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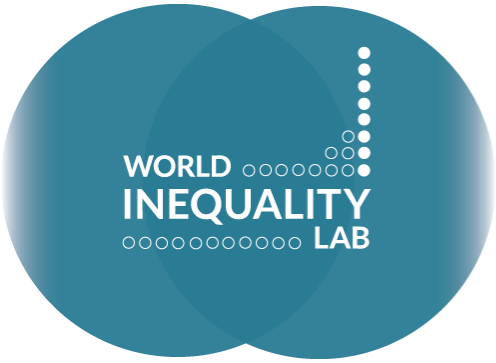
"Revised and extended national wealth series: Australia, Canada, France, Germany, Italy, Japan, the UK and the USA"

Luis Estévez Bauluz

Keywords : DINA; Distributional National Accounts; wealth; inequality; Australia; Canada; France; Germany; Italy; Japan; United Kingdom; United States



World Inequality Lab

Revised national income and wealth series: Australia, Canada, France, Germany, Italy, Japan, UK and USA*

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Abstract

This paper presents updated series of national wealth and of capital-labor shares of national income for the eight countries covered by Piketty and Zucman (2014a): Australia, Canada, France, Germany, Italy, Japan, the UK and the USA. It discusses the adaptation of the series from the SNA93 to the SNA2008, the inclusion of natural capital (i.e. forestry land, mineral and energy resources) within the concept of national wealth and the division of national housing across households and other sectors. I find that adopting the SNA2008 has no relevant consequences for aggregate macro wealth or for the net-of-depreciation capital share. However, gross-of-depreciation capital shares are higher, likely due to the inclusion of R&D as investment in the new system of accounts. Overall, new series reveal that average private wealth to national income ratios have been steadily increasing in recent years with capital-labor shares remaining relatively constant at their 2010 values.

Keywords: Wealth-income ratios; Capital-labor shares; National accounts; Housing; Natural capital. JEL codes: E01, E3, N5.

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1 Introduction

Piketty and Zucman (2014a) (PZ from now on) presented macro series of national wealth and national income for 8 rich countries (Australia, Canada, France, Germany, Italy, Japan, UK and USA) covering the period 1970-2010. For four of these countries (France, Germany, UK and USA), they were able to cover a much longer time-span, going back to the 19th century or before. These series were supplemented by a methodological appendix (Piketty and Zucman (2014b)), which provides detailed information on the sources and methods followed to construct these data. In this paper, I revise and extend PZ's series in light of the most recent available data and the latest accounting standards[1].

For the period 1970-2010, PZ's data are largely based on official national accounts. Before 1970, their evidence relies mostly on the work of economic historians and on contemporaneous authors that reconstructed the wealth and income accounts of these countries. At the time of writing their paper, PZ used official national accounts that followed the 1993 System of National Accounts (SNA93)[2]. Since then, all countries have adapted their balance sheets and income series to the new system of accounts: the 2008 System of National Accounts (SNA2008). Although the main concepts and valuation methods of the SNA93 are still present in the SNA2008, some changes are worth noting and will be discussed in this paper (in particular, the inclusion of Research and Development as an investment good, therefore being part of capital investment and capitalized as a fixed asset).

In addition, since the writing of their paper, the World Inequality Database (WID.world) has evolved to produce a unified framework to compute both macro wealth and income accounts across countries. This framework follows the international accounting guidelines set by the SNA2008 and presents two main difference relative to PZ[3]. Firstly, it includes

[1]The only exception to these updates are the national income accounts of Canada. Statistics Canada has undergone a deep revision of Canada's national income accounts that requires careful understanding. Hence, national income accounts for this country will be provided in the future, but not in the updates presented in this paper.

[2]Australia, by contrast with other countries, had already adapted SNA2008 when Piketty and Zucman wrote their paper.

[3]The detailed methods and concepts used at WID.world are explained in the DINA guidelines written

natural capital (i.e. forestry land, mineral and energy resources) within the non-financial assets of the different institutional sectors. Secondly, it specifically accounts for housing assets owned by corporations and the government (in PZ housing owned by non-private sectors were included within broader categories of assets - i.e. within total public or corporate non-financial assets).

In this paper, I explain the updated series of these 8 countries, whose data now cover up to years 2015-2017, depending on the country. In section 2, I explain the conceptual changes between SNA93 and SNA2008 together with the treatment of natural capital and national housing at WID.world. In section 3, I compare the values taken by the new series relative to the old ones, pointing out the main reasons for the observed differences. Finally, in section 4, I explain the general procedure followed to splice the updated series with the historical data, including country specific notes on the reconstruction of the series. Specific attention is paid to explaining the following two wealth components: housing and natural capital.

2 Conceptual differences between old and new series at WID.world: R&D, natural capital and national housing

2.1 Research and development

The international guidelines to produce national accounts were last revised in 2008 (SNA2008), replacing the previous vintage of 1993 (SNA93). The new updated income and wealth macro series for the 8 countries in PZ follow in their totality the SNA2008, whereas in PZ all data but the Australian were based in the SNA93. The structure and classification of financial assets "were virtually unchanged in the new system" ((Alvaredo et al., 2016, pg. 42)) but some changes are worth mentioning in the case of non-financial

by Alvaredo et al. (2016).

assets and capital income. In particular, three categories that were previously considered as intermediate consumption are now recognised as capital formation (investment) and, hence, capitalised as fixed assets[4]:

1. **Research and development (AN.1171)**: Before viewed as expenditure in intermediate non-durable goods, now is part of investment in intangible assets. In France, for example, in 2015 research and development (R&D) represents 2.9% of the stock of produced assets (AN.1).

2. **Databases**: They are part of the new category 'Software and databases' (AN.1173). Before SNA2008, only expenditure on software, and not on databases, was considered as investment. In France, for the year 2015, this category represents 1.8% of total produced assets, with databases representing around 20% of this category.

3. **Weapons systems (AN.114)**: In SNA93, only the acquisition of military structures and equipment that were considered to have a civilian purpose were recorded as capital formation. In SNA2008, military weapons and supporting system with no civilian purpose are considered as capital assets. In France, AN.114 represents 0.4% of produced assets in 2015.

Conceptually, the recognition of the previous three categories as capital goods (and, especially, of R&D) should raise the value of the stock of non-financial assets in the new series. However, the magnitude is relatively small. Taking the example of France in 2015, the inclusion of these assets would represent around 3.5% of total produced assets or 2% of total non-financial assets (the sum of produced and non-produced assets). Of course, the inclusion of these assets would impact differently some institutional sectors, being more intense for corporations and the government and less so for households.

By contrast, the impact on the national income series is more substantial because this inclusion has had a sizeable effect on the total value of GDP, by raising Gross Fixed Capital

[4] A detailed analysis of the changes between SNA93 and SNA2008 can be found in Eurostat (2014)'s manual.

Formation. Koh et al. (2018) provide values for the share of R&D investment in total US investment since the 1950s showing that its importance has increased considerably over time: from values around 10% of total investment in 1950 to values close 25% in recent years [5]. This rise is also present in other rich economies (European Commission (2009)).

Once R&D is included as investment, this also affects the decomposition of output into capital and labor components. In particular, Koh et al. (2018) estimate that almost all the observed decline in the labor share of the US since the 1950s is the result of including R&D within investment ((Koh et al., 2018, figure 1)). Yet their paper focuses on the gross capital-labor shares (which include capital depreciation within capital income) and not on the net-of-depreciation capital-labor shares. While understanding the impact of including R&D within gross capital-labor shares is important in itself, from a welfare perspective using net-of-depreciation shares is more meaningful. In sections 3 and 4 I present evidence showing that the impact on the net-of-depreciation capital-labor shares is almost negligible. This is because R&D types of assets present very high depreciation rates (around 20% in recent years in the US) when compared to traditional fixed capital assets such as buildings and infrastructures (with rates around 4%). Indeed, the increase in gross investment observed in the new series is offset by similar increases in the value of depreciation. As a consequence, net capital-labor shares are almost identical before and after adapting to the SNA2008 (i.e. in PZ's series and in the new updates).

2.2 Natural capital

There are three big categories of natural resources according to the SNA: Land underlying buildings and structures (AN.2111), Land under cultivation (AN.2112) and Mineral and

[5] In their paper, Koh et al. (2018) discuss the evolution of Intellectual Property Products, which includes R&D, software and artistic originals. In the USA, software was first included within investment in the 1999 BEA revision of national accounts, while R&D and artistic originals were included in the BEA revision of 2013 (which adapted the US national accounts to the SNA 2008). Koh et al. (2018) show that close to 80% of IPP is R&D, with software and artistic originals, hence, accounting for a small fraction.

energy reserves (AN.212)[6]. Furthermore, Land under cultivation may be split into Agricultural land (AN.21121) and Forestry land (AN.21122). The sum of forestry land and mineral and energy resources is what is known as Natural capital in the DINA guidelines and which are implemented in the WID.world database (Alvaredo et al. (2016)). Out of these categories, PZ included Land underlying buildings and structures and Agricultural land in their estimates of national wealth but accounted for natural capital as a memo item, excluded from their benchmark series of national wealth. Two important reasons to do so were the complexity to measure natural capital and the fact that only 4 out of the 8 countries in the sample reported estimates of these assets. However, WID.world intends to progressively account for them, in particular, due to the important role that these assets play in some developing countries. Hence, in the updated series of wealth, natural capital is included in the 4 countries that report their value: Australia, Canada, France and Japan (see table 1).

The inclusion of natural capital for some countries but not for others may generate a comparability problem if natural capital is a significant part of wealth in those countries not reporting their value[7]. For the 4 countries that do not report their value, I can check an alternative source on natural capital to evaluate the importance from this omission. According to the latest UNU-IHDP and UNEP (2014)'s Inclusive Wealth Report, the market value of non-renewable resources (which correspond to mineral and energy resources) are almost negligible in Italy and the UK. Only in Germany and the USA they take a significant value. For 2010, the latest year for which the UNU-IHDP reports estimates, I can compare the value of these same assets in Canada and Australia (the two countries where official accounts report a sizeable value for natural capital) with the estimates of this report[8]. In both cases, estimates from the official national accounts represent around one third of those

[6]There exist other types of natural resources in the SNA (i.e. recreational land and associated surface water, other land and associated surface water, etc.) but their magnitude is relatively small within the very few countries that actually report their value. For example, in Germany, they represent 11.6 million of euros in 2011 or 0.4% of total national land ((Brede and Schmalwasser, 2015, table 1)).

[7]Note, however, that the value of these assets is indeed captured in all countries within the market value of equity of those sectors exploiting these assets.

[8]In 2010, mineral and energy resources represent 99% and 88% of total natural capital in Australia and Canada, respectively.

in the report. Applying this same proportion to the values of Germany and USA in the UNU-IHDP report, I would get a value of mineral and energy resources equivalent to 16% and 10% of national income, respectively (table 1, column 3). Although not negligible, these values are far from being problematic, given that national wealth in this year was equal to 411% of national income in Germany and 416% in the USA. Overall, the measurement of natural capital is a complex area that requires further attention by both academics and official statisticians. In WID.world, we expect to progressively extend these estimates in future updates of the database.

2.3 National housing

In PZ, housing wealth data referred to dwellings owned by the private sector: households and non-profit institutions. While private housing represents the vast majority of the national housing stock, corporations and the government do also hold positions on housing. These positions were not absent in PZ's series, but were included in broader categories of assets of the corporate and public sectors (i.e. within total non-financial assets). Given the important role of housing in national wealth, in this paper I present the first estimates of national housing, by including series of public and corporate housing in addition to those of the private sector.

Overall, the role of corporations and the government in housing markets is limited but varies across countries and over time: from maximum values of 20% of total national housing in Germany and France, to minimum values of 3% in the USA. In addition, a trend is observed for a progressive decrease in the involvement of non-private sectors in national housing, in line with the privatization of publicly-fostered dwellings in some countries (Whitehead and Scanlon (2007)). In the country specific notes of this paper, I discuss how I estimate housing wealth for non-private sectors. It is fair to recognize that the measurement of corporations and public housing is generally of lower quality than the measurement of the private sector. More progress could be done in this area in the future.

3 New results: comparing the old and the new series

In this section, I compare the main results of the updated income and wealth macro series with the equivalent values in PZ. I present the analysis decomposed into two subsections: one for macro wealth; another for capital-labor shares. In both cases, I take the average value of key indicators in the available countries (8 countries in the case of wealth; 7 countries in the case of income, given that updated series for Canada are not provided in this paper) and compare values in PZ with the latest updates. In all cases, the average values of these indicators correspond to an unweighted arithmetic average.

Before commenting on the results, a note of caution is needed. In the previous section, I examined the main conceptual difference between the estimates in PZ and these updates. However, differences between the new and the old series respond to numerous factors that are not only conceptual. In particular, national statisticians revise periodically their historical series: they use new data sources (i.e. on the price of assets), they change the parameters of their models (i.e. modifying the depreciation structure of assets when applying the Perpetual inventory method) or they account for new assets (i.e. new types of natural resources), to name just a few common adjustments. Hence, differences between the new and the old series cannot be uniquely explained by adopting the SNA2008 or by the inclusion of natural capital within non-financial assets.

3.1 Macro wealth

Figures 1, 2, 3 and 4 compare the values in PZ and in the updated series between 1970 and 2015 in four key indicators: (1) private wealth-national income ratio, (2) public wealth-national income ratio, (3) national wealth-national income ratio and (4) Tobin's 'equity' Q (the latter is compared for the period 1990-2015, when data for all countries except Italy are available). In all cases, the evolution of the new series is very close to the old ones, with some small differences. Overall, the new series tend to converge with the old ones in the

initial years (around 1970) and to diverge in the ending years (around 2010).

By 2010, the updated series of private wealth (figure 1) are higher than the old series in the equivalent of 18% of national income: the updated series equal 526% of national income vs 508% in PZ. For public wealth (figure 2), new series are higher than the old series in 2010 too, in the equivalent of 12% of national income: public wealth represents 21% of national income in the new series vs 9% in the old ones. Consequently, market-value national wealth (the sum of private and public net worth) is higher in the new series, in the equivalent of 30% of national income (figure 3): 547% of national income vs 517%. Regarding Tobin's 'equity' Q (figure 4), values are displayed for the period 1990-2015, years for which data are available in 7 of the 8 countries[9]. A ratio below one means that the market value of corporations is lower than their book value or, equivalently, that book-value national wealth is higher than the market value. Over this period, both series of Tobin's Q move together, with the updated series being slightly closer to unity than the old ones, meaning that market and book value measures are slightly closer in the new update.

3.2 National income: capital-labor shares

In this subsection I compare the capital-labor decomposition of national income in the updated series relative to those in PZ for the period 1970-2016 using four indicators: net capital share (figure 5), gross capital share (figure 6), gross capital formation (figure 7) and net capital formation (figure 8). I use the definition of capital income that excludes interests paid by the government but includes foreign capital income, as a percentage of factor-price national income (i.e. excluding product taxes from national income)[10]. Three words of clarification are needed before proceeding with the analysis. First, as commented previously,

[9]Italy is not included in the average Tobin's 'equity' Q values because corporate wealth series are only available for the period 2006-2015.

[10]In addition to this definition, PZ use an alternative definition of capital income where they include interests paid by the government. At WID.world, the two series will be available but I stick to the first definition in this paper as it makes more comparable the different country series (though there are reasons to include some return to government assets, as the second definition does – see (Piketty and Zucman, 2014b, pg. 43)).

in this paper I present updates of capital-labor shares for all countries in PZ except for Canada. Second, out of these seven countries, Australia had already adopted the SNA 2008 by the time when PZ wrote their paper. Hence, to understand the role of adopting this new system of accounts, it is important to exclude Australia from the analysis. Third, the UK has experienced a very significant revision of the gross operating surplus of the housing sector in the most recent updates (see country-specific notes in section 4) which is not related to adopting SNA2008 but to using better and more detailed historical data on housing rents. This revision implies much higher values for households' capital income relative to those in PZ. Thus, in figure 9, figure 10, figure 11 and figure 12 I present the equivalent results to figures 5 to 8 but excluding Australia and the UK from the analysis.

Overall, the analysis of these figures shows the following two simple facts: i) the updated net capital shares (figures 5 and 9) are almost equivalent to those in PZ, ii) gross capital shares are substantially higher in the new updates (figures 6 and 10), with the difference between the new and the old series rising over time (e.g. being smaller in 1970 than in 2016). The second fact (higher gross capital shares in the updated series) is consistent with the findings of Koh et al. (2018) for the case of the US: when gross capital formation includes R&D, this increases both gross capital formation and gross capital shares.

Figures 7 and 11 show, indeed, the rising value of gross capital formation in the updated series when compared with the old ones (around 2-3 percentage points of national income). Yet, net capital formation (figures 8 and 12) is almost identical in the new and the old series. This suggests that the similar values in the net capital shares obtained in the new series relative to the old ones is due to depreciation rising in similar proportion to gross investment.

4 Splicing procedure and country specific notes

Official national accounts (both for income and wealth) are periodically revised but, frequently, the new versions do not cover the whole period for which official statistics have existed. For example, in Canada, the latest official update of the national wealth accounts covers the period 1990-2016 but not the period 1970-1989, for which data had existed in previous editions. As a rule, I use the most recent official accounts and then reconstruct the historical series following the proportional evolution of the corresponding series in PZ. Regarding the specific concepts, sources and adjustments made to the data, in all cases I follow the work of PZ, which is explained in the appendix to their paper (Piketty and Zucman (2014b)) and in the corresponding country-specific excel files[11]. When an alternative procedure is followed, I point to it in this document.

In the next country-specific notes, I comment on the official statistics used in this update and the procedure to splice the new data with older series. Within every country, I explain separately the estimate of wealth and income. Within wealth, I comment in a different sub-section the splicing of the private, public and corporate sectors. Three additional sub-sections cover the estimation of national housing (the sum of private, corporate and public housing), national agricultural land and natural capital.

4.1 Australia

4.1.1 Overview

Data for Australia in PZ covered the period 1960-2011. I have extended the series to 2016 (wealth) and 2017 (income) and revised the existing series for the period 1960-2011.

[11] http://piketty.pse.ens.fr/en/capitalisback

4.1.2 Explanation: wealth

The official balance sheets used by PZ already followed the SNA2008 and ended in 2011. In this update, I use the latest national accounts from the Australian Bureau of Statistics[12], that cover the period 1990-2016, and splice these series with those of PZ for the preceding years. An important novelty with respect to PZ is the inclusion of natural capital in the new series. In addition, I estimate the total stock of national housing for the years 1960-1990.

Private wealth (figure 13): The private sector in Australia is not decomposed into households and NPISH: official statistics group together the two sectors into what is called the private sector in WID.world database. By 1990, the new series of private wealth are slightly higher than those in PZ: 402% of national income in the new series and 391% in the old ones. This is the result of higher financial wealth (financial assets net of liabilities). I extend the series of non-financial assets, financial assets and liabilities taking the first observation in the new series (1990) and using the growth rates in the equivalent series of PZ, up to 1978. Before 1978, only data on non-financial assets and net wealth are available and I follow the same procedure to extend backwards net wealth and non-financial assets. By 1970, the updated series of net private wealth are slightly higher than the old ones: 340% of national income vs 332% in PZ.

Public wealth (figure 14): By 1990, the updated series including natural capital are slightly lower than the equivalent series in PZ (including natural capital too): 103% of national income vs 108%. Before 1990, Piketty and Zucman (2014) do not separate financial wealth into financial assets and liabilities. Instead, they provide data for net financial wealth. Given that by 1990, the new series of financial assets and liabilities are almost equal to the old ones, I extend net financial wealth to 1960 using Piketty and Zucman without modification. For non-financial assets, I extend backwards the new series using the growth rates in PZ. By 1970, the updated series are slightly lower than the old ones: 80% of national income vs 84%.

[12] http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5204.02015-16?OpenDocument

Corporate wealth (figure 15): Corporate balance sheet is available since 1990 in PZ. This is the same year for which the corporate balance sheet is available in national accounts. Hence, I replace the existing series from PZ with the new data, which cover the period 1990-2016. The new Tobin's Q is higher than in PZ. This is mainly the result of the market-value of equity liabilities, which is significantly higher in the new series.

Housing (figure 16): In the updated series, I reconstruct national housing, which is the sum of housing owned by the private, corporate and public sectors. For the years 1990-2016, data are directly taken from the official balance sheets[13]. Before 1990, PZ provide series of housing owned by the private sector (starting on 1960), but not by corporations and the government. To extend private housing, I use the first observation in the new national accounts (year 1990), and extend it backwards using the growth rates in PZ. Given that both series have a similar value in 1990 (231% of national income in the updated series vs 229% in the old ones), they have an almost identical value in the preceding years too. For corporations and the government, I make an assumption. I observe that corporate housing and government housing represent a relatively constant fraction of the value of the domestic stock of over the 1990-2016 period: 5% and 1% respectively. I then assume that this proportion was also constant for the period 1960-1989. Of course, this is approximative and if better data become available, we well correct their value.

Natural capital (figure 17): Official series of natural capital, both at the national and institutional sector level, are available for the period 1990-2016. Within natural capital, mineral and energy resource are the vast majority (around 99% of the total), the remaining being timber and spectrum assets. Before 1990, I extend their value using the growth rates in PZ. Natural capital in Australia is almost exclusively owned by the government (around

[13]The Australian Bureau of Statistics reports the value of housing structures (dwellings, AN.111) but does not decompose land into different uses (i.e. land underlying dwellings, land underlying non-residential structures, agricultural land, etc.). However, for the private sector, the total value of housing (dwellings plus land underlying) is reported in the Reserve Bank of Australia's balance sheets accounts (http://www.rba.gov.au/statistics/tables/), which are fully consistent with ABS's ((Piketty and Zucman, 2014b, pg.139))). Then, for the private sector, the value of land underlying dwellings is obtained as a residual from total housing in RBA minus dwellings in ABS. For corporations and the government, the same ratio land-dwellings is assumed to obtain the total value of housing.

99.8% of the total stock) and has experienced a dramatic rise since the 2000s. The updated series are very close to the old series during the last years of the sample (2008-2011), but they are significantly lower in the preceding years.

Agricultural land: The ABS national accounts do not differentiate agricultural land from other types of land. Hence, we do not account separately for agricultural land in WID.world series.

4.1.3 Explanation: income

The update of the income accounts is simple. I take the new national income accounts from the Australian Bureau of Statistics (which cover the period 1960-2017) and replace the old values with the new ones[14]. Figures 18, 19, 20 and 21 compare the updated series with those in PZ in the following four dimensions: net capital income (% net factor-price national income), gross capital income (% gross factor-price national income), gross capital formation (% national income) and net capital formation (% national income). In addition, figure 22 compares the difference in nominal value of the series of gross capital formation and consumption of fixed capital (this difference in nominal values is expressed as a percentage of the updated series of GDP). Overall new and old series in Australia are almost identical.

4.2 Canada

4.2.1 Overview

Data for Canada in PZ covered the period 1970-2011. I have extended the wealth macro series to 2016 and revised the existing series for the period 1970-2011. In this paper I do not updated the national income series (except the main aggregates: GDP, national income, etc.) given that Statistics Canada has carried a deep revision of their national income accounts. These accounts will be included at WID.world in the next months and will be supported by

[14]Data can be found in the following link: http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5204.02016-17?OpenDocument

a technical note describing the reorganization of the income accounts in Canada.

4.2.2 Explanation: wealth

PZ used the National Balance Sheets statistics from Statistics Canada (Statcan), which covered the period 1970-2011 and followed the SNA93. Since then, Statcan has revised these accounts to match the SNA2008, and now cover the period 1990-2016. One important novelty of the new series is to allocate natural capital across the different institutional sectors (before, natural capital was a satellite variable in the national balance sheet of Canada, but was excluded from the sector accounts). In this update, I replace the series of PZ with the new accounts from Statistics Canada and extend backwards the new series to 1970. I also introduce two adjustments. Firstly, I account for agricultural land at the sector level (in PZ, agricultural land was part of their measure of built-up land, so the latter is slightly overestimated: see 'agricultural land' below). Secondly, I estimate corporate and public housing, so I can compute national housing (the sum of private, public and corporate housing). Some of the explanations for the differences between the new and the old series are based on the raw balance sheets used by PZ. The interested reader can find these data in PZ's directory for Canada[15].

Personal wealth (figure 23): The national accounts used by PZ did not report data for non-profit institutions serving households. Instead, only data for "Persons, and incorporated business" (the equivalent to the households sector in the SNA2008) were available. In the updated national accounts, however, data are reported for both households and NPISH, separately. I use the new data of the personal sector (households) for the years 1990-2016, and extend this sector backwards to 1970 using the growth rates in PZ2014. By 1990, the updated series of personal wealth are slightly below the old ones: 292% of national income and 301%, respectively. In this update, agricultural land is differentiated within non-financial assets (before it was not).

[15] http://piketty.pse.ens.fr/files/capitalisback/CountryData/Canada/

Non-profit institutions: Net wealth of non-profit institutions is a small but growing proportion of national income: from 0.8% in 1990 to 6% in 2016. Given that these data were not reported in PZ, I cannot extend backwards these series using those of PZ214a. Hence, I assume that net worth of non-profit institutions was constant an equal to 0.8% of national income over the preceding years (1970-1989). The goal of doing this extension is to complete the private wealth series, which are the sum of the personal and the non-profit sectors, but not to provide precise estimates of NPISH over the 1970-1990 years. We advise not to use the data of NPISH separately from the private sector before 1990.

Public wealth (figure 24): Contrary to balance sheets employed by PZ, the updated national accounts for the government include natural capital within non-financial assets. Surprisingly, by 1991 net public wealth in the new series is below net wealth in PZ (-36% of national income and -28%, respectively), even though public natural capital equals 9% of national income in this year. This difference is largely explained by non-residential structures, which are worth 25% of national income in the updated series and 40% in the old ones. On the contrary, other types of non-financial assets, financial assets and liabilities have very similar values in the two sets of national accounts. To extend the updated series of public wealth backwards to 1970 I proceed as follows. For financial assets and liabilities, I follow the standard procedure (take the first observation in the new series and extend it backwards with the growth rates of the equivalents in PZ). For non-financial assets, I follow the same procedure but, in this case, I extend non-financial assets net of natural capital with the growth rates of total non-financial assets in PZ2014 (which do not include natural capital). To obtain total non-financial assets according to the new series' definition, in a second step I add public natural capital (see subsection "natural capital" below).

Corporate wealth (figure 25): Like in the case of the public sector, the latest national accounts incorporate natural capital within corporate non-financial assets, while the accounts used by PZ did not. Surprisingly too, by 1991 net corporate wealth (corporate book minus market value) is lower in the new series (58% of national income vs 64%), even with natural

capital representing 17% of national income. Like the public sector, the main reason for this is the higher value of non-residential structures and machinery in the old series: 118% of national income in the old accounts and only 81% in the updated ones. This large difference is slightly compensated by higher net financial wealth in the updated series, in which the value of financial assets net of liabilities equals −107% of national income for −117% in the old series. To extend the new series, I follow the same procedure than in the public sector. Financial assets and liabilities are extended with the growth rates of the equivalent series in PZ. For non-financial assets, I extend corporate non-financial assets net of natural capital. Then, I add natural capital to obtain total non-financial assets as defined in the updated series.

Housing (figure 26): In the updated series I reconstruct national housing, which is the sum of housing owned by the private, corporate and public sectors. For the years 1990-2016, data for the three sectors are based on the latest official balance sheets. For every sector, I follow the same procedure than PZ for households: (1) decompose built-up land into 'land underlying dwellings' and 'land underlying other buildings and structures'; (2) add land underlying dwellings to dwellings to obtain total housing (land plus structure). Decomposing land into types is necessary because the Canadian accounts do not decompose the variable 'land' into different uses. However, PZ treated the variable 'land' in the Canadian accounts as 'built-up land', when it also includes agricultural land. Hence, before splitting built-up land, firstly I subtract an estimated value for agricultural land. To calculate housing for the period 1970-1990, I follow the same system: subtract agricultural land, splice built-up land, add land underlying dwellings to dwellings. The data for this period are the sector balance sheets used by PZ, spliced with the new accounts with standard procedure: extending the first observation available in the new series (1991) with the growth rates in the equivalent data in the previous national accounts.

Natural capital (figure 27): In the national accounts used by PZ, natural capital (variable "natural resources" in the Canadian nomenclature, which include timber, mineral and

energy resources) was not incorporated in the sector accounts, but only in the national balance sheet. Since then, Statcan has incorporated this variable into the non-financial assets of the institutional sectors[16], with series available for the period 1990-2016. Even though natural resources are legally owned by the public sector, Statcan splits them between corporations and the government according to the flow of royalties and profits obtained from the exploitation of these resources (Kazi (2017)). To extend backwards natural resources I follow a twofold approach. Firstly, I extend the total value of natural resources back to 1967. To do so, I use the series of natural resources from Statcan's Natural Resource Asset Account[17]. These series are not completely updated, reason why they show some discrepancies with the new series, especially during the 2000s. Still, they are relatively closer to the updated series than those used by PZ. Secondly, I split the total value of natural capital between corporations and the government according to the proportion observed during the period 1990-2016: 25% of natural capital 'owned' by the government, 75% by corporations. This proportion has been relatively stable during the years 1990-2016 (corporations between 70-80% of the total, the government between 20-30%) but, nonetheless, it should be taken as a rough approximation in the absence of specific data to carry this division.

Agricultural land (figure 28): As explained above, sector balance sheets accounts include a variable named 'land', which includes built-up land and agricultural land. Hence, a decomposition between the two types is necessary before splitting built-up land into underlying dwellings and underlying other buildings and constructions. I take the value of national agricultural land from the balance sheet of the agricultural sector[18], which covers the period 1981-2016. Then, I extend the series backwards to 1970 using the growth rate in the equivalent series of PZ. However, these series are not decomposed across sectors. As a

[16]Technically, Statcan treats natural resources of institutional sectors as intangible non-financial assets which, at the national level, add up as tangible assets. For a deep discussion of the treatment of natural resources in Statcan, see the following link: https://www.statcan.gc.ca/pub/13-605-x/2015009/article/14239-eng.htm

[17]http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=1530121&p2=33

[18]http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0020020&&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=

rough approximation, I consider that 65% is owned by households and 35% by corporations, in line with the values observed in other advanced countries (see, for example, figures 21 and 27 for France and Germany). Overall, the magnitude of agricultural land is relatively small (between 12% and 24% of national income over the period 1990-2016).

4.3 France

4.3.1 Overview

Official balance sheet data for France in PZ covered the period 1970-2010 while for income covered the period 1949-2010. In addition, they present annual series of national income, private, public and national wealth since 1870. I have extended the wealth series to 2015 and revised the previous period. For income series, I take directly those of Garbinti et al. (2018).

4.3.2 Explanation: wealth

Current wealth macro data at WID.world comes from Piketty and Zucman (2014a). These data end in 2010 and follow SNA93. Garbinti et al. (2017) ('GGP2017' from now on) updated these series up to 2014 using more recent data from INSEE, which adopt the latest SNA2008 guidelines. In this update, I follow the latter paper and use the most recent data from INSEE, which covers the period 1978-2015. In this update, I separate natural capital from other natural resources (built-up land and agricultural land).

Private wealth (figure 29): Both the raw series used by PZ and the latest updates of the national accounts report data separately for the personal and the NPISH sectors. I reconstruct separately the evolution of the two sectors for the period 1970-2015, and add them to obtain the private sector. INSEE's accounts report data for non-financial assets for the period 1979-2015. For financial assets and liabilities, data cover the years 1996-2015. In both cases, I use the latest INSEE's data for the available years and extend it backwards to 1970 using the series of GGP2017. Given that the series used by GGP2017 coincide with the

latest INSEE accounts in the earlier years (1980s-1990s) and only slightly differ in the last years, no splicing procedure is needed. For the period 1870-1969, I take the data directly from GGP2017, which present annual series of net private wealth not differentiated into different subcomponents[19].

Corporate wealth (figure 30): Data for the balance sheet of corporations in PZ were available for the period 1970-2010. In GGP2017, these are available for the period 1970-2014. I follow the same procedure than for the private sector during the period 1970-2015: use the latest national accounts covering non-financial assets for the period 1979-2015 and financial wealth for the period 1996-2015, and extend them backwards to 1970 using the data in GGP2017.

Public wealth (figure 31): For the period 1970-2015, I follow the same procedure as in the private and the corporate sector cases. For the period 1870-1969, I take the data on non-financial assets, financial assets and liabilities from PZ, without further modification (no splicing procedure is needed given that both the updated and the PZ series are equal by 1970).

Housing (figure 32): In the updated series, I reconstruct national housing, which is the sum of housing owned by the private, corporate and public sectors. For the years 1979-2015, data for the three sectors are based on the latest official balance sheets from INSEE. As in other countries, INSEE reports data on the value of dwellings (AN.111) but does not separate the variable "Land underlying constructions and civil works" (AN.2111) into different types. I follow the approach of PZ for calculating private housing, and decompose AN.2111 in proportion to the corresponding fixed assets: Dwellings (AN.111), Non-residential buildings (AN.1121) and Civil works (AN.1122). For the period 1970-1978, only data on private housing (as the sum of land plus structure) is available, both in PZ and in GGP2017. Unfortunately, data on housing, as a separate component, within corporations and the public

[19]This is due to the estimation procedure in the original paper by PZ. Data on the balance sheet of households were only available for certain years throughout this period, which are then joint with accumulation equations of private savings and capital gains.

sector's non-financial assets are not available. As a proxy of the evolution of housing in these two sectors, I use the percentage of 'social housing' renters within all households in France, from the French Housing Survey[20]. I observe that in the years 1979-2013, the evolution of corporate plus publicly owned housing as a percentage of national housing follows relatively close the evolution of the percentage of households that are social renters. Hence, I assume that public and corporate housing moved proportionally to the percentage of social renters during the 1970-1978 period too (figure 33). To split the sum of corporate and public housing into these two sectors, I keep constant the proportions observed in 1979: 93% owned by corporations, 7% owned by the government.

Natural capital: INSEE accounts report the value of mineral and energy reserves (AN.212) within their non-produced assets. In PZ and in GPP2017, these assets are included within their measure of non-financial assets but are not reported as a separate category. In this update, I separate this category for the years in which INSEE reports on their value: 1979-2015. Ideally, we would like to account for forestry land too within natural capital, but the variable land under cultivation (AN.2112) is not split into agricultural and forestry by INSEE. Hence, as in other countries, we treat cultivated land as agricultural land at WID.world. Overall, the value of mineral and energy reserves is very small: between 1.1% and 0.1% of national income over the 1979-2015 years. I do not extend this variable backwards from 1979 given the absence of data sources.

