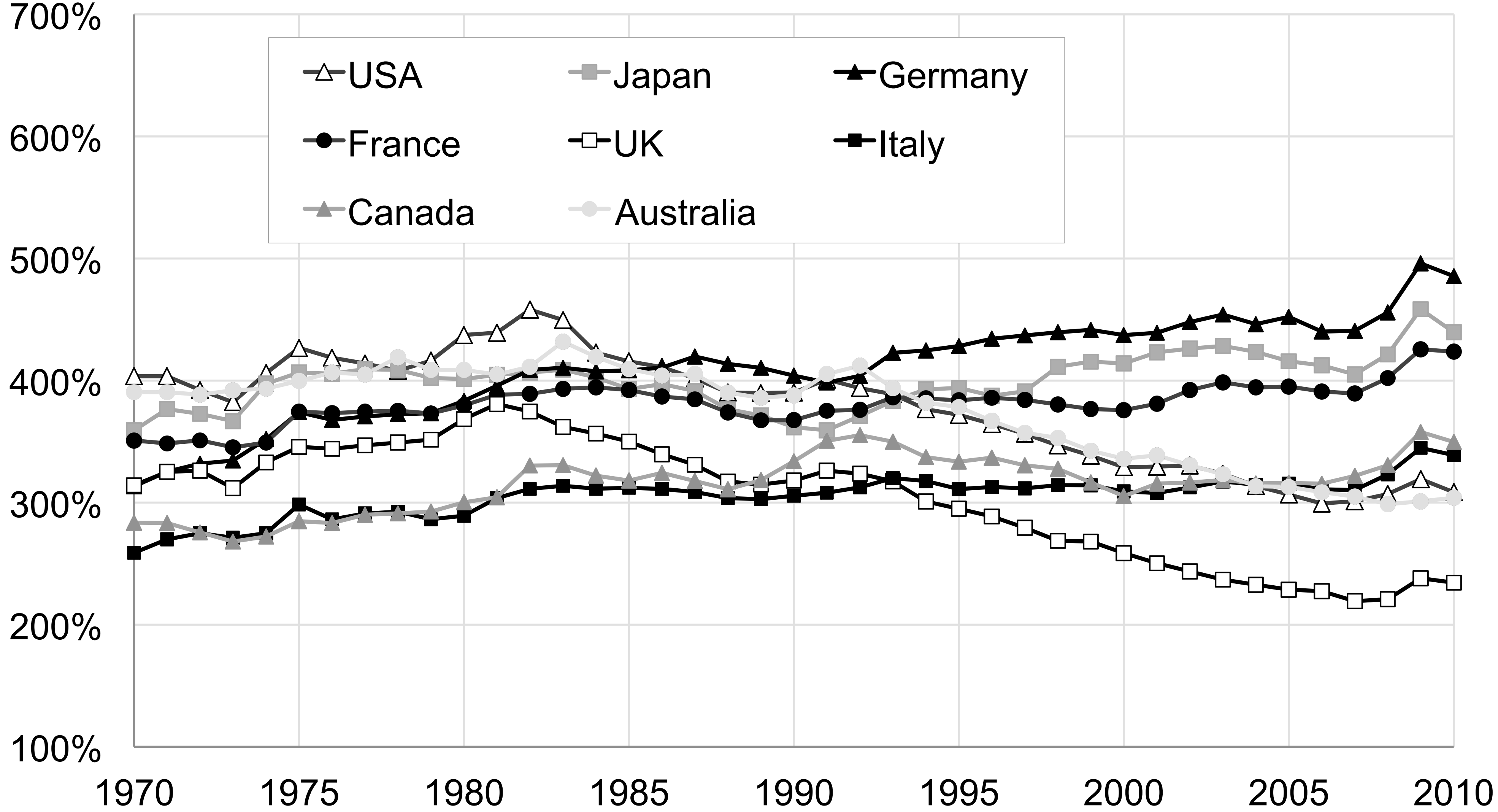
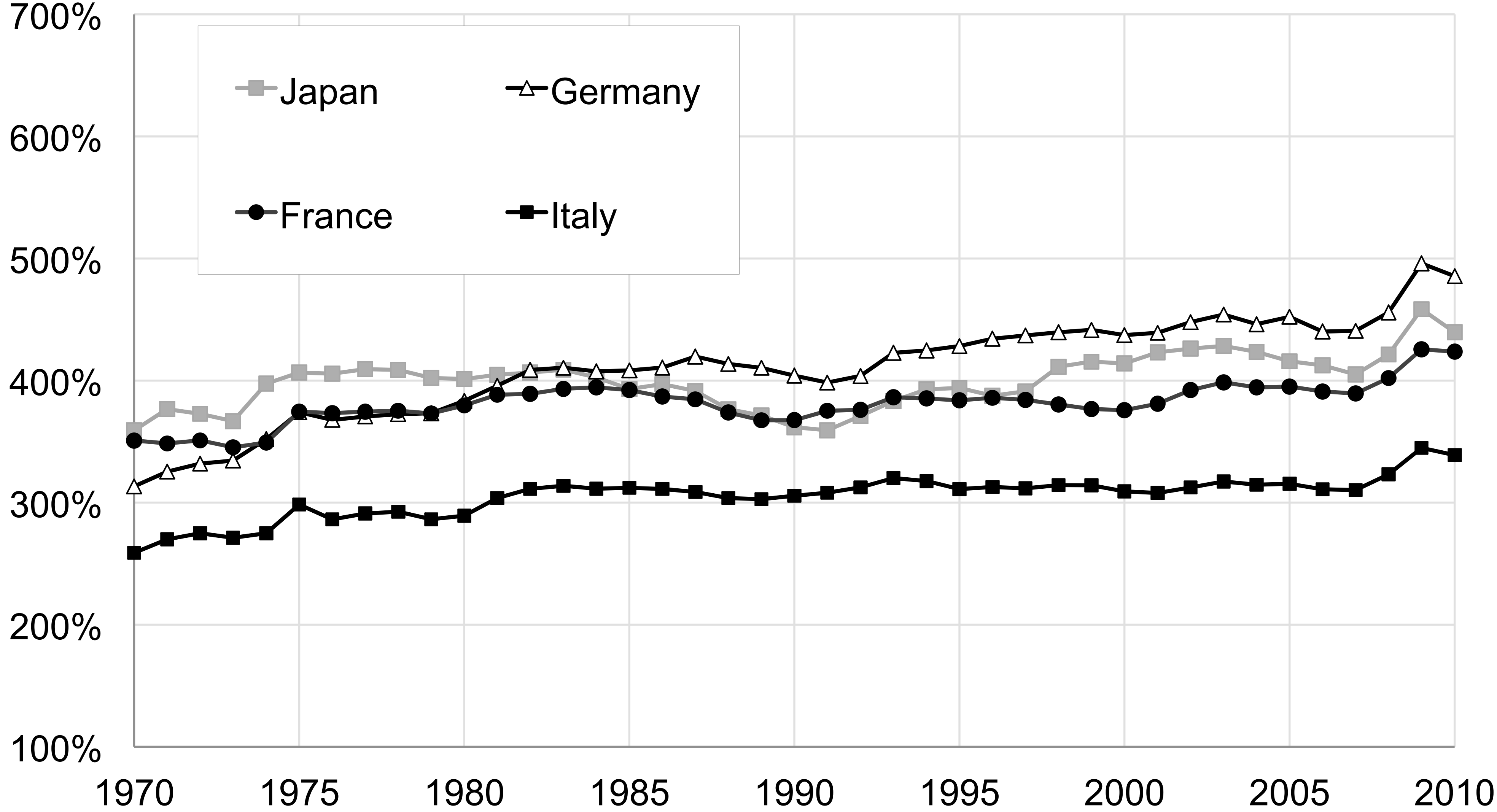


Figure A129: Simulated national wealth / national income ratios in the absence of capital gains, 1970-2010



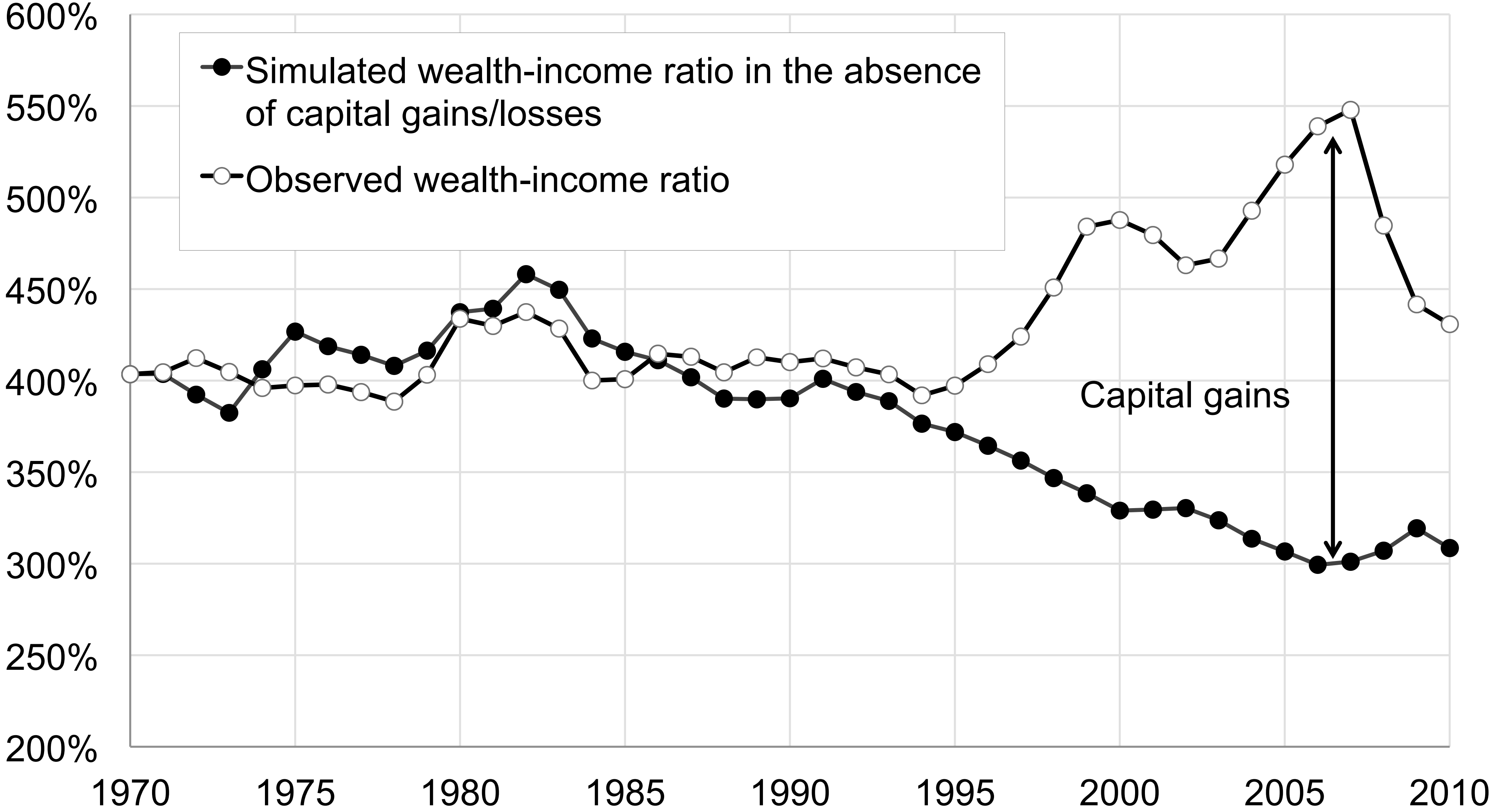
Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

Figure A130: Simulated national wealth / national income ratios in the absence of capital gains, 1970-2010



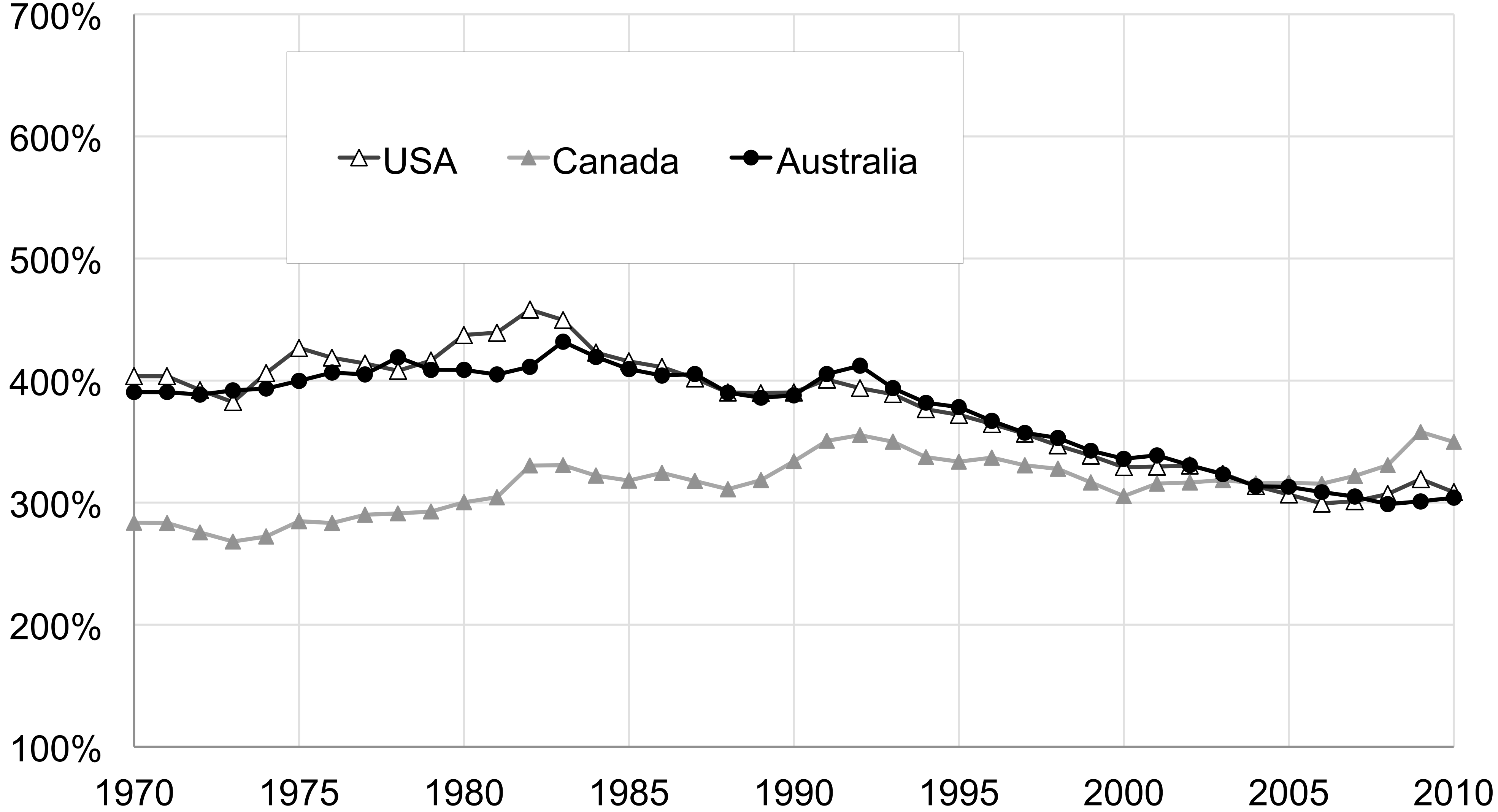
Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

