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A Safe Harbor: Wealth-Income Ratios in Switzerland Over the 20th Century and the Role of Housing Prices*

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Abstract

We estimate the ratio of private wealth to national income, β_{pt}, for Switzerland over the period 1900–2018. Our results indicate that the development of β_{pt} in Switzerland did not follow a U-shaped pattern as in most European countries, but that the evolution was extraordinarily stable, with β_{pt} oscillating around 500% over most of the 20th century. However, the wealth-income ratio has been on the rise since the turn of the century to reach 721% in 2017—a level unprecedented in the past. This considerable increase is mainly driven by large capital gains in housing wealth since 2010. We present new cross-country evidence that capital gains in housing wealth have become an important driver of rising wealth-income ratios in a series of developed economies.

JEL-Classification: N34, D31, D33, E01
Keywords: wealth-income ratio; income distribution; economic growth; housing prices

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1 Introduction

How important wealth is relative to income in an economy, and how and why their relationship changes over time are fundamental economic questions. Where data is available, recent decades have shown that wealth concentration is on the rise. If at the same time total wealth is gaining importance relative to income, wealth inequality (as well as inherited wealth) is likely to play a bigger role for the overall inequality of economic resources. In their seminal contribution, Piketty and Zucman (2014) find that over the 20th century, wealth-income ratios have followed a U-shaped pattern in many industrialized economies, returning back to their high pre-World War I levels. This indeed suggest that wealth is becoming more important relative to income than it was in the post-war period, characterized by high growth and low inequality.

In this paper, we put together new historical wealth and income series to estimate wealth-income ratios for Switzerland over the 20th century, a case which is of great interest. In contrast to most other countries studied in the literature, Switzerland was only a bystander in the military conflicts that shaped the history and economic development of the Western world in the 20th century. As a result, Switzerland, unlike other nations, did not substantially increase tax progressivity either during or after World War I (Dell et al., 2007). Moreover, while most other industrialized countries pursued anti-capital policies after World War I, as Piketty and Zucman (2014) put it, Switzerland had significantly less tight financial market regulations than its neighbors. Particularly, Switzerland allowed imports as well as exports of capital—which most European countries strongly limited in the post-war period.[1] Hence, Switzerland is a particularly intriguing case study to investigate how long-run wealth accumulation unfolds in the absence of more progressive taxation and anti-capitalist policies. Despite being a small country, Switzerland is a major industrialized economy. The large and prominent financial sector is well known for its long history of banking secrecy and its important role in the tax sheltering of large fortunes (Zucman, 2013). This is compounded by the very low taxes by international standards, which have attracted a large number of very wealthy taxpayers (Baselgia and Martínez, 2021). Taken together, these factors are likely to have had an impact on the aggregate wealth dynamics in the country.

We make three major contributions in this paper. First, we combine state-of-the-art national accounts data with various historical sources to obtain consistent long-run time series of aggregate private wealth and national income at market values, dating back as

[1] The open capital market was an important prerequisite for the development of Switzerland's strong, internationally competitive financial sector over the 20th century (Müller, 2012).

far as 1900. This new long-run series allow us to put recent developments in aggregate wealth into historical perspective. Second, for the post-1990 period, we decompose total national wealth into different components. In particular, we provide a detailed decomposition of national wealth accumulation into a savings and a real capital gains component by asset class, which provides useful insights into recent macroeconomic dynamics and highlights the importance of real estate prices in aggregated wealth accumulation. Third, we investigate the role of house price dynamics in the recent rise in wealth-to-income ratios not only in Switzerland but in a number of other developed economies.

Piketty and Zucman (2014) stress that wealth stock data was largely missing until recently, as "national accounts were mostly about flows, not stocks" (p.1255). Switzerland is no exception, and, on the contrary, to this day suffers from substantial data scarcity compared to most other Western economies. We draw on new private wealth estimates provided by the Swiss National Bank and Schmid (2013) as well as on total wealth reported in tax statistics since the beginning of the 20th century (some of which were already used by Dell et al., 2007). Using these new series, our estimates of total private wealth are significantly higher than documented by Brülhart et al. (2018). However, the bulk of this difference can be explained by the fact that Brülhart et al. (2018), who study inheritances, do not look at total aggregate private wealth, but only at the inheritable fraction. In light of our estimate of total private wealth, we revise the existing series of the Swiss wealth-income ratio and the corresponding insights.

Our results suggest that the evolution of the wealth-income ratio in Switzerland did not follow a U-shaped pattern like previously assumed, but rather that the evolution was extraordinarily stable over the 20th century. After the First World War, the wealth-income ratio in Switzerland oscillated around 500% until the eve of the Great Recession. Since 2010, we are witnessing an unbroken, steep upward trend. By 2017, the wealth-income ratio had reached more than 700% for the fist time since 1900 (the beginning of our records), when wealth was worth six times national income of the time.

Starting in the 1990s, the data allow us to study national wealth and its different components, namely public and private wealth, as well as different subcomponents thereof separately. While public wealth is only a small fraction of total national wealth, we show that since 2005 it has been increasing as well. This finding stands in contrast to the experience of other countries: in terms of national income, public wealth almost tripled from 20% to just below 60%. Around 30% of this increase can be attributed to capital gains, the remaining 70% are the result of increased public saving. The latter is likely the result of "debt breaks" introduced at the federal and sub-federal state levels (the Swiss

cantons).

Decomposing private wealth into private pension wealth, net financial wealth, and housing wealth allows us to shed light on the role of housing wealth in Switzerland. Prior research by Martínez-Toledano (2020) as well as Piketty and Zucman (2014) has pointed out the importance of housing price bubbles for short- and medium-run fluctuations in wealth-income ratios. We find that the steep increase in the Swiss private wealth-income ratio observed since 2010 can by and large be attributed to rising housing prices.

To test the hypothesis that capital gains in housing or financial asset price increases have been driving wealth-income ratios in recent decades, we turn to a multivariate regression approach. In a panel regression framework including 12 countries and spanning over 45 years, we find that indeed the correlation between real housing price increases and private wealth-income ratios has become stronger in recent decades. Over the period from 1990 to 2018, a one percent annual increase in housing prices is associated with a 0.31% increase in private wealth-income ratios. This overall result masks some heterogeneity between countries. The house price effect seems to be present in France, Italy, Spain, Norway, the United Kingdom, and the U.S., as well as in Japan and Australia (when including the 1970-1990 period), but we find no effect for Germany, Sweden, or Canada. In Switzerland, the effect is weak and only present in the post-1990 period. Overall, the results support the hypothesis by Piketty and Zucman (2014) that asset price bubbles drive wealth-income ratios in the short- and medium-run. Steeply rising private wealth-income ratios can therefore be considered a warning signal and help designing appropriate financial and monetary policies. As documented in Jordà et al. (2015), with the rise in lending, notably mortgage lending, after World War II, asset price and housing bubbles became both more frequent and larger in magnitude in the second half of the 20th century. In turn this also implies that following the Harrod-Domar-Solow formula and abstracting from capital gains when determining the wealth-income ratio as $\beta = s/g$ may be misleading in times of weaker financial regulations and potentially larger asset price bubbles.

The remainder of the paper is organized as follows. Section 2 gives an overview of the literature. In Section 3 we introduce the key theoretical concepts which we aim to measure in the empirical part. Section 4 describes the data. We present our results in three steps. Section 5 presents our historical estimates of the evolution of private wealth-income ratios in Switzerland over the course of the 20th century. For the recent period 1990–2018, we decompose the national wealth-income ratio into different subcateogries. These results are shown in Section 6. To identify potential drivers of the recent increase

of the wealth-income ratio, in Section 7 we investigate the role of income growth, savings, and capital gains by asset class. Section 8 concludes.

2 Related Literature

Wealth inequality and its evolution in the long run has recently gained large attention by scholars. Due to limited data availability, studies have focused on computing top wealth shares over the 20th century (see for example Dell et al.; Föllmi and Martínez, 2007; 2017 for Switzerland; Kopczuk and Saez; Saez and Zucman, 2004; 2016 for the U.S.; Garbinti et al., 2020 for France; Albers et al., 2020 for Germany). Given the much higher concentration of wealth compared to income, focusing on the top of the distribution is justified when measuring wealth inequality.

The literature on national wealth and how it compares to national income in the long run is still very young. Its emergence is closely tied to data availability: it was only in 1993 when the System of National Accounts (SNA) first included guidelines to take stock of national wealth in a systematic and internationally comparable manner. Not all countries have immediately adopted the guidelines and the scope of these wealth estimates varies considerably across countries: while some provide very complete and long series of national balance sheets, others only report partial results. This is in fact the case for Switzerland, as we shall see. In their seminal contribution, Piketty and Zucman (2014) were the first to make use of these new balance sheets as well as historical data from eight major developed economies[2] to study the evolution of the ratio of total aggregate wealth to national income. Waldenström (2017) compiled series going as far back as 1810 for Sweden, Artola Blanco et al. (2020) present series for Spain.

To put our results into perspective, we compare them to the evolution of the wealth-income ratios in these developed economies (and Norway, for which wealth-income ratios are available from the World Inequality Database).[3] In the meantime, all the countries covered in Piketty and Zucman's (2014) original study have adapted their national accounts to the revised System of National Accounts 2008 (European Commission et al., 2009, SNA-2008). Bauluz (2019) updates Piketty and Zucman's (2014) original series, and we use these updated series when we compare wealth-income ratios across countries. Alvaredo et al. (2017) provide guidelines on the use of national balance sheets to compute

[2]Their study includes Australia, Canada, France, Germany, Italy, Japan, UK, and the U.S., Bauluz (2019) revises and updates their series.

[3]We focus on wealth-income ratios in Switzerland and other developed economies. Other authors have contributed series on emerging economies and young democracies, such as Piketty et al., 2019 for China, Novokmet, 2018 for the Czech Republic, Charalampidis, 2018 for Greece, Kumar, 2019 for India, Novokmet et al., 2018 for Russia, or Orthofer, 2015 for South Africa.

wealth-income ratios as well as distributional national accounts, (another strand of the literature that has emerged in response to improved national accounts data). To ensure comparability, we follow these guidelines as closely as possible.

It is important to note, that we are not the very first to provide estimates of the aggregate wealth-income ratio in Switzerland. Brülhart et al. (2018) study inheritance flows in Switzerland for the period 1911–2011. Along with estimates of the ratio of bequests to national income (in analogy to Piketty, 2011, for France), the authors present estimates of private net wealth as a fraction of net national income. Their estimates show a strong increase in the private wealth-income ratio since the 1970s, similar to the one observed in other European countries. Our own analysis differs significantly in several important aspects from theirs. First, we use market-value estimates of private wealth, rather than taxable wealth. Second, we combine new data sources to estimate aggregate private wealth at market value prior to 2000. This allows us to overcome the inherent undervaluation of certain assets, especially real estate, in taxable wealth. Third and in line with the guidelines established by Alvaredo et al. (2017), we include the total of private pension wealth. Since they are interested in measuring inheritance flows, Brülhart et al. (2018) exclude the non-bequeathable part of private pension wealth. Due to these differences in the measurement of aggregate net private wealth, we obtain a much more stable evolution of the private wealth-income ratio over the past century. For recent decades (1990–2018) we further decompose national wealth into public, private, and net foreign wealth, and study the evolution of private pension, housing, and financial wealth (see Section 6).

Our paper further relates to a growing literature focusing on the role of increasing house prices for wealth inequality and the observed rise in total private wealth. Already in their seminal paper, Piketty and Zucman (2014) have pointed out the importance of capital gains in the housing sector. Stressing the scarcity of land and housing, Rognlie (2015) and Knoll et al. (2017) also attributes major importance to the upward trend in house prices observed in many economies. Artola Blanco et al. (2020) provide a thorough review of the literature that studies house price phenomena. They find that the Spanish housing boom of the early 2000s led to an unprecedented rise in Spain's wealth-income ratio. To our knowledge, however, our paper is the first addressing the role of housing prices for wealth income ratios directly measuring their relationship in a multi-country panel regression framework.

3 Definition of Wealth and Income Components

Building on the work of Piketty and Zucman (2014), Alvaredo et al. (2017) have developed a unified framework (the "DINA Guidelines") to compute national wealth and income series based on the internationally used 2008 System of National Accounts (SNA-2008) (European Commission et al., 2009). To ensure comparability, we follow this framework as close as possible, depending on the availability of the corresponding data for Switzerland.

Private wealth is denoted by W_{pt} and consists of net wealth (assets minus liabilities) of private households.[4] It can be decomposed as follows:

$$W_{pt} = K_{pt} + F_{pt} - L_{pt} \ , \tag{1}$$

where K_{pt} are non-financial assets, F_{pt} are financial assets, and L_{pt} are financial liabilities of private households. Financial assets include bank accounts, stocks and bonds, as well as life insurances and funded pension wealth. In contrast, pay-as-you-go social security pension wealth (called "Old Age and Survivors Insurance" (OASI)) and any other claims on future government expenditures are excluded, as well as durable goods. The exclusion of claims on future government expenditures is justified by the fact that these household assets count as liabilities for the government sector and would therefore cancel out when looking at national wealth—the more meaningful concept (see Piketty and Zucman, 2014, for a detailed discussion).

In the literature, non-financial assets K_{pt} are usually decomposed further into:

$$K_{pt} = H_{pt} + A_{pt} + D_{pt} \tag{2}$$

Housing assets H_{pt} are defined as the sum of the market value of dwellings and land underlying dwellings. A_{pt} denotes the value of agricultural land, and D_{pt} stands for other domestic capital, i.e., all non-financial assets except housing and agricultural land, such as unincorporated business assets.

Public (or government) wealth, W_{gt}, is defined as net wealth of all public administrations and government agencies. Analogous to Equation (1), public wealth can be decomposed into public non-financial and financial assets, K_{gt} and F_{gt}, respectively, and financial liabilities of the public sector, L_{gt}.

[4] Nonprofit institutions serving households (NPISHs) are included in the household sector, since the frontier between individuals and private foundations is not always clear. In the Swiss national account system, NPISHs and private households are reported together as one single category. Net wealth of NPISHs is usually small (e.g., in France about 1% of total net private wealth in 2010 (Piketty and Zucman, 2014)).

The market-value of national wealth W_{nt} is the sum of private and public wealth. National wealth can be split up into market-value domestic capital, K_{nt}, and net foreign wealth, NFA_{nt}:

$$W_{nt} = W_{pt} + W_{gt} = K_{nt} + NFA_{nt} \tag{3}$$

We use income net of depreciation, i.e., gross national income minus consumption of fixed capital, as recommended by Alvaredo et al. (2017). In line with the production approach, net national income, Y_t, is defined as the sum of net domestic output Y_{dt} (GDP minus consumption of fixed capital) plus net foreign income, $r_t NFA_t$:[5]

$$Y_t = Y_{dt} + r_t NFA_t \tag{4}$$

The private wealth-income ratio, β_{pt}, is defined as:

$$\beta_{pt} = \frac{W_{pt}}{Y_t} \tag{5}$$

Analogously, β_{nt} denotes the national wealth-income ratio:

$$\beta_{nt} = \frac{W_{nt}}{Y_t} \tag{6}$$

In a closed economy, β_{nt} equals the domestic wealth-output ratio $\beta_{kt} = \frac{K_t}{Y_{dt}}$. Moreover, if public wealth is zero, it holds that: $\beta_{pt} = \beta_{nt} = \beta_{kt}$.

Next, we turn to the accumulation of wealth. Between time t and $t+1$ the accumulation of national wealth W_{nt} can be split into a volume effect and a relative price effect:

$$W_{nt+1} = W_{nt} + S_t + KG_t \ , \tag{7}$$

where S_t is the net-of-depreciation national saving flow (volume effect), and KG_t are capital gains or losses (relative price effect). In the long run, where relative price effects balance out, at least theoretically, such that $KG_t = 0$, the steady-state national wealth income ratio is given by the Harrod-Domar-Solow formula:

$$\beta_{nt} \longrightarrow \beta_n = \frac{s}{g} \tag{8}$$

where s is a fixed long-run saving rate, and g is a fixed growth rate of national income. That β_{nt} converges to β_n in the steady state relies on the assumption that there is no change in the relative price of assets and consumption goods over time.[6] Although this

[5] In the results section, we use the term national income which always refers to net national income.

[6] For a critical discussion concerning the use of the Harrod-Domar-Solow formula see Krusell and Smith Jr. (2015).

may be a plausible assumption in the long run, in the short and medium run, relative price effects, i.e., capital gains, turn out to be crucial.[7] We thus decompose the evolution of national wealth-income ratios into two multiplicative components—the volume and the relative price effect—as follows:

$$\beta_{nt+1} = \frac{(1+g^w_{st})(1+q_t)}{1+g_t}\beta_{nt} \ , \tag{9}$$

where $1+g^w_{st}$ is the savings-induced wealth growth rate, $1+q_t$ the capital gains induced wealth growth rate and $1+g_t$ the growth rate of national income. The savings-induced wealth growth rate, $1+g^w_{st}$, equals $1+\frac{s_t}{\beta_{nt}}$. The rate of capital gain or loss can then be estimated as a residual.

4 Data

We combine various data sources for our empirical analysis of the wealth-income ratio. To ensure comparability with other countries, we follow the approach and methods developed by Piketty and Zucman (2014) and established in Alvaredo et al. (2017) as closely as possible. Switzerland's national accounts are based on the European System of National Accounts 2010 (European Union, 2013, ESA-2010), which is compatible with the SNA-2008, but Switzerland's national accounts are considerably less detailed than those of larger European countries. We pay particular attention to the construction of a consistent, long-run estimate of total private wealth, starting in 1900. Other wealth aggregates, such as national wealth or public wealth, are only available from official sources for more recent decades, starting in 1990. For a detailed description of the data and list of all sources, we refer to Appendix A.

Private Wealth (W_{pt}). To compute long series of private wealth, we have to distinguish between three sub-periods, each of which is determined by differing limitations to data availability. To obtain a long run series of total private wealth at market value, we combine the estimates from the three sub-periods.

For the period 2000–2018, the Swiss National Bank (SNB) provides reliable data on aggregate private net wealth W_{pt} at market values as part of the financial accounts of Switzerland, which can be broken down into financial assets F_{pt}, financial liabilities L_{pt} and non-financial assets K_{pt}. The stock gross financial wealth, F_{pt}, consist of currency and transferable deposits, debt securities (short-term, long-term and structured products), shares and other equity, units in collective investment schemes as well as insurance

[7] This rationale can be readily supported theoretically with a one-good and a two-good model of wealth accumulation. For a detailed discussion, see sections III.B and III.C in Piketty and Zucman (2014).

and pension schemes. L_{pt} is composed of loans, mortgages, and other outstanding liabilities. For non-financial assets, K_{pt}, the SNB only reports estimates on housing wealth, H_{pt}. To the best of our knowledge no estimates on the value of agricultural land and A_{pt} and other domestic capital D_{pt} exist for Switzerland. Therefore, in our analysis private non-financial assets consist only of housing wealth, such that ($K_{pt} = H_{pt}$), which implies that $A_{pt} = D_{pt} = 0$.[8] Note that by housing wealth H_{pt} we refer to the market value of real estate held by private households.

No official statistics on net private wealth exist for Switzerland prior to 2000. For the period 1981–1999 we rely on the estimates of private net wealth at market value by Schmid (2013). These estimates are based on internal SNB data and were the precursors of the official statistics published later by the SNB. As Figure B1 shows, these series are virtually identical to the official statistics published by the SNB in the overlapping period 2000–2010.[9]

Prior to 1981, data on market value W_{pt} is nonexistent and we have to take an alternative approach. Following Föllmi and Martínez (2017), we combine total wealth estimates based on tax data published in Dell et al. (2007), with historical estimates of total pension fund assets published in Leimgruber (2008). Combining wealth tax and pension data is important, because pension wealth is not taxed and is therefore missing in tax statistics. Next, we calculate the annual growth rate of this combined series and apply the growth rate to the earliest market value observation of private wealth from Schmid (2013) in 1981. This approach allows us to extrapolate the market value wealth backwards using observed changes in taxable and pension wealth (see Appendix A.1 for details). Under the assumption that the latter correspond well to changes in total private wealth, this approach should result in a consistent estimate of private wealth at market value. Figure B4 shows the annual percentage change in private wealth at market value and taxable plus private pension wealth, respectively, for the period 2003–2016, where annual data for both series exist. Growth rates track each other extremely well—including the years around the outbreak of the Great Recession in 2008, which are characterized by large changes from year to year. We are therefore confident that our method is valid to estimate total private wealth at market value over time.

Our approach to measure total private wealth pre-1981 obviously deviates from the methodology proposed by Piketty and Zucman (2014) and established in Alvaredo et al.

[8] All three components (H_{pt}, A_{pt}, D_{pt}) of K_{pt} are available on WID.world for the countries we compare our results to. In Appendix B.2 we describe how we adjusted the international data in order to compare them with the results for Switzerland.

[9] At the time, the author had access to internal data at SNB. We are very grateful to him for sharing this data with us.

(2017), which is based strictly on national accounts data. Note, however, that we refrain from the perpetual inventory method, which cumulates past investment flows. As discussed in (Piketty and Zucman, 2014, p.1265), this method falls short of appropriately measuring the capital stock for several reasons. Our approach, in contrast, is based on changes in actual measures of total private wealth, which, however, do not capture the full capital stock in the economy at market value.

To our knowledge, there exist no other long-run time series on private wealth in Switzerland—apart from Brülhart et al. (2018) and our own estimates. This is because since the 1930s, national income rather than wealth has increasingly served as main indicator for (economic) well-being (Landolt, 2014). At the beginning of the 20th century, however, several attempts were made to record Switzerland's national wealth. Estimates for the early 1910s varied considerably between 30 and 40 billion Swiss francs (in nominal terms). Geering and Hotz (1914) estimated the value of Swiss national wealth around 1914[10] at 30 billion Swiss francs. Later valuations resulted in somewhat higher estimates, such as Landmann (1916), who estimated Swiss national wealth for the year 1913 at 34.6 billion Swiss francs and Fahrländer (1919), also for the year 1913, at 41.96 billion Swiss francs (all estimates in nominal terms). Some of these estimates also include certain assets that are excluded from our definition of wealth, in particular durable goods. For instance, the estimate of Landmann (1916) includes fire insured movable property worth 9.9 billion Swiss francs. Without these movable assets, national wealth would fall considerably to around 24.7 billion Swiss francs. This is very close to our own estimate of private wealth for 1913 of around 26 billion nominal Swiss francs. By comparison Brülhart et al. (2018) estimate private net wealth in 1911 at around 18 billion Swiss francs.

Public Wealth (W_{gt}). All analyzed data on public wealth W_{gt} for Switzerland between 1990 and 2018 can be taken from the "Government Finance Statistics Model" (GFS Model) of the Federal Finance Administration, which follows the International Monetary Fund (IMF) financial statistical standard that ensures international comparability. Note that no data on public wealth exists prior to 1990.

National Wealth (W_{nt}). Equation (3) shows that national wealth is the sum of W_{pt} and W_{gt}, therefore no additional data is required to obtain W_{nt}. Note that no data on national wealth exists prior to 1990, since no data on public wealth is available prior to 1990.

Net Foreign Wealth (NFA_{nt}). W_{nt} can further be split into domestic capital K_{nt}

[10] Geering and Hotz (1914) do not give a particular date for their estimate. The data used also come from different years. The authors state, however, that national wealth may be estimated at 30 billion "**today**".

and net foreign assets NFA_{nt}. For the period 2000–2018 net foreign wealth is provided by the SNB as part of the Swiss balance of payments. For the years 1995–1999 we obtain net foreign wealth from published reports of the SNB.

Net National Income (Y_t). As with private wealth, we have to rely on three different sources to obtain long run series of national income covering the entire 20th century as no uniform series exists for Switzerland. For the period 1995–2018, we use national income data as published by the Federal Statistical Office (FSO) in the Swiss National Accounts, which are fully compatible with the SNA-08 framework. Between 1929 and 1994, we use historical national income time series provided by the Historical Statistics of Switzerland (HSSO) database. Unfortunately, income concepts vary slightly between these sources. We therefore use growth rates to extrapolate income backwards from 1995 (see Appendix A.4 for details). For the years prior to 1929, finally, we have to fall back on growth rates of historical GDP estimates (rather than NNI) by Stohr (2016).

Additional Macroeconomic Data. Occasionally, we present results not as wealth-income ratios, but as aggregated real or as per capita real variables, for which we additionally use population (see Appendix A.5) and price data (see Appendix A.6). In order to split changes in total wealth into a savings and a capital gains/loss component (see Equations (7) and (9)), we use supplementary data on savings (see Appendix A.7). Detailed methodological explanations of this decomposition can be found in Appendix A.9. Where meaningful, we compare our results for Switzerland internationally. The international wealth data presented in our analysis can be directly obtained from the World Inequality Database (WID.world; see Appendix A.8). To analyze how stock and housing prices affected changes in the wealth-income ratio, we use real house price index data (see Appendix A.10) and stock market index data (see Appendix A.11), both obtained from the OECD.

5 Switzerland's Private Wealth-Income Ratio, 1900–2018

In this section we present our estimates of the evolution of Switzerland's private wealth-income ratio, β_{pt}, over the 20th century. In principle, we would prefer to study the development of the *national* wealth-income ratio, since this concept more adequately reflects the importance of total wealth in a country (Piketty and Zucman, 2014). As explained in the data description, however, no data on public wealth is available prior to 1990, and hence our long-run estimates are limited to private wealth.

As we will show in Section 6, at least since the 1990s, public wealth has played a minor

role in Switzerland, such that focusing on the evolution of private wealth seems justified. While we cannot rule out that public wealth was larger in the past, results in Piketty and Zucman (2014) show that in rich countries, net public wealth has always been small compared to private wealth. In all the rich countries they study, they find that the fall in government wealth was much smaller than the rise of private wealth observed in the second half of the 20th century.

In what follows, we first describe how we compute our estimates of private wealth-income ratios for Switzerland and why they differ significantly from the previous estimates by Brülhart et al. (2018) (Section 5.1). Next, we explain the extraordinary trajectory of β_{pt} in Switzerland over the 20th century and how it compares to other countries in Section 5.2.

5.1 Comparison with Prior Estimates

The solid red line in Figure 1 shows our estimates of Switzerland's private net wealth in terms of national income since 1900. The hollow dots indicate the years for which total wealth data is available (either in the form of tax statistics and pension statistics (1900–1981), private net wealth estimates at market value by Schmid (2013) (1981–1999), or aggregate wealth estimates published by the SNB (2000–2018)). Prior to 1981, where wealth data is not available on an annual basis, we linearly interpolate the total wealth series for the missing years in between. We obtain our measure of interest, β_{pt}, by dividing these annual wealth series by national income. This explains why our series fluctuates even in years where no aggregate wealth data exist.

For comparison, the dashed black line in Figure 1 shows private wealth-income ratios presented in Brülhart et al. (2018). Again, data points (black triangles) indicate the years for which they observe total aggregate wealth from tax statistics, while the dashed line depicts a linear interpolation. While both series show a steep increase in the private wealth-income ratio since the mid-1990, the estimates from Brülhart et al. (2018) indicate a lower overall level of β_{pt}, and they lead to a more pronounced U-shape in the long run trend.

Since both approaches use very similar national income series, the principal source of divergence is due to different estimates of total private wealth. Figure B1 in the Appendix shows the wealth estimate of Brülhart et al. (2018) for the period 1981-2018 along with the data on which our wealth estimates are based. Two main reasons explain the significant difference between the two estimates of the private wealth-income ratio.

First, we use data on private net wealth at market prices, while Brülhart et al. (2018)

estimate net private wealth on the basis of tax data. The authors emphasize that net private wealth estimates based on wealth tax statistics will be downward biased, because i) tax valuations of housing wealth are below market value, and ii) because compulsory private pension-fund wealth is exempt from taxes and hence not covered in tax data. Although they attempt to correct for the undervaluation of tax data, their estimate of total private wealth remains below official estimates published by the SNB. According to Brülhart et al. (2018), real estate is valued at approximately 70% of market value. To account for this undervaluation of real estate wealth, they add a 30% mark-up to all their tax-based wealth series. While prior to 1981 we have to rely on tax data to estimate total wealth, too, we use a different approach to Brülhart et al. (2018): rather than using the level of total wealth observed the tax data, we use changes in combined historical tax and pension wealth data to extrapolate backwards the level of total private wealth from 1981, the first year for which private wealth at market value is available (see Appendix A.1 for details).

The second and main reason lies in the focus of the two papers and how, therefore, tax-free pension wealth is taken into account. Both approaches complement the tax series with historical pension assets data found in Leimgruber (2008). However, since Brülhart et al. (2018) are interested in inheritances, they only consider the part of pension assets that is drawn as a lump sum on retirement and is therefore bequeathable. They assume that an estimated 70–80% of total pension wealth will be drawn as ordinary annuities while the rest of the pension wealth is drawn as lump-sum payouts. Hence, they only add 20–30% of total pension assets to their tax-based wealth series. This is certainly justified if one is interested in inheritable wealth, but the approach misses part of total private net wealth—the measure we are interested in. In this sense, the two wealth series can indeed be reconciled (Rais, 2021).[11] As undisbursed pension assets are an integral part of the assets of Swiss households built up through mandatory savings, however, they should be fully taken into account when measuring total private net wealth.

[11] Our time series corresponds to total private net wealth at market values as recommended in the international literature (Alvaredo et al., 2017), while Brülhart et al.'s (2018) series represents inheritable private wealth. Rais (2021) documents and carefully discusses other, though less significant, differences between the two series.

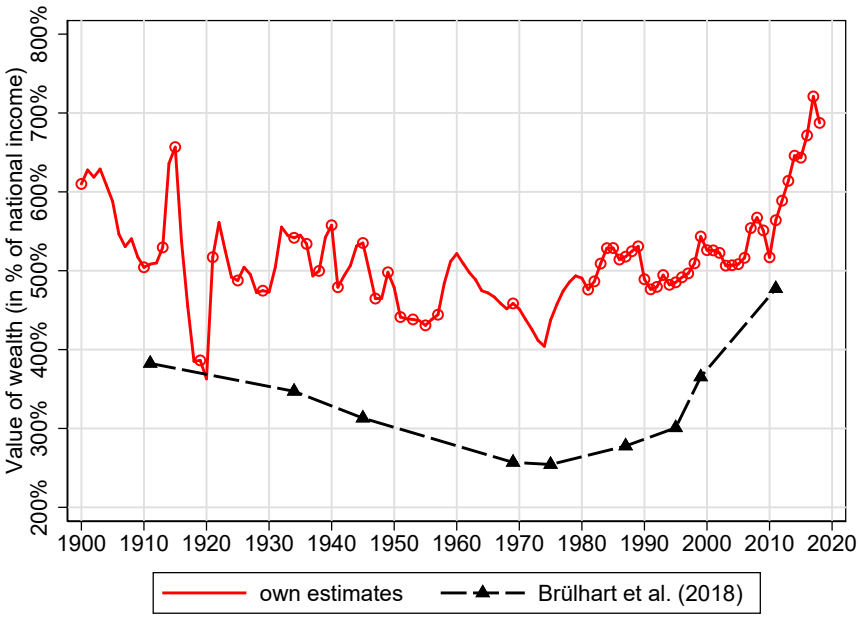


Figure 1: Different Private Wealth Estimates for Switzerland, 1900–2018

Note: This figure shows our estimate of the private wealth-income ratio, β_{pt}, for Switzerland in comparison with the estimates presented in Brülhart et al. (2018), which are based on federal wealth tax statistics. The the red hollow circles in the time series show observations for which we do have data on private wealth. For the years in between, we have interpolated our wealth series linearly. Thus, the total fluctuation between the marked years results exclusively from the change in national income. The data sources for our new historic private wealth estimates of Switzerland are described in Appendix A.1. The observations of Brülhart et al. (2018) are linearly interpolated between years where wealth is observed (black triangles).

5.2 Long-Run Evolution in International Comparison

In this section, we compare the evolution in Switzerland to that of all other countries for which long-run estimates exist, namely Germany, France, the United Kingdom, the United States (Piketty and Zucman, 2014), Sweden (Waldenström, 2017), and Spain (Artola Blanco et al., 2020). Figure 2 shows that our results in terms of the general level of β_{pt} are well in line with those of other countries.

At the onset of the 20th century, Switzerland's wealth-income ratio was at a relatively high level of roughly six times national income. This level was similar to that observed in other countries at that time (e.g., Spain and Germany), as shown in Figure 2).

The observed decline in β_{pt} in Switzerland between 1900 and 1910 was due to increases in real income: between 1900 and 1910, real per capita net national income grew by 21%, while real wealth per capita stagnated (see Appendix Figure B2). The very large swings between 1913 and 1922 were caused by the shock of the First World War (1914–1918). Switzerland experienced a steep rise in price levels and real income fell sharply during the

war. At the same time, total private wealth declined too, such that β_{pt} fell from 654% in 1915 to 383% in 1918. As a result of the subsequent recovery of private wealth after the war and the stagnation of real national income between 1918 and 1922, β_{pt} recovered to a large degree. The few observations of this tumultuous time should be interpreted with care, as data quality is likely limited. Note however, that other countries shown in Figure 2, in particular Sweden and the U.K., experienced similar dynamics during this period leading up to the Great Depression.

In stark contrast to other countries, the wealth-income ratio in Switzerland reached pre-war levels in the 1920s. By that time, France, Germany, or Sweden had already experienced a large decline in their private wealth-income ratio, reaching historically low levels. The shocks of World War I (as well as later in World War II) led to a massive decline of private wealth in Old Europe. Importantly, this was mainly caused by real capital losses and only partly by war destruction (Piketty and Zucman, 2014).

After overcoming the post-World War I recession of the early 1920s, Switzerland recorded above-average growth in national income from 1922 until the onset of the Great Depression (Woitek et al., 2012), leading to a slight decline in β_{pt}. Between 1929 and 1939, Switzerland lived through a decade of declining per capita income (Woitek et al., 2012), and β_{pt} rose back to 550%. While in other countries such as the U.K. or Sweden, but also in France and Germany, we observe similar movements in β_{pt} over this time, the magnitude of the changes is much smaller in Switzerland. As a result, β_{pt} remains relatively stable and high in Switzerland.

Compared to the First World War, World War II hardly seems to have left its mark on the private wealth-income ratio in Switzerland. We observe sharp declines in the U.S., France, the U.K., and—to a smaller degree—Germany, but the decline in Switzerland is moderate and unsteady. Real income and real wealth remained more or less constant over the period 1939–1945.

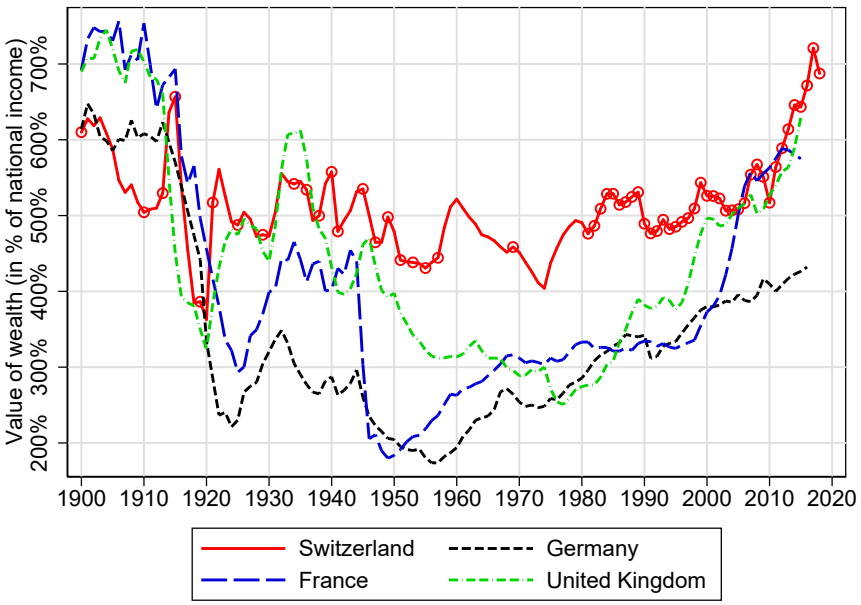
After the end of the Second World War, Switzerland recorded unprecedented, high growth rates. Real national income grew by an average of 5.3% per year until 1970 (Figure B2), contributing to a decline in β_{pt}. From the 1970s onward, however, real income growth fell to 1.8% (geometric average of the 1970–1995 period) and was therefore particularly low—also relative to other countries. The low average income growth rate can be explained by the slump in economic growth in the 1970s and the deep recession and stagnation phase of the 1990s (Woitek et al., 2012). As a result, β_{pt} returned to its 20th century average of 500%. In contrast, wealth-income ratios rose steadily over the second half of the past century in Germany, the United Kingdom, France, and—although

to a lesser extent—also in the United States. Piketty and Zucman (2014) attribute this increase to a long-term recovery in asset prices. They argue that the long-run swing in relative asset prices was itself driven by changes in capital policies. In their view, anticapital policies depressed asset prices in the post war period. When these policies were gradually lifted from the 1980s onward, asset prices started recovering to eventually reach pre-war levels. The Swiss case adds to this evidence, showing a much more stable long-run evolution of private wealth relative to income in the absence of such anticapital policies and increased taxation.

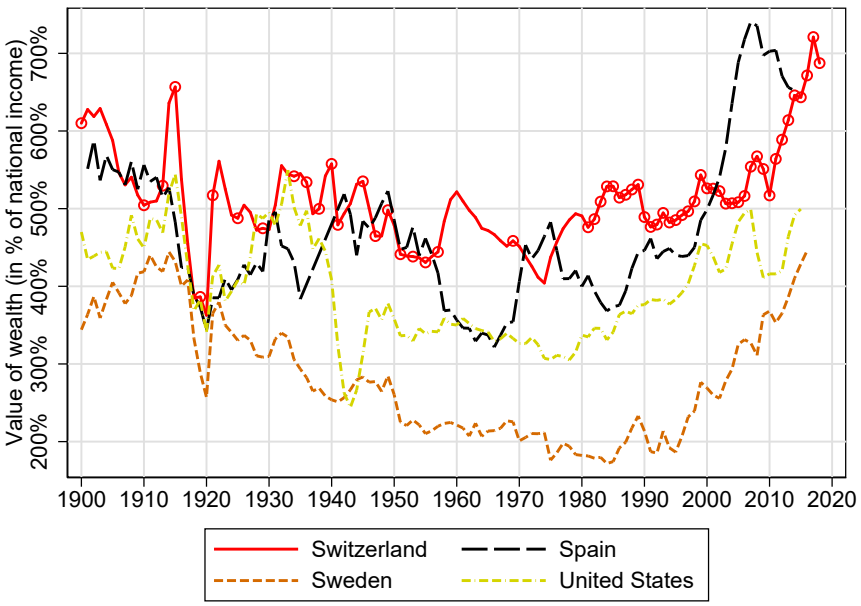
After the turn of the millennium, we observe a steep increase in β_{pt} in several countries, including Switzerland. Within less than 20 years, the Swiss wealth-income ratio rose from 500% to 700%. Also Sweden, France, the United Kingdom, and Spain have been experiencing rapid increases in their wealth-income ratios. Artola Blanco et al. (2020) find that, at least for Spain, the increase was mainly caused by a large housing bubble which burst in the Great Recession. We come back to the role of capital gains in housing wealth in Switzerland and other countries in Sections 7.3 and 7.4.

The long run-evolution of the private wealth-income ratio in Switzerland can be summarized as follows. Over the past century, a series of economic shocks and major historical events have inevitably contributed to considerable fluctuations in β_{pt}, also in Switzerland. However, Figure 2 clearly shows that throughout the 20th century in no other country private wealth-income ratios were as stable as they were in Switzerland. β_{pt} oscillated around 500% until the eve of the Great Recession, averaging 490% over the period 1920–2005. This finding of a very stable long-run evolution of the private wealth-income ratio coincidences with earlier results of Föllmi and Martínez (2017) on the stable level of top wealth shares in Switzerland over the course of the 20th century.

Given that wealth-income ratios in old Europe (especially in France and the United Kingdom) have recently almost returned to the high levels of the early 20th century, scholars have concluded that β_{pt} in Europe has largely followed a pronounced U-shaped pattern over the course of the 20th century. For Switzerland, on the other hand, the evolution is better described by a J-shaped pattern: a stable evolution over the 20th century, followed by a very steep increase in the private wealth-income ratio in recent years, which in turn resulted in a level of β_{pt} unprecedented in the entire 20th century. Switzerland therefore resembles the evolution in Spain, where the marked rise in β_{pt} at the beginning of the 21st century has been driven by real-estate bubbles (Artola Blanco et al., 2020).