Agricultural land (figure 34): PZ reported data for households agricultural land for the years 1970-2010, but not for other sectors. GPP2017 already included corporate holdings of agricultural land for the period 1979-2014 (corporations are the only sector, in addition to households, owning agricultural land according to INSEE's balance sheets). I update these

[20]Between 1970 and 2013, there have been 10 editions of the French Housing Survey: 1970, 1973, 1978, 1984, 1988, 1992, 1996, 2002, 2006 and 2013. Between 1970 and 2006, I define social renting as renters of "HLM" dwellings ("*Habitation à loyer modéré*" in French). For the year 2013, the definition changes slightly: renters of "HLM and of other social housing" (but social housing different from HLM is almost negligible in France). For the years between 1970 and 2006, data can be found in the following link: https://www.data.gouv.fr/fr/datasets/les-menages-et-leur-logement-depuis-1955-et-1970-quelques-resultats-extraits-des-enquetes-logement/ Theyear2013canbefoundhere:https://www.insee.fr/fr/statistiques/1912703?sommaire=1912749

series to the year 2015 and extend them backwards to 1970. For the period 1979-2015, I take data for "Land under cultivation" (AN.2112) from the latest national accounts. As in other countries, this variable adds both agricultural and forestry land (see "Natural capital" sub-section above). This is the same procedure followed by PZ and GGP2017. For the period 1970-1978, I extend the series of households agricultural land using the growth rates of the equivalent series in PZ. Given the absence of data for corporations over these years, I extend corporate agricultural land using the same growth rates than in the case of households.

4.3.3 Explanation: income

Income data are taken directly from the data appendix A to Garbinti et al. (2018). The only exception are the three variables needed to compute Gross Capital Formation (Gross Fixed Capital Formation, Change in inventories and Acquisition less disposal of valuable), which are not part of the already mentioned appendix A. I download these data from INSEE: National accounts, institutional sector, national economy, base 2010. This corresponds with the same set of national accounts used by Garbinti et al. (2018) in their paper, therefore being fully compatible.

Figures 35, 36, 37 and 38 compare the updated series with those in PZ in the following four dimensions: net capital income (% net factor-price national income), gross capital income (% gross factor-price national income), gross capital formation (% national income) and net capital formation (% national income). In addition, figure 39 compares the difference in nominal value of the series of gross capital formation and consumption of fixed capital (this difference in nominal values is expressed as a percentage of the updated series of GDP). Overall, new series of net-of-depreciation capital income are similar to the old series. As it is the case in other countries, gross-of-depreciation capital shares are higher in the new series, with the difference between the new and the old series rising over time. This is consistent with the higher values of gross capital formation in the updated series and the almost equal values of net capital formation.

4.4 Germany

4.4.1 Overview

Official balance sheets for Germany in PZ cover the period 1991-2011. In addition, they present annual series of national income and macro wealth since 1870 (and for corporate wealth since 1971). I have extended the to 2016 (wealth) and 2017 (income) and revised the existing series for the previous years.

4.4.2 Explanation: wealth

Current wealth macro data at WID.world comes from Piketty and Zucman (2014a). These data end in 2011 and follow SNA93. In this update I use the most recent national accounts from Destatis and the Bundesbank (2017 edition), which follow SNA2008 and cover the period 1999-2016[21]. I splice these data with the annual series presented in PZ since 1870[22]. In addition, I estimate national housing (as the sum of private, corporate and public housing) since 1970 and national agricultural land since 1989 (in PZ these two variables were available for the private sector alone, since 1950 and 1989 respectively). Data for natural capital are not available in German national accounts.

Private wealth (figure 40): Official balance sheets in Germany group together households and NPISH (sectors S14 and S15) and cover the period 1999-2016 in the latest update. For financial assets and liabilities, I follow PZ and use data directly from the Financial Ac-

[21]Destatis (the Federal Statistical Office of Germany) publishes the official balance sheets by institutional sector in Germany. The latest accounts cover the period 1999-2016, while those used in PZ covered the period 1991-2011 (2012 edition). Non-financial assets are direct estimates from Destatis while financial assets and liabilities are based on the Financial Accounts from Bundesbank. One difference with respect to the financial data reported in Bundesbank is that Destatis consolidates financial assets and liabilities at the institutional sector while Bundesbank's data are unconsolidated ((Destatis, 2017, pg. 5)). This was also the case with the accounts used by PZ. This is why some discrepancies may arise when comparing gross financial assets and liabilities between the two sources. Data from Destatis and the Bundesbank can be found in the following two links: https://www.destatis.de/EN/Publications/Specialized/Nationalaccounts/BalanceSheetPDF_5816104.html https://www.bundesbank.de/Navigation/EN/Statistics/Time_series_databases/Macroeconomic_accounting_systems/macroeconomic_accounting_systems_node.html

[22]PZ use estimates of contemporaneous authors, economic historians and older versions of official accounts (both from Destatis and the Bundesbank) to extend their annual series back to 1870. They complement these sources with accumulation equations to splice different available years.

counts of Bundesbank, which decompose financial assets and liabilities into more categories than Destatis[23]. Non-financial assets come directly from the Destatis' accounts. By 1999, the new series of private wealth are significantly higher than those in PZ: private wealth equals 376% of national income in the new series and 347% in the old ones. This is due to the higher value of two categories of non-financial assets: business assets different from housing and built-up land[24]. Other types of assets and liabilities are almost identical in the new and the old series by 1999. I then splice the new series of assets and liabilities with the equivalent ones in PZ to extend backwards the data to 1991 (which is the first year of official balance sheets in PZ). Private wealth is then calculated as the sum of the different asset subcomponents, net of liabilities. The splicing procedure is the standard: extend the new series with the growth rates of the equivalent series in PZ.

Before 1990, PZ report data for the household sector only (i.e. not including NPISH). Between 1950 and 1989, they use older versions of Bundesbank's Financial Accounts to account for households financial assets and liabilities. For non-financial assets, they rely on the estimates from Baron (1988), which present data for some given years (1953, 1957, 1960, 1963, 1966, 1972, 1974, 1977 and 1988), which PZ interpolate linearly in between. For financial assets and liabilities differences between the new and the old series are negligible. However, the new series of non-financial assets are higher than the old series for the period 1991-2011. I then upgrade the point estimates of Baron by the observed discrepancy. By 1950, private wealth equals 205% of national income in the new series and 184% in the old version.

For the period 1870-1949, PZ present an annual series of private wealth, which is not decomposed into further categories. This is due to using accumulation equations to splice

[23]For other sectors (corporations and the government) I will use data on financial assets and liabilities from Destatis and not from the Bundesbank. Given that the financial counterpart of households are other institutional sectors, the fact that Bundesbank's data are not consolidated does not generate a problem: unconsolidated and consolidated data within the private sector are identical.

[24]PZ explain in their appendix ((Piketty and Zucman, 2014b, pg. 72)) that land underlying buildings and structures may be downward biased due to the absence of a real census-like estimate. This has been improved in the latest editions of the balance sheets (see subsection: Housing). This can explain the higher values of built-up land in the new official balance sheets.

some year estimates for which they know the balance sheet of households. I use their series of private wealth without further modification for the period 1870-1946, and splice the new series with those in PZ between 1946-1950[25]. Although this splicing is not totally correct, I prefer not to upgrade the previous historical period. In particular, due to the great uncertainty surrounding the stock and value of assets and liabilities during World War II. Overall, differences between the old and the updated series are small so this decision has no significant effect on the long-run development of the series.

Public wealth (figure 41): The procedure to extend and splice public wealth series is the same than in the private sector: use the latest national accounts for 1999-2016[26], extend them with the growth rates in PZ's series for the period 1950-1990, splice the updated series with those in PZ for 1946-1950 (so both converge by 1946), and take, without modification, the annual series for the years 1870-1946. The only difference stems from the fact that PZ provide annual series of non-financial assets, financial assets and liabilities for the period 1870-1949, and not only of net wealth (as it is the case in the private sector).

For the period 1950-2011, the new series are slightly higher than the old ones: in 1950, the updated series are 58% of national income vs 43% in the old series; in 1999 (first year available in the new official balance sheets), the new series are 39% of national income vs 22% in the old ones. This is mostly due to higher non-financial assets, which in the new series represent 77% of national income in 1999 and 62% in the same year of PZ. Financial assets and liabilities, on the contrary, are almost equal.

Corporate wealth (figure 42): I take directly the new data on corporate wealth from Destatis national accounts for the years 1999-2016. I then splice these series with those in PZ backwards to 1971 (first year available in PZ). The splicing procedure is the standard: use the new estimates and extend them with the growth rates of the equivalent data in PZ.

[25] I add a fixed capital gain of 4% to the series of PZ between 1946 and 1950, so their series match the updated ones by 1950.

[26] For the public sector, financial data are taken from Destatis' balance sheets and not from Bundesbank's Financial Accounts (the former take the data from the latter but present them already consolidated at the sector level).

The updated series of net corporate wealth (net worth minus market-value of equity) are lower than those reported in PZ. However, those in PZ contained a mistake in one formula: land underlying buildings and structures took the data of households and NPISH and not of corporations. If I compare the new series with the corrected version in PZ, then net wealth of corporations is higher than before. As in the case of the private and the public sectors, this is mostly the result of higher non-financial assets (financial assets are also slightly higher, but they are compensated by higher non-equity liabilities too). Overall, the Tobin's 'equity' Q follows a similar trend in the three series, with some difference in the levels.

Housing (figure 43): PZ present series of private housing for the period 1950-2011 but do not separate housing assets within the non-financial assets of corporations and the government. In this update I present data on national housing (the sum of housing owned by private, corporate and public sectors) for the period 1970-2016, in addition to revising the private housing series of PZ for the years 1950-2011. For the period 1990-2011, PZ use the official balance sheets from Destatis, which provide data on the value of dwellings and of land underlying dwellings for the three institutional sectors[27]. Then they splice the private housing series with the series of housing owned by households from Baron (1988), which provides estimates for certain years within 1950 and 1980.

In this update, I use Destatis' balance sheets for the period 1999-2016, which report the value of housing for the three sectors. One novelty of these national accounts with respect to those used by PZ is the improved treatment of land underlying buildings (including land underlying dwellings). As PZ explain in page 72 of their appendix, estimates of land underlying buildings from Destatis could be biased as the valuation is based on prices of new land for building development. These estimates were produced by the Bundesbank and were incorporated by Destatis into their balance sheets. However, Destatis now produces their

[27] As it is the case in other countries, the German balance sheets do not decompose land underlying buildings and structures (AN.2111) into land underlying dwellings (AN.2111A) and land underlying other buildings and structures (AN.2111B). Following PZ and DINA guidelines, I split AN.2111 into the two types, in the same proportions than corresponding categories of produced assets: dwellings (AN.111) and other buildings and structures (AN.112).

own estimates of land underlying dwellings which are based on series of prices for already built land. Overall, both series follow a similar trend with the new ones having a higher value than the old ones (i.e. by 1999, the new series of national land underlying dwellings are worth 78% of national income, while it was 58% in the old ones).

By 1999, the new series of private housing are equal to 218% of national income, while they were equal to 200% in PZ. I extend backwards to 1990, separately, dwellings and of land underlying dwellings, for each sector, using the equivalent variables in PZ. Then, for private housing, I splice the new series with those of Baron (the series of Baron correspond to the total value of households housing, and are not decomposed into land and structure). Similar to what I do with other components of private wealth, I upgrade the series of Baron with the discrepancy observed between the new and the old series in 1990 (first year for which PZ report data on housing from the modern national accounts) (figure 44). For corporations and the government, series for dwellings are available in PZ since 1970. I splice these series with the new updated series in 1999 using the standard procedure (extending the updated series with the growth rates in the equivalent ones in PZ). Then I follow PZ and assume that the evolution of land underlying dwellings follows that of dwellings (i.e. the growth rates of the two series over 1970-1999 are equal). This assumption is done to approximate the total value of housing in Germany (as the sum of private, corporate and public housing) and implies fixing the ratio land-structure during the period 1970-1989 taking 1990 as reference. Given the predominant role played by the household sector in housing, the margin of error is limited when looking at the total value of housing in Germany (which is the goal in these estimates). However, if more specific data on the value of land underlying dwellings becomes available, we will correct these numbers.

Agricultural land (figure 45): In the 2012 edition of Destatis national accounts used by PZ, only data on land underlying buildings and structures (AN.2111) were reported, but not on other types of land: cultivated land (AN.2112), recreational land and associated surface water (AN.2113) and other land and associated surface water (AN.2119). Hence, to

correct for these missing data, PZ estimated agricultural land by assuming a ratio of land to cultivated assets of 9 (cultivated assets are part of produced assets and are available in the official balance sheets accounts). The latest balance sheets from Destatis, however, do report the value of total land (AN.211) but only reports in a differentiated manner one of the subcomponents: land underlying buildings and structures. This implies that the residual from total land minus land underlying buildings and structures includes cultivated land but also other types. However, in a note from Destatis ((Brede and Schmalwasser, 2015, table 1)), land is decomposed into lower categories for two single years: 2011 and 2012. It shows that within land different from built-up land, cultivated land (*Landwirtschafts/Waldfläche*) accounts for the vast part. For example, in 2011, cultivated land equals 379.2 million euros, while other types of land (*Flächen anderer Nutzung*) equals 11.6. In other words, in these two years, the role played by land different from built-up and cultivated is negligible. I then assume that the residual of land net of built-up land only captures cultivated land over the 1999-2016 years. Overall, these new data imply two changes: (1) The government sector owns cultivated land (in PZ public cultivated assets have zero value, therefore public cultivated land too); (2) agricultural land is higher in the new series than in those in PZ.

I extend backwards these series to 1989, using the evolution of cultivated assets in PZ, for each institutional sector. The splicing procedure is the standard: extend the updated series using the growth rates of the series for cultivated assets in PZ. Given that the public sector has no cultivated assets, I assume that they follow the trend of the corporate sector.

Natural capital: According to (Destatis, 2017, pg. 4), natural capital other than land is not estimated.

4.4.3 Explanation: income

The national accounts used by PZ covered up to 2011. In this update I use the latest national income accounts from Destatis, which cover the period 1991-2017[28]. In addition,

[28] https://www.destatis.de/DE/Publikationen/Thematisch/VolkswirtschaftlicheGesamtrechnungen/Nationaleinkommen/SectorAccountsAnnualresultsPDF_5812106.html

some selected components of the national accounts are available since 1970[29] and I use them too. As a general rule, I splice the new series with the old ones apply the proportional difference of the new series with those in PZ, except in those cases in which it was preferable to use the original data from PZ to avoid inconsistencies across different income component (details are explained in the corresponding excel file for Germany). Given that for some components of national income data are only available since 1980, the new series and the old ones tend to converge around this year and have similar values for the historical period before 1980.

Figures 46, 47, 48 and 49 compare the updated series with those in PZ in the following four dimensions: net capital income (% net factor-price national income), gross capital income (% gross factor-price national income), gross capital formation (% national income) and net capital formation (% national income). In addition, figure 50 compares the difference in nominal value of the series of gross capital formation and consumption of fixed capital (this difference in nominal values is expressed as a percentage of the updated series of GDP). Overall, new series of net-of-depreciation capital income are similar to the old series (with some differences emerging in the 1950-1980 period). As it is the case in other countries, gross-of-depreciation capital shares are higher in the new series, with the difference between the new and the old series rising over time. This is consistent with the higher values of gross capital formation in the updated series and the almost equal values of net capital formation.

4.5 Italy

4.5.1 Overview

PZ presented series of national income for the period 1960-2011. In the case of macro wealth, they presented series of private and public wealth in Italy for the periods 1966-2011 and 1960-2011, respectively. Not for corporations. In this update I extend these series to

[29] https://www.destatis.de/DE/Publikationen/Thematisch/VolkswirtschaftlicheGesamtrechnungen/Inlandsprodukt/InlandsproduktsberechnungLangeReihenPDF_2180150.pdf?__blob=publicationFile

2015 (wealth) and to 2017 (income) and revise the existing series of PZ. I also estimate corporations wealth for 2006-2015, using the recently published non-financial accounts of Italy.

4.5.2 Explanation: wealth

At the time of the work of PZ, Italy did not publish official non-financial stock accounts for the institutional sectors. The only exception were households, for which the Bank of Italy did publish its full balance sheet for the period 1995-2011. Contrary to non-financial assets, the Bank of Italy had an already long tradition publishing the Financial Accounts of Italy, including a comprehensive decomposition for all institutional sector, and with annual estimates starting in 1950. For the private sector, PZ relied on these data, which they complemented with the estimates of households' non-financial assets for the period 1966-1995 in Brandolini et al. (2006)[30]. For the government sector, financial information came from Bank of Italy's Financial Accounts. For non-financial assets, their estimates were based on a paper by ISTAT (2017), which computes government non-financial assets for 2006, 2007 and 2008, and which PZ extrapolated for the preceding years ((Piketty and Zucman, 2014b, pgs. 127 and 128)). All data used by PZ followed the SNA93.

In 2015, ISTAT (the Italian National Institute of Statistics) published, for the first time, non-financial accounts for institutional sectors in Italy, which follow SNA2008. These accounts cover the period 2005-2015, except for housing and cultivated land, which series start in 2001. The Italian Financial Accounts continued being published by the Bank of Italy, and at the present follow SNA2008 too. These accounts cover the period 1995-2016 in its most recent edition, but historical accounts exist for the 1950-1994 years. I then use these series to compute private, corporate and public wealth over the period 2005-2015. Then I follow PZ to reconstruct private and public wealth for the preceding years (with data starting in

[30]Over the period 1966-2011, Bank of Italy's Financial accounts referred to the private sector (households plus NPISH), while the non-financial data did not include NPISH. However, given the low net holdings of NPISH, PZ did not consider necessary to correct this discrepancy ((Piketty and Zucman, 2014b, pg. 127))

1966 and 1960 respectively). In addition, I present an estimate of national housing and national agricultural land, based on the sum of the holdings of the private, corporate and public sectors. Natural capital is not reported by ISTAT's accounts.

Private wealth (figure 51): For the period 2005-2015, I take the data on non-financial assets of the private sector (households plus NPISH) directly from ISTAT's non-financial accounts (March of 2017 edition). Data for financial assets and liabilities come (for the same sector: Households plus NPISH) from the Bank of Italy's Financial Accounts (available for the period 1995-2016). I extend the series of housing, business assets and agricultural land backwards to 1995, using the growth rates of the equivalent series of non-financial assets from the Bank of Italy's Supplements to the Statistical Bulletin of 2014[31]. Note that these series of non-financial assets of Bank of Italy only include households. But I extend the series of the private sector with the growth rates of households. If I were to obtain NPISH's wealth as a residual from ISTAT's private sector and Bank of Italy's households one, I get that NPISH account for about 6% of total private wealth, or the equivalent to around 27% of national income.

Before 1995, I extend the updated series with the growth rates of the equivalent asset categories in PZ. Recall that PZ's data are based on the Historical Financial Accounts from the Bank of Italy and on the work of Brandolini et al. (2006) (the latter for the case of non-financial assets, the former for financial assets and liabilities). For financial assets I extend three series for which data are available: Equity and fund shares, Pension funds and life insurance, and other financial assets. I then extend liabilities and three types of non-financial assets: housing, business assets and agricultural land. In all cases I follow the standard procedure: extend the updated series with the growth rates of those in PZ.

Overall, the new private series are slightly higher than those in PZ throughout the 1966-2005, with differences being more significant from 2005 onwards. The main reason are higher non-financial assets in the new series, particularly housing.

[31] https://www.bancaditalia.it/pubblicazioni/ricchezza-famiglie-italiane/index.html?com.dotmarketing.htmlpage.language=1

Public wealth (figure 52): In this update I report series of government wealth for the period 1960-2015. For 2005-2015, non-financial assets are taken directly from ISTAT's non-financial accounts. For the preceding years, official data do not exist. Given the relative stability of the value of public non-financial assets over the period 2005-2015, around 36% of national income, I assume that the value of these assets was equal to this percentage of national income over the 1960-2005 period too. This is below the previous assumption in PZ's: 52% of national income (see subsection 'Explanation'). The stability of the value of non-financial assets may be justified by the evolution of public investment in Italy ((Piketty and Zucman, 2014b, pgs. 127 and 128)), but the levels seem a bit low relative to the evolution in similar countries. In the absence of better data, this value should be understood as our best guest and will be revised if new data become available.

Financial assets and liabilities are taken from the official Financial Accounts for the period 1995-2015. I then extend these series backwards to 1960 using the growth rates of the equivalent ones in PZ (which are taken from the Historical Financial Accounts of the Bank of Italy). Overall, the updated series of public wealth are lower than those in PZ (between the equivalent to 10-20% of national income). The main reason are the lower non-financial assets which are slightly compensated by higher financial assets in the updated series.

Corporate wealth (figure 53): In PZ, corporate wealth was not covered due to the absence of non-financial assets data. The ISTAT non-financial accounts (which were not published yet at the time that PZ wrote their article), cover all institutional, for the period 2005-2015. In addition, Bank of Italy's Financial Accounts report corporations financial balance sheets for the period 1995-2016. In this update I present corporations wealth series between 2005 and 2015, years in which the two data sources overlap.

Housing (figure 54): In this update I present series of national housing (as the sum of private, corporate and public housing) for the period 1966-2015. For the period 2001-2015, data for all sectors are directly available at ISTAT's balance sheets[32]. Before 2005, the

[32]ISTAT's accounts do not decompose the total value of housing into dwellings and land underlying dwellings.

extension is as follows. For the private sector, I extend the series of private housing with the growth rates of housing owned by households in the Bank of Italy's Supplement to the Statistical Bulletin (2015) for the years 1995-2005. For the period 1966-1995, I use the series from PZ, which are based on Brandolini et al. (2006).

To account for housing owned by corporations and the government, I need to make a series of approximations. Firstly, I observe their share on national housing for the years for which official ISTAT accounts are available (2001-2015). Over these years, corporate and public housing represented a relatively constant share of national housing: around 8% and 2%, respectively. Then, I observe the evolution of the tenure structure in Italy (figure 55), to track if there exist important changes that could alter the proportion of private housing in the total stock of dwellings. The idea is to look at the evolution of owner-occupied and privately rented dwellings relative to other types of tenures: social housing and the category 'others'. According to SNA, privately owned and owner-occupied dwelling are owned by the households sector, while social housing and other types of dwellings are typically owned by corporations and the government.

Data on renting, differentiated into private and social, are only available since 1981. Before, only total renting is reported. Over the 1981-2011 years, owner-occupied and privately rented dwellings represent around 87-89% of total stock of dwellings in Italy. If the proportion of social housing before 1981 remained relatively similar to the proportions observed in the 1980s (around 5% of the total), then private housing will continue representing around 88-89% of the total. In light of this plausible stability of the share of private housing on the total stock of dwellings, I assume that corporate and public housing represented the same proportions into national housing than those observed in the 2001-2015 period: 8% and 2% respectively. Of course, this is a rough estimate. However, note that the idea of this exercise is to approximate national housing and not, specifically, the share owned by corporations and the government individually and we will correct these estimates if better data become available. Nevertheless, changes to national housing should be of minor importance given

that the vast majority of this stock should be owned by households, which in principle are correctly captured in our series.

Agricultural land: I report values for national agricultural land (as the sum of the holdings of the private, corporate and public sector) for the period 2002-2015. In addition, for the private sector, series are extended back to 1966, the same year in which data for private agricultural land are reported in PZ. For the period 2002-2015, data are taken directly from ISTAT's non-financial accounts, which includes the variable "cultivated land" for all institutional sectors. Before 2002, the procedure to estimate private agricultural land is the same than for private housing: between 1995 and 2001, use the series of households' non-financial assets from the Bank of Italy (2015) Supplement to the Statistical Bulletin; for the period 1966-1994, use the equivalent series in PZ. The splicing procedure is the standard: extend the updated series with the growth rates of the equivalent ones. Note that, by definition, "cultivated land" in national accounts includes forestry land in addition to agricultural land.

Natural capital: In Italy, natural capital is not covered by the non-financial accounts of ISTAT. However, according to the latest UNU-IHDP and UNEP (2014)'s Inclusive Wealth Report, natural capital has a negligible value in Italy.

4.5.3 Explanation: income

PZ presented series of national income covering the period 1960-2011. In this update I use the latest available accounts from ISTAT covering the period 1995-2017. I then splice the new series with those in PZ for the historical period (i.e. 1960-1994).

Figures 56, 57, 58 and 59 compare the updated series with those in PZ in the following four dimensions: net capital income (% net factor-price national income), gross capital income (% gross factor-price national income), gross capital formation (% national income) and net capital formation (% national income). In addition, figure 60 compares the difference in nominal value of the series of gross capital formation and consumption of fixed capital (this

difference in nominal values is expressed as a percentage of the updated series of GDP). Contrary to other countries, net-of-depreciation series of capital income are significantly higher than those in PZ. As shown in figure 61 this is the result of both higher households and corporations net capital income. Gross-of-depreciation capital shares are also higher, but this is not because gross capital formation and capital formation are substantially higher (as it is the case in other countries): these two variables present similar values in the old and the new series (figures 58 and 59). As figure 60 shows, the new nominal values of gross capital formation and capital depreciation are higher in the new series, but the magnitude is small (i.e. below 1% of GDP). Investigating why the adaptation to the SNA2008 has not brought substantially higher values of gross investment and depreciation is a pending issue.

4.6 Japan

4.6.1 Overview

The latest official national accounts for Japan used by PZ covered the period 2001-2010They spliced these data with previous editions of national accounts to present annual estimates of national income for the period 1955-2011 and of national wealth since 1970. I have extended their series to 2015 (wealth) and 2016 (income) and revised the existing series for the previous period.

4.6.2 Explanation: wealth

PZ used the 2010 edition of Japan's National Accounts from the Cabinet Office, that covered the period 2001-2010 and followed the SNA93 (with 2005 as benchmark year). These national accounts report the balance sheets of institutional sectors (including the separation of the private sector into households and NPISH) and offer a great detail in the decomposition of assets and liabilities[33]. For the previous years (1970-2000), they used older editions of

[33]The main tables for institutional sectors balance sheets (Stock accounts classified by institutional sector) only decompose non-financial assets into four categories: inventories, fixed assets, land and other non-produced assets (this latter category are fisheries for households and subsoil assets for non-financial corpora-

national accounts: the 2000 edition (SNA93) and the 1990 edition (SNA68). In this update I use the 2015 edition of Japan's national accounts (with 2011 as benchmark year), which follows SNA2008 and covers a longer period than those used by PZ: 1994-2015[34]. One novelty of these accounts with respect to the 2010 edition, is that they systematically report two categories of natural capital for each institutional sector: mineral and energy resources (AN.212) and Non-cultivated biological resources (AN.213)[35]. For the earlier years (1970-1993), I follow PZ and rely on the previous editions of national accounts. Finally, I include an estimate of national housing and national natural capital for the period 1970-2015, as the sum of the holdings of these assets by the different institutional sectors[36].

Private wealth (figure 62): The national accounts of Japan already differentiate the households and the NPISH sectors. We report series of wealth for the two sectors separately, which are then added into the private sector[37]. For the period 1994-2015, I use directly the data from the 2015 National Accounts of Japan. Financial assets and liabilities already offer a great detail in their decomposition, but non-financial assets are only decomposed into 5 categories: inventories, fixed assets, land, mineral and energy resources and non-cultivated biological resources. To compute housing assets, I use data on dwellings from the supporting table "Net Capital Stocks of Fixed Assets classified by Institutional Sectors and Economic Activities (At current price)" and data on land underlying dwellings from the supplementary table "Value of Land by Prefectures (owned by Private Sectors)"[38]. This supplementary

tions; other institutional sectors only hold non-produced assets in the form of land). However, data offering greater detail in the decomposition of fixed assets and land are available in two supplementary tables to the national accounts: "Net Capital Stocks of Fixed Assets classified by Institutional Sectors and Economic Activities" and "Value of Land by Prefectures (owned by Private Sectors)".

[34] http://www.esri.cao.go.jp/en/sna/data/kakuhou/files/2015/29annual_report_e.html

[35] In the 2010 edition, only households and non-financial corporations included a non-produced asset different from land: fisheries in the case of households and subsoil assets in the case of non-financial corporations. In the new accounts, the general government also holds non-produced assets different from land (in the form of non-cultivated biological resources). Nevertheless, the value of these holdings, for the three sectors, is very small (see subsection natural capital).

[36] PZ report the value of private housing, but do not differentiate housing within the non-financial assets owned by other sectors. Natural capital is a memo item in their benchmark series of national wealth.

[37] Net wealth of NPISH is a very small part of private sector, with value closer to 20% of national income according to the latest national accounts (years 1994-2015). Households net wealth, on the contrary, is valued at around 600% of national income in the same period.

[38] According to the decomposition of dwellings across sectors from the fixed assets accounts, NPISH do

table decomposes the total value of land into three categories: land underlying buildings and construction (AN.2111), Land underlying cultivation (AN.2112) and Others. I compute land underlying dwellings by using the proportion of dwellings relative to other buildings and construction in the fixed assets accounts (this is the same procedure used by PZ and recommended by DINA guidelines). Note that this table (Land) is not available in the 2015 edition of the national accounts, so I use the data from the 2014 edition[39]. Overall, the new series of private wealth are slightly higher than the older ones during the 2000s, but are almost identical in the initial year of the new series: 1994. The difference between the two is mostly due to higher financial assets in the new series.

For the period 1970-1993, I extend separately the series of households and NPISH. For households I extend the following variables for which data are available: dwellings, land underlying dwellings, business assets[40], equity assets, pension and insurance assets, other financial assets and liabilities. Households net wealth is then obtained as the sum of the previous categories of financial and non-financial assets, net of liabilities. For NPISH I extend non-financial assets, financial assets and liabilities (there is no lower level of decomposition in the original data from PZ). In all cases the splicing procedure between the updated series and the series in PZ is the standard: extend backwards the new series using the growth rates of the equivalent categories in PZ. Over the period 1970-1993, the new series of private wealth are almost identical to those in PZ.

Public wealth (figure 63): For the period 1994-2015, data on public assets and liabilities are taken directly from the 2015 national accounts of Japan. These data include natural capital owned by the public sector (in the 2010 edition no category existed for public natural capital). In particular, the new accounts report a positive (although small) value for non-

not own dwellings. Only households do within the private sector.

[39]The values of total land owned by households are identical between the two editions over the period 1994-2013, but are slightly higher in the 2015 accounts for the year 2014: 680,525 billion of yens in the 2015 edition and 672,514 in the 2014 one. I then extend the total value of land in the 2014 edition to the year 2015 using the growth rates between these two years in the 2015 accounts. Data for the 2014 edition of the national accounts can be found in the following link: http://www.esri.cao.go.jp/en/sna/data/kakuhou/files/2014/28annual_report_e.html

[40]Within business assets, two additional categories are extended: agricultural land and natural capital.

cultivated biological resources of the government. According to the supporting table on fixed assets (see private subsection above), the general government does not own dwellings, therefore, it is not necessary to compute the value of housing for this sector. Unfortunately, one limitation of Japan's national accounts has to do with the presentation of the variable "Land", which in the benchmark balance sheets is not decomposed into different types. For households and corporations this is not an issue given that this decomposition is available in the supplementary table on land, but this is not the case for the government. Hence, it is not possible to separate public agricultural and forestry land from public built-up land.

During the period 1994-2011, the updated series of government wealth are higher than the old ones, by about 20-25% of national income. This is mostly due to higher non-financial assets and, to a lesser extent, to slightly higher financial assets too. By 1994 (first year of data in the new official series), the updated public net wealth equals 125% of national income while it was 104% in PZ. To extend the series backwards to 1970, I splice the latest official series with those in PZ. Before 2000, PZ report data for three variables of the public sector: non-financial assets, financial assets and liabilities. I then extend these three variables in the new data with the growth rates of the equivalent ones in PZ for the period before 1994. In addition, I extend also the public natural capital series (see subsection on natural capital). Given the initial differences in 1994, government wealth is also higher in the revised series during the 1970-1993 years. However, differences tend to decrease backwards in time due to the better financial position (financial assets net of liabilities) of the Japanese government at the beginning of the 1970s, and to the lower importance that non-financial assets had in these initial years.

Corporate wealth (figure 64): The procedure to update the corporate wealth series follows that of the private and the public sectors: use the new official national accounts for the period 1994-2016, and extend backwards the new series with the growth rates in those from PZ. The only difference between the new series and those in PZ is that I include an estimate of housing and natural capital owned by corporations (see the subsections housing

and natural capital). Overall, the updated series are very close to the old series, with Tobin's Q being slightly higher in the new ones.

Housing (figure 65): In this update I provide series of national housing (as the sum of housing owned by the different institutional sectors), in addition to the series of private housing presented by PZ. As explained in the private sector section, to construct the variable housing it is necessary to estimate two of its subcomponents for each sector: dwellings (the value of the structure) and land underlying dwellings. According to the supplementary tables on fixed assets (which in the latest national accounts of 2015 cover the period 1994-2015), only households and corporations own housing in Japan. For these two sectors, it is possible to reconstruct land underlying dwellings using the supplementary table on land, which decomposes the land of these sectors into three different types: land underlying buildings and constructions, land underlying cultivations, and others. During the period 1994-2015, households' share on national housing represented between 85% and 87% of the total, the residual being held by corporations. It is easy to extend the series of private housing backwards to 1970, given that these two variables were already estimated by PZ.

To reconstruct corporate housing over the 1970-1993 period, I need to make some assumptions. This is because data are not available for dwellings or for land owned by this sector over these years as a separate item within the corporate balance sheet. I start by observing that the share of corporate dwellings over total national dwellings is relatively constant over the 1994-2015 years: between 13% and 15% of the total. Then I assume that the share observed in 1994 (15%) is constant for the previous period too. This way I obtain an estimate of corporate dwellings based on the private series. Then I calculate corporate land underlying dwellings. To do this, I assume that the value of corporate land relative to households' land kept the same proportion over the period 1970-1993 than the one observed in 1994, and I apply the ratio of land over dwellings to the previously calculated series. Needless to say, this estimate should be taken as an imperfect approximation in the absence of richer data, with the goal of having national, and not only private, series of housing.

Overall, these estimates point to corporate housing representing around 7% to 10% of total national housing over the full period 1970-2015.

Agricultural land: I use the latest national accounts of 2015 to report agricultural land owned the private and corporate sectors for the years 1994-2015. In both cases, I use the variable "land underlying cultivations" in the supplementary table to the national accounts on land (see private sector subsection). Given that similar data are not available for the government sector, I do not report data for this sector or for the national economy (the latter would be the sum of agricultural land owned by the private, corporate and public sectors). Before 1994, I only extend backwards the series of private agricultural land using the equivalent variable in PZ (which is available since 1970). The splicing procedure is the standard: extend backwards the updated series with the growth rates in PZ.

Natural capital: The latest national accounts already report data on natural capital for every institutional sector, concretely for the following two variables: Mineral and energy resources (AN.212) and non-cultivated biological resources (AN.213). On the contrary, the 2010 edition of the national accounts used by PZ only reported data for two items: fisheries owned by households and subsoil assets owned by corporations. PZ reported these assets as a memo item, not included in their benchmark series of wealth.

For the period 1994-2015, I use the data on natural capital directly from the 2015 national accounts. Overall, the value of these assets is very small (below 3% of national income over the period 1994-2015). For the period before 1994, PZ report the value of total natural capital in Japan. I then extend national natural capital with the growth rates in PZ, and assume that the distribution across sectors follows the same proportions than in 1994. This is a rough approximation. However, given the small dimension of these assets, these assumptions have no significant consequences on the aggregate values of wealth for each institutional sector.

4.6.3 Explanation: income

PZ used the Annual Report of National Accounts (benchmark year 2010), which followed SNA93. In this update I use the Annual Report of National Accounts (benchmark year). The latest report provides annual national income accounts for the period 1994-2016 and follows SNA2008. The report used by PZ covered the period 2001-2011. I splice the new series with the old ones using the proportional difference between the new and the old series by 1994.

