CAPITAL IS BACK: WEALTH-INCOME RATIOS IN RICH COUNTRIES 1700–2010*

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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 eight developed economies. For the United States, United Kingdom, 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 in recent decades, 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 $\beta = \frac{s}{g}$ 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 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. *JEL* Codes: E10, E20, D30, D31, D33.

I. Introduction

This article addresses what is arguably one of the most basic economic questions: how do wealth-income and capital-output ratios evolve in the long run and why?

Until recently it was difficult to properly address this question, because 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. Although suitable for some purposes, this procedure 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 nonfinancial 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 article makes use of these new balance sheets to establish a number of facts and analyze whether standard capital accumulation models can account for these facts. We stress at 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 we have to study wealth accumulation—a question so important that we cannot wait for perfect data before we start addressing it, and which 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 article, therefore, can also be viewed as an attempt to assess 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.

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 I. To our knowledge, it is the first international database to include long-run, homogeneous information on national wealth. The database is available online, along with a comprehensive Data Appendix that precisely documents the data construction process. For the eight largest developed economies in the world—the United States, Japan, Germany, France, the United Kingdom, 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 (United States), and 1700 (United Kingdom 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.

TABLE I

A New Macro Database on Income and Wealth

	Total period covered in database	Annual series	Decennial estimates
United States	1770–2010	1869–2010	1770–2010
Japan	1960–2010	1960–2010	
Germany	1870–2010	1870–2010	
France	1700–2010	1896–2010	1700–2010
United Kingdom	1700–2010	1855–2010	1700–2010
Italy	1965–2010	1965–2010	
Canada	1970–2010	1970–2010	
Australia	1970–2010	1970–2010	

Notes. Income and wealth database constructed by the authors using country national accounts (official series and balance sheets and nonofficial historical estimates). See country Online Appendixes for sources, methods, and detailed series.

Our second contribution is to exploit the database to establish a number of new results. We first document that wealth-income ratios have been gradually rising in each of the top eight developed countries over the past four decades, from about 200–300% in 1970 to 400–600% in 2010 (Figure I). Taking a long-run perspective, 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 (Figures II and III). In the United States, the wealth-income ratio has also followed a U-shaped pattern, but less marked (Figure IV).

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 European wealth-income ratios can be explained by two main factors. The first is a long-run swing in relative asset prices, which, we argue, was 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 anticapital 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
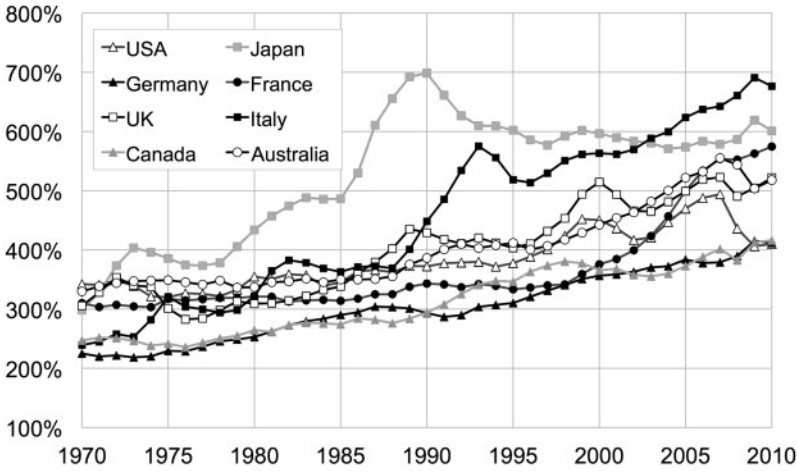
FIGURE I

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).
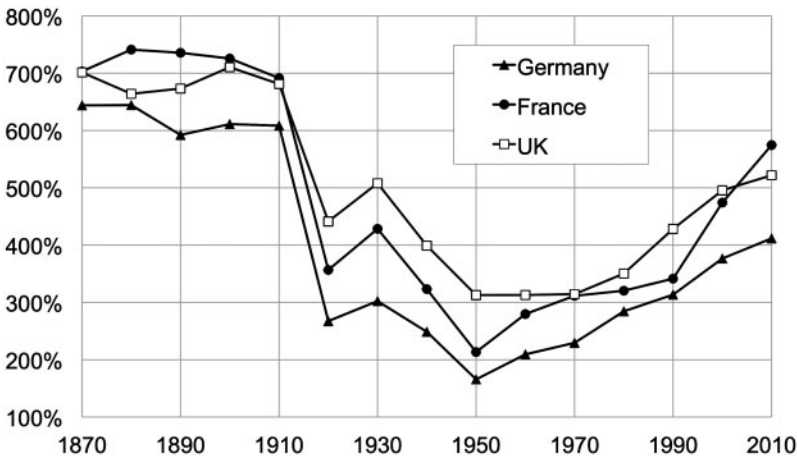
FIGURE II

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 III

The Changing Nature of National Wealth: United Kingdom, 1700–2010

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

FIGURE IV

Private Wealth-National Income Ratios, 1870–2010: Europe versus United States

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 Europe).
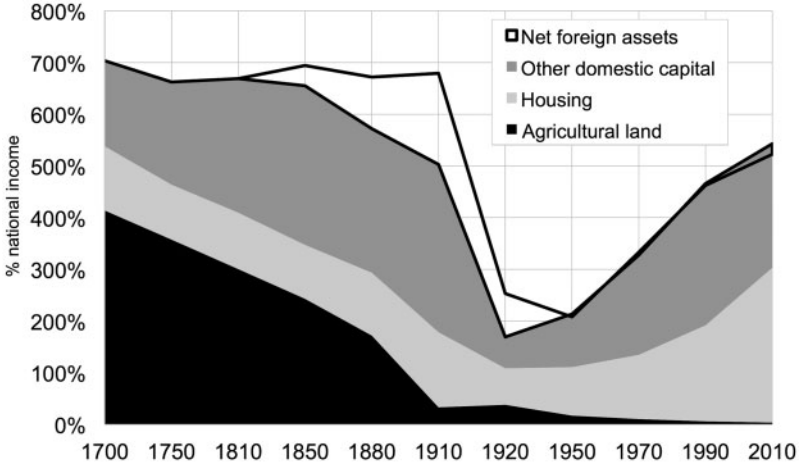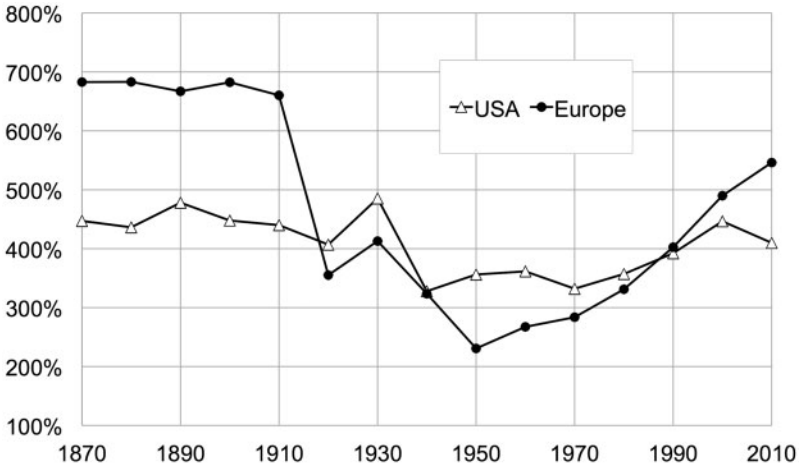
long run the wealth-income ratio β is equal to the net-of-depreciation saving rate s divided by the income growth rate g. So for a given saving rate $s = 10\%$, the long-run β is about 300% if $g = 3\%$ and about 600% if $g = 1.5\%$. In a broad class of general equilibrium models with endogenous saving, the steady-state wealth-income ratio is also a decreasing function of the income growth rate g.

This mechanism sheds light on the rise in the wealth-income ratios of Europe and Japan, two economies where population and productivity growth has slowed markedly: capital is back because low growth is back. It also helps understand why wealth-income ratios are lower in the United States, where population growth—but not saving—is larger than in Europe. Last, the $\beta = \frac{s}{g}$ steady-state 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 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, there seems to be no significant divergence between the price of consumption and capital goods.

We stress, however, that despite our efforts we still face data limitations when decomposing wealth accumulation in the very long run. Our interpretations are subject to these limitations, and we hope our findings will motivate new research on the historical dynamics of asset prices. Furthermore, in some countries capital gains—particularly on housing—explain a large part of the recent rise of wealth-income ratios. It is only in the very long run or at a very aggregate level (i.e., at a European rather than country level) that relative price effects seem to wash out.

Our findings have implications for the future and for policy making. First, the low wealth-income ratios of the mid-twentieth century were due to special circumstances. The world wars and anticapital 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, if income growth slows down in the decades ahead, then wealth-income ratios may become high pretty much everywhere. 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.

The return of high wealth-income ratios is 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 taxation (Piketty, 2011, 2014; Piketty and Saez, 2013), which in turn would require a high degree of international cooperation to prevent wealth from hiding in offshore tax havens (Zucman, 2013). If international tax competition prevents these policy changes from happening, one cannot exclude the development of a new wave of antiglobalization and anticapital policies.

Furthermore, because s and g are largely determined by different forces, wealth-income ratios can vary a lot between countries. The implications for financial regulation are important. 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.[1] Housing and financial bubbles are potentially more devastating when the total stock of wealth amounts to six to eight years of national income rather than two to three years only. The fact that the Japanese and Spanish bubbles are easily identifiable in our data set also suggests that monitoring wealth-income ratios may help in 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.

1. See Online Appendix Figure A8. We do not include Spain in our main sample of countries because the Bank of Spain balance sheets 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-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 wealth, the shape of the production function, and the recent rise in capital shares. In the eighteenth and early nineteenth century, capital was mostly land, so that there was limited scope for substituting labor to capital. In the twentieth and twenty-first 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 rich countries since the 1970s.

The article is organized as follows. Section II relates our work to the existing literature. In Section III we define the key ratios and present the accounting framework. We describe the 1970–2010 evolution of wealth-income ratios in Section IV, before decomposing the accumulation of wealth into volume and price effects (Section V). In Section VI, we present decomposition results over a longer period (1870–2010) for a subset of countries (United States, Germany, France, United Kingdom). We take an even longer perspective in Section VII, in which we discuss the changing nature of wealth in the United Kingdom, France, and the United States since the eighteenth century. In Section VIII, we compare the long-run evolution of capital-output ratios and capital shares to discuss the changing nature of technology and the pros and cons of the Cobb-Douglas approximation. Section IX concludes.