(a) Switzerland, Germany, France and the United Kingdom



(b) Switzerland, Spain, Sweden and the United States

Figure 2: Private Wealth-Income Ratio in International Comparison, 1900-2018

Note: This figure shows the historical evolution of the private wealth-income ratio, β_{pt}, for the countries indicated from 1900 to 2018. β_{pt} indicates how many years it would take to accumulate total private wealth if none of national income would be spent on consumption. For Switzerland, the hollow red circles indicate observations for which we have wealth data. The years in between are linearly interpolated, and fluctuations are due to fluctuations in income. The data sources for Switzerland are described in detail in Appendix A.1. The series for Germany, France, the United Kingdom and the United States are based on Piketty and Zucman (2014), from Artola Blanco et al. (2020) for Spain and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

6 Wealth-Income Ratios – Recent Evolution

For the time from 1990 onward, detailed data on the different components of national wealth allows us to study the evolution of private, public, and net foreign wealth in turn.

6.1 National Wealth

Figure 3 shows the national wealth-income ratios for Switzerland, Germany, France, Italy, Sweden, and the United States over the period 1990–2018. Switzerland stands out with the highest wealth-income ratio among these economies. We can further distinguish two periods in Switzerland: the years 1990–2006, where the total wealth-income ratio was remarkably stable, ranging around 500 to 550% of annual national income, and the period since 2006 where we observe an increase from 540 to 740%.

This period of rising importance of wealth in comparison to income started during the economic expansion prior to the Great Recession. In contrast to other European countries, the Great Recession and the following European debt crisis only led to a very brief contraction in Switzerland's wealth-income ratio between 2008 and 2010. This dip in 2010 was the combined result of i) a drop in wealth per capita (see Appendix Figure B3); and ii) an increase in national income per capita of 15% between 2008 and 2010 after the 11% fall between 2006 and 2008 as a result of the Great Recession (see Appendix Figure B2). In other countries, there is hardly any change visible around the 2007–2011 period, with the exception of the U.S. In the U.S., the Great Recession led to a strong drop in the national wealth-income ratio and stabilized after 2009 at around 380–400% of national income—substantially below the 2007 level of almost 500%.

Switzerland's steady growth in the national wealth-income ratio since 2010 stands in strong contrast to other countries' experience. Only in Sweden do we observe an upward trend throughout the period 1995–2018. At 740%, however, the wealth-income ratio in Switzerland is around two years of national income higher than in Sweden. Most other countries saw their wealth income ratio stagnate or fall after the Great Recession.

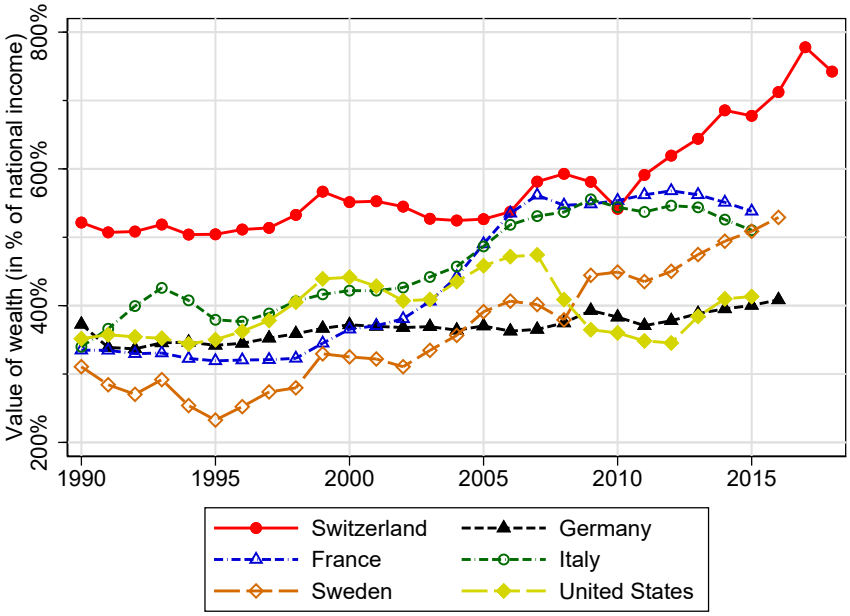


Figure 3: National Wealth-Income Ratios in International Comparison, 1990–2018

Note: This figure shows the evolution of the national wealth-income ratio, β_{nt}, for several countries from 1990 to 2018. β_{nt} is derived by dividing the sum of net private wealth, W_{pt}, and net public wealth, W_{gt}, by net national income, Y_t. Both, private and public wealth, are the sum of financial and non-financial assets minus financial liabilities. In order to present series which are harmonized across countries and over time, non-financial assets of private households, K_{pt}, only include of housing wealth (i.e., $K_{pt} = H_{pt}$). The data sources for Switzerland are described in detail in Appendix A.1 and A.2. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

6.2 Public Wealth

The share of public wealth in total national wealth is relatively low, ranging between 3 to 7% in the period 1990–2018. As a consequence, the value of public wealth measured in national income is low. As Figure 4 shows, it would take around half a year's national income to buy all the government owned assets—compared to the 7 annual national incomes needed to match private wealth. Even though estimates of public wealth at market value are likely less precise than those for private wealth (since the market value of assets such as schools, hospitals or highways cannot be measured directly; see Piketty, 2014, for a discussion) and assuming a relatively large margin of error, it is apparent that national wealth consists largely of private wealth.

Interestingly, the increasing wealth-income ratio can be observed in both, public and private wealth-income ratios. Over the entire observable period Switzerland's public wealth-income ratio rose from 32% in 1990 to 55% in 2018. For both series, the increase has become very steep since 2010.

This upward trend in public wealth stands in clear contrast to most other countries' experiences (shown in Figure B7), as they have seen a decline in public wealth measured in national income over this period—particularly, Italy (-81pp), Germany (-65pp) or the U.S. (-46pp). These developments are the result of continuing public deficit spending. Over the period 1995–2010, 30–45% of private savings in these countries were absorbed by government budget deficits, as governments ran these deficits to pay current expenses, rather than for investments—with the result that they saw their public net wealth shrink (Piketty, 2014, p. 185–186).

Piketty (2014) further estimates that in Germany and France, public wealth accounted for up to one-third of national wealth between 1950 and 1970. In recent years, that figure was down to 3–5% in both countries. Due to the lack of data, we are unfortunately not able to compute series on public wealth in Switzerland for the time before 1990 to understand the long run trend in public wealth. Since 1990, however, the share of public wealth in national wealth has been rather stable and even increasing in recent years.

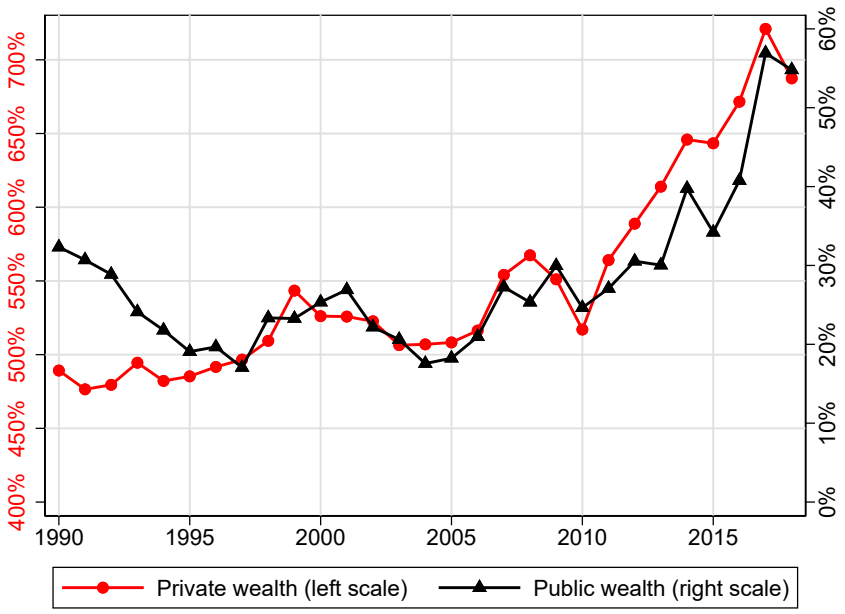


Figure 4: Private and Public Wealth in Percent of National Income in Switzerland, 1990–2018

Note: This figure displays both the evolution of the private wealth-income ratio, β_{pt}, and the public wealth-income ratio, β_{gt}, of Switzerland between 1990 and 2018. Private wealth, W_{pt}, is the sum of private non-financial assets (consisting only of housing wealth) and financial assets minus financial liabilities. Public wealth, W_{gt}, is net wealth of all public administrations and government agencies at all government levels. For both public and private wealth the development is shown in terms of national income, Y_t. The data sources are described in detail in Appendix A.1 for private wealth, and in A.2 for public wealth.

In our view, the following three key factors have most likely contributed to the ob-

served increase in public wealth in Switzerland since 2004, the year public wealth was at its lowest value in the period we study. First, price effects led to significant capital gains. Second, the introduction of the "debt brake"—a fiscal budget rule to avoid structural deficits—at national level in 2003 (and subsequently in a series of cantons), led to a substantial reduction in public debt. Third, the exceptional monetary policy with negative interest rates and the strong Swiss currency lead to large seigniorage incomes from the Swiss National Bank over the past years. Below, we discuss these three factors in turn.

i) Capital Gains in Public Wealth. The increase in the public wealth-income ratio can be the result of saving as well as price effects leading to capital gains, as shown in the decomposition in equation (9). Re-arranging equation (9) allows to estimate the price effect, $(1 + q_t)$, on the change in β_g from public saving rate $(1 + g^w_{st})$ and income growth rate $(1 + g_t)$:

$$(1 + q_t) = \frac{1 + g_t}{1 + g^w_{st}} \frac{\beta_{gt+1}}{\beta_{gt}}$$

Accordingly, around 30% of the increase in the public wealth-income ratio between 1995 and 2018 can be attributed to capital gains.

ii) The "Debt Brake". The decomposition above implies that the other 70% of the increase has to be attributed to public savings.[12] This is in line with Figure 5, according to which debt reduction has contributed the most towards the increase of total net public wealth. Liabilities fell substantially after 2002, from 73% to 52% in 2008. The timing coincides well with the introduction of the "debt brake" at the federal level in 2003, a fiscal rule which requires the government to save during economic expansions, thereby reducing and avoiding structural deficits.[13] Using a synthetic control approach, Schaltegger and Salvi (2016) show that the "debt brake" indeed contributed substantially towards the significant public debt reduction that took place since 2003. Similar developments are observed at the cantonal level, as cantons also adopted "debt brakes" and similar budget rules in the 2000s (see Yerly, 2013, for an overview).

iii) Expansionary Monetary Policy. The increase in public wealth during this period was further fueled by monetary policy. With the aim to counteract the appreciation of the Swiss Franc, the Swiss National Bank (SNB) has adopted a quantitative easing policy which includes negative interest rates. As a side effect, this significantly reduced the

[12] Note that net public savings (see Table B1) and capital gains in public wealth (see Table B5) exhibit significant fluctuations over time.

[13] For additional information see: https://www.efv.admin.ch/efv/en/home/themen/finanzpolitik_grundlagen/schuldenbremse.html

burden of public debt service. In addition, the SNB's policy generated large seigniorage incomes, of which two thirds are distributed to the cantons and one third to the central government. Between 2003 and 2011, the SNB distributed 2.5 billion and more each year to the cantons and the federation together. Taken together, all these developments led to an increase in financial public wealth.

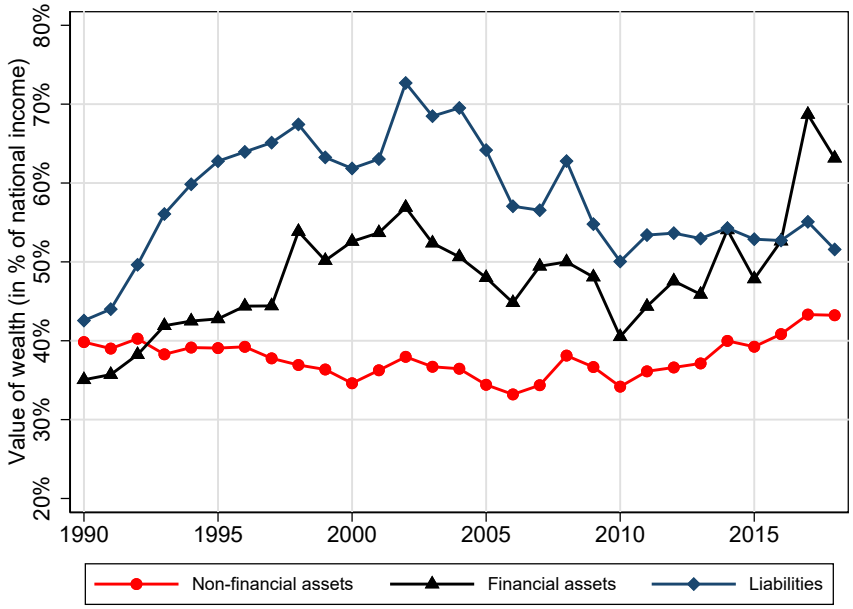


Figure 5: Decomposition of Total Net Public Wealth in Switzerland, 1990–2018

Note: This figure shows the evolution of three main components of net public wealth, W_{gt}: public non-financial assets,K_{gt}, public financial assets, F_{gt}, and public financial liabilities, L_{gt}, measured in percent of national income, Y_t. W_{gt} is the sum of all net wealth of public administrations and government agencies at all government levels. The corresponding data sources are described in Appendix A.2.

The increase in financial assets described in Figure 5 reflects the evolution over all government levels. While the overall value of government-owned non-financial assets in terms of national income remained relatively stable over the past three decades, this development masks considerable heterogeneity. Non-financial assets rose at the municipality and cantonal levels, but fell for the confederation (see Figure B8).

To uncover heterogeneity in net public wealth at different government levels, we further decompose total public wealth into wealth held by the Swiss Federation, the cantons (i.e., Switzerland's federal states), municipalities, and social security funds.

Figure 6 reveals the relative importance of public wealth as a share of total wealth since 1990 by government level. Undoubtedly, a major shift has taken place from the central government (federal government including social security funds) to the lower levels

of government, i.e., the cantons and municipalities.

At the federal level, the development is striking: net wealth measured in national income fell from 17% in 1990, when Switzerland entered a decade of economic crisis and stagnation, to as little as 1.6% in 2005. Since then, a gradual recovery can be observed, although at 15.5% the wealth-income ratio at the federal level is still slightly below its 1990 level. The situation is very different for the cantons and municipalities. The entire increase in Switzerland's public net wealth—relative to national income—has taken place at these two levels of government. The rise in cantons' public wealth accounts for roughly 17.5pp of the total 22.5 percentage point increase in the public wealth-to-income ratio. Municipalities added another 7.6pp of the total 22.5pp increase in the public wealth-to-income ratio. This leaves the federal level and the social security funds with a negative contribution (-1.7pp and -0.9pp, respectively) to the change in the public wealth-income ratio between 1990 and 2018 (see Appendix Figure B9, which shows the different components in percent of national income).

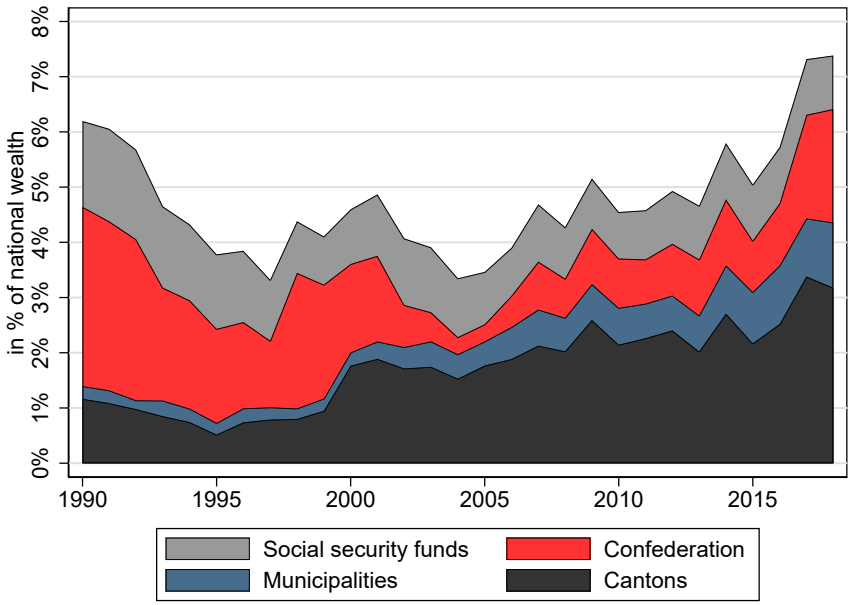


Figure 6: Public Wealth by Government-Level as Share of National Wealth, 1990–2018

Note: This figure displays the evolution of net public wealth, W_{gt}, of Switzerland as share of total national net wealth, W_{nt}, from 1990 to 2018 decomposed by the four government levels indicated in the legend. The data sources are described in detail in Appendix A.2.

6.3 Net Foreign Wealth

As described in equation (3), total national wealth can further be decomposed into net national and foreign wealth. Switzerland stands out with its high value of net foreign wealth, which for the period 1995–2018 lies between 100 and 170%. This is substantially more than in most other countries, where this ratio has rarely ever exceeded 25% in the post-war period and even turned negative in recent decades (see Appendix Figure B11). Despite Switzerland's high level of net foreign wealth, however, the recent increase in national wealth is solely due to an increase in domestic wealth as shown in Figure 7.

The high net foreign asset position of Switzerland itself is the result of a set of factors which have been changing over time. The stable evolution therefore masks substantial heterogeneity among the different net foreign wealth components. Until the Great Recession, direct investment and portfolio investment compromised 70–95% of total foreign net wealth. The reasons for these high values lie in the high savings rate[14] and the limited investment opportunities within Switzerland. After 2009, however, net direct and, in particular, net portfolio investment have declined substantially and now account for a much smaller share of total net foreign wealth than they did back in 2009.

Furthermore, other investment[15] had an increasingly dampening effect on the Swiss net foreign wealth position. On the other hand, however, in an attempt to stabilize the Swiss currency, the Swiss National Bank bought unprecedented amounts of foreign currency, leading to an increase in reserve assets, which in turn more or less offset the fall in foreign investment (Swiss National Bank, 2018).

[14] Table B2 in the Appendix gives an overview of saving rates across countries.

[15] The category other investments includes in particular interest and other investment income from insurance companies, pension funds, the Swiss Confederation and the SNB (excluding currency reserves). For more detailed explanations see: https://data.snb.ch/de/topics/aube#!/doc/explanations_aube_bopauverm.

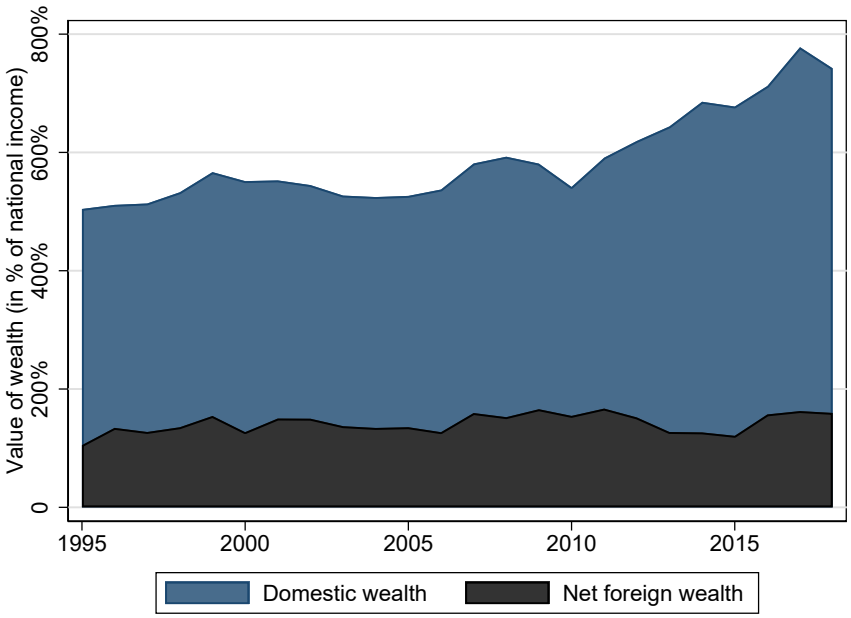


Figure 7: The Evolution of Domestic an Net Foreign Wealth of Switzerland, 1995–2018

Note: This figure displays the evolution of Switzerland's national wealth-income ratio, β_{nt}, distinguishing between domestic capital, K_{nt}, and net foreign wealth, NFA_{nt}. By construction it is the case that domestic capital plus net foreign wealth equals the sum of net private and public wealth. The data sources are described in Appendix A.3.

6.4 Private Wealth and the Rise in Housing Wealth

Since private wealth makes up around 95% of national wealth in Switzerland, private wealth parallels the evolution of national wealth. The composition of net private wealth in Switzerland shown in Figure 8 further reveals that the evolution of total wealth can be traced back almost one to one to housing wealth. Net-financial wealth has been very stable at around 100% of national income, and pension wealth has risen steadily but slowly to just below 200% of national income. This slow but steady increase in pension wealth is the combined result of pension reforms and individual responses to demographic change and longer life expectancy.

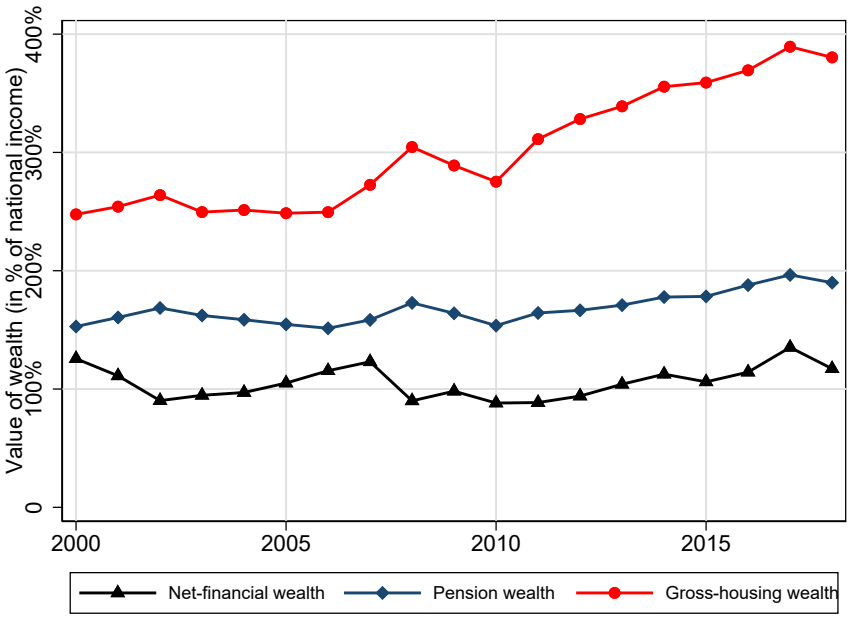


Figure 8: Main Components of Private Wealth in Switzerland, 2000–2018

Note: This figure shows the evolution of three main components of private wealth, W_{pt}: gross housing wealth, net financial wealth and pension wealth measured in national income, Y_t. The sum of these three sub components add up to total net private wealth, as depicted in Appendix Figure B5. Detailed information on these three subcomponents can be found in Appendix A.1.

The strong increase in housing wealth as share of total wealth is striking, especially because, like Germany, Switzerland is a land of tenants: the homeownership rate amounts to 38% of households and was at 32% in 1990.[16] Since 2010, when the steep rise in housing wealth began, the homeownership rate has been roughly stable.

One likely explanation for the rise in housing wealth is the sharp increase in real housing prices that has been taking place since 2010. While real estate prices in Switzerland started to rise already after 2003, the increase clearly became steeper after 2010. In an environment of a strong currency and extremely low—since December 2014 even negative—interest rates, domestic investment opportunities in Swiss Francs have become more attractive (as cheap money has been readily available), but also harder to find due to increased demand. Real estate is an alternative asset class to government bonds and stocks, promising high returns. Private households as well as institutional investors (e.g., pension funds) and firms have been seeking out investment opportunities in real estate (Wijburg and Aalbers, 2017). Prevailing low interest rates therefore have likely increased the demand for real estate (Wildauer and Stockhammer, 2018; André, 2010). This is supported by the fact that during that time also mortgage debt levels have in-

[16] Source: Federal Statistics Office

creased by one quarter, going from 122% of national income in 2010 to 153% in 2018, as shown in Figure 9.

Figure 9: Private Debt-Income Ratios in Switzerland, 1999–2018

Note: This figure illustrates the evolution of total private financial liabilities, L_{pt}, and its main sub-component, mortgages, as a ratio of national income. The data sources for Switzerland are described in detail in Appendix A.1.

At the same time, also annual population growth has spurred, increasing from 0.24% in 1997 to 1.27% in 2008. Ever since, it has remained above 1%, and is therefore larger than in most other developed economies.[17] Population growth contributes to increased housing demand. Because it takes time to increase housing supply and moreover urban land is fixed and therefore scarce, prices typically rise. This idea dates back to Ricardo's (1817) famous principle of scarcity. Recent empirical contributions supporting this view include Rognlie (2015), Knoll et al. (2017), or Grossman and Steger (2017). It seems likely that increased demand for housing from continuous population growth combined with low interest rates ultimately fueled into the observed increase in real estate prices, which can be seen in Panel a) of Figure 10.

We come back to the role of capital gains—and hence: price increases—and savings in housing wealth in Section 7, where we argue that this recent increase in housing wealth is driven by a relative increase in housing prices (rather than savings in housing).

Figure 10 further reveals the general trend in rising housing prices across Europe and

[17] Data source: The World Bank.

in the U.S. Likewise, the increase in housing wealth relative to national income is by no means a unique Swiss feature. Appendix Figure B6 shows how the value of housing wealth in national income has been rising for a series of countries, with the exception of the U.S.

7 What Explains the Rising Wealth-Income Ratio?

Switzerland's national wealth-income ratio has risen sharply over the past decade. In principle, there are two possible drivers to account for this enormous rise: lower income growth and faster wealth accumulation. The latter can further be the result of an increased saving rate or large capital gains. Capital gains arise when the valuation of an asset increases, which is why we also refer to capital gains as (relative) price effects. Price effects typically affect certain types of assets, such as stocks or housing wealth. In this section, we discuss these different factors in turn.

7.1 Income Growth and Savings

In a model with a constant relative price between capital and consumption goods (and hence no capital gains) as outlined by the Harrod-Domar-Solow formula adopted in Piketty and Zucman (2014), the national wealth-income ratio is determined by the national savings and income growth rates: $\beta_n = s/g$. Table 1 presents the savings and income growth rates in Switzerland for the period 1995 to 2018 and three sub-periods.

We draw three findings from this table. First, the income growth rate has declined over time. In the recent period 2010–2018, marked by the large increase in the national wealth-income ratio, national income growth was very low. The per capita growth rate was even negative. In the preceding 2002–2010 period, in contrast, national income grew extraordinarily strongly at 3.0% (see Table 1). This in turn has led to a slight decline in the national wealth-income ratio during that time, despite a relatively high growth rate of national wealth of 2.9%. Second, the net national savings rate has been relatively stable over the period 1995–2018.[18] Third, in contrast to income growth and despite the stable evolution of savings, the real growth rate of national wealth has been high and even rising over time. Over the full period from 1995 to 2018, the annual real growth rate of national wealth was 3.4%, but it reached 4.9% in the 2010–2018 sub-period.

[18] This stability conceals some heterogeneity in the composition of national savings. For a breakdown of the structure of Swiss national savings, see Table B1. Table B2 shows the structure of national savings in an international comparison, whereby the high level of savings in Switzerland, but also the international heterogeneity in particular, should be noted.

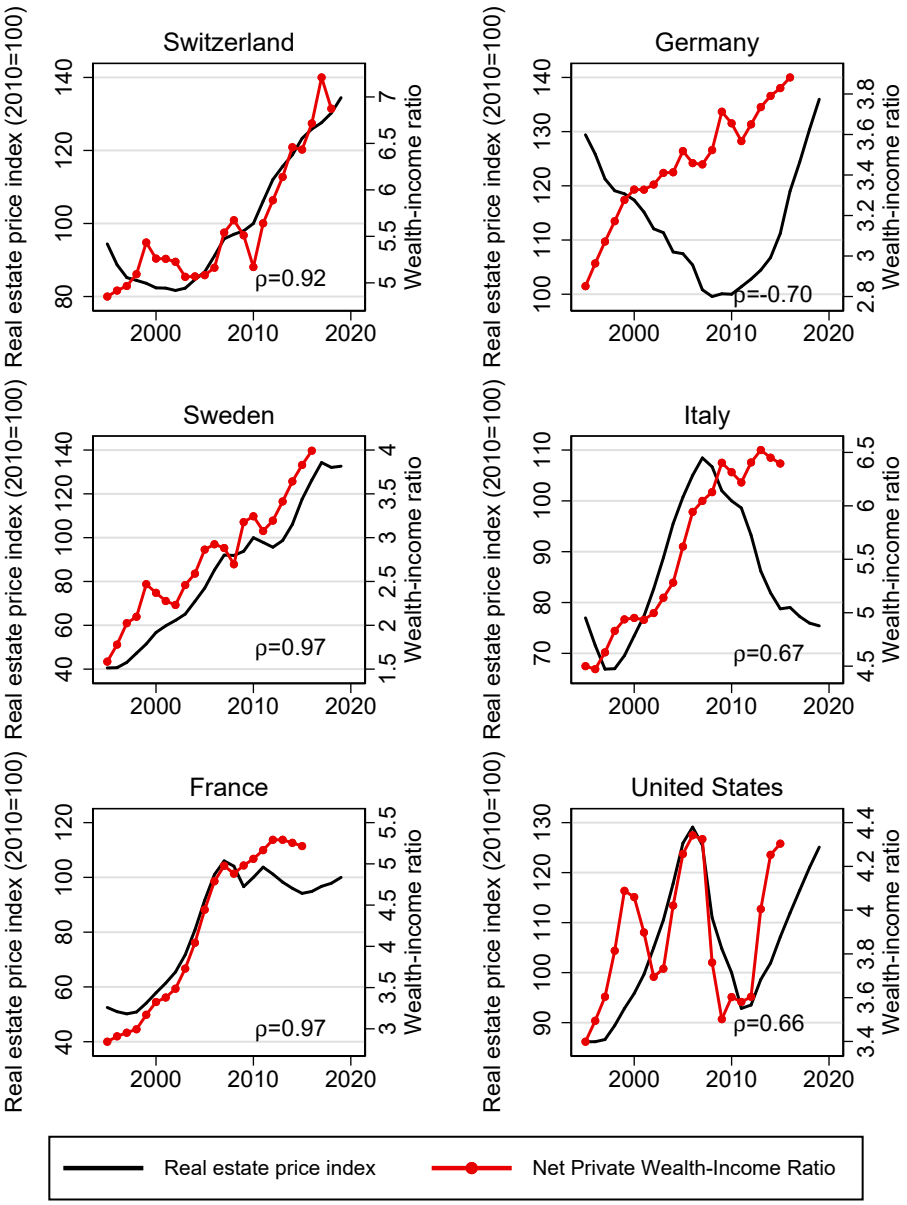


Figure 10: Wealth-Income Ratios and Real Estate Price Indices, 1995–2017

Note: This figure shows private wealth-income ratios in Switzerland, the U.S., Sweden, Germany, Italy and France along with real house price indices of each of those countries. The price indices were obtained online from the OECD in September 2020. The data for the real house price indices are described in Appendix A.10. Appendix Figure B10 illustrates private wealth-income ratios along with real house price indices for the U.K., Australia, Canada, Spain, Japan and Norway. All international private wealth-income ratios data is available for download at https://wid.world.

Attributing the increase in the national wealth-income ratio merely to a decline in growth does therefore not do justice to reality.[19] To accommodate the observed real growth in wealth accumulation, we next turn to capital gains.

Table 1: Income Growth, Saving Rates and Wealth Accumulation in Switzerland, 1995–2018

			Sub-Periods		
		1995–2018	1995–2002	2002–2010	2010–2018
Income growth					
Real income growth rate	g	1.7%	1.2%	3.0%	0.8%
Population growth rate	n	0.8%	0.5%	0.9%	1.1%
Real income p.c. growth rate	$\hat{g}$	0.9%	0.7%	2.1%	-0.2%
Capital accumulation					
Net saving rate	s	15.7%	14.6%	16.4%	15.9%
Real wealth growth rate	g^w	3.4%	2.4%	2.9%	4.9%
... savings-induced ($g_s^w = s/\beta_n$)	g_s^w	2.7%	2.8%	2.8%	2.5%
... capital gains induced	q	0.7%	-0.4%	0.1%	2.4%
Rel. contribution savings	g_s^w/g^w	80%	119%	98%	52%
Rel. contribution capital gains	q/g^w	20%	-19%	2%	48%
Wealth-income ratio					
At beginning of period	$\beta_{n,t}$	504%	504%	545%	542%
At end of period	$\beta_{n,t+d}$	742%	545%	542%	742%
Change	$\Delta\beta_{n,t}$	+238 pp.	+40 pp.	-3 pp.	+201 pp.

Note: This table displays annual growth rates of real national income, net national savings, and real wealth, respectively, along with the population growth rate. All growth rates are geometric averages over the indicated period. The average saving rates are obtained by weighting annual saving rates by real national income. The average real growth rate of national wealth, g^w, is decomposed into a savings-induced component, g_s^w, and capital gains or losses, q, using the formula in equation (9). Wealth-income ratios in the corresponding years, $\beta_{n,t}$ and $\beta_{n,t+d}$, are indicated at the bottom of the table. The last row shows the change in percentage points (pp.) of the national wealth-income ratio, β_{nt}, over the corresponding period. Detailed information on the data can be found in the corresponding subsections in Appendix A.

7.2 Wealth Accumulation Through Capital Gains

While the Harrod-Domar-Solow formula abstracts from capital gains, in reality we do observe large capital gains due to relative price changes. Especially in the short to

[19] This is also apparent from the international comparison of growth rates and changes in national wealth-income ratios, which are summarized in Table B3. In this short-run comparison, higher growth rates coincide with an increase in β_{nt}, which is unreasonable on the basis of a one-good capital accumulation model.

medium run, capital gains turn out to be crucial for the accumulation and evolution of wealth.

By taking into account capital gains, we can decompose the accumulation of national wealth into a savings and a capital gains component using equation (9). Following equation (9), 2.7pp of the 3.4% annual real growth rate of national wealth is attributable to savings, leaving a capital gain effect of 0.7pp.[20] Accordingly, four-fifths of the increase in the national wealth-income ratio between 1995 and 2018 is attributable to savings, while capital gains accounted for about one-fifth.

Comparing different sub-periods between 1995 and 2018, Table 1 reveals some remarkable differences in how new savings and capital gains have contributed to the accumulation of national wealth.[21] First, real annual growth of national wealth was about twice as high after the Great Recession than it was in the 1990s and the first decade of the 21st century.

Second, the savings-induced growth rate of wealth has been rather stable over the different periods. This is largely due to the stable national saving rate. If anything, the savings-induced growth rate of wealth has been declining and has been lowest in the 2010–2018 period, for which we observe by far the largest increase in the national wealth-income ratio.

Third, we can distinguish three sub-periods which mark the changing importance of capital gains over time: i) Between 1995 and 2002, capital gains were slightly negative, such that capital losses dampened the real growth of national wealth. ii) From 2002 to 2010, the growth rate of national wealth was almost exclusively determined by savings. Capital gains induced growth was virtually zero and in line with the Harrod-Domar-Solow formula. iii) In the most recent period from 2010 to 2018, national wealth grew exceptionally fast as a result of high capital gains. Substantial capital gains of around 2.4% per year have nearly doubled the growth rate of real national wealth to 4.9% in the years between 2010 and 2018.

Hence we conclude that the marked increase in the national wealth-income ratio after the Great Recession was mainly driven by the emergence of large capital gains, which led to a substantial increase in the national wealth growth rate. At the same time, this period coincided with a considerable deceleration in income growth, allowing the wealth-income ratio to rise even more.

[20] Note that because we have to estimate capital gains as a residual, these figures may include not only actual valuation effects but also potential measurement errors.

[21] Table B4 in the Appendix provides the same decomposition for Switzerland, Germany, Italy, Sweden and the United States.

7.3 The Origin of Capital Gains: Housing vs. Financial Wealth

Next, we turn to the nature of these capital gains. From 2000 to 2018, real national net wealth rose by 1'704 billion Swiss francs, 88.7% of which is attributable to an increase in private wealth.[22] Therefore, in this section, we focus on private wealth, which can further be decomposed into financial and housing wealth.

Analogous to Table 1, Table 2 decomposes the real growth rate of total net private wealth, W_{pt}, as well as gross housing wealth, H_{pt}, and net financial wealth, $F_{pt} - L_{pt}$, into a savings-induced and an estimated capital gains component.[23] Again we study different periods, but note that due to data availability of different components of private wealth prior to the year 2000 (as described in Section 4), this analysis is limited to the first two decades of the 21st century.

Over the entire 2000–2018 period, housing wealth grew twice as fast as net financial wealth (i.e., non-housing wealth). At 2.1% and 2.2%, respectively, the savings-induced growth rate was about just as large for housing wealth as it was for financial wealth. What sets the two of asset classes apart are the large capital gains incurred in the housing sector over this period, which contributed 1.7pp (or 44%) to the annual growth rate. In contrast, financial assets incurred capital losses over this period, lowering the overall growth rate in financial wealth.

These capital losses were incurred during the first decade of the 21st century, as shown in Panel B of Table 2. During this period, financial markets were hit by both, the Dot-com Bubble and the Great Recession. Nevertheless national income grew, and as a result the non-housing wealth-to-income ratio fell between 2000 and 2010, and so did the total private wealth-income ratio. Only housing wealth was growing faster than national income. The savings-induced growth rate in financial wealth remained stable during that period. It was even slightly higher than in the subsequent period (shown in Panel C of Table 2), and considerably higher than the savings-induced growth rate in housing wealth. Yet while financial wealth suffered from capital losses, housing prices picked up, which led to an annual increase of 1.1% in housing wealth.

Growth in housing wealth accelerated further after 2010, spurred once more by capital gains. And their role seems to be growing over time: they made up for almost half of the 5% annual growth rate in housing wealth between 2010 and 2018. Performance of housing wealth since 2010 has been exceptional: in less than a decade, housing wealth

[22] As in Table 1, Table B5 in the Appendix provides a decomposition of the growth rates of national wealth into a savings and a capital gains component for the period 2000–2018, breaking down national wealth according to its components of private and public wealth.

[23] The approach and the data with which we decompose the real growth rates are described in detail Appendix Section A.9.

grew by more than the size of one year of national income. About half of this increase is the result of a relative increase in real estate prices.

Financial wealth recovered and grew at a high rate as well during the 2010–2018 period, but growth still remained below that of housing wealth. Overall, housing wealth has been gaining ground over financial wealth since the turn of the century. As a result, the housing wealth-to-income ratio stood at 380% in 2018—132pp higher than almost two decades earlier.

Table 2: The Accumulation of Private Wealth in Switzerland, 2000–2018

			Decomposition of the private wealth growth rate (%)		
	Private wealth-income ratios (%)		Real growth rate of private wealth	Savings-induced wealth growth rate	Capital gains induced wealth growth rate
	$\beta_{p,t}$	$\beta_{p,t+n}$	g_w	$g_{ws} = s/\beta_p$	q
Panel A: 2000–2018					
Total Private Wealth	526%	687%	2.9%	2.2% (76)	0.7% (24)
Housing Wealth	248%	380%	3.8%	2.1% (56)	1.7% (44)
Non-Housing Wealth	278%	307%	1.9%	2.2% (113)	-0.3% (-13)
Panel B: 2000–2010					
Total Private Wealth	526%	517%	1.6%	2.1% (130)	-0.5% (-30)
Housing Wealth	248%	275%	2.9%	1.8% (63)	1.1% (37)
Non-Housing Wealth	278%	242%	0.4%	2.4% (625)	-2.0% (-525)
Panel C: 2010–2018					
Total Private Wealth	517%	687%	4.5%	2.3% (51)	2.2% (49)
Housing Wealth	275%	380%	5.0%	2.6% (51)	2.4% (49)
Non-Housing Wealth	242%	307%	3.9%	1.9% (48)	2.0% (52)

Note: This table displays the changes in private net wealth $W_{p,t}$ and its to main subcomponents—private housing, (H_{pt}), and non-housing wealth, ($F_{pt} - L_{pt}$)—between 2000 and 2018. The first two columns indicate the level of the total private wealth-income ratio $\beta_{p,t}$, the housing wealth-income ratio and the non-housing wealth-income ratio respectively in the corresponding years. The third column shows the average real growth rate g_w of the respective wealth components over the different time periods. With the formula in Equation (9) it is possible to decompose the real wealth growth rate g_w into two multiplicative components. Where one part of the wealth growth rate is savings-induced g_s^w and the other part are capital gains or losses q. The small numbers below the growth rates in columns 5 and 6 indicate the share in the total average real growth rate g_w. The methodology used to decompose the changes of the depicted private wealth categories into a savings and capital gains component is described in detail in Section A.9 in the Appendix. Note that the saving rate used in the above decomposition is the net saving rate of private households. The results of the same decomposition using the net private saving rate (including retained earnings of corporations) is shown in Table B6 in the Appendix (see in this context also Footnote 45). All growth rates are geometric averages. Detailed information on the data can be found in the corresponding subsections in Appendix A.