Figures 66, 67, 68 and 69 compare the updated series with those in PZ in the following four dimensions: net capital income (% net factor-price national income), gross capital income (% gross factor-price national income), gross capital formation (% national income) and net capital formation (% national income). In addition, figure 70 compares the difference in nominal value of the series of gross capital formation and consumption of fixed capital (this difference in nominal values is expressed as a percentage of the updated series of GDP). Overall, new series of net-of-depreciation capital income are slightly higher than the old ones in the initial years (up to the 1990s) but then converge to the old values in the last two decades. Gross-of-depreciation capital shares follow the opposite trajectory: they are almost equal to the old series before the 1990s but then are higher afterwards. The case of Japan, therefore, is somewhat different to that of other countries. In particular, I find higher values of gross capital formation in the new series throughout the whole period, with net capital formation showing similar values in both the updated and the series in PZ. Hence, difference between net-of-depreciation capital share should respond to other elements of capital income that have been revised by Cabinet Office of Japan, and not only to the adoption of the SNA2008 and the inclusion of R&D as gross investment.

4.7 United Kingdom

4.7.1 Overview

PZ's data for the UK spliced different periods of official national accounts, some of them starting as far as 1948, and ending in all cases in 2010. In addition, they presented annual series of national income and of private, public and national wealth since 1855. I have extended the series to 2015 (wealth) and 2016 (income) and revised the existing series for the period before.

4.7.2 Explanation: wealth

For the period 1987-2010, PZ used the 2011 edition of the official national accounts in the UK ('Blue Book'), produced by the Office for National Statistics (ONS). This edition follows the SNA93. Before 1987, they combined official national accounts from previous editions of the Blue Book with the work of economic historians and contemporaneous authors. In this update I use the latest edition of the Blue Book (2016), which already follows SNA2008 and covers the years 1995-2015 for non-financial assets and 1987-2015 for financial assets and liabilities. To cover the period 1987-1995 for non-financial assets, I have used data from the Blue Book of 2012, whose values are almost identical to the 2016 Blue Book during the years in which both editions coincide: 1995-2011. In addition, I splice the new series with the historical ones. A correction is made to the series of private housing for the period 1948-1987, to make them more consistent with the way SNA defines economic assets and classifies them across sectors. I also estimate national housing and agricultural land during the period 1920-2015 (in PZ, the focus was in housing and agricultural land owned by the private sector). It is worth noting that the ONS prepares a substantial revision of their balance sheets in the next edition of the Blue Book (2017), which will affect the measurement of land and its classification across sectors[41].

[41] ONS's revision of the Blue Book is a step forward to fully adapting the SNA's guidelines. In this edition, housing and other types of constructions will be separated into the produced element (structure) and the non-produced element (land underlying). It will also report separately the households sec-

Private wealth (figure 71): For the period 1987-2010, PZ's data for the UK comes straight from the 2011 edition of the Blue Book, which reports together (not separately) the households and the NPISH sectors. For the years 1948-1986, they relied on the work of Blake and Orszag (1999) ('BO', from now on) while for the period 1920-1948 they used the estimates from Solomou and Weale (1997). For the period 1855-1920, they present annual series of net private wealth based on certain year-specific estimates made by contemporaneous authors, which they splice using accumulation equations.

In this update, I use the 2016 edition of the Blue Book to cover the period 1987-2015. The only exception are non-financial assets, which are not available in the 2016 edition and are taken from the 2012 edition instead[42] (see above). The extension for the period 1920-1987, is a bit complex. For non-financial assets, PZ present two series of assets: housing and other business assets. For housing, I make a conceptual correction (see below: sub-section 'housing'). Other business assets are extended using the standard procedure: take the most recent series, and extend them using the growth rates in the old ones. Between 1948 and 1987, total financial assets are the result of extending, separately, two sub-categories of assets which are available in these years: pension assets and other financial assets. Before 1948, only total financial assets are available. In all cases, the extension of financial assets is based on the standard procedure. Liabilities are extended throughout the period 1920-1987 without a further decomposition and using the same procedure than with other business assets and financial assets. For the period 1855-1920, PZ present annual series of net private wealth but not for different subcomponents. This is because they calculate net private wealth in some specific years, which are then spliced with accumulation equations. Given that the new and

tor (S.14) and the Non-profit institutions serving households sector (S.15) and will split cultivated assets into agricultural and forestry types. Importantly, there will be a significant reallocation of housing across sectors, reducing the holdings of households and increasing those of public corporations (NPISH will not own housing). This is likely the result of classifying housing associations within the public corporate sector. See: https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/articles/nationalaccountsarticles/changestothenationalbalancesheetforthebluebook2017

[42]Up to the 2011 edition of the Blue Book, non-financial assets included the category "non-marketable tenancy rights", which are not an asset according to SNA (reason why PZ excluded this variable in their series). Since the 2012 edition, this variable is no longer part of the private sector balance sheet. Hence, I do not need to make any adjustment to the data.

the old series of private wealth are almost identical by 1920, I take directly the values in PZ without modification.

Public wealth (figure 72): PZ present two series of government wealth, the benchmark series correcting financial assets and the non-corrected series. In this update I use the corrected series. These series upgrade government net wealth during the 1940-2010 years by including within them the net wealth of the public corporate sector. This is due to a significant mismatch between market-value and book-value of equity for public corporations, which artificially lowers government financial assets (see (Piketty and Zucman, 2014b, pg. 105)). Before 1958, Piketty and Zucman use accumulation equations to extend the non-financial assets of the public sector based on existing estimates for certain years (they do have data on net financial assets). Then, they add non-financial assets, net financial assets and the net wealth of public corporations to obtain total government wealth[43].

I follow the same procedure. For the years 1987-2015, I use the ONS2016 and ONS2012 series of government wealth to which I add the net wealth of public corporations (over these years this variable is very small: between 1-6% of national income). Then I extend backwards the series of non-financial assets, financial assets and liabilities, using the growth rates of the equivalent series in PZ. Non-financial assets are available since 1958 (including two subcomponents: housing and agricultural land), but detailed data on financial assets and liabilities are only available since 1967. Given that by 1967 the new series of government wealth are very close to those in PZ (31% of national income ad 29% respectively), I extend the variable government wealth for the period 1855-1967 using the series in PZ without further modification.

Corporate wealth (figure 73): In this update I report the corporate balance sheet for the years 1988-2015. For financial assets and liabilities, data come from the 2016 edition of the Blue Book. For non-financial assets, the data corresponding the years 1995-2015 come from the Blue Book of 2016, while data for the period 1988-1995 come from the 2012

[43]Net wealth of public corporations is only significant since 1940 onwards.

edition of the Blue Book (the two vintages of national accounts are spliced with the standard procedure: extending the new series with the growth rates of the older ones). In addition, data for housing and agricultural land are extended backwards to 1967 (these variables are available since this date in the Blue Book of 2012). Overall, the updated Tobin's 'equity' Q is close to the old one, but it is slightly higher. This is mostly the result of higher values for non-equity liabilities in the new series, which reduce the net worth of corporations (denominator in the Q ratio).

Housing (figure 74): In this update, I make some conceptual corrections to the measurement of private housing in PZ for the period 1948-1987. Over these years, they use the data from BO, but the measurement of housing in BO is not fully consistent with the current definition and sector classification of economic assets in SNA guidelines. In addition, I account for housing owned by corporations and the government, two concepts that were not previously differentiated within the non-financial assets of corporations and the government in PZ. Note, however, that the actual values of the new series do not differ substantially from the older ones (figure 75), but they are better at approximating the changing tenure structure in the UK: the rise of social housing during the 1960s and 1970s, and the reversal after the introduction of the Right to buy Scheme at the beginning of Margaret Thatcher's government[44].

The backwards extension to 1948 is more complex. Over the 1948-1987 years, PZ used data from BO, which they slightly upgraded to match the ONS's series of private housing from 1987 onwards. However, BO series are not completely compatible with the modern series of housing, for two reasons:

[44]The Right to buy scheme is a policy enacted by the Thatcher's government and still active today, which was passed within the Housing Act 1980. It allowed tenants of social housing owned by local authorities, to buy their homes with a discount with respect to their market value (between 33% and 50% discount), and which was complemented with lending facilities to access housing mortgages. Under this scheme, social housing sales peaked during the 1980s, lowering afterwards (for a detailed description, see chapter 5 in Whitehead and Scanlon (2007)). In 2015, the Cameron's government extended the Right to buy scheme to social housing owned by housing associations (the other major provider of social housing in the UK, together with local authorities, and which presence has risen since the 1980s). For data on the evolution of UK's housing tenure structure see: https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants

1. BO estimate personal housing, and not private housing. However, housing associations (a type of NPISH) own a non-negligible share of the UK's housing stock: from 2% of the total stock in 1980 to 10% in 2014. Hence, they should be included within housing owned by the private sector.

2. Their measure of personal housing is not compatible with the SNA criteria to classify assets at the sector level. This is because they include "non-marketable tenancy rights" within personal housing. From 1975 onwards, BO use data on personal wealth from historical versions of the UK national accounts. In these series, the ONS estimated an asset category for tenants named "non-marketable tenancy rights". However, this asset category is not recognized as such in the SNA (reason why PZ also deduct their value in the post-1987 period, when they use the 2011 Blue Book series that still included this category). For the period 1948-1975, BO multiply the average market value of dwellings by the number of owner-occupied dwellings. Then, they calculate "non-marketable tenancy rights" for the remaining stock of dwellings (which include, mainly, tenants of both private and social dwellings). They assume that non-owner-occupied dwellings are worth a constant 70% of the market value of owner-occupied dwellings, which is the ratio of tenancy rights relative to owner-occupied dwellings observed in the official ONS data for 1975.

   But this is incorrect. To explain the need for a correction, let me explain the tenure structure in the UK and how the sector classification should be according to the SNA. In the UK, there exist 5 types of tenure: (a) Owner-occupied; (b) Rented privately; (c) Rented from local authorities; (d) Rented from housing associations; (e) Other public sector dwellings. From the SNA perspective, (a) and (b) are part of the personal sector; (c) are social dwellings owned by public corporations; (d) are social dwellings owned by NPISH; (e) are dwellings owned by the public sector. Hence, housing of the private sector (personal plus NPISH) should include categories (a), (b) and (d). Category (c)

should be part of the corporate sector and (e) of the public sector[45]. However, BO are assuming, implicitly, that the average market value of dwellings is only representative of owner-occupied dwellings and that both social and privately rented dwellings should be part of personal housing with a 30% discount with respect to the average market value. In a historical period (1948-1987) of drastic changes in the tenure composition in the UK (figure 76)[46], this approach is particularly problematic.

I propose an alternative estimate of housing in the UK for the period 1948-1987, which accounts for national housing, and which is decomposed across institutional sectors (private, corporate and public sectors). Firstly, I obtain national housing over the period 1948-1987 by multiplying the average price of dwellings by the number of dwellings in the UK (data from table 3 in BO). Then I upgrade the value of these series to match the ONS data since 1987 (ONS series are about 10% higher by 1987). Next, I decompose national housing into the private sector (households plus NPISH) and the non-private sector (corporations plus government). I do this by comparing two indicators for the period 1987-1994 (period of overlap of BO series and the new ONS accounts): (i) the evolution of private tenure as a percentage of total UK households; (ii) the share of national housing owned by the private sector in ONS statistics. I observe that during the period 1987-1994: (i) the average share of private tenure was 77%; (ii) the average share of the private sector on the value of national housing was 90%. I then split total national housing over the period 1948-1987 into private and non-private owners according to the corresponding tenure proportions. Then I upgrade this splitting to account for the higher value of private housing relative to non-

[45] General government dwellings are almost negligible during the whole period (i.e. below 1% of national income) given that local authorities, the main public housing provider, own equity on public corporations providing social housing. Therefore, dwellings owned by local authorities are classified within the corporate sector, while the equity held by local authorities on these corporations are classified within the general government financial assets.

[46] Sources for this figure are: Department for Communities and Local Government (2012, last update April 2017): https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants and ONS historical data on England and Wales tenure: http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/rel/census/2011-census-analysis/a-century-of-home-ownership-and-renting-in-england-and-wales/short-story-on-housing.html

private housing using the proportions of private value vs private tenure observed in the 1987-1994 years (1.16 = 90/77).

Finally, for the period 1920-1948, I follow PZ and splice the new series of private housing with those of Solomou and Weale (1997) so they converge by 1940. I also make a rough estimate of non-private housing by using the proportion of non-private tenure over the total. By 1919, non-private tenure represents 1% of the total stock of dwellings in the UK, and 10% by 1939. I linearly interpolate in between. These values for non-private housing should be seen as a rough approximation in the absence of more specific data.

Agricultural land: In this update I estimate private, corporate and public agricultural land. For the period 1995-2015, I use the latest Blue Book of 2016, and I take the value of the variable "Cultivated biological resources" at the sector level. Note that this variable includes both the produced element (i.e. crops) and the non-produced element (land). It also groups agricultural and forestry land together. Hence, it overestimates the value of this asset. However, the bulk of this value probably captures agricultural land: forestry land is almost negligible in the UK, according to the UNU-IHDP Inclusive Wealth Report, and produced agricultural asset are typically about 15% of the value of land in other countries. In the forthcoming 2017 edition of the Blue Book, ONS plans to estimate separately agricultural land from the other components.

For the period 1987-1995, I splice the ONS2016 series with the equivalent in ONS2012. By 1995, the ONS2016 are slightly higher than the ONS2012, so I apply the standard splicing procedure: extend the new series with the growth rate of the old ones. The ONS2012 series are identical to the data used by PZ. Hence, I splice the new series with those in PZ for the period 1920-1987. Over the period 1920-1987 I also estimate national agricultural land. I observe that by 1987, private agricultural land represents 87% of national agricultural land. I assume that this value goes up to 100% in 1920, and I linearly interpolate in between. Overall, agricultural land has a limited role in the UK throughout the period 1920-2015, representing 33% of national income in 1920 and 14% in 2015.

Natural capital: Data for natural resources other than forestry land (which is included in the variable cultivated assets: see above) are not available in UK's balance sheets. According to the UNU-IHDP Inclusive Wealth Report, as of 2010 energy and mineral reserves are almost negligible in the UK (around 2% of GDP).

4.7.3 Explanation: income

In this update I use the 2017 edition of the UK National Accounts, which follows the SNA2008. PZ, by contrast, used the 2011, which followed the SNA1993. The latest accounts provide data since 1948, but some components are only available since some more recent years. As a general rule, I use the latest accounts and splice them with the historical series in PZ using the proportional difference between the new series and the old ones.

Figures 77, 78, 79 and 80 compare the updated series with those in PZ in the following four dimensions: net capital income (% net factor-price national income), gross capital income (% gross factor-price national income), gross capital formation (% national income) and net capital formation (% national income). In addition, figure 81 compares the difference in nominal value of the series of gross capital formation and consumption of fixed capital (this difference in nominal values is expressed as a percentage of the updated series of GDP). As figure 77 shows, the new series of net-of-depreciation capital income are substantially higher than the old ones. Figures 82 and 83 show the capital income of the three production sectors: housing, non-corporate businesses and corporations. The comparison the two figures shows that the increase is mostly due to higher housing capital income (operating surplus of households and non-profit institutions). This is due to a large revision undertaken by the ONS in the 2016 edition of the Blue Book[47]. The large revision was due to improvements to data sources and methods in the calculation of owner-occupied imputed rentals. In particular, the deflator used to calculate current price was greatly improved with the introduction and

[47] Seethefollowinglinkforathoroughdescriptionofthechanges:https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/articles/changestonationalaccounts/imputedrental

use of administrative data. Figure 84 shows the important difference between the gross operating surplus in the 2017 edition of the Blue Book with respect to the 2012 one. Overall, this change has a profound impact on both the net and gross capital shares, much more important that any possible change in the accounting of R&D investment.

4.8 United States

4.8.1 Overview

PZ present series of US national income and private and public wealth, with annual frequency, for the period 1870-2010 and for corporate wealth for the period 1946-2010. In this update I use the new data on US income and wealth from Piketty et al. (2018), which revise the existing series of PZ for the years 1913-2010 and extend them for the years 2011-2015. In addition, I splice these new series with those in PZ for the years 1870-1913.

4.8.2 Explanation: wealth

PZ covered in great depth the evolution of wealth in the US. They provide annual series of private and public wealth since 1870 and of corporate wealth since 1946. These series end in 2010. In a recent work, Piketty et al. (2018) ('PSZ' from now on) update these series to 2015, presenting the private and public series since 1913 and the corporate ones since 1946. In this update I use directly these revised data. In addition, for the private and public sectors, I splice the series of PSZ with those of PZ for the years 1870-1913. The splicing procedure is very simple. Public wealth series are equal in the new and updated series in 1913, so I take data from PZ for the previous period without any modification. The new series of private wealth, however, are slightly higher in 1913: they are equal to 469% of national income in the updated series and to 437% in the old version. I then make the two series converge in 1907, and assign a negative annual capital gain of 1.5% to the growth rates of the updated series over the years 1907-1913. Figures 85, 86 and 87 compare the update and the old series of private, public and corporate wealth (Tobin's Q), respectively.

In addition, I include two new series in this update of the WID.world database: national housing for the period 1946-2015 (figure 88) and national agricultural land for the period 1913-2015 years. Data are taken directly from the sector-specific wealth series in PSZ. Natural capital other than land is not covered in PZ or PSZ given that these data are not reported in the official balance sheets of the US.

4.8.3 Explanation: income

In the case of income, I do not carry any adjustment and take directly all income components from PSZ for the available period (1913-2015), spliced with the series in PZ for the years 1870-1912.

Figures 89, 90, 91 and 92 compare the updated series with those in PZ in the following four dimensions: net capital income (% net factor-price national income), gross capital income (% gross factor-price national income), gross capital formation (% national income) and net capital formation (% national income). In addition, figure 93 compares the difference in nominal value of the series of gross capital formation and consumption of fixed capital (this difference in nominal values is expressed as a percentage of the updated series of GDP). Overall, new series of net-of-depreciation capital income are similar to the old series with the new series being slightly below the old ones in recent years. Gross-of-depreciation series have slightly higher values in the new series since 1970 but converge to the old series in the latest years. As in other countries, net capital formation in the new and the old series are almost equal with gross capital formation being higher in the new series.

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Figures and tables

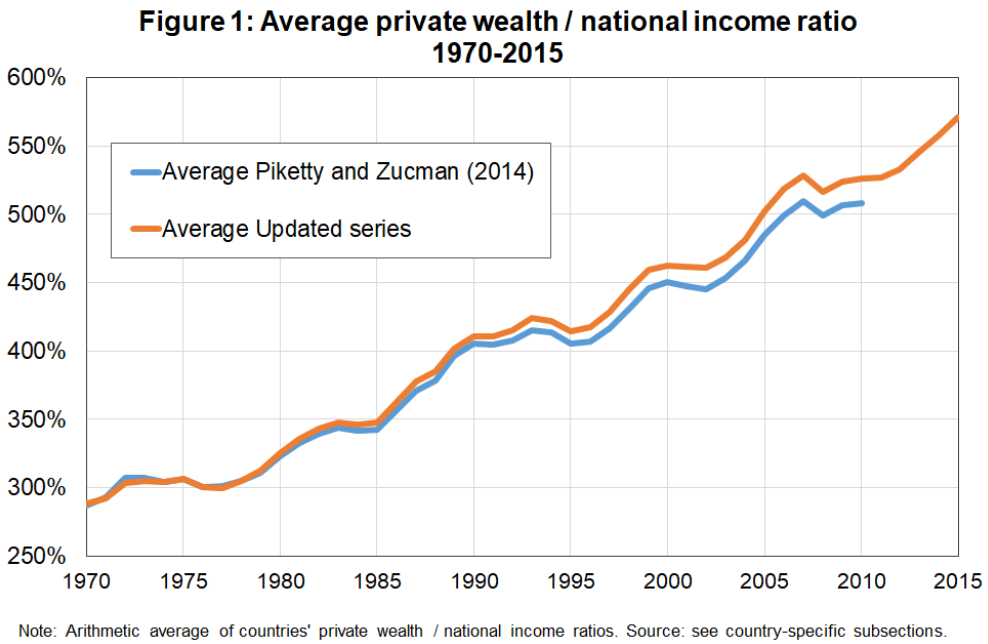

Figure 1: Average private wealth-to-national income ratios, 1970-2015

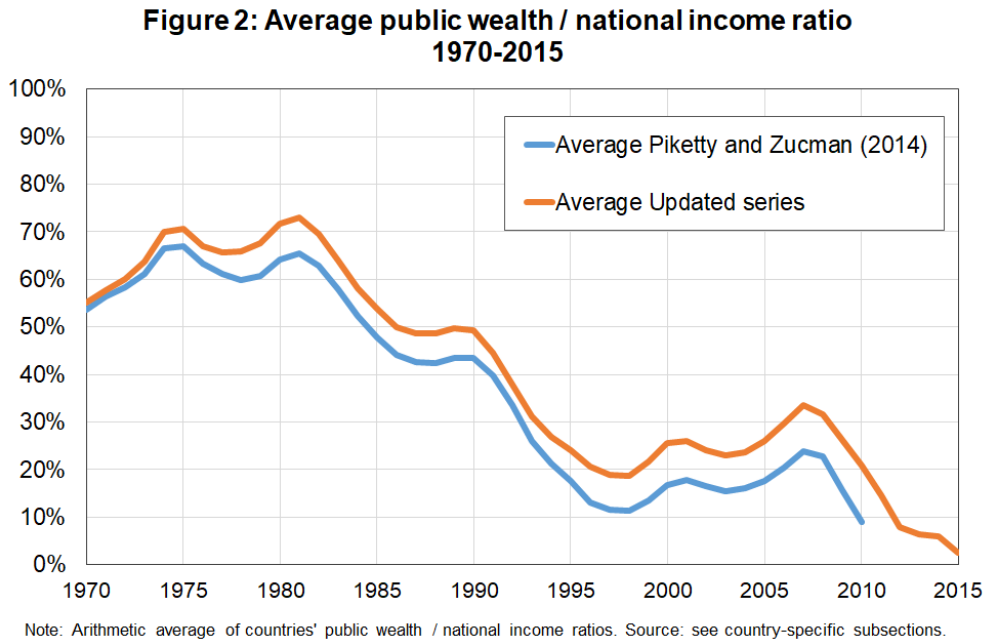

Figure 2: Average public wealth-to-national income ratios, 1970-2015

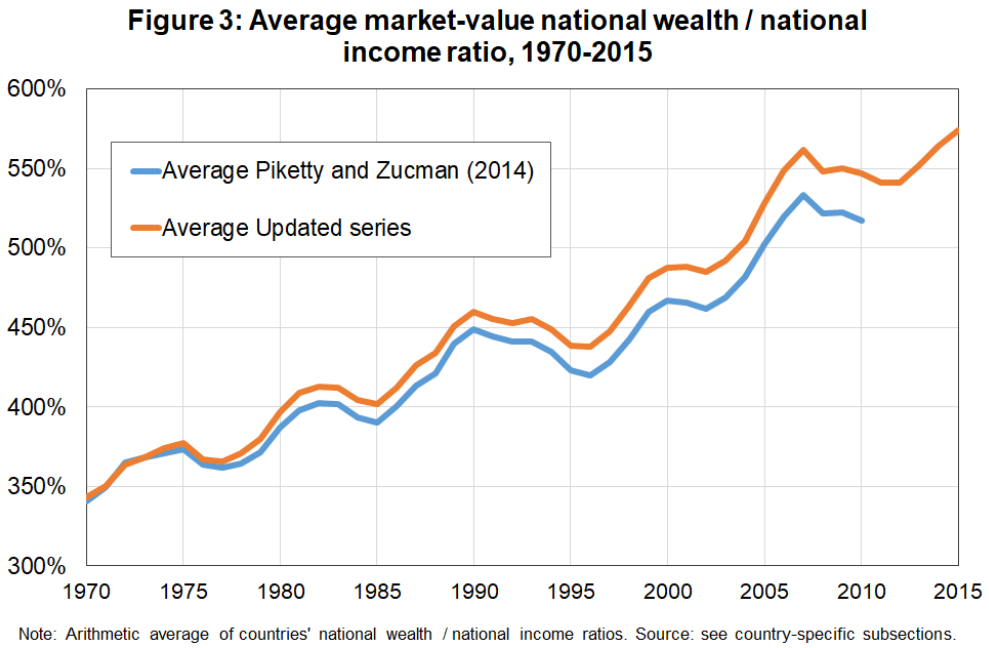

Figure 3: Average market-value national wealth-to-national income ratios, 1970-2015

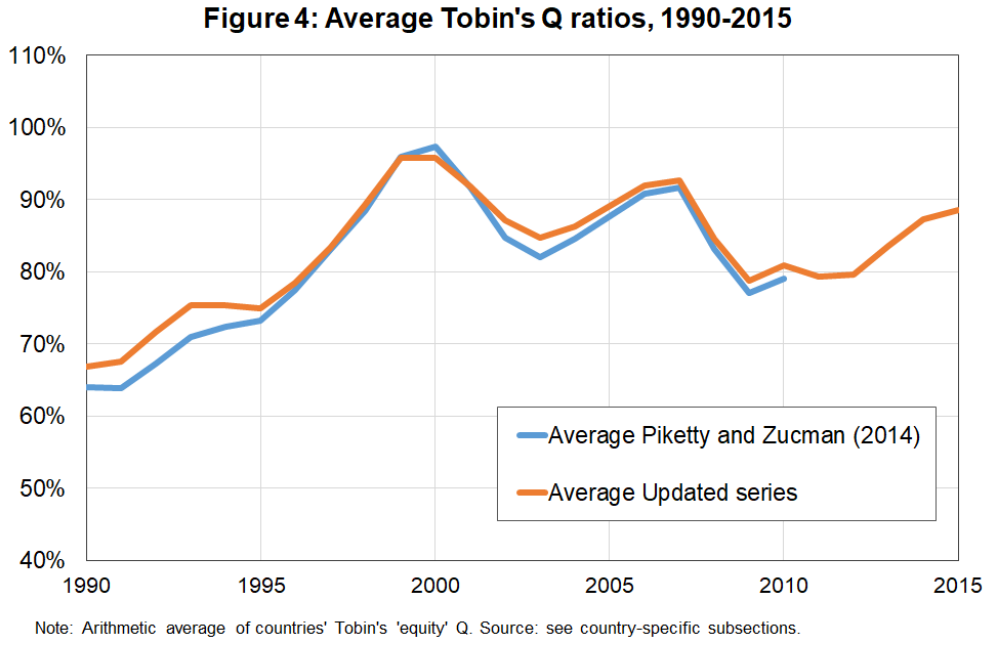

Figure 4: Average Tobin's Q ratios, 1990-2015

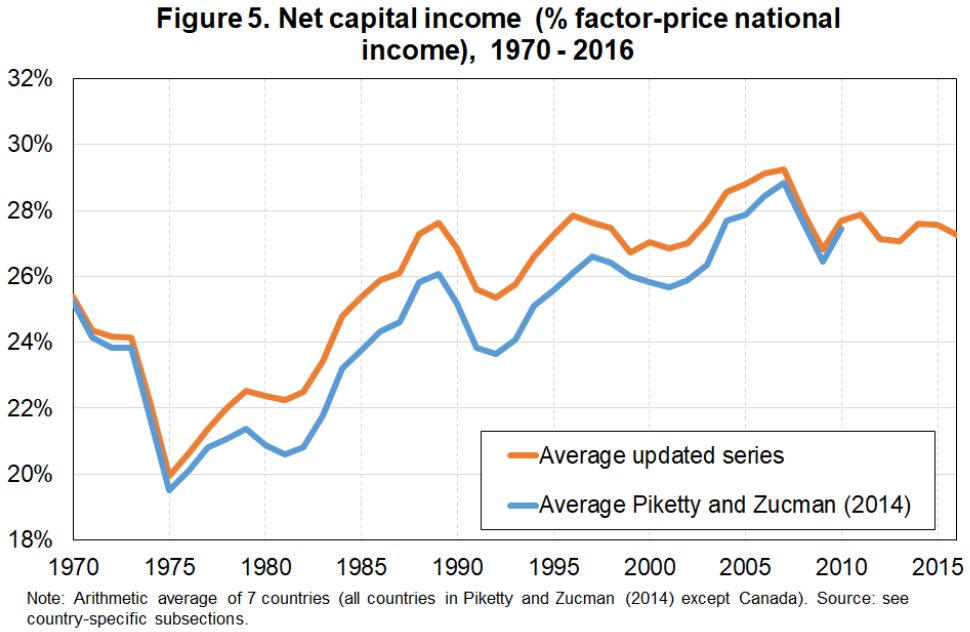

Figure 5: Average net capital income (% net factor-price national income), 1970 - 2016

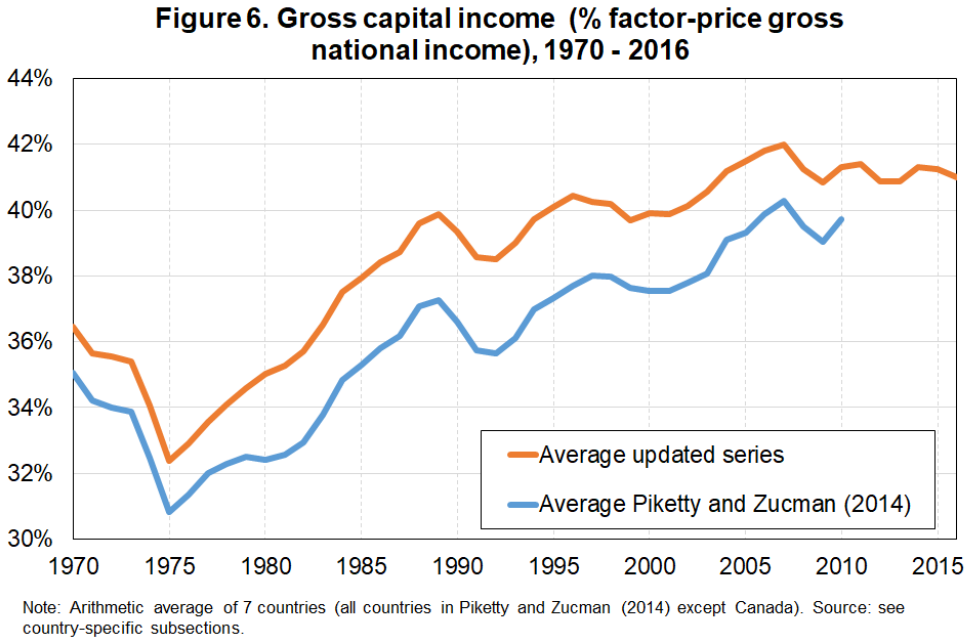

Figure 6: Average gross capital income (% gross factor-price national income), 1970 - 2016

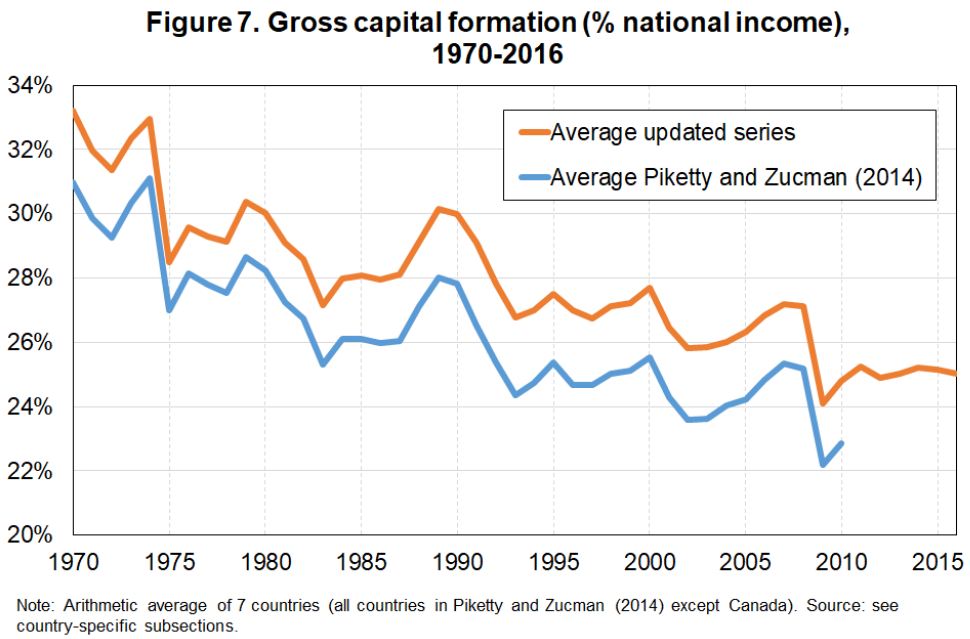

Figure 7: Average gross capital formation (% national income), 1970-2016

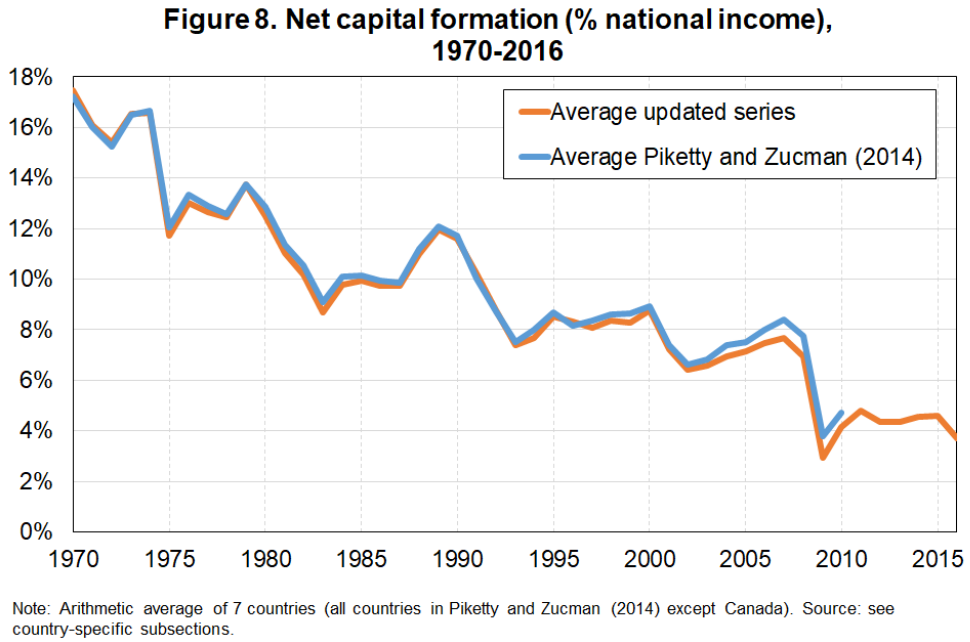

Figure 8: Average net capital formation (% national income), 1970-2016

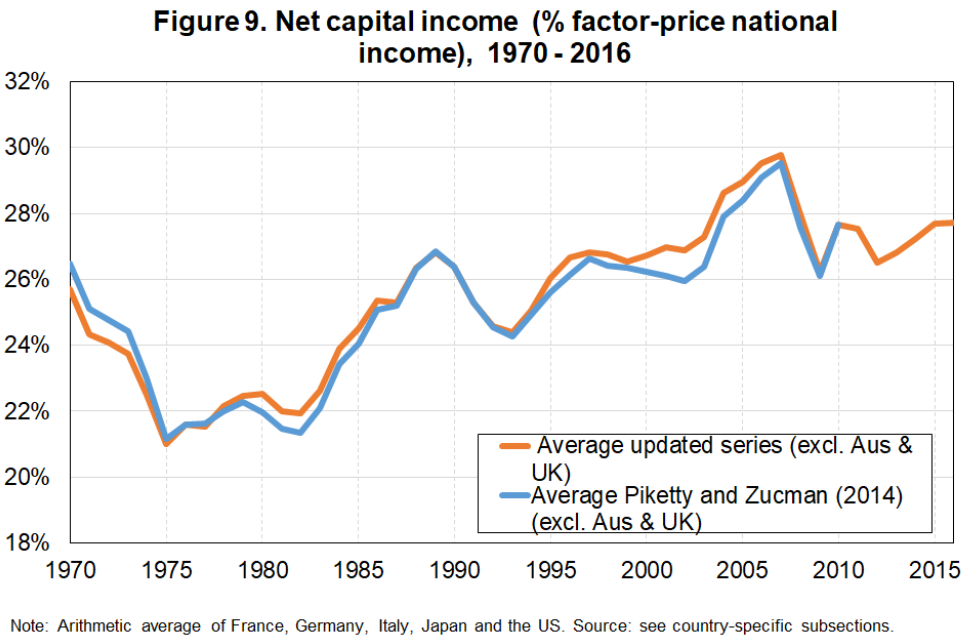

Figure 9: Average net capital income (% net factor-price national income), 1970 - 2016 (excluding Australia and UK)