Figure A131: Simulated national wealth-income ratios in the absence of capital gains: U.S. 1970-2010



Authors' computations based on 1970 wealth-income ratios, 1970-2010 natinoal saving flows (including other volume changes) and real income growth rates

Figure A132: Simulated private wealth / national income ratios in the absence of capital gains, 1970-2010



Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

Figure A133: Simulated private wealth / national income ratios in the absence of capital gains, 1970-2010

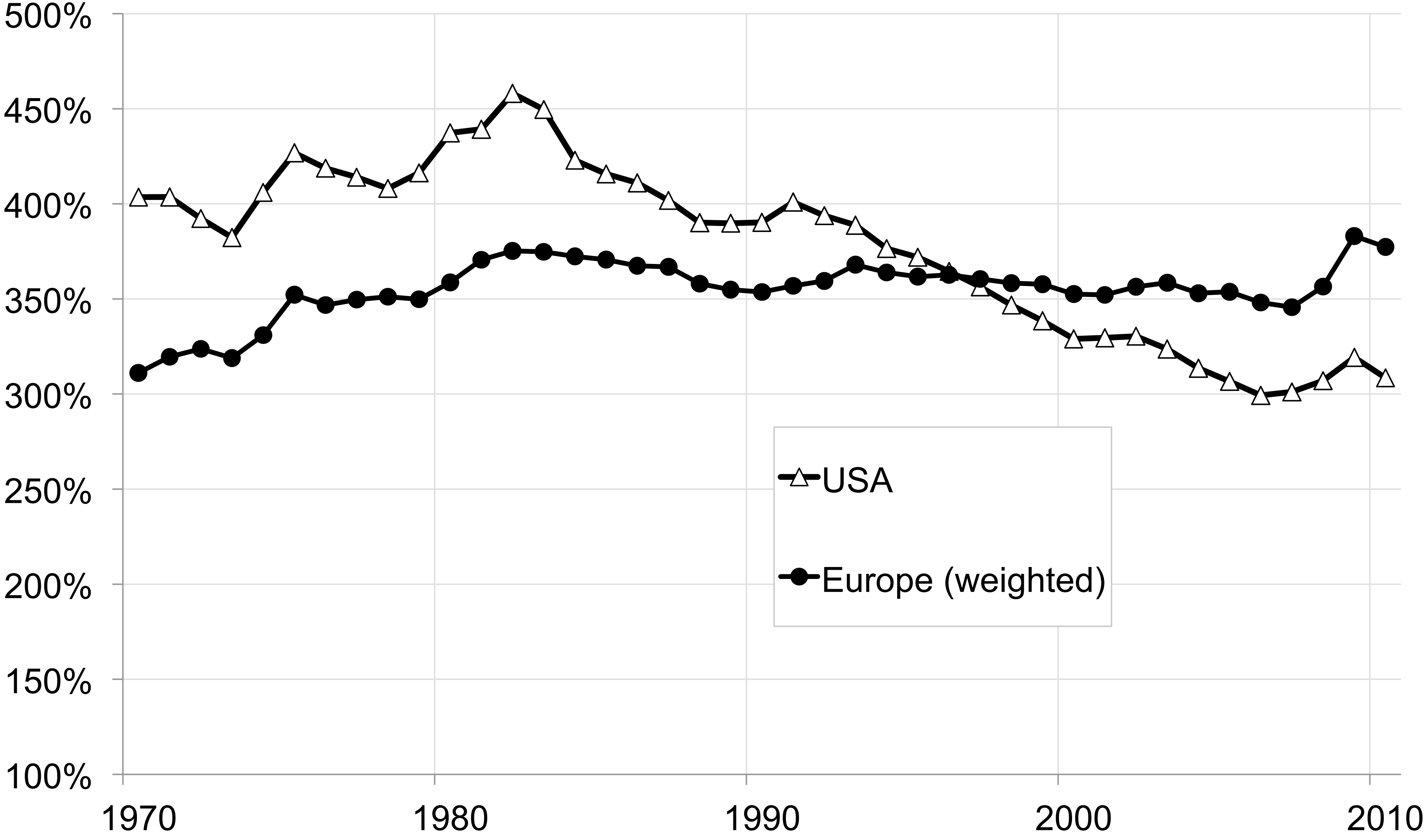
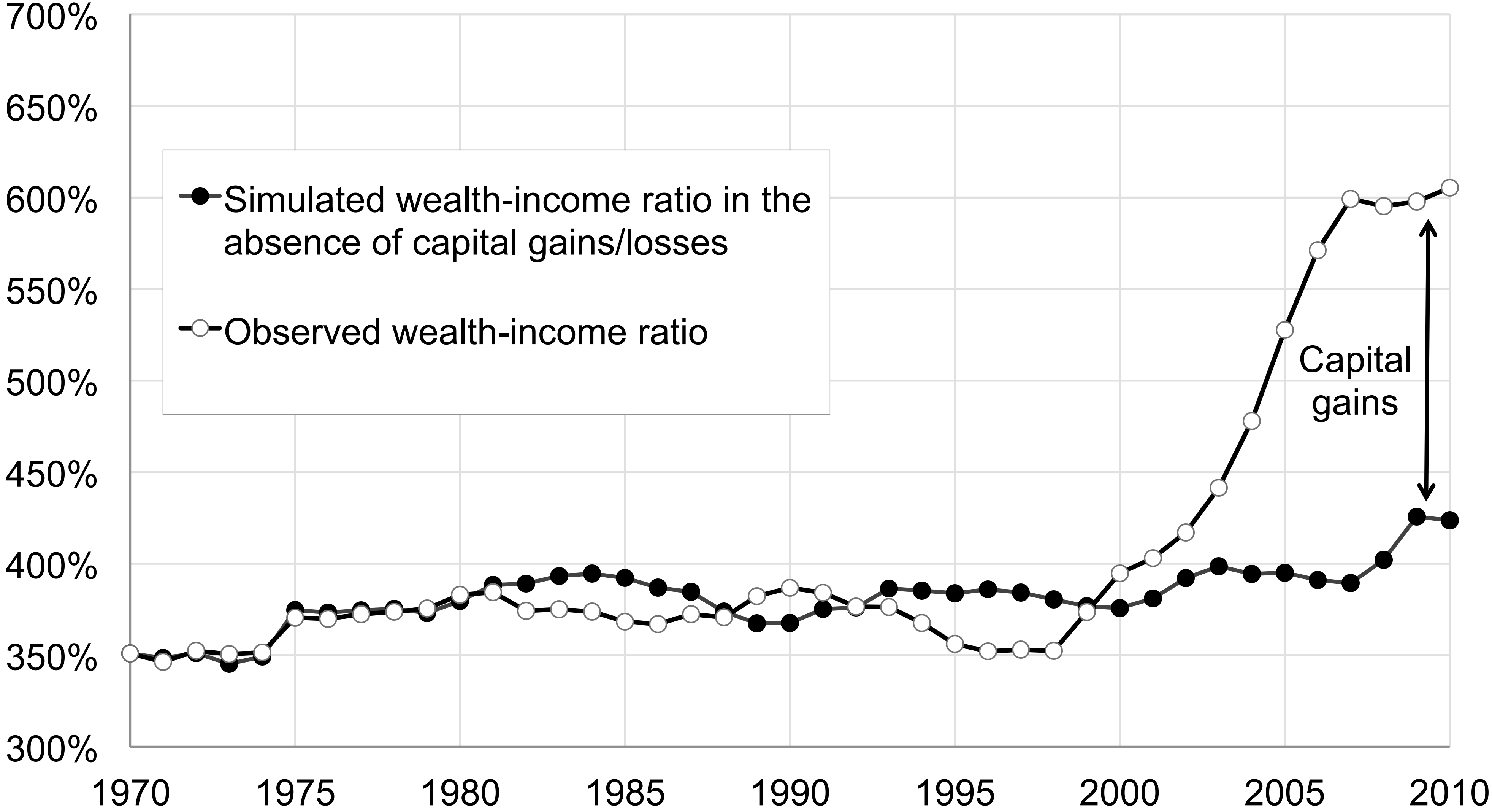
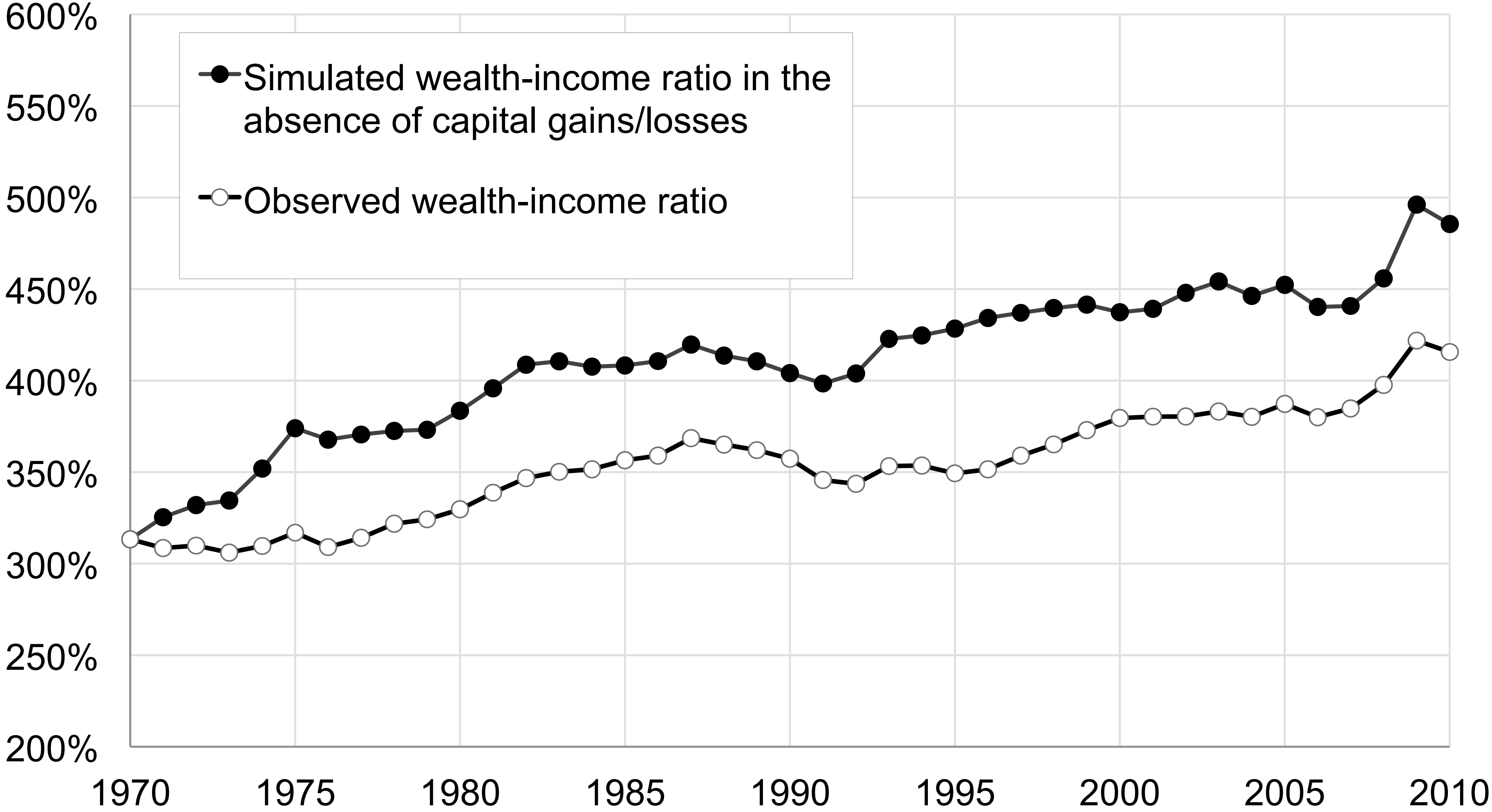


Figure A134: Simulated national wealth / national income ratios in the absence of capital gains: France, 1970-2010