II. RELATED LITERATURE

II.A. Literature on National Wealth

To the best of our knowledge, this article is the first attempt to gather a large set of national balance sheets 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.

The recent emphasis on national wealth, however, largely represents a return to older practice. Until the early twentieth century, economists and statisticians 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 United Kingdom and Boisguillebert (1695) and Vauban (1707) in France. National wealth estimates then became plentiful in the nineteenth and early twentieth centuries, with the work of Colqhoun (1815), Giffen (1889), and Bowley (1920) in the United Kingdom; Foville (1893) and Colson (1903) in France; Helfferich (1913) in Germany; King (1915) in the United States, 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. In many ways, it was also easier to estimate national wealth around 1900 than it is today: the structure of property was simpler, with 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 between the wars made the computation of the current market value of wealth and the comparison with pre–World War I estimates much more difficult. Although 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.[2] The reason is

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

probably that it is only recently that official balance sheets have become sufficiently widespread to make the exercise meaningful.

II.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 $\beta = \frac{s}{g}$ 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.[3] 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 Denison 1962; Jorgenson and Griliches 1967; Feinstein 1978) and it was later on extended to human capital (Barro 1991; Mankiw, Romer, and Weil 1992). 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 measured indirectly by cumulating past investment flows and attempting to adjust for changes in relative prices—what is known as the perpetual inventory method. By contrast, we measure capital directly by using country balance sheets in which we observe the actual market value of most types of assets: real estate, equities (which capture the market value of corporations), bonds, and so on. We are interested in what nonhuman private capital is worth for households and in what public capital would be worth if privatized. This notion is precisely what the

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3. Harrod emphasized the inherent instability of the growth process, whereas Domar stressed the possibility that β and s can adjust in case the natural growth rate g differs from $\frac{s}{\beta}$.

economists of the eighteenth and nineteenth centuries aimed to capture. We believe it is a useful and well-defined starting point.[4]

Compared to the capital stock estimates obtained by the perpetual inventory method, country balance sheets have four important advantages. First, they include nonproduced assets, such as land, which cannot be measured by cumulating past investment flows. It is critical to consistently account for nonproduced assets if one wants to conduct Solow-type growth accounting exercises and compute the marginal product of capital (Caselli and Feyrer 2007). Second, balance sheets rely for the most part on observed market prices—obtained from real estate and financial market transactions—while perpetual inventory method capital stocks rely on estimated prices that suffer from a number of pitfalls.[5] Third, our measure of country capital stocks includes most forms of intangible capital, contrary to older estimates. Last and most important, country balance sheets now follow standardized international definitions and are available for many countries and over long periods of time. Market-value balance sheets have their own deficiencies, but as we argue their advantages vastly exceed their limitations. In our view, they ought to be used more extensively in economic research.

In particular, 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 is not a fact for Europe and Japan and is quite debatable for the United States. Although this constancy is often seen as one of the key regularities in economics, there has always been some confusion about what the level of the capital-output ratio is supposed to be (see Kaldor 1961; Samuelson 1970; Simon 1990; Jones and Romer

4. 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 confusion in this controversy owes to the lack of balance sheet data and to the difficulty of making comparisons with pre–World War I capital stock estimates. It is natural to use relative market prices to aggregate the various capital assets into national capital, just as it is natural to use relative market prices to aggregate the various goods and services into national output.

5. Online Appendix Section A.1.2 provides a detailed discussion of the many issued faced by the price estimates used in the perpetual inventory method: the accounting of depreciation, quality improvement, aggregation bias, and so on. Equity market prices are themselves not perfect; they can be very volatile in the short run. But in the long run they are arguably the best data we have to capture the market value of corporations' capital stocks.

2010). The data we now have suggest that the ratio is closer to 5–6 in most rich countries today than to the values of 3–4 often used in macro models and textbooks.[6]

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 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.

II.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 (Gourinchas and Rey 2007; Lane and Milesi-Ferretti 2007; Zucman 2013). We 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, whereas the net foreign asset position accounts for −10% to +10% only. Nevertheless, external wealth will turn out to play an important role in the dynamics of national wealth, more spectacularly in the United States. 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.[7]

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6. 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 Online Appendix Figures A70–A71). This, however, disregards the large stock of housing capital (as well as noncorporate businesses and government capital), which we feel is inappropriate (more on this below).

7. See Obstfeld (2012) and Gourinchas and Rey (2013) for recent papers surveying the literature on this issue.

II.D. Literature on Income and Wealth Inequalities

Last, this article is to a large extent the continuation of the study of the long-run evolution of private wealth in France undertaken by Piketty (2011). We extend Piketty's analysis to many countries, longer time periods, and 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 life cycle 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 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 distributional trends in the analysis.[8]

III. CONCEPTUAL FRAMEWORK AND METHODOLOGY

III.A. Concepts and Definitions

The concepts we use are standard: we strictly follow the UN 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). We take the data exactly as published, except in the rare cases where the balance sheets deviate from the SNA, in which case we correct the data to ensure consistency across countries.[9] For the previous periods, we have gathered 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. Section A of the Data Appendix provides a thorough discussion of the concepts and definitions used by the 1993 and 2008 SNA. All the details on how we have used available historical estimates to construct our own pre-1970 wealth series are provided in the country-specific sections of the Data Appendix; see in particular sections B (devoted to the United States), D (Germany),

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8. See Davies et al. (2010) for a study of the world distribution of personal wealth.

9. For example, U.S. Flow of Funds balance sheets include durable goods, contrary to other countries (see below), so to ensure consistency we subtract durables.

E (France), and F (United Kingdom). Here we provide the main definitions.

Private wealth W_t is the net wealth (assets minus liabilities) of households and nonprofit institutions serving households.[10] Following SNA guidelines, assets include all the nonfinancial assets—land, buildings, machines, and so on—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).[11] Durable goods owned by households, such as cars and furniture, are excluded as well.[12] 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 and corporate bonds. 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 nonfinancial 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:

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

10. The main reason for including nonprofit institutions serving households (NPISHs) in private wealth is that the frontier between individuals and private foundations is not always clear. The net wealth of NPISHs 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 United States; see online Appendix Table A65. The household sector also includes unincorporated businesses.

11. In any case, such claims would wash out for the computation of national wealth—which we view as a more meaningful concept than private wealth—since they would count as assets for households and liabilities for the government.

12. 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 Online Appendix Table US.6f for durable goods in the United States.

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

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

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 nonfinancial 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 nonequity 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 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 we prefer our market-value concept of national wealth (or national capital), both definitions have some merit, as we shall see.[13]

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 nonfinancial 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 Online Appendix for a precise discussion of the methods used by the leading rich countries.

13. W_{bt} corresponds to the concept of "national net worth" in the SNA (see Data Appendix A.4.2). In this article, we propose to use "national wealth" and "national capital" interchangeably (and similarly for "domestic wealth" and "domestic capital," "foreign wealth" and "foreign capital," and "private wealth" and "private capital") and to specify whether one uses "market value" or "book value" aggregates (unless specified otherwise, we use "market value" concepts). Nineteenth-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, whereas we recognize that both definitions have some merit (see the discussion on Germany later).

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: $Y_t = Y_{dt} + r_t NFA_t$.[14] 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 $\beta_t = \frac{W_t}{Y_t}$ and of the (market-value) national wealth–national income ratio $\beta_{nt} = \frac{W_{nt}}{Y_t}$. 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 $\beta_{kt} = \frac{K_t}{Y_{dt}}$.[15] In case public wealth is equal to 0, 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 $\alpha_t = r_t \frac{K_t}{Y_{dt}} = r_t \beta_{kt}$, where r_t is the average rate of return on domestic capital. With imperfect capital markets, r_t can substantially vary across assets. With perfect capital markets and no aggregate uncertainty, r_t is the same for all assets and is equal to the marginal product of capital. With a Cobb-Douglas production function $F(K_t, L_t) = K_t^\alpha L_t^{1-\alpha}$, and a closed economy setting, the capital share is entirely set by technology: $\alpha_t = r_t \beta_{kt} = \alpha$. A higher capital-output ratio β_{kt} is exactly compensated by a lower capital return $r_t = \frac{\alpha}{\beta_{kt}}$, 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 $r_t = \frac{\alpha}{\beta_{kt}}$, 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 $r_t \frac{W_t}{Y_t} = r_t \beta_t$ is larger than α.

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14. National income also includes net foreign labor income and net foreign production taxes—both of which are usually negligible.

15. In principle, one can imagine a country with a zero net foreign asset position (so that $W_{nt} = K_t$) but nonzero 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 Online Appendix Figure A57). Net foreign asset positions are usually small as well, so that the capital-output ratio β_{kt} turns out to be usually close to the national wealth-income ratio β_{nt} in the 1970–2010 period (see Online Appendix Figure A67).

With a constant elasticity of substitution (CES) production function, much depends on whether the capital-labor elasticity of substitution σ is larger or smaller than 1. If $\sigma > 1$, then as β_{kt} rises, the fall of the marginal product of capital r_t is smaller than the rise of β_{kt}, so that the capital share $\alpha_t = r_t \beta_{kt}$ is an increasing function of β_{kt}. Conversely, if $\sigma < 1$, the fall of r_t is bigger than the rise of β_{kt}, so that the capital share is a decreasing function of β_{kt}.[16] Because we include all forms of capital assets into our aggregate capital concept K (including housing), the aggregate elasticity of substitution σ should be interpreted as resulting from both supply forces (producers shift between technologies with different capital intensities) and demand forces (consumers shift between goods and services with different capital intensities, including housing services versus other goods and services).[17]

III.B. The One-Good Wealth Accumulation Model

Wealth accumulation between time t and $t+1$ can always be decomposed into a volume effect and a relative price effect: $W_{nt+1} = W_{nt} + S_t + KG_t$, where W_{nt} is the market value of national wealth at time t, S_t is the net-of-depreciation national saving flow between time t and $t+1$ (volume effect), and KG_t is the capital gain or loss between time t and $t+1$ (relative price effect). 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 national wealth-income ratio $\beta_{nt} = \frac{W_{nt}}{Y_t}$ is given by the following equation:

$$\beta_{nt+1} = \frac{1 + g_{wst}}{1 + g_t} \beta_{nt},$$

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16. A CES production function is given by: $F(K,L) = (aK^{\frac{\sigma-1}{\sigma}} + (1-a)L^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}}$. As $\sigma \to \infty$, the production function becomes linear, that is, 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, that is, the return to capital falls to 0 if the quantity of capital is slightly above the fixed proportion technology. We return to this discussion in Section VII.