7.4 Do Capital Gains Drive Wealth-Income Ratios Across Countries?

The different developments in financial and housing wealth raise the question whether changes in the wealth-income ratio can be explained by capital gains in either housing wealth or financial wealth. The role of housing prices and bubbles in the accumulation and distribution of wealth has recently been documented for a series of countries, including Spain, France, and the U.S. (Martínez-Toledano, 2020). Piketty and Zucman (2014) and Artola Blanco et al. (2020) find that the recent rise in household wealth to national income ratios has mainly been driven by capital gains on housing. A visual comparison of housing prices and private wealth-income ratios supports this hypothesis for a large number of countries (see Figure 10; Appendix Figure B10 includes six additional countries, for which data is available).

To understand to which degree this is true, we run OLS country regressions of the annual change in the wealth-income ratio on the change in real stock prices and the change in real housing prices in Switzerland and 11 countries, for which data is available.[24] The country regressions generally cover 45–50 years, depending on data availability, from the 1970s to the present. As most wealth-income ratios and price indices exhibit a clear trend, we transform all the series to changes. These series, shown in Figure B15 in the Appendix, are stationary (as are the residuals from our regressions). Since all units are percentage changes, it is further possible to directly compare the regression coefficients.

Results for Switzerland and the full panel of countries are shown in Panels A and B, respectively, of Table 3. We regress the change in wealth-income ratios either on the change in real house or real share prices in the respective country (Columns 1 and 2), or on both (Column 3). In Column 4, we further control for changes in the MSCI world share price index, which captures global stock price changes. While investors typically have a home bias, it might nevertheless be that in some countries investors seek out for greener grass abroad, in which case financial wealth fluctuates more strongly with international stock prices as measured by the MSCI world index. The multi-country panel regressions (shown in bottom Panel B of Table 3) further include country and year fixed effects. Because the year fixed effects would fully absorb the time variation in the MSCI World Index, we do not report results from this specification in Column 4 (the are identical to the results in Column 3). The country panel regressions, however, are

[24] House and stock price data are available on a country by country base from the OECD and data on the private wealth-income ratio from WID.world, see Appendix for details. We include in our analysis all developed economies for which long-run series on the private wealth-income ratio exist. These are namely Australia, Canada, France, Germany, Italy, Japan, Norway, Spain, Sweden, Switzerland, the U.K. and the U.S. The observation period is limited due to the availability of data on β_{pt} for the three countries Canada (1980–2010), Germany (1989–2016) and Norway (1993–2015). All data used in the regression analysis are shown country by country in Figure B15.

not sensitive to the inclusion of these fixed effects (the detailed regression results for the different specifications can be found in Appendix Table B7). To account for correlation of observations within country and years, we report two-way clustered standard errors by country and year.

Table 3: Regressions of Private Wealth-Income Ratios on Stock and House Prices

	(1)		(2)		(3)		(4)	
Panel A: Switzerland								
1970–2018								
House prices	-0.05	(0.10)			-0.05	(0.10)	-0.07	(0.11)
Share prices			0.04	(0.03)	0.04	(0.03)	0.02	(0.06)
MSCI world							0.03	(0.07)
Constant	1.00*	(0.56)	0.74	(0.55)	0.84	(0.58)	0.84	(0.58)
Adj. R^2	-0.017		0.011		-0.011		-0.029	
Obs.	48		49		48		48	
1990–2018								
House prices	0.34*	(0.18)			0.35*	(0.18)	0.28	(0.19)
Share prices			0.05	(0.05)	0.05	(0.05)	-0.04	(0.08)
MSCI world							0.14	(0.11)
Constant	1.00	(0.74)	0.70	(0.83)	0.67	(0.79)	0.77	(0.78)
Adj. R^2	0.080		-0.004		0.092		0.116	
Obs.	29		29		29		29	
Panel B: Multi-Country Panel Analysis								
1970–2018								
House prices	0.22***	(0.04)			0.24***	(0.03)		
Share prices			0.03	(0.02)	0.03	(0.02)		
Adj. R^2	0.161		0.085		0.184			
Obs.	483		469		469			
1990–2018								
House prices	0.31***	(0.06)			0.31***	(0.07)		
Share prices			-0.01	(0.03)	-0.01	(0.03)		
Adj. R^2	0.237		0.122		0.235			
Obs.	304		304		304			

Note: The table shows results for OLS regressions of changes in private wealth-income ratios on changes in real house prices (Column 1), changes in real share prices (Column 2) and both (Column 3). Column (4) further includes the global MSCI world share price index as a control. Top Panel A shows the results for Switzerland. We show results for the whole period 1970–1918, for which data is available, as well as for the sub-period 1990–2018. Bottom Panel B shows the results of panel regressions including 12 countries. Private wealth-income ratio data are available for: Australia 1970–2014; Canada 1980–2010; France 1970–2015; Germany 1989–2016; Italy 1970–2015; Japan 1970–2015; Norway 1993–2015; Spain 1970–2014; Sweden 1970–2016; Switzerland 1970–2018; U.K 1970–2015; U.S. 1970–2015. See Figure B15 for details on data availability by country. All specifications in Panel B include year and country fixed effects. We do not report estimates in column (4) of Panel B because the year fixed effects fully absorb the variation in the MSCI World Index. Table B7 shows alternative specifications without fixed effects. We use house price (see Appendix A.10) and share price indices (see Appendix A.11) as published by the OECD in September 2020. Residuals in all models are stationary. Two-way clustered standard errors by country and year are shown in parentheses, next to coefficients. * p<.1, ** p<.05, *** p<.01.

Considering the whole period from 1970 to 2018, we do not find a systematic correlation between real house prices and share prices on the one hand and the wealth-income ratio on the other in Switzerland. Only when looking at the more recent period from 1990 onward, we find that growth in housing prices is systematically correlated with changes in the wealth-income ratio: a one percentage point increase in real housing prices is associated with a 0.34 percentage point increase in the wealth-income ratio. Statistical significance, however, remains weak, as limiting the period of analysis also reduces the number of observations. The finding is robust to simultaneously controlling for stock price changes, but additionally including changes in the MSCI world index leads to insignificant results (Column 4, Panel A of Table 3).

Turning to the panel analysis including all 12 countries for which data is available (Panel B of Table 3), alleviates the small N problem. Across all specifications we find that a one percentage point increase in real housing prices is associated with a 0.22–0.24 percentage point increase in wealth income ratios. These estimates are throughout statistically significant at the 1 percent level. Again this correlation increases to 0.31 percentage points in the more recent period since 1990. These findings suggest that rising housing prices are related to rising wealth-income ratios across many countries, and that this association has become stronger in more recent decades.

While the multi-country panel regressions are in line with findings for Switzerland, they mask some heterogeneity across countries. In Figure 11 we show the coefficients from regressions by country for the 1990–2018 period, corresponding to Column 3 in Table 3.

While the association seems to be particularly strong in Norway (0.59 pp), France (0.44 pp), the U.S. (0.43 pp), and Spain (0.39 pp), we find no effect in Germany, Sweden, Japan, Canada, and Australia. Results for Japan are significant only when we include the 1970-1990 period—which covers the country's large housing and stock market bubble of the late 1980s. We take this as evidence that asset price effects become main drivers for the aggregate wealth-income ratios in periods of rapid price changes. Although this is a simple empirical model, it explains around 70% of the variation in wealth-income ratios in the period after 1990 in Spain and France, suggesting that real estate prices play a crucial role in the evolution of wealth-income ratios.

Share prices seem to be important in all English-speaking countries except Canada. The U.S. stands out as the country where both, share prices as well as real estate prices simultaneously are strongly related to changes in the wealth-income ratio. Together these variables explain 80% of the observed variation in the wealth-income ratio. In Norway,

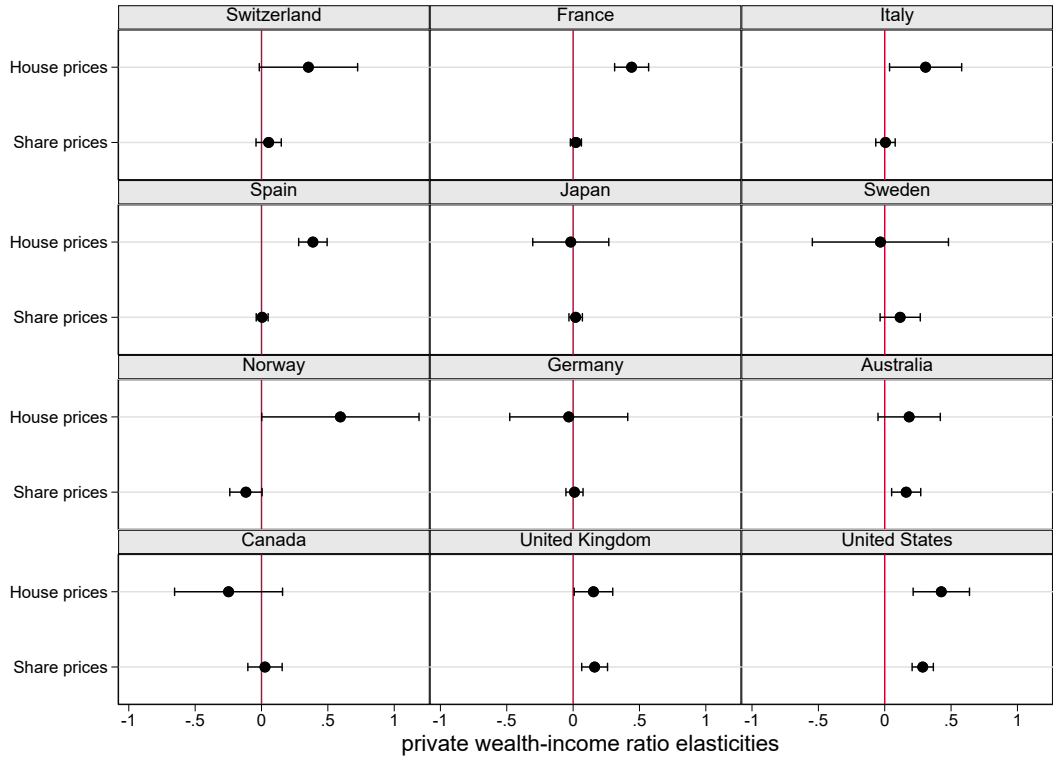


Figure 11: Regression Coefficients for Real Housing and Share Price Changes, 1990–2018

Note: The figure displays the coefficients along with the 95% confidence intervals from the regression of annual changes in the wealth-income ratio on annual changes of real housing prices and real share prices by country for the period 1990–2018. The model corresponds to Column (3) in Table 3. The full set of results by country is reported in Tables B8 and B9 in the Appendix.

interestingly, increases in share prices are significantly related to *negative* changes in the wealth-income ratio.[25] Overall these results suggest that capital gains in housing have become an important driver of the increasing wealth-income ratio—both in Switzerland and other developed economies. This (direct) evidence of a positive relationship between real housing prices and wealth-income ratios is particularly consistent with the findings of Knoll et al. (2017), who document the crucial role of higher land prices.

After WWII, asset price and housing bubbles occurred both more frequently and in greater magnitude than in the first half of the 20th century (see Table 2 in Jordà et al., 2015). In fact, some of the largest bubbles in economic history built up post-1980, including Japan's real estate and stock market bubble of the 1980s, which burst in 1991; the "Dot-com Bubble", which peaked in 2000; and the U.S. housing bubble bursting in 2009. For Switzerland, we know that in the 1980s a real estate bubble was building up to burst in 1990 (see Appendix Figure B15.a), that shows real annual changes in housing prices). This explains the distinct drop in β_{pt} between 1989 and 1991. Our results suggest that rising house prices due to augmented bubbles had a stronger impact on aggregate wealth-income ratios in the post-1990 period than they did in the more distant past—particularly in France, Italy, Spain, the U.S., and Switzerland (see Tables B7 and B8).

8 Conclusion

In this paper, we combine new data to estimate the private wealth-income ratio, β_{pt}, in Switzerland over the entire 20th century. Our results show that aggregate private wealth was likely higher than previously assumed (Brülhart et al., 2018), and that the evolution of β_{pt} in Switzerland did not follow a pronounced U-shaped pattern during the 20th century. This stands in contrast to other European countries. The relationship between wealth and income in Switzerland has been particularly stable over the last century: after World War I, β_{pt} oscillated around 500% until the eve of the Great Recession. This marked difference in the trajectory of β_{pt} is presumably explained by the fact that Switzerland was not directly involved in the two world wars that had a profound and lasting impact on the history and economic development of most European countries. In particular, that Switzerland did not pursue more progressive tax and anti-capital policies after World War I is likely to have had a direct bearing on the long-term stability of the Swiss wealth-income ratio. As a result of this political stability, Switzerland has been a

[25] This could be due to the oil industry: if during booms share prices of petrol companies as well as incomes earned in these companies located in Norway go up, the wealth-income ratio might fall.

"safe harbor" for wealth (accumulation) by international standards.

Since the turn of the century and especially since 2010, however, we document a strong deviation from this long-term trend. From 2010 to 2018, the share of national wealth relative to national income increased from 542% to 742%—a magnitude unprecedented in the 20th century. Considering the period from 1900 to today, the evolution of β_{pt} in Switzerland is therefore best described by a J-shaped pattern: a stable development during the 20th century, followed by a very steep increase in the private wealth-income ratio in recent years. Switzerland thus resembles the evolution in Spain, where the marked rise in β_{pt} has been driven by real-estate bubbles (Artola Blanco et al., 2020). We provide evidence for a similar situation in Switzerland. The steep rise in the private wealth-income ratio is particularly attributable to capital gains in housing wealth. Since 2010, capital gains in real estate alone have contributed to an increase in private wealth in the order of half a year's national income. Our results can therefore be interpreted as a serious warning signal for an overheating of the Swiss real estate market and thus have direct policy implications. The expansionary monetary policy of the past years—with low and since December 2014 even negative interest rates—may well have contributed to this development. Of particular concern is the 25% increase in the mortgage debt-income ratio since 2010 (see Figure 9), because as shown by Jordà et al. (2015), the bursting of credit-financed housing price bubbles has significant and long-lasting negative effects on real GDP. Consequently, the monetary authorities should carefully monitor the Swiss real estate market in their upcoming monetary policy decisions.

In the last part of the paper, we show that such rapid house price appreciations are systematically correlated with wealth-income ratios in a number of rich economies. In a multi-country panel analysis, we find that in recent decades, a one percentage point increase in real house prices has been associated with a 0.31pp increase in private wealth-income ratios. While this correlation remains rather weak in Switzerland, it is particularly strong in Norway, France, the U.S., and Spain. If real estate prices continue to rise due to scarcity of land and housing (especially in combination with expansive monetary policy), we are likely to see further hikes in wealth-income ratios. A related question that requires further thorough research is how different monetary policies affect the valuation of different asset categories and thus shape and change the distribution of wealth within a society.

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A Data Appendix

In this section we provide the comprehensive description of all data sources used in our analysis. We explain the data by category from the most recent years to the past, as some series are constructed by backward interpolation.

A.1 Private Wealth (W_{pt})

For the years 2000–2018 official and reliable data of aggregate private wealth at market value are provided by the SNB in the context of the Swiss financial account.[26]

For the period 2000–2018 private wealth can be split up into three main components: financial assets F_{pt}, financial liabilities L_{pt} and non-financial assets K_{pt}. The position financial assets particularly consist of currency and transferable deposits, debt securities (short-term, long-term and structured products), shares and other equity, units in collective investment schemes as well as insurance and pension schemes. The stock of liabilities L_{pt} is composed of mortgages, loans and other accounts payable.

For private non-financial assets K_{pt} the SNB only reports estimates on housing wealth H_{pt}. To best of our knowledge no estimates on the value of agricultural land and A_{pt} and other domestic capital D_{pt} exist for Switzerland. Therefore, in our analysis private non-financial assets consist only of housing wealth ($K_{pt} = H_{pt}$), which implies that $A_{pt} = D_{pt} = 0$.[27]

For the years prior to 2000 no official statistics on the value of net private wealth for Switzerland exist. For the period 1981–1999 we use the aggregate net private wealth estimates submitted by Schmid (2013), who could rely on SNB internal data, which are partly gathered numbers from hardcopy prints of the relevant statistics and are not publicly available.[28] Since the estimates of Schmid (2013) follow the estimation techniques of the SNB we consider this estimates to be relatively reliable.

For the years prior to 1981 we follow an alternative approach which clearly deviates from the methodology used by Piketty and Zucman (2014) and suggested by Alvaredo et al. (2017), since we are not able to observe the wealth stock for

[26] See https://data.snb.ch/en/publishingSet/FIN

[27] For the countries with which we compare our results all three components (H_{pt}, A_{pt}, D_{pt}) of K_{pt} are available on WID.world. We have excluded A_{pt} and D_{pt} for the comparison countries in Section 6, but included A_{pt} and D_{pt} in Section 5. This decision is set out in the Appendix B.2 (see in particular Figure B12 and Figure B13).

[28] Data received on email request: frank.schmid@sif.admin.ch We are very grateful to Frank Schmid for sharing his data with us.

Switzerland at market value any more. In order to provide an estimate of total private net wealth, we draw on historical tax and pension wealth data and follow an approach similar to Brülhart et al. (2018).

The primary sources we use to construct our net private wealth series are the wealth estimates based on tax data provided by Dell et al. (2007).[29] Their estimates cover 22 years between 1913 and 1997. We linearly interpolated the missing years of this period. To extend private wealth estimates back to 1900 we used additional tax data for the years 1900 and 1910 based on the assumption that taxable wealth represented 80% of taxable capital.[30] The missing years are in turn interpolated linearly, which leads to a tax wealth series covering the period 1900–1997.

Estimating net private wealth based on Swiss wealth tax data has two main drawbacks. First pension wealth is not covered at all in tax data and secondly the tax value of real estate is underestimating the true market value (Brülhart et al., 2018).

To account for the first issue we use estimates of pension fund assets to correct the private wealth series based on tax data. For this purpose, we could rely on the historical estimates of total pension fund assets as reported by Leimgruber (2008). The estimates of Leimgruber (2008) cover 13 years between 1922 and 2004. We linearly interpolated this estimates for the missing years. In 1922 total pension wealth was only 200 million nominal Swiss francs. Since there exist no older observations, we assume that the pension assets before 1922 are 0.

From the sources outlined we have two linearly interpolated series for tax wealth (1900–1997) and pension wealth (1900–2004). To estimate a long run series of total net private wealth we proceed as follows. First we add up these two linearly interpolated series. To address the second issue—the undervaluation of housing wealth in tax data—we do not use the absolute nominal value of the combined series of tax private wealth (including an optional mark-up) and pension wealth. Instead we calculate the growth rate of this combined series. By applying this growth rate to last market value observation of private wealth recorded by Schmid (2013) in 1981, we estimate private wealth back to the year 1900. Prior to 1981, we only display estimates of net private wealth for years in which we have an actual

[29] This data can be found in their paper in table 11.3 column 2.

[30] The data is obtained from the 'Statistisches Jahrbuch der Schweiz 1920' (p. 395). The assumption that taxable wealth represents 80% of taxable capital is derived by comparing the two observations of taxable capital from 1913 (81%) and 1919 (79%) with the observations reported by Dell et al. (2007).

observations from tax data (see, e.g., Figure 1).

Our estimation approach relies on the assumption that changes in taxable wealth (including private pension wealth) correspond well to changes in total private wealth at market value. To verify this assumption we compare the growth rates in total private wealth at market value (as provided by the SNB) with the growth rate of taxable wealth (including pension wealth) for the period 2003–2016, where annual data for both series exist.[31] Figure B4 shows the annual percentage change in private wealth at market value and taxable wealth (including pension wealth) for the period 2003–2016. Growth rates track each other extremely well including in the years around the outbreak of the Great Recession in 2008, which are characterized by large changes from year to year. We are therefore confident that our method is valid to estimate total private wealth at market value over time.

A.2 Public Wealth (W_{gt})

Data on public gross financial wealth, public gross non-financial wealth, public gross debt and thus public net wealth W_{gt} can be obtained for the period 1990–2018 from the GFS-Model of the Federal Finance Administration.[32] With the GFS-Model international comparability of the Swiss data is ensured, since the financial statistic standard of the International Monetary Fund (IMF) is applied, which is in turn compatible with the ESA-2010.

In the non-financial assets time series at the federal-level a significant one-time shift occurs. From 2006 to 2008 non-financial assets increased from 41.1 to 84.6 billions Swiss francs (see Figure B14). This level shift is due to a break in the series in 2008, where accounting followed the new FS-Model. The Federal Finance Administration notes itself that the new standards introduced in 2008 restricts comparability with the figures in the national FS-Model from earlier years. Since the GFS-Model is based on the FS-Model, statistical inaccuracies cannot be ruled out.[33]

[31] For taxable wealth, we use data from the Swiss wealth statistics for natural persons published annually between 2003 and 2016 by the Swiss Federal Tax Administration (see https://www.estv.admin.ch/estv/de/home/allgemein/steuerstatistiken/fachinformationen/steuerstatistiken/gesamtschweizerische-vermoegensstatistik-der-natuerlichen-person.html). For pension wealth we use the data provided by the SNB. Note that the results shown in Figure B4 are not driven by the inclusion of the pension wealth data. The omission of the pension wealth would only marginally reduces the correlation from 0.91 to 0.88.

[32] See https://www.bfs.admin.ch/bfs/en/home/statistics/general-government-finance/financial-situation/gfs-model-international-IMF.html

[33] https://www.efv.admin.ch/efv/en/home/themen/finanzstatistik/methoden.html (published on 13.04.2016).

We corrected for this brake in the series by applying the average growth rate of non-financial assets at the federal level (computed based on the years 1997–2006 and 2009–2018) for the two years 2007 and 2008. This adjustment is shown graphically in Figure B14. This leads to a more steady and plausible evolution of public non-financial assets. Note that this correction not only affects non-financial assets but also total net public wealth. Thus, since national wealth is the sum of private and public wealth this correction also slightly changes the value of national wealth.

A.3 National Wealth (W_{nt}) and Net Foreign Wealth (NFA_{nt})

Because the market-value of national wealth W_{nt} is simply the sum of private and public wealth, no additional data is needed to construct a national wealth series. Equation (3) shows that national wealth can be decompose into domestic capital K_{nt} and net foreign wealth NFA_{nt}.

For the period 2000–2018 net foreign wealth is published by the SNB as part of the Swiss balance of payments.[34] For the years 1995–1999 net foreign wealth can be obtained from published reports of the SNB. Observations on net foreign wealth for 1998 and 1999 are obtained from the publication 'Switzerland's International Investment Position 2000'.[35] For the years 1995–1997 we use net foreign wealth as reported in the 'Monthly Statistical Bulletin January 2000'.[36]

A.4 Net National Income (Y_t)

For the years 1995–2018 we use net national income as published by the FSO as part of the Swiss national accounts (B5n, S1).[37] These are the best data available, since they are fully compatible with the SNA-2008 and can therefore be compared internationally. We used growth rates of similar historical income data to calculate net national income back until 1900. In case of overlaps in the data we always prefer to calculate the growth rates based on national income at market prices. For the period 1990–1994 we use the growth rates of national income at factor cost ("Volkseinkommen") that can be found in table Q.5. from the HSSO-database.[38]

[34] See https://data.snb.ch/en/topics/aube#!/cube/auvekoma

[35] See https://www.snb.ch/en/iabout/stat/statrep/id/statpub_bopiip_all#t4; only available in French or German.

[36] See https://www.snb.ch/de/iabout/stat/statrep/statpubdis/id/statpub_statmon_arch#t2; only available in French or German.

[37] See https://www.bfs.admin.ch/bfs/en/home/statistics/national-economy/national-accounts/sequence.html

[38] See https://hsso.ch

For the years 1948–1989 we use growth rates of net national income that are also available at the HSSO-database in table Q.6a. For the period 1929–1947 there exist again data of national income at factor cost at the HSSO-database in table Q.4a. For the years 1900–1929 we had to resort on historical nominal GDP data estimated by Stohr (2016).[39]

A.5 Population (N_t)

Data on Switzerland's total population are available from the FSO for the period 1861–2018.[40] The balance of the permanent resident population is composed of different statistical sources by the FSO. Although the individual data sources change over time, this long run population series is the most reliable data available.

The population data in WID.world corresponds to the population of a country on the 1st July of the year indicated (Blanchet and Chancel, 2016). For Switzerland, no such data exists. We therefore used the average of the total population between January 1st and December 31st of the year in question. This ensures comparability across countries.

A.6 Price Index

Sometimes we show the absolute value of wealth at constant prices, rather than wealth-income ratios. To deflate the nominal wealth or national income series we use a composed consumer price index (CPI). Switzerland's CPI can be obtained for the period 1914–2018 from the FSO.[41] To prolong this series back to 1900, we used CPI data available on the HSSO-database in table H.17.[42]

A.7 Savings and Savings Rates (s_t)

The net savings flows can be directly obtained from the Swiss national accounts[43] Net saving rates are then calculated by dividing the corresponding net savings flow by net national income (B.5*n, S1). The following net savings rates are computed:

- non-financial corporate savings = (B.8n, S11)/(B.5*n, S1)
- financial corporate savings = (B.8n, S12)/(B.5*n, S1)

[39] Data received on email request: christian.stohr@unige.ch. We are very grateful to Christian Stohr for sharing his data with us.

[40] See https://www.bfs.admin.ch/bfs/en/home/statistics/catalogues-databases/tables.assetdetail.9486043.html

[41] See https://www.bfs.admin.ch/bfs/en/home/statistics/prices/consumer-price-index.html

[42] See https://hsso.ch

[43] See https://www.bfs.admin.ch/bfs/en/home/statistics/national-economy/national-accounts/sequence.html

– corporate savings = non-financial + financial corporate savings

– household savings = (B.8n, S14)/(B.5*n, S1)

– private savings = corporate savings + household savings

– public savings = (B.8n, S13)/(B.5*n, S1)

– national savings = private savings + public savings = (B.8n, S1)/(B.5*n, S1)

A.8 World Inequality Database

Most international data we show in this paper can be obtained directly from the World Inequality Database (WID.world).[44] The series for Australia, Canada, France, Germany, Italy, Japan, the U.K. and the U.S. are based on Piketty and Zucman (2014), from Artola Blanco et al. (2020) for Spain and from Waldenström (2017) for Sweden. All these have been updated and are available for download from WID.world. The corresponding data for Norway are WID.world estimates.

Further note that for the countries other than Switzerland all three subcomponents of K_{pt} (H_{pt}, A_{pt}, D_{pt}) are available. We refer to the remarks in Appendix B.2 to comprehend which adjustments we made to ensure that the international data is as comparable as possible with Switzerland.

A.9 Savings and Capital Gains in Private Wealth

In Section 7, we split the newly accrued accumulation of net national respectively private wealth (and it's two main subcomponents non-housing wealth (i.e., net financial wealth including pension wealth) and gross housing wealth) into a savings and capital gains component. This section outlines the methodological procedure and the additional sources used.

For the decomposition of national wealth shown in Table 1 we use Equation (9). The only unknown variable in Equation (9) is the rate of capital gain or loss q_t, which is simply calculated as residual. The data sources for the other variables β_{nt}, g^w_{st} and g^w_{st} variables are outlined in corresponding sections in Appendix A. For the national wealth-income $\beta_{nt} = \frac{W_{nt}}{Y_t}$ they can be found in A.3 for W_{nt} and in A.4 for Y_t. To compute the savings-induced wealth growth rate $g^w_{st} = \frac{s_t}{\beta_{nt}}$ one needs additional data on national savings as set out in A.7. The data sources of the growth rate of national income g_t are described in A.4.

[44] see https://wid.world

The decomposition of net private wealth and it's subcomponents housing wealth and non-housing wealth as shown in Table 2 is conducted as follows. By using Equation 7 the level decomposition of the year to year change in net private wealth is straightforward. By deducting the net savings flow of private households[45] (source outlined in A.7) from the year to year change in net private wealth (source of private wealth and it's subcomponents are outlined in A.1) one immediately obtains the capital gains or loss flow KG_t of net private wealth.

For the analysis conducted in Section 7 we split net private wealth into two subcomponents non-housing wealth (i.e., net financial wealth including pensions wealth, $F_{pt} - L_{pt}$) and gross housing wealth H_{pt}. Since we observe the stock at market value of both subcomponents every year since 2000, we can compute the year to year change in levels. To further split the changes of both subcomponents into savings and capital gains part, we use additional data provided by the SNB in the context of the Swiss financial accounts.[46] For the year to year change in the stock of total net financial wealth the SNB provides detailed information and decomposes the changes into financial transactions (i.e savings), capital gains and losses and statistical changes and reclassifications. Unfortunately, statistical changes and reclassifications are not insignificant and renders a clear assignment to one of the two components of interest somewhat difficult. However, around half (in absolute value) of the statistical changes and reclassifications are due to changes in pension wealth caused by emigrants who leave Switzerland with their pension assets. Since we are interested in net private wealth held by Swiss

[45] Following Piketty and Zucman (2014) we carried out the decomposition with two different savings concepts, namely the net saving rate of private households and the net private saving rate (i.e., the net saving rate of private households including retained earnings of corporations). Table 2 provides the results using the households savings rate and Table B6 shows the results using the net private savings rate. It is not a priori clear which savings rate should be used, as both concepts have their own drawbacks (for a detailed discussion see Piketty and Zucman (2013)). By excluding retained corporate earnings capital gains mechanically increase as the savings rate is lower. However, if companies retain their profits to finance new investments and new acquisitions (leading to rising share prices), this is not a real relative price effect, but rather a savings effect (Piketty and Zucman, 2013). On the other hand, if the net private savings rate is used, all retained earnings of Swiss corporations are attributed to the domestic household sector, which in turn might be problematic. Firstly, a part of the retained profits belonging to foreign shareholders will be attributed to domestic shareholders (the same applies vice versa). Furthermore, at least part of the retained earnings of domestic companies should be assigned to the government sector (Piketty and Zucman, 2013). Note that in Switzerland retained corporate profits account for less than 20% of total private net savings, which is a small share in international comparison (see Table B2). Nevertheless, the results differ depending on the savings concept used when decomposing the real private growth rate. Due to the methodology used (which is determined by data availability), the differences occur in the capital gains of the housing wealth rather than in the non-housing wealth component (as the housing wealth components are estimated as residuals). The reason why we prefer the decomposition based on the household saving rate is that otherwise there would be no capital gains in housing wealth over the period 2000-2010, which is rather inconsistent with the evolution of Swiss real estate price indices over this period (see Figure 10). Note in particular that in the 2010-2018 sub-period (in which the fast increase in the private wealth-income ratio takes place) both decompositions yield virtually identical results.

[46] See https://data.snb.ch/en/publishingSet/FIN

residents, this outflow represents negative savings. We thus deduct this part of statistical reclassification from the households savings. For the remaining part of the statistical changes and reclassifications no entirely clear allocation between savings and capital gains can be achieved. However, in order for the flows to correctly reflect the change in the stock of net financial wealth, we have included the remaining statistical changes in the capital gains component.[47]

The decomposition of housing wealth H_{pt} into savings and capital gains part is in turn straightforward. Since savings and capital gains of the two subcomponents must reflect the changes of total private net wealth at the macroeconomic level, the savings and capital gains part of housing wealth are estimated as residuals. Such that the savings (capital gains) of non-housing wealth and housing wealth add up to the savings (capital gains) of net private wealth.

A.10 Real Estate Price Index Data

We use real estate price index data as published by the OECD in September 2020.[48] As we are interested in determining the influence of changes in real estate prices on changes in the wealth-income ratio (which is a real variable), we deflate the nominal house price index using CPI data from OCED.[49]

The data are graphically represented for all countries separately in Figure 10 and B10 in levels and in Figure B15 as annual changes.

A.11 Stock Market Index Data

As with real estate prices, we use the same method for share prices. For all countries in our analysis we use the stock price index data as published by the OECD in September 2020.[50] In addition to the share price data from the individual countries, we take into account the international price development on stock markets with the MSCI World Index.[51]

Again, we deflate all share price time series with CPI data because we are interested in real changes (see Footnote 49). As the MSCI World Index is measured in USD, we use the CPI of the United States for deflation. The data are graphically

[47] This is justified by the fact that the capital gains, which are estimated as a residual, include all sorts of measurement errors anyway. These estimates are subject to revision when better data sources become available. However, the order of magnitude appears to be clear.

[48] See https://data.oecd.org/price/housing-prices.htm

[49] See https://data.oecd.org/price/inflation-cpi.htm

[50] See https://data.oecd.org/price/share-prices.htm

[51] See https://www.msci.com/end-of-day-data-search

represented for all countries separately in Figure 10 and B10 in levels and in Figure B15 as annual changes.

B Additional Tables and Figures

B.1 Additional Tables

Table B1: Structure of National Savings in Switzerland, 1995–2018

	Net private saving (household & corporate) (%)	Net household saving (%)	Net corporate saving (retained earnings) (%)	Net public saving (%)	Net national saving (%)
1995–2018	14.1	12.3	1.8	1.6	15.7
1995–2002	14.0	10.8	3.3	0.5	14.6
2002–2010	14.7	11.4	3.3	1.7	16.4
2010–2018	13.7	14.0	-0.3	2.2	15.9

Note: All average saving rates are obtained by weighting yearly saving rates by real national income. Net private savings are the sum of household and corporate savings. Net national savings are in turn the sum of private and public savings. Detailed information on savings data for Switzerland can be found in Appendix A.7.

Table B2: Structure of National Savings in International Comparison

	Net private saving (household & corporate) (%)	Net household saving (%)	Net corporate saving (retained earnings) (%)	Net public saving (%)	Net national saving (%)
Switzerland (1995–2015)	14.6	11.9	2.6	1.4	16.0
Germany (1995–2013)	11.2	6.3	4.8	-3.0	8.2
France (1995–2010)	11.1	8.5	2.6	-3.1	8.0
Italy (1995–2014)	8.4	6.4	2.0	-3.8	4.7
Sweden (1995–2015)	16.1	7.4	8.7	2.6	18.7
United States (1995–2013)	7.9	4.3	3.6	-4.8	3.1

Note: Saving rates are calculated for different time periods as savings data for certain countries are not available for the entire period: Switzerland 1995–2015; Germany 1995–2013; France 1995–2010; Italy 1995–2014; Sweden 1995–2015; United States 1995–2013. All average saving rates are obtained by weighting yearly saving rates by real national income. Net private savings are the sum of household and corporate savings. Net national savings are in turn the sum of private and public savings. Detailed information on savings data for Switzerland can be found in Appendix A.7. The results for the other countries are own calculations based on updated data which are available for download from https://wid.world. The original data for Germany, France, Italy and the United States are taken from Piketty and Zucman (2014) and for Sweden from Waldenström (2017).

Table B3: Growth and Saving Rates, 1995–2015

	Real growth rate of national income (%)	Population growth rate (%)	Real growth rate of per capita national income (%)	Net national saving (%)*	$\Delta\ \beta_{nt}$
Switzerland	1.86	0.82	1.04	16.0	+ 173 pp.
Germany	1.38	0.05	1.33	8.2	+ 58 pp.
France	1.49	0.53	0.96	8.0	+ 219 pp.
Italy	0.31	0.35	-0.04	4.7	+ 131 pp.
Sweden	3.03	0.55	2.48	18.7	+ 276 pp.
United States	2.42	0.94	1.48	3.1	+ 63 pp.

Note: This table displays the real growth rates of national income, which can be decomposed into population and per capita income growth. All growth rates are geometric averages over the period 1995–2015. Except for net national saving rates* which are calculated for different time periods as savings data for certain countries are not available for the entire period: Switzerland 1995–2015; Germany 1995–2013; France 1995–2010; Italy 1995–2014; Sweden 1995–2015; United States 1995–2013. The average saving rates are obtained by weighting yearly saving rates by real national income. The last column shows the change in percentage points (pp.) of the national wealth-income ratio β_{nt} over the period 1995–2015. Detailed information on the data for Switzerland can be found in the corresponding subsections in Appendix A. The results for the other countries are own calculations based on updated data which are available for download from https://wid.world. The original data for Germany, France, Italy and the United States are taken from Piketty and Zucman (2014) and for Sweden from Waldenström (2017).

Table B4: The Accumulation of National Wealth, 1995–2013

			Decompositon of the wealth growth rate (%)		
	National wealth-income ratios (%)		Real growth rate of national wealth	Savings-induced wealth growth rate	Capital gains induced wealth growth rate
	$\beta_{n,t}$	$\beta_{n,t+n}$	g_w	$g_{ws} = \frac{s}{\beta_n}$	q
Switzerland	504%	644%	3.2%	2.9% 90%	0.3% 10%
Germany	342%	388%	2.1%	2.2% 106%	-0.1% -6%
Italy	379%	544%	2.3%	1.2% 52%	1.1% 48%
Sweden	233%	475%	6.9%	5.4% 78%	1.5% 22%
United States	350%	384%	2.9%	0.8% 28%	2.1% 72%

Note: This table displays changes in national wealth W_{nt} for the indicated countries between 1995 and 2013. The first two columns indicate the level of the national wealth-income ratio β_{nt} in 1995 respectively 2013. The third column shows the average real growth rate of national wealth g_w. With the formula in equation (9) it is possible to decompose the real growth rate of national wealth g_w into two multiplicative components. Where one part of the national wealth growth rate is savings-induced g_s^w and the other part are capital gains or losses q. All growth rates are geometric averages. Detailed information on the data for Switzerland can be found in the corresponding subsections in Appendix A. The results for the other countries are own calculations based on updated data which are available for download from https://wid.world. The original data for Germany, France, Italy and the United States are taken from Piketty and Zucman (2014) and for Sweden from Waldenström (2017).

Table B5: The Accumulation of National Wealth in Switzerland, 2000–2018

	Wealth-income ratios (%)		Decomposition of the real wealth growth rate (%)		
			Real growth rate of wealth	Savings-induced wealth growth rate	Capital gains induced wealth growth rate
	β_t	β_{t+n}	g_w	$g_{ws} = s/\beta$	q
2000–2018					
National Wealth	551%	742%	3.1%	2.7% (89)	0.3% (11)
Public Wealth	25%	55%	5.8%	6.7% (115)	-0.9% (-15)
Private Wealth	526%	687%	2.9%	2.2% (76)	0.7% (24)
2000–2010					
National Wealth	551%	542%	1.6%	2.9% (177)	-1.3% (-77)
Public Wealth	25%	25%	1.5%	7.3% (475)	-5.7% (-375)
Private Wealth	526%	517%	1.6%	2.1% (130)	-0.5% (-30)
2010–2018					
National Wealth	542%	742%	4.9%	2.5% (52)	2.4% (48)
Public Wealth	25%	55%	11.4%	6.0% (53)	5.4% (47)
Private Wealth	517%	687%	4.5%	2.3% (51)	2.2% (49)

Note: This table displays the changes in national wealth $W_{n,t}$ and its two main subcomponents —net private wealth, $W_{p,t}$, and net public wealth $W_{g,t}$—between 2000 and 2018. The first two columns indicate the level of the different wealth-income ratios $\beta_{n,t}$, $\beta_{p,t}$ and $\beta_{g,t}$ respectively for the corresponding periods. The third column shows the average real growth rate g_w of the respective wealth components over the different time periods. With the formula in Equation (9) it is possible to decompose the real wealth growth rate g_w into two multiplicative components. Where one part of the wealth growth rate is savings-induced g_s^w and the other part are capital gains or losses q. The small numbers below the growth rates in columns 5 and 6 indicate the share in the total average real growth rate g_w. Note that the saving rate used in the above decomposition for the private wealth component is the net saving rate of private households. The results of the same decomposition using the net private saving rate (including retained earnings of corporations) is shown in Table B6 (see in this context also Footnote 45). All growth rates are geometric averages. Detailed information on the data used can be found in the corresponding subsections in Appendix A.