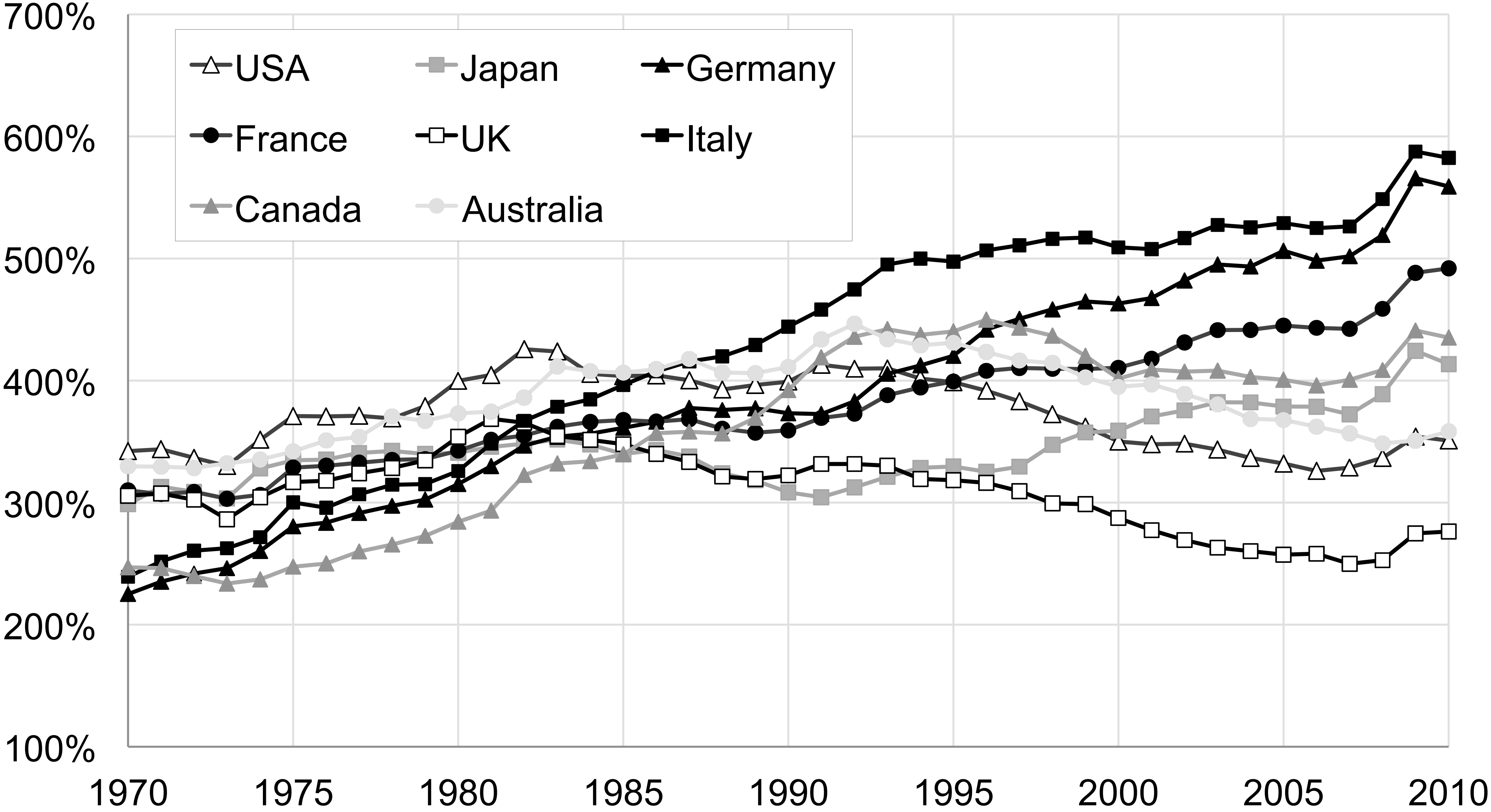
Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

Figure A135: Simulated national wealth / national income ratios in the absence of capital gains: Germany, 1970-2010



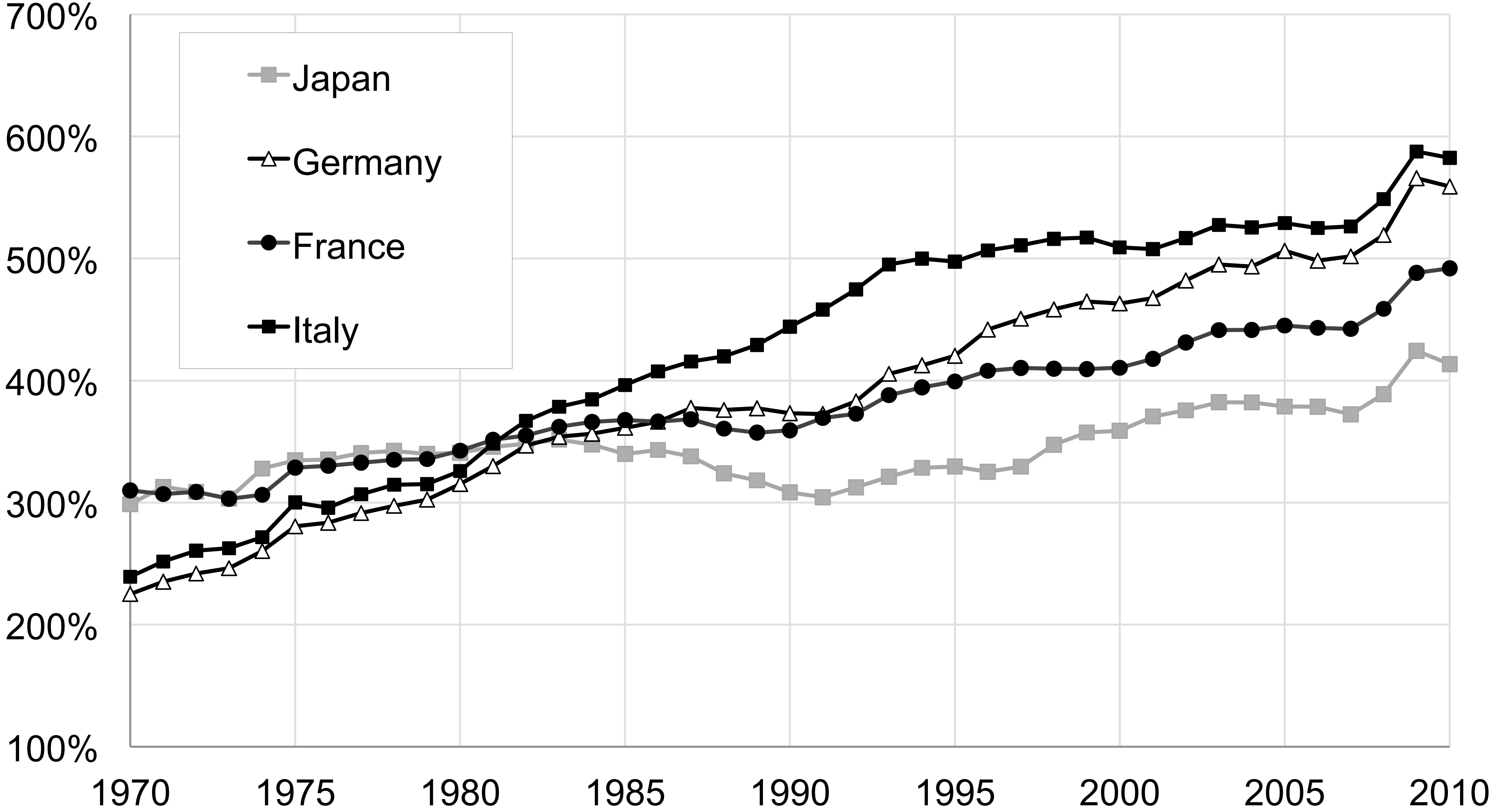
Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

Figure A136: Simulated private wealth / national income ratios in the absence of capital gains, 1970-2010



Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

Figure A137: Simulated private wealth / national income ratios in the absence of capital gains, 1970-2010



Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

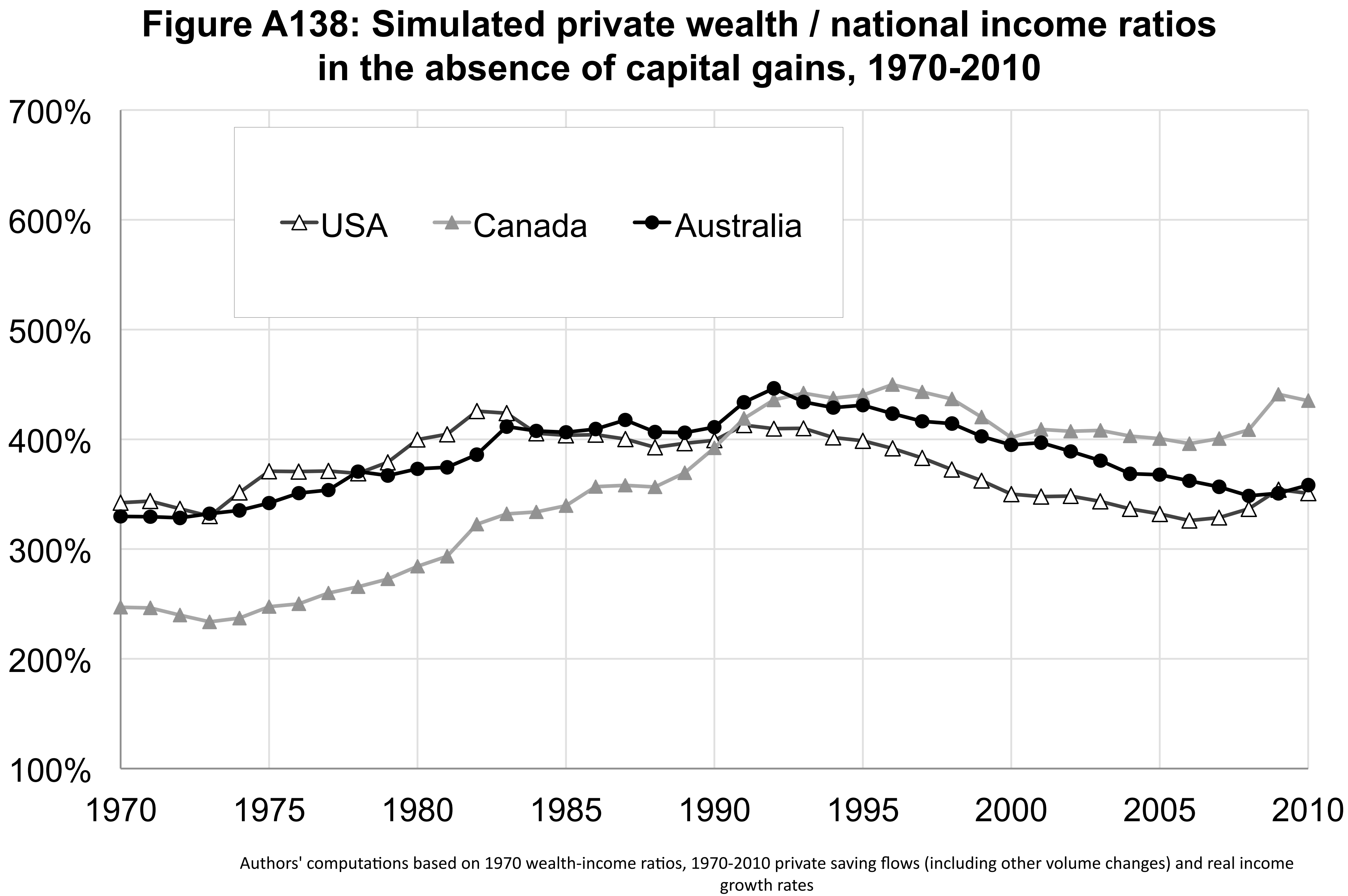


Figure A138: Simulated private wealth / national income ratios
in the absence of capital gains, 1970-2010
700%
600%
500%
400%
300%
200%
100%
1970
1975
1980
1985
1990
1995
2000
2005
2010
USA
Canada
Australia
Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

Figure A139: Simulated private wealth / national income ratios in the absence of capital gains, 1970-2010