17. Excluding housing from wealth strikes us an inappropriate, first because it typically represents about half of the capital stock, and then because the frontier with other capital assets is not always clear. In particular, the same assets can be reallocated between housing and business uses. Note also that official balance sheets treat housing assets owned by corporations (and sometime those rented by households) as corporate capital assets.

where $1 + g_{wst} = 1 + \frac{S_t}{\beta_{nt}}$ = saving-induced wealth growth rate; $1 + g_t = \frac{Y_{t+1}}{Y_t}$ = growth rate of national income; and $s_t = \frac{S_t}{Y_t}$ = net-of-depreciation national saving rate (domestic + net foreign saving).

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

$$\beta_{nt} \rightarrow \beta_n = \frac{s}{g}.$$

Should we use gross-of-depreciation saving rates rather than net rates, the steady-state formula would be $\beta_n = \frac{s}{(g+\delta)}$ 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 $\frac{s}{g}$ formulation, so as to better focus on the saving versus capital gain decomposition. Both formulas are equivalent and require the same data.[18]

The $\frac{s}{g}$ formulation also applies to the capital-output ratio β_k, with the only difference that for β_k the saving rate s to take into consideration is the domestic saving rate (i.e., national saving minus net foreign saving[19]) and g is the growth rate of domestic output (i.e., national income minus net foreign income).

The steady-state formula $\beta = \frac{s}{g}$ is a pure accounting equation. 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: $g_{ws} = \frac{s}{\beta} = 2\% = g$. The formula holds in the steady state of any micro-founded model, independently of the nature of saving motives. In models where saving is exogenous, the long-run wealth-income ratio is obviously a decreasing function of g. Importantly, however, the negative relationship between steady-state β and g also holds true in a very large class of models

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

19. Net foreign saving equals the current account balance plus net foreign capital transfers (which are usually negligible) minus net errors and omissions in the balance of payments.

in which s is endogenous.[20] It holds true, in particular, in different variants of the "bequest-in-the-utility-function" model;[21] in overlapping generations models;[22] in the dynastic, infinite-horizon model;[23] and in most endogenous growth models.[24] In all those models, a growth slowdown—due to a decrease in population growth, productivity growth, or both—leads to higher capital-output and wealth-income ratios in the long run.

III.C. The Two-Good Model: Volume versus Relative Price Effects

The steady-state $\beta = \frac{s}{g}$ formula only relies on the assumption that there is no change in the relative price between capital and consumption goods over time. 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 article is whether relative price effects also matter for the analysis of long-run wealth accumulation. There are many reasons 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 in which the volume of capital is fixed: $V_t = V$ (say, fixed land supply). The market value of capital if given by $K_t = q_t V$, where q_t is the price of the capital good (say, land price per acre) relative to the consumption

20. For more details, see the working paper version of this article, Piketty and Zucman (2013, section 3).

21. In such models, the saving rate parameter s follows directly from the strength of the taste for bequest or wealth in the utility function.

22. The saving rate s is then determined—among other things—by the number of years spent in retirement and the generosity of the public pension system.

23. In this model, each dynasty maximizes $\sum_{t \geq 0} \frac{U(c_t)}{(1+\theta)^t}$. The long-run rate of return is entirely determined by preference parameters and the growth rate: $r_t \to r = \theta + \gamma g$, where $\gamma \geq 0$ is the curvature of the utility function $U(c) = \frac{c^{1-\gamma}}{(1-\gamma)}$ ($\gamma > 1$ is usually assumed to be more realistic). The steady-state saving rate is equal to $s = \frac{\alpha g}{r} = \frac{\alpha g}{(\theta + \gamma g)}$, where $\alpha = r\beta$ is the capital share. Intuitively, a fraction $\frac{g}{r}$ of capital income is saved in the long run, so that dynastic wealth grows at the same rate g as national income. 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 $\beta = \frac{s}{g}$ decreases with g. With a Cobb-Douglas production function (fixed capital share), the wealth-income ratio is given by $\beta = \frac{\alpha}{r} = \frac{\alpha}{(\theta + \gamma g)}$ and takes its maximum value $\overline{\beta} = \frac{\alpha}{\theta}$ for $g = 0$.

24. In endogenous growth models with imperfect international capital flows, the growth rate might rise with the saving rate, but it will usually rise less than proportionally. It is only in the AK closed-economy model that the growth rate rises proportionally with the saving rate.

good. Assume fixed population and labor supply and positive labor productivity growth $g > 0$. 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 capital rises as fast as output and income: there are positive capital gains in the steady state. By construction, there is no saving at all in this model (since the capital good is in fixed supply), and the rise in the value of capital is entirely due to a relative price effect.[25] This is the opposite extreme of the one-good model, whereby the rise in the value of capital is entirely due to a volume effect.

In practice, there are all sorts of intermediate cases between these 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 national wealth-income ratio into two multiplicative components (volume and relative price) using the following accounting equation:

$$\beta_{nt+1} = \frac{(1 + g_{wst})(1 + q_t)}{1 + g_t} \beta_{nt},$$

where $1 + g_{wst} = 1 + \frac{S_t}{\beta_{nt}} = $ saving-induced wealth growth rate; $1 + q_t = $ capital-gains-induced wealth growth rate; and $1 + g_t = \frac{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 the two sectors), and we infer it from the data at our disposal on $\beta_{nt}, \ldots, \beta_{nt+n}, s_t, \ldots, s_{t+n}$, and $g_t, \ldots, g_{t+n}$. In effect, if we observe that the wealth-income ratio rises too fast 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. By construction, our residual capital gains q are the same as those found in the income-wealth reconciliation accounts published by a growing number

25. See the working paper version of this article, Piketty and Zucman (2013), sections 3.3. and 3.4.

of statistical agencies, with the only difference that q is net of consumer price inflation.[26]

In the next sections, we present the main descriptive statistics for private wealth, national wealth, and domestic capital, as well as the decomposition results for national wealth (additional decomposition results are in Online Appendix K). We start with the 1970–2010 period before moving to longer periods of time.

IV. THE RISE OF WEALTH-INCOME RATIOS 1970–2010

IV.A. *Private Wealth-Income Ratios*

Private wealth-income ratios have gradually increased in rich countries since 1970, from about 200–300% in 1970 to about 400–600% today (Figure I). In top of this general trend, there are interesting cross-country variations. Within Europe, the French and U.K. trajectories are comparable: in both countries, private wealth rose from about 300% of national income in 1970 to about 550% 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 United Kingdom, 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 return. At this stage, we note that we are unable to identify any methodological or conceptual difference in the work of German statisticians (who apply the same SNA guidelines as everybody else) that could explain the gap with other European countries.[27]

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26. In the United States, for example, the Bureau of Economic Analysis publishes a set of integrated macroeconomic accounts that combine their national income and product accounts (for income) and the Federal Reserve Board's Flow of Funds (for wealth). For the recent decades, all the U.S. series in our database come from the integrated macro accounts, so that by construction the residual capital gains we report are consistent with those presented in these accounts.

27. See Online 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 an explanation for the lower wealth-income ratio. For a given saving rate, one can purchase different types of assets, and there is no general reason housing should deliver higher capital gains than financial assets.

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 magnitude. In the United States, 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.[28]

The rise in private wealth–national income ratios would be even more spectacular should we use disposable personal income—that is, 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% everywhere in 1970.[29] Whether one should divide private wealth by national or disposable income 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 to compare private wealth-income ratios over long periods of time and across

28. With the interesting exception of Spain, where private wealth fell with a comparable magnitude as in the United States since 2007 (i.e., by the equivalent of about 50–75% of national income, or 10–15% of initial wealth).

29. See Online Appendix Figure A9. Should we include durable goods in 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.

countries, it is more justified to look at economic values and therefore to divide private wealth by national income.[30]

IV.B. From Private to National Wealth

We now move from private to national wealth—the sum of private and government wealth—which in our view is a more meaningful and comprehensive concept of wealth. In rich countries, net government wealth has always been relatively small compared to private wealth, and it has declined since 1970, as Figure V illustrates. This decline is due to privatizations—leading to a reduction in government assets—and an increase in public debt.

For example, in the United States, as well as in Germany, France, and the United Kingdom, net government wealth was around 50–100% of national income in the 1970s–1980s, and is now close to 0. 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 0. 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 appears to be much smaller than the rise of private wealth. As a result, national wealth has increased a lot, from 250–400% of national income in 1970 to 400–650% in 2010 (Figure VI).[31]

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30. In the end it really depends on how one views government-provided services (and in our database, we provide both ratios). If one assumes that government expenditures are useless, and that the rise of government during the twentieth century has limited the ability of private individuals to accumulate private wealth, then one should use disposable income as the denominator. But to the extent that government expenditures are mostly useful (in the absence of public spending in health and education, 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 is that national income tends to be better measured. Disposable income can display large time-series and cross-country variations for purely definitional reasons. In European countries 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% if one includes all in-kind transfers (education, housing, etc.). See Online Appendix Figure A65.

31. Should we include claims on future government spending in wealth, private wealth would be higher and government wealth lower, leaving national wealth unchanged.

FIGURE V

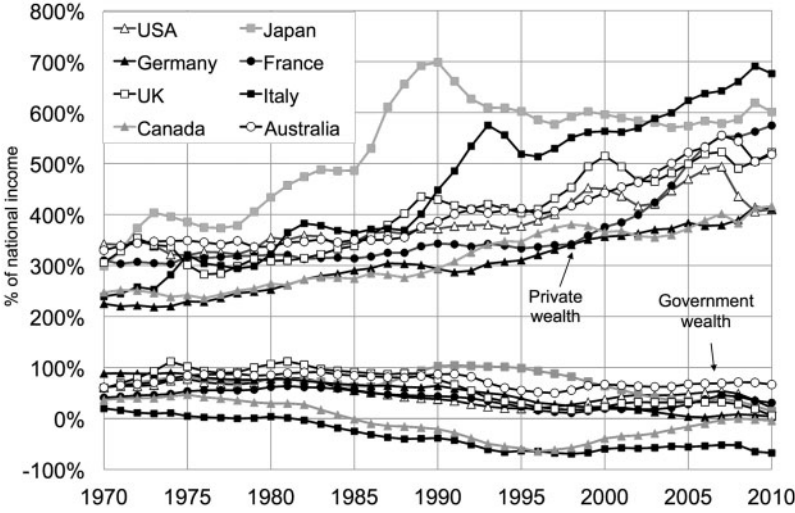Private versus Government Wealth, 1970–2010

Authors' computations using country national accounts. Government wealth = non-financial assets + financial assets − liabilities of the government sector.
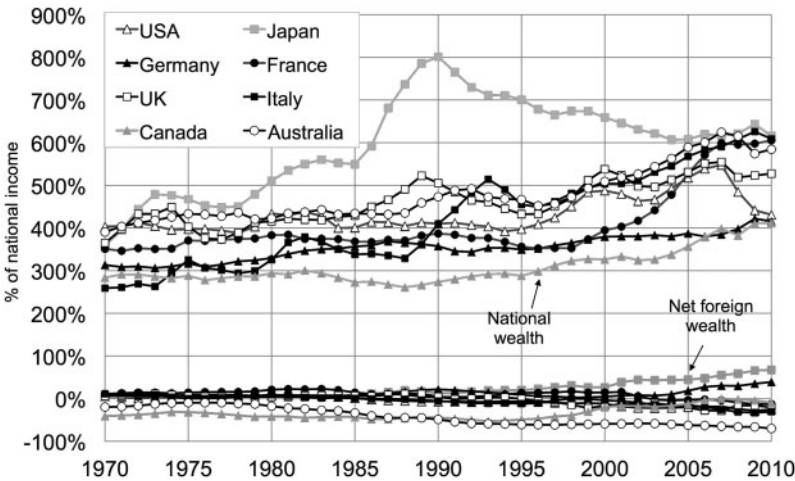
FIGURE VI

National versus 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).