Table B6: The Accumulation of Private Wealth in Switzerland, 2000–2018

	Private wealth-income ratios (%)		Decomposition of the private wealth growth rate (%)		
			Real growth rate of national wealth	Savings-induced wealth growth rate	Capital gains induced wealth growth rate
	$\beta_{p,t}$	$\beta_{p,t+n}$	g_w	$g_{ws} = s/\beta_p$	q
2000–2018					
Total Private Wealth	526%	687%	2.9%	2.5% 87	0.4% 13
Housing Wealth	248%	380%	3.8%	2.8% 74	1.0% 26
Non-Housing Wealth	278%	307%	1.9%	2.2% 113	-0.3% -13
2000–2010					
Total Private Wealth	526%	517%	1.6%	2.7% 163	-1.0% -63
Housing Wealth	248%	275%	2.9%	3.0% 102	-0.1% -2
Non-Housing Wealth	278%	242%	0.4%	2.4% 625	-2.0% -525
2010–2018					
Total Private Wealth	517%	687%	4.5%	2.3% 52	2.1% 48
Housing Wealth	275%	380%	5.0%	2.7% 54	2.3% 46
Non-Housing Wealth	242%	307%	3.9%	1.9% 48	2.0% 52

Note: This table displays the changes in private net wealth $W_{p,t}$ and its to main subcomponents—private housing (H_{pt}) and non-housing wealth ($F_{pt} - L_{pt}$)–between 2000 and 2018. The first two columns indicate the level of the total private wealth-income ratio $\beta_{p,t}$, the housing wealth-income ratio and the non-housing wealth-income ratio respectively for the corresponding years. The third column shows the average real growth rate g_w of the respective wealth components over the different time periods. With the formula in Equation (9) it is possible to decompose the real wealth growth rate g_w into two multiplicative components. Where one part of the wealth growth rate is savings-induced g_s^w and the other part are capital gains or losses q. The small numbers below the growth rates in columns 5 and 6 indicate the share in the total average real growth rate g_w. The methodology used to decompose the changes of the depicted private wealth categories into a savings and capital gains component is described in detail in Section A.9 in the Appendix. Note that the saving rate used in the above decomposition is the net private saving rate (i.e., including retained earnings of corporations).The results of the same decomposition using the net saving rate of private households is shown in Table 2 (see in this context also Footnote 45). All growth rates are geometric averages. Detailed information on the data can be found in the corresponding subsections in Appendix A.

Table B7: Panel Regressions of Private Wealth-Income Ratios on Stock and House Prices

	(1)		(2)		(3)		(4)	
1970-2018								
Pooled OLS								
House prices	0.21***	(0.04)			0.20***	(0.04)	0.20***	(0.04)
Share prices			0.05***	(0.02)	0.04**	(0.02)	0.03	(0.02)
MSCI world							0.03	(0.02)
Adj. R^2	0.103		0.058		0.155		0.158	
Obs.	485		471		471		471	
Year FE								
House prices	0.22***	(0.03)			0.23***	(0.02)	0.23***	(0.02)
Share prices			0.03	(0.02)	0.03	(0.02)	0.03	(0.02)
MSCI world							0.00	(.)
Adj. R^2	0.167		0.093		0.190		0.190	
Obs.	483		469		469		469	
Country FE								
House prices	0.21***	(0.04)			0.21***	(0.04)	0.20***	(0.04)
Share prices			0.05***	(0.02)	0.05**	(0.02)	0.03	(0.02)
MSCI world							0.03	(0.02)
Adj. R^2	0.097		0.052		0.150		0.153	
Obs.	485		471		471		471	
1990-2018								
Pooled OLS								
House prices	0.27***	(0.06)			0.25***	(0.06)	0.25***	(0.06)
Share prices			0.05**	(0.02)	0.04	(0.03)	-0.00	(0.03)
MSCI world							0.08	(0.04)
Adj. R^2	0.127		0.046		0.148		0.166	
Obs.	306		306		306		306	
Year FE								
House prices	0.31***	(0.05)			0.32***	(0.05)	0.32***	(0.05)
Share prices			0.01	(0.03)	-0.01	(0.03)	-0.01	(0.03)
MSCI world							0.00	(.)
Adj. R^2	0.253		0.120		0.251		0.251	
Obs.	304		304		304		304	
Country FE								
House prices	0.26***	(0.07)			0.24***	(0.07)	0.24***	(0.07)
Share prices			0.05*	(0.02)	0.04	(0.03)	-0.00	(0.03)
MSCI world							0.08*	(0.04)
Adj. R^2	0.112		0.042		0.134		0.154	
Obs.	306		306		306		306	

Note: The table shows alternative specifications for the panel regressions in the bottom Panel B of Table 3. The table in turn reports the results for OLS regressions of changes in private wealth-income ratios on changes in real house prices (Column 1), changes in real share prices (Column 2) and both (Column 3). Column (4) further includes the global MSCI world share price index as a control. In the "Year FE" specification, the coefficient for the MSCI World is zero, as the effect is fully absorbed by the fixed effects. See Figure B15 for details on data availability by country. We use house price (see Appendix A.10) and share price indices (see Appendix A.11) as published by the OECD in September 2020. Residuals in all models are stationary. Two-way clustered standard errors by country and year are shown in parentheses, next to coefficients. * p<.1, ** p<.05, *** p<.01.

Table B8: OLS Regressions of Wealth-Income Ratios on Stock and House Prices, 1970–2018

	(1)		(2)		(3)		(4)	
Switzerland								
House prices	-0.05	(0.10)			-0.05	(0.10)	-0.07	(0.11)
Share prices			0.04	(0.03)	0.04	(0.03)	0.02	(0.06)
MSCI world							0.03	(0.07)
Constant	1.00*	(0.56)	0.74	(0.55)	0.84	(0.58)	0.84	(0.58)
Adj. R^2	-0.017		0.011		-0.011		-0.029	
Obs.	48		49		48		48	
France								
House prices	0.36***	(0.06)			0.34***	(0.05)	0.35***	(0.05)
Share prices			0.05**	(0.02)	0.04**	(0.01)	0.06**	(0.02)
MSCI world							-0.03	(0.03)
Constant	1.50***	(0.31)	2.00***	(0.39)	1.38***	(0.30)	1.42***	(0.30)
Adj. R^2	0.469		0.090		0.525		0.528	
Obs.	45		45		45		45	
Italy								
House prices	0.20***	(0.07)			0.21***	(0.07)	0.17**	(0.07)
Share prices			0.02	(0.02)	0.02	(0.02)	0.04	(0.03)
MSCI world							-0.06	(0.06)
Constant	2.40***	(0.63)	2.67***	(0.67)	2.33***	(0.63)	2.57***	(0.67)
Adj. R^2	0.156		-0.006		0.159		0.161	
Obs.	45		46		45		45	
Spain								
House prices	0.22***	(0.06)			0.32***	(0.04)	0.33***	(0.04)
Share prices			0.03	(0.03)	-0.01	(0.02)	-0.05	(0.03)
MSCI world							0.07	(0.05)
Constant	0.98	(0.65)	2.24***	(0.78)	1.29***	(0.46)	1.17**	(0.47)
Adj. R^2	0.221		0.008		0.675		0.686	
Obs.	43		29		29		29	
Japan								
House prices	0.55***	(0.09)			0.46***	(0.08)	0.46***	(0.09)
Share prices			0.12***	(0.03)	0.07***	(0.03)	0.07*	(0.04)
MSCI world							0.02	(0.05)
Constant	2.19***	(0.50)	1.73***	(0.60)	1.88***	(0.47)	1.86***	(0.48)
Adj. R^2	0.482		0.273		0.560		0.551	
Obs.	45		45		45		45	
Sweden								
House prices	0.19	(0.17)			0.17	(0.17)	0.16	(0.17)
Share prices			0.10**	(0.05)	0.08	(0.05)	0.06	(0.07)
MSCI world							0.05	(0.11)
Constant	1.67	(1.18)	1.08	(1.15)	1.06	(1.22)	1.10	(1.23)
Adj. R^2	0.006		0.064		0.041		0.023	
Obs.	46		47		46		46	

	(1)		(2)		(3)		(4)	
Australia								
House prices	0.16**	(0.07)			0.17**	(0.07)	0.18**	(0.07)
Share prices			0.06**	(0.03)	0.06**	(0.03)	0.02	(0.04)
MSCI world							0.05	(0.04)
Constant	1.11**	(0.47)	1.45***	(0.42)	0.99**	(0.46)	0.85*	(0.47)
Adj. R^2	0.082		0.070		0.156		0.164	
Obs.	44		45		44		44	
Canada								
House prices	-0.15	(0.10)			-0.17	(0.11)	-0.22*	(0.11)
Share prices			-0.01	(0.04)	0.01	(0.04)	-0.05	(0.06)
MSCI world							0.10*	(0.06)
Constant	2.44***	(0.64)	2.14***	(0.64)	2.42***	(0.65)	2.29***	(0.63)
Adj. R^2	0.046		-0.033		0.015		0.087	
Obs.	30		30		30		30	
United Kingdom								
House prices	0.21***	(0.05)			0.19***	(0.05)	0.16***	(0.05)
Share prices			0.10***	(0.04)	0.09**	(0.03)	0.02	(0.06)
MSCI world							0.07	(0.06)
Constant	1.12**	(0.51)	1.63***	(0.52)	0.99**	(0.48)	1.04**	(0.49)
Adj. R^2	0.262		0.132		0.353		0.347	
Obs.	46		46		46		45	
United States								
House prices	0.46***	(0.15)			0.27**	(0.11)	0.25**	(0.12)
Share prices			0.24***	(0.03)	0.23***	(0.03)	0.20**	(0.07)
MSCI world							0.03	(0.07)
Constant	0.75	(0.64)	0.30	(0.47)	0.06	(0.46)	0.08	(0.47)
Adj. R^2	0.151		0.527		0.569		0.561	
Obs.	45		46		45		45	

Note: The table shows results for OLS regressions of percentage changes in wealth-income ratios on percentage changes in real house prices, real share prices, and real the MSCI world stock index, respectively, by country. We use house price (see Appendix A.10) and share price indices (see Appendix A.11) as published by the OECD in September 2020. Period of analysis are the years 1970–2018 or the latest year with available data (see Figure B15 for details on data availability by country). We regress the change in wealth-income ratios either on real house or share prices in the respective country (columns 1 and 2), on both (column 3), and on changes in the MSCI world share price index (column 4). Residuals in all models are stationary. Standard errors shown in parentheses, next to coefficients. * p<.1, ** p<.05, *** p<.01.

Table B9: OLS Regressions of Wealth-Income Ratios on Stock and House Prices, 1990–2018

	(1)		(2)		(3)		(4)	
Switzerland								
House prices	0.34*	(0.18)			0.35*	(0.18)	0.28	(0.19)
Share prices			0.05	(0.05)	0.05	(0.05)	-0.04	(0.08)
MSCI world							0.14	(0.11)
Constant	1.00	(0.74)	0.70	(0.83)	0.67	(0.79)	0.77	(0.78)
Adj. R^2	0.080		-0.004		0.092		0.116	
Obs.	29		29		29		29	
France								
House prices	0.45***	(0.06)			0.44***	(0.06)	0.44***	(0.06)
Share prices			0.05	(0.03)	0.02	(0.02)	-0.00	(0.04)
MSCI world							0.04	(0.05)
Constant	1.58***	(0.36)	2.29***	(0.61)	1.52***	(0.37)	1.50***	(0.37)
Adj. R^2	0.687		0.043		0.688		0.683	
Obs.	26		26		26		26	
Italy								
House prices	0.31**	(0.13)			0.31**	(0.13)	0.29**	(0.14)
Share prices			-0.00	(0.04)	0.01	(0.04)	0.02	(0.05)
MSCI world							-0.04	(0.09)
Constant	2.30***	(0.73)	2.42***	(0.81)	2.29***	(0.74)	2.38***	(0.79)
Adj. R^2	0.159		-0.041		0.123		0.091	
Obs.	26		26		26		26	
Spain								
House prices	0.39***	(0.05)			0.39***	(0.05)	0.43***	(0.05)
Share prices			0.04	(0.04)	0.00	(0.02)	-0.06**	(0.03)
MSCI world							0.13***	(0.05)
Constant	1.27***	(0.42)	1.72**	(0.78)	1.26***	(0.43)	1.06**	(0.38)
Adj. R^2	0.722		0.013		0.710		0.784	
Obs.	25		25		25		25	
Japan								
House prices	-0.02	(0.14)			-0.02	(0.14)	-0.02	(0.14)
Share prices			0.02	(0.02)	0.02	(0.02)	0.03	(0.03)
MSCI world							-0.03	(0.05)
Constant	0.13	(0.53)	0.18	(0.46)	0.15	(0.53)	0.23	(0.56)
Adj. R^2	-0.041		-0.014		-0.058		-0.092	
Obs.	26		26		26		26	
Sweden								
House prices	0.10	(0.24)			-0.03	(0.25)	-0.03	(0.26)
Share prices			0.11	(0.07)	0.12	(0.07)	0.11	(0.13)
MSCI world							0.01	(0.21)
Constant	2.95*	(1.73)	2.42	(1.54)	2.51	(1.70)	2.52	(1.74)
Adj. R^2	-0.033		0.065		0.026		-0.016	
Obs.	27		27		27		27	

	(1)		(2)		(3)		(4)	
Norway								
House prices	0.22	(0.23)			0.59**	(0.28)	0.51*	(0.29)
Share prices			-0.04	(0.05)	-0.12*	(0.06)	-0.16**	(0.07)
MSCI world							0.12	(0.11)
Constant	0.98	(1.70)	2.70**	(1.16)	0.08	(1.64)	0.56	(1.70)
Adj. R^2	-0.003		-0.017		0.131		0.136	
Obs.	22		22		22		22	
Germany								
House prices	-0.04	(0.21)			-0.03	(0.22)	-0.05	(0.22)
Share prices			0.01	(0.03)	0.01	(0.03)	0.03	(0.05)
MSCI world							-0.04	(0.07)
Constant	1.19**	(0.54)	1.14**	(0.55)	1.14*	(0.56)	1.16*	(0.57)
Adj. R^2	-0.038		-0.035		-0.077		-0.106	
Obs.	27		27		27		27	
Australia								
House prices	0.25*	(0.13)			0.18	(0.11)	0.17	(0.12)
Share prices			0.18***	(0.05)	0.16***	(0.05)	0.21**	(0.09)
MSCI world							-0.05	(0.08)
Constant	1.18	(0.78)	1.42**	(0.62)	0.91	(0.68)	0.98	(0.70)
Adj. R^2	0.096		0.290		0.337		0.317	
Obs.	25		25		25		25	
Canada								
House prices	-0.22	(0.18)			-0.25	(0.19)	-0.23	(0.19)
Share prices			-0.00	(0.06)	0.03	(0.06)	-0.08	(0.10)
MSCI world							0.14	(0.10)
Constant	2.69***	(0.87)	2.28**	(0.87)	2.63***	(0.90)	2.80***	(0.89)
Adj. R^2	0.026		-0.053		-0.018		0.027	
Obs.	21		21		21		21	
United Kingdom								
House prices	0.19**	(0.08)			0.15**	(0.07)	0.16*	(0.08)
Share prices			0.18***	(0.05)	0.16***	(0.05)	0.17	(0.12)
MSCI world							-0.01	(0.11)
Constant	1.60**	(0.65)	1.64***	(0.57)	1.31**	(0.55)	1.31**	(0.56)
Adj. R^2	0.143		0.317		0.410		0.383	
Obs.	26		26		26		26	
United States								
House prices	0.64***	(0.18)			0.43***	(0.10)	0.41***	(0.10)
Share prices			0.33***	(0.05)	0.29***	(0.04)	0.18**	(0.08)
MSCI world							0.11	(0.08)
Constant	0.81	(0.80)	-0.39	(0.62)	-0.46	(0.48)	-0.26	(0.49)
Adj. R^2	0.329		0.653		0.793		0.801	
Obs.	26		26		26		26	

Note: The table shows results for OLS regressions of percentage changes in wealth-income ratios on percentage changes in real house prices, real share prices, and real the MSCI world stock index, respectively, by country. We use house price (see Appendix A.10) and share price indices (see Appendix A.11) as published by the OECD in September 2020. Period of analysis are the years 1990–2018 or the latest year with available data (see Figure B15 for details on data availability by country). We regress the change in wealth-income ratios either on real house or share prices in the respective country (columns 1 and 2), on both (column 3), and on changes in the MSCI world share price index (column 4). Residuals in all models are stationary. Standard errors shown in parentheses, next to coefficients. * p<.1, ** p<.05, *** p<.01.

B.2 Additional Figures

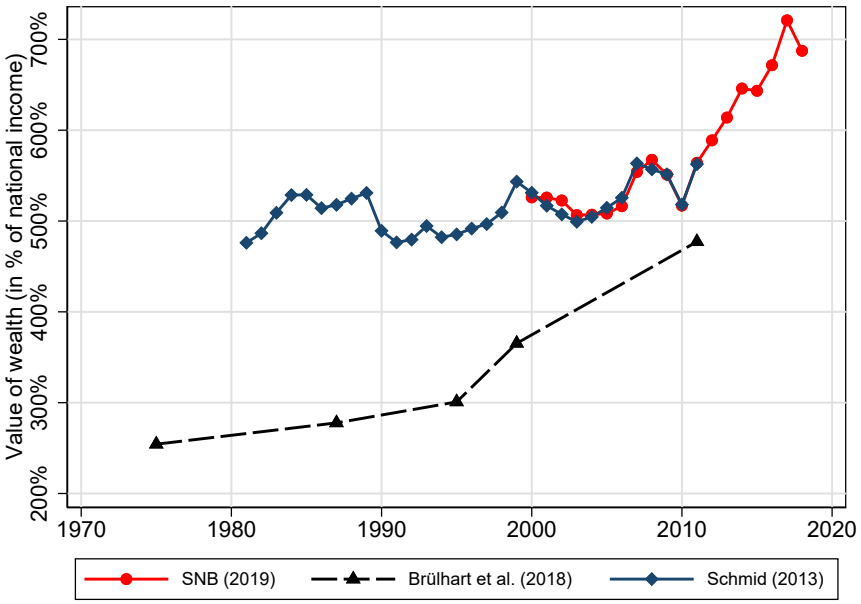
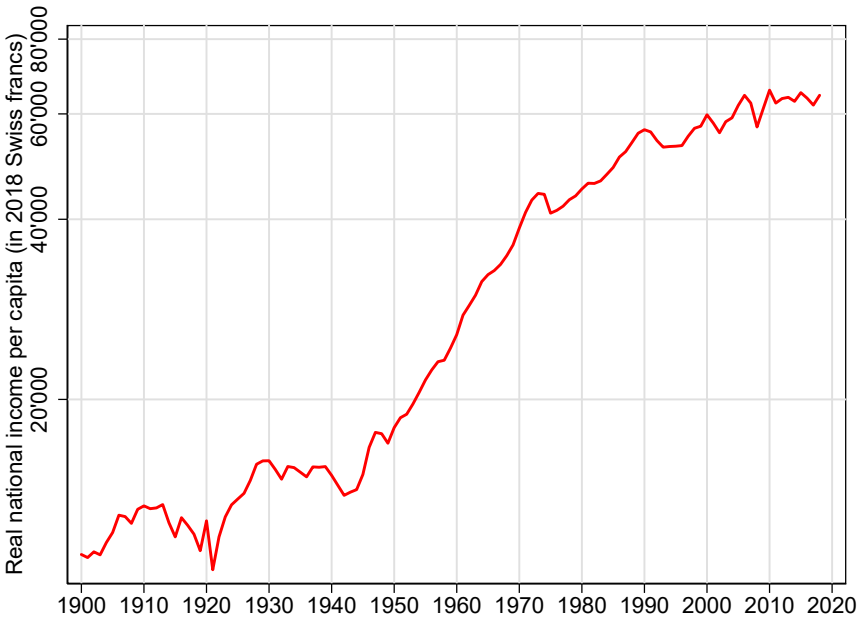
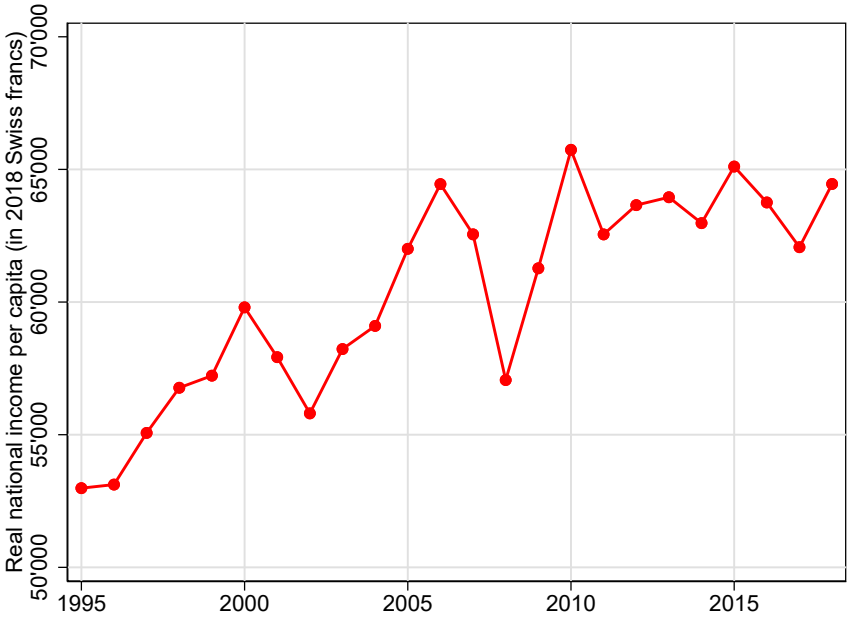


Figure B1: Different Private Wealth Estimates for Switzerland, 1975–2018

Note: This figure displays different estimates of private wealth measured in national income for Switzerland from 1975 to 2018. The red line shows the private wealth estimates at market value which are provided by the SNB in the context of the Swiss financial account. The dark blue line displays the aggregate net private wealth estimates submitted by Schmid (2013), who could rely on SNB internal data, which are partly gathered numbers from hardcopy prints of the relevant statistics and are not publicly available. Finally the black line shows net private wealth estimates of Brülhart et al. (2018), which are mainly based on wealth tax statistics.



(a) 1900–2018



(b) 1995–2018

Figure B2: Real Net National Income per Capita in Switzerland

Note: This figure shows Switzerland's real per capita national income. Nominal net national income is deflated by the Swiss CPI (A.6) and divided by the total population of Switzerland (A.5) in the corresponding year. Thus, the figure displays the average real net national income of Switzerland, expressed in 2018 Swiss francs.

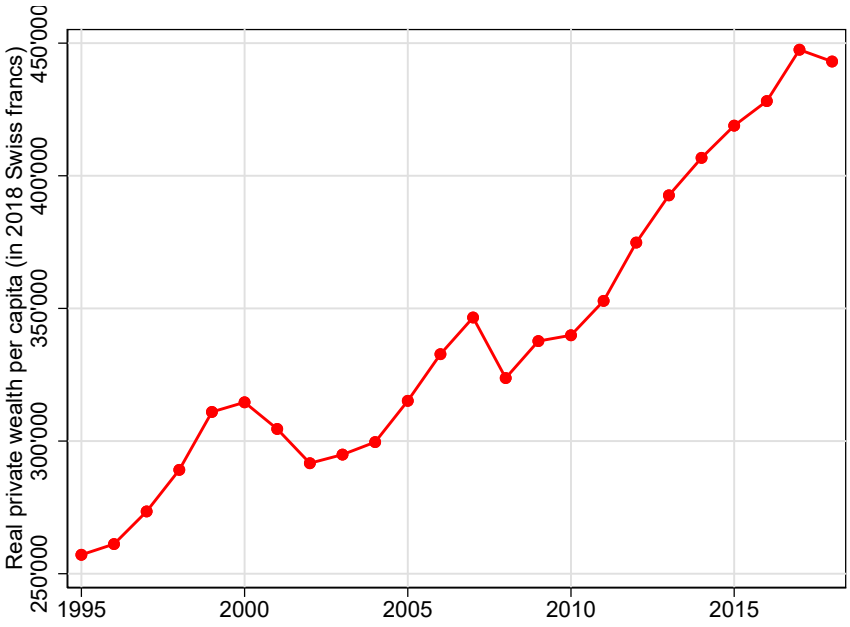


Figure B3: Real Private Wealth per Capita in Switzerland, 1995–2018

Note: This figure displays the evolution of real private wealth per capita in Switzerland between 1995 and 2018. The total nominal private wealth series is deflated by the Swiss CPI (A.6) and divided by the total population of Switzerland (A.5) in the corresponding year. Thus, the figure shows the average real net private of wealth of Switzerland, expressed in 2018 Swiss francs.

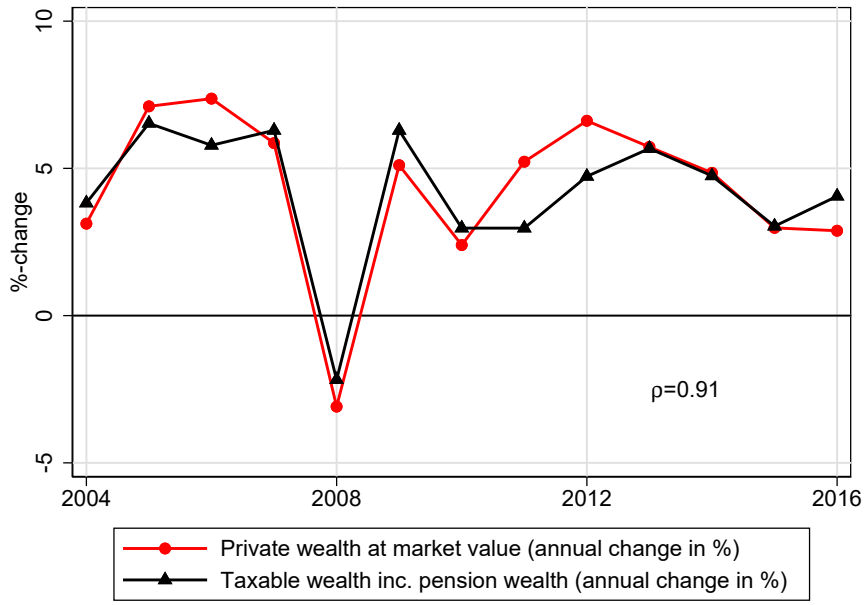


Figure B4: Annual Percentage Change in Taxable Wealth (including Pension Wealth) and Total Private Wealth at Market Value, 2003–2016

Note: This figure shows the annual change in total wealth at market values published by the SNB (red line with circles) and taxable wealth plus private pension wealth (black line with triangles) for the years where the two wealth series overlap. While these wealth series differ in levels, the figure shows that their annual growth rates are very similar.

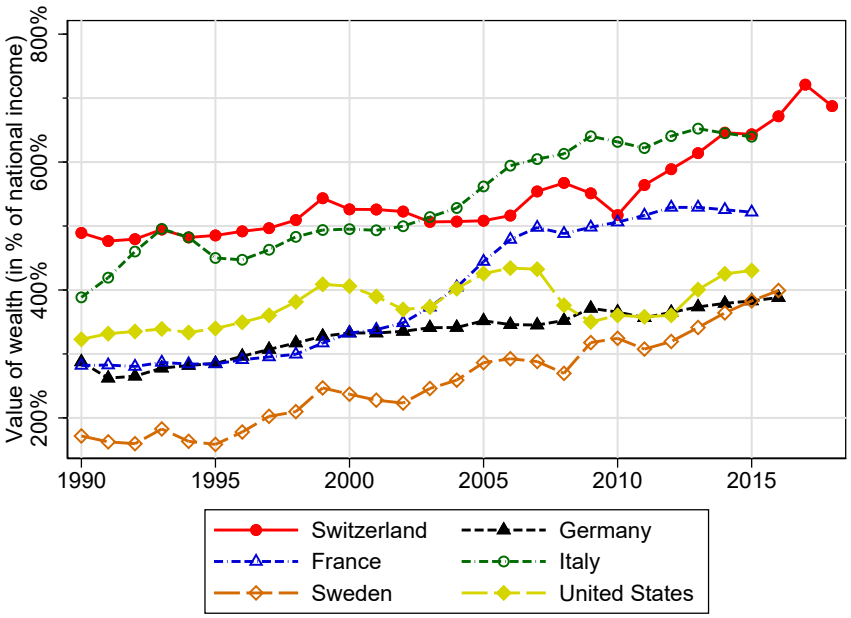
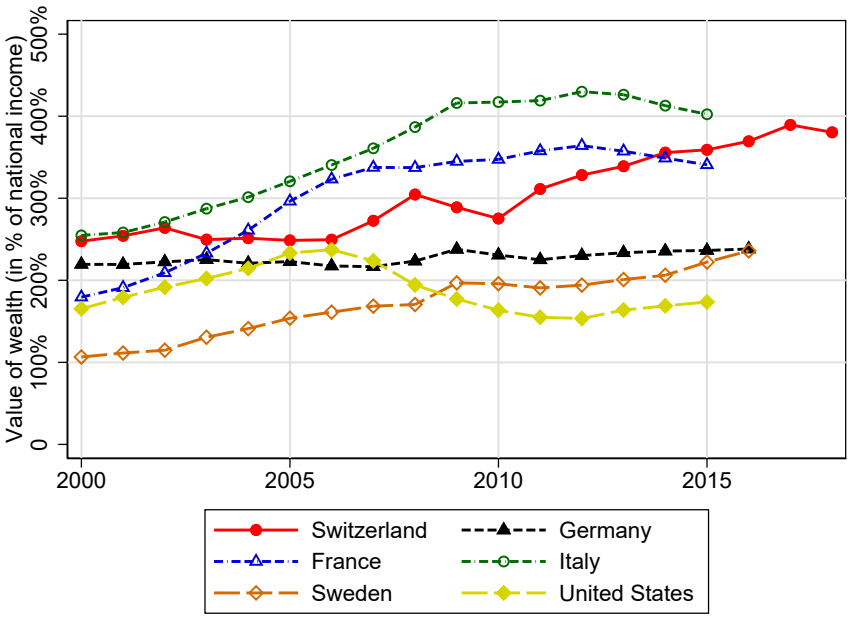
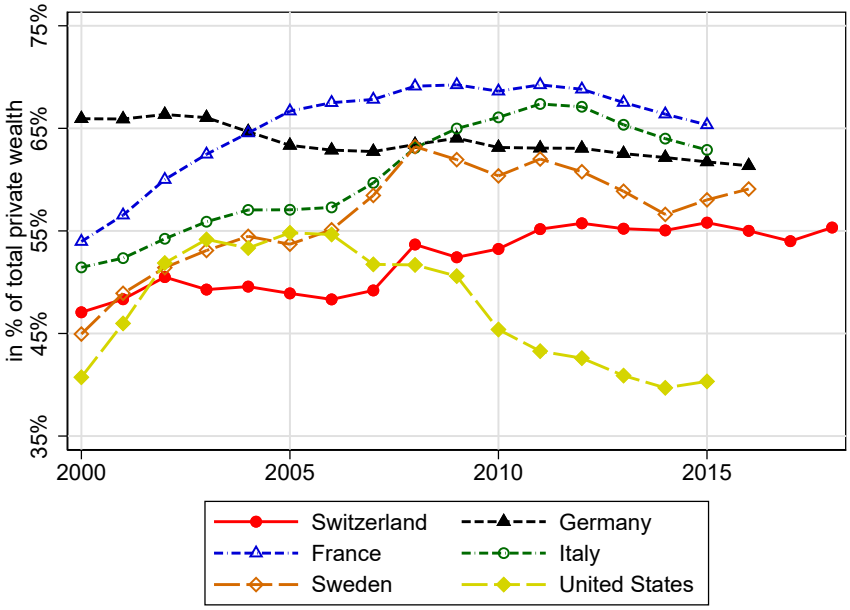


Figure B5: Private Wealth-Income Ratios in International Comparison, 1990–2018

Note: This figure shows the evolution of the private wealth-income ratio β_{pt} for several countries from 1990 to 2018. β_{pt} is derived by dividing total net household wealth—i.e., the sum of private non-financial assets (consisting only of housing wealth) and financial assets minus financial liabilities—by national income, Y_t. The data sources for Switzerland are described in detail in Appendix A.1. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.



(a) Housing Wealth-Income Ratio



(b) Housing Wealth as Share of Total Net Private Wealth

Figure B6: Housing Wealth H_{pt} in International Comparison, 2000-2018

Note: Panel a) displays the evolution of the housing wealth H_{pt} measured in national income Y_t for the countries indicated from 2000 to 2018. Where the private housing wealth-income ratio is derived by dividing total gross housing assets of private households by national income. Panel b) shows the development of housing wealth H_{pt} as a share of total private wealth W_{pt} for the same period and countries. The data sources for Switzerland are described in detail in A.1. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

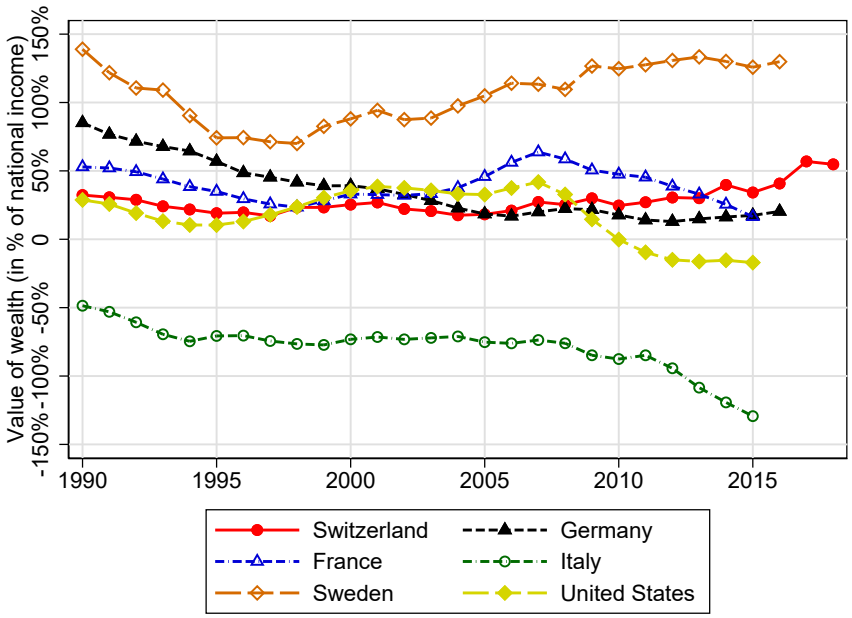
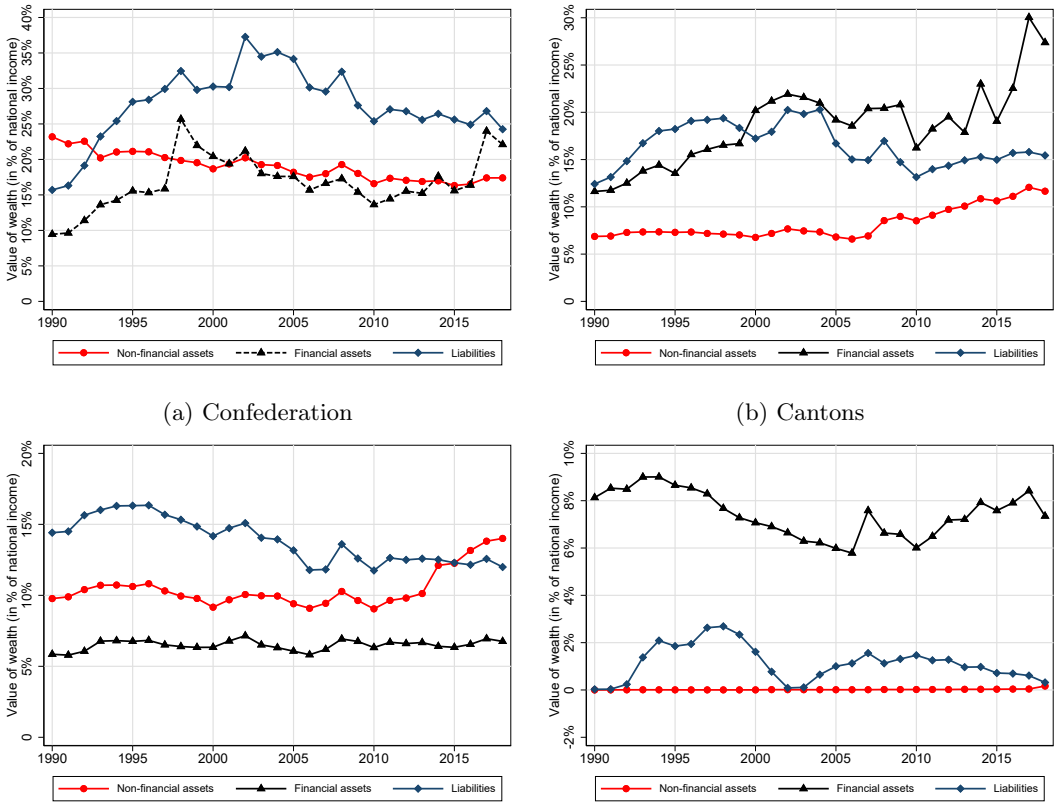


Figure B7: Public Wealth-Income Ratios, 1990–2018

Note: This figure displays the evolution of the public wealth-income ratio β_{gt} for the countries indicated from 1990 to 2018. Where β_{gt} is derived by dividing the sum of public non-financial assets K_{gt}, public financial assets F_{gt} minus public financial liabilities L_{gt} by national income Y_t. The data sources for Switzerland are described in detail in the A.2. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.



(a) Confederation

(b) Cantons

(c) Municipalities

(d) Social Security Funds

Figure B8: Decomposition of Public Wealth in Switzerland by Government-levels, 1990–2018

Note: This figure shows the development of three main components of public assets W_{gt}—Public non-financial assets K_{gt}, public financial assets F_{gt} and public financial liabilities L_{gt}—for the period 1990–2018 measured by national income Y_t separately for each government level. In addition to the three government levels of Switzerland—the federal level, the cantonal level (state level) and the municipality level—we display the evolution of the state-owned social security funds. Note that public financial liabilities L_{gt} are actually negative. To obtain net public wealth W_{gt} one has to subtract L_{gt} from the sum of K_{gt} and F_{gt}. The data sources are described in detail in Appendix A.2.

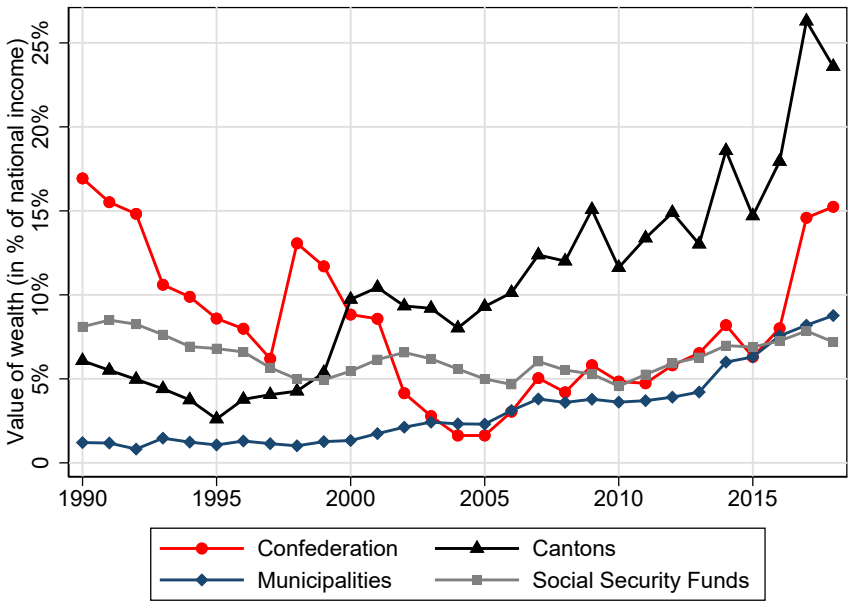


Figure B9: Public Wealth-Income Ratios in Switzerland by Government-level, 1990–2018

Note: This figure shows the evolution of net public wealth by the different government-levels of Switzerland expressed in terms of national income Y_t from 1990 to 2018. The data sources are described in detail in Appendix A.2.