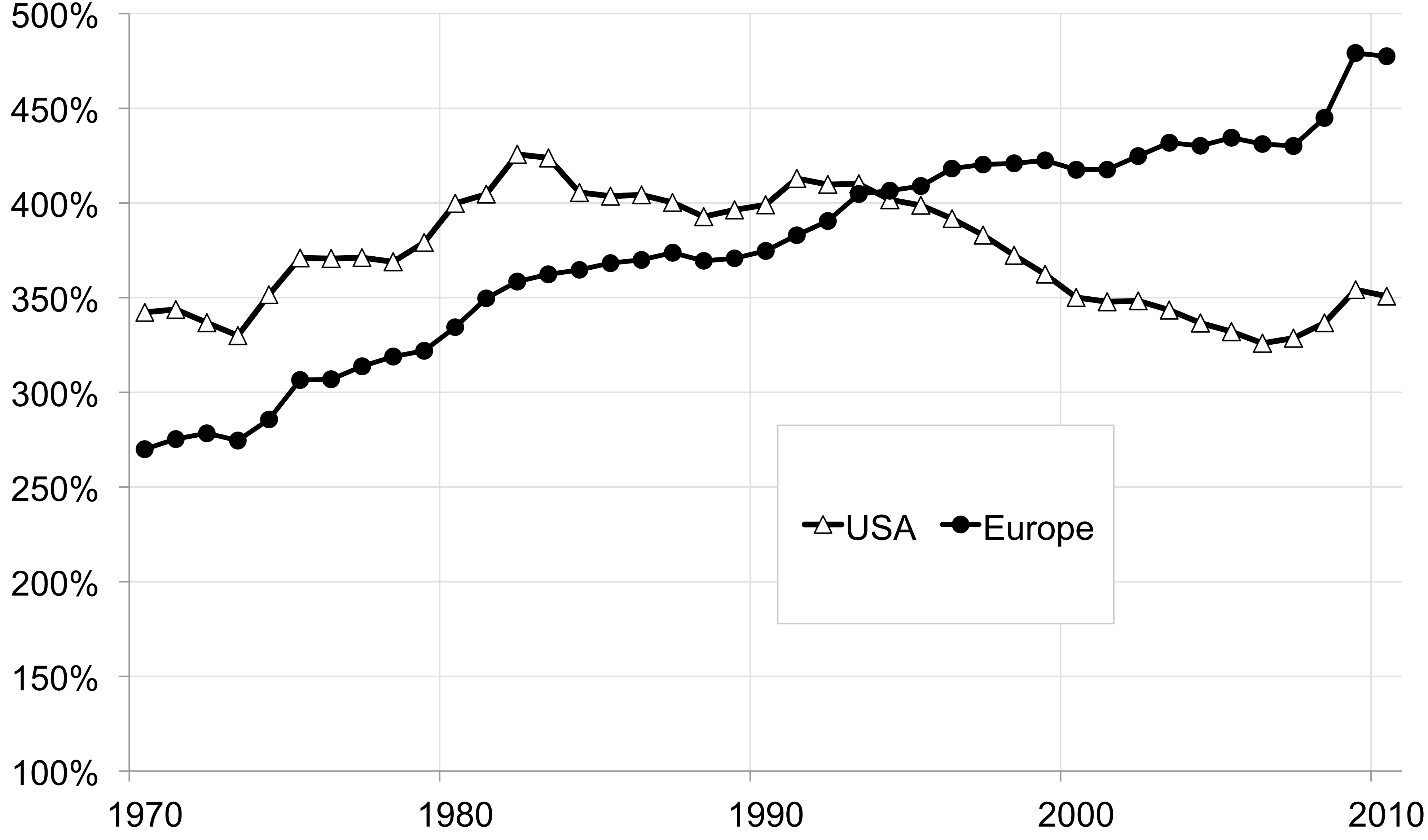
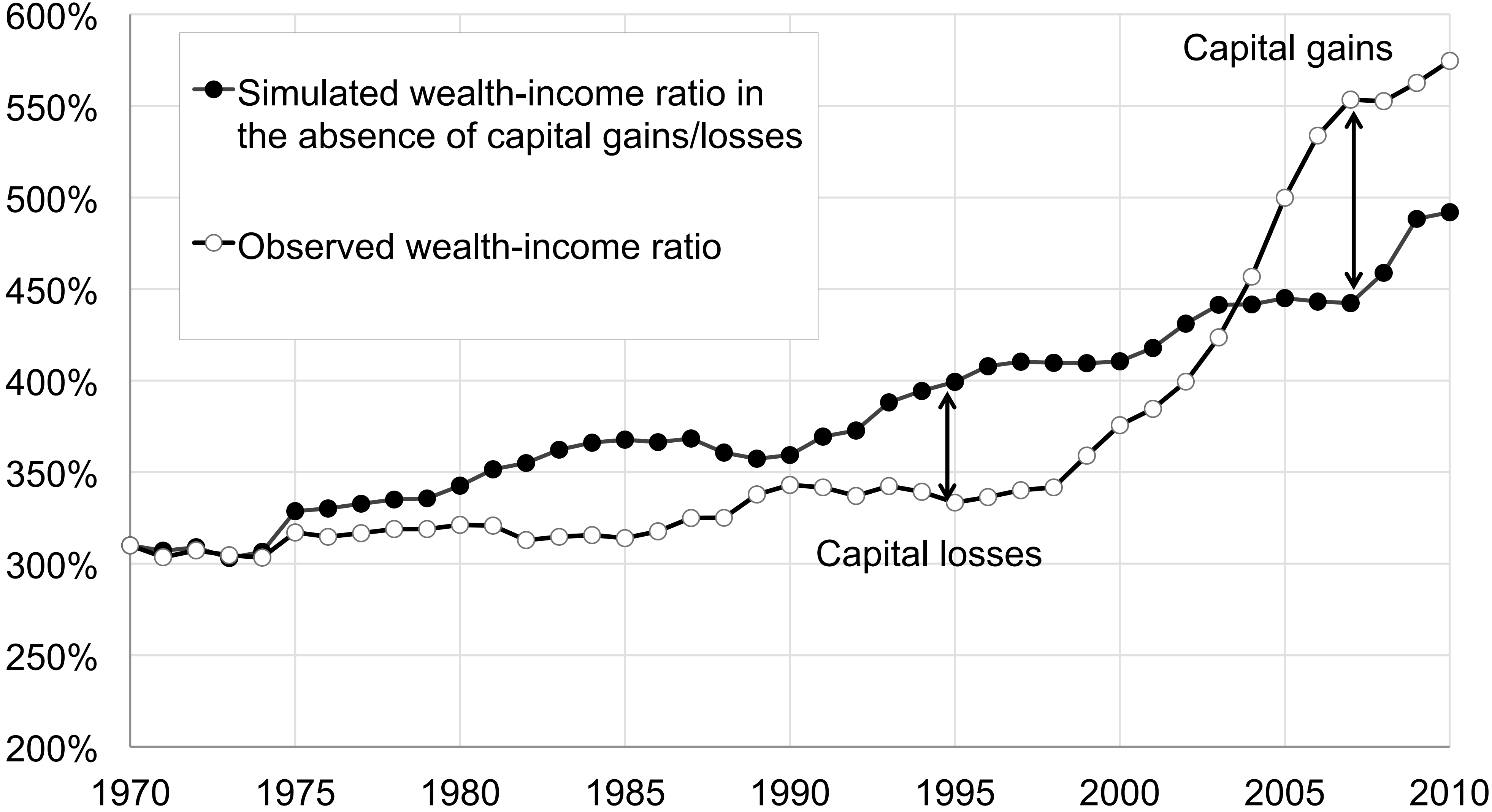
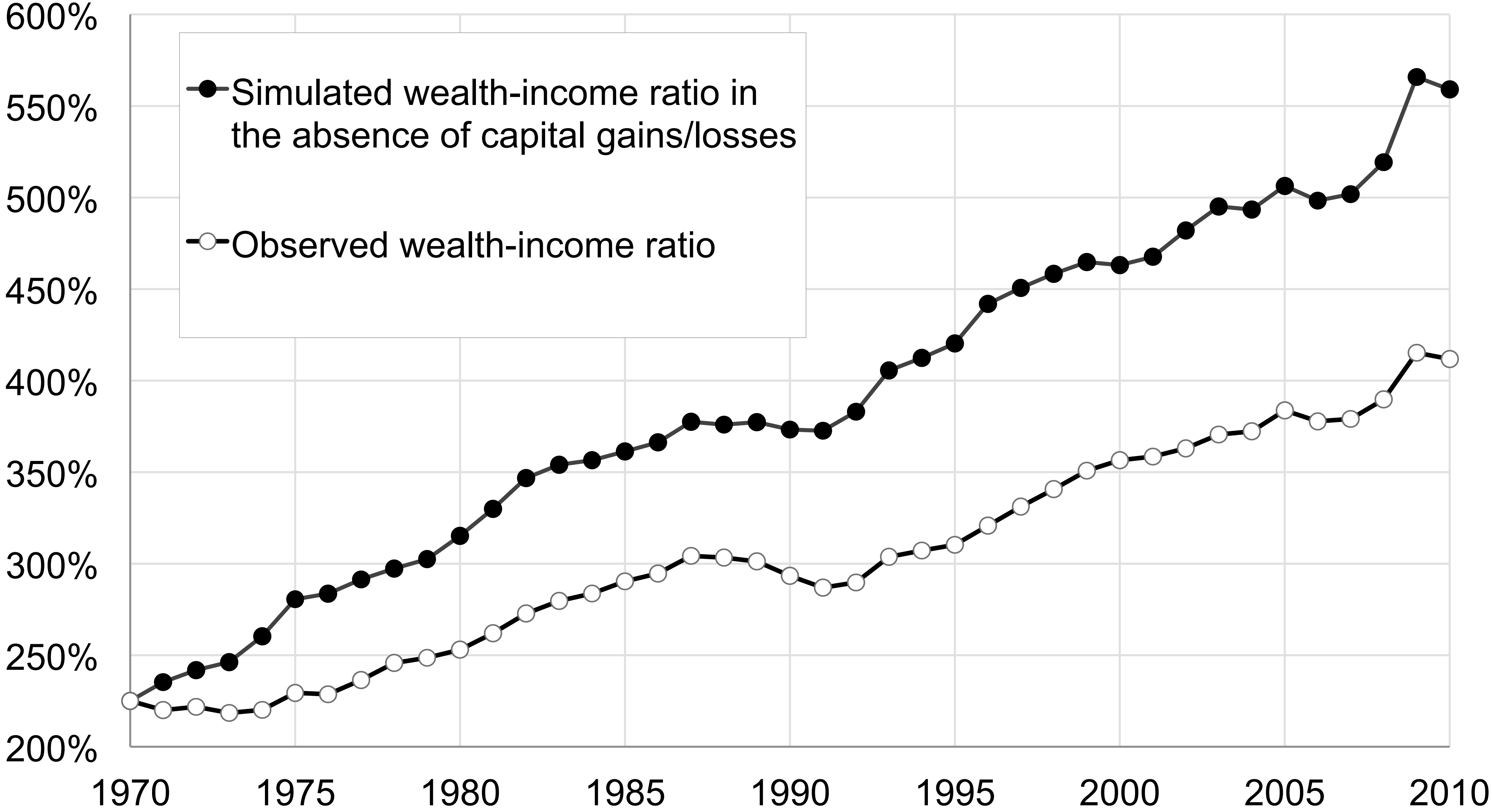


Figure A140: Simulated private wealth / national income ratios in the absence of capital gains, France, 1970-2010

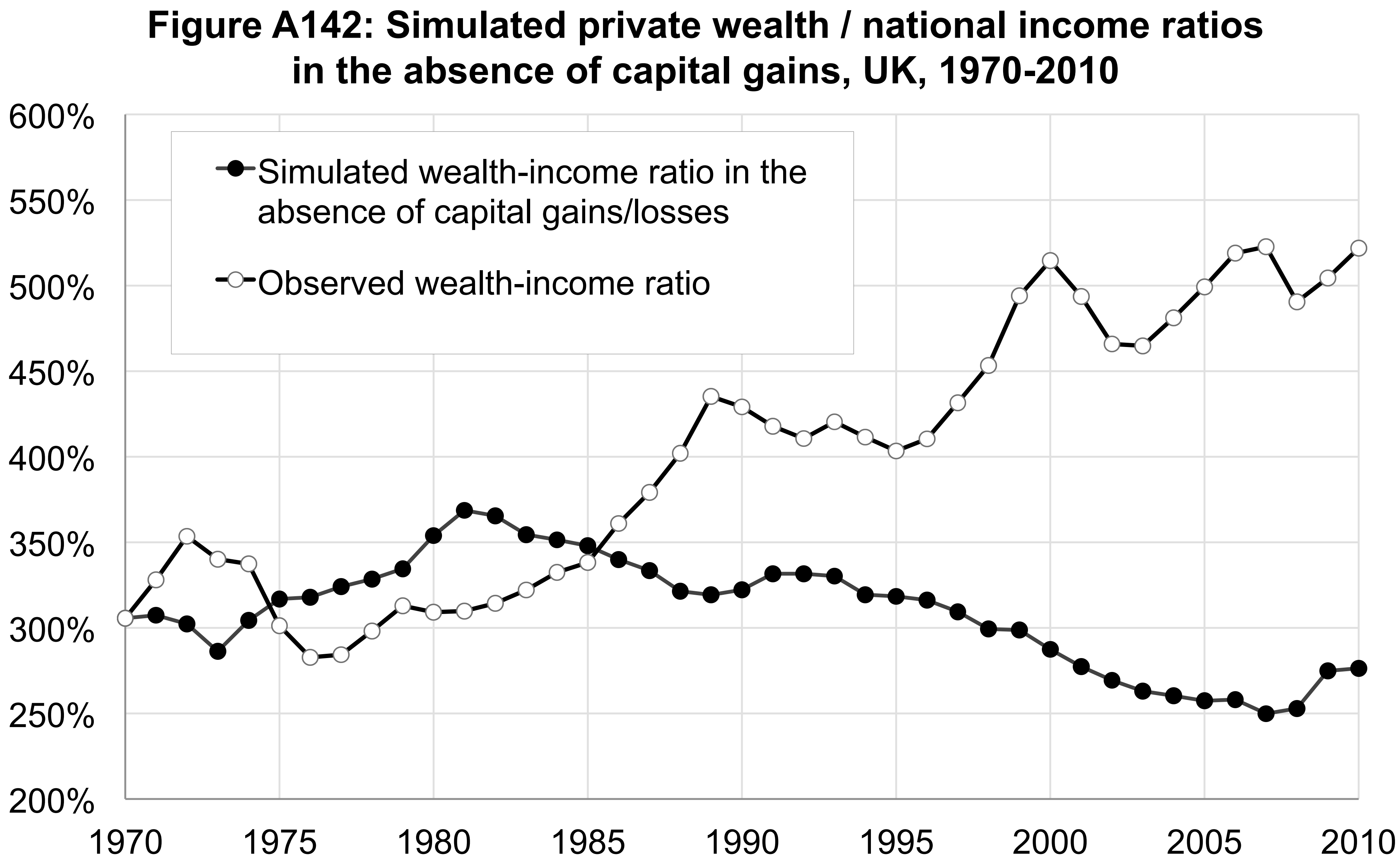


Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

Figure A141: Simulated private wealth / national income ratios in the absence of capital gains, Germany, 1970-2010



Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates



Authors' computations based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

Figure A143: Real Capital Gains on Private Wealth vs. on Listed Equities: U.S., 1930-2010