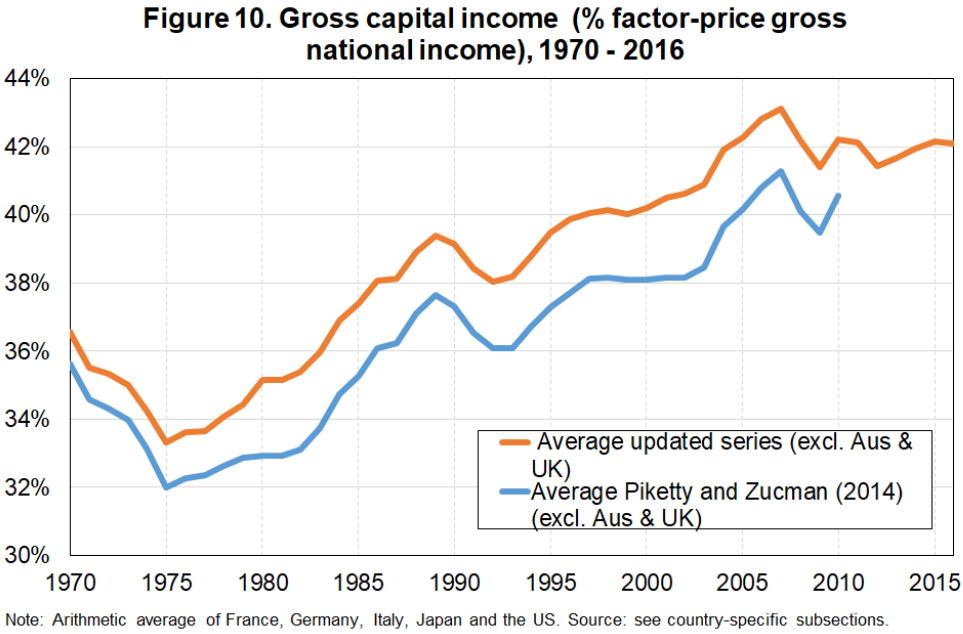

Figure 10: Average gross capital income (% gross factor-price national income), 1970 - 2016 (excluding Australia and UK)

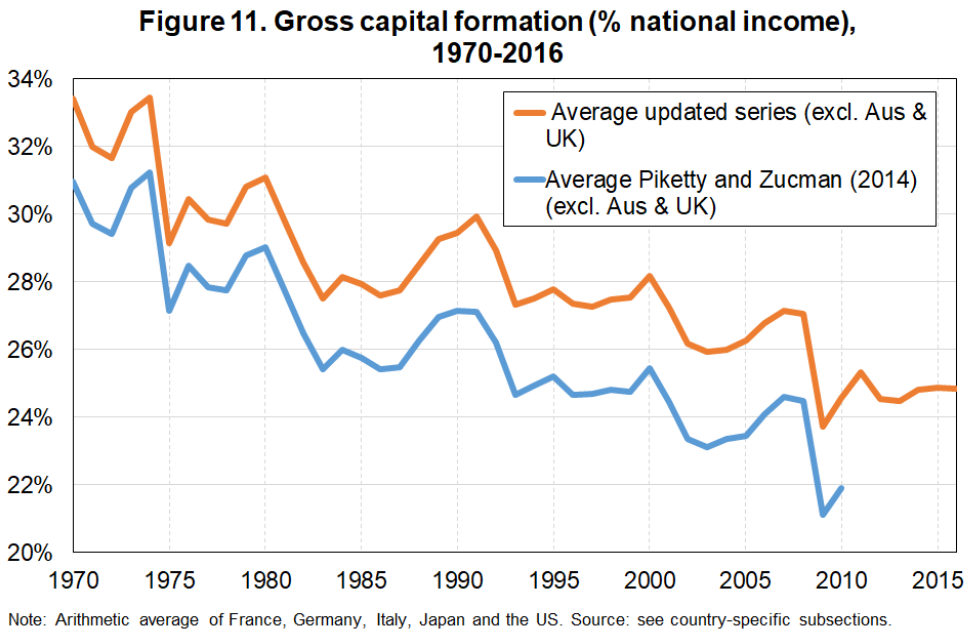

Figure 11: Average gross capital formation (% national income), 1970-2016 (excluding Australia and UK)

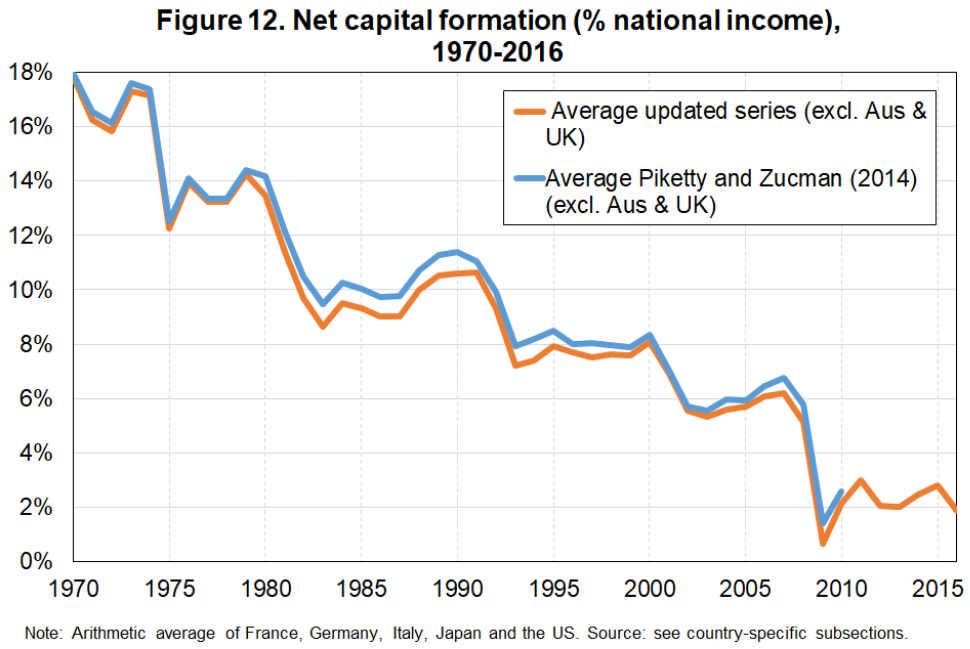

Figure 12: Average net capital formation (% national income), 1970-2016 (excluding Australia and UK)

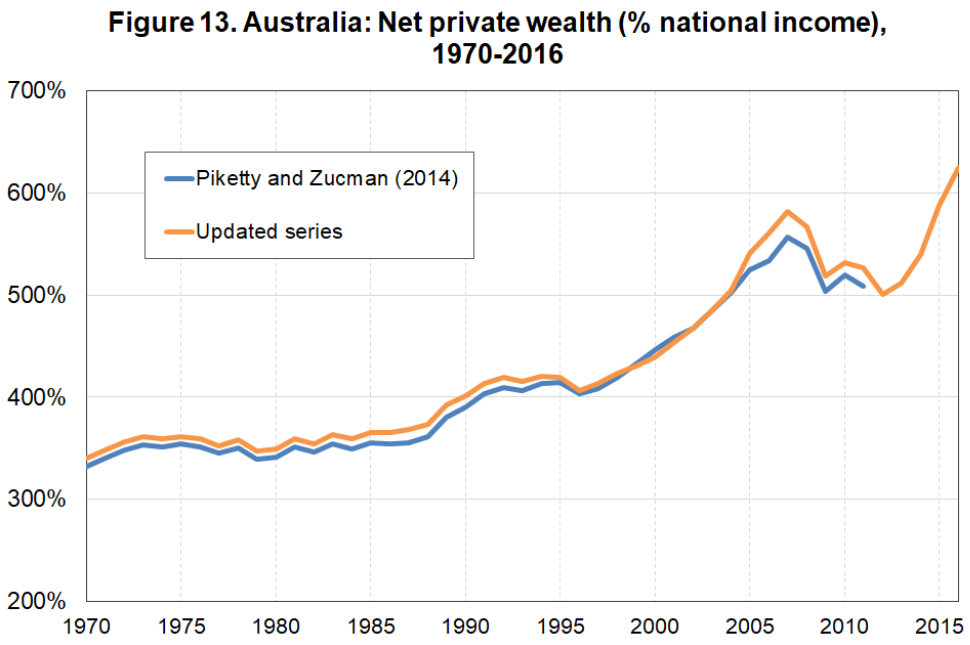

Figure 13: Australia: Net private wealth (% national income), 1970-2016

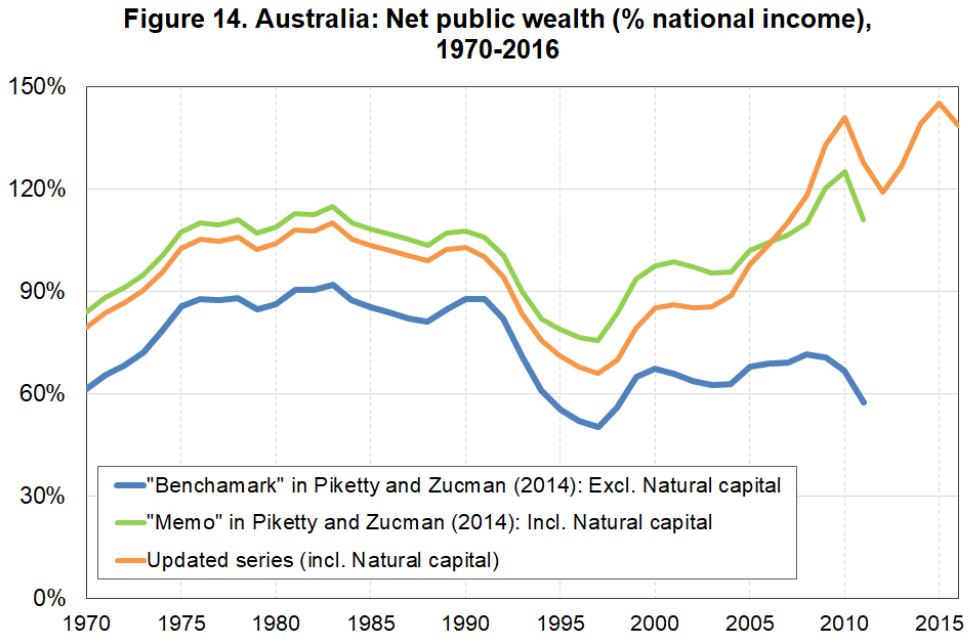

Figure 14: Australia: Net public wealth (% national income), 1970-2016

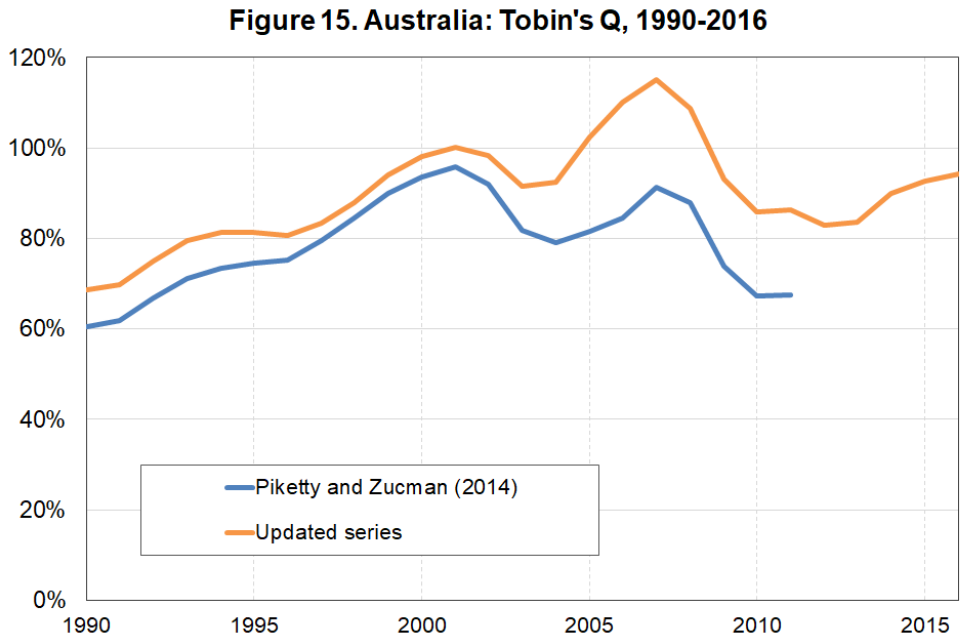

Figure 15: Australia: Tobins'Q, 1990-2016

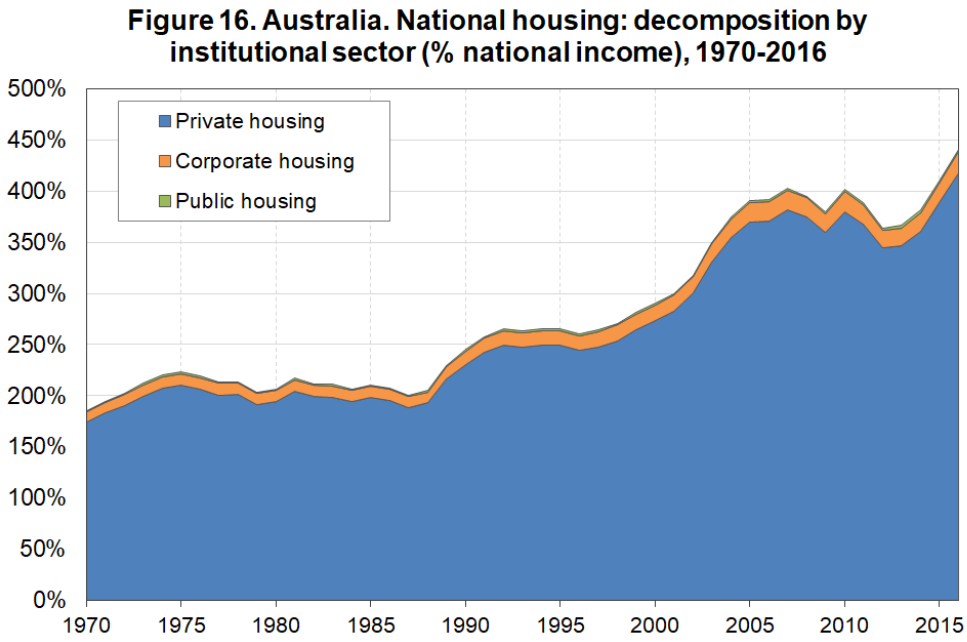

Figure 16: Australia: National housing: decomposition by institutional sector (% national income), 1970-2016

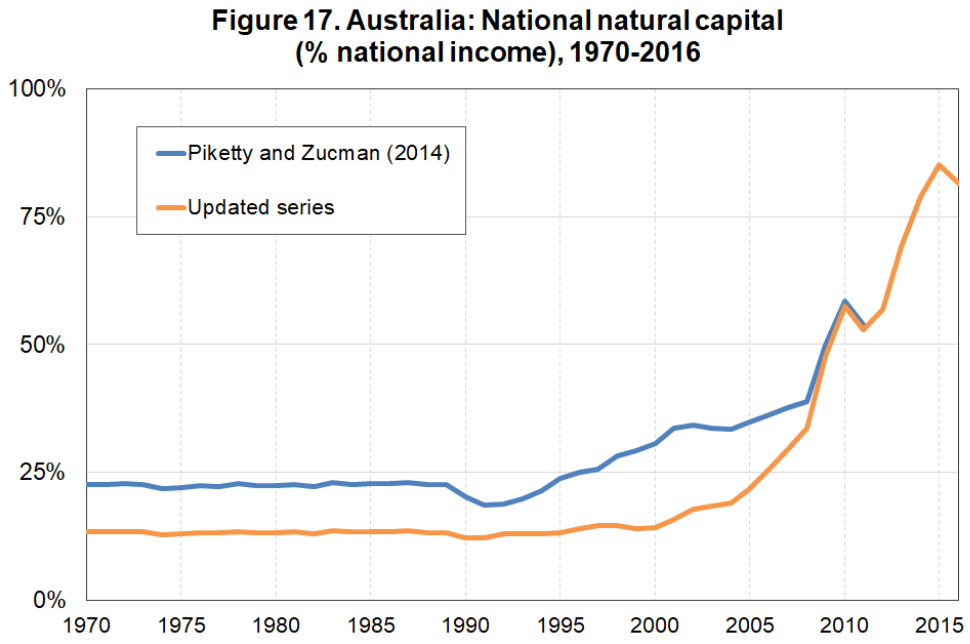

Figure 17: Australia: Natural capital (% national income), 1970-2016

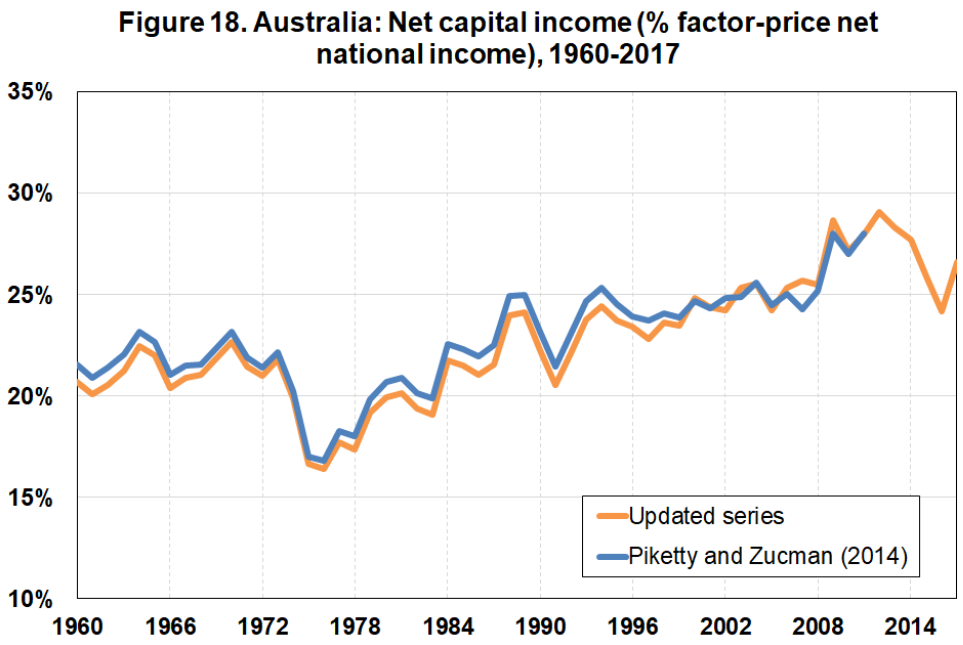

Figure 18: Australia: Net capital income (% factor-price net national income), 1960-2017

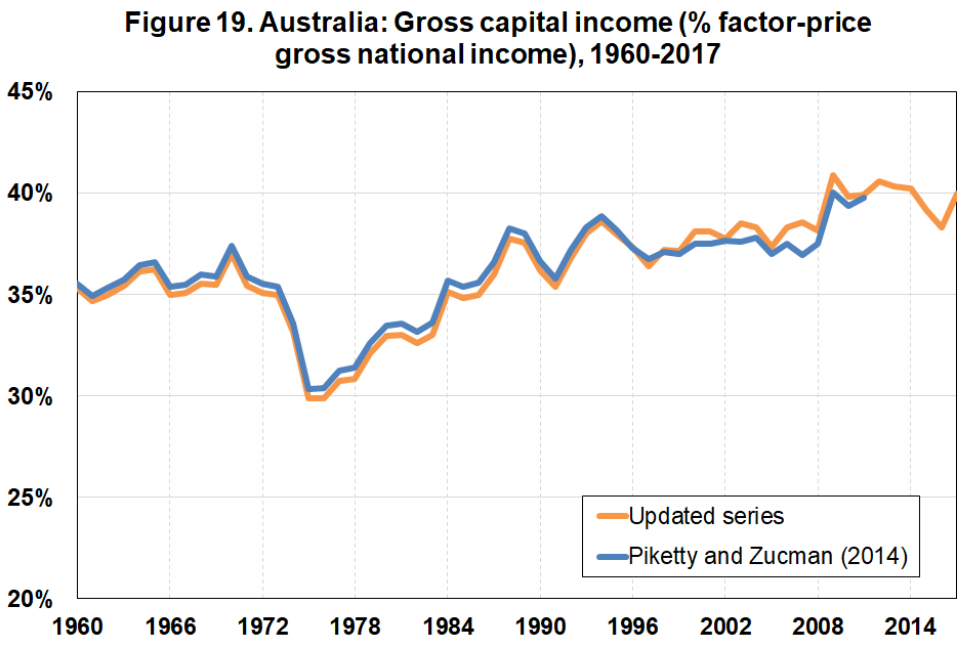

Figure 19: Australia: Gross capital income (% factor-price gross national income), 1960-2017

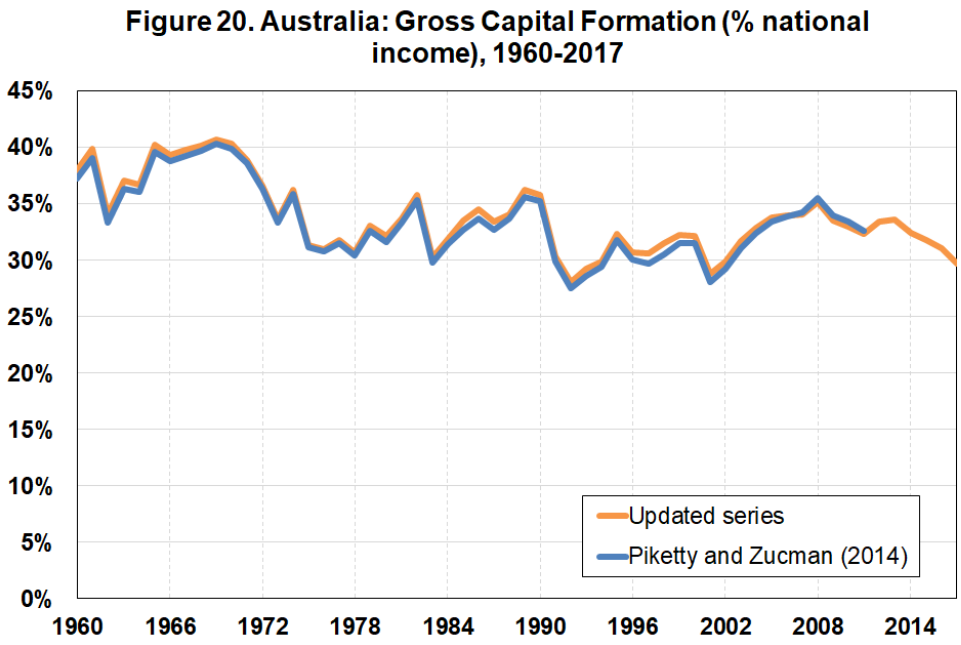

Figure 20: Australia: Gross capital formation (% national income), 1960-2017

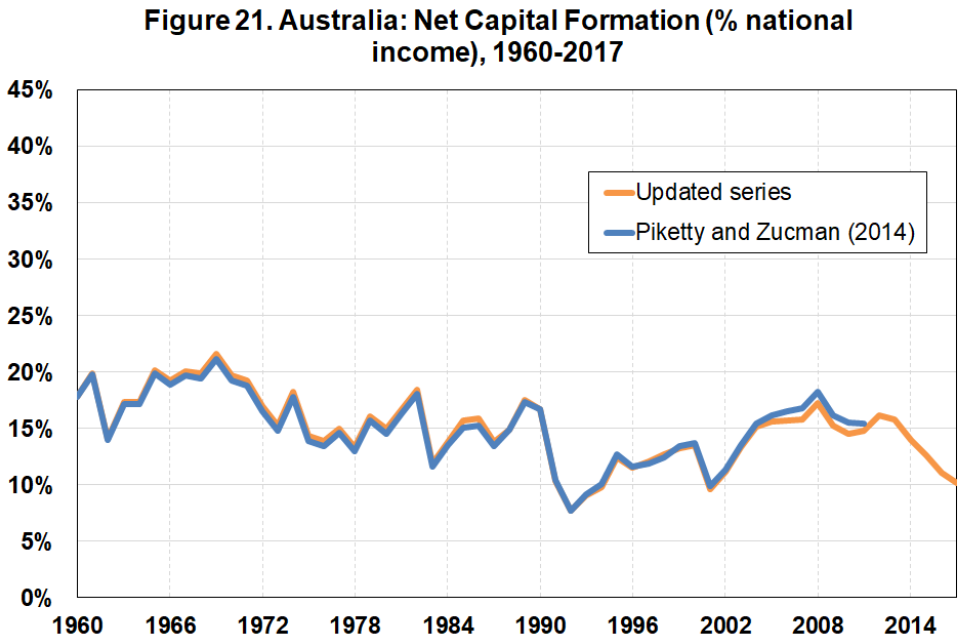

Figure 21: Australia: Net capital formation (% national income), 1960-2017

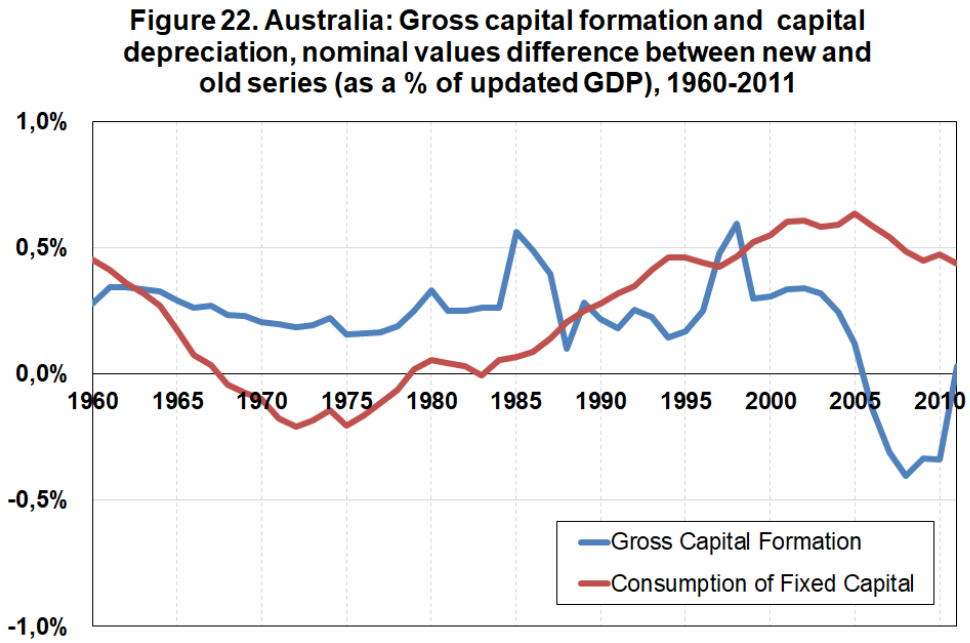

Figure 22: Australia: Difference in nominal value between new and old series (% of new GDP), 1960-2011

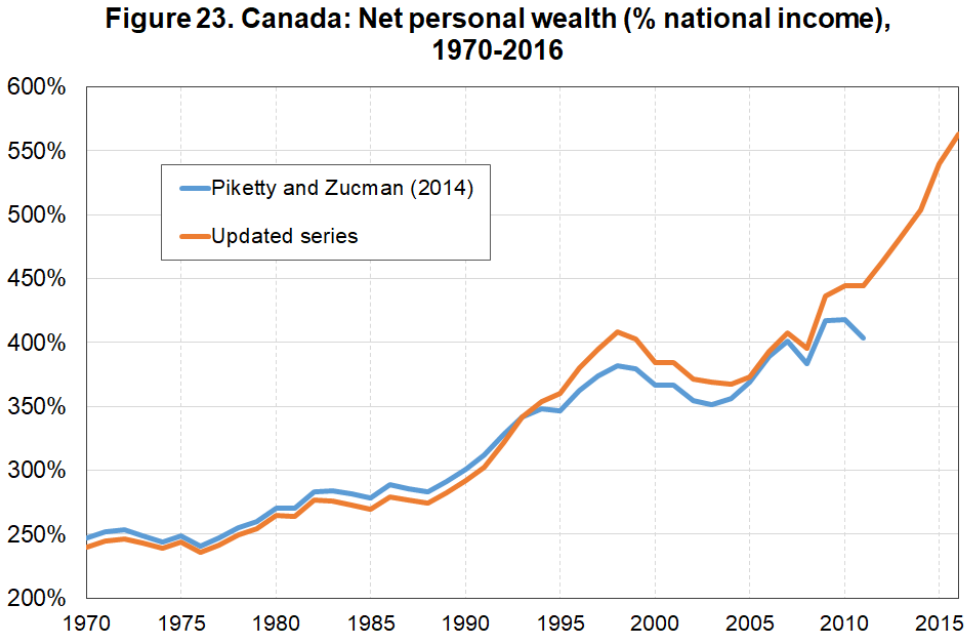

Figure 23: Canada: Net personal wealth (% national income), 1970-2016

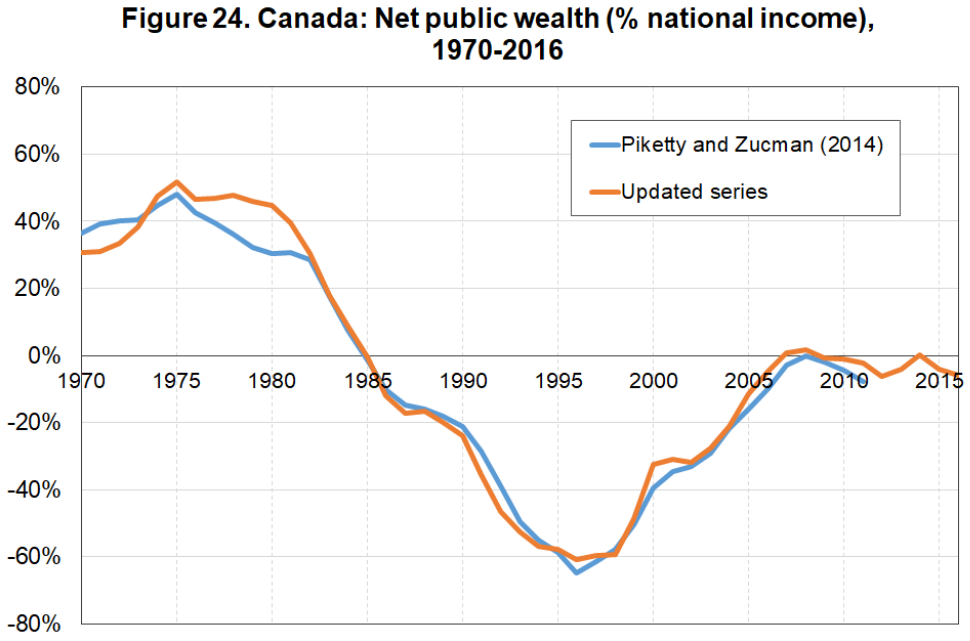

Figure 24: Canada: Net public wealth (% national income), 1970-2016

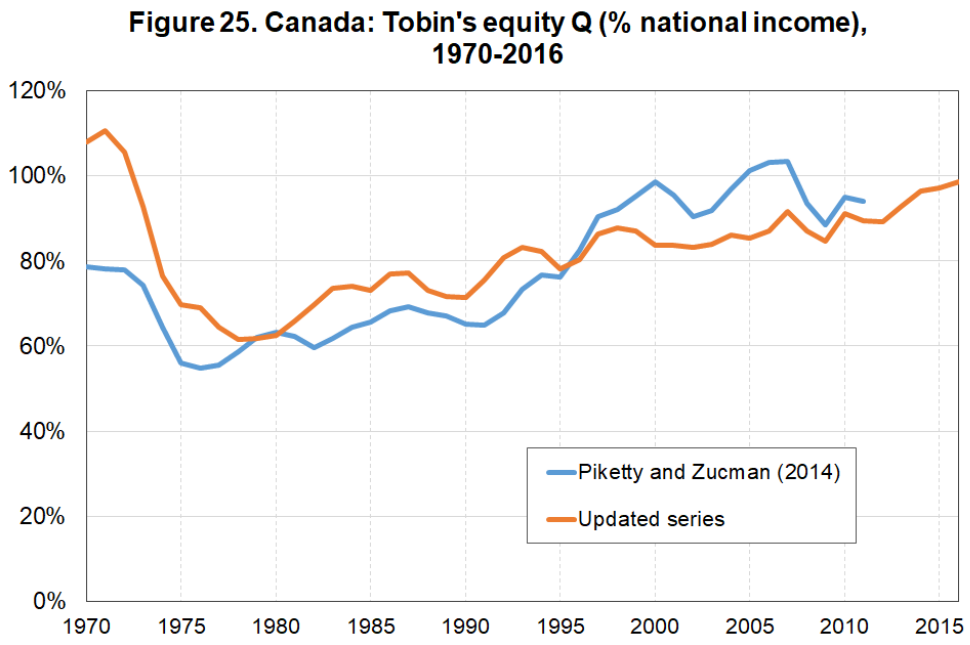

Figure 25: Canada: Tobin's equity Q, 1970-2016

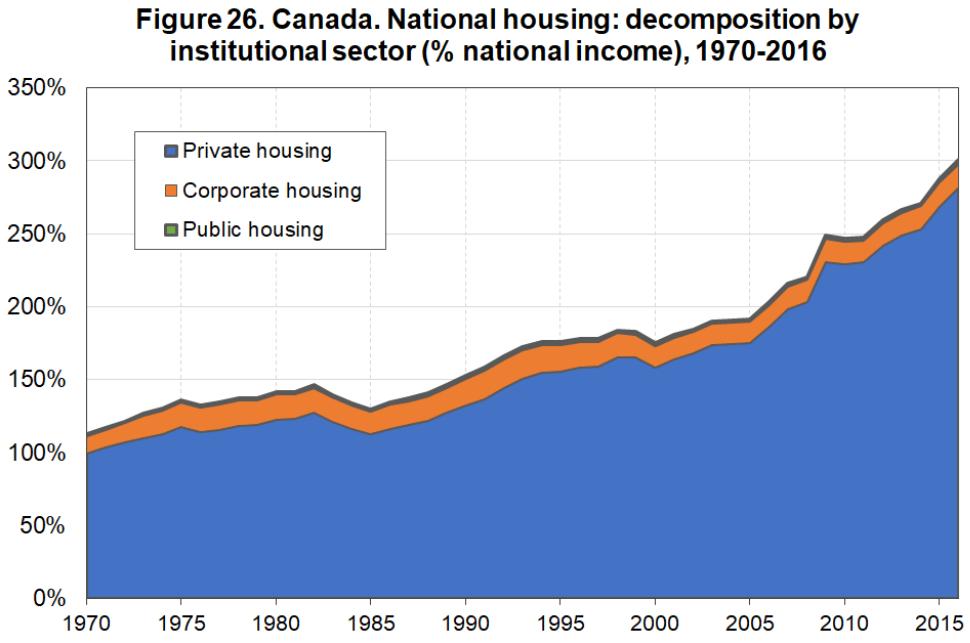

Figure 26: Canada: National housing: decomposition by institutional sector (% national income), 1970-2016