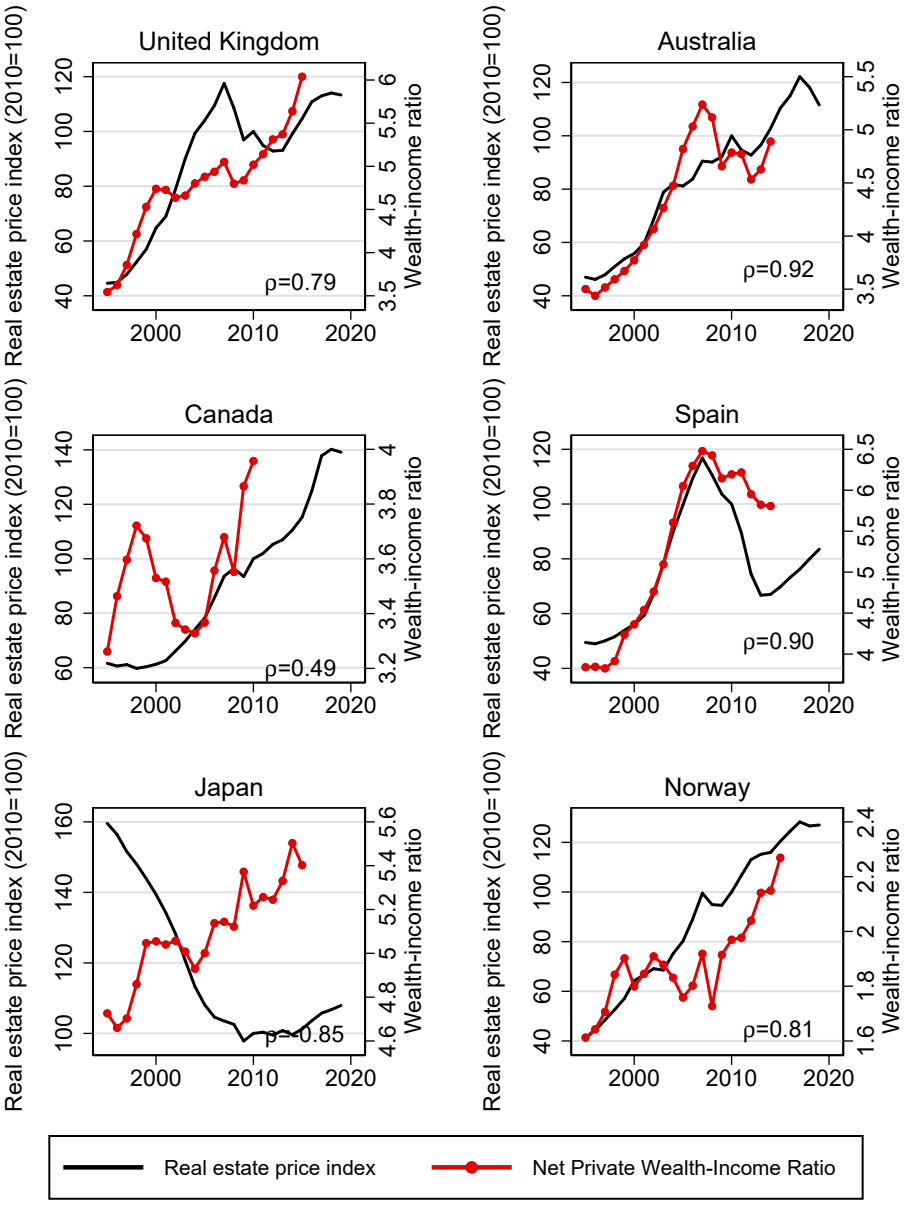


Figure B10: Wealth-Income Ratios and Real Estate Price Indices, 1995–2017

Note: This figure shows private wealth-income ratios in the U.K., Australia, Canada, Spain, Japan and Norway along with real house price indices of each of those countries. The price indices were obtained online from the OECD in September 2020. The data for the real house price indices are described in Appendix A.10. All international private wealth-income ratios data is available for download at https://wid.world.

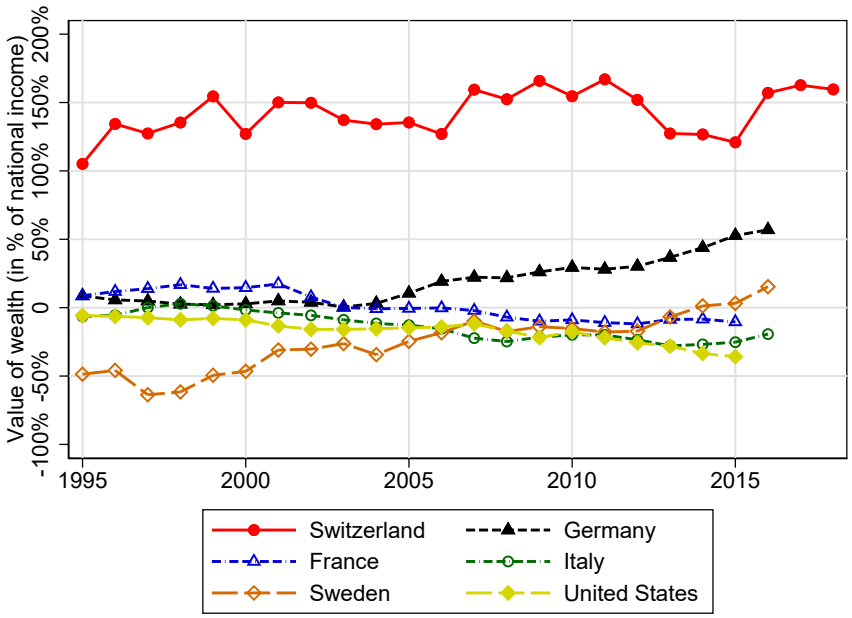


Figure B11: Evolution of Net Foreign Wealth, 1995–2018

Note: This figure displays the evolution of net foreign wealth NFA_{nt} expressed in terms of national income Y_t for the countries indicated from 1995 to 2018. The data sources for Switzerland are described in detail in the A.3. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

Remarks on the International Non-Financial Assets (K_{pt}) Data

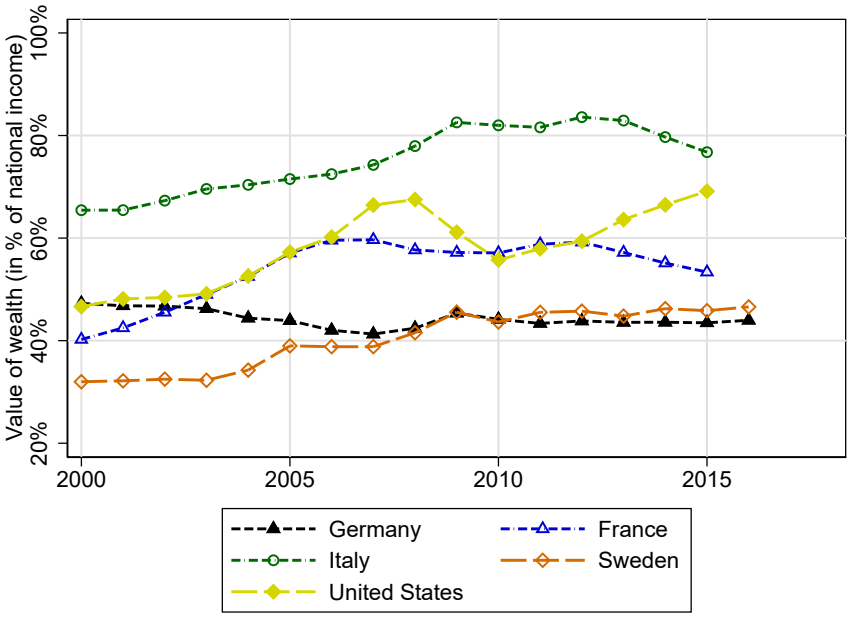


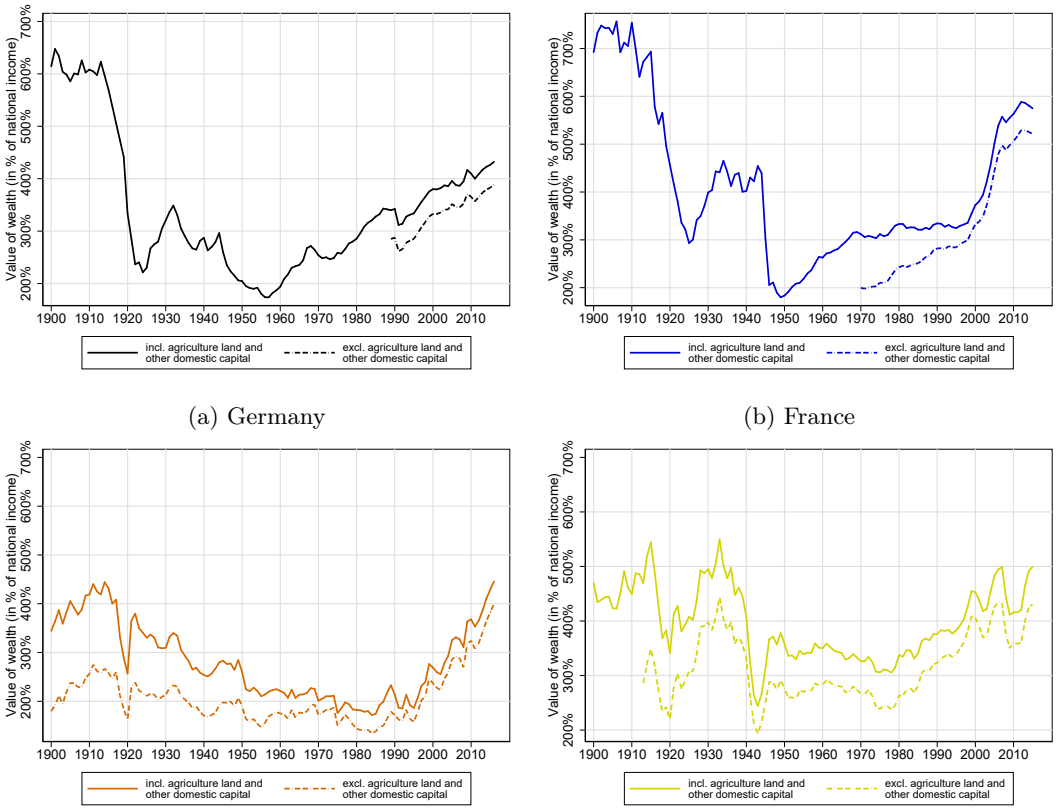
Figure B12: Agriculture Land & other Domestic Capital, 2000–2016

Note: This figure displays the evolution of the sum of agricultural land A_{pt} and other domestic capital D_{pt} in terms of net national income Y_t for the countries indicated from 2000 to 2016. We subtract this ratio from β_{pt} and β_{nt} in Section 6 in order to compare the evolution of these countries with Switzerland, where no data for A_{pt} and D_{pt} exist. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

As described in the data section 4, there exist no estimates on the value of agricultural land A_{pt} and other domestic capital D_{pt} for Switzerland. Therefore, private non-financial assets K_{pt} consist only of housing wealth H_{pt}, such that $A_{pt} = D_{pt} = 0$. Since we want to compare Switzerland's total net private wealth W_{pt} with those of other countries in which private non-financial assets K_{pt} also include A_{pt} and D_{pt}, it seems plausible to deduct A_{pt} and D_{pt} from total private net wealth W_{pt} for the reference countries. Figure B12 shows the value of $A_{pt} + D_{pt}$ in terms of national income for the reference countries. Note that if we subtract $A_{pt} + D_{pt}$ from W_{pt} their net national wealth also decreases. This ensures that we actually compare like with like. We thus deduct A_{pt} and D_{pt} from net wealth W_{pt} of the benchmark countries for the period in which we are able to observe net private wealth for Switzerland at market value (Section 6).

In Section 5 we do not subtract $A_{pt} + D_{pt}$ from W_{pt}. This may seem odd at first glance due to the above explanations. The reason for this is that in Chapter

5, where we study the historical evolution of private wealth for Switzerland, we can no longer observe W_{pt} directly. Instead, we estimate net private wealth on the basis of growth rates from a combination of tax and pension wealth data. Reasonable to assume is that over the course of the 20th century agricultural land in particular has given way to other investment opportunities; this can be inferred at least from the observation from the reference countries (see Figure B13). This in turn means that, based on our estimation method (backward interpolation), we obtain an estimate of private net wealth at the beginning of the twentieth century, which includes, at least in part, also the value of agriculture land. Therefore, if we were to deduct $A_{pt} + D_{pt}$ from W_{pt} for the other countries over the entire period, Switzerland would look relatively wealthier in comparison in the first half of the 20th century. Moreover, the values for A_{pt} and D_{pt} are only available for Sweden and the United States over an extended period (see Figure B13).



(a) Germany

(b) France

(c) Sweden

(d) United States

Figure B13: Private Wealth-Income Ratios including and excluding A_{pt} and D_{pt}, 1900–2016

Note: This figure displays the evolution of the private wealth-income ratio β_{pt} for the countries indicated from 1900 to 2016. Where the solid line shows the evolution β_{pt} including the value of A_{pt} and D_{pt}. The dotted line, on the other hand, shows the development of β_{pt} without A_{pt} and D_{pt}. In particular, the graph for the United States and Sweden show that the importance of agriculture land was greater at the beginning of the century. The series for Germany, France and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

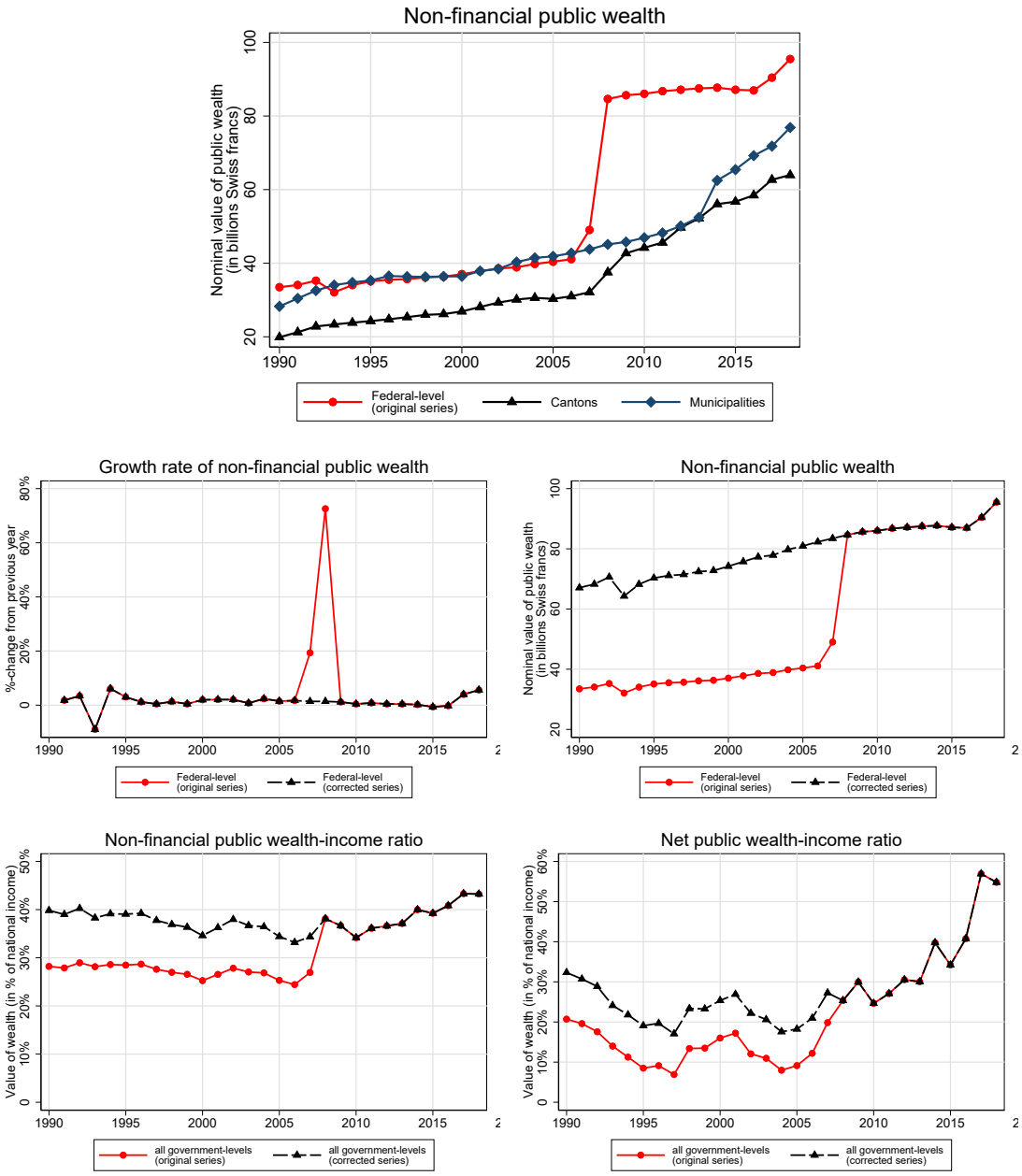
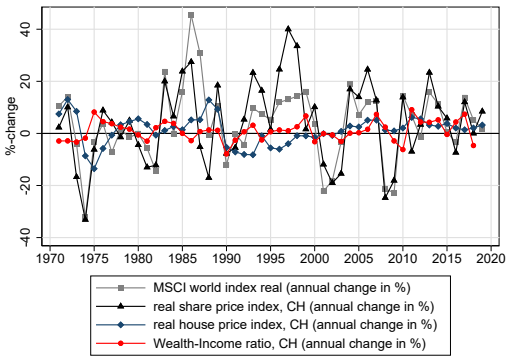
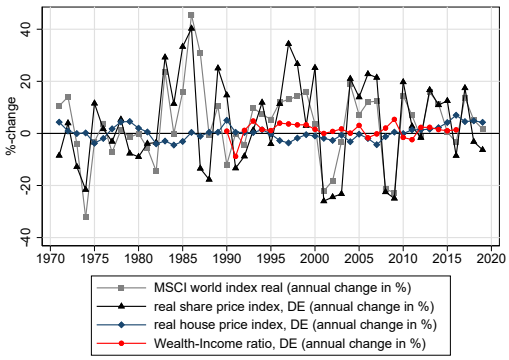


Figure B14: Correction of the non-financial public wealth series at the federal-level, 1990–2018

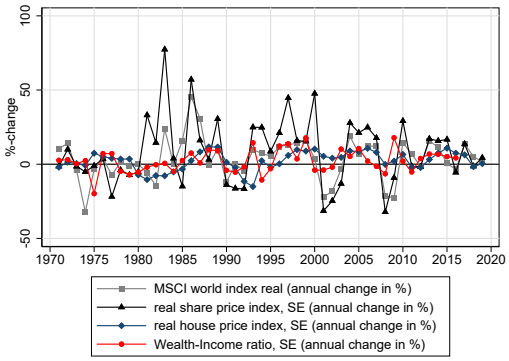
Note: Public non-financial assets K_{gt} usually grew at very modest rates except in 2007 (+19.3%) and 2008 (+72.6%). For these two years we corrected the series by applying the average growth rate of +1.4%. This leads to a more stable and plausible evolution of the public wealth income ratio.



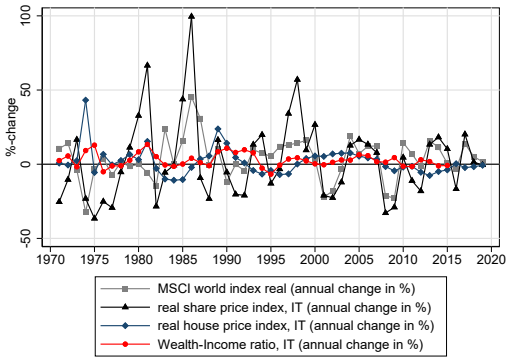
(a) Switzerland



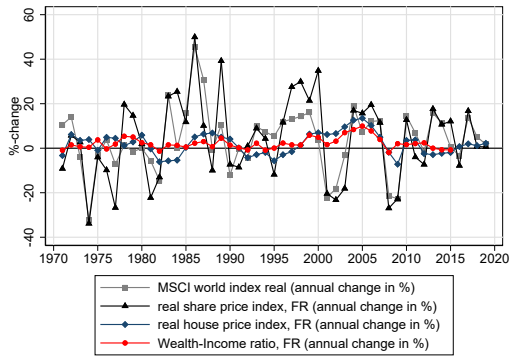
(b) Germany



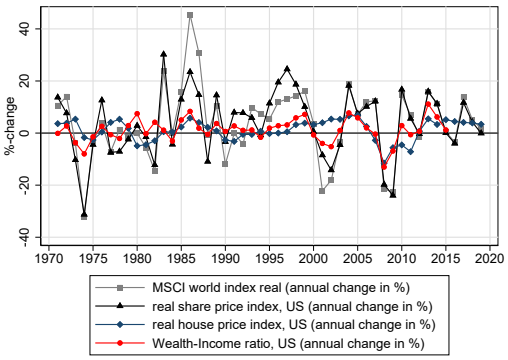
(c) Sweden



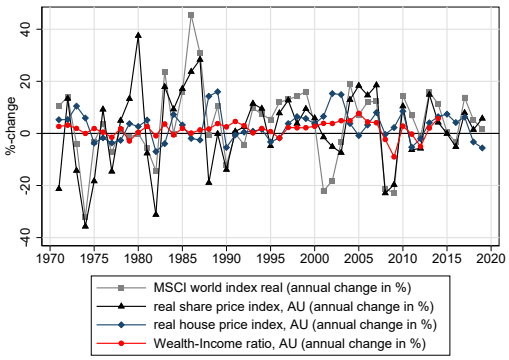
(d) Italy



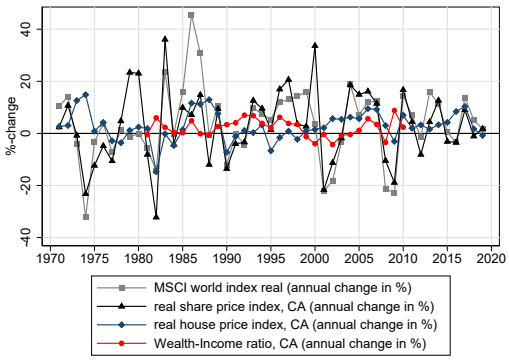
(e) France



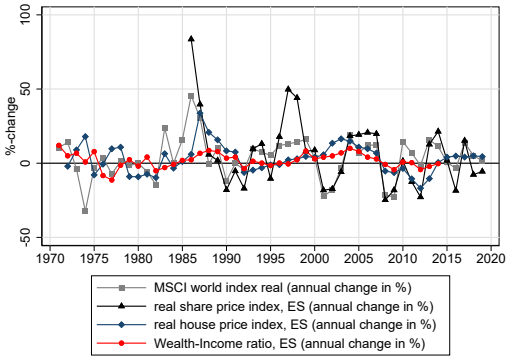
(f) United States



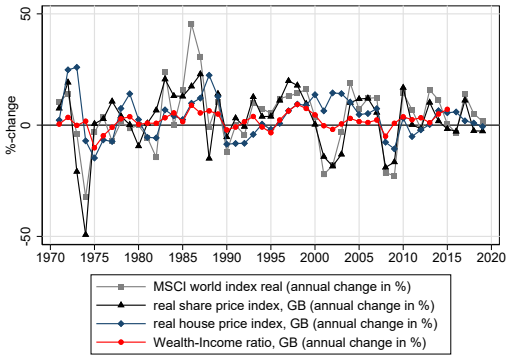
(g) Australia



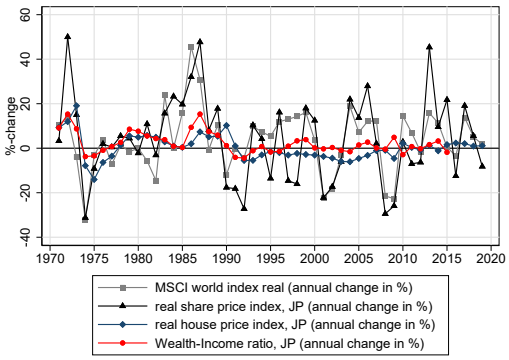
(h) Canada



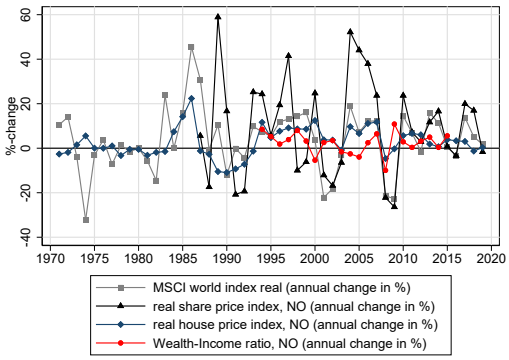
(i) Spain



(j) United Kingdom



(k) Japan



(l) Norway

Figure B15: Annual Changes in β_{pt}, Real House Prices and Real Share Prices

Note: This figure shows the data used for the regressions of wealth-income ratios on real share prices and real housing prices in Section 7.3. The price indices were obtained online from the OECD in September 2020. For the real house price indices, the data are described in Appendix A.10 and for the real share price indices in Appendix A.11. All international private wealth-income ratios data is available for download at https://wid.world.

A Safe Harbor: Wealth-Income Ratios in Switzerland Over the 20th Century and the Role of Housing Prices*

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Isabel Z. Martínez‡

October 18, 2021

Abstract

We estimate the ratio of private wealth to national income, β_{pt}, for Switzerland over the period 1900–2018. Our results indicate that the development of β_{pt} in Switzerland did not follow a U-shaped pattern as in most European countries, but that the evolution was extraordinarily stable, with β_{pt} oscillating around 500% over most of the 20th century. However, the wealth-income ratio has been on the rise since the turn of the century to reach 721% in 2017—a level unprecedented in the past. This considerable increase is mainly driven by large capital gains in housing wealth since 2010. We present new cross-country evidence that capital gains in housing wealth have become an important driver of rising wealth-income ratios in a series of developed economies.

JEL-Classification: N34, D31, D33, E01
Keywords: wealth-income ratio; income distribution; economic growth; housing prices

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1 Introduction

How important wealth is relative to income in an economy, and how and why their relationship changes over time are fundamental economic questions. Where data is available, recent decades have shown that wealth concentration is on the rise. If at the same time total wealth is gaining importance relative to income, wealth inequality (as well as inherited wealth) is likely to play a bigger role for the overall inequality of economic resources. In their seminal contribution, Piketty and Zucman (2014) find that over the 20th century, wealth-income ratios have followed a U-shaped pattern in many industrialized economies, returning back to their high pre-World War I levels. This indeed suggest that wealth is becoming more important relative to income than it was in the post-war period, characterized by high growth and low inequality.

In this paper, we put together new historical wealth and income series to estimate wealth-income ratios for Switzerland over the 20th century, a case which is of great interest. In contrast to most other countries studied in the literature, Switzerland was only a bystander in the military conflicts that shaped the history and economic development of the Western world in the 20th century. As a result, Switzerland, unlike other nations, did not substantially increase tax progressivity either during or after World War I (Dell et al., 2007). Moreover, while most other industrialized countries pursued anti-capital policies after World War I, as Piketty and Zucman (2014) put it, Switzerland had significantly less tight financial market regulations than its neighbors. Particularly, Switzerland allowed imports as well as exports of capital—which most European countries strongly limited in the post-war period.[1] Hence, Switzerland is a particularly intriguing case study to investigate how long-run wealth accumulation unfolds in the absence of more progressive taxation and anti-capitalist policies. Despite being a small country, Switzerland is a major industrialized economy. The large and prominent financial sector is well known for its long history of banking secrecy and its important role in the tax sheltering of large fortunes (Zucman, 2013). This is compounded by the very low taxes by international standards, which have attracted a large number of very wealthy taxpayers (Baselgia and Martínez, 2021). Taken together, these factors are likely to have had an impact on the aggregate wealth dynamics in the country.

We make three major contributions in this paper. First, we combine state-of-the-art national accounts data with various historical sources to obtain consistent long-run time series of aggregate private wealth and national income at market values, dating back as

[1] The open capital market was an important prerequisite for the development of Switzerland's strong, internationally competitive financial sector over the 20th century (Müller, 2012).

far as 1900. This new long-run series allow us to put recent developments in aggregate wealth into historical perspective. Second, for the post-1990 period, we decompose total national wealth into different components. In particular, we provide a detailed decomposition of national wealth accumulation into a savings and a real capital gains component by asset class, which provides useful insights into recent macroeconomic dynamics and highlights the importance of real estate prices in aggregated wealth accumulation. Third, we investigate the role of house price dynamics in the recent rise in wealth-to-income ratios not only in Switzerland but in a number of other developed economies.

Piketty and Zucman (2014) stress that wealth stock data was largely missing until recently, as "national accounts were mostly about flows, not stocks" (p.1255). Switzerland is no exception, and, on the contrary, to this day suffers from substantial data scarcity compared to most other Western economies. We draw on new private wealth estimates provided by the Swiss National Bank and Schmid (2013) as well as on total wealth reported in tax statistics since the beginning of the 20th century (some of which were already used by Dell et al., 2007). Using these new series, our estimates of total private wealth are significantly higher than documented by Brülhart et al. (2018). However, the bulk of this difference can be explained by the fact that Brülhart et al. (2018), who study inheritances, do not look at total aggregate private wealth, but only at the inheritable fraction. In light of our estimate of total private wealth, we revise the existing series of the Swiss wealth-income ratio and the corresponding insights.

Our results suggest that the evolution of the wealth-income ratio in Switzerland did not follow a U-shaped pattern like previously assumed, but rather that the evolution was extraordinarily stable over the 20th century. After the First World War, the wealth-income ratio in Switzerland oscillated around 500% until the eve of the Great Recession. Since 2010, we are witnessing an unbroken, steep upward trend. By 2017, the wealth-income ratio had reached more than 700% for the fist time since 1900 (the beginning of our records), when wealth was worth six times national income of the time.

Starting in the 1990s, the data allow us to study national wealth and its different components, namely public and private wealth, as well as different subcomponents thereof separately. While public wealth is only a small fraction of total national wealth, we show that since 2005 it has been increasing as well. This finding stands in contrast to the experience of other countries: in terms of national income, public wealth almost tripled from 20% to just below 60%. Around 30% of this increase can be attributed to capital gains, the remaining 70% are the result of increased public saving. The latter is likely the result of "debt breaks" introduced at the federal and sub-federal state levels (the Swiss

cantons).

Decomposing private wealth into private pension wealth, net financial wealth, and housing wealth allows us to shed light on the role of housing wealth in Switzerland. Prior research by Martínez-Toledano (2020) as well as Piketty and Zucman (2014) has pointed out the importance of housing price bubbles for short- and medium-run fluctuations in wealth-income ratios. We find that the steep increase in the Swiss private wealth-income ratio observed since 2010 can by and large be attributed to rising housing prices.

To test the hypothesis that capital gains in housing or financial asset price increases have been driving wealth-income ratios in recent decades, we turn to a multivariate regression approach. In a panel regression framework including 12 countries and spanning over 45 years, we find that indeed the correlation between real housing price increases and private wealth-income ratios has become stronger in recent decades. Over the period from 1990 to 2018, a one percent annual increase in housing prices is associated with a 0.31% increase in private wealth-income ratios. This overall result masks some heterogeneity between countries. The house price effect seems to be present in France, Italy, Spain, Norway, the United Kingdom, and the U.S., as well as in Japan and Australia (when including the 1970-1990 period), but we find no effect for Germany, Sweden, or Canada. In Switzerland, the effect is weak and only present in the post-1990 period. Overall, the results support the hypothesis by Piketty and Zucman (2014) that asset price bubbles drive wealth-income ratios in the short- and medium-run. Steeply rising private wealth-income ratios can therefore be considered a warning signal and help designing appropriate financial and monetary policies. As documented in Jordà et al. (2015), with the rise in lending, notably mortgage lending, after World War II, asset price and housing bubbles became both more frequent and larger in magnitude in the second half of the 20th century. In turn this also implies that following the Harrod-Domar-Solow formula and abstracting from capital gains when determining the wealth-income ratio as $\beta = s/g$ may be misleading in times of weaker financial regulations and potentially larger asset price bubbles.

The remainder of the paper is organized as follows. Section 2 gives an overview of the literature. In Section 3 we introduce the key theoretical concepts which we aim to measure in the empirical part. Section 4 describes the data. We present our results in three steps. Section 5 presents our historical estimates of the evolution of private wealth-income ratios in Switzerland over the course of the 20th century. For the recent period 1990–2018, we decompose the national wealth-income ratio into different subcateogries. These results are shown in Section 6. To identify potential drivers of the recent increase

of the wealth-income ratio, in Section 7 we investigate the role of income growth, savings, and capital gains by asset class. Section 8 concludes.

2 Related Literature

Wealth inequality and its evolution in the long run has recently gained large attention by scholars. Due to limited data availability, studies have focused on computing top wealth shares over the 20th century (see for example Dell et al.; Föllmi and Martínez, 2007; 2017 for Switzerland; Kopczuk and Saez; Saez and Zucman, 2004; 2016 for the U.S.; Garbinti et al., 2020 for France; Albers et al., 2020 for Germany). Given the much higher concentration of wealth compared to income, focusing on the top of the distribution is justified when measuring wealth inequality.

The literature on national wealth and how it compares to national income in the long run is still very young. Its emergence is closely tied to data availability: it was only in 1993 when the System of National Accounts (SNA) first included guidelines to take stock of national wealth in a systematic and internationally comparable manner. Not all countries have immediately adopted the guidelines and the scope of these wealth estimates varies considerably across countries: while some provide very complete and long series of national balance sheets, others only report partial results. This is in fact the case for Switzerland, as we shall see. In their seminal contribution, Piketty and Zucman (2014) were the first to make use of these new balance sheets as well as historical data from eight major developed economies[2] to study the evolution of the ratio of total aggregate wealth to national income. Waldenström (2017) compiled series going as far back as 1810 for Sweden, Artola Blanco et al. (2020) present series for Spain.

To put our results into perspective, we compare them to the evolution of the wealth-income ratios in these developed economies (and Norway, for which wealth-income ratios are available from the World Inequality Database).[3] In the meantime, all the countries covered in Piketty and Zucman's (2014) original study have adapted their national accounts to the revised System of National Accounts 2008 (European Commission et al., 2009, SNA-2008). Bauluz (2019) updates Piketty and Zucman's (2014) original series, and we use these updated series when we compare wealth-income ratios across countries. Alvaredo et al. (2017) provide guidelines on the use of national balance sheets to compute

[2]Their study includes Australia, Canada, France, Germany, Italy, Japan, UK, and the U.S., Bauluz (2019) revises and updates their series.

[3]We focus on wealth-income ratios in Switzerland and other developed economies. Other authors have contributed series on emerging economies and young democracies, such as Piketty et al., 2019 for China, Novokmet, 2018 for the Czech Republic, Charalampidis, 2018 for Greece, Kumar, 2019 for India, Novokmet et al., 2018 for Russia, or Orthofer, 2015 for South Africa.

wealth-income ratios as well as distributional national accounts, (another strand of the literature that has emerged in response to improved national accounts data). To ensure comparability, we follow these guidelines as closely as possible.

It is important to note, that we are not the very first to provide estimates of the aggregate wealth-income ratio in Switzerland. Brülhart et al. (2018) study inheritance flows in Switzerland for the period 1911–2011. Along with estimates of the ratio of bequests to national income (in analogy to Piketty, 2011, for France), the authors present estimates of private net wealth as a fraction of net national income. Their estimates show a strong increase in the private wealth-income ratio since the 1970s, similar to the one observed in other European countries. Our own analysis differs significantly in several important aspects from theirs. First, we use market-value estimates of private wealth, rather than taxable wealth. Second, we combine new data sources to estimate aggregate private wealth at market value prior to 2000. This allows us to overcome the inherent undervaluation of certain assets, especially real estate, in taxable wealth. Third and in line with the guidelines established by Alvaredo et al. (2017), we include the total of private pension wealth. Since they are interested in measuring inheritance flows, Brülhart et al. (2018) exclude the non-bequeathable part of private pension wealth. Due to these differences in the measurement of aggregate net private wealth, we obtain a much more stable evolution of the private wealth-income ratio over the past century. For recent decades (1990–2018) we further decompose national wealth into public, private, and net foreign wealth, and study the evolution of private pension, housing, and financial wealth (see Section 6).

Our paper further relates to a growing literature focusing on the role of increasing house prices for wealth inequality and the observed rise in total private wealth. Already in their seminal paper, Piketty and Zucman (2014) have pointed out the importance of capital gains in the housing sector. Stressing the scarcity of land and housing, Rognlie (2015) and Knoll et al. (2017) also attributes major importance to the upward trend in house prices observed in many economies. Artola Blanco et al. (2020) provide a thorough review of the literature that studies house price phenomena. They find that the Spanish housing boom of the early 2000s led to an unprecedented rise in Spain's wealth-income ratio. To our knowledge, however, our paper is the first addressing the role of housing prices for wealth income ratios directly measuring their relationship in a multi-country panel regression framework.

3 Definition of Wealth and Income Components

Building on the work of Piketty and Zucman (2014), Alvaredo et al. (2017) have developed a unified framework (the "DINA Guidelines") to compute national wealth and income series based on the internationally used 2008 System of National Accounts (SNA-2008) (European Commission et al., 2009). To ensure comparability, we follow this framework as close as possible, depending on the availability of the corresponding data for Switzerland.

Private wealth is denoted by W_{pt} and consists of net wealth (assets minus liabilities) of private households.[4] It can be decomposed as follows:

$$W_{pt} = K_{pt} + F_{pt} - L_{pt} \ , \tag{1}$$

where K_{pt} are non-financial assets, F_{pt} are financial assets, and L_{pt} are financial liabilities of private households. Financial assets include bank accounts, stocks and bonds, as well as life insurances and funded pension wealth. In contrast, pay-as-you-go social security pension wealth (called "Old Age and Survivors Insurance" (OASI)) and any other claims on future government expenditures are excluded, as well as durable goods. The exclusion of claims on future government expenditures is justified by the fact that these household assets count as liabilities for the government sector and would therefore cancel out when looking at national wealth—the more meaningful concept (see Piketty and Zucman, 2014, for a detailed discussion).

In the literature, non-financial assets K_{pt} are usually decomposed further into:

$$K_{pt} = H_{pt} + A_{pt} + D_{pt} \tag{2}$$

Housing assets H_{pt} are defined as the sum of the market value of dwellings and land underlying dwellings. A_{pt} denotes the value of agricultural land, and D_{pt} stands for other domestic capital, i.e., all non-financial assets except housing and agricultural land, such as unincorporated business assets.

Public (or government) wealth, W_{gt}, is defined as net wealth of all public administrations and government agencies. Analogous to Equation (1), public wealth can be decomposed into public non-financial and financial assets, K_{gt} and F_{gt}, respectively, and financial liabilities of the public sector, L_{gt}.

[4] Nonprofit institutions serving households (NPISHs) are included in the household sector, since the frontier between individuals and private foundations is not always clear. In the Swiss national account system, NPISHs and private households are reported together as one single category. Net wealth of NPISHs is usually small (e.g., in France about 1% of total net private wealth in 2010 (Piketty and Zucman, 2014)).

The market-value of national wealth W_{nt} is the sum of private and public wealth. National wealth can be split up into market-value domestic capital, K_{nt}, and net foreign wealth, NFA_{nt}:

$$W_{nt} = W_{pt} + W_{gt} = K_{nt} + NFA_{nt} \tag{3}$$

We use income net of depreciation, i.e., gross national income minus consumption of fixed capital, as recommended by Alvaredo et al. (2017). In line with the production approach, net national income, Y_t, is defined as the sum of net domestic output Y_{dt} (GDP minus consumption of fixed capital) plus net foreign income, $r_t NFA_t$:[5]

$$Y_t = Y_{dt} + r_t NFA_t \tag{4}$$

The private wealth-income ratio, β_{pt}, is defined as:

$$\beta_{pt} = \frac{W_{pt}}{Y_t} \tag{5}$$

Analogously, β_{nt} denotes the national wealth-income ratio:

$$\beta_{nt} = \frac{W_{nt}}{Y_t} \tag{6}$$

In a closed economy, β_{nt} equals the domestic wealth-output ratio $\beta_{kt} = \frac{K_t}{Y_{dt}}$. Moreover, if public wealth is zero, it holds that: $\beta_{pt} = \beta_{nt} = \beta_{kt}$.