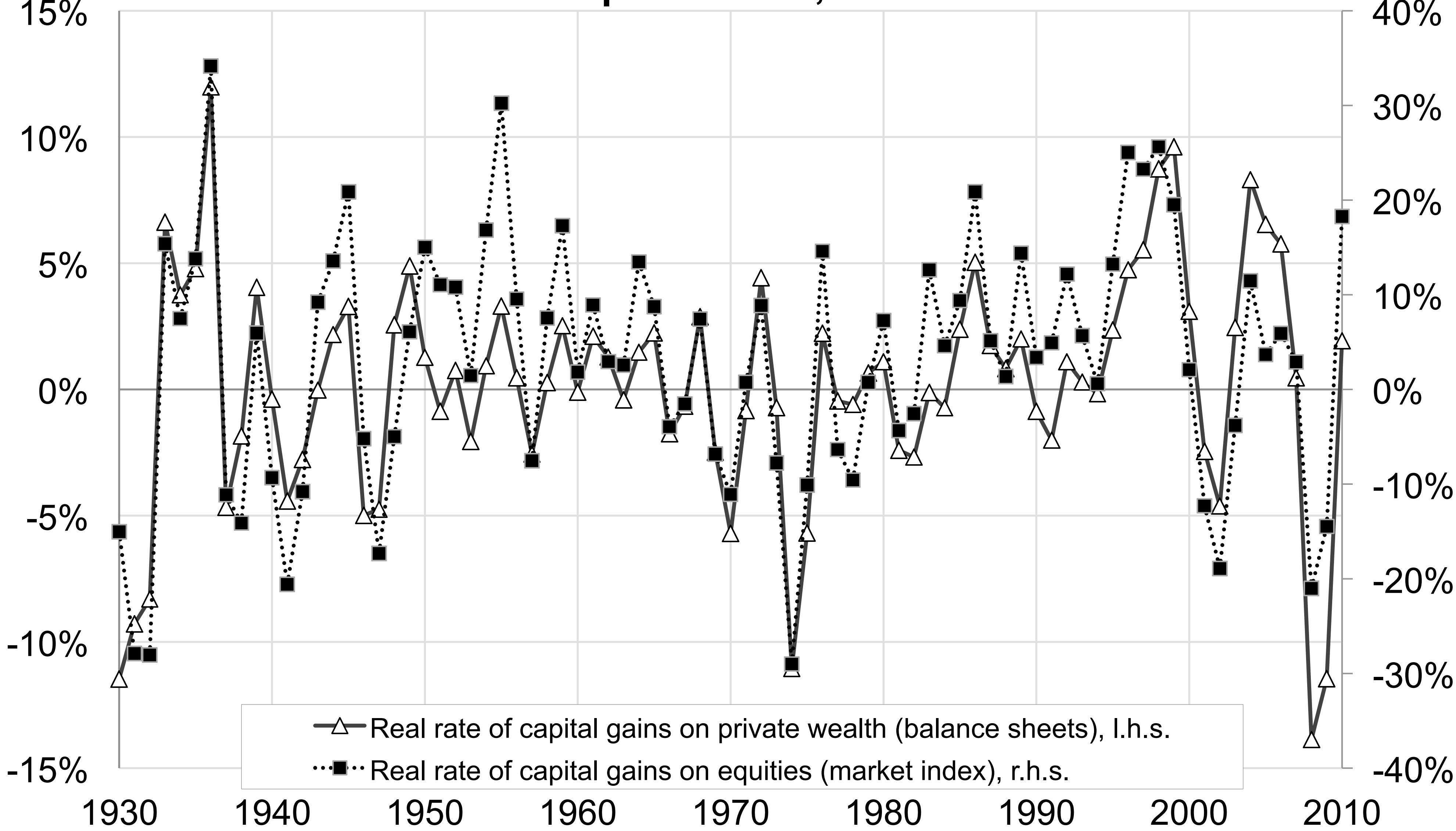
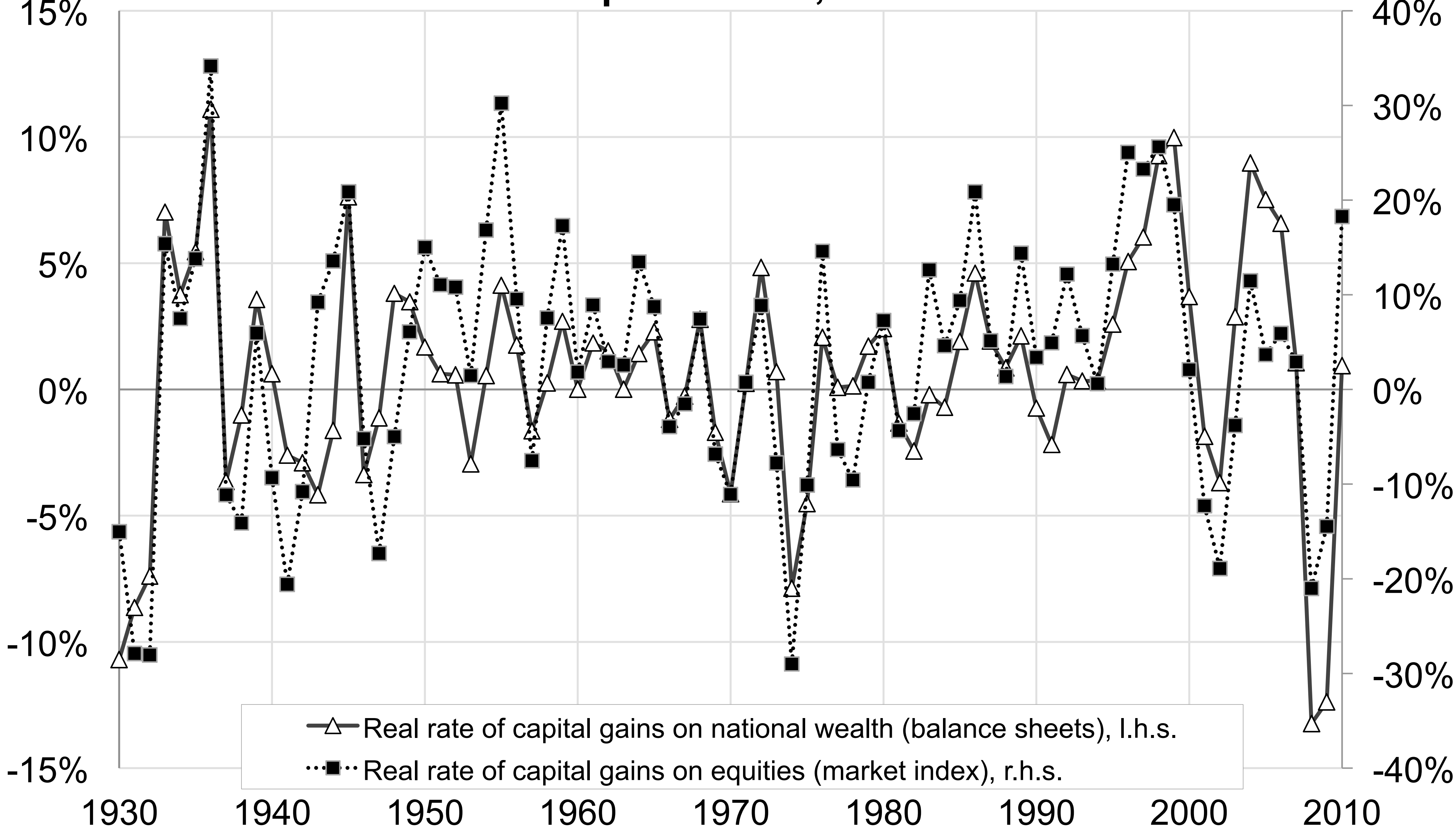


Figure A144: Real Capital Gains on National Wealth vs. on Listed Equities: U.S., 1930-2010



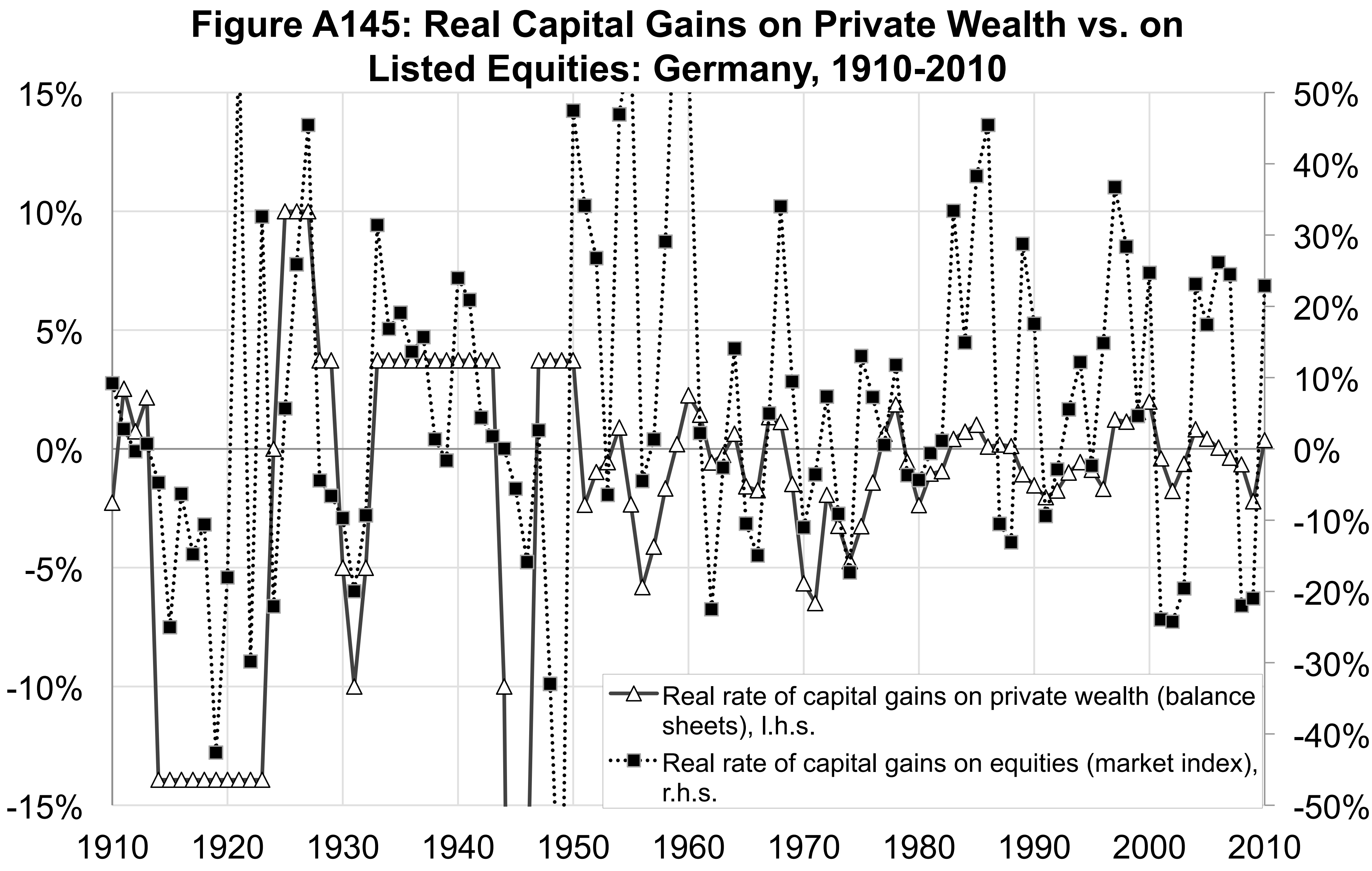


Figure A145: Real Capital Gains on Private Wealth vs. on Listed Equities: Germany, 1910-2010
15%
10%
5%
0%
-5%
-10%
-15%
50%
40%
30%
20%
10%
0%
-10%
-20%
-30%
-40%
-50%
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Real rate of capital gains on private wealth (balance sheets), l.h.s.
Real rate of capital gains on equities (market index), r.h.s.

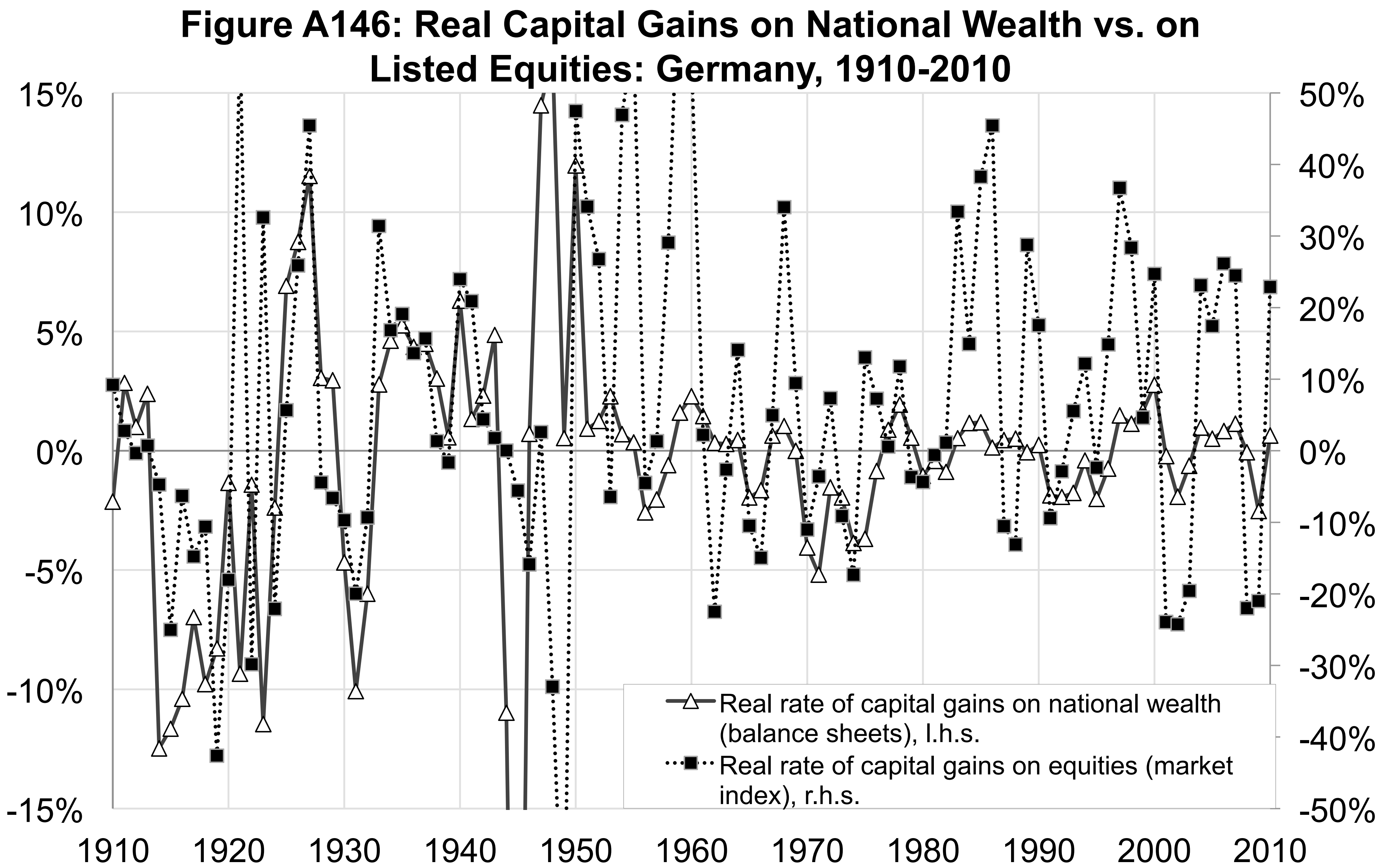


Figure A146: Real Capital Gains on National Wealth vs. on Listed Equities: Germany, 1910-2010
15%
10%
5%
0%
-5%
-10%
-15%
50%
40%
30%
20%
10%
0%
-10%
-20%
-30%
-40%
-50%
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Real rate of capital gains on national wealth (balance sheets), l.h.s.
Real rate of capital gains on equities (market index), r.h.s.