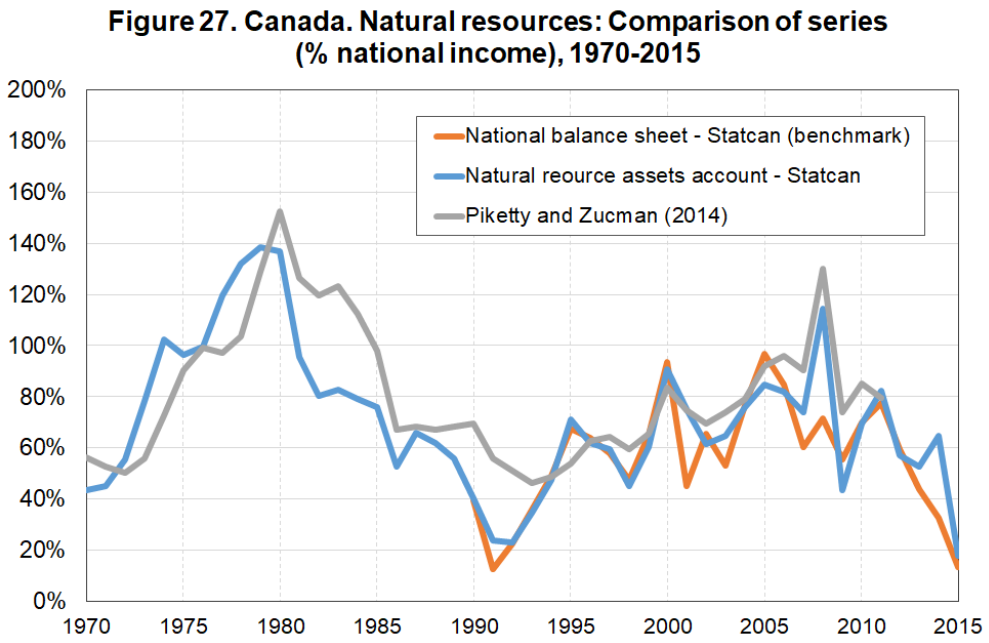

Figure 27: Canada: Natural resources: comparison of series (% national income), 1970-2016

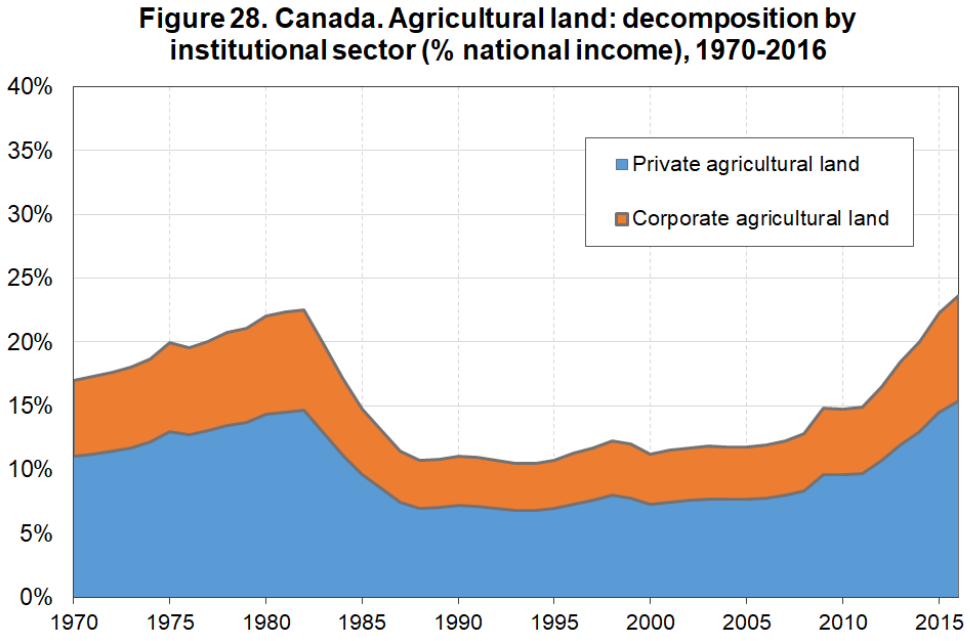

Figure 28: Canada: Agricultural land: decomposition by institutional sector (% national income), 1970-2016

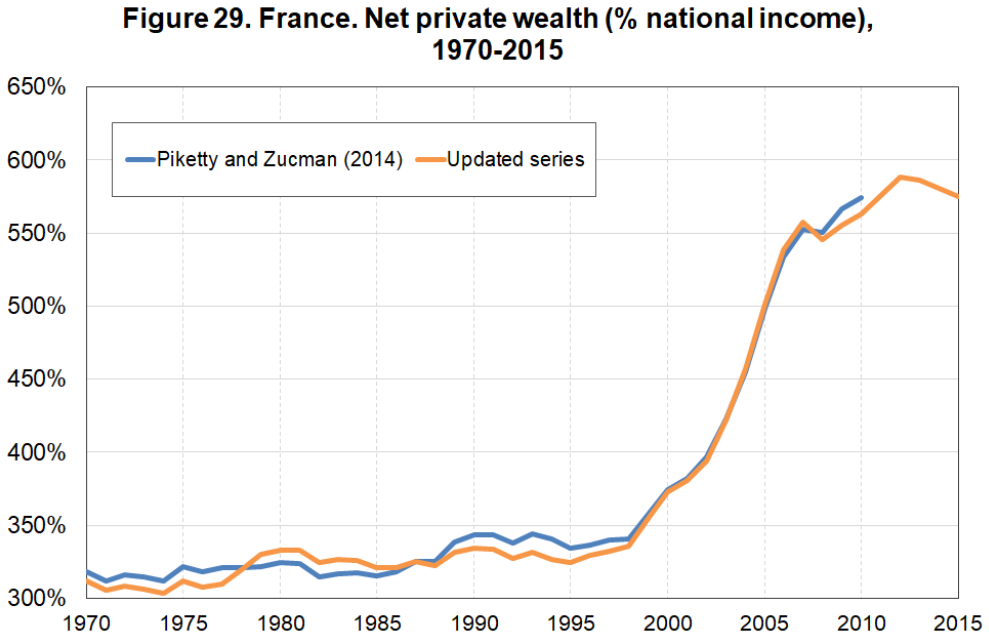

Figure 29: France: Net private wealth (% national income), 1970-2015

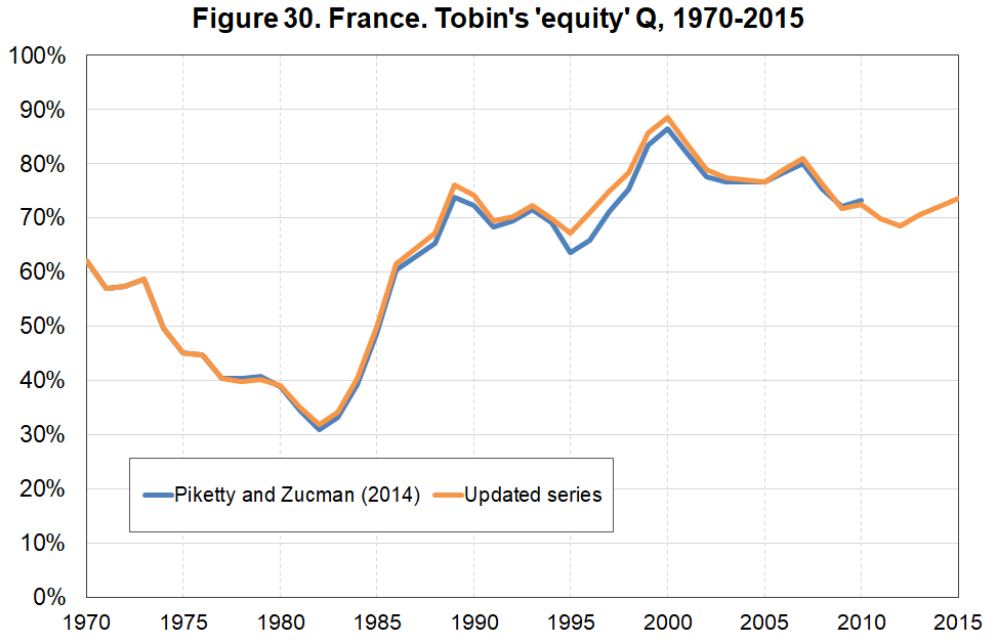

Figure 30: France: Tobin's equity Q, 1970-2015

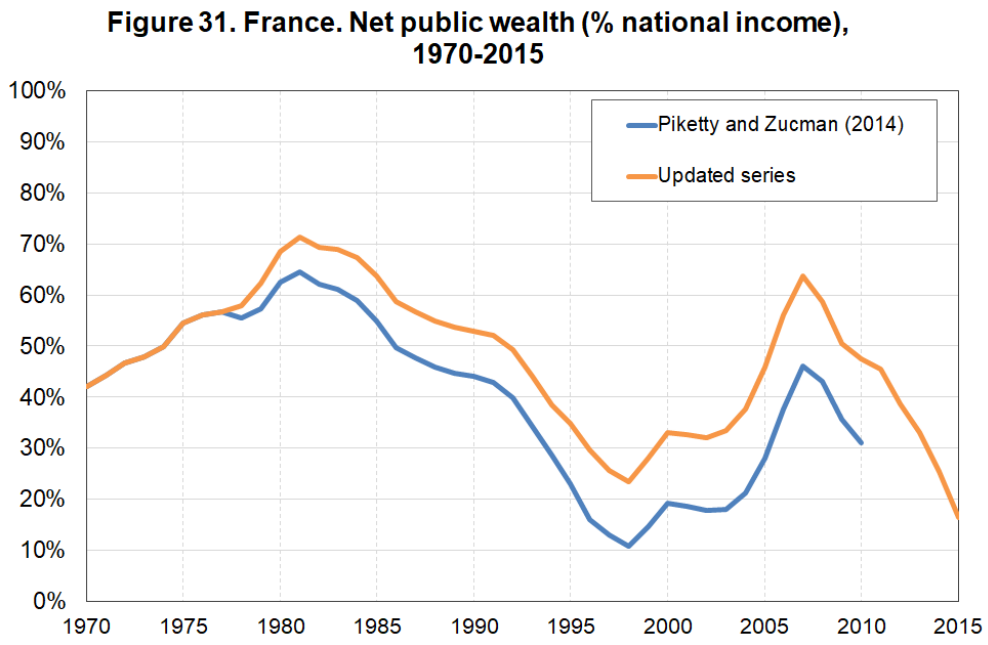

Figure 31: France: Net public wealth (% national income), 1970-2015

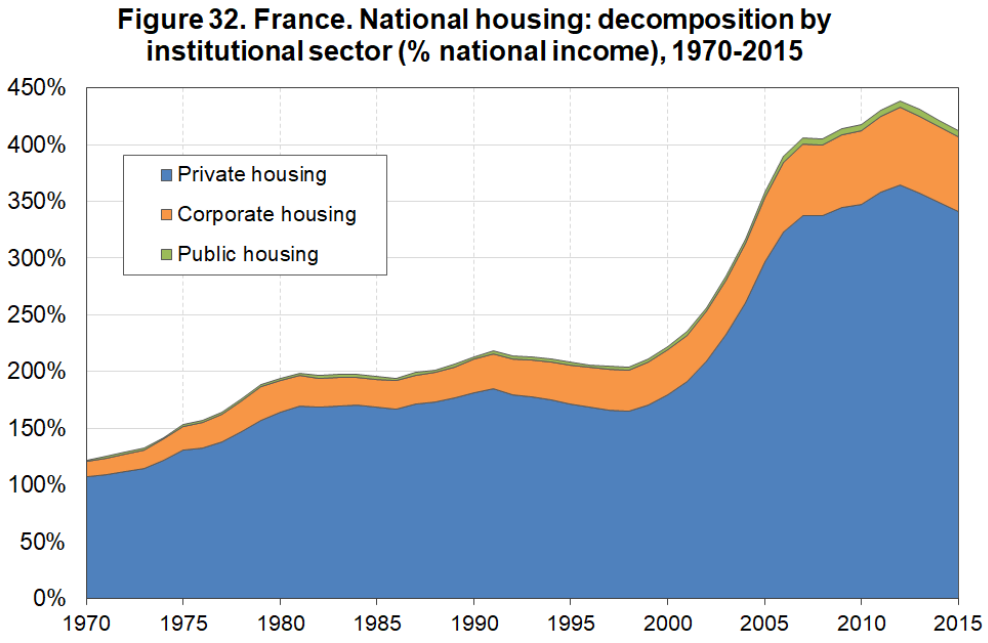

Figure 32: France: National housing: decomposition by institutional sector (% national income), 1970-2015

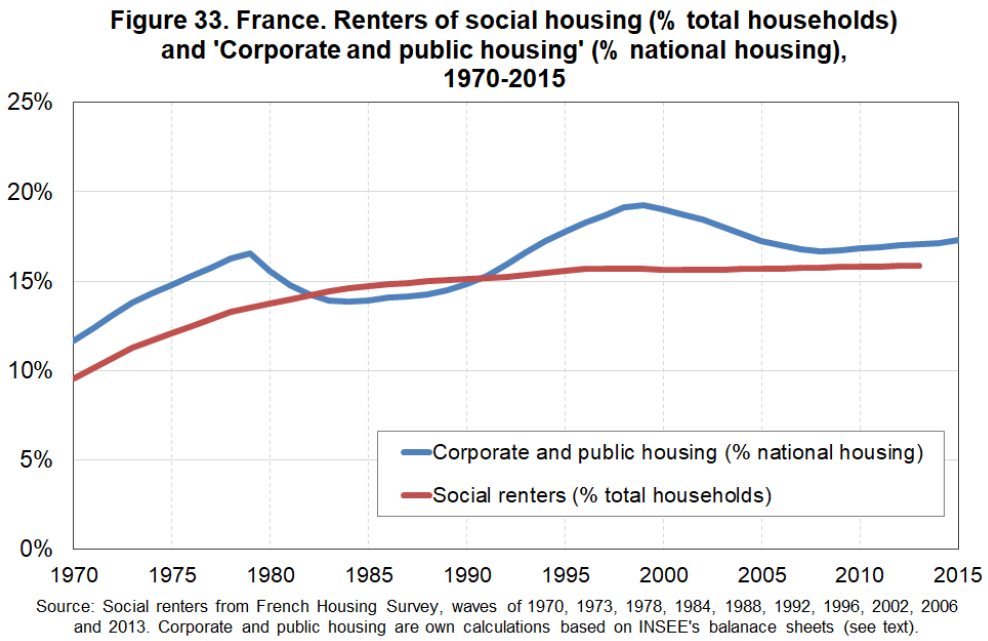

Figure 33: France: Renters of social housing (% total households) and 'Corporate and public' housing (% national housing), 1970-2015

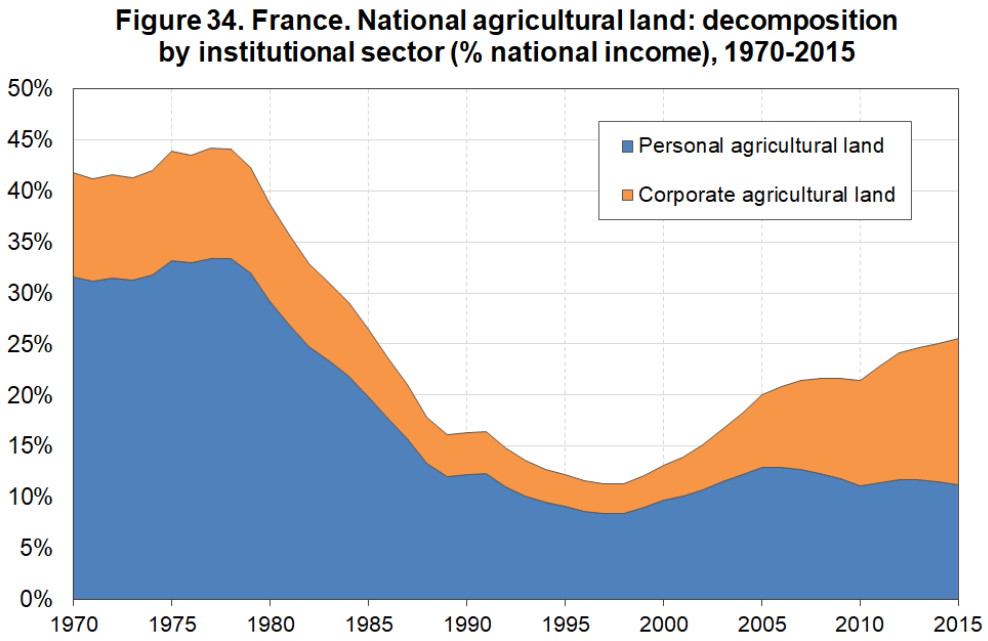

Figure 34: France: National agricultural land: decomposition by institutional sector (% national income), 1970-2015

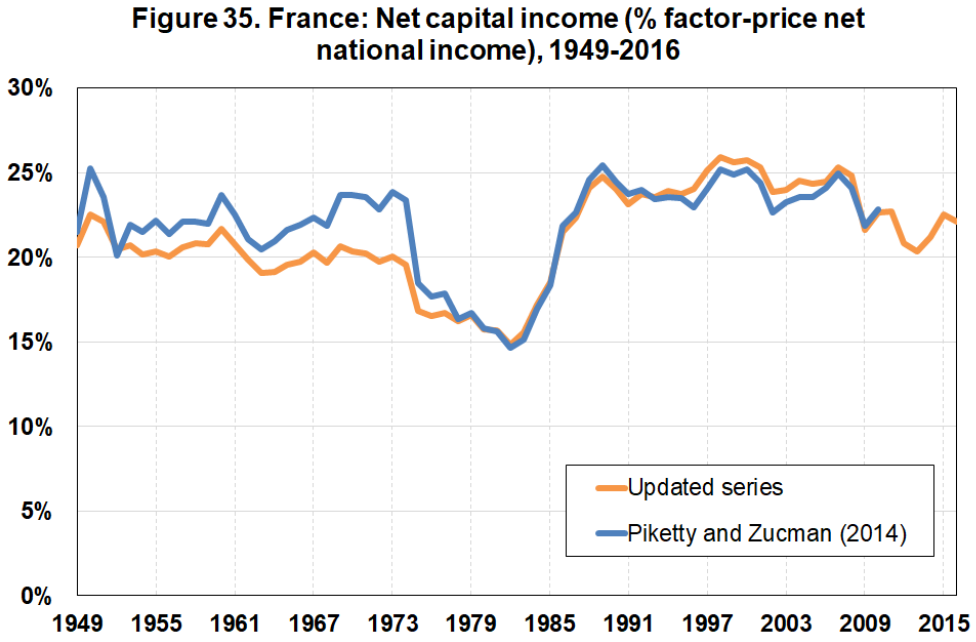

Figure 35: France: Net capital income (% factor-price net national income), 1949-2016

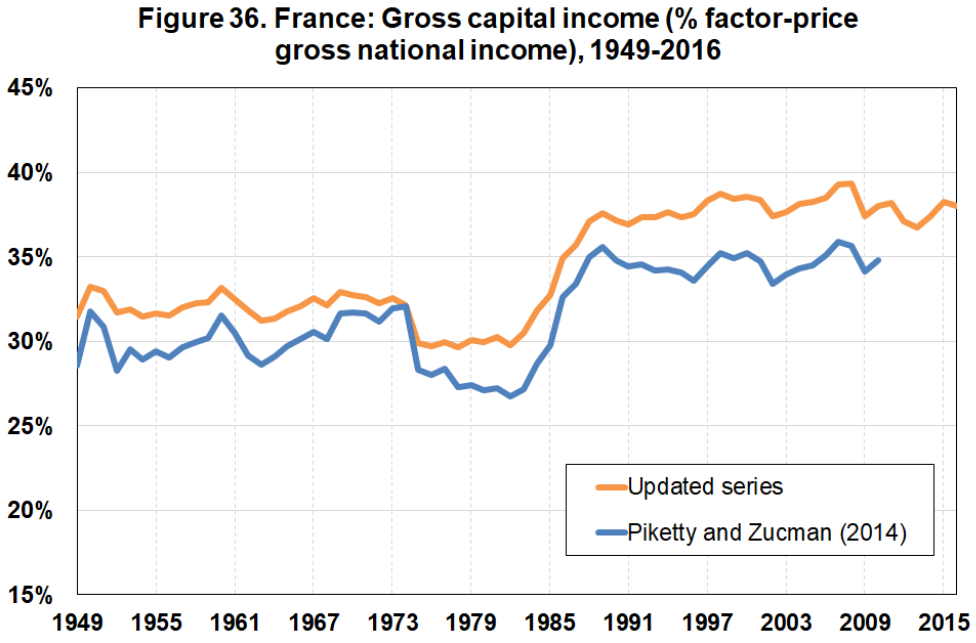

Figure 36: France: Gross capital income (% factor-price gross national income), 1949-2016

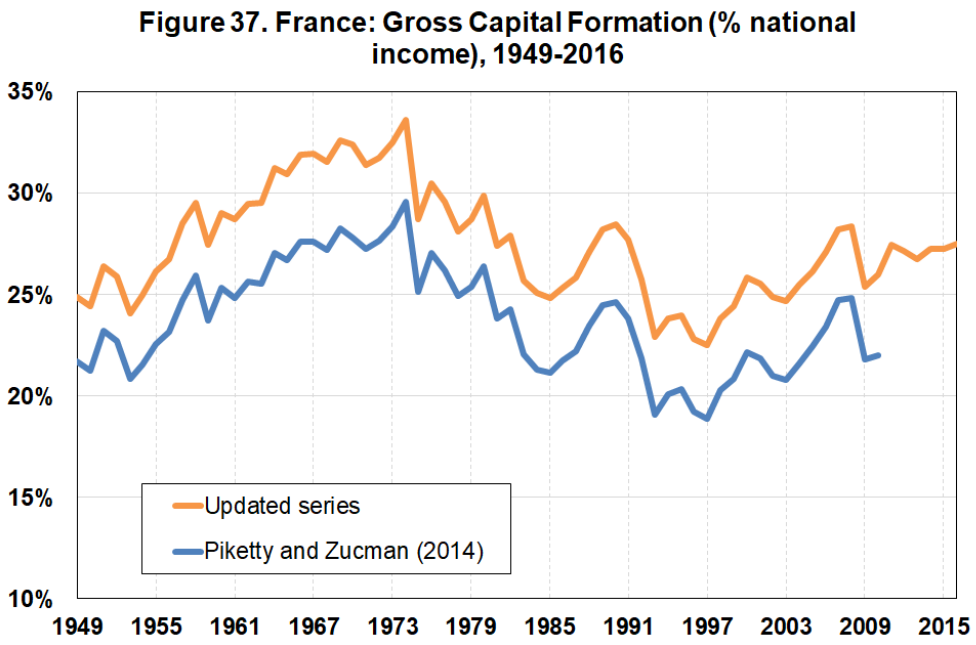

Figure 37: France: Gross capital formation (% national income), 1949-2016

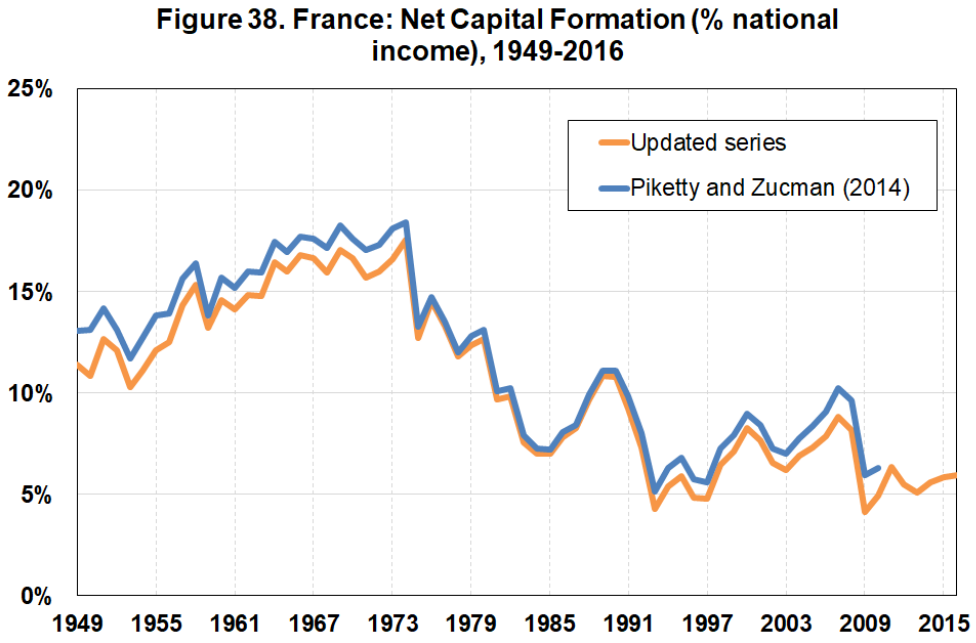

Figure 38: France: Net capital formation (% national income), 1949-2016

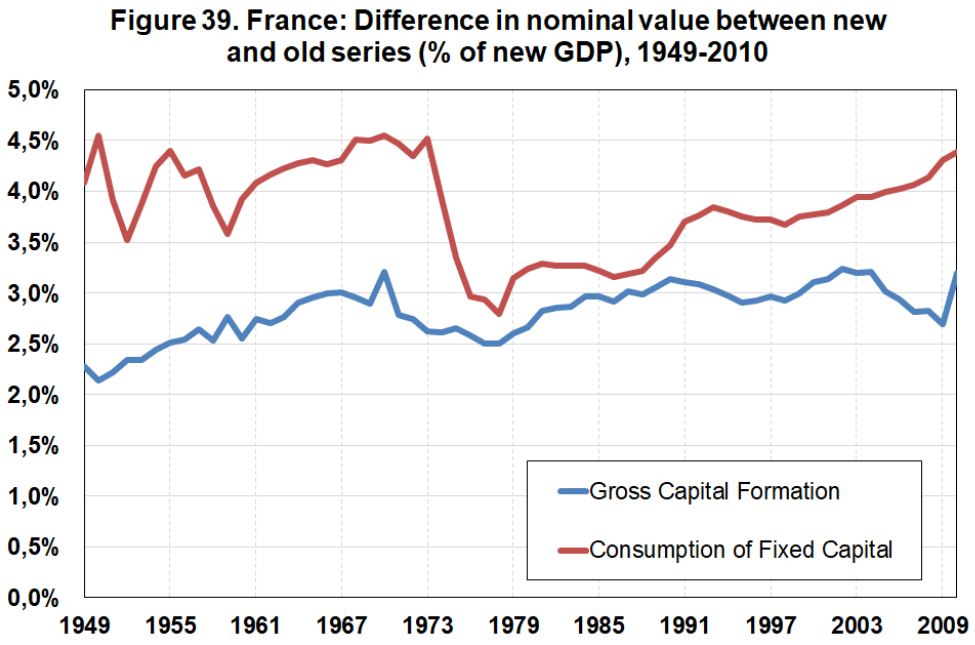

Figure 39: France: Difference in nominal value between new and old series (% of new GDP), 1949-2010

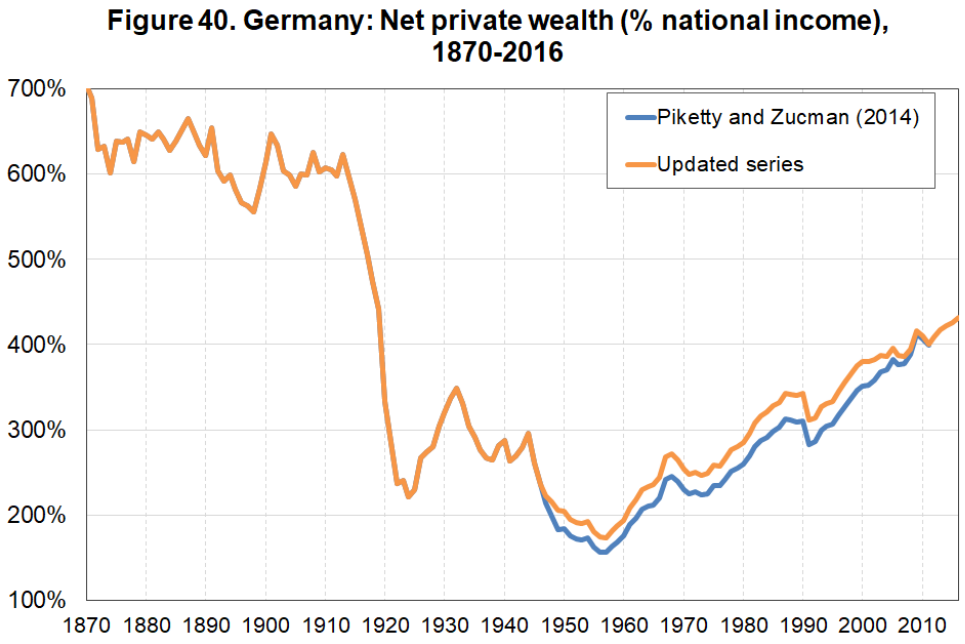

Figure 40: Germany: Net private wealth (% national income), 1870-2016

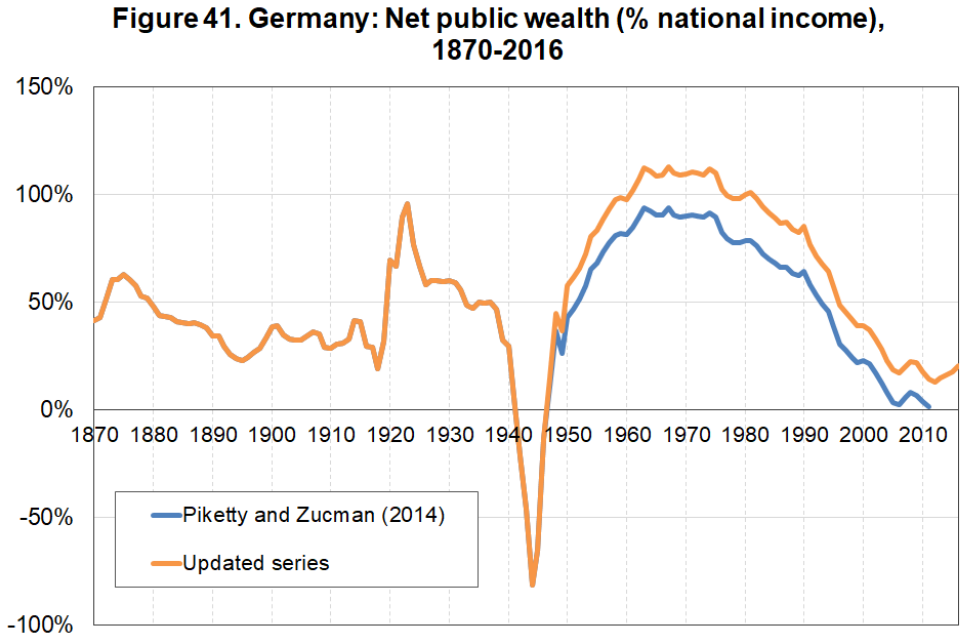

Figure 41: Germany: Net public wealth (% national income), 1870-2016

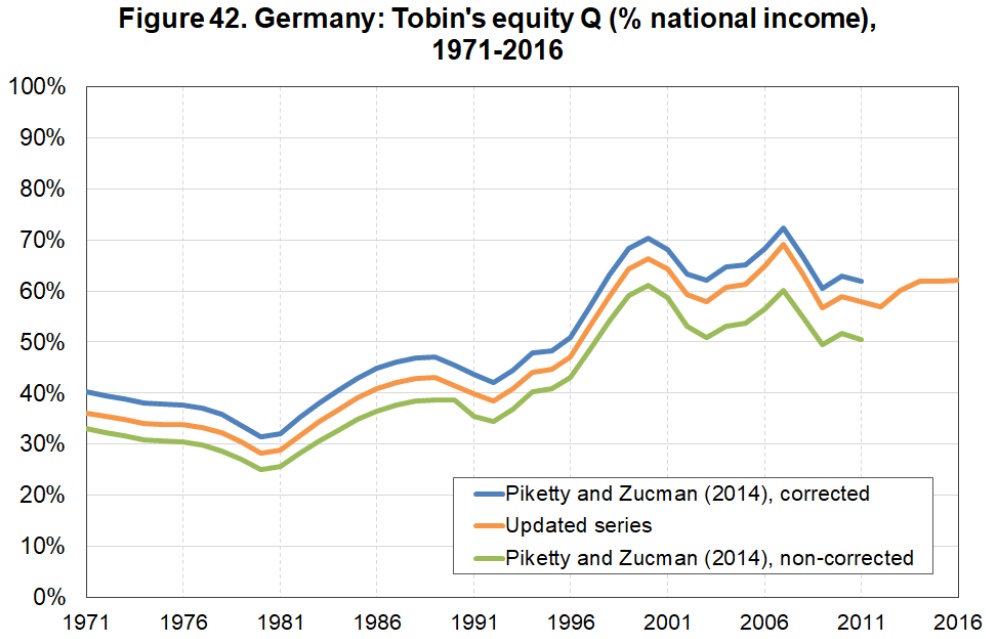

Figure 42: Germany: Tobin's equity Q, 1971-2016

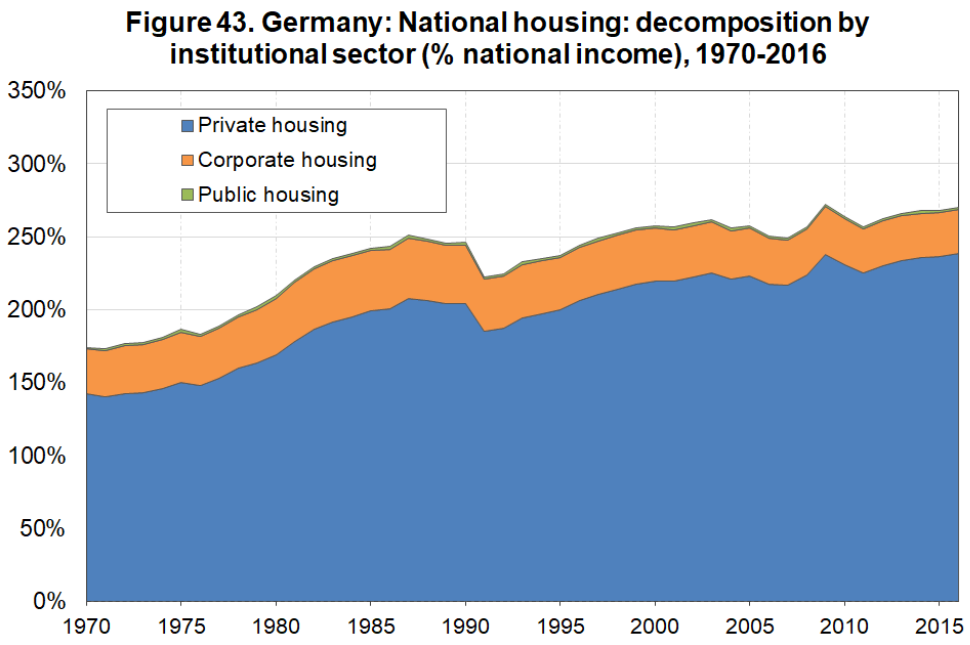

Figure 43: Germany: National housing: decomposition by institutional sector (% national income), 1970-2016