Next, we turn to the accumulation of wealth. Between time t and $t+1$ the accumulation of national wealth W_{nt} can be split into a volume effect and a relative price effect:

$$W_{nt+1} = W_{nt} + S_t + KG_t \ , \tag{7}$$

where S_t is the net-of-depreciation national saving flow (volume effect), and KG_t are capital gains or losses (relative price effect). In the long run, where relative price effects balance out, at least theoretically, such that $KG_t = 0$, the steady-state national wealth income ratio is given by the Harrod-Domar-Solow formula:

$$\beta_{nt} \longrightarrow \beta_n = \frac{s}{g} \tag{8}$$

where s is a fixed long-run saving rate, and g is a fixed growth rate of national income. That β_{nt} converges to β_n in the steady state relies on the assumption that there is no change in the relative price of assets and consumption goods over time.[6] Although this

[5] In the results section, we use the term national income which always refers to net national income.

[6] For a critical discussion concerning the use of the Harrod-Domar-Solow formula see Krusell and Smith Jr. (2015).

may be a plausible assumption in the long run, in the short and medium run, relative price effects, i.e., capital gains, turn out to be crucial.[7] We thus decompose the evolution of national wealth-income ratios into two multiplicative components—the volume and the relative price effect—as follows:

$$\beta_{nt+1} = \frac{(1+g^w_{st})(1+q_t)}{1+g_t}\beta_{nt} \ , \tag{9}$$

where $1+g^w_{st}$ is the savings-induced wealth growth rate, $1+q_t$ the capital gains induced wealth growth rate and $1+g_t$ the growth rate of national income. The savings-induced wealth growth rate, $1+g^w_{st}$, equals $1+\frac{s_t}{\beta_{nt}}$. The rate of capital gain or loss can then be estimated as a residual.

4 Data

We combine various data sources for our empirical analysis of the wealth-income ratio. To ensure comparability with other countries, we follow the approach and methods developed by Piketty and Zucman (2014) and established in Alvaredo et al. (2017) as closely as possible. Switzerland's national accounts are based on the European System of National Accounts 2010 (European Union, 2013, ESA-2010), which is compatible with the SNA-2008, but Switzerland's national accounts are considerably less detailed than those of larger European countries. We pay particular attention to the construction of a consistent, long-run estimate of total private wealth, starting in 1900. Other wealth aggregates, such as national wealth or public wealth, are only available from official sources for more recent decades, starting in 1990. For a detailed description of the data and list of all sources, we refer to Appendix A.

Private Wealth (W_{pt}). To compute long series of private wealth, we have to distinguish between three sub-periods, each of which is determined by differing limitations to data availability. To obtain a long run series of total private wealth at market value, we combine the estimates from the three sub-periods.

For the period 2000–2018, the Swiss National Bank (SNB) provides reliable data on aggregate private net wealth W_{pt} at market values as part of the financial accounts of Switzerland, which can be broken down into financial assets F_{pt}, financial liabilities L_{pt} and non-financial assets K_{pt}. The stock gross financial wealth, F_{pt}, consist of currency and transferable deposits, debt securities (short-term, long-term and structured products), shares and other equity, units in collective investment schemes as well as insurance

[7] This rationale can be readily supported theoretically with a one-good and a two-good model of wealth accumulation. For a detailed discussion, see sections III.B and III.C in Piketty and Zucman (2014).

and pension schemes. L_{pt} is composed of loans, mortgages, and other outstanding liabilities. For non-financial assets, K_{pt}, the SNB only reports estimates on housing wealth, H_{pt}. To the best of our knowledge no estimates on the value of agricultural land and A_{pt} and other domestic capital D_{pt} exist for Switzerland. Therefore, in our analysis private non-financial assets consist only of housing wealth, such that ($K_{pt} = H_{pt}$), which implies that $A_{pt} = D_{pt} = 0$.[8] Note that by housing wealth H_{pt} we refer to the market value of real estate held by private households.

No official statistics on net private wealth exist for Switzerland prior to 2000. For the period 1981–1999 we rely on the estimates of private net wealth at market value by Schmid (2013). These estimates are based on internal SNB data and were the precursors of the official statistics published later by the SNB. As Figure B1 shows, these series are virtually identical to the official statistics published by the SNB in the overlapping period 2000–2010.[9]

Prior to 1981, data on market value W_{pt} is nonexistent and we have to take an alternative approach. Following Föllmi and Martínez (2017), we combine total wealth estimates based on tax data published in Dell et al. (2007), with historical estimates of total pension fund assets published in Leimgruber (2008). Combining wealth tax and pension data is important, because pension wealth is not taxed and is therefore missing in tax statistics. Next, we calculate the annual growth rate of this combined series and apply the growth rate to the earliest market value observation of private wealth from Schmid (2013) in 1981. This approach allows us to extrapolate the market value wealth backwards using observed changes in taxable and pension wealth (see Appendix A.1 for details). Under the assumption that the latter correspond well to changes in total private wealth, this approach should result in a consistent estimate of private wealth at market value. Figure B4 shows the annual percentage change in private wealth at market value and taxable plus private pension wealth, respectively, for the period 2003–2016, where annual data for both series exist. Growth rates track each other extremely well—including the years around the outbreak of the Great Recession in 2008, which are characterized by large changes from year to year. We are therefore confident that our method is valid to estimate total private wealth at market value over time.

Our approach to measure total private wealth pre-1981 obviously deviates from the methodology proposed by Piketty and Zucman (2014) and established in Alvaredo et al.

[8] All three components (H_{pt}, A_{pt}, D_{pt}) of K_{pt} are available on WID.world for the countries we compare our results to. In Appendix B.2 we describe how we adjusted the international data in order to compare them with the results for Switzerland.

[9] At the time, the author had access to internal data at SNB. We are very grateful to him for sharing this data with us.

(2017), which is based strictly on national accounts data. Note, however, that we refrain from the perpetual inventory method, which cumulates past investment flows. As discussed in (Piketty and Zucman, 2014, p.1265), this method falls short of appropriately measuring the capital stock for several reasons. Our approach, in contrast, is based on changes in actual measures of total private wealth, which, however, do not capture the full capital stock in the economy at market value.

To our knowledge, there exist no other long-run time series on private wealth in Switzerland—apart from Brülhart et al. (2018) and our own estimates. This is because since the 1930s, national income rather than wealth has increasingly served as main indicator for (economic) well-being (Landolt, 2014). At the beginning of the 20th century, however, several attempts were made to record Switzerland's national wealth. Estimates for the early 1910s varied considerably between 30 and 40 billion Swiss francs (in nominal terms). Geering and Hotz (1914) estimated the value of Swiss national wealth around 1914[10] at 30 billion Swiss francs. Later valuations resulted in somewhat higher estimates, such as Landmann (1916), who estimated Swiss national wealth for the year 1913 at 34.6 billion Swiss francs and Fahrländer (1919), also for the year 1913, at 41.96 billion Swiss francs (all estimates in nominal terms). Some of these estimates also include certain assets that are excluded from our definition of wealth, in particular durable goods. For instance, the estimate of Landmann (1916) includes fire insured movable property worth 9.9 billion Swiss francs. Without these movable assets, national wealth would fall considerably to around 24.7 billion Swiss francs. This is very close to our own estimate of private wealth for 1913 of around 26 billion nominal Swiss francs. By comparison Brülhart et al. (2018) estimate private net wealth in 1911 at around 18 billion Swiss francs.

Public Wealth (W_{gt}). All analyzed data on public wealth W_{gt} for Switzerland between 1990 and 2018 can be taken from the "Government Finance Statistics Model" (GFS Model) of the Federal Finance Administration, which follows the International Monetary Fund (IMF) financial statistical standard that ensures international comparability. Note that no data on public wealth exists prior to 1990.

National Wealth (W_{nt}). Equation (3) shows that national wealth is the sum of W_{pt} and W_{gt}, therefore no additional data is required to obtain W_{nt}. Note that no data on national wealth exists prior to 1990, since no data on public wealth is available prior to 1990.

Net Foreign Wealth (NFA_{nt}). W_{nt} can further be split into domestic capital K_{nt}

[10] Geering and Hotz (1914) do not give a particular date for their estimate. The data used also come from different years. The authors state, however, that national wealth may be estimated at 30 billion "**today**".

and net foreign assets NFA_{nt}. For the period 2000–2018 net foreign wealth is provided by the SNB as part of the Swiss balance of payments. For the years 1995–1999 we obtain net foreign wealth from published reports of the SNB.

Net National Income (Y_t). As with private wealth, we have to rely on three different sources to obtain long run series of national income covering the entire 20th century as no uniform series exists for Switzerland. For the period 1995–2018, we use national income data as published by the Federal Statistical Office (FSO) in the Swiss National Accounts, which are fully compatible with the SNA-08 framework. Between 1929 and 1994, we use historical national income time series provided by the Historical Statistics of Switzerland (HSSO) database. Unfortunately, income concepts vary slightly between these sources. We therefore use growth rates to extrapolate income backwards from 1995 (see Appendix A.4 for details). For the years prior to 1929, finally, we have to fall back on growth rates of historical GDP estimates (rather than NNI) by Stohr (2016).

Additional Macroeconomic Data. Occasionally, we present results not as wealth-income ratios, but as aggregated real or as per capita real variables, for which we additionally use population (see Appendix A.5) and price data (see Appendix A.6). In order to split changes in total wealth into a savings and a capital gains/loss component (see Equations (7) and (9)), we use supplementary data on savings (see Appendix A.7). Detailed methodological explanations of this decomposition can be found in Appendix A.9. Where meaningful, we compare our results for Switzerland internationally. The international wealth data presented in our analysis can be directly obtained from the World Inequality Database (WID.world; see Appendix A.8). To analyze how stock and housing prices affected changes in the wealth-income ratio, we use real house price index data (see Appendix A.10) and stock market index data (see Appendix A.11), both obtained from the OECD.

5 Switzerland's Private Wealth-Income Ratio, 1900–2018

In this section we present our estimates of the evolution of Switzerland's private wealth-income ratio, β_{pt}, over the 20th century. In principle, we would prefer to study the development of the *national* wealth-income ratio, since this concept more adequately reflects the importance of total wealth in a country (Piketty and Zucman, 2014). As explained in the data description, however, no data on public wealth is available prior to 1990, and hence our long-run estimates are limited to private wealth.

As we will show in Section 6, at least since the 1990s, public wealth has played a minor

role in Switzerland, such that focusing on the evolution of private wealth seems justified. While we cannot rule out that public wealth was larger in the past, results in Piketty and Zucman (2014) show that in rich countries, net public wealth has always been small compared to private wealth. In all the rich countries they study, they find that the fall in government wealth was much smaller than the rise of private wealth observed in the second half of the 20th century.

In what follows, we first describe how we compute our estimates of private wealth-income ratios for Switzerland and why they differ significantly from the previous estimates by Brülhart et al. (2018) (Section 5.1). Next, we explain the extraordinary trajectory of β_{pt} in Switzerland over the 20th century and how it compares to other countries in Section 5.2.

5.1 Comparison with Prior Estimates

The solid red line in Figure 1 shows our estimates of Switzerland's private net wealth in terms of national income since 1900. The hollow dots indicate the years for which total wealth data is available (either in the form of tax statistics and pension statistics (1900–1981), private net wealth estimates at market value by Schmid (2013) (1981–1999), or aggregate wealth estimates published by the SNB (2000–2018)). Prior to 1981, where wealth data is not available on an annual basis, we linearly interpolate the total wealth series for the missing years in between. We obtain our measure of interest, β_{pt}, by dividing these annual wealth series by national income. This explains why our series fluctuates even in years where no aggregate wealth data exist.

For comparison, the dashed black line in Figure 1 shows private wealth-income ratios presented in Brülhart et al. (2018). Again, data points (black triangles) indicate the years for which they observe total aggregate wealth from tax statistics, while the dashed line depicts a linear interpolation. While both series show a steep increase in the private wealth-income ratio since the mid-1990, the estimates from Brülhart et al. (2018) indicate a lower overall level of β_{pt}, and they lead to a more pronounced U-shape in the long run trend.

Since both approaches use very similar national income series, the principal source of divergence is due to different estimates of total private wealth. Figure B1 in the Appendix shows the wealth estimate of Brülhart et al. (2018) for the period 1981-2018 along with the data on which our wealth estimates are based. Two main reasons explain the significant difference between the two estimates of the private wealth-income ratio.

First, we use data on private net wealth at market prices, while Brülhart et al. (2018)

estimate net private wealth on the basis of tax data. The authors emphasize that net private wealth estimates based on wealth tax statistics will be downward biased, because i) tax valuations of housing wealth are below market value, and ii) because compulsory private pension-fund wealth is exempt from taxes and hence not covered in tax data. Although they attempt to correct for the undervaluation of tax data, their estimate of total private wealth remains below official estimates published by the SNB. According to Brülhart et al. (2018), real estate is valued at approximately 70% of market value. To account for this undervaluation of real estate wealth, they add a 30% mark-up to all their tax-based wealth series. While prior to 1981 we have to rely on tax data to estimate total wealth, too, we use a different approach to Brülhart et al. (2018): rather than using the level of total wealth observed the tax data, we use changes in combined historical tax and pension wealth data to extrapolate backwards the level of total private wealth from 1981, the first year for which private wealth at market value is available (see Appendix A.1 for details).

The second and main reason lies in the focus of the two papers and how, therefore, tax-free pension wealth is taken into account. Both approaches complement the tax series with historical pension assets data found in Leimgruber (2008). However, since Brülhart et al. (2018) are interested in inheritances, they only consider the part of pension assets that is drawn as a lump sum on retirement and is therefore bequeathable. They assume that an estimated 70–80% of total pension wealth will be drawn as ordinary annuities while the rest of the pension wealth is drawn as lump-sum payouts. Hence, they only add 20–30% of total pension assets to their tax-based wealth series. This is certainly justified if one is interested in inheritable wealth, but the approach misses part of total private net wealth—the measure we are interested in. In this sense, the two wealth series can indeed be reconciled (Rais, 2021).[11] As undisbursed pension assets are an integral part of the assets of Swiss households built up through mandatory savings, however, they should be fully taken into account when measuring total private net wealth.

[11] Our time series corresponds to total private net wealth at market values as recommended in the international literature (Alvaredo et al., 2017), while Brülhart et al.'s (2018) series represents inheritable private wealth. Rais (2021) documents and carefully discusses other, though less significant, differences between the two series.

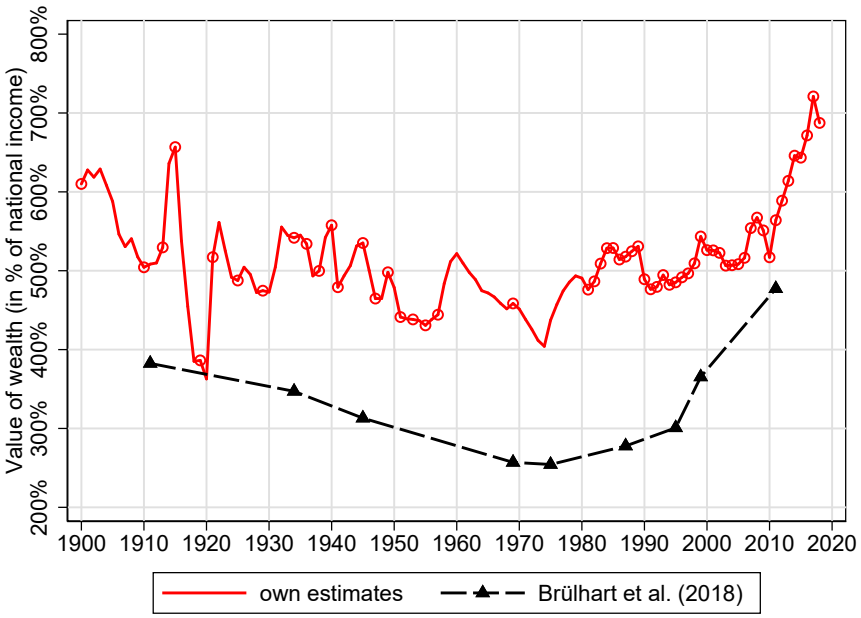


Figure 1: Different Private Wealth Estimates for Switzerland, 1900–2018

Note: This figure shows our estimate of the private wealth-income ratio, β_{pt}, for Switzerland in comparison with the estimates presented in Brülhart et al. (2018), which are based on federal wealth tax statistics. The the red hollow circles in the time series show observations for which we do have data on private wealth. For the years in between, we have interpolated our wealth series linearly. Thus, the total fluctuation between the marked years results exclusively from the change in national income. The data sources for our new historic private wealth estimates of Switzerland are described in Appendix A.1. The observations of Brülhart et al. (2018) are linearly interpolated between years where wealth is observed (black triangles).

5.2 Long-Run Evolution in International Comparison

In this section, we compare the evolution in Switzerland to that of all other countries for which long-run estimates exist, namely Germany, France, the United Kingdom, the United States (Piketty and Zucman, 2014), Sweden (Waldenström, 2017), and Spain (Artola Blanco et al., 2020). Figure 2 shows that our results in terms of the general level of β_{pt} are well in line with those of other countries.

At the onset of the 20th century, Switzerland's wealth-income ratio was at a relatively high level of roughly six times national income. This level was similar to that observed in other countries at that time (e.g., Spain and Germany), as shown in Figure 2).

The observed decline in β_{pt} in Switzerland between 1900 and 1910 was due to increases in real income: between 1900 and 1910, real per capita net national income grew by 21%, while real wealth per capita stagnated (see Appendix Figure B2). The very large swings between 1913 and 1922 were caused by the shock of the First World War (1914–1918). Switzerland experienced a steep rise in price levels and real income fell sharply during the

war. At the same time, total private wealth declined too, such that β_{pt} fell from 654% in 1915 to 383% in 1918. As a result of the subsequent recovery of private wealth after the war and the stagnation of real national income between 1918 and 1922, β_{pt} recovered to a large degree. The few observations of this tumultuous time should be interpreted with care, as data quality is likely limited. Note however, that other countries shown in Figure 2, in particular Sweden and the U.K., experienced similar dynamics during this period leading up to the Great Depression.

In stark contrast to other countries, the wealth-income ratio in Switzerland reached pre-war levels in the 1920s. By that time, France, Germany, or Sweden had already experienced a large decline in their private wealth-income ratio, reaching historically low levels. The shocks of World War I (as well as later in World War II) led to a massive decline of private wealth in Old Europe. Importantly, this was mainly caused by real capital losses and only partly by war destruction (Piketty and Zucman, 2014).

After overcoming the post-World War I recession of the early 1920s, Switzerland recorded above-average growth in national income from 1922 until the onset of the Great Depression (Woitek et al., 2012), leading to a slight decline in β_{pt}. Between 1929 and 1939, Switzerland lived through a decade of declining per capita income (Woitek et al., 2012), and β_{pt} rose back to 550%. While in other countries such as the U.K. or Sweden, but also in France and Germany, we observe similar movements in β_{pt} over this time, the magnitude of the changes is much smaller in Switzerland. As a result, β_{pt} remains relatively stable and high in Switzerland.

Compared to the First World War, World War II hardly seems to have left its mark on the private wealth-income ratio in Switzerland. We observe sharp declines in the U.S., France, the U.K., and—to a smaller degree—Germany, but the decline in Switzerland is moderate and unsteady. Real income and real wealth remained more or less constant over the period 1939–1945.

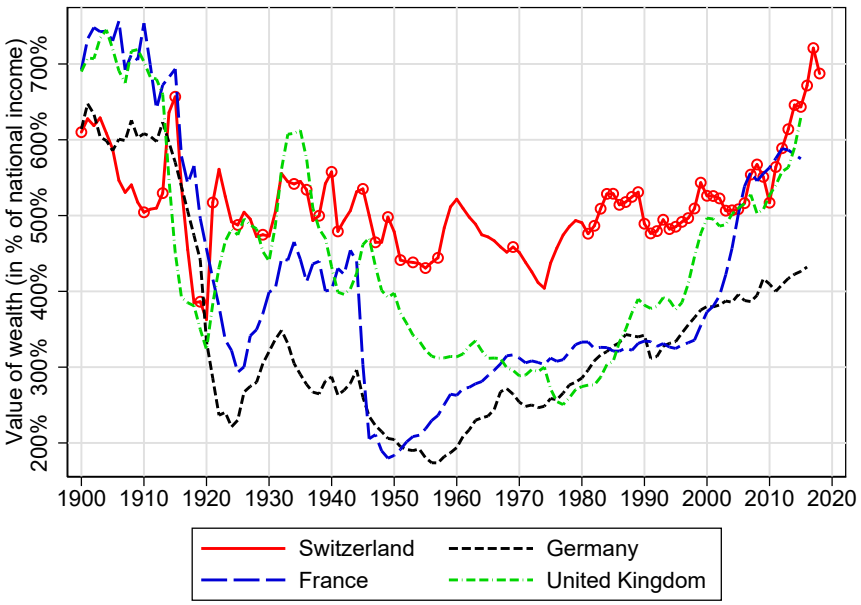
After the end of the Second World War, Switzerland recorded unprecedented, high growth rates. Real national income grew by an average of 5.3% per year until 1970 (Figure B2), contributing to a decline in β_{pt}. From the 1970s onward, however, real income growth fell to 1.8% (geometric average of the 1970–1995 period) and was therefore particularly low—also relative to other countries. The low average income growth rate can be explained by the slump in economic growth in the 1970s and the deep recession and stagnation phase of the 1990s (Woitek et al., 2012). As a result, β_{pt} returned to its 20th century average of 500%. In contrast, wealth-income ratios rose steadily over the second half of the past century in Germany, the United Kingdom, France, and—although

to a lesser extent—also in the United States. Piketty and Zucman (2014) attribute this increase to a long-term recovery in asset prices. They argue that the long-run swing in relative asset prices was itself driven by changes in capital policies. In their view, anticapital policies depressed asset prices in the post war period. When these policies were gradually lifted from the 1980s onward, asset prices started recovering to eventually reach pre-war levels. The Swiss case adds to this evidence, showing a much more stable long-run evolution of private wealth relative to income in the absence of such anticapital policies and increased taxation.

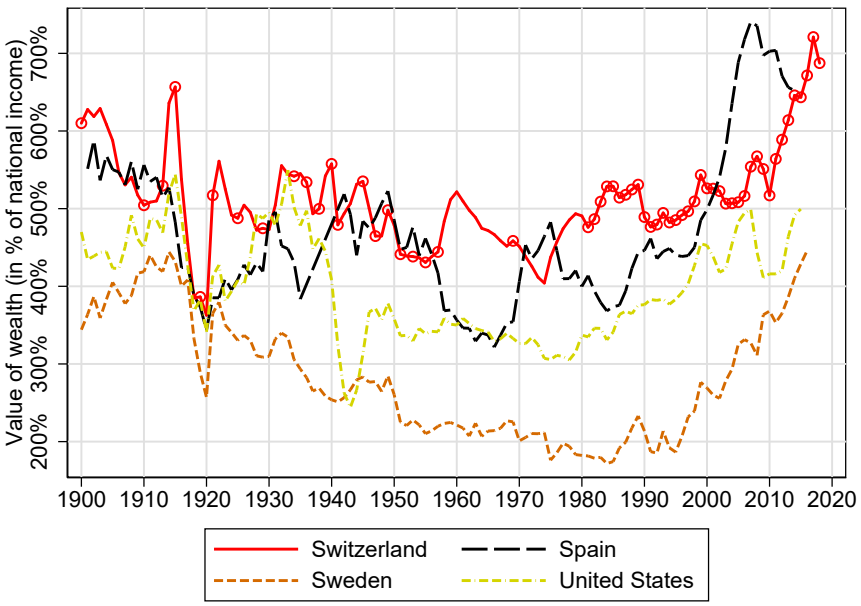
After the turn of the millennium, we observe a steep increase in β_{pt} in several countries, including Switzerland. Within less than 20 years, the Swiss wealth-income ratio rose from 500% to 700%. Also Sweden, France, the United Kingdom, and Spain have been experiencing rapid increases in their wealth-income ratios. Artola Blanco et al. (2020) find that, at least for Spain, the increase was mainly caused by a large housing bubble which burst in the Great Recession. We come back to the role of capital gains in housing wealth in Switzerland and other countries in Sections 7.3 and 7.4.

The long run-evolution of the private wealth-income ratio in Switzerland can be summarized as follows. Over the past century, a series of economic shocks and major historical events have inevitably contributed to considerable fluctuations in β_{pt}, also in Switzerland. However, Figure 2 clearly shows that throughout the 20th century in no other country private wealth-income ratios were as stable as they were in Switzerland. β_{pt} oscillated around 500% until the eve of the Great Recession, averaging 490% over the period 1920–2005. This finding of a very stable long-run evolution of the private wealth-income ratio coincidences with earlier results of Föllmi and Martínez (2017) on the stable level of top wealth shares in Switzerland over the course of the 20th century.

Given that wealth-income ratios in old Europe (especially in France and the United Kingdom) have recently almost returned to the high levels of the early 20th century, scholars have concluded that β_{pt} in Europe has largely followed a pronounced U-shaped pattern over the course of the 20th century. For Switzerland, on the other hand, the evolution is better described by a J-shaped pattern: a stable evolution over the 20th century, followed by a very steep increase in the private wealth-income ratio in recent years, which in turn resulted in a level of β_{pt} unprecedented in the entire 20th century. Switzerland therefore resembles the evolution in Spain, where the marked rise in β_{pt} at the beginning of the 21st century has been driven by real-estate bubbles (Artola Blanco et al., 2020).



(a) Switzerland, Germany, France and the United Kingdom



(b) Switzerland, Spain, Sweden and the United States

Figure 2: Private Wealth-Income Ratio in International Comparison, 1900-2018

Note: This figure shows the historical evolution of the private wealth-income ratio, β_{pt}, for the countries indicated from 1900 to 2018. β_{pt} indicates how many years it would take to accumulate total private wealth if none of national income would be spent on consumption. For Switzerland, the hollow red circles indicate observations for which we have wealth data. The years in between are linearly interpolated, and fluctuations are due to fluctuations in income. The data sources for Switzerland are described in detail in Appendix A.1. The series for Germany, France, the United Kingdom and the United States are based on Piketty and Zucman (2014), from Artola Blanco et al. (2020) for Spain and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

6 Wealth-Income Ratios – Recent Evolution

For the time from 1990 onward, detailed data on the different components of national wealth allows us to study the evolution of private, public, and net foreign wealth in turn.

6.1 National Wealth

Figure 3 shows the national wealth-income ratios for Switzerland, Germany, France, Italy, Sweden, and the United States over the period 1990–2018. Switzerland stands out with the highest wealth-income ratio among these economies. We can further distinguish two periods in Switzerland: the years 1990–2006, where the total wealth-income ratio was remarkably stable, ranging around 500 to 550% of annual national income, and the period since 2006 where we observe an increase from 540 to 740%.

This period of rising importance of wealth in comparison to income started during the economic expansion prior to the Great Recession. In contrast to other European countries, the Great Recession and the following European debt crisis only led to a very brief contraction in Switzerland's wealth-income ratio between 2008 and 2010. This dip in 2010 was the combined result of i) a drop in wealth per capita (see Appendix Figure B3); and ii) an increase in national income per capita of 15% between 2008 and 2010 after the 11% fall between 2006 and 2008 as a result of the Great Recession (see Appendix Figure B2). In other countries, there is hardly any change visible around the 2007–2011 period, with the exception of the U.S. In the U.S., the Great Recession led to a strong drop in the national wealth-income ratio and stabilized after 2009 at around 380–400% of national income—substantially below the 2007 level of almost 500%.

Switzerland's steady growth in the national wealth-income ratio since 2010 stands in strong contrast to other countries' experience. Only in Sweden do we observe an upward trend throughout the period 1995–2018. At 740%, however, the wealth-income ratio in Switzerland is around two years of national income higher than in Sweden. Most other countries saw their wealth income ratio stagnate or fall after the Great Recession.

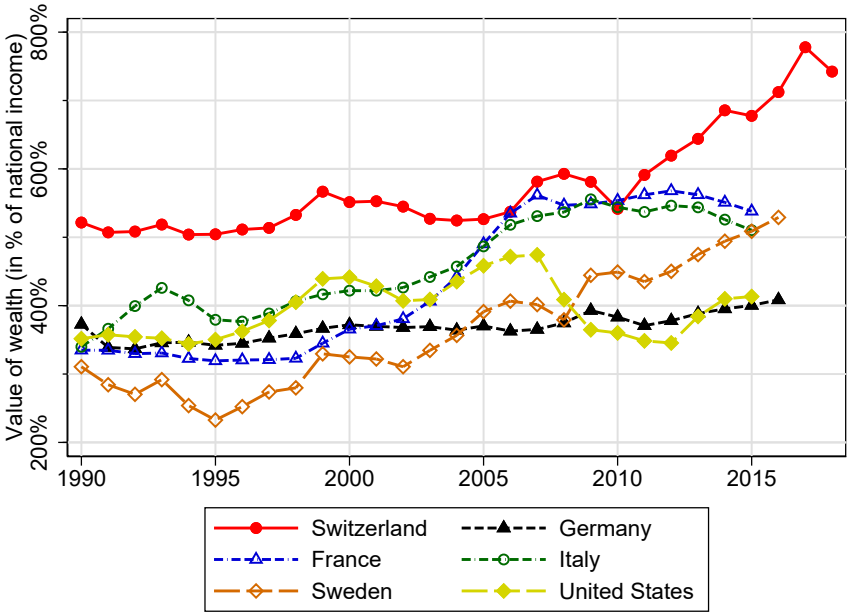


Figure 3: National Wealth-Income Ratios in International Comparison, 1990–2018

Note: This figure shows the evolution of the national wealth-income ratio, β_{nt}, for several countries from 1990 to 2018. β_{nt} is derived by dividing the sum of net private wealth, W_{pt}, and net public wealth, W_{gt}, by net national income, Y_t. Both, private and public wealth, are the sum of financial and non-financial assets minus financial liabilities. In order to present series which are harmonized across countries and over time, non-financial assets of private households, K_{pt}, only include of housing wealth (i.e., $K_{pt} = H_{pt}$). The data sources for Switzerland are described in detail in Appendix A.1 and A.2. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

6.2 Public Wealth

The share of public wealth in total national wealth is relatively low, ranging between 3 to 7% in the period 1990–2018. As a consequence, the value of public wealth measured in national income is low. As Figure 4 shows, it would take around half a year's national income to buy all the government owned assets—compared to the 7 annual national incomes needed to match private wealth. Even though estimates of public wealth at market value are likely less precise than those for private wealth (since the market value of assets such as schools, hospitals or highways cannot be measured directly; see Piketty, 2014, for a discussion) and assuming a relatively large margin of error, it is apparent that national wealth consists largely of private wealth.

Interestingly, the increasing wealth-income ratio can be observed in both, public and private wealth-income ratios. Over the entire observable period Switzerland's public wealth-income ratio rose from 32% in 1990 to 55% in 2018. For both series, the increase has become very steep since 2010.

This upward trend in public wealth stands in clear contrast to most other countries' experiences (shown in Figure B7), as they have seen a decline in public wealth measured in national income over this period—particularly, Italy (-81pp), Germany (-65pp) or the U.S. (-46pp). These developments are the result of continuing public deficit spending. Over the period 1995–2010, 30–45% of private savings in these countries were absorbed by government budget deficits, as governments ran these deficits to pay current expenses, rather than for investments—with the result that they saw their public net wealth shrink (Piketty, 2014, p. 185–186).

Piketty (2014) further estimates that in Germany and France, public wealth accounted for up to one-third of national wealth between 1950 and 1970. In recent years, that figure was down to 3–5% in both countries. Due to the lack of data, we are unfortunately not able to compute series on public wealth in Switzerland for the time before 1990 to understand the long run trend in public wealth. Since 1990, however, the share of public wealth in national wealth has been rather stable and even increasing in recent years.

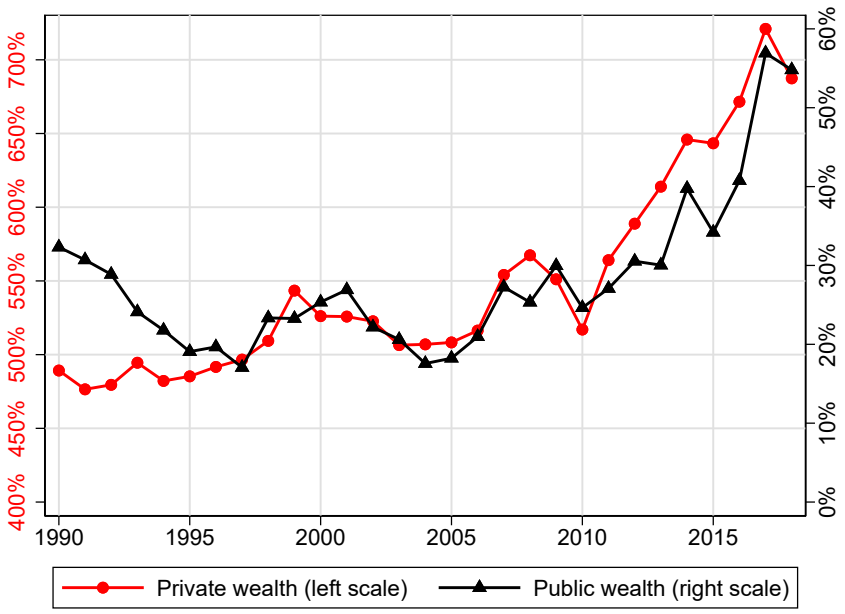


Figure 4: Private and Public Wealth in Percent of National Income in Switzerland, 1990–2018

Note: This figure displays both the evolution of the private wealth-income ratio, β_{pt}, and the public wealth-income ratio, β_{gt}, of Switzerland between 1990 and 2018. Private wealth, W_{pt}, is the sum of private non-financial assets (consisting only of housing wealth) and financial assets minus financial liabilities. Public wealth, W_{gt}, is net wealth of all public administrations and government agencies at all government levels. For both public and private wealth the development is shown in terms of national income, Y_t. The data sources are described in detail in Appendix A.1 for private wealth, and in A.2 for public wealth.

In our view, the following three key factors have most likely contributed to the ob-

served increase in public wealth in Switzerland since 2004, the year public wealth was at its lowest value in the period we study. First, price effects led to significant capital gains. Second, the introduction of the "debt brake"—a fiscal budget rule to avoid structural deficits—at national level in 2003 (and subsequently in a series of cantons), led to a substantial reduction in public debt. Third, the exceptional monetary policy with negative interest rates and the strong Swiss currency lead to large seigniorage incomes from the Swiss National Bank over the past years. Below, we discuss these three factors in turn.

i) Capital Gains in Public Wealth. The increase in the public wealth-income ratio can be the result of saving as well as price effects leading to capital gains, as shown in the decomposition in equation (9). Re-arranging equation (9) allows to estimate the price effect, $(1 + q_t)$, on the change in β_g from public saving rate $(1 + g^w_{st})$ and income growth rate $(1 + g_t)$:

$$(1 + q_t) = \frac{1 + g_t}{1 + g^w_{st}} \frac{\beta_{gt+1}}{\beta_{gt}}$$

Accordingly, around 30% of the increase in the public wealth-income ratio between 1995 and 2018 can be attributed to capital gains.

ii) The "Debt Brake". The decomposition above implies that the other 70% of the increase has to be attributed to public savings.[12] This is in line with Figure 5, according to which debt reduction has contributed the most towards the increase of total net public wealth. Liabilities fell substantially after 2002, from 73% to 52% in 2008. The timing coincides well with the introduction of the "debt brake" at the federal level in 2003, a fiscal rule which requires the government to save during economic expansions, thereby reducing and avoiding structural deficits.[13] Using a synthetic control approach, Schaltegger and Salvi (2016) show that the "debt brake" indeed contributed substantially towards the significant public debt reduction that took place since 2003. Similar developments are observed at the cantonal level, as cantons also adopted "debt brakes" and similar budget rules in the 2000s (see Yerly, 2013, for an overview).

iii) Expansionary Monetary Policy. The increase in public wealth during this period was further fueled by monetary policy. With the aim to counteract the appreciation of the Swiss Franc, the Swiss National Bank (SNB) has adopted a quantitative easing policy which includes negative interest rates. As a side effect, this significantly reduced the

[12] Note that net public savings (see Table B1) and capital gains in public wealth (see Table B5) exhibit significant fluctuations over time.

[13] For additional information see: https://www.efv.admin.ch/efv/en/home/themen/finanzpolitik_grundlagen/schuldenbremse.html

burden of public debt service. In addition, the SNB's policy generated large seigniorage incomes, of which two thirds are distributed to the cantons and one third to the central government. Between 2003 and 2011, the SNB distributed 2.5 billion and more each year to the cantons and the federation together. Taken together, all these developments led to an increase in financial public wealth.

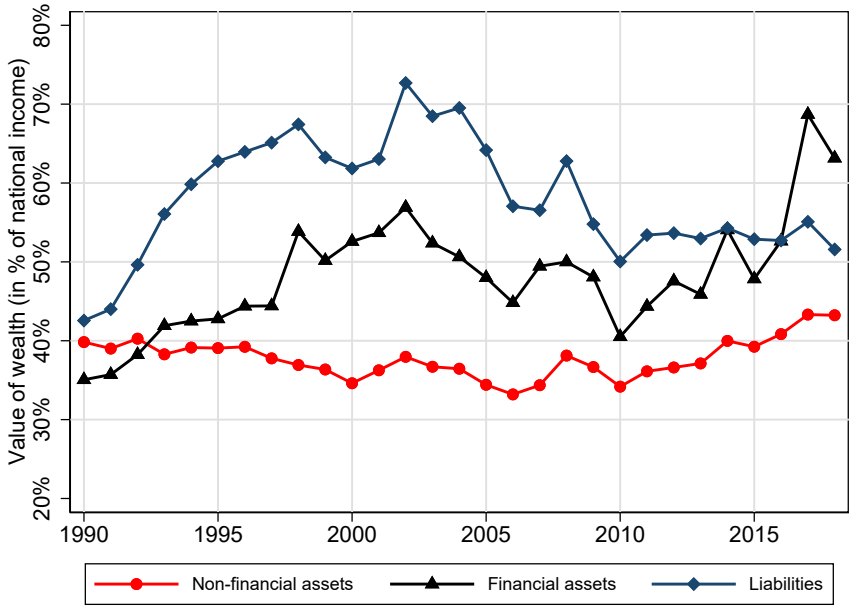


Figure 5: Decomposition of Total Net Public Wealth in Switzerland, 1990–2018

Note: This figure shows the evolution of three main components of net public wealth, W_{gt}: public non-financial assets,K_{gt}, public financial assets, F_{gt}, and public financial liabilities, L_{gt}, measured in percent of national income, Y_t. W_{gt} is the sum of all net wealth of public administrations and government agencies at all government levels. The corresponding data sources are described in Appendix A.2.

The increase in financial assets described in Figure 5 reflects the evolution over all government levels. While the overall value of government-owned non-financial assets in terms of national income remained relatively stable over the past three decades, this development masks considerable heterogeneity. Non-financial assets rose at the municipality and cantonal levels, but fell for the confederation (see Figure B8).

To uncover heterogeneity in net public wealth at different government levels, we further decompose total public wealth into wealth held by the Swiss Federation, the cantons (i.e., Switzerland's federal states), municipalities, and social security funds.

Figure 6 reveals the relative importance of public wealth as a share of total wealth since 1990 by government level. Undoubtedly, a major shift has taken place from the central government (federal government including social security funds) to the lower levels

of government, i.e., the cantons and municipalities.

At the federal level, the development is striking: net wealth measured in national income fell from 17% in 1990, when Switzerland entered a decade of economic crisis and stagnation, to as little as 1.6% in 2005. Since then, a gradual recovery can be observed, although at 15.5% the wealth-income ratio at the federal level is still slightly below its 1990 level. The situation is very different for the cantons and municipalities. The entire increase in Switzerland's public net wealth—relative to national income—has taken place at these two levels of government. The rise in cantons' public wealth accounts for roughly 17.5pp of the total 22.5 percentage point increase in the public wealth-to-income ratio. Municipalities added another 7.6pp of the total 22.5pp increase in the public wealth-to-income ratio. This leaves the federal level and the social security funds with a negative contribution (-1.7pp and -0.9pp, respectively) to the change in the public wealth-income ratio between 1990 and 2018 (see Appendix Figure B9, which shows the different components in percent of national income).