In Italy, for instance, net government 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.

IV.C. From National Wealth to Domestic Capital

Last, our database provides evidence on the evolution of the structure of national wealth. National wealth is the sum of domestic capital and net foreign wealth. The first basic fact is that net foreign wealth—whether positive or negative—has generally been a relatively small part of national wealth in rich countries throughout the 1970–2010 period (see Figure VI). However, 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 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 United Kingdom and France around 1910, they are starting to be substantial. The German position is rising fast. As a result, in Japan and Germany, the rise in net foreign assets represents more than a quarter of the total rise of the national wealth-income ratio.

In most of the other countries in our database, by contrast, recorded net foreign positions are currently slightly negative—typically between -10% and -30% of national income—and have been declining.[32] So for those countries, the rise in the domestic capital-output ratio β_k has been larger than the rise in the national wealth-income ratio β_n. For example, the capital-output ratio was about 400% in the United States in 1970 and reached 460% in 2010.[33]

As we already noted, our measure of the capital-output ratio β_k based on balance sheet data differs from (and is arbuably more comparable over time and across countries than) previously available estimates obtained by the perpetual inventory method

32. However, the official net foreign asset positions do not include the sizable assets held by rich country residents in tax havens. In all likelihood, including these assets would turn the rich world's total net foreign asset position from negative to positive. The improvement would be particularly large for Europe (Zucman 2013).

33. See Online Appendix Table A51 and Appendix Figure A67.

(PIM). There are two main reasons for this discrepancy: different valuations of housing capital and of corporations' assets.[34]

In balance sheets, real estate is measured at its current market value, using censuses and observed market prices. By contrast, PIM estimates only capture the value of "structures," and this value is obtained indirectly by cumulating past real estate investments, adjusting for the evolution of the relative price of construction (in a way that makes it difficult to properly account for changes in quality). This procedure misses a large fraction of the value of the housing stock.[35] It fails to capture the large increase in housing wealth that has happened since 1970 (with notable variations across countries). As Table II shows, the rise of housing at market value accounts for virtually all of the increase in β_k in the United Kingdom, France, and Canada, for about two-thirds of the increase in the United States, and about half in Japan.[36]

Second, in our benchmark measure of the capital-output ratio, corporate capital is measured through the market value of equities, while in older estimates corporate capital is at book value (i.e., based on PIM estimates of corporations' non-financial assets). Tobin's Q ratios between market and book values were much below 1 in the 1970s and are closer to 1 (and

34. Section A.4.5 of the Data Appendix provides a detailed reconciliation on the basis of the U.S. case. A third and less important reason is that balance sheets include inventories and valuables, following international guidelines, whereas PIM estimates of the capital stock generally do not.

35. The gap between the balance sheet and the PIM-based measures of real estate includes the value of land underlying buildings, as well as any measurement error on any side, and all cumulated changes in market-value real estate prices that cannot be attributed to the evolution of construction costs. In the United States, the gap amounts to about 60% of domestic output in 2010. Whether this should be interpreted as the value of land is unclear, given the imperfections of the price data used in PIM estimates and the fact that the distinction between structures and land is somewhat arbitrary.

36. 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 an area where progress still needs to be made. Online Appendix A.9 pinpoints the key areas in which we believe national accounts could be improved.

TABLE II

DOMESTIC CAPITAL ACCUMULATION IN RICH COUNTRIES, 1970–2010: HOUSING VERSUS 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
United States	399		456		57	
	142	257	182	274	41	17
Japan	356		548		192	
	131	225	220	328	89	103
Germany	305		377		71	
	129	177	241	136	112	−41
France	340		618		278	
	104	236	371	247	267	11
United Kingdom	359		548		189	
	98	261	300	248	202	−13
Italy	247		640		392	
	107	141	386	254	279	113
Canada	325		422		97	
	108	217	208	213	101	−4
Australia	410		655		244	
	172	239	364	291	193	52

at times above 1) in the 1990s–2000s.[37] As a result, measured at market value, domestic capital goods other than housing have significantly contributed to the rise of β_k in a number of countries, most spectacularly Japan and Italy (Table II).

Which measure of the corporate capital stock, market or book, is more appropriate? Both have their merits. Take the case of Germany. Tobin's Q is low: it has remained around 0.5 since the 1970s, contrary to the United Kingdom and the United States. One interpretation is a "stakeholder effect": shareholders of German companies do not have full control of company assets—they share their voting rights with workers' representatives and sometime regional governments—which might push

37. See Online Appendix Figure A92 and Appendix Table A78. For example, in 2010, the value of the U.S. corporate capital stock is approximately the same whether one looks at equity market prices or at the current cost of corporate capital goods as estimated by BEA statisticians. That is, Tobin's Q is around 1.

Q below 1.[38] If that is true, measuring corporate capital stocks at book value might be desirable for some purposes (e.g., for growth accounting), so in our database we also report series with corporate capital at book value. There are, however, issues with book-value estimates (one of which being that intangible capital is imperfectly accounted for) that lead us to view market values as probably more informative in the long run.[39] Whether one uses book or market values for corporate capital, the capital-output ratio has increased markedly in all rich countries since the 1970s.[40]

V. DECOMPOSITIONS OF 1970–2010 WEALTH ACCUMULATION

V.A. *Growth Rates versus Saving Rates*

How can we account for the rise and cross-country variations of national wealth-income ratio? According to the one-good capital accumulation model, wealth-income ratios are driven by two key forces: the saving rate s and the income growth rate g. So it is useful to have in mind the magnitude of 1970–2010 growth and saving rates. The basic fact is that both rates vary widely across countries and seem largely unrelated (Tables III–IV), which creates room for wide, multidimensional variations in wealth-income ratios across countries.

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

38. In Germany, book-value national wealth is substantially above market-value national wealth (about five years of national income instead of four years). The opposite occurs in the United Kingdom.

39. See Online Appendix Section A.1.2. The fact that intangible capital is not fully accounted tends to bias PIM-corporate capital stocks downward. Other measurement issues, however, tend to bias them upward, in particular errors in price deflators and problems in accounting for the assets of firms going out of business (which sometimes incorrectly continue to be counted in the capital stock). Overall, it seems that PIM estimates of corporations' capital stocks have historically tended to be overestimated. Quite puzzlingly, indeed, in most countries Tobin's Q appears to be structurally below 1, although intangible capital is imperfectly accounted for, which in principle should push it above 1. This is an area in which existing statistics might need to be improved.

40. In particular, book-value national wealth (expressed as a fraction of national income) has increased almost as much as market-value national wealth (see Online Appendix Figure A25), despite the increase in Tobin's Q.

TABLE III

GROWTH AND SAVING RATES 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)
United States	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	0.6	1.6	11.1
United Kingdom	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

Notes. Authors' computations using country national accounts. Growth rates are geometric averages and for income use chain-weighted GDP deflators. For alternative deflators, see Online Appendix Table A3 and Country Tables US.3, JP.3, and so on. 1970–2010 average saving rates are obtained by weighting yearly saving rates by real national income.

TABLE IV

STRUCTURE OF NATIONAL SAVING, 1970–2010

	Net national saving (private + government) (%)	Net private saving (personal + corporate) (%)	Incl. personal saving (%)	Incl. corporate saving (retained earnings) (%)	Net government saving (%)
United States	5.2	7.7	4.6	3.1	−2.4
			60	40	
Japan	14.6	14.6	6.8	7.8	0.0
			47	53	
Germany	10.2	12.2	9.4	2.9	−2.1
			76	24	
France	9.2	11.1	9.0	2.1	−1.9
			81	19	
United Kingdom	5.3	7.3	2.8	4.6	−2.0
			38	62	
Italy	8.5	15.0	14.6	0.4	−6.5
			97	3	
Canada	10.1	12.1	7.2	4.9	−2.0
			60	40	
Australia	8.9	9.9	5.9	3.9	−0.9
			60	40	

Notes. Authors' computations using country national accounts. 1970–2010 averages are obtained by weighting yearly saving rates by real national income. The Table reads as follows: the net national saving rate of the United States has been 5.2% of national income on average per year over 1970–2010. The private saving rate has been 7.7%, including 4.6% (or 60% of 7.7%) of personal saving, and 3.1% (or 40% of 7.7%) of corporate saving.

countries. In most cases they fall between 1.7% and 1.9% a year, and 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.[41]

In contrast, variations in population growth are large and significant, as shown in Table III. Since 1970, population growth has exceeded 1% per year in New World countries (United States, Canada, Australia), and has been 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, there is a well-known gap between high fertility countries such as France (with population growth equal to 0.5% a year) and low fertility countries like Germany (less than 0.2% a year, with a sharp fall at the end of the period).[42]

Average net-of-depreciation private saving rates also vary widely, from 7–8% in the United States and the United Kingdom to 14–15% in Japan and Italy, with a large group of countries around 10–12%. 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, saving rates seem to vary for all sorts of reasons other than life cycle motives, probably reflecting differences in tastes for saving, wealth accumulation, and

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

42. 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 Online Appendix Table JP.3.

transmission,[43] as well as differences in levels of trust and confidence in the future.[44] As a result, there is only a weakly significant negative relationship between private saving and growth rates at the country level, and no relationship at all when one considers national rather than private saving (see Table IV).[45]

Thus, 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. These facts help us understand why national wealth-income ratios vary so much across countries, and in particular why high-population growth New World countries tend to have lower ratios than low-growth Europe and Japan.