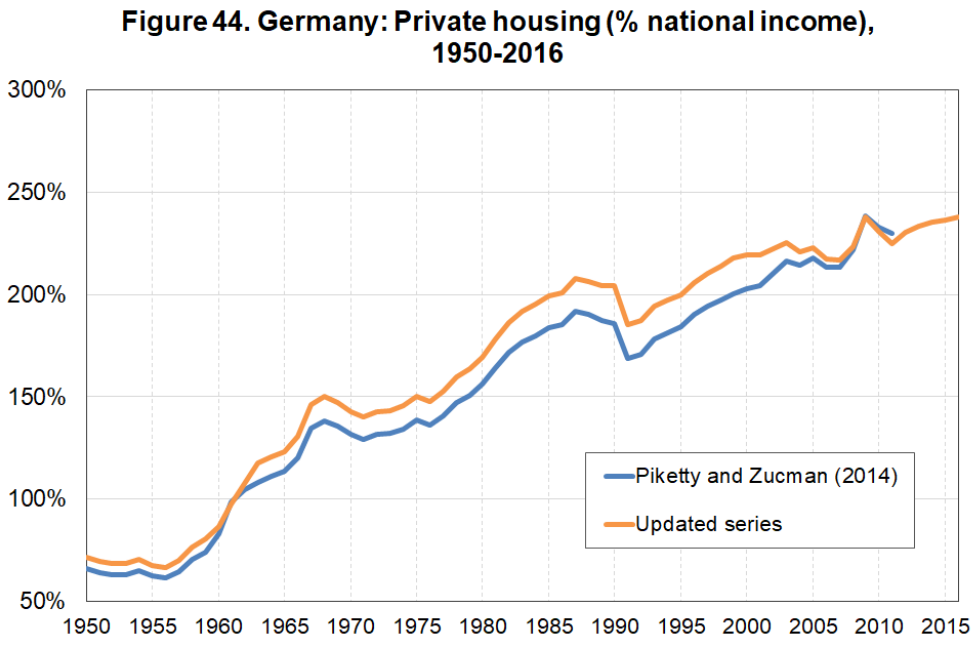

Figure 44: Germany: Private housing (% national income), 1950-2016

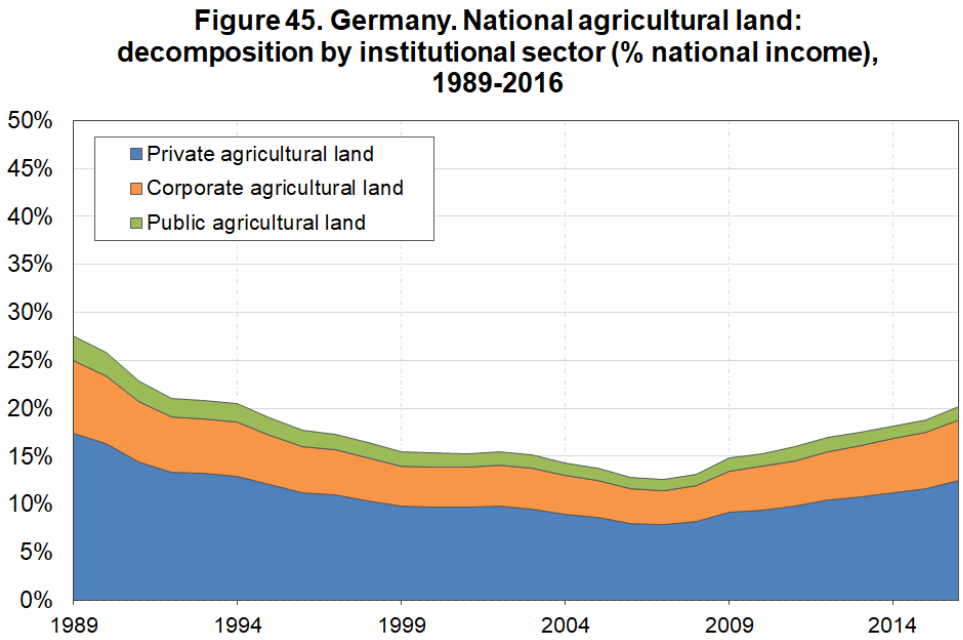

Figure 45: Germany: National agricultural land: decomposition by institutional sector (% national income), 1989-2016

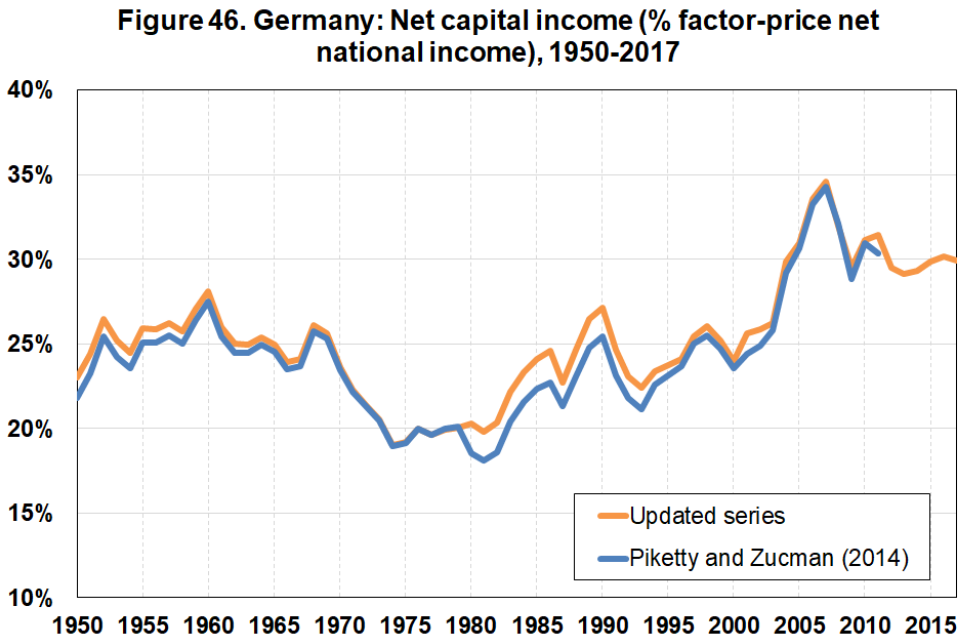

Figure 46: Germany: Net capital income (% factor-price net national income), 1950-2017

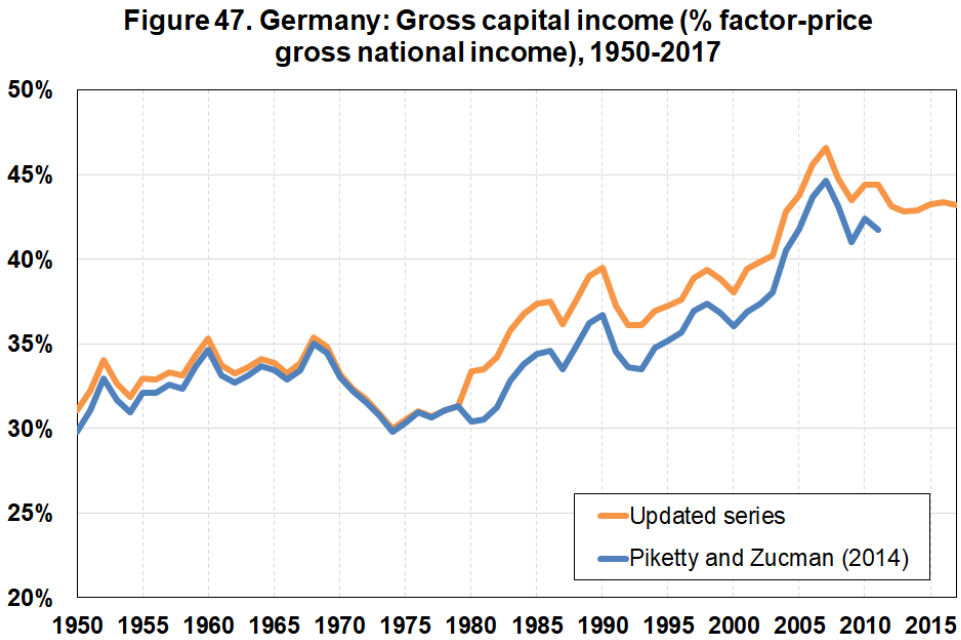

Figure 47: Germany: Gross capital income (% factor-price gross national income), 1950-2017

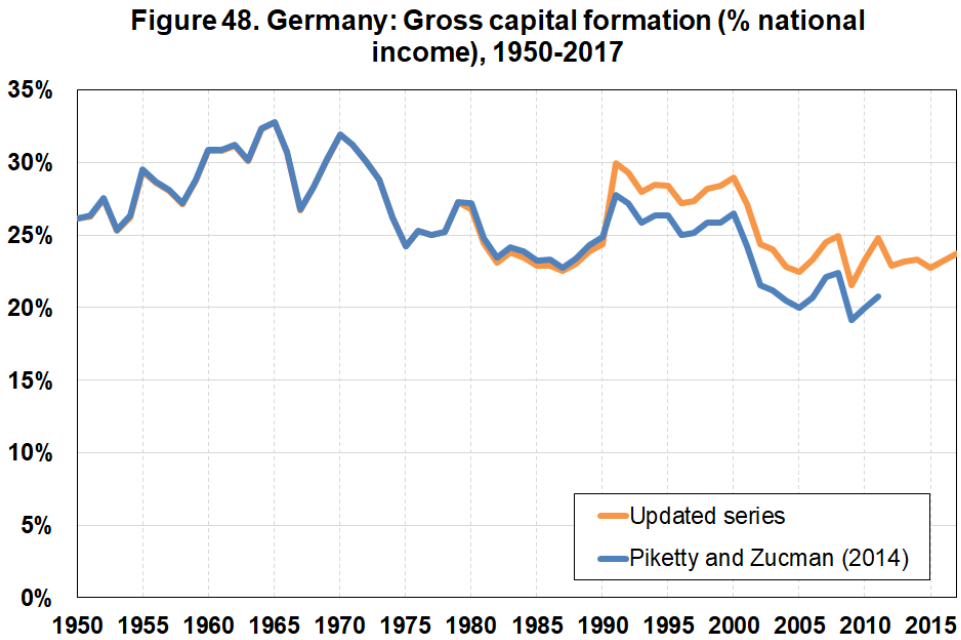

Figure 48: Germany: Gross capital formation (% national income), 1950-2017

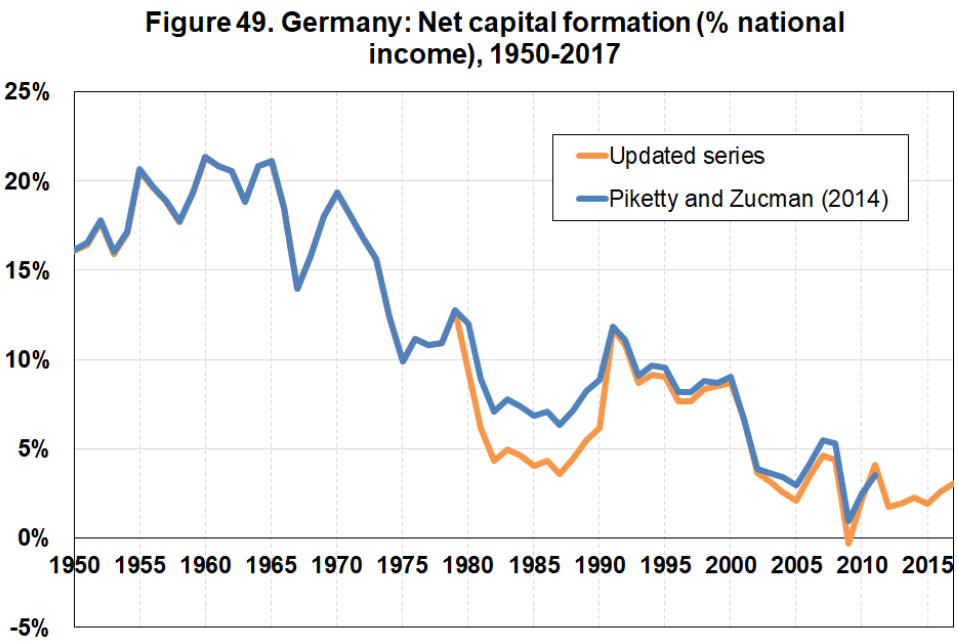

Figure 49: Germany: Net capital formation (% national income), 1950-2017

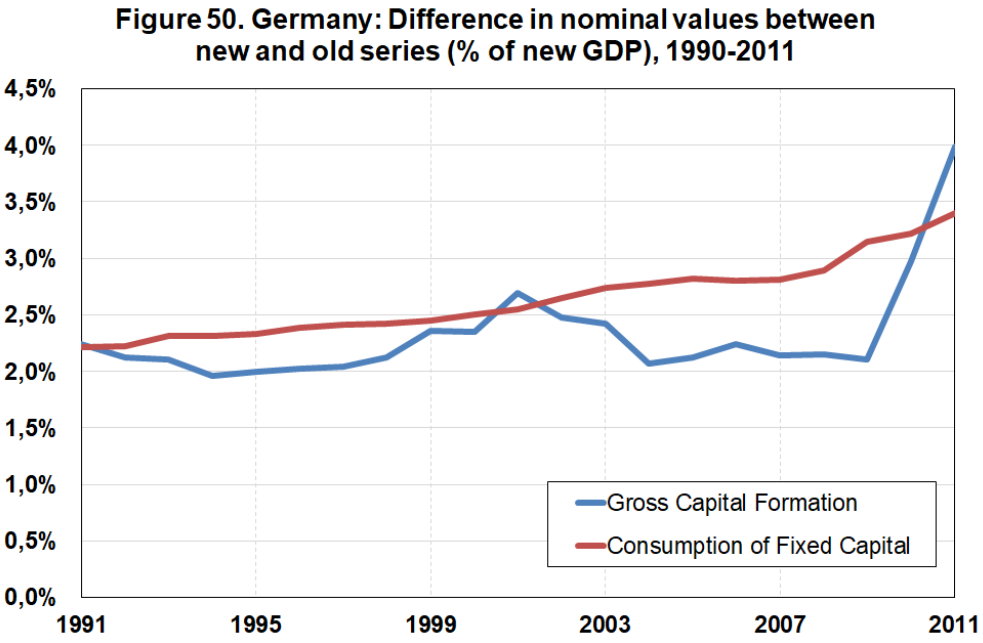

Figure 50: Germany: Difference in nominal value between new and old series (% of new GDP), 1990-2011

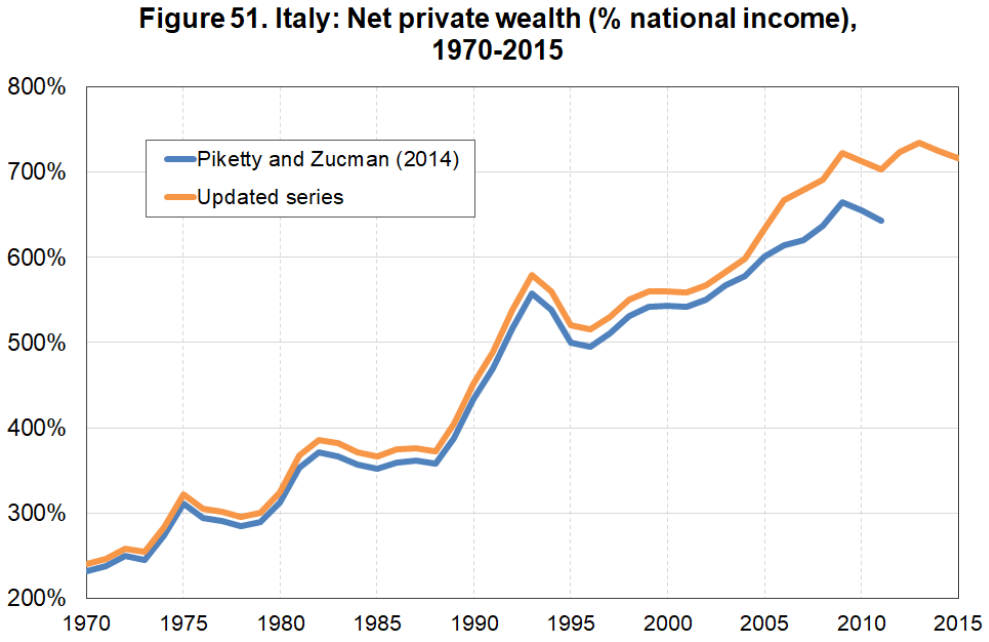

Figure 51: Italy: Net private wealth (% national income), 1970-2015

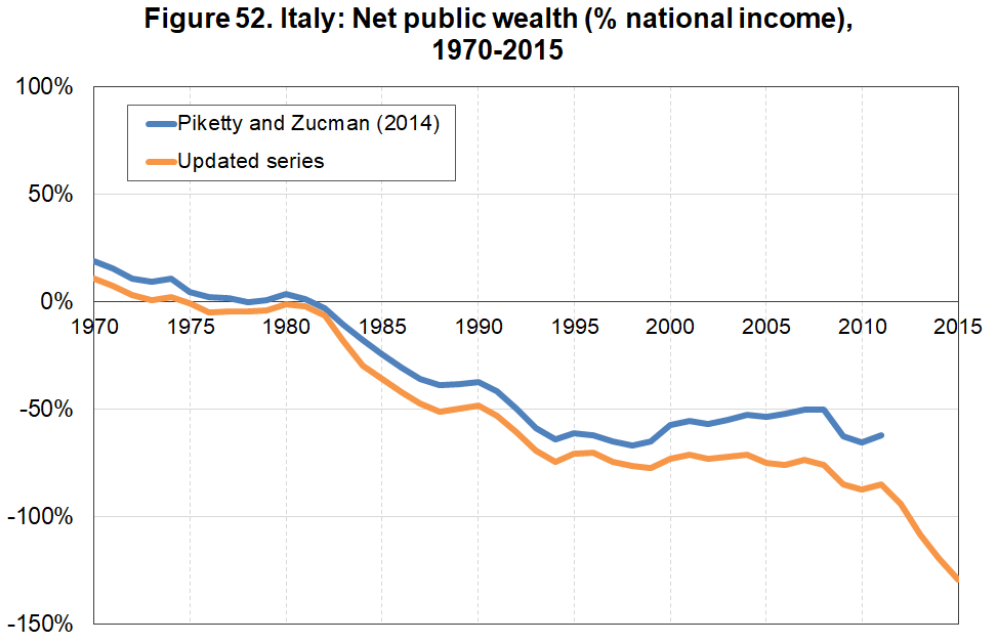

Figure 52: Italy: Net public wealth (% national income), 1970-2015

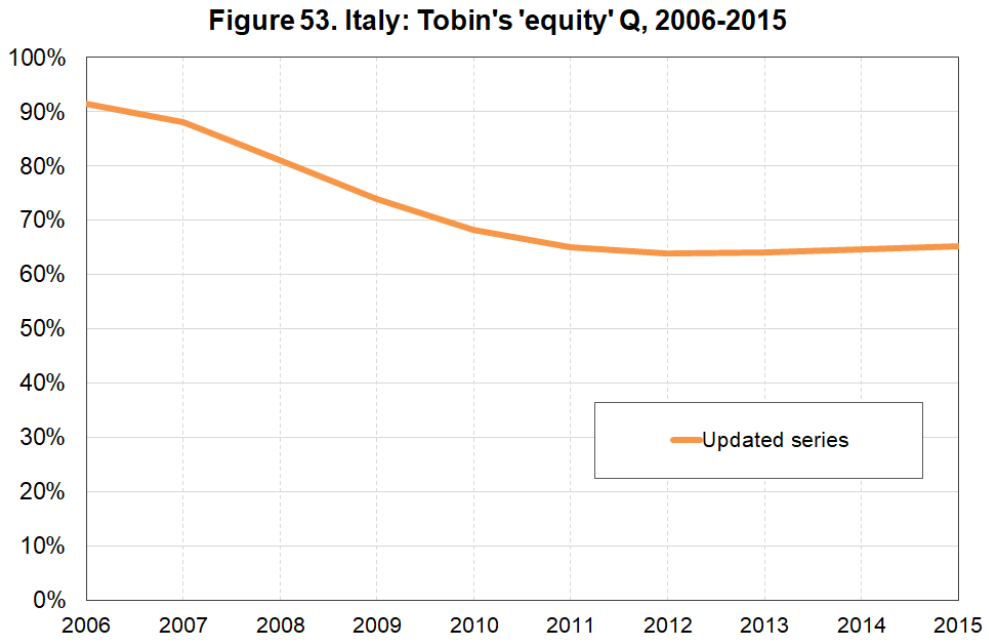

Figure 53: Italy: Tobin's equity Q, 2006-2015

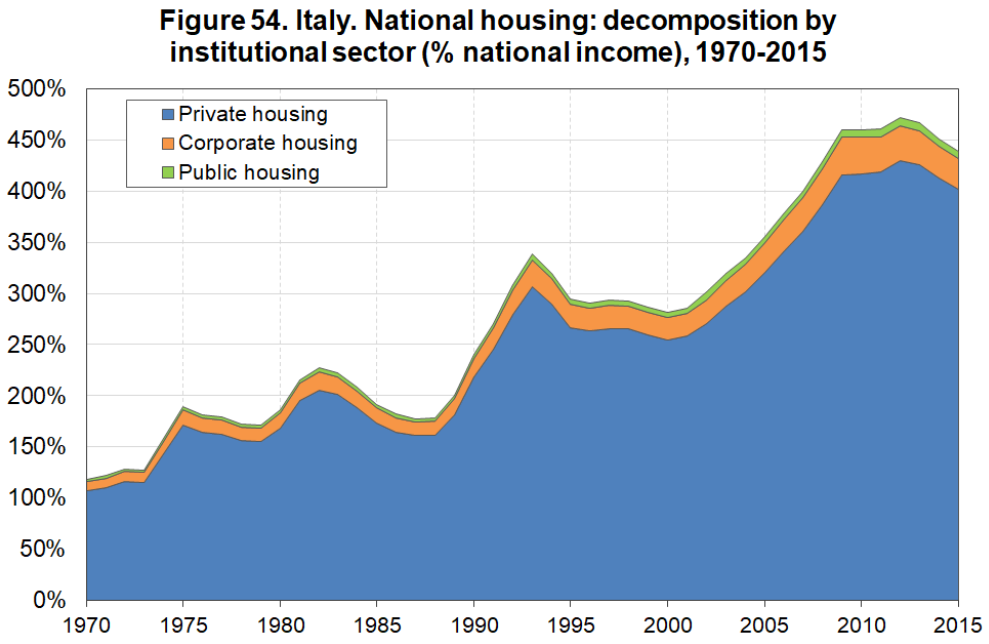

Figure 54: Italy: National housing: decomposition by institutional sector (% national income), 1970-2015

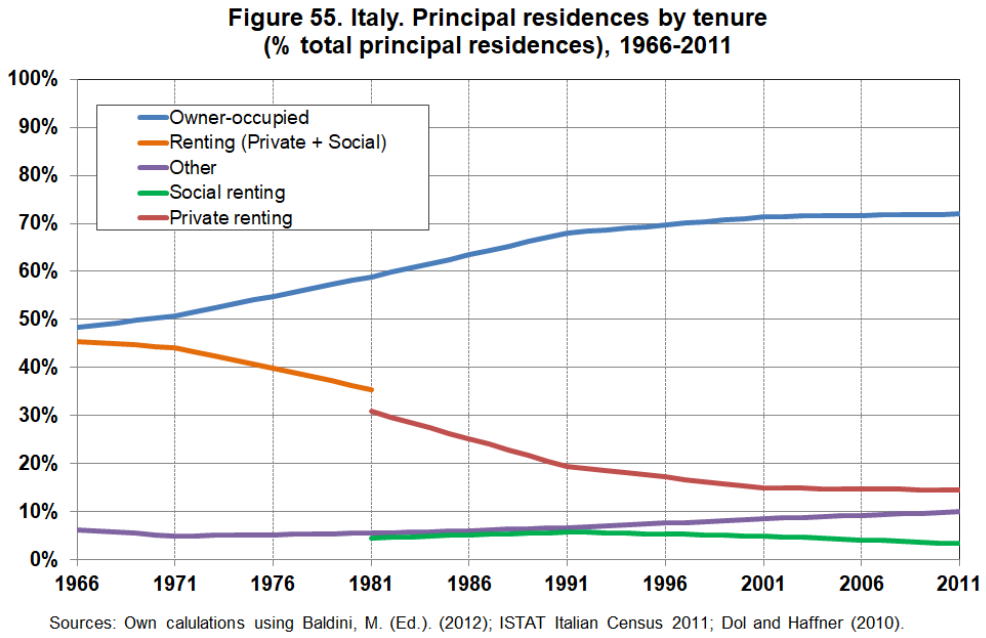

Figure 55: Italy: Principal residences by tenure (% total principal residences), 1966-2011

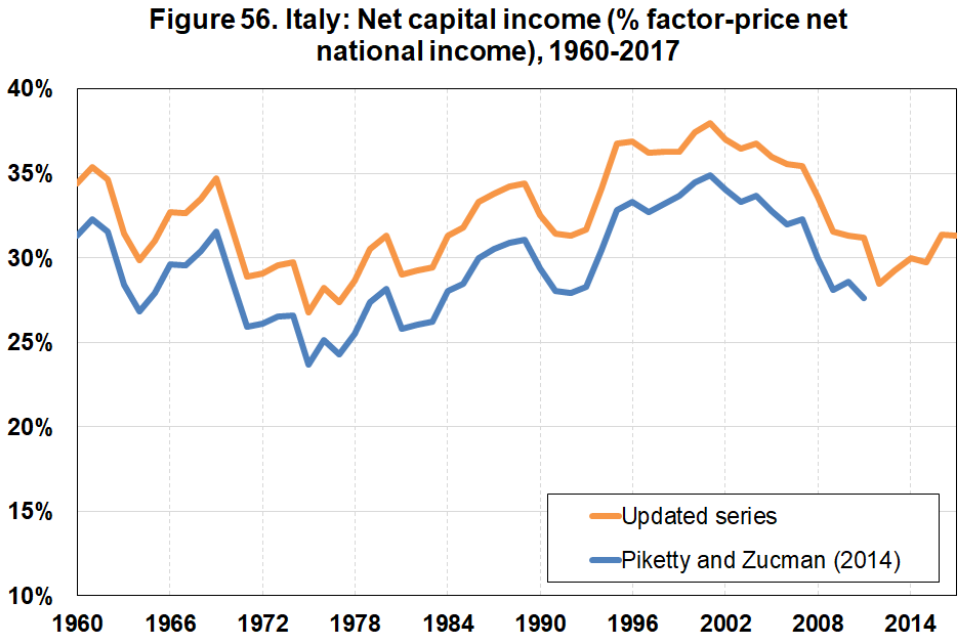

Figure 56: Italy: Net capital income (% factor-price net national income), 1960-2017

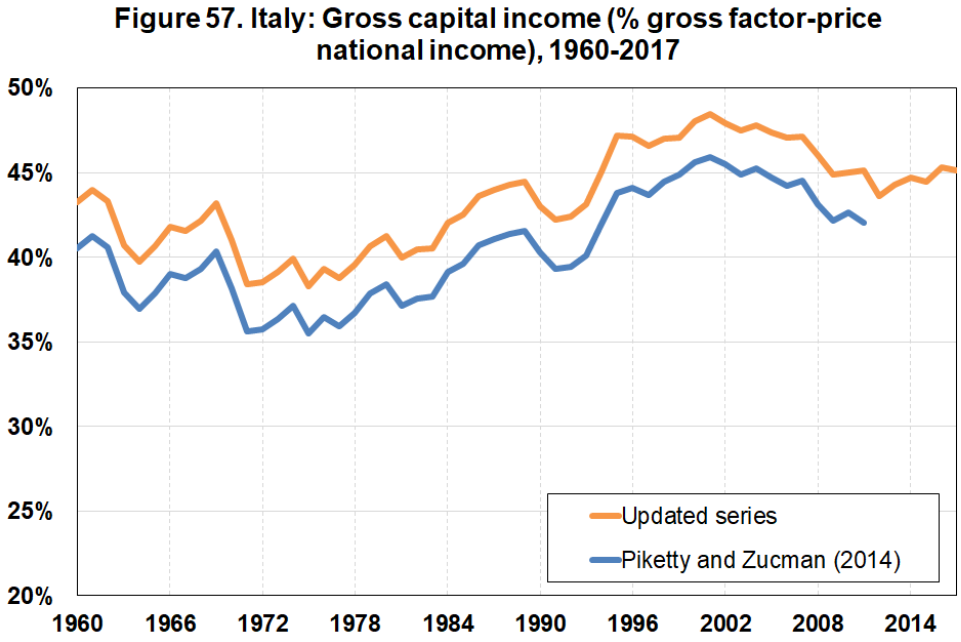

Figure 57: Italy: Gross capital income (% factor-price gross national income), 1960-2017

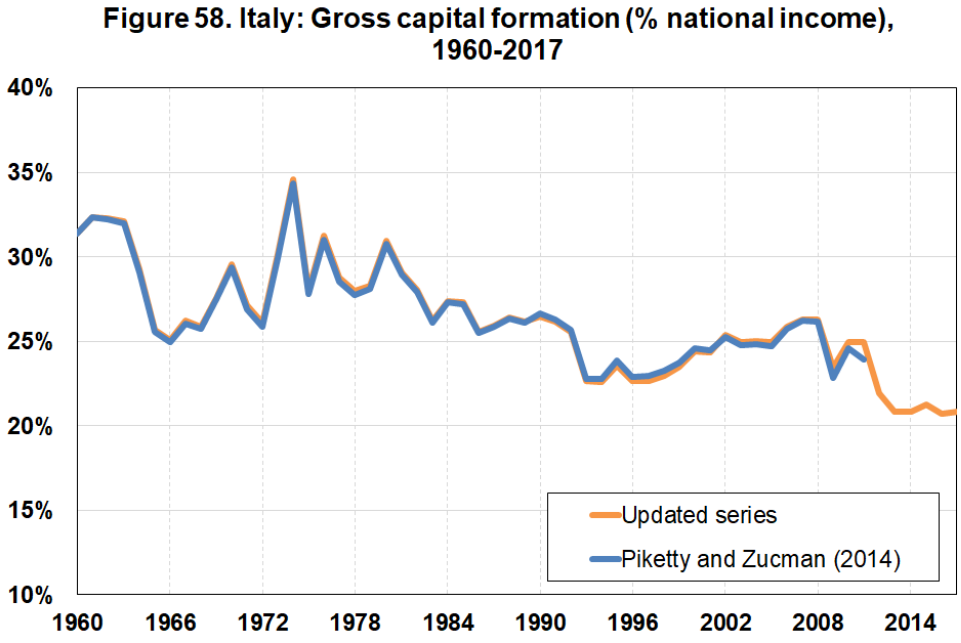

Figure 58: Italy: Gross capital formation (% national income), 1960-2017

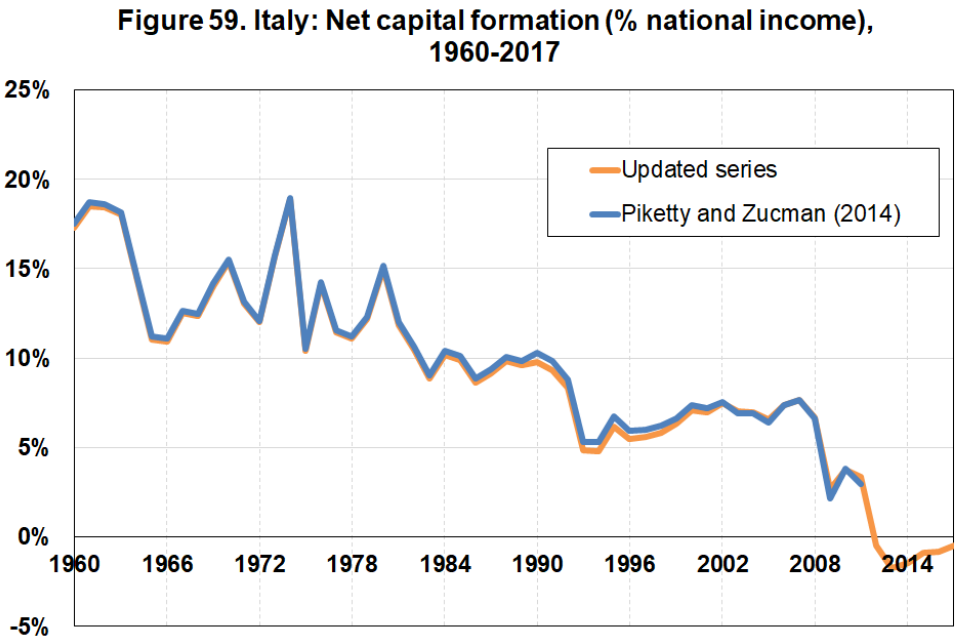

Figure 59: Italy: Net capital formation (% national income), 1960-2017

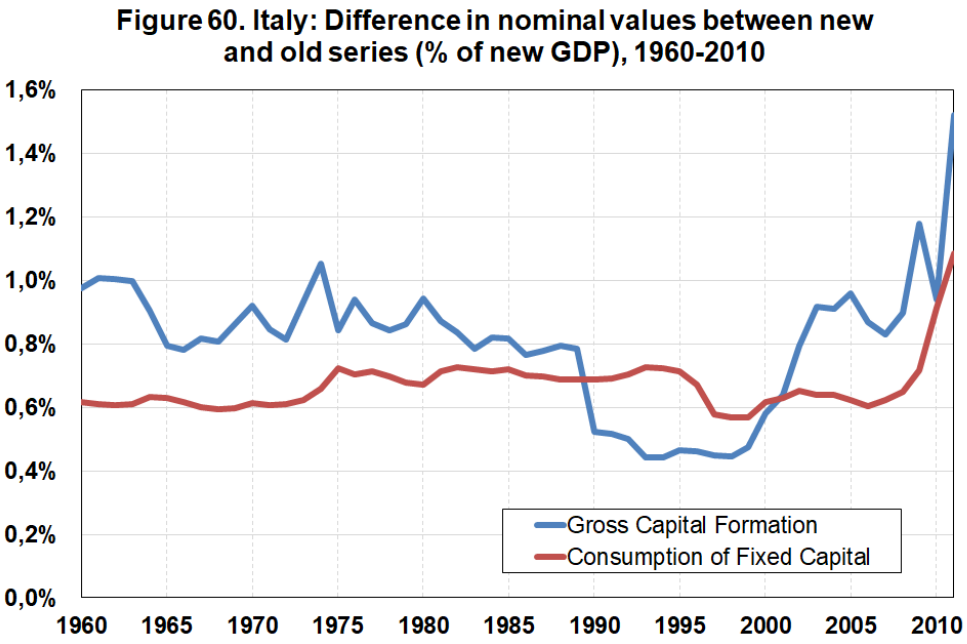

Figure 60: Italy: Difference in nominal value between new and old series (% of new GDP), 1960-2010