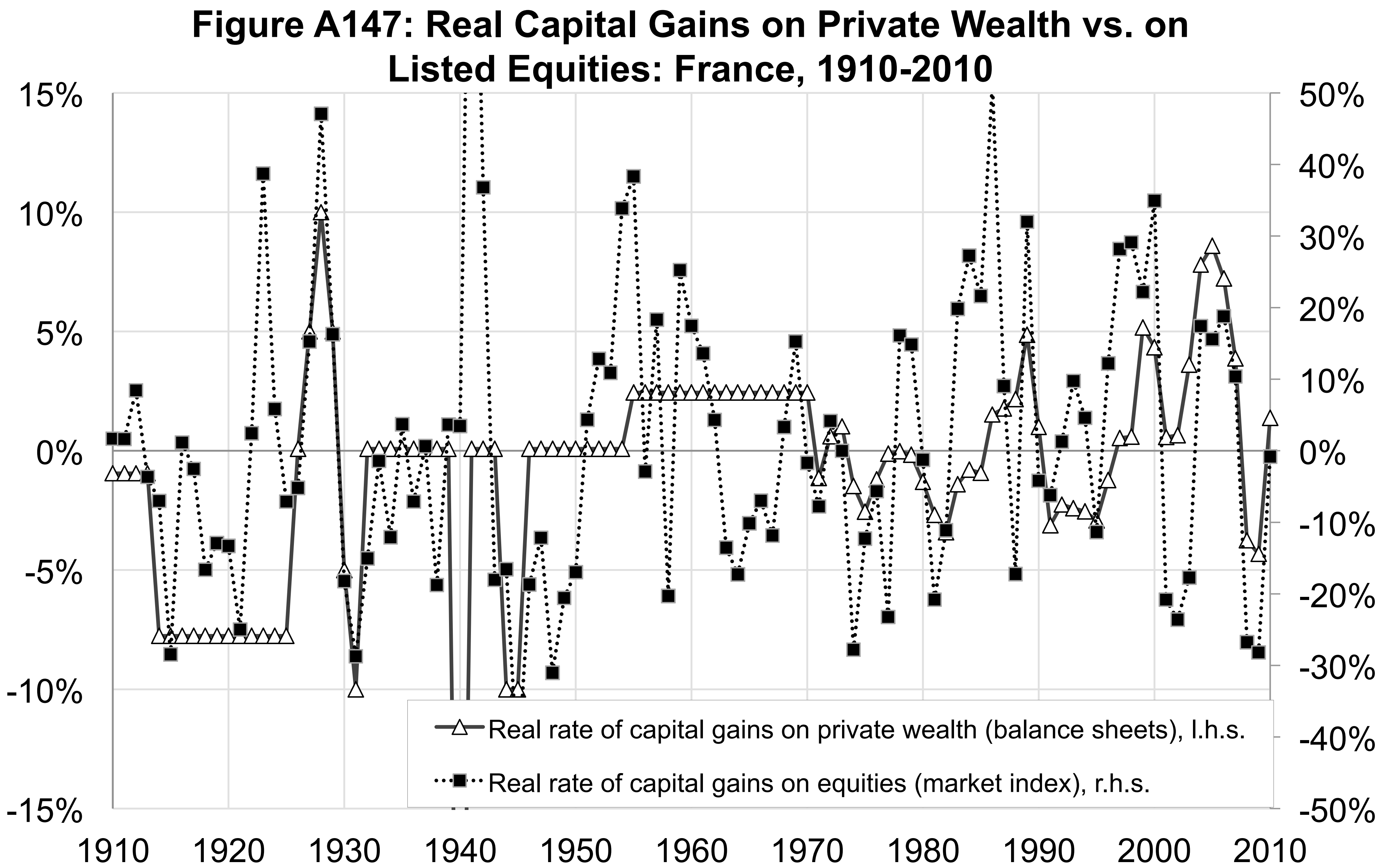
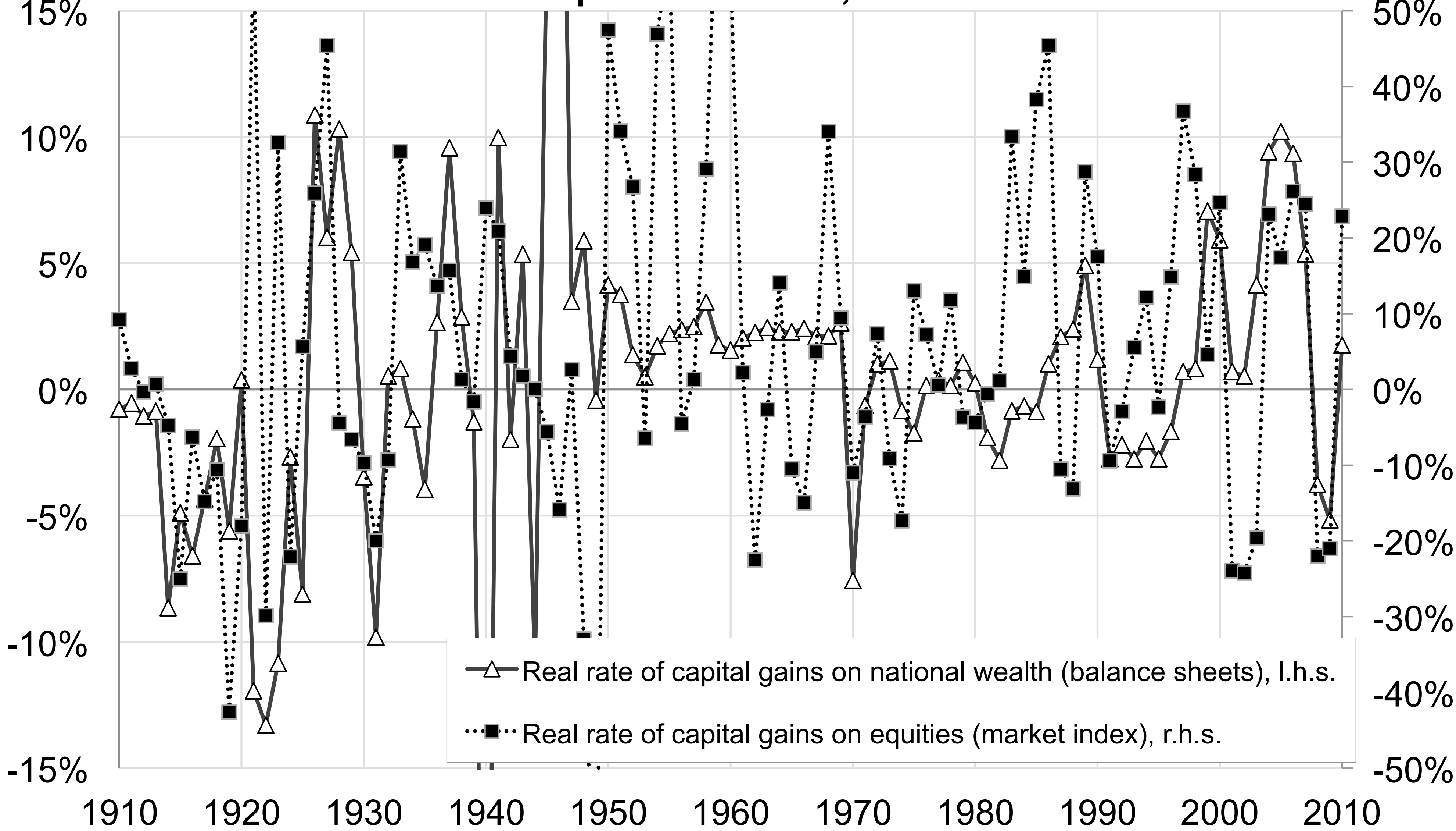


Figure A147: Real Capital Gains on Private Wealth vs. on Listed Equities: France, 1910-2010
15%
10%
5%
0%
-5%
-10%
-15%
50%
40%
30%
20%
10%
0%
-10%
-20%
-30%
-40%
-50%
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Real rate of capital gains on private wealth (balance sheets), l.h.s.
Real rate of capital gains on equities (market index), r.h.s.

Figure A148: Real Capital Gains on National Wealth vs. on Listed Equities: France, 1910-2010



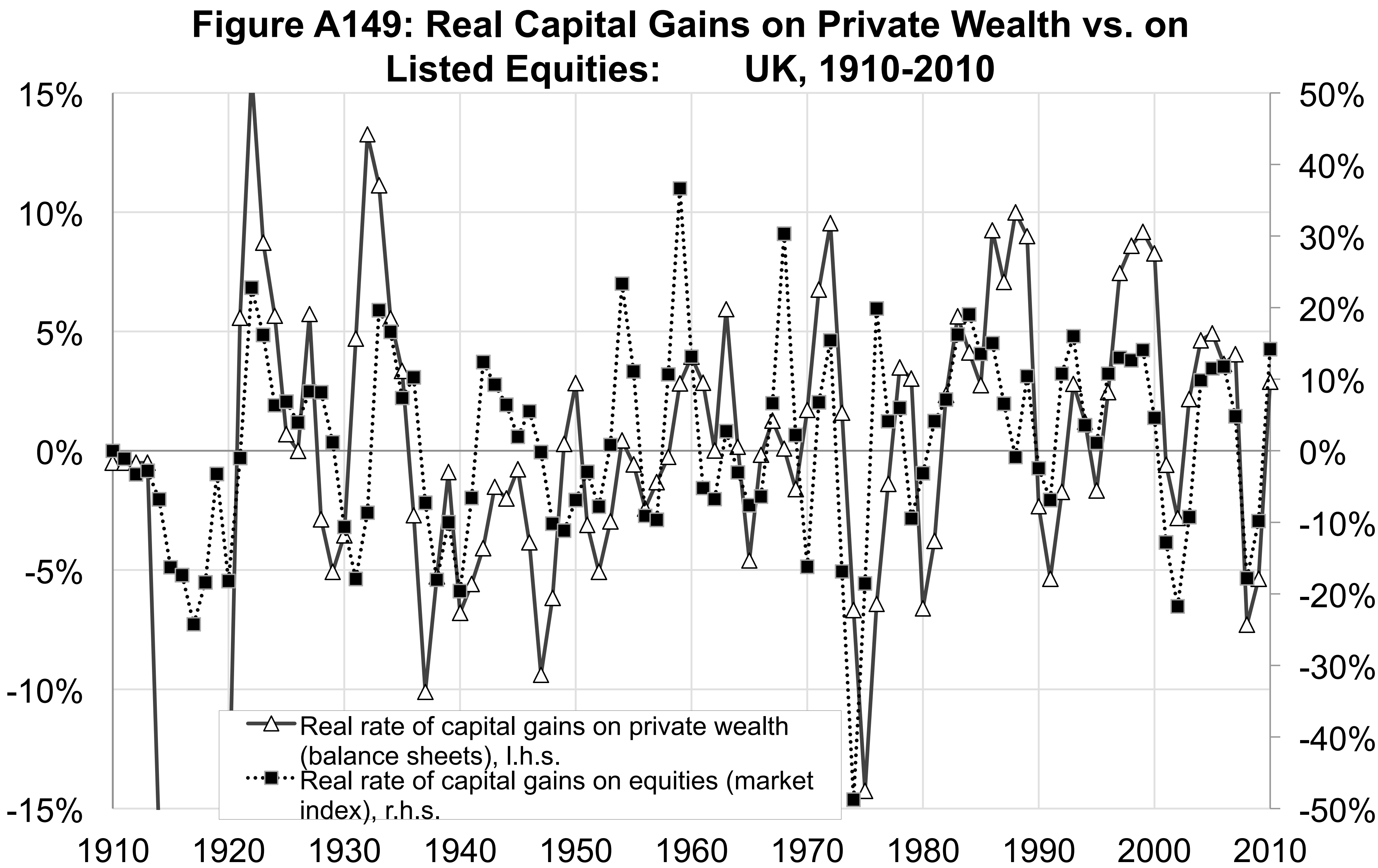


Figure A149: Real Capital Gains on Private Wealth vs. on Listed Equities: UK, 1910-2010
15%
10%
5%
0%
-5%
-10%
-15%
50%
40%
30%
20%
10%
0%
-10%
-20%
-30%
-40%
-50%
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Real rate of capital gains on private wealth (balance sheets), l.h.s.
Real rate of capital gains on equities (market index), r.h.s.

Figure A150: Real Capital Gains on National Wealth vs. on Listed Equities: UK, 1910-2010

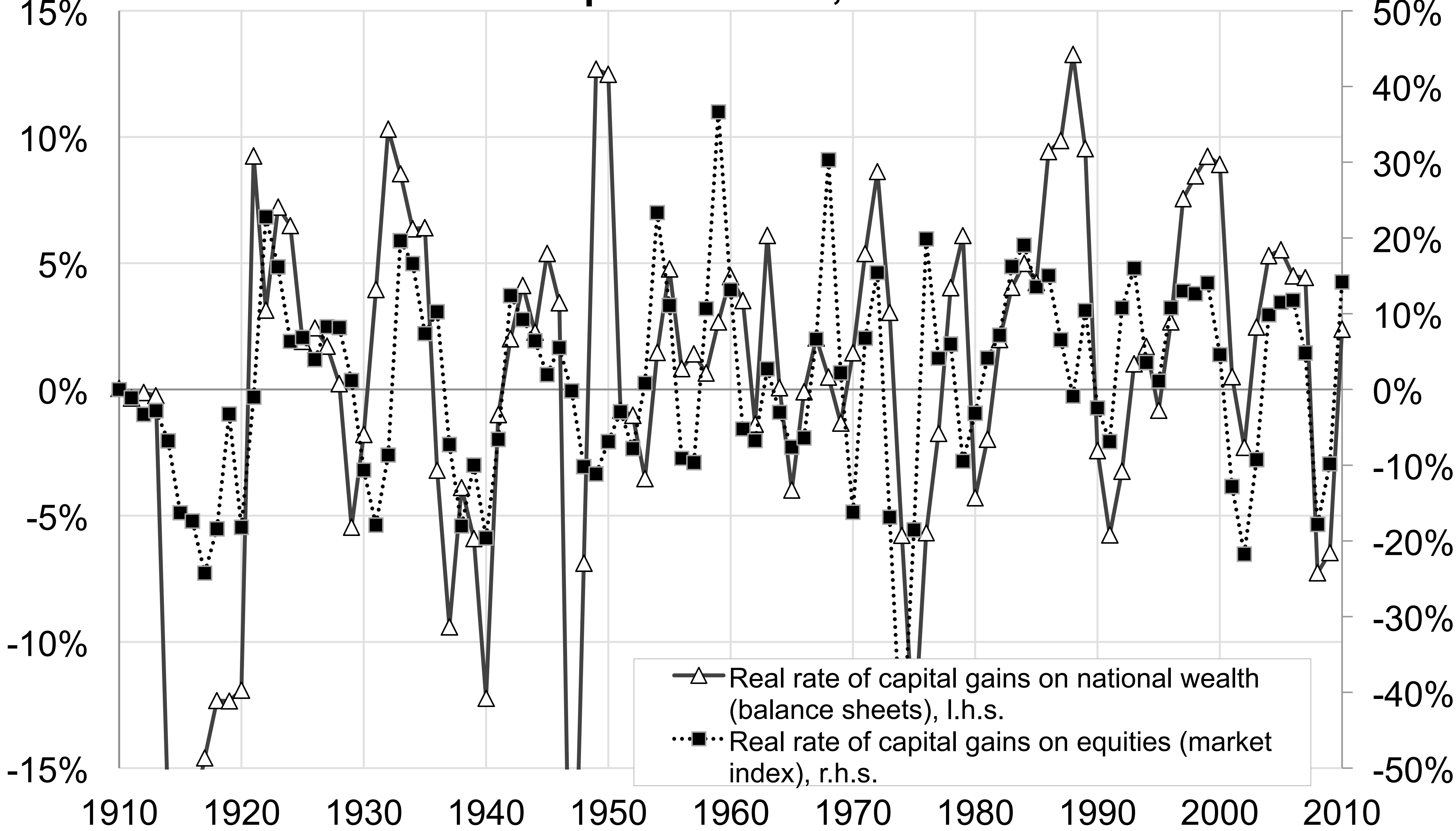


Figure A151: Real Rate of Capital Gains on Private Wealth, 1870-2010, Decennial Averages