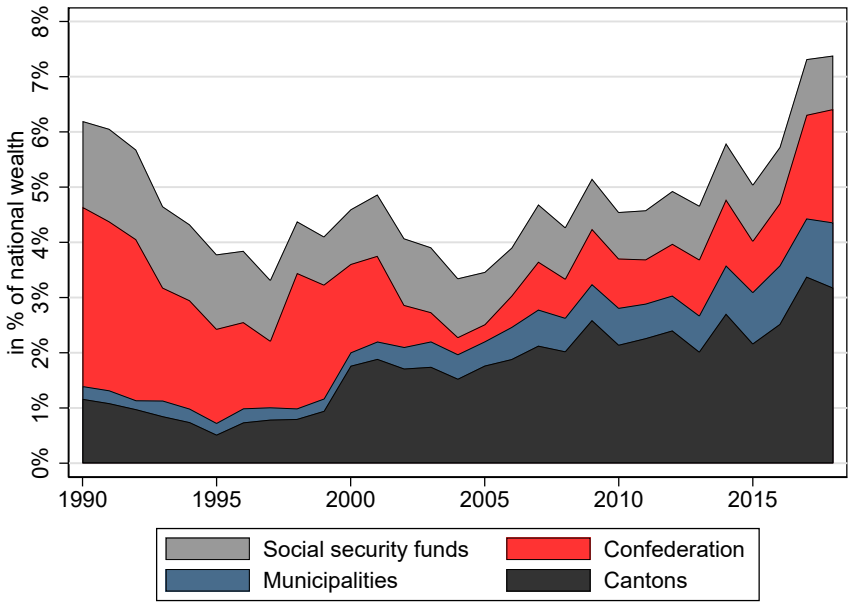


Figure 6: Public Wealth by Government-Level as Share of National Wealth, 1990–2018

Note: This figure displays the evolution of net public wealth, W_{gt}, of Switzerland as share of total national net wealth, W_{nt}, from 1990 to 2018 decomposed by the four government levels indicated in the legend. The data sources are described in detail in Appendix A.2.

6.3 Net Foreign Wealth

As described in equation (3), total national wealth can further be decomposed into net national and foreign wealth. Switzerland stands out with its high value of net foreign wealth, which for the period 1995–2018 lies between 100 and 170%. This is substantially more than in most other countries, where this ratio has rarely ever exceeded 25% in the post-war period and even turned negative in recent decades (see Appendix Figure B11). Despite Switzerland's high level of net foreign wealth, however, the recent increase in national wealth is solely due to an increase in domestic wealth as shown in Figure 7.

The high net foreign asset position of Switzerland itself is the result of a set of factors which have been changing over time. The stable evolution therefore masks substantial heterogeneity among the different net foreign wealth components. Until the Great Recession, direct investment and portfolio investment compromised 70–95% of total foreign net wealth. The reasons for these high values lie in the high savings rate[14] and the limited investment opportunities within Switzerland. After 2009, however, net direct and, in particular, net portfolio investment have declined substantially and now account for a much smaller share of total net foreign wealth than they did back in 2009.

Furthermore, other investment[15] had an increasingly dampening effect on the Swiss net foreign wealth position. On the other hand, however, in an attempt to stabilize the Swiss currency, the Swiss National Bank bought unprecedented amounts of foreign currency, leading to an increase in reserve assets, which in turn more or less offset the fall in foreign investment (Swiss National Bank, 2018).

[14] Table B2 in the Appendix gives an overview of saving rates across countries.

[15] The category other investments includes in particular interest and other investment income from insurance companies, pension funds, the Swiss Confederation and the SNB (excluding currency reserves). For more detailed explanations see: https://data.snb.ch/de/topics/aube#!/doc/explanations_aube_bopauverm.

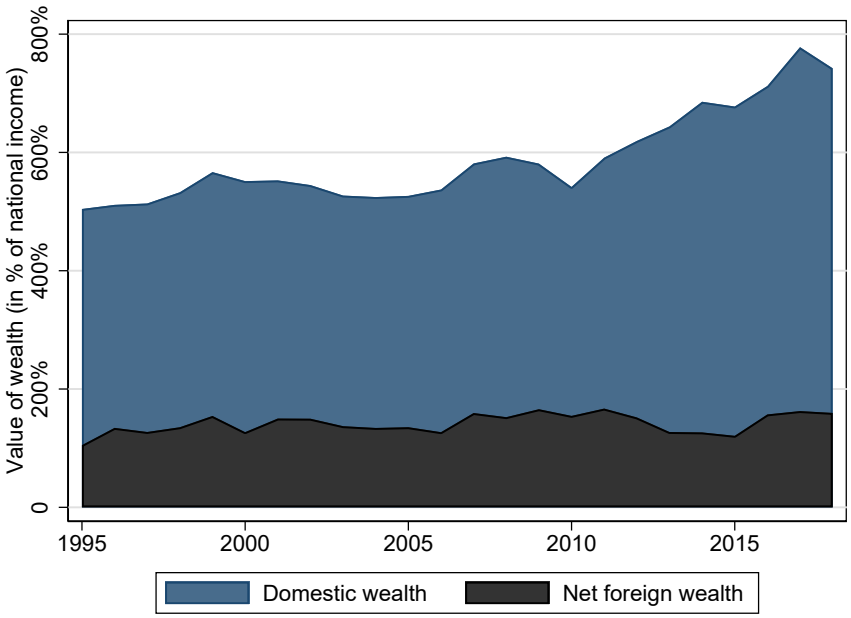


Figure 7: The Evolution of Domestic an Net Foreign Wealth of Switzerland, 1995–2018

Note: This figure displays the evolution of Switzerland's national wealth-income ratio, β_{nt}, distinguishing between domestic capital, K_{nt}, and net foreign wealth, NFA_{nt}. By construction it is the case that domestic capital plus net foreign wealth equals the sum of net private and public wealth. The data sources are described in Appendix A.3.

6.4 Private Wealth and the Rise in Housing Wealth

Since private wealth makes up around 95% of national wealth in Switzerland, private wealth parallels the evolution of national wealth. The composition of net private wealth in Switzerland shown in Figure 8 further reveals that the evolution of total wealth can be traced back almost one to one to housing wealth. Net-financial wealth has been very stable at around 100% of national income, and pension wealth has risen steadily but slowly to just below 200% of national income. This slow but steady increase in pension wealth is the combined result of pension reforms and individual responses to demographic change and longer life expectancy.

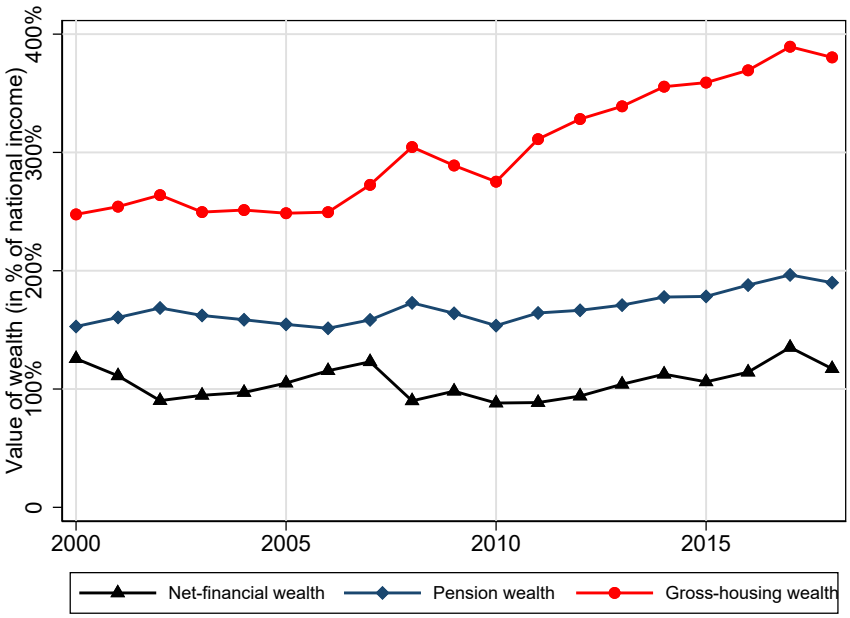


Figure 8: Main Components of Private Wealth in Switzerland, 2000–2018

Note: This figure shows the evolution of three main components of private wealth, W_{pt}: gross housing wealth, net financial wealth and pension wealth measured in national income, Y_t. The sum of these three sub components add up to total net private wealth, as depicted in Appendix Figure B5. Detailed information on these three subcomponents can be found in Appendix A.1.

The strong increase in housing wealth as share of total wealth is striking, especially because, like Germany, Switzerland is a land of tenants: the homeownership rate amounts to 38% of households and was at 32% in 1990.[16] Since 2010, when the steep rise in housing wealth began, the homeownership rate has been roughly stable.

One likely explanation for the rise in housing wealth is the sharp increase in real housing prices that has been taking place since 2010. While real estate prices in Switzerland started to rise already after 2003, the increase clearly became steeper after 2010. In an environment of a strong currency and extremely low—since December 2014 even negative—interest rates, domestic investment opportunities in Swiss Francs have become more attractive (as cheap money has been readily available), but also harder to find due to increased demand. Real estate is an alternative asset class to government bonds and stocks, promising high returns. Private households as well as institutional investors (e.g., pension funds) and firms have been seeking out investment opportunities in real estate (Wijburg and Aalbers, 2017). Prevailing low interest rates therefore have likely increased the demand for real estate (Wildauer and Stockhammer, 2018; André, 2010). This is supported by the fact that during that time also mortgage debt levels have in-

[16] Source: Federal Statistics Office

creased by one quarter, going from 122% of national income in 2010 to 153% in 2018, as shown in Figure 9.

Figure 9: Private Debt-Income Ratios in Switzerland, 1999–2018

Note: This figure illustrates the evolution of total private financial liabilities, L_{pt}, and its main sub-component, mortgages, as a ratio of national income. The data sources for Switzerland are described in detail in Appendix A.1.

At the same time, also annual population growth has spurred, increasing from 0.24% in 1997 to 1.27% in 2008. Ever since, it has remained above 1%, and is therefore larger than in most other developed economies.[17] Population growth contributes to increased housing demand. Because it takes time to increase housing supply and moreover urban land is fixed and therefore scarce, prices typically rise. This idea dates back to Ricardo's (1817) famous principle of scarcity. Recent empirical contributions supporting this view include Rognlie (2015), Knoll et al. (2017), or Grossman and Steger (2017). It seems likely that increased demand for housing from continuous population growth combined with low interest rates ultimately fueled into the observed increase in real estate prices, which can be seen in Panel a) of Figure 10.

We come back to the role of capital gains—and hence: price increases—and savings in housing wealth in Section 7, where we argue that this recent increase in housing wealth is driven by a relative increase in housing prices (rather than savings in housing).

Figure 10 further reveals the general trend in rising housing prices across Europe and

[17] Data source: The World Bank.

in the U.S. Likewise, the increase in housing wealth relative to national income is by no means a unique Swiss feature. Appendix Figure B6 shows how the value of housing wealth in national income has been rising for a series of countries, with the exception of the U.S.

7 What Explains the Rising Wealth-Income Ratio?

Switzerland's national wealth-income ratio has risen sharply over the past decade. In principle, there are two possible drivers to account for this enormous rise: lower income growth and faster wealth accumulation. The latter can further be the result of an increased saving rate or large capital gains. Capital gains arise when the valuation of an asset increases, which is why we also refer to capital gains as (relative) price effects. Price effects typically affect certain types of assets, such as stocks or housing wealth. In this section, we discuss these different factors in turn.

7.1 Income Growth and Savings

In a model with a constant relative price between capital and consumption goods (and hence no capital gains) as outlined by the Harrod-Domar-Solow formula adopted in Piketty and Zucman (2014), the national wealth-income ratio is determined by the national savings and income growth rates: $\beta_n = s/g$. Table 1 presents the savings and income growth rates in Switzerland for the period 1995 to 2018 and three sub-periods.

We draw three findings from this table. First, the income growth rate has declined over time. In the recent period 2010–2018, marked by the large increase in the national wealth-income ratio, national income growth was very low. The per capita growth rate was even negative. In the preceding 2002–2010 period, in contrast, national income grew extraordinarily strongly at 3.0% (see Table 1). This in turn has led to a slight decline in the national wealth-income ratio during that time, despite a relatively high growth rate of national wealth of 2.9%. Second, the net national savings rate has been relatively stable over the period 1995–2018.[18] Third, in contrast to income growth and despite the stable evolution of savings, the real growth rate of national wealth has been high and even rising over time. Over the full period from 1995 to 2018, the annual real growth rate of national wealth was 3.4%, but it reached 4.9% in the 2010–2018 sub-period.

[18] This stability conceals some heterogeneity in the composition of national savings. For a breakdown of the structure of Swiss national savings, see Table B1. Table B2 shows the structure of national savings in an international comparison, whereby the high level of savings in Switzerland, but also the international heterogeneity in particular, should be noted.

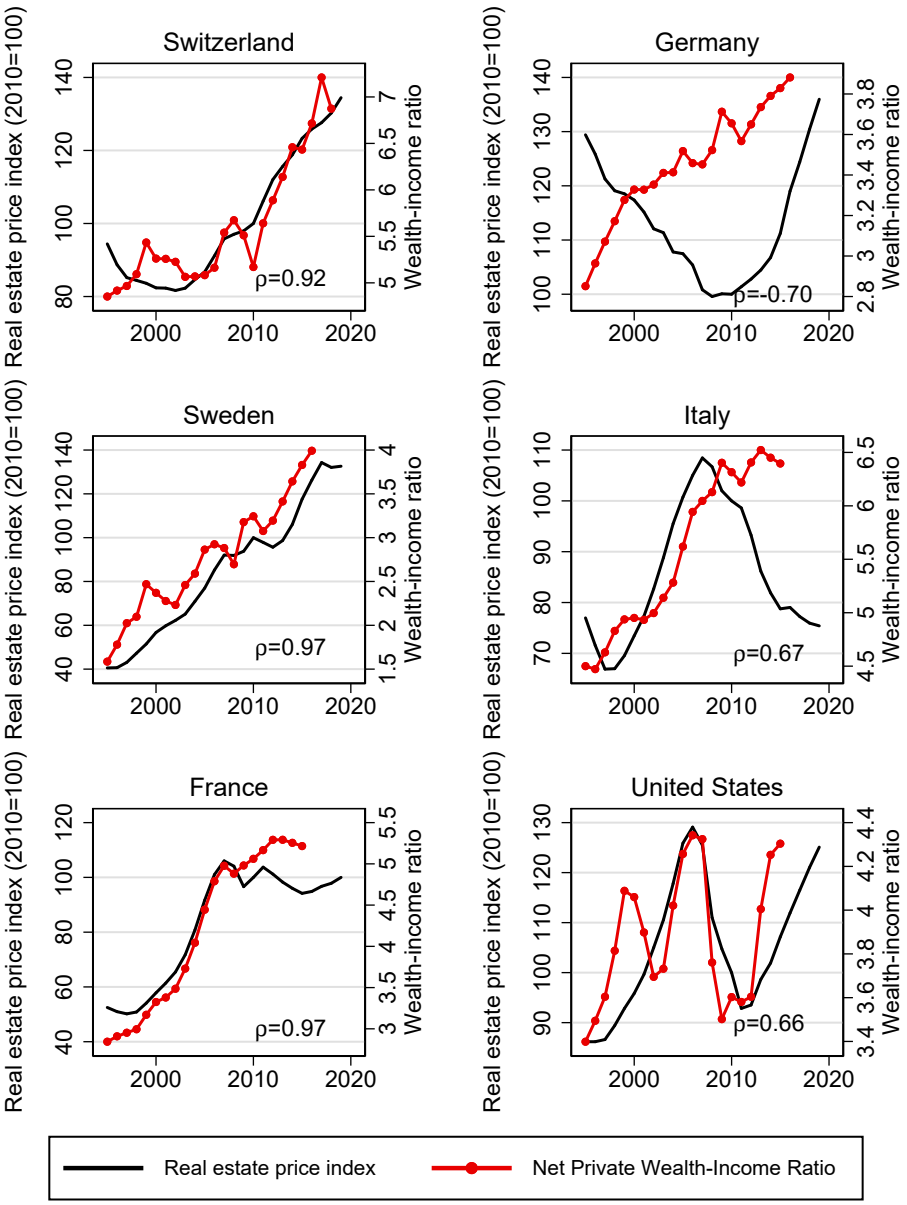


Figure 10: Wealth-Income Ratios and Real Estate Price Indices, 1995–2017

Note: This figure shows private wealth-income ratios in Switzerland, the U.S., Sweden, Germany, Italy and France along with real house price indices of each of those countries. The price indices were obtained online from the OECD in September 2020. The data for the real house price indices are described in Appendix A.10. Appendix Figure B10 illustrates private wealth-income ratios along with real house price indices for the U.K., Australia, Canada, Spain, Japan and Norway. All international private wealth-income ratios data is available for download at https://wid.world.

Attributing the increase in the national wealth-income ratio merely to a decline in growth does therefore not do justice to reality.[19] To accommodate the observed real growth in wealth accumulation, we next turn to capital gains.

Table 1: Income Growth, Saving Rates and Wealth Accumulation in Switzerland, 1995–2018

			Sub-Periods		
		1995–2018	1995–2002	2002–2010	2010–2018
Income growth					
Real income growth rate	g	1.7%	1.2%	3.0%	0.8%
Population growth rate	n	0.8%	0.5%	0.9%	1.1%
Real income p.c. growth rate	$\hat{g}$	0.9%	0.7%	2.1%	-0.2%
Capital accumulation					
Net saving rate	s	15.7%	14.6%	16.4%	15.9%
Real wealth growth rate	g^w	3.4%	2.4%	2.9%	4.9%
... savings-induced ($g_s^w = s/\beta_n$)	g_s^w	2.7%	2.8%	2.8%	2.5%
... capital gains induced	q	0.7%	-0.4%	0.1%	2.4%
Rel. contribution savings	g_s^w/g^w	80%	119%	98%	52%
Rel. contribution capital gains	q/g^w	20%	-19%	2%	48%
Wealth-income ratio					
At beginning of period	$\beta_{n,t}$	504%	504%	545%	542%
At end of period	$\beta_{n,t+d}$	742%	545%	542%	742%
Change	$\Delta\beta_{n,t}$	+238 pp.	+40 pp.	-3 pp.	+201 pp.

Note: This table displays annual growth rates of real national income, net national savings, and real wealth, respectively, along with the population growth rate. All growth rates are geometric averages over the indicated period. The average saving rates are obtained by weighting annual saving rates by real national income. The average real growth rate of national wealth, g^w, is decomposed into a savings-induced component, g_s^w, and capital gains or losses, q, using the formula in equation (9). Wealth-income ratios in the corresponding years, $\beta_{n,t}$ and $\beta_{n,t+d}$, are indicated at the bottom of the table. The last row shows the change in percentage points (pp.) of the national wealth-income ratio, β_{nt}, over the corresponding period. Detailed information on the data can be found in the corresponding subsections in Appendix A.

7.2 Wealth Accumulation Through Capital Gains

While the Harrod-Domar-Solow formula abstracts from capital gains, in reality we do observe large capital gains due to relative price changes. Especially in the short to

[19] This is also apparent from the international comparison of growth rates and changes in national wealth-income ratios, which are summarized in Table B3. In this short-run comparison, higher growth rates coincide with an increase in β_{nt}, which is unreasonable on the basis of a one-good capital accumulation model.

medium run, capital gains turn out to be crucial for the accumulation and evolution of wealth.

By taking into account capital gains, we can decompose the accumulation of national wealth into a savings and a capital gains component using equation (9). Following equation (9), 2.7pp of the 3.4% annual real growth rate of national wealth is attributable to savings, leaving a capital gain effect of 0.7pp.[20] Accordingly, four-fifths of the increase in the national wealth-income ratio between 1995 and 2018 is attributable to savings, while capital gains accounted for about one-fifth.

Comparing different sub-periods between 1995 and 2018, Table 1 reveals some remarkable differences in how new savings and capital gains have contributed to the accumulation of national wealth.[21] First, real annual growth of national wealth was about twice as high after the Great Recession than it was in the 1990s and the first decade of the 21st century.

Second, the savings-induced growth rate of wealth has been rather stable over the different periods. This is largely due to the stable national saving rate. If anything, the savings-induced growth rate of wealth has been declining and has been lowest in the 2010–2018 period, for which we observe by far the largest increase in the national wealth-income ratio.

Third, we can distinguish three sub-periods which mark the changing importance of capital gains over time: i) Between 1995 and 2002, capital gains were slightly negative, such that capital losses dampened the real growth of national wealth. ii) From 2002 to 2010, the growth rate of national wealth was almost exclusively determined by savings. Capital gains induced growth was virtually zero and in line with the Harrod-Domar-Solow formula. iii) In the most recent period from 2010 to 2018, national wealth grew exceptionally fast as a result of high capital gains. Substantial capital gains of around 2.4% per year have nearly doubled the growth rate of real national wealth to 4.9% in the years between 2010 and 2018.

Hence we conclude that the marked increase in the national wealth-income ratio after the Great Recession was mainly driven by the emergence of large capital gains, which led to a substantial increase in the national wealth growth rate. At the same time, this period coincided with a considerable deceleration in income growth, allowing the wealth-income ratio to rise even more.

[20] Note that because we have to estimate capital gains as a residual, these figures may include not only actual valuation effects but also potential measurement errors.

[21] Table B4 in the Appendix provides the same decomposition for Switzerland, Germany, Italy, Sweden and the United States.

7.3 The Origin of Capital Gains: Housing vs. Financial Wealth

Next, we turn to the nature of these capital gains. From 2000 to 2018, real national net wealth rose by 1'704 billion Swiss francs, 88.7% of which is attributable to an increase in private wealth.[22] Therefore, in this section, we focus on private wealth, which can further be decomposed into financial and housing wealth.

Analogous to Table 1, Table 2 decomposes the real growth rate of total net private wealth, W_{pt}, as well as gross housing wealth, H_{pt}, and net financial wealth, $F_{pt} - L_{pt}$, into a savings-induced and an estimated capital gains component.[23] Again we study different periods, but note that due to data availability of different components of private wealth prior to the year 2000 (as described in Section 4), this analysis is limited to the first two decades of the 21st century.

Over the entire 2000–2018 period, housing wealth grew twice as fast as net financial wealth (i.e., non-housing wealth). At 2.1% and 2.2%, respectively, the savings-induced growth rate was about just as large for housing wealth as it was for financial wealth. What sets the two of asset classes apart are the large capital gains incurred in the housing sector over this period, which contributed 1.7pp (or 44%) to the annual growth rate. In contrast, financial assets incurred capital losses over this period, lowering the overall growth rate in financial wealth.

These capital losses were incurred during the first decade of the 21st century, as shown in Panel B of Table 2. During this period, financial markets were hit by both, the Dot-com Bubble and the Great Recession. Nevertheless national income grew, and as a result the non-housing wealth-to-income ratio fell between 2000 and 2010, and so did the total private wealth-income ratio. Only housing wealth was growing faster than national income. The savings-induced growth rate in financial wealth remained stable during that period. It was even slightly higher than in the subsequent period (shown in Panel C of Table 2), and considerably higher than the savings-induced growth rate in housing wealth. Yet while financial wealth suffered from capital losses, housing prices picked up, which led to an annual increase of 1.1% in housing wealth.

Growth in housing wealth accelerated further after 2010, spurred once more by capital gains. And their role seems to be growing over time: they made up for almost half of the 5% annual growth rate in housing wealth between 2010 and 2018. Performance of housing wealth since 2010 has been exceptional: in less than a decade, housing wealth

[22] As in Table 1, Table B5 in the Appendix provides a decomposition of the growth rates of national wealth into a savings and a capital gains component for the period 2000–2018, breaking down national wealth according to its components of private and public wealth.

[23] The approach and the data with which we decompose the real growth rates are described in detail Appendix Section A.9.

grew by more than the size of one year of national income. About half of this increase is the result of a relative increase in real estate prices.

Financial wealth recovered and grew at a high rate as well during the 2010–2018 period, but growth still remained below that of housing wealth. Overall, housing wealth has been gaining ground over financial wealth since the turn of the century. As a result, the housing wealth-to-income ratio stood at 380% in 2018—132pp higher than almost two decades earlier.

Table 2: The Accumulation of Private Wealth in Switzerland, 2000–2018

			Decomposition of the private wealth growth rate (%)		
	Private wealth-income ratios (%)		Real growth rate of private wealth	Savings-induced wealth growth rate	Capital gains induced wealth growth rate
	$\beta_{p,t}$	$\beta_{p,t+n}$	g_w	$g_{ws} = s/\beta_p$	q
Panel A: 2000–2018					
Total Private Wealth	526%	687%	2.9%	2.2% (76)	0.7% (24)
Housing Wealth	248%	380%	3.8%	2.1% (56)	1.7% (44)
Non-Housing Wealth	278%	307%	1.9%	2.2% (113)	-0.3% (-13)
Panel B: 2000–2010					
Total Private Wealth	526%	517%	1.6%	2.1% (130)	-0.5% (-30)
Housing Wealth	248%	275%	2.9%	1.8% (63)	1.1% (37)
Non-Housing Wealth	278%	242%	0.4%	2.4% (625)	-2.0% (-525)
Panel C: 2010–2018					
Total Private Wealth	517%	687%	4.5%	2.3% (51)	2.2% (49)
Housing Wealth	275%	380%	5.0%	2.6% (51)	2.4% (49)
Non-Housing Wealth	242%	307%	3.9%	1.9% (48)	2.0% (52)

Note: This table displays the changes in private net wealth $W_{p,t}$ and its to main subcomponents—private housing, (H_{pt}), and non-housing wealth, ($F_{pt} - L_{pt}$)—between 2000 and 2018. The first two columns indicate the level of the total private wealth-income ratio $\beta_{p,t}$, the housing wealth-income ratio and the non-housing wealth-income ratio respectively in the corresponding years. The third column shows the average real growth rate g_w of the respective wealth components over the different time periods. With the formula in Equation (9) it is possible to decompose the real wealth growth rate g_w into two multiplicative components. Where one part of the wealth growth rate is savings-induced g_s^w and the other part are capital gains or losses q. The small numbers below the growth rates in columns 5 and 6 indicate the share in the total average real growth rate g_w. The methodology used to decompose the changes of the depicted private wealth categories into a savings and capital gains component is described in detail in Section A.9 in the Appendix. Note that the saving rate used in the above decomposition is the net saving rate of private households. The results of the same decomposition using the net private saving rate (including retained earnings of corporations) is shown in Table B6 in the Appendix (see in this context also Footnote 45). All growth rates are geometric averages. Detailed information on the data can be found in the corresponding subsections in Appendix A.

7.4 Do Capital Gains Drive Wealth-Income Ratios Across Countries?

The different developments in financial and housing wealth raise the question whether changes in the wealth-income ratio can be explained by capital gains in either housing wealth or financial wealth. The role of housing prices and bubbles in the accumulation and distribution of wealth has recently been documented for a series of countries, including Spain, France, and the U.S. (Martínez-Toledano, 2020). Piketty and Zucman (2014) and Artola Blanco et al. (2020) find that the recent rise in household wealth to national income ratios has mainly been driven by capital gains on housing. A visual comparison of housing prices and private wealth-income ratios supports this hypothesis for a large number of countries (see Figure 10; Appendix Figure B10 includes six additional countries, for which data is available).

To understand to which degree this is true, we run OLS country regressions of the annual change in the wealth-income ratio on the change in real stock prices and the change in real housing prices in Switzerland and 11 countries, for which data is available.[24] The country regressions generally cover 45–50 years, depending on data availability, from the 1970s to the present. As most wealth-income ratios and price indices exhibit a clear trend, we transform all the series to changes. These series, shown in Figure B15 in the Appendix, are stationary (as are the residuals from our regressions). Since all units are percentage changes, it is further possible to directly compare the regression coefficients.

Results for Switzerland and the full panel of countries are shown in Panels A and B, respectively, of Table 3. We regress the change in wealth-income ratios either on the change in real house or real share prices in the respective country (Columns 1 and 2), or on both (Column 3). In Column 4, we further control for changes in the MSCI world share price index, which captures global stock price changes. While investors typically have a home bias, it might nevertheless be that in some countries investors seek out for greener grass abroad, in which case financial wealth fluctuates more strongly with international stock prices as measured by the MSCI world index. The multi-country panel regressions (shown in bottom Panel B of Table 3) further include country and year fixed effects. Because the year fixed effects would fully absorb the time variation in the MSCI World Index, we do not report results from this specification in Column 4 (the are identical to the results in Column 3). The country panel regressions, however, are

[24] House and stock price data are available on a country by country base from the OECD and data on the private wealth-income ratio from WID.world, see Appendix for details. We include in our analysis all developed economies for which long-run series on the private wealth-income ratio exist. These are namely Australia, Canada, France, Germany, Italy, Japan, Norway, Spain, Sweden, Switzerland, the U.K. and the U.S. The observation period is limited due to the availability of data on β_{pt} for the three countries Canada (1980–2010), Germany (1989–2016) and Norway (1993–2015). All data used in the regression analysis are shown country by country in Figure B15.

not sensitive to the inclusion of these fixed effects (the detailed regression results for the different specifications can be found in Appendix Table B7). To account for correlation of observations within country and years, we report two-way clustered standard errors by country and year.

Table 3: Regressions of Private Wealth-Income Ratios on Stock and House Prices

	(1)		(2)		(3)		(4)	
Panel A: Switzerland								
1970–2018								
House prices	-0.05	(0.10)			-0.05	(0.10)	-0.07	(0.11)
Share prices			0.04	(0.03)	0.04	(0.03)	0.02	(0.06)
MSCI world							0.03	(0.07)
Constant	1.00*	(0.56)	0.74	(0.55)	0.84	(0.58)	0.84	(0.58)
Adj. R^2	-0.017		0.011		-0.011		-0.029	
Obs.	48		49		48		48	
1990–2018								
House prices	0.34*	(0.18)			0.35*	(0.18)	0.28	(0.19)
Share prices			0.05	(0.05)	0.05	(0.05)	-0.04	(0.08)
MSCI world							0.14	(0.11)
Constant	1.00	(0.74)	0.70	(0.83)	0.67	(0.79)	0.77	(0.78)
Adj. R^2	0.080		-0.004		0.092		0.116	
Obs.	29		29		29		29	
Panel B: Multi-Country Panel Analysis								
1970–2018								
House prices	0.22***	(0.04)			0.24***	(0.03)		
Share prices			0.03	(0.02)	0.03	(0.02)		
Adj. R^2	0.161		0.085		0.184			
Obs.	483		469		469			
1990–2018								
House prices	0.31***	(0.06)			0.31***	(0.07)		
Share prices			-0.01	(0.03)	-0.01	(0.03)		
Adj. R^2	0.237		0.122		0.235			
Obs.	304		304		304			

Note: The table shows results for OLS regressions of changes in private wealth-income ratios on changes in real house prices (Column 1), changes in real share prices (Column 2) and both (Column 3). Column (4) further includes the global MSCI world share price index as a control. Top Panel A shows the results for Switzerland. We show results for the whole period 1970–1918, for which data is available, as well as for the sub-period 1990–2018. Bottom Panel B shows the results of panel regressions including 12 countries. Private wealth-income ratio data are available for: Australia 1970–2014; Canada 1980–2010; France 1970–2015; Germany 1989–2016; Italy 1970–2015; Japan 1970–2015; Norway 1993–2015; Spain 1970–2014; Sweden 1970–2016; Switzerland 1970–2018; U.K 1970–2015; U.S. 1970–2015. See Figure B15 for details on data availability by country. All specifications in Panel B include year and country fixed effects. We do not report estimates in column (4) of Panel B because the year fixed effects fully absorb the variation in the MSCI World Index. Table B7 shows alternative specifications without fixed effects. We use house price (see Appendix A.10) and share price indices (see Appendix A.11) as published by the OECD in September 2020. Residuals in all models are stationary. Two-way clustered standard errors by country and year are shown in parentheses, next to coefficients. * p<.1, ** p<.05, *** p<.01.

Considering the whole period from 1970 to 2018, we do not find a systematic correlation between real house prices and share prices on the one hand and the wealth-income ratio on the other in Switzerland. Only when looking at the more recent period from 1990 onward, we find that growth in housing prices is systematically correlated with changes in the wealth-income ratio: a one percentage point increase in real housing prices is associated with a 0.34 percentage point increase in the wealth-income ratio. Statistical significance, however, remains weak, as limiting the period of analysis also reduces the number of observations. The finding is robust to simultaneously controlling for stock price changes, but additionally including changes in the MSCI world index leads to insignificant results (Column 4, Panel A of Table 3).

Turning to the panel analysis including all 12 countries for which data is available (Panel B of Table 3), alleviates the small N problem. Across all specifications we find that a one percentage point increase in real housing prices is associated with a 0.22–0.24 percentage point increase in wealth income ratios. These estimates are throughout statistically significant at the 1 percent level. Again this correlation increases to 0.31 percentage points in the more recent period since 1990. These findings suggest that rising housing prices are related to rising wealth-income ratios across many countries, and that this association has become stronger in more recent decades.

While the multi-country panel regressions are in line with findings for Switzerland, they mask some heterogeneity across countries. In Figure 11 we show the coefficients from regressions by country for the 1990–2018 period, corresponding to Column 3 in Table 3.

While the association seems to be particularly strong in Norway (0.59 pp), France (0.44 pp), the U.S. (0.43 pp), and Spain (0.39 pp), we find no effect in Germany, Sweden, Japan, Canada, and Australia. Results for Japan are significant only when we include the 1970-1990 period—which covers the country's large housing and stock market bubble of the late 1980s. We take this as evidence that asset price effects become main drivers for the aggregate wealth-income ratios in periods of rapid price changes. Although this is a simple empirical model, it explains around 70% of the variation in wealth-income ratios in the period after 1990 in Spain and France, suggesting that real estate prices play a crucial role in the evolution of wealth-income ratios.

Share prices seem to be important in all English-speaking countries except Canada. The U.S. stands out as the country where both, share prices as well as real estate prices simultaneously are strongly related to changes in the wealth-income ratio. Together these variables explain 80% of the observed variation in the wealth-income ratio. In Norway,

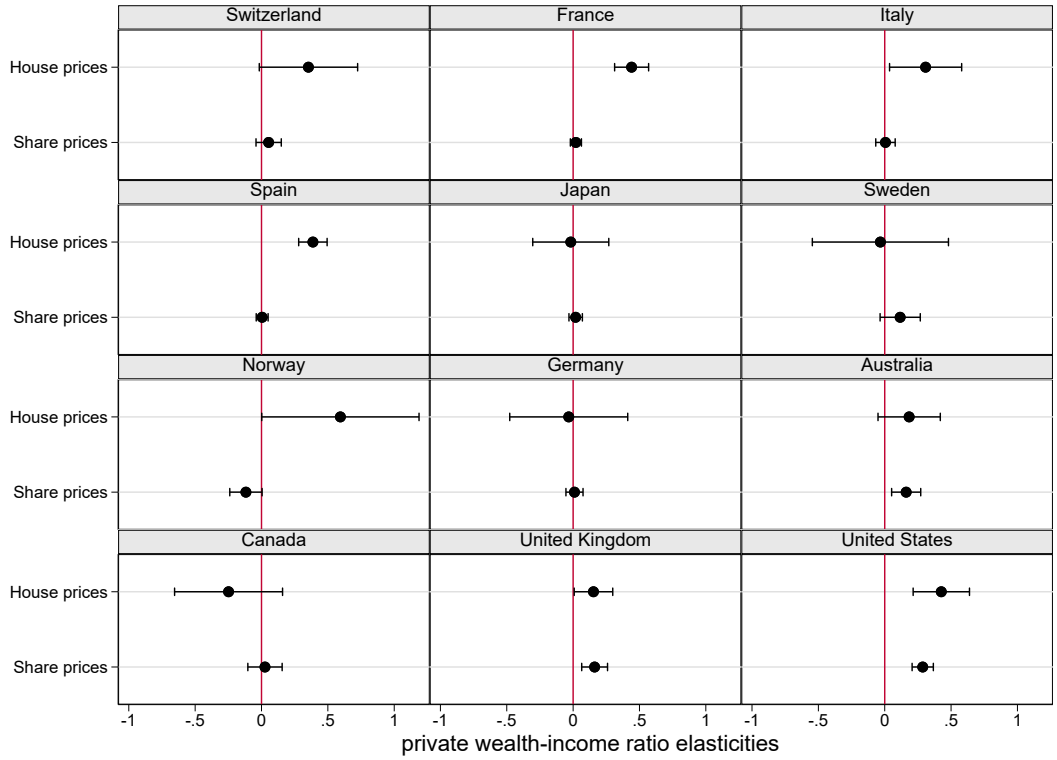


Figure 11: Regression Coefficients for Real Housing and Share Price Changes, 1990–2018

Note: The figure displays the coefficients along with the 95% confidence intervals from the regression of annual changes in the wealth-income ratio on annual changes of real housing prices and real share prices by country for the period 1990–2018. The model corresponds to Column (3) in Table 3. The full set of results by country is reported in Tables B8 and B9 in the Appendix.

interestingly, increases in share prices are significantly related to *negative* changes in the wealth-income ratio.[25] Overall these results suggest that capital gains in housing have become an important driver of the increasing wealth-income ratio—both in Switzerland and other developed economies. This (direct) evidence of a positive relationship between real housing prices and wealth-income ratios is particularly consistent with the findings of Knoll et al. (2017), who document the crucial role of higher land prices.

After WWII, asset price and housing bubbles occurred both more frequently and in greater magnitude than in the first half of the 20th century (see Table 2 in Jordà et al., 2015). In fact, some of the largest bubbles in economic history built up post-1980, including Japan's real estate and stock market bubble of the 1980s, which burst in 1991; the "Dot-com Bubble", which peaked in 2000; and the U.S. housing bubble bursting in 2009. For Switzerland, we know that in the 1980s a real estate bubble was building up to burst in 1990 (see Appendix Figure B15.a), that shows real annual changes in housing prices). This explains the distinct drop in β_{pt} between 1989 and 1991. Our results suggest that rising house prices due to augmented bubbles had a stronger impact on aggregate wealth-income ratios in the post-1990 period than they did in the more distant past—particularly in France, Italy, Spain, the U.S., and Switzerland (see Tables B7 and B8).

8 Conclusion

In this paper, we combine new data to estimate the private wealth-income ratio, β_{pt}, in Switzerland over the entire 20th century. Our results show that aggregate private wealth was likely higher than previously assumed (Brülhart et al., 2018), and that the evolution of β_{pt} in Switzerland did not follow a pronounced U-shaped pattern during the 20th century. This stands in contrast to other European countries. The relationship between wealth and income in Switzerland has been particularly stable over the last century: after World War I, β_{pt} oscillated around 500% until the eve of the Great Recession. This marked difference in the trajectory of β_{pt} is presumably explained by the fact that Switzerland was not directly involved in the two world wars that had a profound and lasting impact on the history and economic development of most European countries. In particular, that Switzerland did not pursue more progressive tax and anti-capital policies after World War I is likely to have had a direct bearing on the long-term stability of the Swiss wealth-income ratio. As a result of this political stability, Switzerland has been a

[25] This could be due to the oil industry: if during booms share prices of petrol companies as well as incomes earned in these companies located in Norway go up, the wealth-income ratio might fall.

"safe harbor" for wealth (accumulation) by international standards.

Since the turn of the century and especially since 2010, however, we document a strong deviation from this long-term trend. From 2010 to 2018, the share of national wealth relative to national income increased from 542% to 742%—a magnitude unprecedented in the 20th century. Considering the period from 1900 to today, the evolution of β_{pt} in Switzerland is therefore best described by a J-shaped pattern: a stable development during the 20th century, followed by a very steep increase in the private wealth-income ratio in recent years. Switzerland thus resembles the evolution in Spain, where the marked rise in β_{pt} has been driven by real-estate bubbles (Artola Blanco et al., 2020). We provide evidence for a similar situation in Switzerland. The steep rise in the private wealth-income ratio is particularly attributable to capital gains in housing wealth. Since 2010, capital gains in real estate alone have contributed to an increase in private wealth in the order of half a year's national income. Our results can therefore be interpreted as a serious warning signal for an overheating of the Swiss real estate market and thus have direct policy implications. The expansionary monetary policy of the past years—with low and since December 2014 even negative interest rates—may well have contributed to this development. Of particular concern is the 25% increase in the mortgage debt-income ratio since 2010 (see Figure 9), because as shown by Jordà et al. (2015), the bursting of credit-financed housing price bubbles has significant and long-lasting negative effects on real GDP. Consequently, the monetary authorities should carefully monitor the Swiss real estate market in their upcoming monetary policy decisions.

In the last part of the paper, we show that such rapid house price appreciations are systematically correlated with wealth-income ratios in a number of rich economies. In a multi-country panel analysis, we find that in recent decades, a one percentage point increase in real house prices has been associated with a 0.31pp increase in private wealth-income ratios. While this correlation remains rather weak in Switzerland, it is particularly strong in Norway, France, the U.S., and Spain. If real estate prices continue to rise due to scarcity of land and housing (especially in combination with expansive monetary policy), we are likely to see further hikes in wealth-income ratios. A related question that requires further thorough research is how different monetary policies affect the valuation of different asset categories and thus shape and change the distribution of wealth within a society.