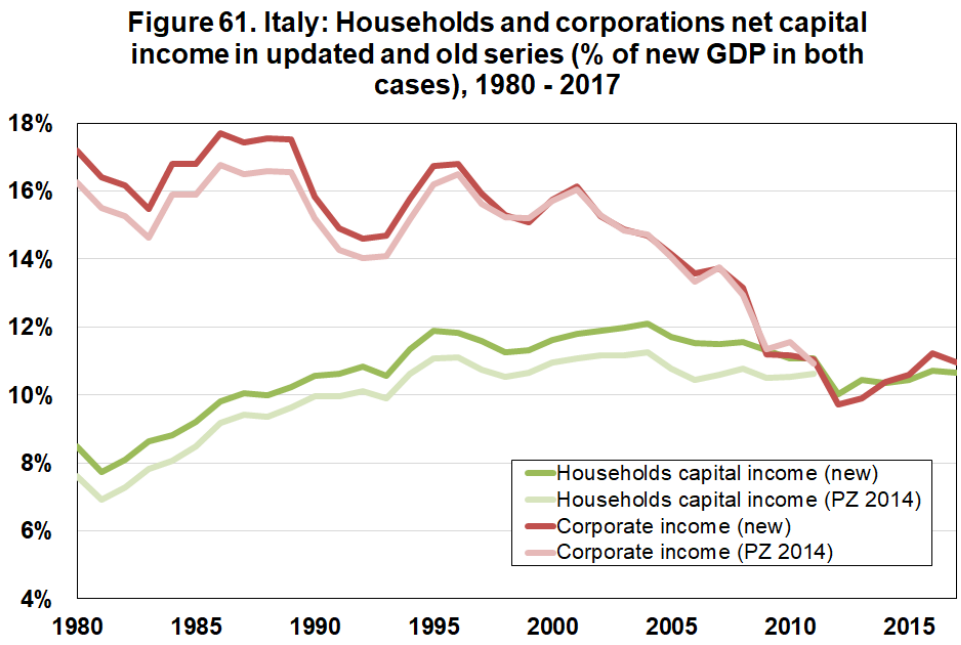

Figure 61: Italy: Households and corporations net capital income in updated and old series (% of new GDP in both cases), 1980 - 2017

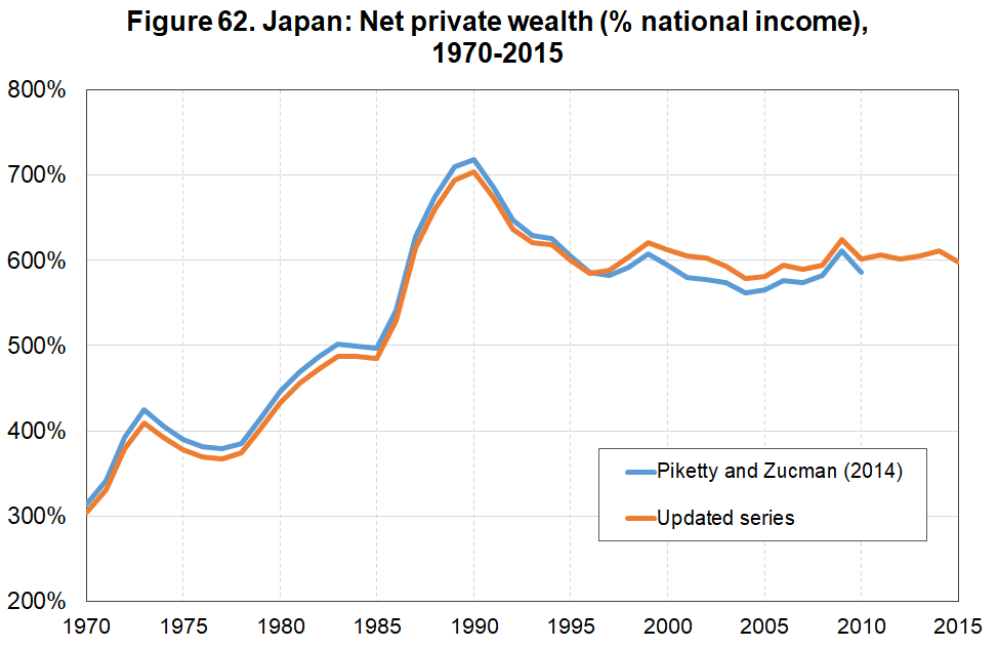

Figure 62: Japan: Net private wealth (% national income), 1970-2015

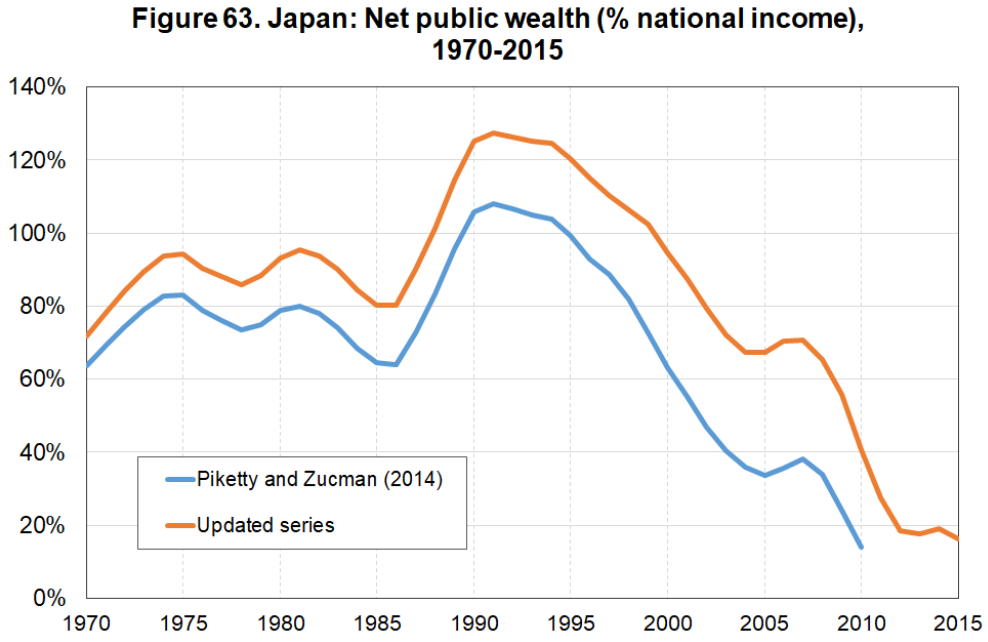

Figure 63: Japan: Net public wealth (% national income), 1970-2015

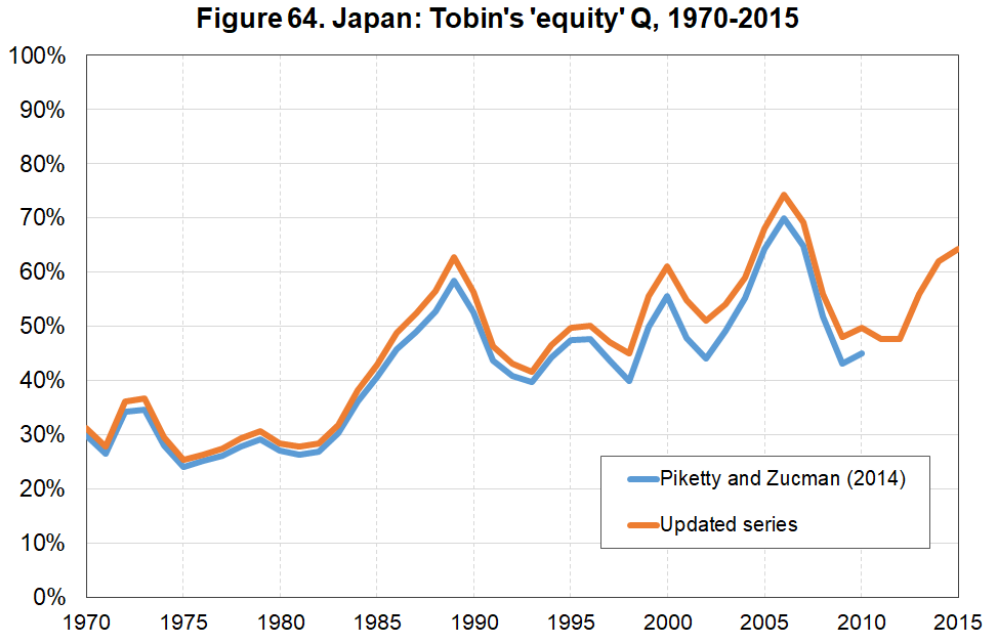

Figure 64: Japan: Tobin's equity Q, 1970-2015

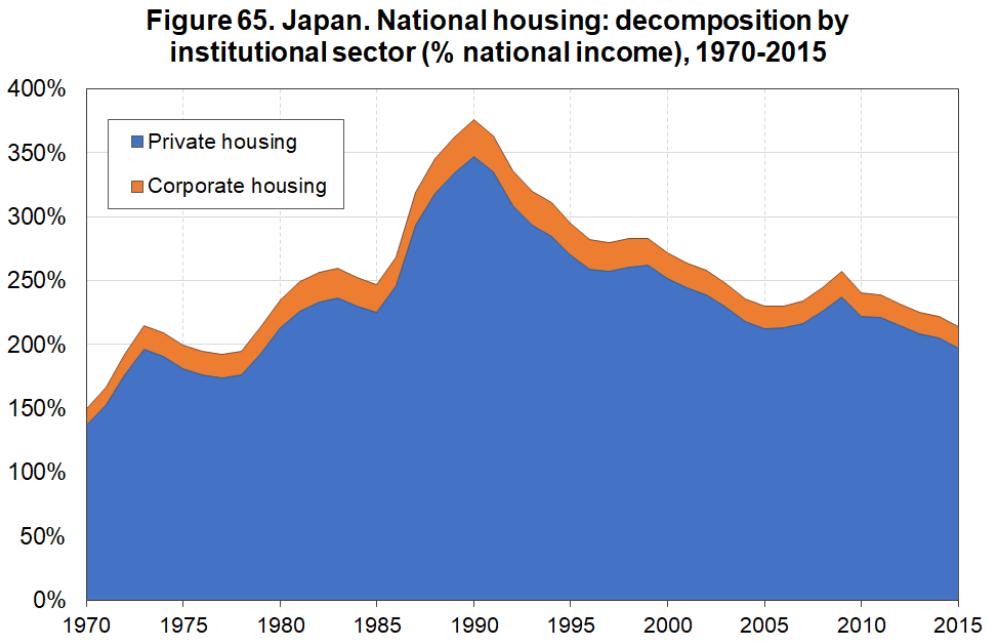

Figure 65: Japan: National housing: decomposition by institutional sector (% national income), 1970-2015

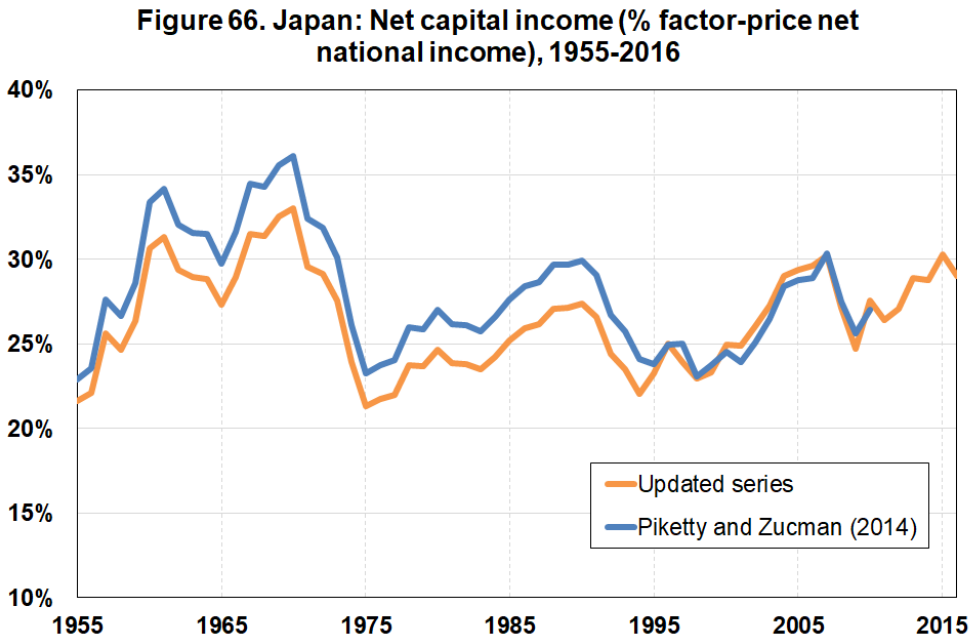

Figure 66: Japan: Net capital income (% factor-price net national income), 1955-2016

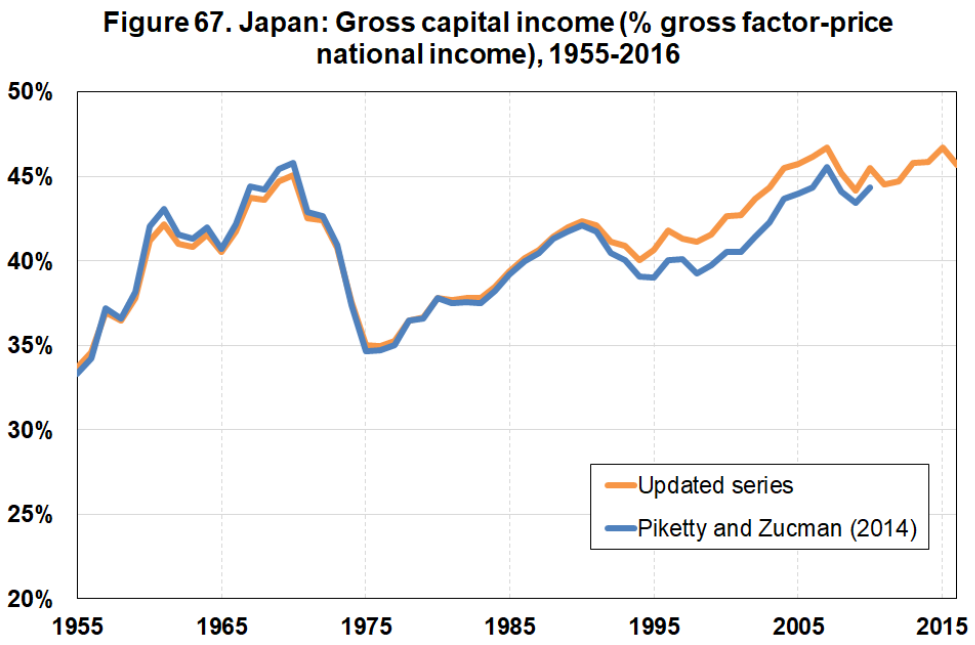

Figure 67: Japan: Gross capital income (% factor-price gross national income), 1955-2016

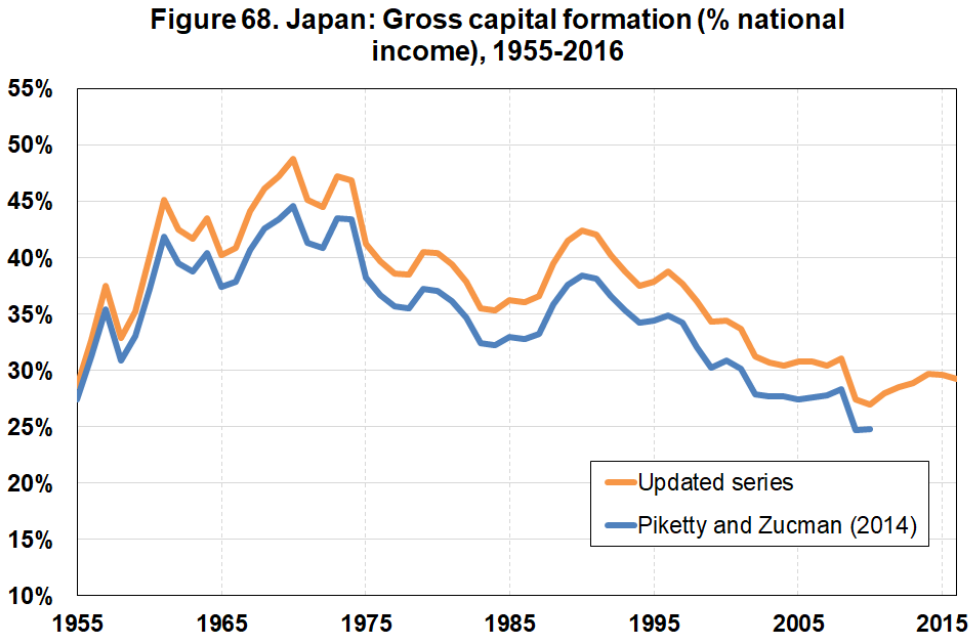

Figure 68: Japan: Gross capital formation (% national income), 1955-2016

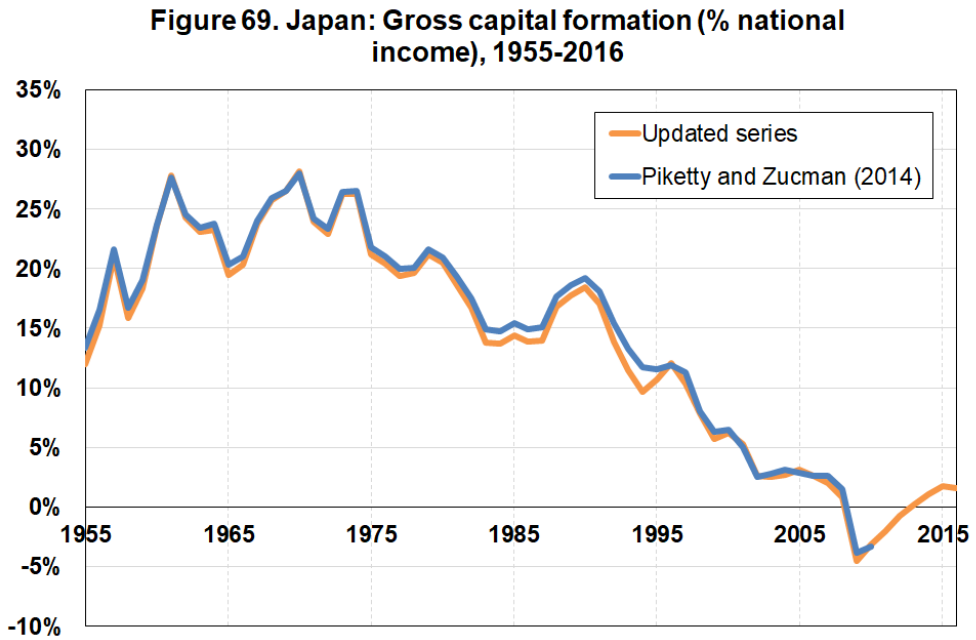

Figure 69: Japan: Net capital formation (% national income), 1955-2016

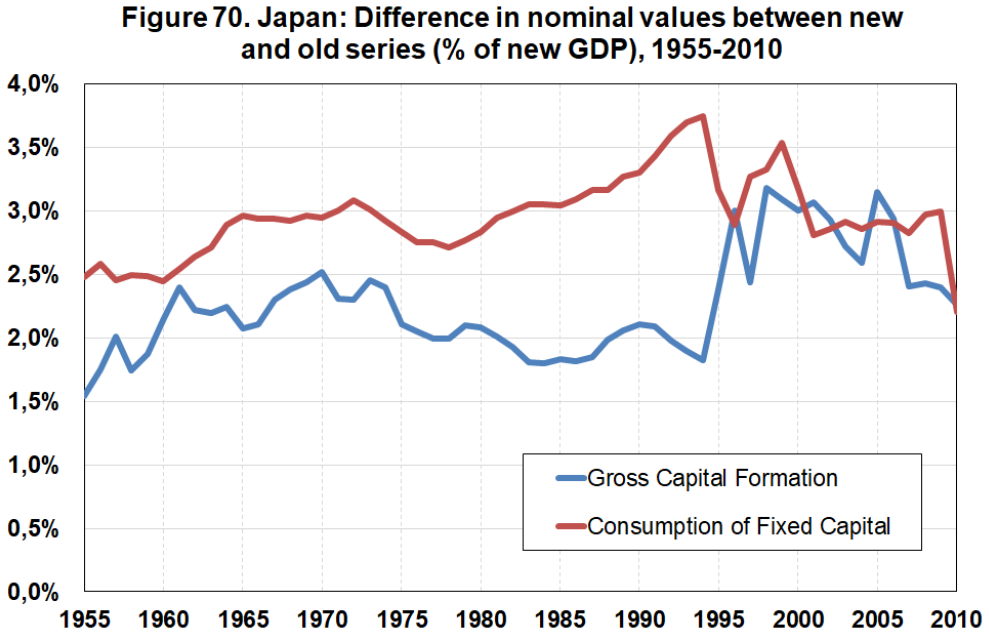

Figure 70: Japan: Difference in nominal value between new and old series (% of new GDP), 1955-2010

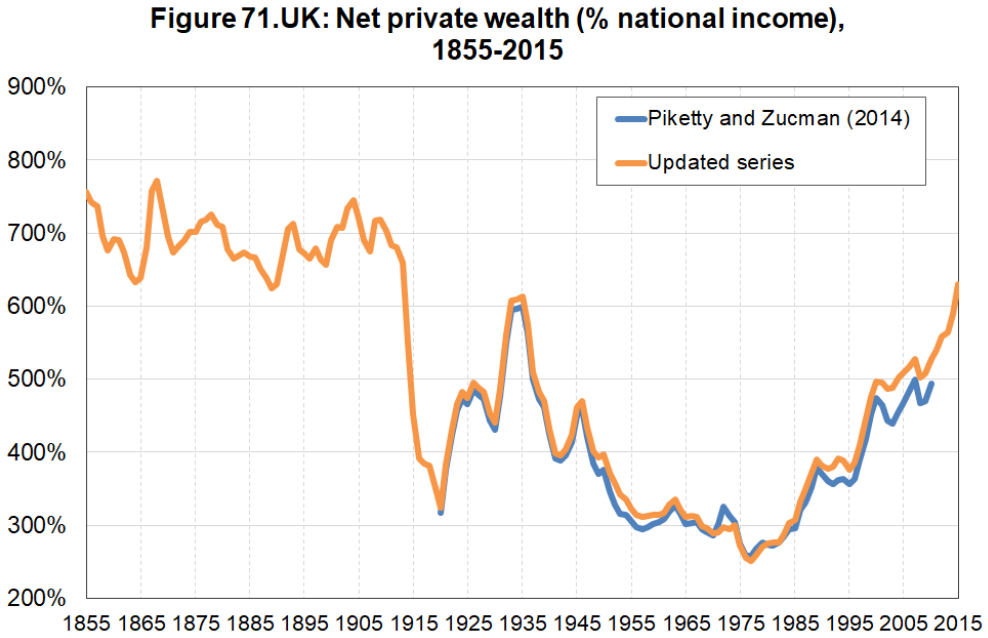

Figure 71: UK: Net private wealth (% national income), 1855-2015

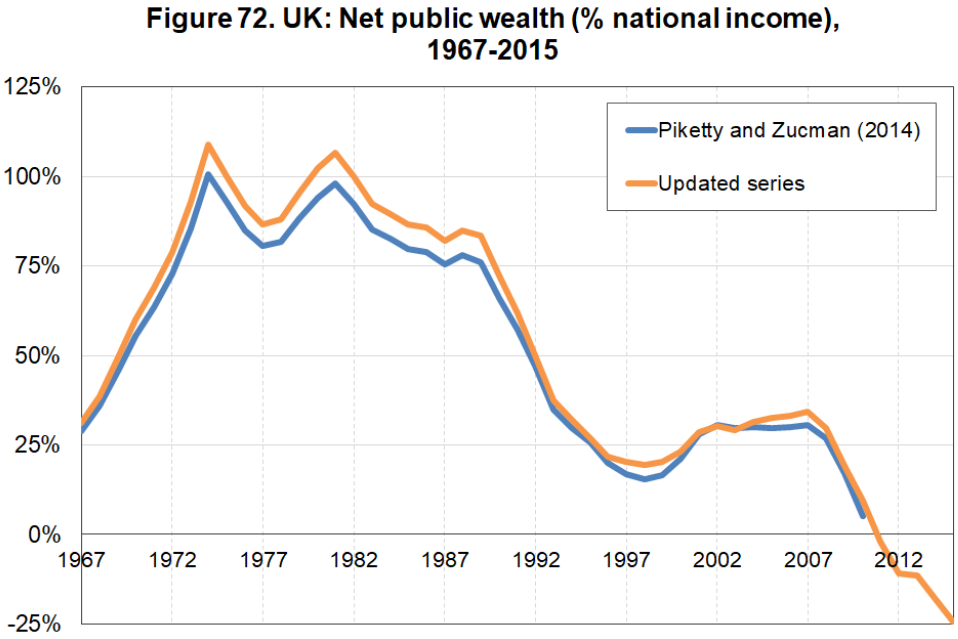

Figure 72: UK: Net public wealth (% national income), 1967-2015

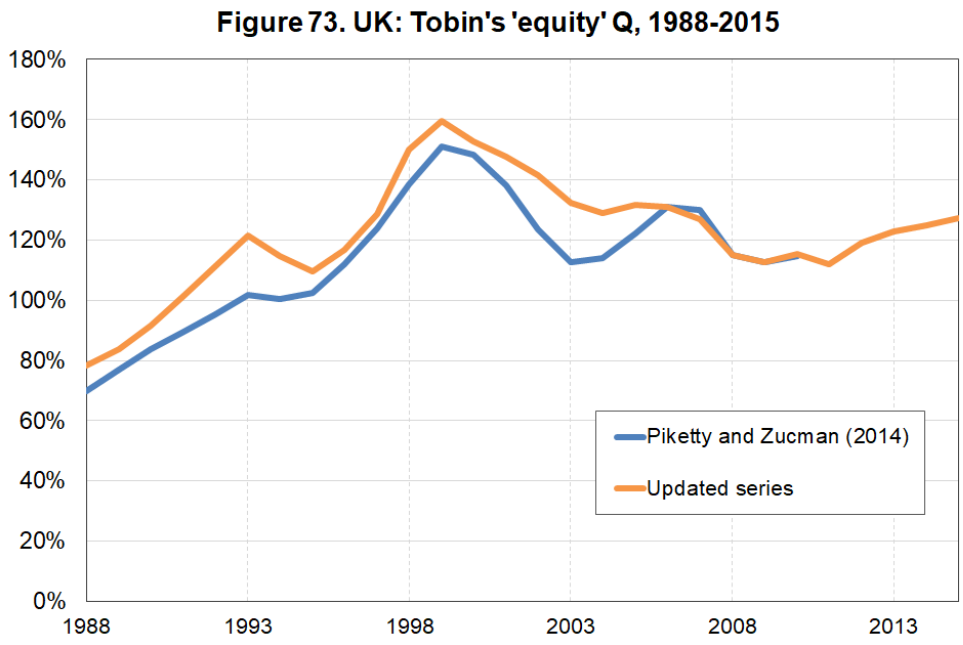

Figure 73: UK: Tobin's equity Q, 1988-2015

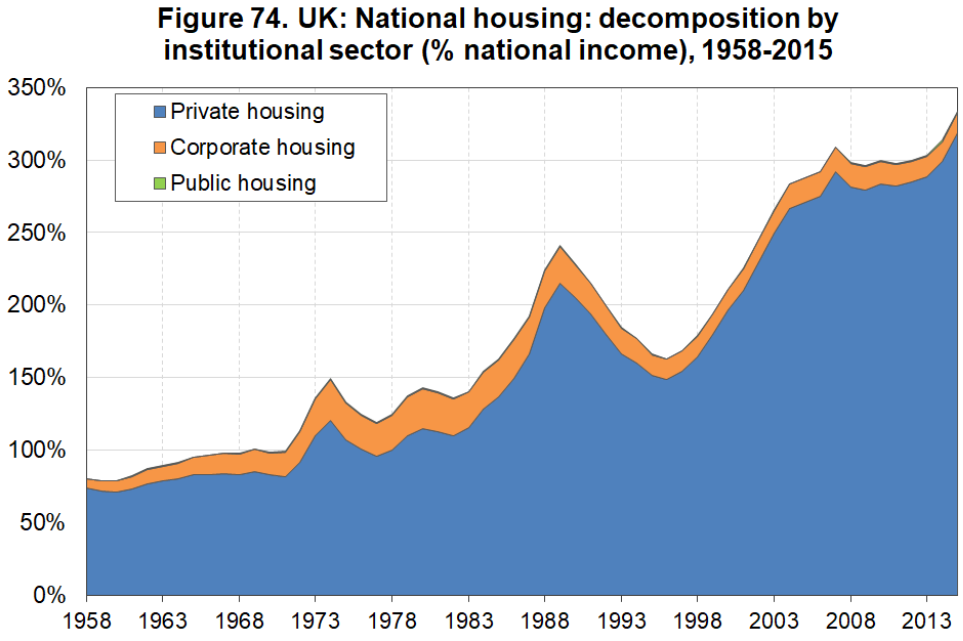

Figure 74: UK: National housing: decomposition by institutional sector (% national income), 1958-2015

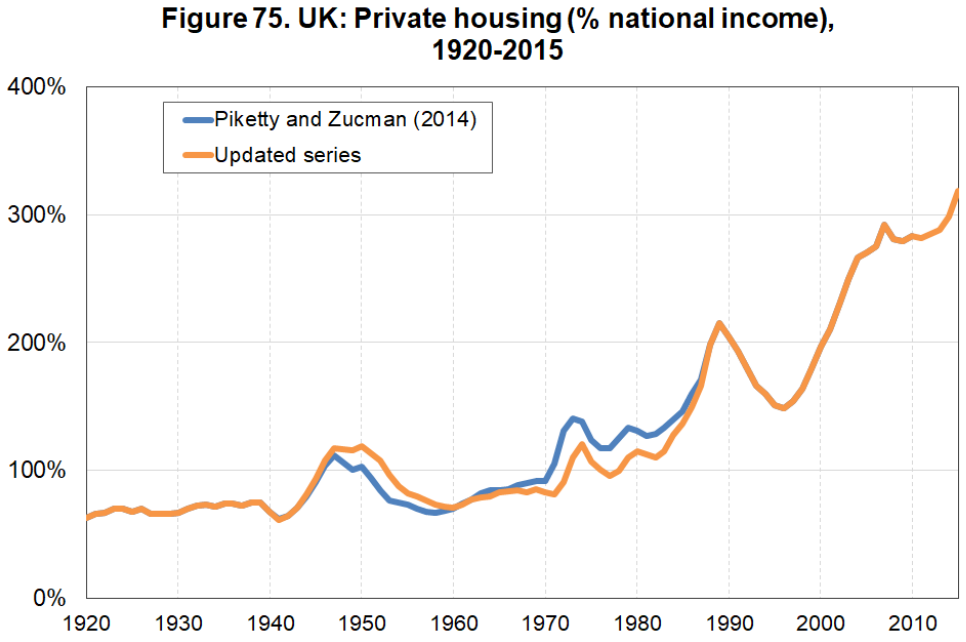

Figure 75: UK: Private housing (% national income), 1920-2015

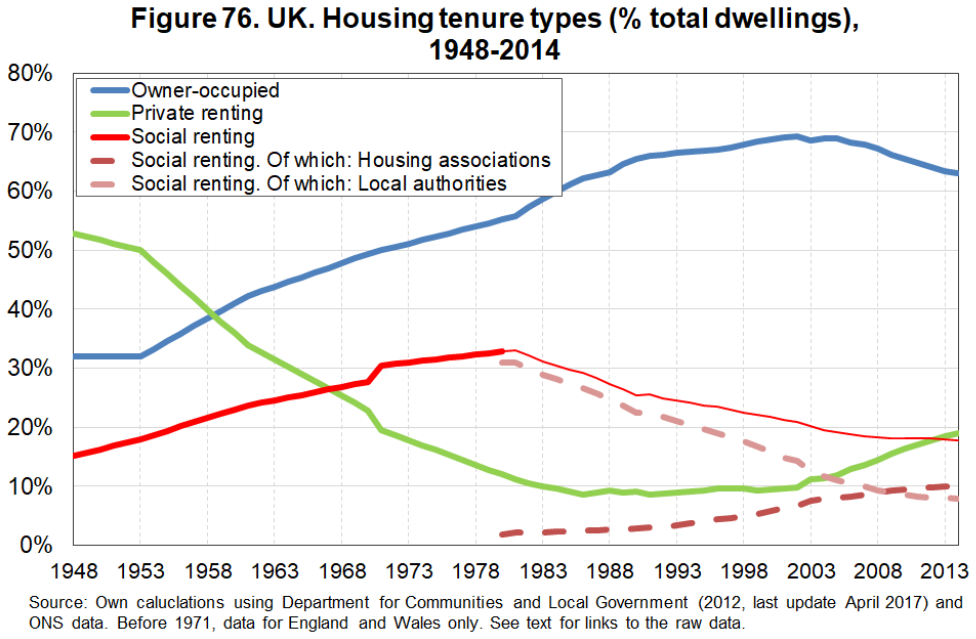

Figure 76: UK. Housing tenure types (% total dwellings), 1948-2014

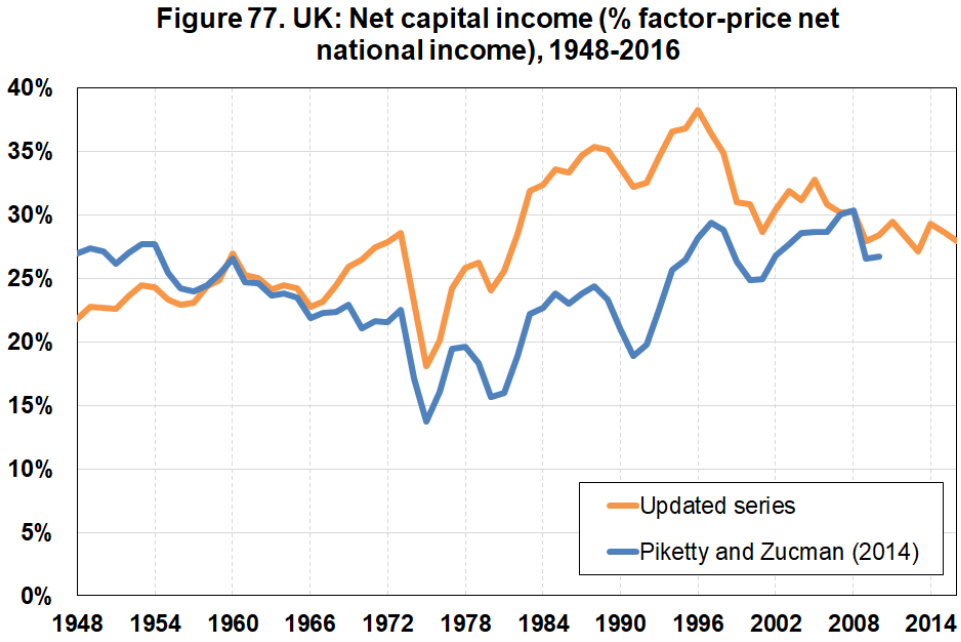

Figure 77: UK: Net capital income (% factor-price net national income), 1948-2016