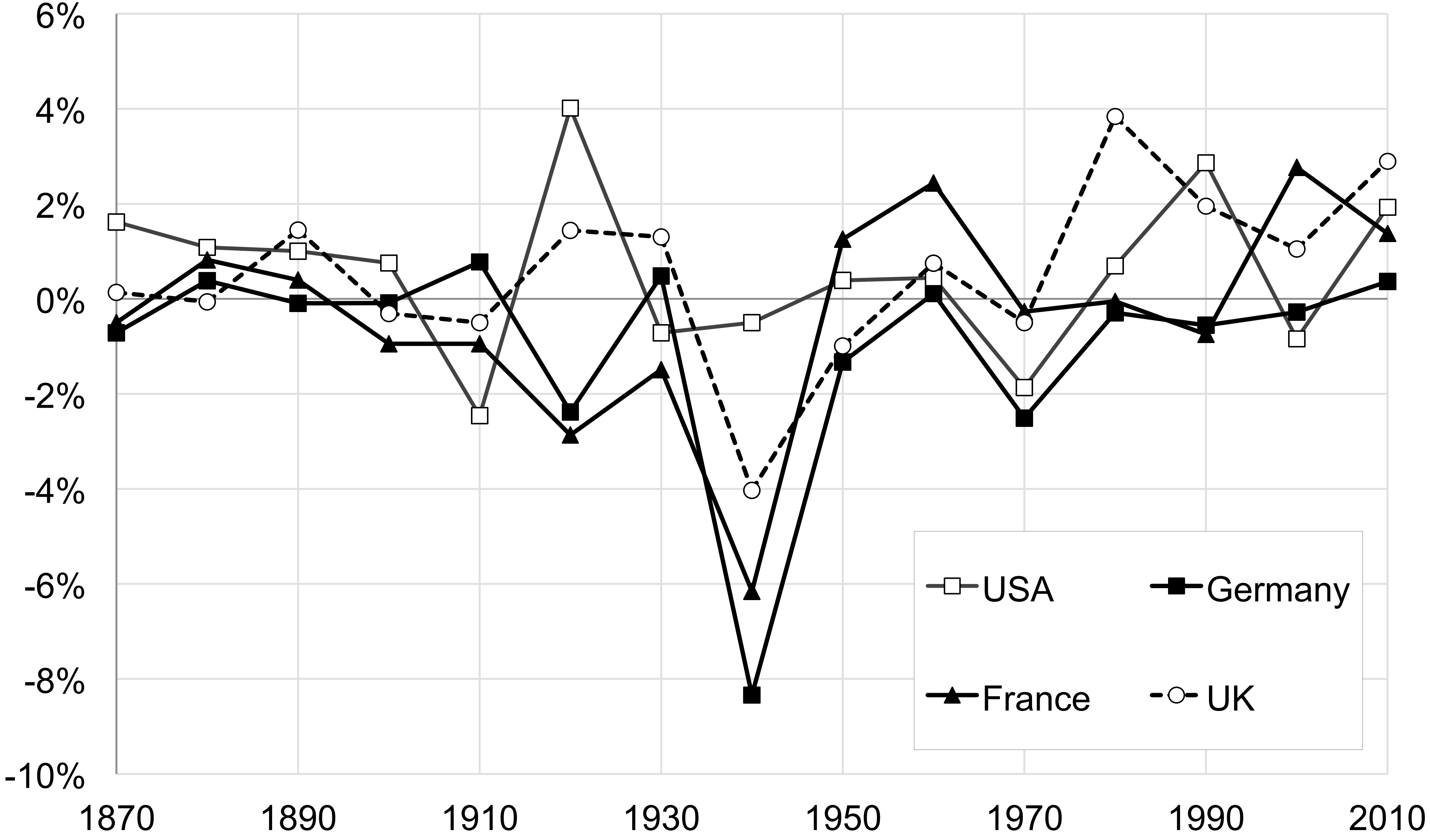


Figure A152: Real Rate of Capital Gains on National Wealth, 1870-2010, Decennial Averages

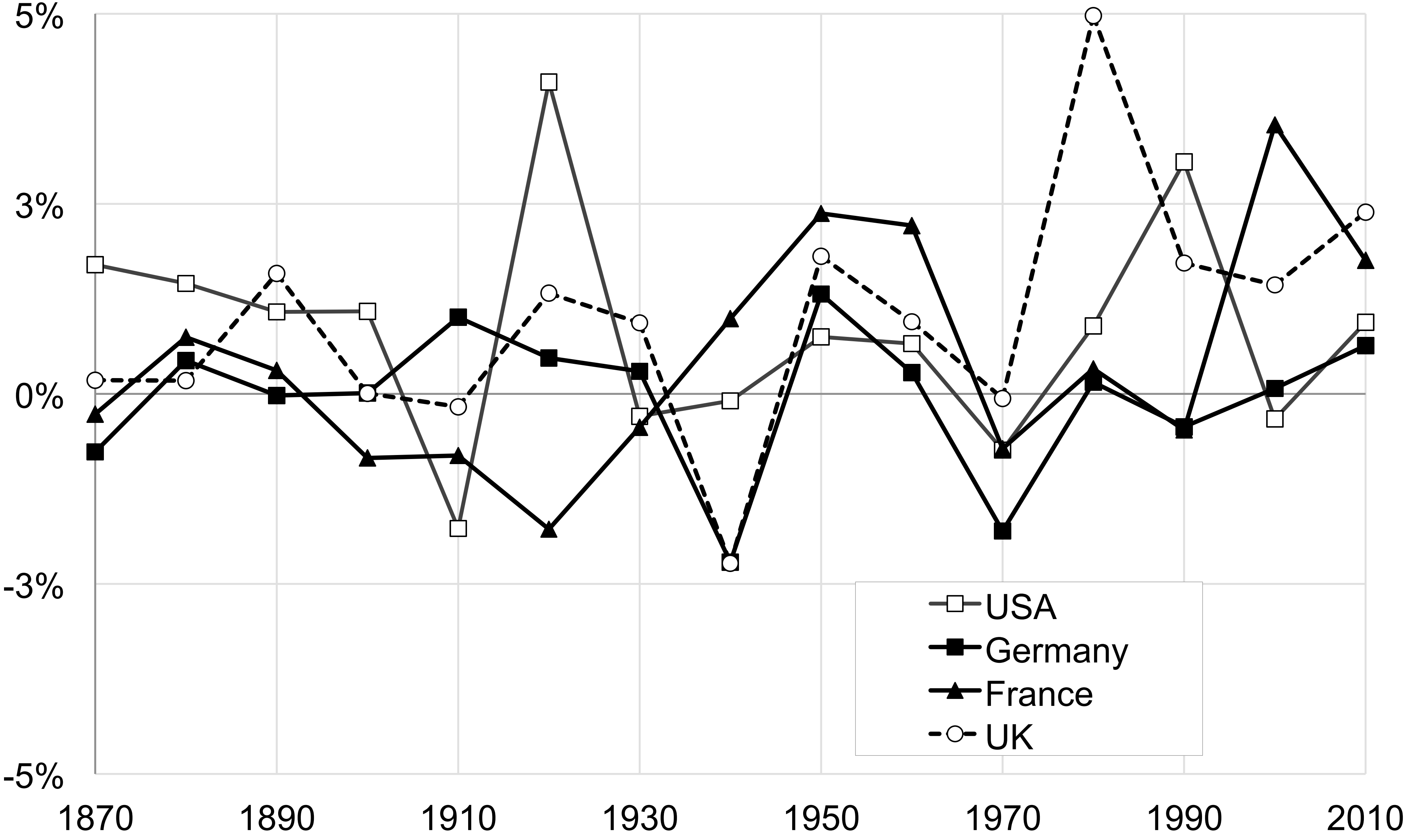


Figure A153: Real Rate of Capital Gains on Equities, 1870-2010, Decennial Averages

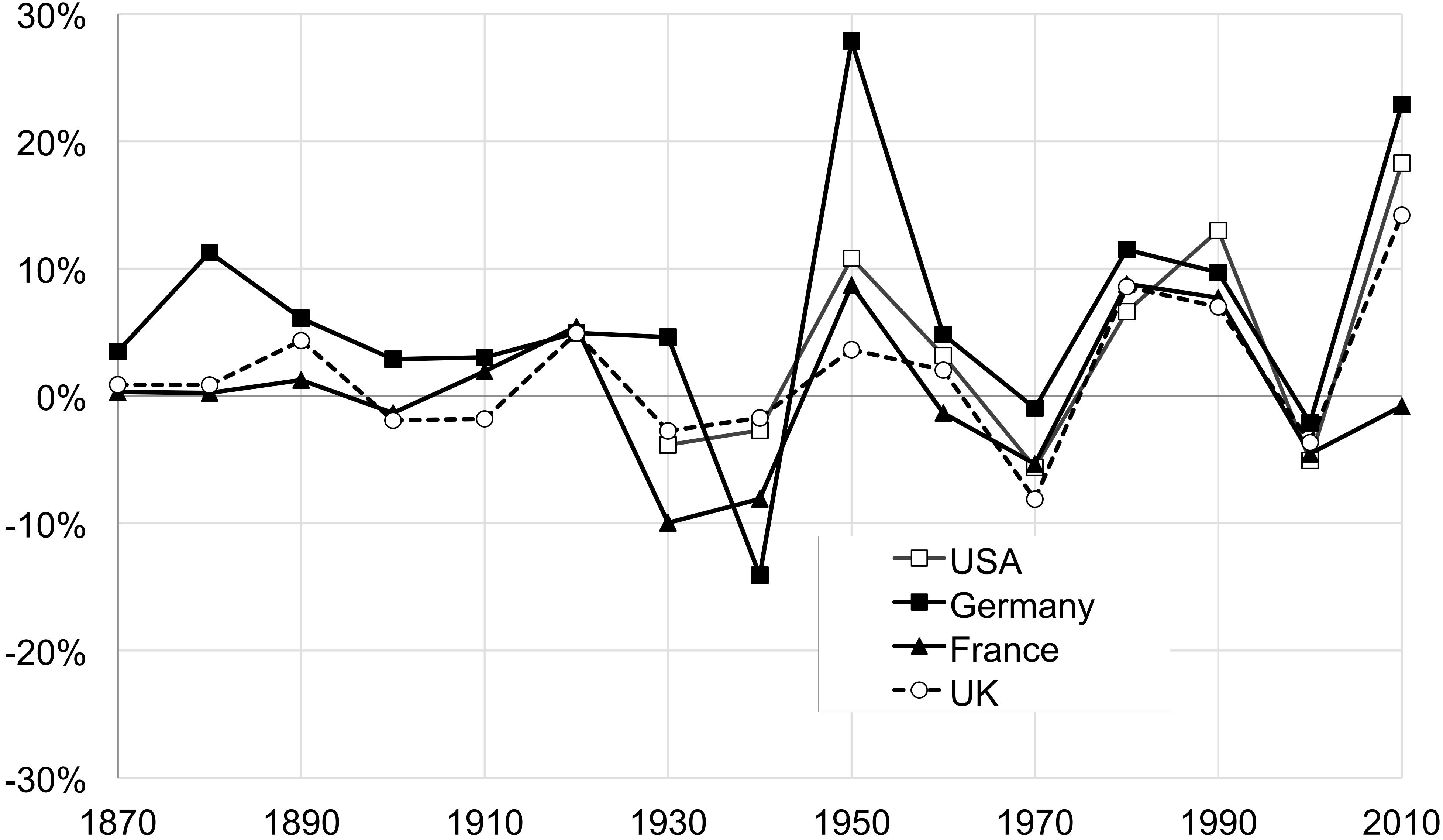
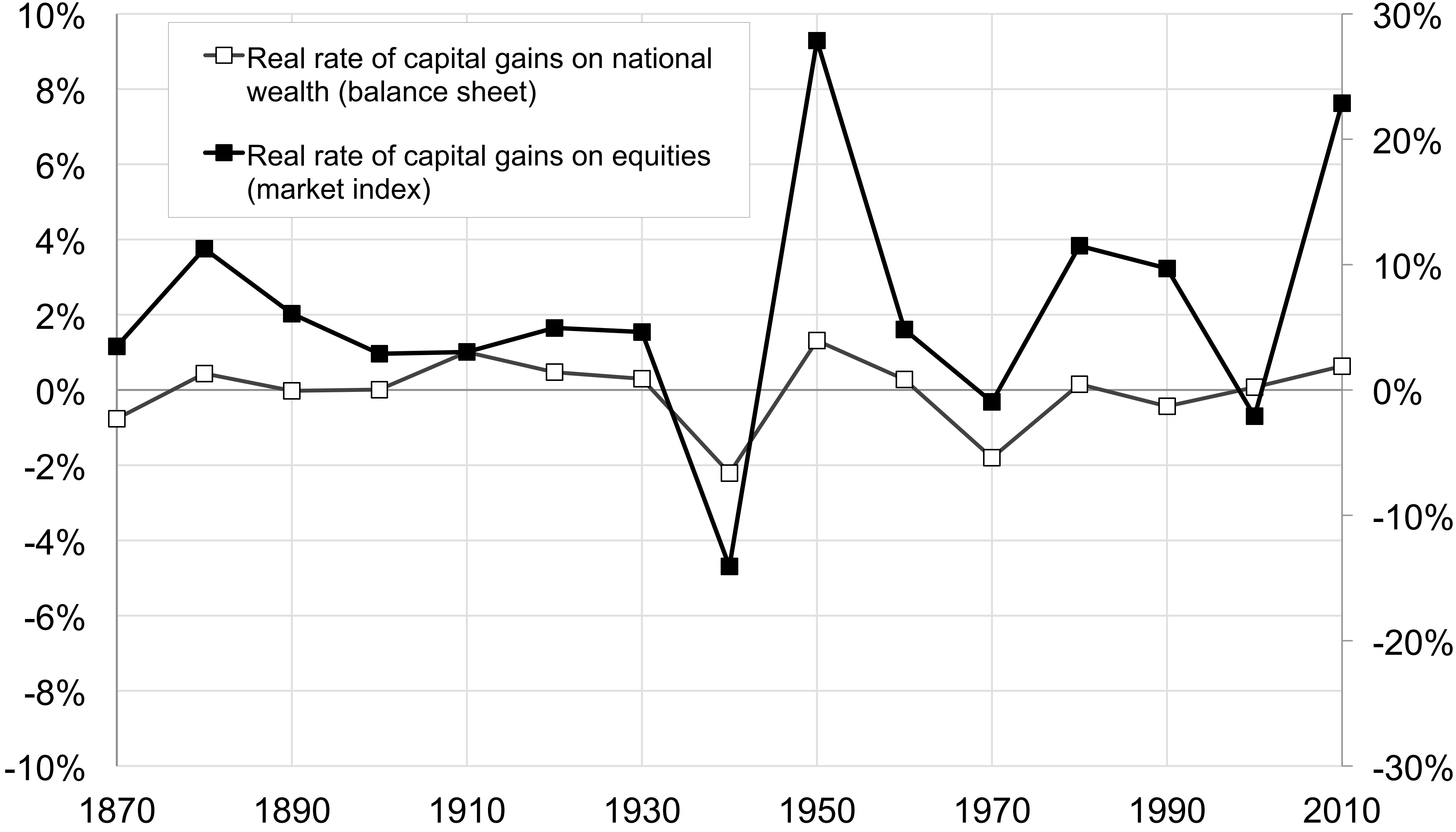