V.B. Volume versus Price Effects

Table V presents our results on the decomposition of 1970–2010 national wealth accumulation into saving and capital gains effects.[46] New savings explain the largest part of wealth accumulation, but there is also a clear pattern of positive capital gains. Take the U.S. case. National wealth was equal to 404% of national income in 1970, and is equal to 431% of national income in 2010. National wealth has grown at an average real rate $g_w = 3.0\%$ a year. On the basis of national saving flows alone, wealth would have grown at rate $g_{ws} = 2.1\%$ a year only. We conclude that the residual capital gains–induced wealth

43. See, for example, Hayashi (1986) on Japanese tastes for bequest.

44. The effect of the rise of life expectancy on saving behavior is unclear. In theory, rising life expectancy may have contributed to pushing saving rates upward, but in practice the level of annuitized wealth seems to be relatively low in a number of rich countries. In France for instance, annuitized wealth represents less than 3% of aggregate private wealth (see Piketty 2011, Appendix A, pp. 37–38), suggesting that this channel does not play an important role in the rise of the wealth-income ratio. In countries with less generous pay-as-you-go pension systems, annuitized wealth can be as large as 10–20% of aggregate private wealth.

45. See also Online Appendix Figures A122 and A123. Note that in some countries a large fraction of private saving is in effect absorbed by government deficits (more than one third in Italy in 1970–2010). Whether private saving responds to public deficits is an important issue (e.g., it could be that Italian households would have saved less without rising public deficits and the fear of future public finance crisis). However, it is far beyond the scope of the present article: here we take saving behavior—private, public, and national—as given and attempt to analyze the extent to which these volume effects account for the evolution of wealth.

46. Here we only show the multiplicative decompositions of national wealth. The additive decompositions yield similar conclusions; see Online Appendix Table A101.

TABLE V

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	$g_{ws}=\frac{s}{\beta}$	q
United States	404	431	3.0	2.1	0.8
				72	28
Japan	359	616	3.9	3.1	0.8
				78	22
Germany	313	416	2.7	3.1	−0.4
				114	−14
France	351	605	3.6	2.7	0.9
				75	25
United Kingdom	314	523	3.5	1.5	2.0
				42	58
Italy	259	609	4.1	2.6	1.5
				63	37
Canada	284	412	3.8	3.4	0.4
				89	11
Australia	391	584	4.2	2.5	1.6
				61	39

Notes. Authors' computations using country national accounts. Other volume changes were included in savings-induced wealth growth rate. For full decomposition, see Online Appendix Country Tables US.4d, JP. 4d, and so on. The Table reads as follows: the real growth rate of national wealth in the United States has been 3.0% a year on average over 1970–2010. This can be decomposed into a 2.1% savings-induced wealth growth rate (72% of 3.0%) and a 0.8% capital gains-induced wealth growth rate (28% of 3.0%).

growth rate $q=\frac{(1+g_w)}{(1+g_{ws})} - 1$ has been equal to 0.8% a year on average. New savings explain 72% of the accumulation of national wealth in the United States between 1970 and 2010, and residual capital gains 28%.

Just like in the United States, new savings also appear to explain around 70–80% of 1970–2010 national wealth accumulation in Japan, France, and Canada, and residual capital gains 20–30%. Capital gains are larger in the United Kingdom, Italy, and Australia.

The capital gains we compute are obtained as a residual, and so may reflect measurement errors in addition to real valuation effects.[47] There are two main possible issues. First, it is possible

47. In the Online Appendix, we check that the pattern of capital gains residuals is highly correlated with capital gains on listed equities and housing coming from

that national saving flows are underestimated because they do not include R&D expenditure. To address this concern, we have recomputed our wealth accumulation equations using saving flows that include R&D. Even after we include generous R&D estimates, in many countries the 2010 observed levels of national wealth are still significantly larger than those predicted by 1970 wealth levels and 1970–2010 saving flows alone (Figure VII).[48] 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 wealth is 605%. There is over 100% of national income in "excess wealth."[49]

Second, we might somewhat underestimate the value of public assets in the 1970s in countries like the United Kingdom, France, and Italy. Part of the capital gains we measure might simply correspond 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

available asset price indexes (see Figures A143 to A157). Note that the capital gains inferred from our wealth decomposition exercises are structurally lower than those coming from equity price indexes, for a good reason. A substantial fraction of national saving takes the form of corporate retained earnings (see Table IV) and these earnings generate structural capital gains in equity markets. Should we exclude retained earnings from saving in the wealth accumulation equation, then we would similarly find much larger residual capital gains (see Appendix Table A105, and studies by Eisner 1980; Babeau 1983; Wolff and Greenwood 1992; Wolff 1999; Gale and Sabelhaus 1999). Such capital gains, however, would be spurious, in the sense that they correspond to the accumulation of earnings retained within corporations to finance new investment (thereby leading to rising stock prices), rather than to a true relative price effect.

48. 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 VII and VIII include generous estimates of R&D investment based on the level of R&D expenditure observed in the U.S. satellite account over the 1970–2010 period (see Online Appendix A.5.2 for a detailed discussion).

49. Saving flows might be underestimated for reasons other than R&D. Given the limitations of national accounts (in particular regarding the measurement of depreciation, which is discussed in Online Appendix Section A.1.2.), this possibility cannot completely be ruled out. One would need, however, large and systematic errors to account for the amount of excess wealth we find.
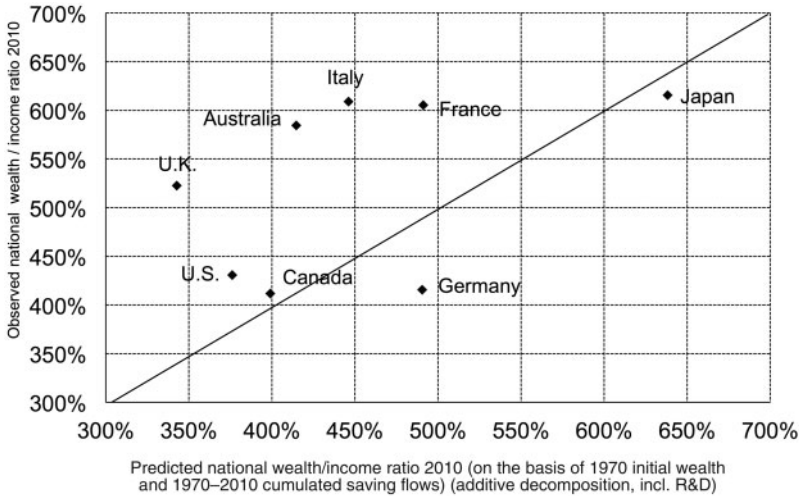
FIGURE VII

Observed versus Predicted National Wealth-National Income Ratios (2010)

period (including in 1970), but we might still slightly underestimate 1970 government wealth levels.

In the end, in our preferred specification that includes generous R&D expenditure in saving flows, capital gains account for about 40% on average of the 1970–2010 increase in national wealth-income ratios β_n, and saving for about 60%, with a lot of heterogeneity across countries.[50] The only exception to the general pattern of positive capital gains is Germany. Given the large 1970–2010 saving flows and low growth rates, we should observe more wealth in 2010 than 400% of national income. There is the equivalent of 50–100% of national income in "missing wealth."

V.C. Domestic versus Foreign Capital Gains

How can we explain the substantial capital gains we find on national wealth and the losses in the case of Germany? To address this question, it is useful to distinguish capital gains/losses on domestic assets and on net external wealth (Table VI). Our series suggest a number of interpretations, but we stress that data limitations make it impossible to rigorously estimate the exact role played by each of them.

50. See Online Appendix A.5.2 and Appendix Table A99.

TABLE VI

National Wealth Accumulation in Rich Countries: Domestic versus Foreign Capital Gains

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

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

All countries (except Germany) have experienced positive capital gains on domestic wealth. These gains have been particularly large in Europe and mostly (though not entirely) driven by housing. One hypothesis—which, as we shall see, is consistent with the historical data—is that countries like the United Kingdom and France have benefited from a long-run asset price recovery. Asset prices fell substantially between 1910 and 1950, and have been rising ever since. There might, however, have been some overshooting in the recovery process, particularly in housing prices. The four countries with the largest capital gains—United Kingdom, France, Italy, and 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. So part of the capital gains we measure might 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, savings are sufficiently large relative to growth to generate a significant increase in the national wealth-income ratio: given the values taken by s and g over the 1970–2010 period and the steady-state formula $\beta_n = \frac{s}{g}$, the β_n observed in 1970 were too low and had to increase. If in addition households in these countries have a particularly strong taste for domestic assets like real estate (or do not want to diversify their

portfolio internationally as much as they could) then maybe it is not too surprising if this generates upward pressure on housing prices.

Regarding the atypical German capital losses, German statisticians might overestimate saving flows, underestimate the current stock of wealth, or both. Yet another possibility is that Germany has not experienced any asset price recovery so far because the German legal system still 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.[51] Germans might also have less taste for expensive capital goods (particularly housing) than do 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 at our disposal, we are not able to put a precise number on each explanation.

It is interesting to note, however, that when we compute a European average wealth accumulation equation—by taking a weighted average of Germany, France, the United Kingdom, and Italy—then capital gains and losses seem to partly wash out (Figure VIII). Europe as a whole has less residual capital gains than the United Kingdom, 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 United States that would not be too different from those we find in Europe. One possibility is that substantial relative asset price movements happens permanently within small national or regional economic units, but tend to correct themselves at more aggregate levels. If that is the case, German asset prices might rise in the near future and fall in other European countries.