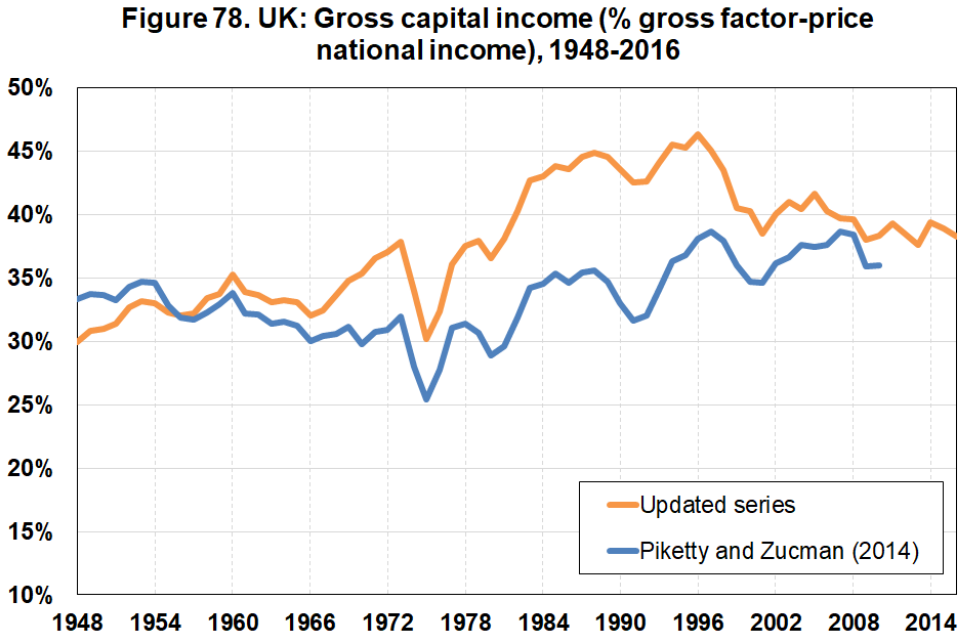

Figure 78: UK: Gross capital income (% factor-price gross national income), 1948-2016

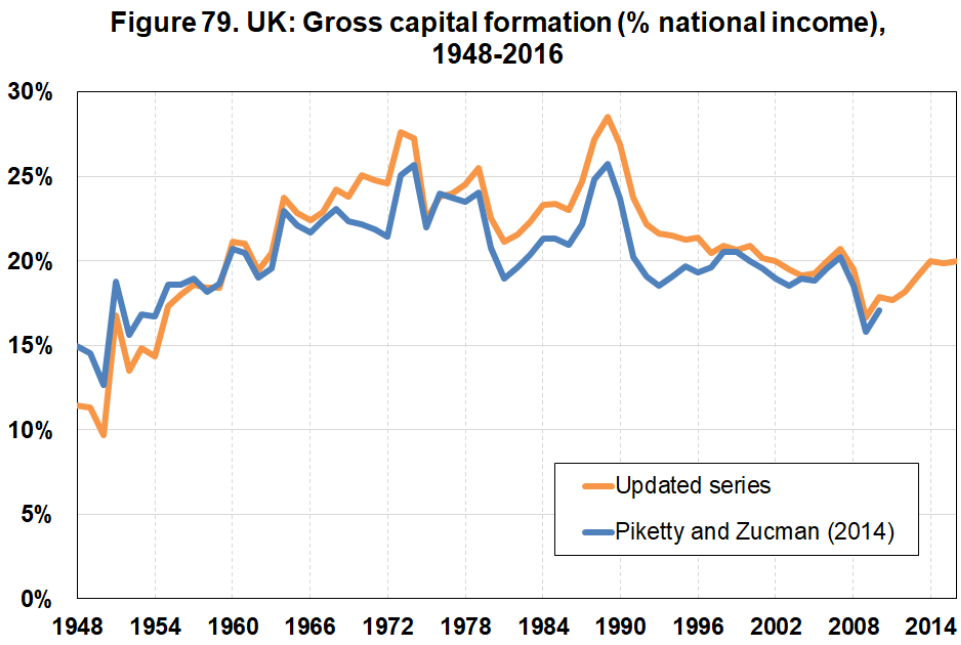

Figure 79: UK: Gross capital formation (% national income), 1948-2016

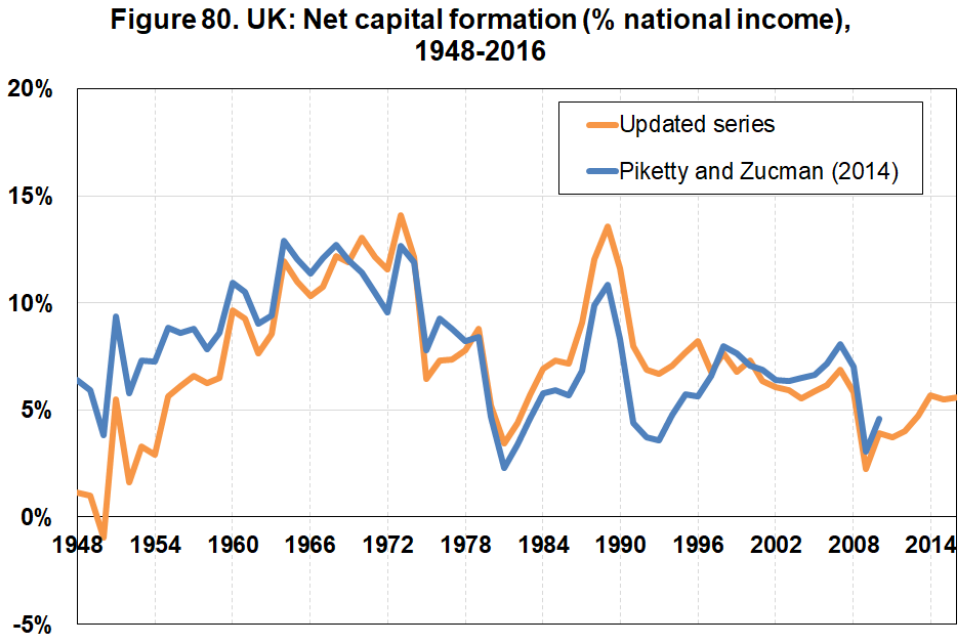

Figure 80: UK: Net capital formation (% national income), 1948-2016

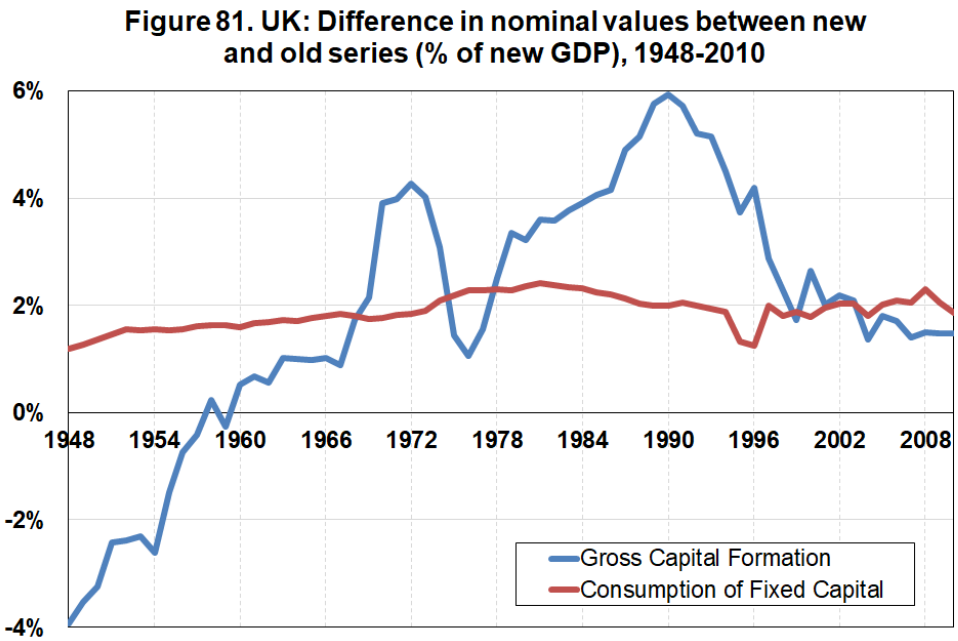

Figure 81: UK: Difference in nominal value between new and old series (% of new GDP), 1948-2010

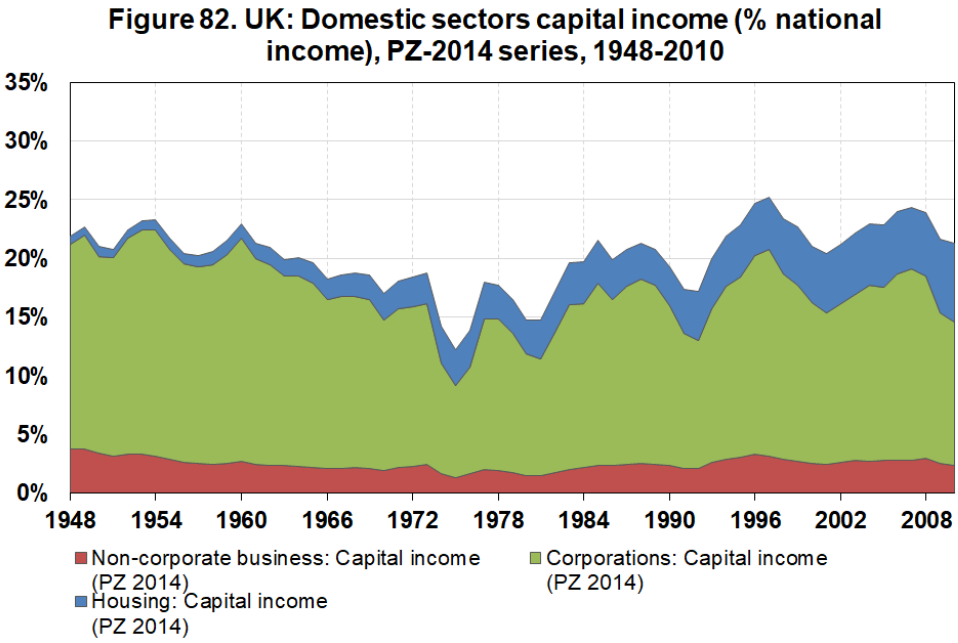

Figure 82: UK: Domestic sectors capital income (% national income), PZ-2014 series, 1948-2010

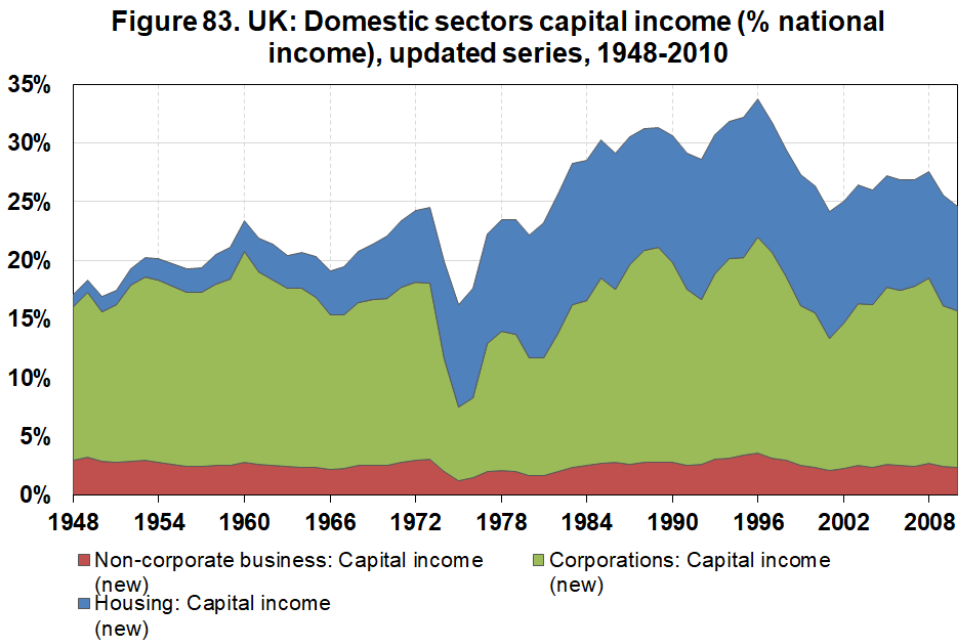

Figure 83: UK: Domestic sectors capital income (% national income), updated series, 1948-2010

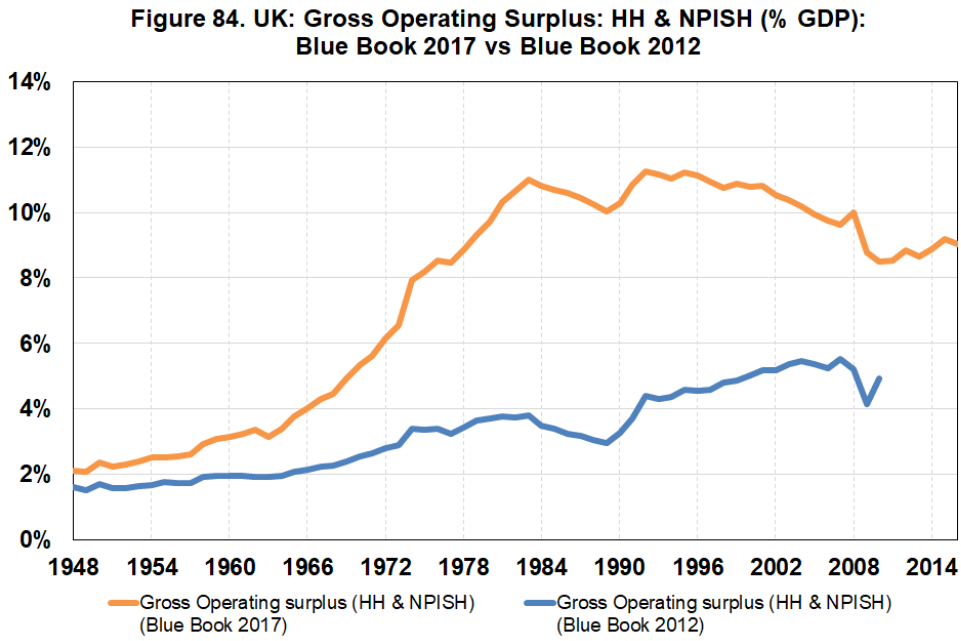

Figure 84: UK: Gross Operating Surplus: HH and NPISH (% GDP): Blue Book 2017 vs Blue Book 2012

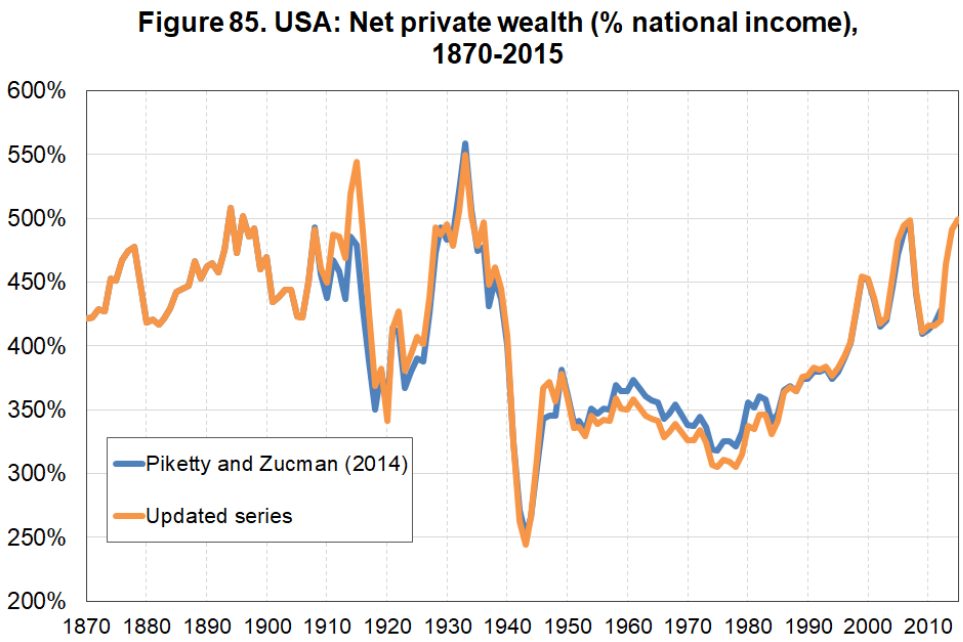

Figure 85: USA: Net private wealth (% national income), 1870-2015

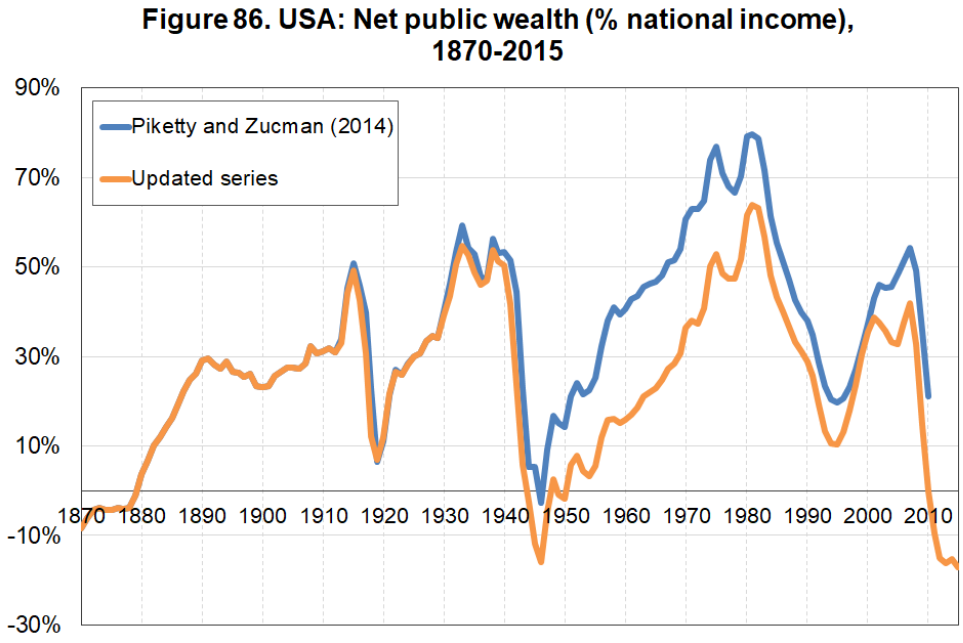

Figure 86: USA: Net public wealth (% national income), 1870-2015

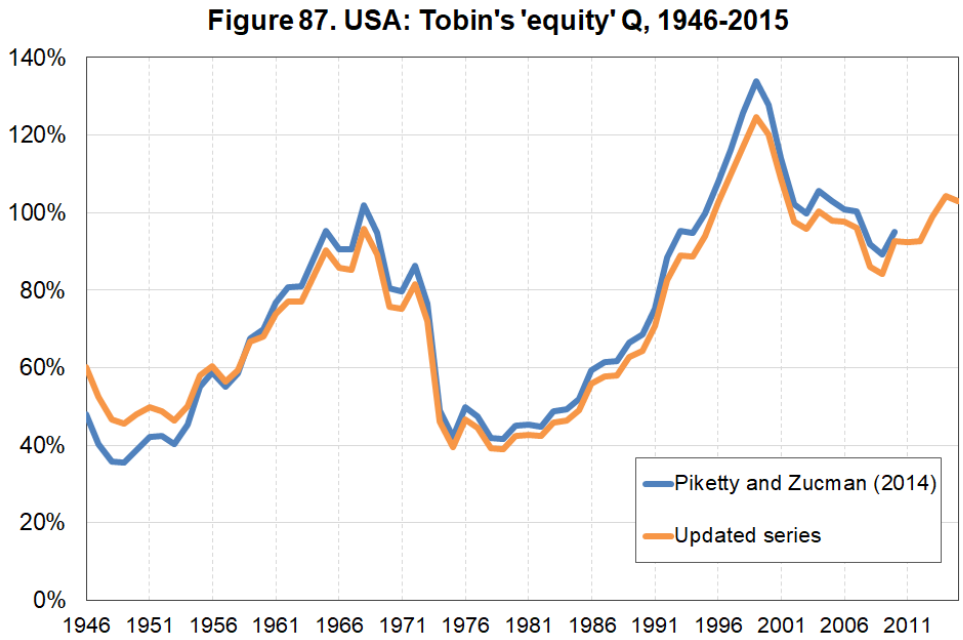

Figure 87: USA: Tobin's equity Q, 1946-2015

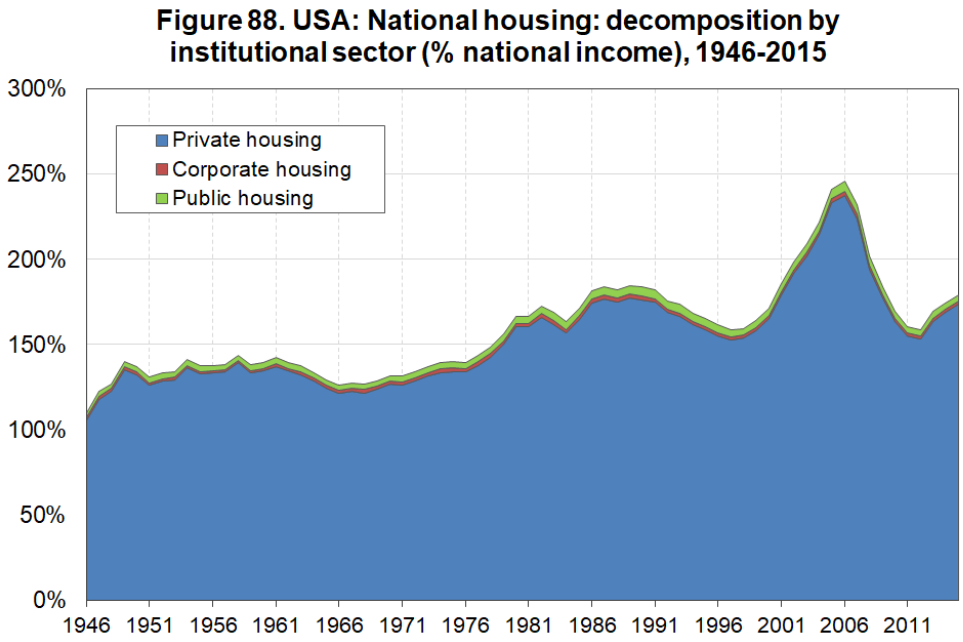

Figure 88: USA: National housing: decomposition by institutional sector (% national income), 1946-2015

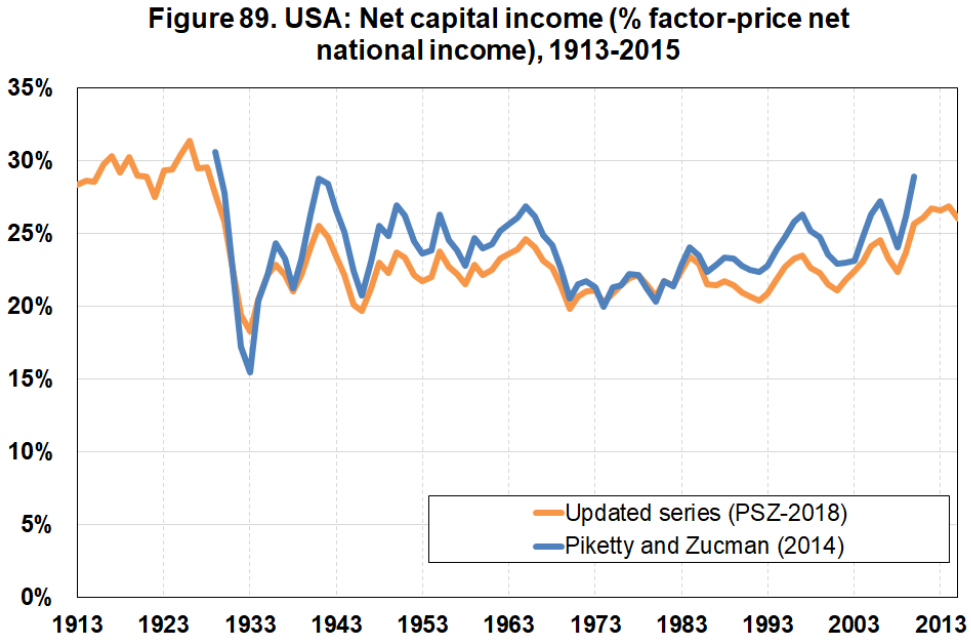

Figure 89: USA: Net capital income (% factor-price net national income), 1913-2015

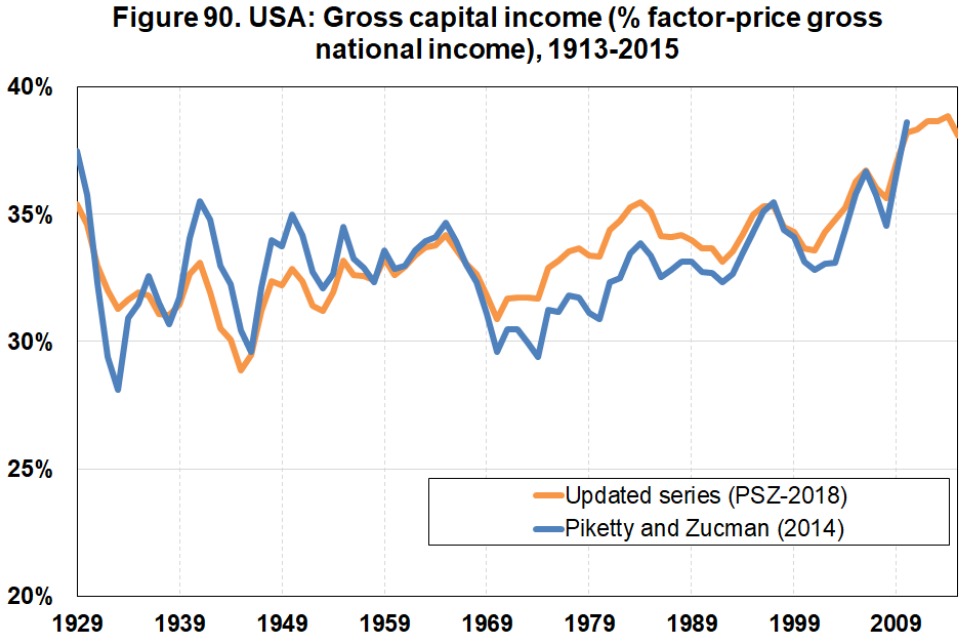

Figure 90: USA: Gross capital income (% factor-price gross national income), 1913-2015

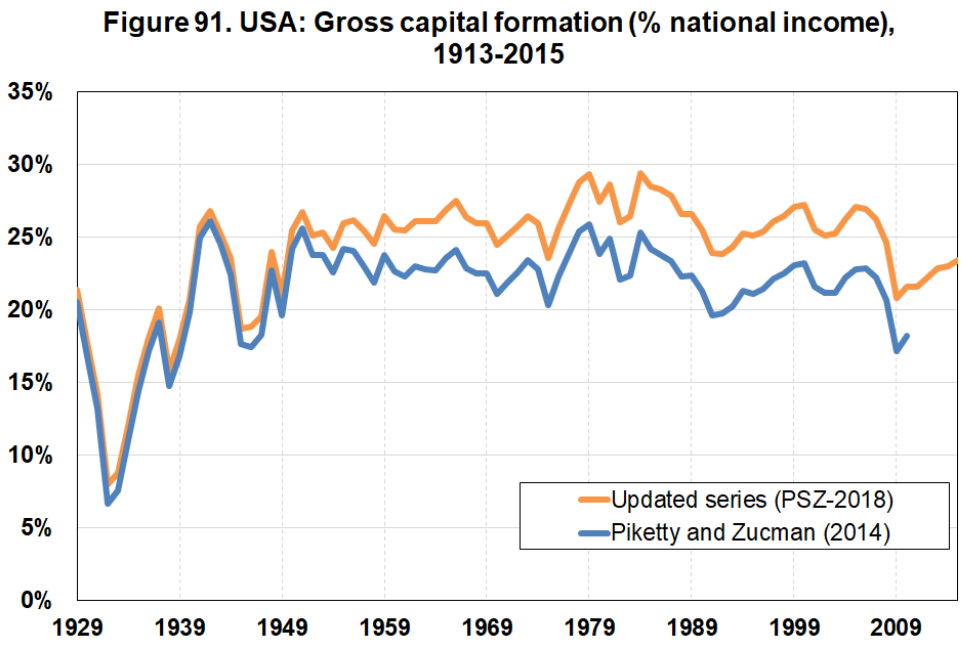

Figure 91: USA: Gross capital formation (% national income), 1913-2015

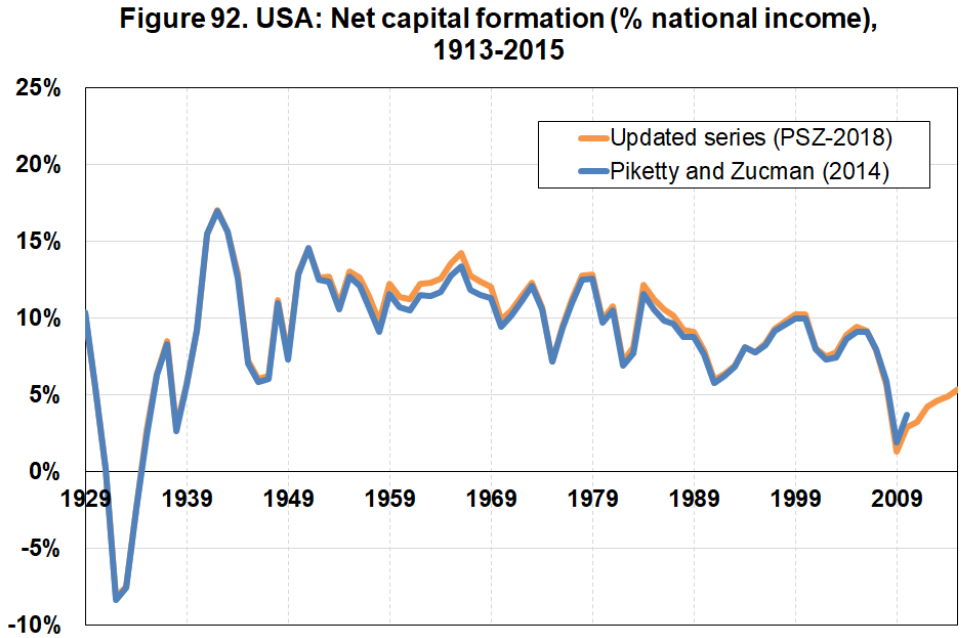

Figure 92: USA: Net capital formation (% national income), 1913-2015

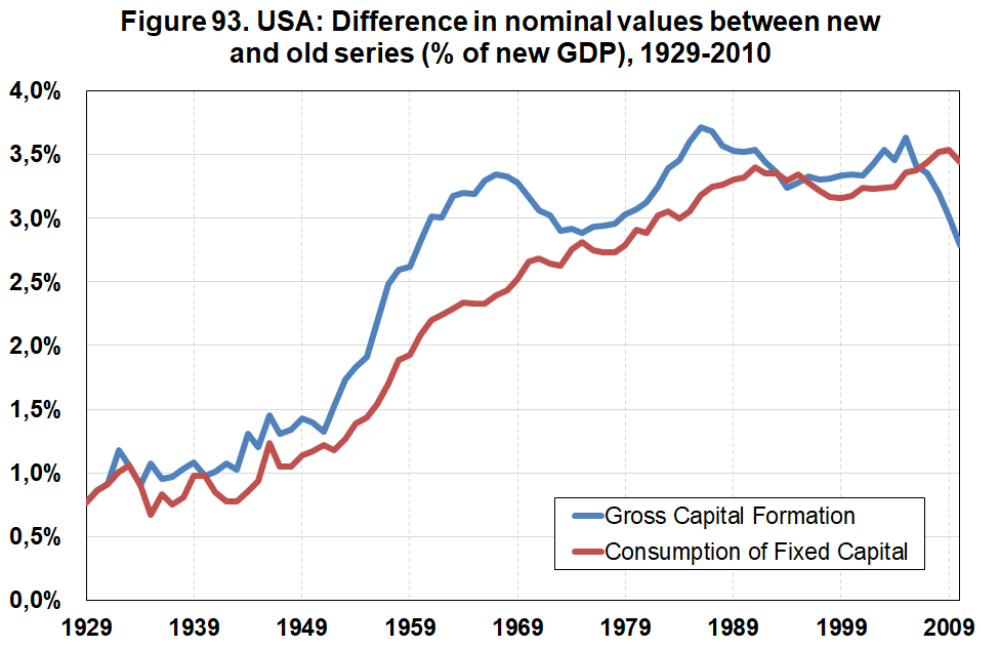

Figure 93: USA: Difference in nominal value between new and old series (% of new GDP), 1929-2010

Table 1: Natural capital in 2010 (% national income)

Table: National natural capital in 2010 (% nat. Income)			
	(1) Piketty and Zucman (2014)	**(2)** Updated series	**(3)** Extrapolated from UNU-IHDP (2014)*
Australia	58,6%	57,4%	
Canada	77,1%	60,8%	
France	No data	0,1%	
Germany	No data	No data	16,0%
Italy	No data	No data	0,1%
Japan	0,3%	1,6%	
UK	No data	No data	0,6%
USA	No data	No data	10,3%

* These values correspond to mineral and energy resources, but not to all types of natural capital. In Australia and Canada, mineral and energy resources represent 99% and 88% of natural capital in 2010, respectively.

Notes: This table displays the value of natural capital in 2010 (as % of national income) for the countries for which official estimates exist: Australia, Canada, France and Japan. Column 1 reports the values of these assets in the national accounts used in Piketty and Zucman (2014a). Column 2 reports the values of these same assets in the latest national accounts. Column 3 reports tentative estimates of natural capital based on UNU-IHDP and UNEP (2014)'s Inclusive Wealth Report for those countries for which oficial data do not exist.