Figure A154: Real Rate of Capital Gains on National Wealth & Equities, Germany, 1870-2010 (decennial averages)



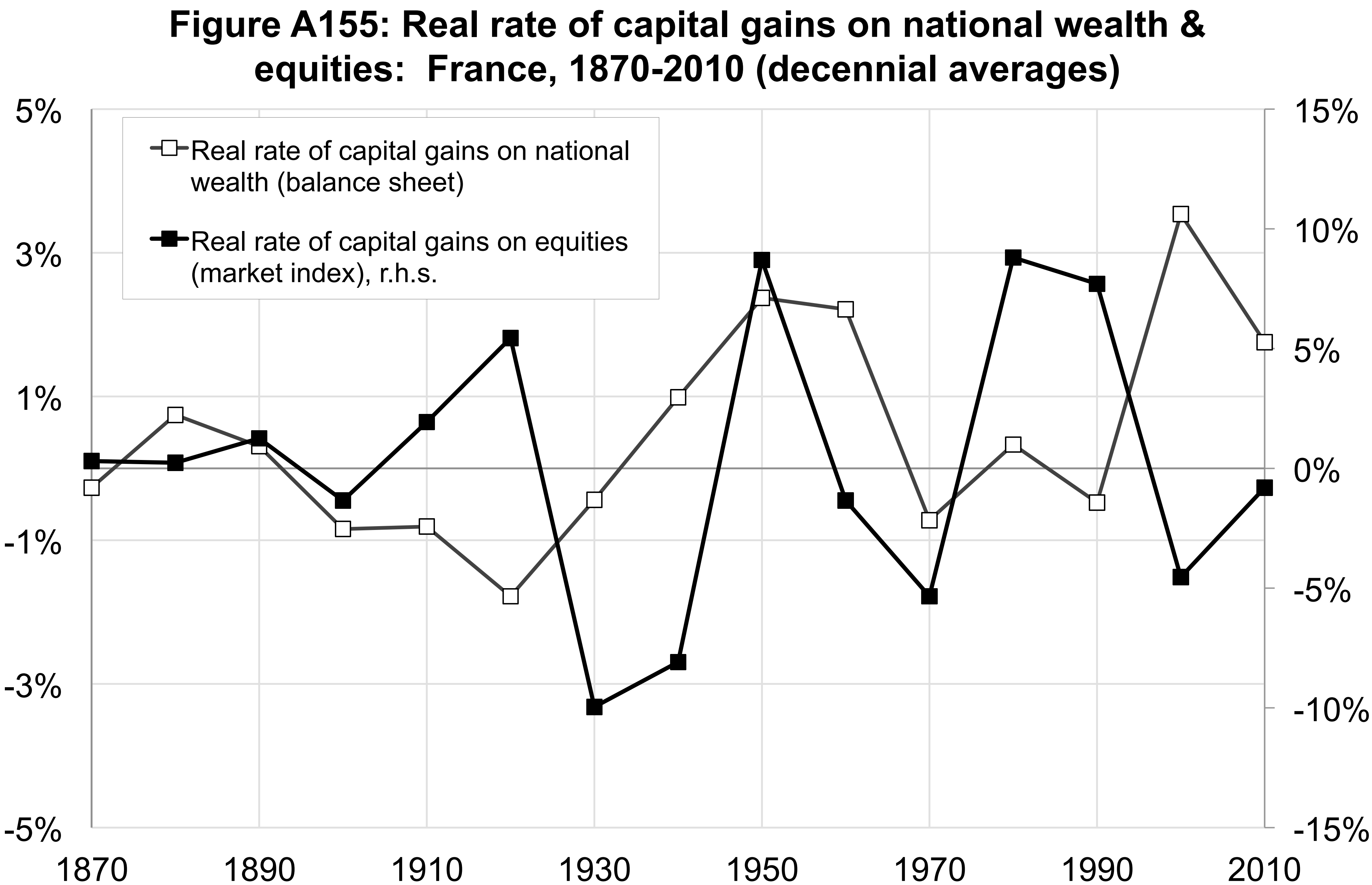


Figure A155: Real rate of capital gains on national wealth & equities: France, 1870-2010 (decennial averages)
Real rate of capital gains on national wealth (balance sheet)
Real rate of capital gains on equities (market index), r.h.s.
5%
3%
1%
-1%
-3%
-5%
15%
10%
5%
0%
-5%
-10%
-15%
1870
1890
1910
1930
1950
1970
1990
2010

Figure A156: Real rate of capital gains on national wealth and on equities: UK, 1870-2010 (decennial averages)

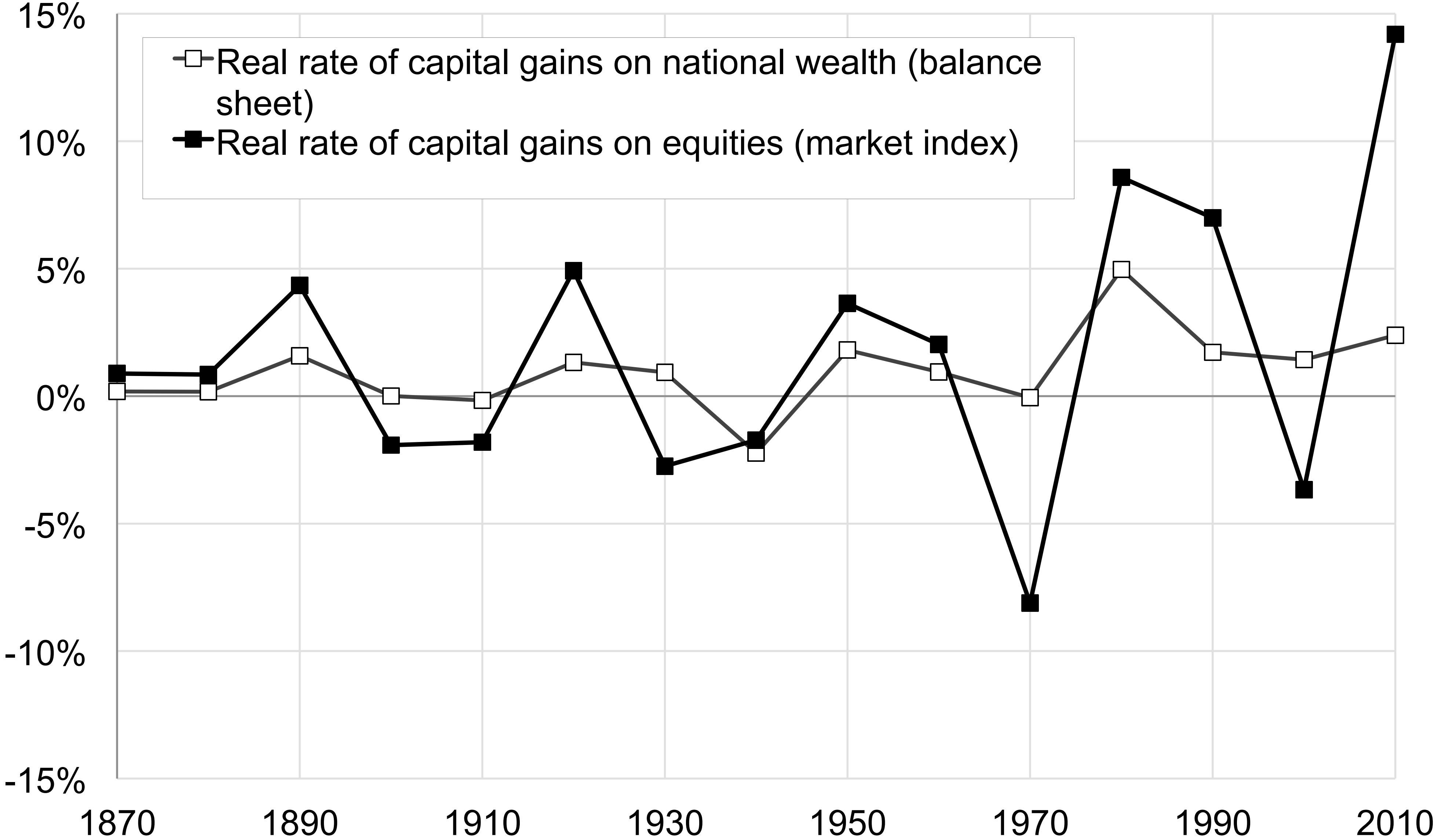
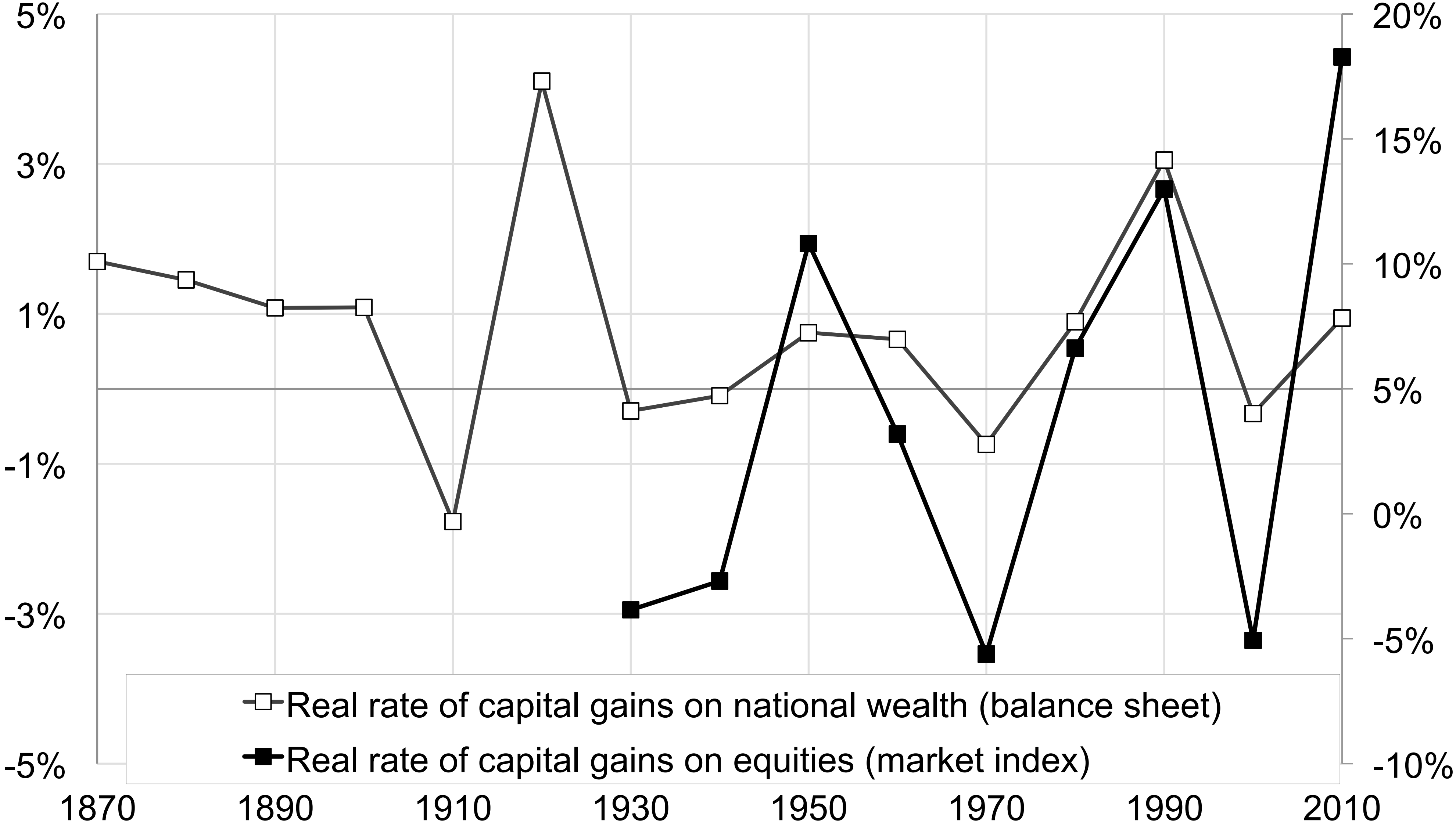


Figure A157: Real rate of capital gains on national wealth & equities: USA, 1870-2010 (decennial averages)



B Appendix Tables

The Data Appendix is supplemented by a detailed wealth and income database, which is available online in Excel format, as well as in PDF format in a separate Databook (594 p.). The Databook is not reproduced in this dissertation.