Turning now to net foreign assets, we find that capital gains and losses on external portfolios have played a large role in the

51. Whether this is good or bad for productive efficiency is a complex issue that we do not address here (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, whereas the book value can be interpreted as the value for all stakeholders. Both views have their merits.
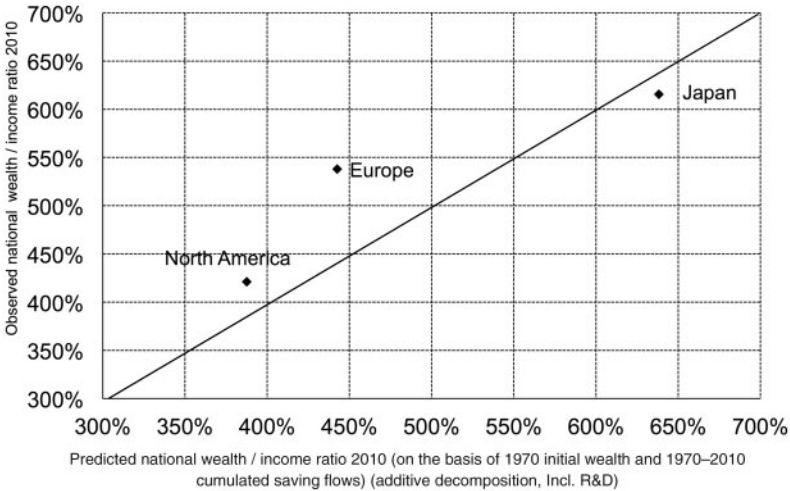
FIGURE VIII

Observed versus Predicated National Wealth–National Income Ratios (2010)

overall dynamics of national wealth (Table VI). The U.S. and German cases are particularly striking. In the Unite dStates, net capital gains on cross-border portfolios represent one third of total capital gains at the national level. Absent net foreign gains, the U.S. wealth-income ratio would not have increased at all since 1970.[52] In Germany virtually all capital losses at the national level can be attributed to foreign assets.

The reason capital gains on foreign portfolios matter so much is that the gross foreign positions of countries have massively increased since the 1970s—the rise has been spectacular in Europe, a bit less so in the world's largest economies, the United States and Japan.[53] A significant share of each country's

52. Our results on U.S. external wealth capital gains 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 but exclude R&D from saving. We provide detailed accumulation results isolating saving, "other volume changes." and capital gains in the country-specific tables of the Online Appendix.

53. In 2010, gross assets held in France by the rest of the world amount to about 310% of national income, whereas gross assets held by French residents in the rest of the world amount to about 300% of national (hence a negative position of

domestic capital is now owned by other countries. With huge gross positions, even moderate returns differentials on cross-border assets and liabilities are enough to generate large and volatile gains and losses on net foreign wealth over time and across countries.

VI. WEALTH-INCOME RATIOS IN RICH COUNTRIES 1870–2010

It is impossible to properly understand the recent rise of wealth-income ratios in rich countries without putting the 1970–2010 period into a longer historical perspective. As we have seen, on average about 40% of the rise of β_n since the 1970s is due to capital gains, 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? We argue that it is mostly a recovery effect: the 1970–2010 capital gains largely seem to compensate the capital losses observed during earlier parts of the twentieth century.

The argument relies on the analysis of 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 United States, the United Kingdom, 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 II). For the United States, the U-shaped pattern is much less strong (Figure IV). In addition, European public wealth–national income ratios have followed an inverted U-curve over the past century.[54] 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,

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about −10%, in the official data). For the United States, recorded gross foreign assets amount to about 120% of national income, and gross liabilities to about 100% of national. See Online Appendix Figures A39–A42.

54. 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 I.

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 United States.

Starting with this set of facts, and using the best historical estimates of saving and growth rates, we have estimated detailed 1870–2010 wealth accumulation equations. As Table VII shows, the total accumulation of national wealth over this 140-year-long period seems to be well accounted for by saving flows. To fully reconcile the stock and flow data, we need a small residual capital gain for the United States, France, and the United Kingdom, 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.[55]

Looking at each subperiod, we find a strong U-shaped relative capital price effect in European countries. The United Kingdom, for example, experienced real capital losses at a rate of −1.9% per year between 1910 and 1950, followed by real gains of +0.9% between 1950 and 1980 and +2.4% between 1980 and 2010. The pattern is similar for France. In these two countries, there seems to have been a slight overshooting 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 United Kingdom, +0.3% in France). In Germany, by contrast, the recovery is yet to 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 over- or undervaluation in 2010. In any multisector model with uneven technical change between capital and consumption goods, one should expect capital gains and losses that could vary between countries (for instance, depending on comparative advantage). The residual capital gains we estimate might also reflect measurement issues: 1870–2010 saving flows might be somewhat underestimated in the United Kingdom and 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

55. These results are robust to a wide range of specifications. Online 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.

TABLE VII

ACCUMULATION OF NATIONAL WEALTH: UNITED STATES, UNITED KINGDOM, 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	0.8
				76	24
1870–1910	413	469	4.3	2.9	1.4
				68	32
1910–2010	469	431	3.1	2.5	0.6
				80	20
1910–1950	469	380	2.7	2.2	0.5
				82	18
1950–1980	380	434	4.0	3.7	0.2
				94	6
1980–2010	434	431	2.7	1.6	1.1
				58	42
Panel B: United Kingdom					
1870–2010	656	527	1.8	1.5	0.3
				83	17
1870–1910	656	694	2.1	1.7	0.4
				79	21
1910–2010	719	527	1.6	1.4	0.2
				86	14
1910–1950	719	241	−1.3	0.6	−1.9
				−43	143
1950–1980	241	416	4.0	3.0	0.9
				76	24
1980–2010	416	527	3.4	1.0	2.4
				28	72
Panel C: Germany					
1870–2010	745	416	2.0	2.6	−0.6
				128	−28
1870–1910	745	637	2.1	2.3	−0.1
				107	−7
1910–2010	637	416	2.0	2.8	−0.8
				137	−37
1910–1950	637	223	−1.4	0.0	−1.5
				−3	103
1950–1980	223	330	6.3	6.8	−0.5
				108	−8
1980–2010	330	416	2.5	2.5	0.0
				101	−1

TABLE VII

(CONTINUED)

	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 D: France					
1870–2010	689	605	2.0	1.8	0.2
				91	9
1870–1910	689	747	1.3	1.4	0.0
				103	−3
1910–2010	747	605	2.2	2.0	0.3
				89	11
1910–1950	747	261	−1.2	−0.1	−1.1
				8	92
1950–1980	261	383	5.9	4.7	1.2
				80	20
1980–2010	383	605	3.4	2.2	1.2
				65	35

Notes. The real growth rate of national wealth has been 3.1% a year in the United States 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). Savings account for 80% of wealth accumulation and the residual term for 20%. Authors' computations using country national accounts. War destructions and other volume changes were included in savings-induced wealth growth rate. For full decomposition, see Online Appendix Country Tables US.4c, DE.4c, and so on.

the long run, and that the stock and flow sides of historical national accounts are roughly consistent with one another.

Table VIII decomposes the huge decline in national wealth-income ratios that occurred in Europe between 1910 and 1950. In the United Kingdom, war destructions play a negligible role—an estimated 4% of the total decline in β_n. Low national saving accounts for 46% of the fall in β_n and negative valuation effects (including losses on foreign portfolios) for the remaining 50%. In France and Germany, cumulated physical war destructions account for about one quarter of the fall in β_n. Low national saving and real capital losses each explain about half of the remaining three quarters. Interestingly, the private wealth-national income ratio has declined less in the United Kingdom 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).[56]

56. U.K. net public wealth then turned positive during the 1950s–1960s. See Online Appendix Figures A16 and A22.

TABLE VIII

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
United States	469	380	132	193	0	55
Germany	637	223	400	109	−120	−165
				31	29	40
France	747	261	421	144	−132	−172
				38	27	35
United Kingdom	719	208	409	75	−19	−256
				46	4	50

Notes. Germany's national wealth-income ratio fell from 637% to 223% between 1910 and 1950. On the basis of Germany's 1910 wealth-income ratio and cumulated 1910–1950 saving, the wealth-income ratio should have been 400% + 109% = 509% in 1950. But Germany experienced the equivalent of −120% of national income in war destructions and −165% in capital losses, so that the 1950 wealth-income ratio was only 223%. Maintaining the 1910 wealth-income ratio would have required 637% − 509% = 128% of national income in additional cumulated saving over 1910–1950. Thirty-one percent of the fall in the wealth-income ratio can thus be attributed to insufficient saving, 29% to war destructions, and 40% to real capital losses.

The U.S. case is again fairly different from that of Europe. The fall of β_n during the 1910–1950 period was more modest, and so was the recovery since 1950. Regarding capital gains, we find in every subperiod a small but positive relative price effect. 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.

VII. THE CHANGING NATURE OF NATIONAL WEALTH, 1700–2010

VII.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 United Kingdom—the country with the most comprehensive historical balance sheets—the national wealth-income ratio appears to have been roughly stable around 650–700% during the eighteenth and nineteenth centuries (Figure III). In France, where a large number of historical national wealth estimates were also established, the picture is similar (Figure IX).
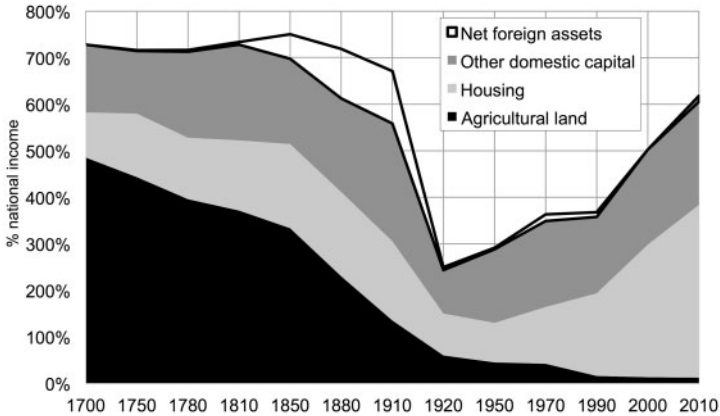
FIGURE IX

The Changing Nature of National Wealth: France, 1700–2010

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

We should make clear that the raw data sources available for the eighteenth and nineteenth centuries are insufficient to precisely compare the levels of wealth-income ratios between the two countries or between the various subperiods. But the general pattern seems robust: all estimates, coming from many different authors using independent methodologies, provide the same orders of magnitude. National wealth always seems to be between six and eight years of national income from 1700 to 1914 in both countries, with no obvious long-run trend.

Strikingly, today's wealth-income ratios in the United Kingdom and France seem relatively close to their eighteenth-century levels, in spite of considerable changes in the nature of wealth. Agricultural land—including land improvement of all sorts—was between four and five years of national income around 1700; it is now negligible and has been replaced by housing and other domestic capital (offices, machines, patents, etc.). In the long run, the decline of the share of agricultural land in national wealth mirrors that of the share of agriculture in national income, from over two thirds in the eighteenth century to a few percent today—with a faster and earlier decline in the United Kingdom. The variations in the share of net foreign assets in national wealth are also striking. Net foreign assets were virtually zero in the eighteenth century. They reached very high levels in

the late nineteenth and early twentieth centuries—almost two years of national income in the United Kingdom in 1910, over one year in France. Following the wars and the collapse of the colonial empires, they came back to virtually zero around 1950.

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

That is probably an important part of the explanation. Unfortunately, data limitations again 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.

The main difficulty is that pre-1870 estimates of saving and investment flows are too fragile to be used in wealth accumulation decompositions. With very low growth, any error in the net-of-depreciation saving rate s can make a big difference in terms of predicted steady-state wealth-income ratio $\beta = \frac{s}{g}$. 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 eighteenth-century United Kingdom and France actually derived from past investment. In all likelihood, the "pure land value" (i.e., the value of land before any improvement, as it was discovered at prehistoric times) was much less than four years of national income. Some eighteenth-century estimates tend to suggest that it was around one year of national income.[57] Saving and investment

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57. See in particular the famous estimates by Thomas Paine (1795), who suggested in front of the French National Assembly to confiscate the "pure land" component of inheritance, which he estimated to be about one year of national income. On saving and investment series covering the eighteenth and nineteenth centuries, particularly for the United Kingdom and France, see the Data Appendix.

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 1.5 years of national income.

VII.B. *The Nature of Wealth: Old Europe versus the New World*

To make some progress on this question, it is useful to compare the value of land in Old Europe (United Kingdom, France, Germany) and in the New World. For the United States, we have put together historical balance sheets starting around 1770 (Figure X). We find that the value of agricultural land in the late eighteenth and early nineteenth centuries was much less in the United States (one to two years of national income) than in Old Europe (three to four years).[58] Part of the explanation could well be lower accumulated investment relative to economic and population growth in the New World (i.e., a lower cumulated $\frac{s}{g}$ 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 America that its price per acre was low. The right model to think about this effect involves a production function with an elasticity of substitution between land and labor lower than 1—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 III.B. That is, assume that the capital good solely consists of land and that land volume V_t (measured in acres) is in fixed supply: $V_t = V$. For the sake of simplicity, assume that no land improvement is possible. The market value of land if given by $K = qV$, where q is the price of land relative to the consumption good. The production function $Y = F(V, L)$ transforms capital (land volume) V and labor L into output Y. Assume that $F(V, L)$ 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 country 1 (America) has more land volume relative to labor than country 0 (Old Europe): $\frac{V_1}{L_1} > \frac{V_0}{L_0}$. Then

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58. For the long-run evolution of wealth composition in Germany and Canada, see Online Appendix Figures A46 and A47. The German pattern is close to that of the United Kingdom 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 United States (except that net foreign asset position is strongly negative throughout the nineteenth century and much of the twentieth century).
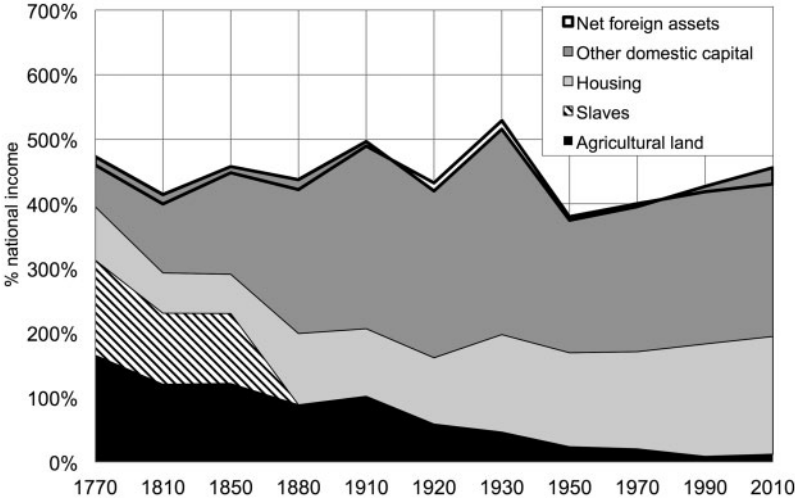
FIGURE X

The Changing Nature of Wealth: United States, 1770–2010

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

country 1 will end up with lower land value (relative to income) than country 0 (i.e., $\beta_1 < \beta_0$, with $\beta_1 = \frac{K_1}{Y_1} = \frac{q_1 V_1}{Y_1}$ and $\beta_0 = \frac{K_0}{Y_0} = \frac{q_0 V_0}{Y_0}$) if and only if the elasticity of substitution σ is less than 1. This result directly follows from the fact that the capital share α is smaller in the land-abundant country (i.e., $\alpha_1 = F_V \frac{V_1}{Y_1} < \alpha_0 = F_V \frac{V_0}{Y_0}$) if and only if σ is less than 1. Under standard assumptions on preferences and equilibrium rates of return, this in turn implies that land value is lower in the land-abundant country: $\beta_1 < \beta_0$.[59]

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

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[59]. In a dynastic utility model with zero growth, the rate of return is set by the rate of time preference ($r = \theta$), so that $\beta_1 = \frac{\alpha_1}{r} < \beta_0 = \frac{\alpha_0}{r}$. With a bequest-in-the-utility-function model $U(c, b) = c^{1-s} b^s$, the wealth-income ratio is set by $\beta = \frac{s}{(1-s)}$, so that the difference in capital share entirely translates into a difference in rates of return: $r_1 = \frac{\alpha_1}{\beta} < r_0 = \frac{\alpha_0}{\beta}$. However to the extent that the interest elasticity of saving $s = s(r)$ is positive, this also implies $\beta_1 < \beta_0$. A similar intuition applies to the case with $U(c, b) = c^{1-s} \Delta b^s$ (assuming positive population or productivity growth so as to obtain a well-defined steady-state $\beta = \frac{s}{g}$). See the working paper version, Piketty and Zucman (2013).

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.

Thus, part of the initial difference in β between Europe and America in the eighteenth and nineteenth centuries seems to be due to a relative price effect (due to land abundance) rather than to a pure saving effect (via the $\beta = \frac{s}{g}$ formula). Both logic actually tend to reinforce each other: the lower land prices and higher wage rates attracted labor to the New World, implying large population growth rates and relatively low steady-state $\beta = \frac{s}{g}$ ratios.[60]

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 control a large share of national income by owning the labor force. Should a tiny elite own the entire labor force, the total value of the slave stock could in principle be very 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%).[61] In the case of the antebellum United States, 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 one

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60. There is a large historical literature on the factor flows that characterized the nineteenth-century Atlantic economy. 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; 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 United States—suggests that today's differences in pure land values are less central than they used to be.

61. With a one-good model and a Cobb-Douglas production function $F(K, L) = K^\alpha L^{1-\alpha}$, the market value β_H of the human capital stock (i.e., the value of the labor force from the viewpoint of a potential slave owner) is always equal to $\frac{(1-\alpha)}{\alpha}$ times the nonhuman capital stock. If $\alpha = \frac{1}{3}$, then $\beta_H = 2\beta$. This is assuming that the slave owner equates returns across all human and nonhuman assets. With a CES production function $F(K, L) = (aK^{\frac{\sigma-1}{\sigma}} + (1-a)L^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}}$, we have $\beta_H = \frac{1}{a}\beta^{\frac{1}{\sigma}} - \beta$.

and two years of national income for the entire United States, and up to three years of income in Southern states. When we add up slaves and land values, wealth-income ratios in the U.S. South are relatively close to those of the Old World. Slaves approximately compensate the lower price of land (Figure XI).

Obviously, 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, antebellum America is the land of equal opportunity, the place where past wealth does not matter much. But it is also the place where a new form of class structure—even more extreme than Europe's—flourished, whereby part of the population owned another part.[62]

VIII. Capital Shares and the Changing Nature of Technology

In this section we attempt a brief look at the implications of our new data on capital for understanding the evolution of factor shares and the shape of the production function. The results should be taken with caution, because measuring factor shares raises many difficulties. But this question is so important that we feel it deserves a few words.

Starting first with the recent decades, Figure XII shows that capital shares have increased in all rich countries from about 15–25% in the 1970s to 25–35% in 2010, with large variations over time and across countries.[63] By our estimates, however, capital-output ratios β_k have risen even more than capital shares α, so that the average return to domestic capital r—which can be computed as $\frac{\alpha}{\beta_k}$—has declined somewhat (Figure XIII).[64]

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

63. Our results are consistent with a growing literature on the global rise of capital shares since the 1970s (Ellis and Smith 2007; Azmat, Manning, and Van Reenen 2011; Karabarbounis and Neiman 2014).

64. Remember that domestic capital K is national wealth W minus the net foreign asset position. The capital-output ratio β_k is the ratio of domestic capital K to domestic output Y_d. The capital share α is equal to the output Y_K generated by domestic capital divided by Y_d. So it is pure accounting that the average return to
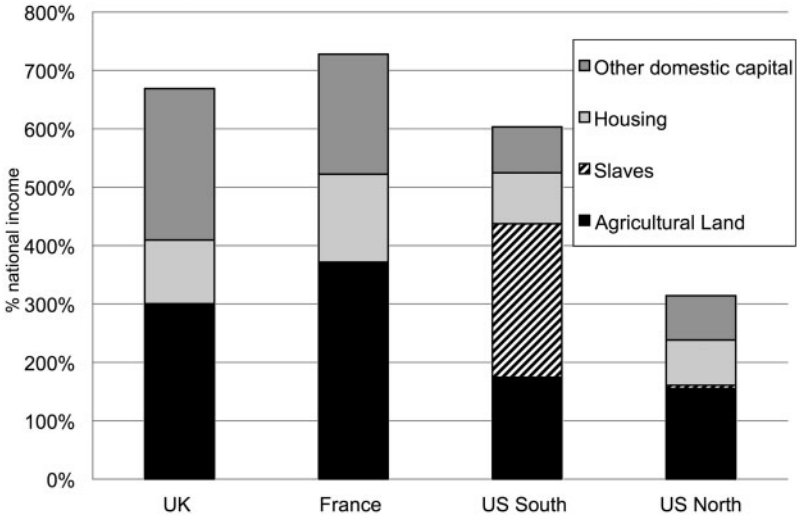
FIGURE XI

National Wealth in 1770–1810: Old World versus New World

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). A production function with three factors—capital and high-skill and low-skill labor—where capital is more strongly complementary with skilled than with unskilled labor would also do, if there is a rise in skills or skill-biased technical change. Yet another—and more parsimonious—way to explain the rise in α is a standard two-factor CES

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domestic capital, $r = \frac{Y_K}{K}$, is equal to the capital share $\frac{Y_K}{Y_d}$ divided by the capital-output ratio $\frac{K}{Y_d}$. Note that the results on Figure XII are robust to the various ways of taking into account government capital and interest payment in these computations, which are discussed in Online Appendix A.7.5. The reader should have in mind that like all our income series, the capital shares displayed in Figure XII are net of depreciation.
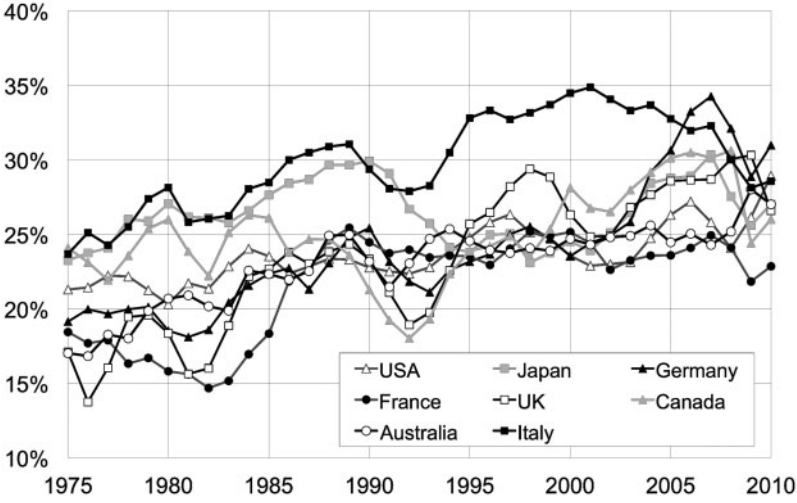
FIGURE XII

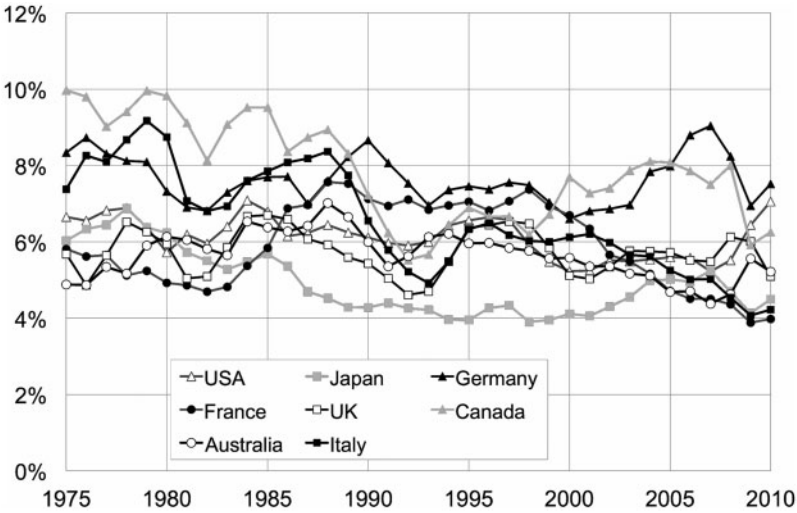Capital Shares in Factor-Price National Income, 1975–2010

FIGURE XIII

Average Return on Private Wealth, 1975–2010

production function $F(K, L)$ with an elasticity of substitution $\sigma > 1$.[65] Importantly, with large changes in the capital-output ratio β_k (which in the long run seem to be mostly due to volume rather relative price effects),[66] one can obtain substantial movements in the capital share with a production function that is only moderately more flexible than the standard Cobb-Douglas. For instance, with $\sigma = 1.5$, the capital share rises from $\alpha = 28\%$ to $\alpha = 36\%$ if β_k jumps from 2.5 to 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 β_k attains 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. One can of course combine the various possible explanations. Karabarbounis and Neiman (2014), for instance, use a two-goods model in which there is a decline in the relative price of investment. As a result, firms shift away from labor toward capital, and with an elasticity of substitution σ larger than 1 the capital share α increases. As the two-goods model we apply in Section VII.B to the nineteenth-century United States and Europe illustrates, when the relative price of investment is lower (e.g., lower land values) and $\sigma > 1$, the wealth-income ratio has to be higher. Thus, the explanation for the rise in α put forward by Karabarbounis and Neiman (2014) is consistent with our findings of rising β. The difference is that we do not need a two-goods model to account for the rise in α: in a broad class of one-good general equilibrium models, when g decreases β increases, and when in addition $\sigma > 1$, α has to rise. In the real world, both forces (lower g and declining relative price of some capital goods) probably play a role in the dynamics of α, so the two explanations should be seen as complementary. One problem, however, with the declining relative price of capital story is that while the price of corporate tangible fixed assets may have declined, taking a broader view of capital we actually find a positive relative price effect over 1970–2010 (see Section V). This could be due to a positive price effect for land and R&D assets, which are not included in standard measures of the relative price of capital.

66. Our market-value domestic capital stock K can be viewed as $K = q_1 V_1 + \cdots + q_n V_n$, where $V_1, \ldots, V_n$ are the volumes of the various capital assets (land, housing, structures, machines, patents, ...) and $q_1, \ldots, q_n$ their market prices (relatively to the consumption price index). With a single capital good in fixed supply (e.g., pure land), it makes more sense to view the production function as $Y = F(V, L)$ (see Section VII.B). With many capital goods, the market-value concept of capital stock K is the most natural definition, especially given that the aggregate relative capital price q seems to be close to 1 in the very long run; otherwise one might want to use $V = \frac{K}{q}$. In any case, for reasons already explained, the best way to use available data is to start from market-value balance sheets and compute the implicit q from wealth decomposition equations.

67. In a perfectly competitive model with $Y = F(K, L) = (aK^{\frac{\sigma-1}{\sigma}} + (1-a)L^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}}$, the rate of return is given by $r = F_K = a\beta^{-1/\sigma}$ (with $\beta = \frac{K}{Y}$), and the capital share is

This scenario will not necessarily happen, but it cannot be entirely excluded either. Capital-output ratios and capital shares have no strong reason to be constant. Since domestic saving rates s and output growth rates g vary for all sorts of reasons over time and across countries, it is natural to expect β_k to vary widely. Small departures from standard Cobb-Douglas assumptions then imply that the capital share $\alpha = r\beta_k$ can also vary substantially. It is natural to imagine that σ was much less than 1 in the eighteenth and nineteenth centuries and became larger than 1 in the twentieth and twenty-first centuries. One expects a higher elasticity of substitution in high-tech economies where there are lots of alternative uses and forms for capital.[68]

Taking now a very long-run perspective on the evolution of factor shares, there seems to be evidence—in both the United Kingdom and France—that the capital share was somewhat larger in the eighteenth and nineteenth centuries (around 40%) than it is in the early twenty-first century (about 30%), despite the recent rise (Figure XIV). Will capital shares return to their eighteenth- and nineteenth-century levels? The capital-output ratio β_k is still somewhat lower today than in the distant past. One possibility is that the capital share α will slowly return to about 40% as β_k keeps increasing in the coming decades. However, it could also be that the labor exponent in the production function has declined since the eighteenth and nineteenth centuries, because of the rise of human capital. Over time, human inputs may have become relatively more important than 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.

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

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given by $\alpha = r\beta = a\beta^{\frac{\sigma-1}{\sigma}}$. With $a = 0.21$ and $\sigma = 1.5$, α goes from 28% to 36% and 42% as β rises from 2.5 to 5 and 8. With $\sigma = 1.8$, α rises to 53% if $\beta = 8$.

68. The fact that the capital share α was low in the mid-twentieth century (when β_k was also low) can also be viewed as evidence for $\sigma > 1$. Indeed, α and β_k move in the same direction if $\sigma > 1$, and in opposite directions if $\sigma < 1$.
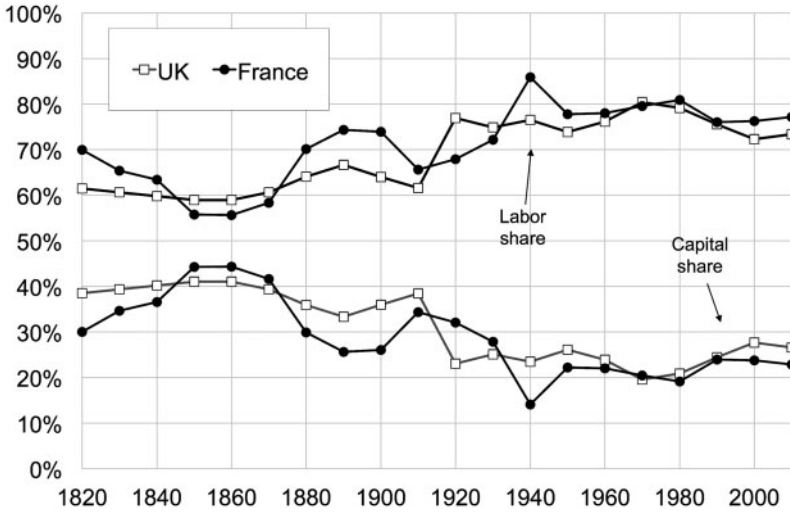
FIGURE XIV

Factor Shares in Factor-Price National Income, 1820–2010: United Kingdom and France

shares α than capital-output ratios β_k. The measurement of α—and therefore of the average rate of return to capital—is complicated by self-employment and tax optimization behaviors of business owners (a growing concern in a number of countries), by the measurement of housing product (which is not fully homogeneous internationally), and also by the problem of informal financial intermediation. National accounts deduct from the return to capital the costs of intermediation services provided by banks and real estate agents, but not the time spent by capital owners to manage their portfolios. Such costs might well vary over time. They might be larger in fast-growing economies rather than in the stagnant, rural economies of the eighteenth century. So we may overestimate average rates of return when using national accounts capital income flow series (and the $r = \frac{\alpha}{\beta_k}$ formula), especially in high-growth economies. In this article, we have tried to show that an alternative way to study 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.

IX. Conclusion

The new wealth-income database introduced in this article reveals some striking facts. Capital is making a comeback: in the top eight developed economies, aggregate wealth has risen from about 200–300% of national income in 1970 to a range of 400–600% today. In effect, today's wealth-income ratios appear to be returning to the high values observed in eighteenth and nineteenth centuries Europe—namely, 600–700%—in spite of considerable changes in the nature of wealth. The low European ratios of the postwar decades thus appear to be a historical anomaly. With low growth and substantial saving, long-run β can naturally be very high—600–700%, or even more.

A full understanding of the implications of the return of high-wealth income ratios calls for at least three extensions. It would be good to study wealth-income ratios at the world level, include individual-level wealth inequality in the analysis, and decompose wealth into an inherited component on the one hand and a self-made component on the other. All of this raises important challenges for future research.

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Supplementary Material

An Online Appendix for this article can be found at QJE online (qje.oxfordjournals.org). A detailed database and Data Appendix supplementing this article are available online: http://piketty.pse.ens.fr/capitalisback and http://www.gabriel-zucman.eu/capitalisback.

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