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A Data Appendix

In this section we provide the comprehensive description of all data sources used in our analysis. We explain the data by category from the most recent years to the past, as some series are constructed by backward interpolation.

A.1 Private Wealth (W_{pt})

For the years 2000–2018 official and reliable data of aggregate private wealth at market value are provided by the SNB in the context of the Swiss financial account.[26]

For the period 2000–2018 private wealth can be split up into three main components: financial assets F_{pt}, financial liabilities L_{pt} and non-financial assets K_{pt}. The position financial assets particularly consist of currency and transferable deposits, debt securities (short-term, long-term and structured products), shares and other equity, units in collective investment schemes as well as insurance and pension schemes. The stock of liabilities L_{pt} is composed of mortgages, loans and other accounts payable.

For private non-financial assets K_{pt} the SNB only reports estimates on housing wealth H_{pt}. To best of our knowledge no estimates on the value of agricultural land and A_{pt} and other domestic capital D_{pt} exist for Switzerland. Therefore, in our analysis private non-financial assets consist only of housing wealth ($K_{pt} = H_{pt}$), which implies that $A_{pt} = D_{pt} = 0$.[27]

For the years prior to 2000 no official statistics on the value of net private wealth for Switzerland exist. For the period 1981–1999 we use the aggregate net private wealth estimates submitted by Schmid (2013), who could rely on SNB internal data, which are partly gathered numbers from hardcopy prints of the relevant statistics and are not publicly available.[28] Since the estimates of Schmid (2013) follow the estimation techniques of the SNB we consider this estimates to be relatively reliable.

For the years prior to 1981 we follow an alternative approach which clearly deviates from the methodology used by Piketty and Zucman (2014) and suggested by Alvaredo et al. (2017), since we are not able to observe the wealth stock for

[26] See https://data.snb.ch/en/publishingSet/FIN

[27] For the countries with which we compare our results all three components (H_{pt}, A_{pt}, D_{pt}) of K_{pt} are available on WID.world. We have excluded A_{pt} and D_{pt} for the comparison countries in Section 6, but included A_{pt} and D_{pt} in Section 5. This decision is set out in the Appendix B.2 (see in particular Figure B12 and Figure B13).

[28] Data received on email request: frank.schmid@sif.admin.ch We are very grateful to Frank Schmid for sharing his data with us.

Switzerland at market value any more. In order to provide an estimate of total private net wealth, we draw on historical tax and pension wealth data and follow an approach similar to Brülhart et al. (2018).

The primary sources we use to construct our net private wealth series are the wealth estimates based on tax data provided by Dell et al. (2007).[29] Their estimates cover 22 years between 1913 and 1997. We linearly interpolated the missing years of this period. To extend private wealth estimates back to 1900 we used additional tax data for the years 1900 and 1910 based on the assumption that taxable wealth represented 80% of taxable capital.[30] The missing years are in turn interpolated linearly, which leads to a tax wealth series covering the period 1900–1997.

Estimating net private wealth based on Swiss wealth tax data has two main drawbacks. First pension wealth is not covered at all in tax data and secondly the tax value of real estate is underestimating the true market value (Brülhart et al., 2018).

To account for the first issue we use estimates of pension fund assets to correct the private wealth series based on tax data. For this purpose, we could rely on the historical estimates of total pension fund assets as reported by Leimgruber (2008). The estimates of Leimgruber (2008) cover 13 years between 1922 and 2004. We linearly interpolated this estimates for the missing years. In 1922 total pension wealth was only 200 million nominal Swiss francs. Since there exist no older observations, we assume that the pension assets before 1922 are 0.

From the sources outlined we have two linearly interpolated series for tax wealth (1900–1997) and pension wealth (1900–2004). To estimate a long run series of total net private wealth we proceed as follows. First we add up these two linearly interpolated series. To address the second issue—the undervaluation of housing wealth in tax data—we do not use the absolute nominal value of the combined series of tax private wealth (including an optional mark-up) and pension wealth. Instead we calculate the growth rate of this combined series. By applying this growth rate to last market value observation of private wealth recorded by Schmid (2013) in 1981, we estimate private wealth back to the year 1900. Prior to 1981, we only display estimates of net private wealth for years in which we have an actual

[29] This data can be found in their paper in table 11.3 column 2.

[30] The data is obtained from the 'Statistisches Jahrbuch der Schweiz 1920' (p. 395). The assumption that taxable wealth represents 80% of taxable capital is derived by comparing the two observations of taxable capital from 1913 (81%) and 1919 (79%) with the observations reported by Dell et al. (2007).

observations from tax data (see, e.g., Figure 1).

Our estimation approach relies on the assumption that changes in taxable wealth (including private pension wealth) correspond well to changes in total private wealth at market value. To verify this assumption we compare the growth rates in total private wealth at market value (as provided by the SNB) with the growth rate of taxable wealth (including pension wealth) for the period 2003–2016, where annual data for both series exist.[31] Figure B4 shows the annual percentage change in private wealth at market value and taxable wealth (including pension wealth) for the period 2003–2016. Growth rates track each other extremely well including in the years around the outbreak of the Great Recession in 2008, which are characterized by large changes from year to year. We are therefore confident that our method is valid to estimate total private wealth at market value over time.

A.2 Public Wealth (W_{gt})

Data on public gross financial wealth, public gross non-financial wealth, public gross debt and thus public net wealth W_{gt} can be obtained for the period 1990–2018 from the GFS-Model of the Federal Finance Administration.[32] With the GFS-Model international comparability of the Swiss data is ensured, since the financial statistic standard of the International Monetary Fund (IMF) is applied, which is in turn compatible with the ESA-2010.

In the non-financial assets time series at the federal-level a significant one-time shift occurs. From 2006 to 2008 non-financial assets increased from 41.1 to 84.6 billions Swiss francs (see Figure B14). This level shift is due to a break in the series in 2008, where accounting followed the new FS-Model. The Federal Finance Administration notes itself that the new standards introduced in 2008 restricts comparability with the figures in the national FS-Model from earlier years. Since the GFS-Model is based on the FS-Model, statistical inaccuracies cannot be ruled out.[33]

[31] For taxable wealth, we use data from the Swiss wealth statistics for natural persons published annually between 2003 and 2016 by the Swiss Federal Tax Administration (see https://www.estv.admin.ch/estv/de/home/allgemein/steuerstatistiken/fachinformationen/steuerstatistiken/gesamtschweizerische-vermoegensstatistik-der-natuerlichen-person.html). For pension wealth we use the data provided by the SNB. Note that the results shown in Figure B4 are not driven by the inclusion of the pension wealth data. The omission of the pension wealth would only marginally reduces the correlation from 0.91 to 0.88.

[32] See https://www.bfs.admin.ch/bfs/en/home/statistics/general-government-finance/financial-situation/gfs-model-international-IMF.html

[33] https://www.efv.admin.ch/efv/en/home/themen/finanzstatistik/methoden.html (published on 13.04.2016).

We corrected for this brake in the series by applying the average growth rate of non-financial assets at the federal level (computed based on the years 1997–2006 and 2009–2018) for the two years 2007 and 2008. This adjustment is shown graphically in Figure B14. This leads to a more steady and plausible evolution of public non-financial assets. Note that this correction not only affects non-financial assets but also total net public wealth. Thus, since national wealth is the sum of private and public wealth this correction also slightly changes the value of national wealth.

A.3 National Wealth (W_{nt}) and Net Foreign Wealth (NFA_{nt})

Because the market-value of national wealth W_{nt} is simply the sum of private and public wealth, no additional data is needed to construct a national wealth series. Equation (3) shows that national wealth can be decompose into domestic capital K_{nt} and net foreign wealth NFA_{nt}.

For the period 2000–2018 net foreign wealth is published by the SNB as part of the Swiss balance of payments.[34] For the years 1995–1999 net foreign wealth can be obtained from published reports of the SNB. Observations on net foreign wealth for 1998 and 1999 are obtained from the publication 'Switzerland's International Investment Position 2000'.[35] For the years 1995–1997 we use net foreign wealth as reported in the 'Monthly Statistical Bulletin January 2000'.[36]

A.4 Net National Income (Y_t)

For the years 1995–2018 we use net national income as published by the FSO as part of the Swiss national accounts (B5n, S1).[37] These are the best data available, since they are fully compatible with the SNA-2008 and can therefore be compared internationally. We used growth rates of similar historical income data to calculate net national income back until 1900. In case of overlaps in the data we always prefer to calculate the growth rates based on national income at market prices. For the period 1990–1994 we use the growth rates of national income at factor cost ("Volkseinkommen") that can be found in table Q.5. from the HSSO-database.[38]

[34] See https://data.snb.ch/en/topics/aube#!/cube/auvekoma

[35] See https://www.snb.ch/en/iabout/stat/statrep/id/statpub_bopiip_all#t4; only available in French or German.

[36] See https://www.snb.ch/de/iabout/stat/statrep/statpubdis/id/statpub_statmon_arch#t2; only available in French or German.

[37] See https://www.bfs.admin.ch/bfs/en/home/statistics/national-economy/national-accounts/sequence.html

[38] See https://hsso.ch

For the years 1948–1989 we use growth rates of net national income that are also available at the HSSO-database in table Q.6a. For the period 1929–1947 there exist again data of national income at factor cost at the HSSO-database in table Q.4a. For the years 1900–1929 we had to resort on historical nominal GDP data estimated by Stohr (2016).[39]

A.5 Population (N_t)

Data on Switzerland's total population are available from the FSO for the period 1861–2018.[40] The balance of the permanent resident population is composed of different statistical sources by the FSO. Although the individual data sources change over time, this long run population series is the most reliable data available.

The population data in WID.world corresponds to the population of a country on the 1st July of the year indicated (Blanchet and Chancel, 2016). For Switzerland, no such data exists. We therefore used the average of the total population between January 1st and December 31st of the year in question. This ensures comparability across countries.

A.6 Price Index

Sometimes we show the absolute value of wealth at constant prices, rather than wealth-income ratios. To deflate the nominal wealth or national income series we use a composed consumer price index (CPI). Switzerland's CPI can be obtained for the period 1914–2018 from the FSO.[41] To prolong this series back to 1900, we used CPI data available on the HSSO-database in table H.17.[42]

A.7 Savings and Savings Rates (s_t)

The net savings flows can be directly obtained from the Swiss national accounts[43] Net saving rates are then calculated by dividing the corresponding net savings flow by net national income (B.5*n, S1). The following net savings rates are computed:

- non-financial corporate savings = (B.8n, S11)/(B.5*n, S1)
- financial corporate savings = (B.8n, S12)/(B.5*n, S1)

[39] Data received on email request: christian.stohr@unige.ch. We are very grateful to Christian Stohr for sharing his data with us.

[40] See https://www.bfs.admin.ch/bfs/en/home/statistics/catalogues-databases/tables.assetdetail.9486043.html

[41] See https://www.bfs.admin.ch/bfs/en/home/statistics/prices/consumer-price-index.html

[42] See https://hsso.ch

[43] See https://www.bfs.admin.ch/bfs/en/home/statistics/national-economy/national-accounts/sequence.html

– corporate savings = non-financial + financial corporate savings

– household savings = (B.8n, S14)/(B.5*n, S1)

– private savings = corporate savings + household savings

– public savings = (B.8n, S13)/(B.5*n, S1)

– national savings = private savings + public savings = (B.8n, S1)/(B.5*n, S1)

A.8 World Inequality Database

Most international data we show in this paper can be obtained directly from the World Inequality Database (WID.world).[44] The series for Australia, Canada, France, Germany, Italy, Japan, the U.K. and the U.S. are based on Piketty and Zucman (2014), from Artola Blanco et al. (2020) for Spain and from Waldenström (2017) for Sweden. All these have been updated and are available for download from WID.world. The corresponding data for Norway are WID.world estimates.

Further note that for the countries other than Switzerland all three subcomponents of K_{pt} (H_{pt}, A_{pt}, D_{pt}) are available. We refer to the remarks in Appendix B.2 to comprehend which adjustments we made to ensure that the international data is as comparable as possible with Switzerland.

A.9 Savings and Capital Gains in Private Wealth

In Section 7, we split the newly accrued accumulation of net national respectively private wealth (and it's two main subcomponents non-housing wealth (i.e., net financial wealth including pension wealth) and gross housing wealth) into a savings and capital gains component. This section outlines the methodological procedure and the additional sources used.

For the decomposition of national wealth shown in Table 1 we use Equation (9). The only unknown variable in Equation (9) is the rate of capital gain or loss q_t, which is simply calculated as residual. The data sources for the other variables β_{nt}, g^w_{st} and g^w_{st} variables are outlined in corresponding sections in Appendix A. For the national wealth-income $\beta_{nt} = \frac{W_{nt}}{Y_t}$ they can be found in A.3 for W_{nt} and in A.4 for Y_t. To compute the savings-induced wealth growth rate $g^w_{st} = \frac{s_t}{\beta_{nt}}$ one needs additional data on national savings as set out in A.7. The data sources of the growth rate of national income g_t are described in A.4.

[44] see https://wid.world

The decomposition of net private wealth and it's subcomponents housing wealth and non-housing wealth as shown in Table 2 is conducted as follows. By using Equation 7 the level decomposition of the year to year change in net private wealth is straightforward. By deducting the net savings flow of private households[45] (source outlined in A.7) from the year to year change in net private wealth (source of private wealth and it's subcomponents are outlined in A.1) one immediately obtains the capital gains or loss flow KG_t of net private wealth.

For the analysis conducted in Section 7 we split net private wealth into two subcomponents non-housing wealth (i.e., net financial wealth including pensions wealth, $F_{pt} - L_{pt}$) and gross housing wealth H_{pt}. Since we observe the stock at market value of both subcomponents every year since 2000, we can compute the year to year change in levels. To further split the changes of both subcomponents into savings and capital gains part, we use additional data provided by the SNB in the context of the Swiss financial accounts.[46] For the year to year change in the stock of total net financial wealth the SNB provides detailed information and decomposes the changes into financial transactions (i.e savings), capital gains and losses and statistical changes and reclassifications. Unfortunately, statistical changes and reclassifications are not insignificant and renders a clear assignment to one of the two components of interest somewhat difficult. However, around half (in absolute value) of the statistical changes and reclassifications are due to changes in pension wealth caused by emigrants who leave Switzerland with their pension assets. Since we are interested in net private wealth held by Swiss

[45] Following Piketty and Zucman (2014) we carried out the decomposition with two different savings concepts, namely the net saving rate of private households and the net private saving rate (i.e., the net saving rate of private households including retained earnings of corporations). Table 2 provides the results using the households savings rate and Table B6 shows the results using the net private savings rate. It is not a priori clear which savings rate should be used, as both concepts have their own drawbacks (for a detailed discussion see Piketty and Zucman (2013)). By excluding retained corporate earnings capital gains mechanically increase as the savings rate is lower. However, if companies retain their profits to finance new investments and new acquisitions (leading to rising share prices), this is not a real relative price effect, but rather a savings effect (Piketty and Zucman, 2013). On the other hand, if the net private savings rate is used, all retained earnings of Swiss corporations are attributed to the domestic household sector, which in turn might be problematic. Firstly, a part of the retained profits belonging to foreign shareholders will be attributed to domestic shareholders (the same applies vice versa). Furthermore, at least part of the retained earnings of domestic companies should be assigned to the government sector (Piketty and Zucman, 2013). Note that in Switzerland retained corporate profits account for less than 20% of total private net savings, which is a small share in international comparison (see Table B2). Nevertheless, the results differ depending on the savings concept used when decomposing the real private growth rate. Due to the methodology used (which is determined by data availability), the differences occur in the capital gains of the housing wealth rather than in the non-housing wealth component (as the housing wealth components are estimated as residuals). The reason why we prefer the decomposition based on the household saving rate is that otherwise there would be no capital gains in housing wealth over the period 2000-2010, which is rather inconsistent with the evolution of Swiss real estate price indices over this period (see Figure 10). Note in particular that in the 2010-2018 sub-period (in which the fast increase in the private wealth-income ratio takes place) both decompositions yield virtually identical results.

[46] See https://data.snb.ch/en/publishingSet/FIN

residents, this outflow represents negative savings. We thus deduct this part of statistical reclassification from the households savings. For the remaining part of the statistical changes and reclassifications no entirely clear allocation between savings and capital gains can be achieved. However, in order for the flows to correctly reflect the change in the stock of net financial wealth, we have included the remaining statistical changes in the capital gains component.[47]

The decomposition of housing wealth H_{pt} into savings and capital gains part is in turn straightforward. Since savings and capital gains of the two subcomponents must reflect the changes of total private net wealth at the macroeconomic level, the savings and capital gains part of housing wealth are estimated as residuals. Such that the savings (capital gains) of non-housing wealth and housing wealth add up to the savings (capital gains) of net private wealth.

A.10 Real Estate Price Index Data

We use real estate price index data as published by the OECD in September 2020.[48] As we are interested in determining the influence of changes in real estate prices on changes in the wealth-income ratio (which is a real variable), we deflate the nominal house price index using CPI data from OCED.[49]

The data are graphically represented for all countries separately in Figure 10 and B10 in levels and in Figure B15 as annual changes.

A.11 Stock Market Index Data

As with real estate prices, we use the same method for share prices. For all countries in our analysis we use the stock price index data as published by the OECD in September 2020.[50] In addition to the share price data from the individual countries, we take into account the international price development on stock markets with the MSCI World Index.[51]

Again, we deflate all share price time series with CPI data because we are interested in real changes (see Footnote 49). As the MSCI World Index is measured in USD, we use the CPI of the United States for deflation. The data are graphically

[47] This is justified by the fact that the capital gains, which are estimated as a residual, include all sorts of measurement errors anyway. These estimates are subject to revision when better data sources become available. However, the order of magnitude appears to be clear.

[48] See https://data.oecd.org/price/housing-prices.htm

[49] See https://data.oecd.org/price/inflation-cpi.htm

[50] See https://data.oecd.org/price/share-prices.htm

[51] See https://www.msci.com/end-of-day-data-search

represented for all countries separately in Figure 10 and B10 in levels and in Figure B15 as annual changes.

B Additional Tables and Figures

B.1 Additional Tables

Table B1: Structure of National Savings in Switzerland, 1995–2018

	Net private saving (household & corporate) (%)	Net household saving (%)	Net corporate saving (retained earnings) (%)	Net public saving (%)	Net national saving (%)
1995–2018	14.1	12.3	1.8	1.6	15.7
1995–2002	14.0	10.8	3.3	0.5	14.6
2002–2010	14.7	11.4	3.3	1.7	16.4
2010–2018	13.7	14.0	-0.3	2.2	15.9

Note: All average saving rates are obtained by weighting yearly saving rates by real national income. Net private savings are the sum of household and corporate savings. Net national savings are in turn the sum of private and public savings. Detailed information on savings data for Switzerland can be found in Appendix A.7.

Table B2: Structure of National Savings in International Comparison

	Net private saving (household & corporate) (%)	Net household saving (%)	Net corporate saving (retained earnings) (%)	Net public saving (%)	Net national saving (%)
Switzerland (1995–2015)	14.6	11.9	2.6	1.4	16.0
Germany (1995–2013)	11.2	6.3	4.8	-3.0	8.2
France (1995–2010)	11.1	8.5	2.6	-3.1	8.0
Italy (1995–2014)	8.4	6.4	2.0	-3.8	4.7
Sweden (1995–2015)	16.1	7.4	8.7	2.6	18.7
United States (1995–2013)	7.9	4.3	3.6	-4.8	3.1

Note: Saving rates are calculated for different time periods as savings data for certain countries are not available for the entire period: Switzerland 1995–2015; Germany 1995–2013; France 1995–2010; Italy 1995–2014; Sweden 1995–2015; United States 1995–2013. All average saving rates are obtained by weighting yearly saving rates by real national income. Net private savings are the sum of household and corporate savings. Net national savings are in turn the sum of private and public savings. Detailed information on savings data for Switzerland can be found in Appendix A.7. The results for the other countries are own calculations based on updated data which are available for download from https://wid.world. The original data for Germany, France, Italy and the United States are taken from Piketty and Zucman (2014) and for Sweden from Waldenström (2017).

Table B3: Growth and Saving Rates, 1995–2015

	Real growth rate of national income (%)	Population growth rate (%)	Real growth rate of per capita national income (%)	Net national saving (%)*	$\Delta\ \beta_{nt}$
Switzerland	1.86	0.82	1.04	16.0	+ 173 pp.
Germany	1.38	0.05	1.33	8.2	+ 58 pp.
France	1.49	0.53	0.96	8.0	+ 219 pp.
Italy	0.31	0.35	-0.04	4.7	+ 131 pp.
Sweden	3.03	0.55	2.48	18.7	+ 276 pp.
United States	2.42	0.94	1.48	3.1	+ 63 pp.

Note: This table displays the real growth rates of national income, which can be decomposed into population and per capita income growth. All growth rates are geometric averages over the period 1995–2015. Except for net national saving rates* which are calculated for different time periods as savings data for certain countries are not available for the entire period: Switzerland 1995–2015; Germany 1995–2013; France 1995–2010; Italy 1995–2014; Sweden 1995–2015; United States 1995–2013. The average saving rates are obtained by weighting yearly saving rates by real national income. The last column shows the change in percentage points (pp.) of the national wealth-income ratio β_{nt} over the period 1995–2015. Detailed information on the data for Switzerland can be found in the corresponding subsections in Appendix A. The results for the other countries are own calculations based on updated data which are available for download from https://wid.world. The original data for Germany, France, Italy and the United States are taken from Piketty and Zucman (2014) and for Sweden from Waldenström (2017).

Table B4: The Accumulation of National Wealth, 1995–2013

			Decompositon of the wealth growth rate (%)		
	National wealth-income ratios (%)		Real growth rate of national wealth	Savings-induced wealth growth rate	Capital gains induced wealth growth rate
	$\beta_{n,t}$	$\beta_{n,t+n}$	g_w	$g_{ws} = \frac{s}{\beta_n}$	q
Switzerland	504%	644%	3.2%	2.9% 90%	0.3% 10%
Germany	342%	388%	2.1%	2.2% 106%	-0.1% -6%
Italy	379%	544%	2.3%	1.2% 52%	1.1% 48%
Sweden	233%	475%	6.9%	5.4% 78%	1.5% 22%
United States	350%	384%	2.9%	0.8% 28%	2.1% 72%

Note: This table displays changes in national wealth W_{nt} for the indicated countries between 1995 and 2013. The first two columns indicate the level of the national wealth-income ratio β_{nt} in 1995 respectively 2013. The third column shows the average real growth rate of national wealth g_w. With the formula in equation (9) it is possible to decompose the real growth rate of national wealth g_w into two multiplicative components. Where one part of the national wealth growth rate is savings-induced g_s^w and the other part are capital gains or losses q. All growth rates are geometric averages. Detailed information on the data for Switzerland can be found in the corresponding subsections in Appendix A. The results for the other countries are own calculations based on updated data which are available for download from https://wid.world. The original data for Germany, France, Italy and the United States are taken from Piketty and Zucman (2014) and for Sweden from Waldenström (2017).

Table B5: The Accumulation of National Wealth in Switzerland, 2000–2018

	Wealth-income ratios (%)		Decomposition of the real wealth growth rate (%)		
			Real growth rate of wealth	Savings-induced wealth growth rate	Capital gains induced wealth growth rate
	β_t	β_{t+n}	g_w	$g_{ws} = s/\beta$	q
2000–2018					
National Wealth	551%	742%	3.1%	2.7% (89)	0.3% (11)
Public Wealth	25%	55%	5.8%	6.7% (115)	-0.9% (-15)
Private Wealth	526%	687%	2.9%	2.2% (76)	0.7% (24)
2000–2010					
National Wealth	551%	542%	1.6%	2.9% (177)	-1.3% (-77)
Public Wealth	25%	25%	1.5%	7.3% (475)	-5.7% (-375)
Private Wealth	526%	517%	1.6%	2.1% (130)	-0.5% (-30)
2010–2018					
National Wealth	542%	742%	4.9%	2.5% (52)	2.4% (48)
Public Wealth	25%	55%	11.4%	6.0% (53)	5.4% (47)
Private Wealth	517%	687%	4.5%	2.3% (51)	2.2% (49)

Note: This table displays the changes in national wealth $W_{n,t}$ and its two main subcomponents —net private wealth, $W_{p,t}$, and net public wealth $W_{g,t}$—between 2000 and 2018. The first two columns indicate the level of the different wealth-income ratios $\beta_{n,t}$, $\beta_{p,t}$ and $\beta_{g,t}$ respectively for the corresponding periods. The third column shows the average real growth rate g_w of the respective wealth components over the different time periods. With the formula in Equation (9) it is possible to decompose the real wealth growth rate g_w into two multiplicative components. Where one part of the wealth growth rate is savings-induced g_s^w and the other part are capital gains or losses q. The small numbers below the growth rates in columns 5 and 6 indicate the share in the total average real growth rate g_w. Note that the saving rate used in the above decomposition for the private wealth component is the net saving rate of private households. The results of the same decomposition using the net private saving rate (including retained earnings of corporations) is shown in Table B6 (see in this context also Footnote 45). All growth rates are geometric averages. Detailed information on the data used can be found in the corresponding subsections in Appendix A.

Table B6: The Accumulation of Private Wealth in Switzerland, 2000–2018

	Private wealth-income ratios (%)		Decomposition of the private wealth growth rate (%)		
			Real growth rate of national wealth	Savings-induced wealth growth rate	Capital gains induced wealth growth rate
	$\beta_{p,t}$	$\beta_{p,t+n}$	g_w	$g_{ws} = s/\beta_p$	q
2000–2018					
Total Private Wealth	526%	687%	2.9%	2.5% 87	0.4% 13
Housing Wealth	248%	380%	3.8%	2.8% 74	1.0% 26
Non-Housing Wealth	278%	307%	1.9%	2.2% 113	-0.3% -13
2000–2010					
Total Private Wealth	526%	517%	1.6%	2.7% 163	-1.0% -63
Housing Wealth	248%	275%	2.9%	3.0% 102	-0.1% -2
Non-Housing Wealth	278%	242%	0.4%	2.4% 625	-2.0% -525
2010–2018					
Total Private Wealth	517%	687%	4.5%	2.3% 52	2.1% 48
Housing Wealth	275%	380%	5.0%	2.7% 54	2.3% 46
Non-Housing Wealth	242%	307%	3.9%	1.9% 48	2.0% 52

Note: This table displays the changes in private net wealth $W_{p,t}$ and its to main subcomponents—private housing (H_{pt}) and non-housing wealth ($F_{pt} - L_{pt}$)–between 2000 and 2018. The first two columns indicate the level of the total private wealth-income ratio $\beta_{p,t}$, the housing wealth-income ratio and the non-housing wealth-income ratio respectively for the corresponding years. The third column shows the average real growth rate g_w of the respective wealth components over the different time periods. With the formula in Equation (9) it is possible to decompose the real wealth growth rate g_w into two multiplicative components. Where one part of the wealth growth rate is savings-induced g_s^w and the other part are capital gains or losses q. The small numbers below the growth rates in columns 5 and 6 indicate the share in the total average real growth rate g_w. The methodology used to decompose the changes of the depicted private wealth categories into a savings and capital gains component is described in detail in Section A.9 in the Appendix. Note that the saving rate used in the above decomposition is the net private saving rate (i.e., including retained earnings of corporations).The results of the same decomposition using the net saving rate of private households is shown in Table 2 (see in this context also Footnote 45). All growth rates are geometric averages. Detailed information on the data can be found in the corresponding subsections in Appendix A.

Table B7: Panel Regressions of Private Wealth-Income Ratios on Stock and House Prices

	(1)		(2)		(3)		(4)	
1970-2018								
Pooled OLS								
House prices	0.21***	(0.04)			0.20***	(0.04)	0.20***	(0.04)
Share prices			0.05***	(0.02)	0.04**	(0.02)	0.03	(0.02)
MSCI world							0.03	(0.02)
Adj. R^2	0.103		0.058		0.155		0.158	
Obs.	485		471		471		471	
Year FE								
House prices	0.22***	(0.03)			0.23***	(0.02)	0.23***	(0.02)
Share prices			0.03	(0.02)	0.03	(0.02)	0.03	(0.02)
MSCI world							0.00	(.)
Adj. R^2	0.167		0.093		0.190		0.190	
Obs.	483		469		469		469	
Country FE								
House prices	0.21***	(0.04)			0.21***	(0.04)	0.20***	(0.04)
Share prices			0.05***	(0.02)	0.05**	(0.02)	0.03	(0.02)
MSCI world							0.03	(0.02)
Adj. R^2	0.097		0.052		0.150		0.153	
Obs.	485		471		471		471	
1990-2018								
Pooled OLS								
House prices	0.27***	(0.06)			0.25***	(0.06)	0.25***	(0.06)
Share prices			0.05**	(0.02)	0.04	(0.03)	-0.00	(0.03)
MSCI world							0.08	(0.04)
Adj. R^2	0.127		0.046		0.148		0.166	
Obs.	306		306		306		306	
Year FE								
House prices	0.31***	(0.05)			0.32***	(0.05)	0.32***	(0.05)
Share prices			0.01	(0.03)	-0.01	(0.03)	-0.01	(0.03)
MSCI world							0.00	(.)
Adj. R^2	0.253		0.120		0.251		0.251	
Obs.	304		304		304		304	
Country FE								
House prices	0.26***	(0.07)			0.24***	(0.07)	0.24***	(0.07)
Share prices			0.05*	(0.02)	0.04	(0.03)	-0.00	(0.03)
MSCI world							0.08*	(0.04)
Adj. R^2	0.112		0.042		0.134		0.154	
Obs.	306		306		306		306	

Note: The table shows alternative specifications for the panel regressions in the bottom Panel B of Table 3. The table in turn reports the results for OLS regressions of changes in private wealth-income ratios on changes in real house prices (Column 1), changes in real share prices (Column 2) and both (Column 3). Column (4) further includes the global MSCI world share price index as a control. In the "Year FE" specification, the coefficient for the MSCI World is zero, as the effect is fully absorbed by the fixed effects. See Figure B15 for details on data availability by country. We use house price (see Appendix A.10) and share price indices (see Appendix A.11) as published by the OECD in September 2020. Residuals in all models are stationary. Two-way clustered standard errors by country and year are shown in parentheses, next to coefficients. * p<.1, ** p<.05, *** p<.01.

Table B8: OLS Regressions of Wealth-Income Ratios on Stock and House Prices, 1970–2018

	(1)		(2)		(3)		(4)	
Switzerland								
House prices	-0.05	(0.10)			-0.05	(0.10)	-0.07	(0.11)
Share prices			0.04	(0.03)	0.04	(0.03)	0.02	(0.06)
MSCI world							0.03	(0.07)
Constant	1.00*	(0.56)	0.74	(0.55)	0.84	(0.58)	0.84	(0.58)
Adj. R^2	-0.017		0.011		-0.011		-0.029	
Obs.	48		49		48		48	
France								
House prices	0.36***	(0.06)			0.34***	(0.05)	0.35***	(0.05)
Share prices			0.05**	(0.02)	0.04**	(0.01)	0.06**	(0.02)
MSCI world							-0.03	(0.03)
Constant	1.50***	(0.31)	2.00***	(0.39)	1.38***	(0.30)	1.42***	(0.30)
Adj. R^2	0.469		0.090		0.525		0.528	
Obs.	45		45		45		45	
Italy								
House prices	0.20***	(0.07)			0.21***	(0.07)	0.17**	(0.07)
Share prices			0.02	(0.02)	0.02	(0.02)	0.04	(0.03)
MSCI world							-0.06	(0.06)
Constant	2.40***	(0.63)	2.67***	(0.67)	2.33***	(0.63)	2.57***	(0.67)
Adj. R^2	0.156		-0.006		0.159		0.161	
Obs.	45		46		45		45	
Spain								
House prices	0.22***	(0.06)			0.32***	(0.04)	0.33***	(0.04)
Share prices			0.03	(0.03)	-0.01	(0.02)	-0.05	(0.03)
MSCI world							0.07	(0.05)
Constant	0.98	(0.65)	2.24***	(0.78)	1.29***	(0.46)	1.17**	(0.47)
Adj. R^2	0.221		0.008		0.675		0.686	
Obs.	43		29		29		29	
Japan								
House prices	0.55***	(0.09)			0.46***	(0.08)	0.46***	(0.09)
Share prices			0.12***	(0.03)	0.07***	(0.03)	0.07*	(0.04)
MSCI world							0.02	(0.05)
Constant	2.19***	(0.50)	1.73***	(0.60)	1.88***	(0.47)	1.86***	(0.48)
Adj. R^2	0.482		0.273		0.560		0.551	
Obs.	45		45		45		45	
Sweden								
House prices	0.19	(0.17)			0.17	(0.17)	0.16	(0.17)
Share prices			0.10**	(0.05)	0.08	(0.05)	0.06	(0.07)
MSCI world							0.05	(0.11)
Constant	1.67	(1.18)	1.08	(1.15)	1.06	(1.22)	1.10	(1.23)
Adj. R^2	0.006		0.064		0.041		0.023	
Obs.	46		47		46		46	

	(1)		(2)		(3)		(4)	
Australia								
House prices	0.16**	(0.07)			0.17**	(0.07)	0.18**	(0.07)
Share prices			0.06**	(0.03)	0.06**	(0.03)	0.02	(0.04)
MSCI world							0.05	(0.04)
Constant	1.11**	(0.47)	1.45***	(0.42)	0.99**	(0.46)	0.85*	(0.47)
Adj. R^2	0.082		0.070		0.156		0.164	
Obs.	44		45		44		44	
Canada								
House prices	-0.15	(0.10)			-0.17	(0.11)	-0.22*	(0.11)
Share prices			-0.01	(0.04)	0.01	(0.04)	-0.05	(0.06)
MSCI world							0.10*	(0.06)
Constant	2.44***	(0.64)	2.14***	(0.64)	2.42***	(0.65)	2.29***	(0.63)
Adj. R^2	0.046		-0.033		0.015		0.087	
Obs.	30		30		30		30	
United Kingdom								
House prices	0.21***	(0.05)			0.19***	(0.05)	0.16***	(0.05)
Share prices			0.10***	(0.04)	0.09**	(0.03)	0.02	(0.06)
MSCI world							0.07	(0.06)
Constant	1.12**	(0.51)	1.63***	(0.52)	0.99**	(0.48)	1.04**	(0.49)
Adj. R^2	0.262		0.132		0.353		0.347	
Obs.	46		46		46		45	
United States								
House prices	0.46***	(0.15)			0.27**	(0.11)	0.25**	(0.12)
Share prices			0.24***	(0.03)	0.23***	(0.03)	0.20**	(0.07)
MSCI world							0.03	(0.07)
Constant	0.75	(0.64)	0.30	(0.47)	0.06	(0.46)	0.08	(0.47)
Adj. R^2	0.151		0.527		0.569		0.561	
Obs.	45		46		45		45	

Note: The table shows results for OLS regressions of percentage changes in wealth-income ratios on percentage changes in real house prices, real share prices, and real the MSCI world stock index, respectively, by country. We use house price (see Appendix A.10) and share price indices (see Appendix A.11) as published by the OECD in September 2020. Period of analysis are the years 1970–2018 or the latest year with available data (see Figure B15 for details on data availability by country). We regress the change in wealth-income ratios either on real house or share prices in the respective country (columns 1 and 2), on both (column 3), and on changes in the MSCI world share price index (column 4). Residuals in all models are stationary. Standard errors shown in parentheses, next to coefficients. * p<.1, ** p<.05, *** p<.01.

Table B9: OLS Regressions of Wealth-Income Ratios on Stock and House Prices, 1990–2018

	(1)		(2)		(3)		(4)	
Switzerland								
House prices	0.34*	(0.18)			0.35*	(0.18)	0.28	(0.19)
Share prices			0.05	(0.05)	0.05	(0.05)	-0.04	(0.08)
MSCI world							0.14	(0.11)
Constant	1.00	(0.74)	0.70	(0.83)	0.67	(0.79)	0.77	(0.78)
Adj. R^2	0.080		-0.004		0.092		0.116	
Obs.	29		29		29		29	
France								
House prices	0.45***	(0.06)			0.44***	(0.06)	0.44***	(0.06)
Share prices			0.05	(0.03)	0.02	(0.02)	-0.00	(0.04)
MSCI world							0.04	(0.05)
Constant	1.58***	(0.36)	2.29***	(0.61)	1.52***	(0.37)	1.50***	(0.37)
Adj. R^2	0.687		0.043		0.688		0.683	
Obs.	26		26		26		26	
Italy								
House prices	0.31**	(0.13)			0.31**	(0.13)	0.29**	(0.14)
Share prices			-0.00	(0.04)	0.01	(0.04)	0.02	(0.05)
MSCI world							-0.04	(0.09)
Constant	2.30***	(0.73)	2.42***	(0.81)	2.29***	(0.74)	2.38***	(0.79)
Adj. R^2	0.159		-0.041		0.123		0.091	
Obs.	26		26		26		26	
Spain								
House prices	0.39***	(0.05)			0.39***	(0.05)	0.43***	(0.05)
Share prices			0.04	(0.04)	0.00	(0.02)	-0.06**	(0.03)
MSCI world							0.13***	(0.05)
Constant	1.27***	(0.42)	1.72**	(0.78)	1.26***	(0.43)	1.06**	(0.38)
Adj. R^2	0.722		0.013		0.710		0.784	
Obs.	25		25		25		25	
Japan								
House prices	-0.02	(0.14)			-0.02	(0.14)	-0.02	(0.14)
Share prices			0.02	(0.02)	0.02	(0.02)	0.03	(0.03)
MSCI world							-0.03	(0.05)
Constant	0.13	(0.53)	0.18	(0.46)	0.15	(0.53)	0.23	(0.56)
Adj. R^2	-0.041		-0.014		-0.058		-0.092	
Obs.	26		26		26		26	
Sweden								
House prices	0.10	(0.24)			-0.03	(0.25)	-0.03	(0.26)
Share prices			0.11	(0.07)	0.12	(0.07)	0.11	(0.13)
MSCI world							0.01	(0.21)
Constant	2.95*	(1.73)	2.42	(1.54)	2.51	(1.70)	2.52	(1.74)
Adj. R^2	-0.033		0.065		0.026		-0.016	
Obs.	27		27		27		27	

	(1)		(2)		(3)		(4)	
Norway								
House prices	0.22	(0.23)			0.59**	(0.28)	0.51*	(0.29)
Share prices			-0.04	(0.05)	-0.12*	(0.06)	-0.16**	(0.07)
MSCI world							0.12	(0.11)
Constant	0.98	(1.70)	2.70**	(1.16)	0.08	(1.64)	0.56	(1.70)
Adj. R^2	-0.003		-0.017		0.131		0.136	
Obs.	22		22		22		22	
Germany								
House prices	-0.04	(0.21)			-0.03	(0.22)	-0.05	(0.22)
Share prices			0.01	(0.03)	0.01	(0.03)	0.03	(0.05)
MSCI world							-0.04	(0.07)
Constant	1.19**	(0.54)	1.14**	(0.55)	1.14*	(0.56)	1.16*	(0.57)
Adj. R^2	-0.038		-0.035		-0.077		-0.106	
Obs.	27		27		27		27	
Australia								
House prices	0.25*	(0.13)			0.18	(0.11)	0.17	(0.12)
Share prices			0.18***	(0.05)	0.16***	(0.05)	0.21**	(0.09)
MSCI world							-0.05	(0.08)
Constant	1.18	(0.78)	1.42**	(0.62)	0.91	(0.68)	0.98	(0.70)
Adj. R^2	0.096		0.290		0.337		0.317	
Obs.	25		25		25		25	
Canada								
House prices	-0.22	(0.18)			-0.25	(0.19)	-0.23	(0.19)
Share prices			-0.00	(0.06)	0.03	(0.06)	-0.08	(0.10)
MSCI world							0.14	(0.10)
Constant	2.69***	(0.87)	2.28**	(0.87)	2.63***	(0.90)	2.80***	(0.89)
Adj. R^2	0.026		-0.053		-0.018		0.027	
Obs.	21		21		21		21	
United Kingdom								
House prices	0.19**	(0.08)			0.15**	(0.07)	0.16*	(0.08)
Share prices			0.18***	(0.05)	0.16***	(0.05)	0.17	(0.12)
MSCI world							-0.01	(0.11)
Constant	1.60**	(0.65)	1.64***	(0.57)	1.31**	(0.55)	1.31**	(0.56)
Adj. R^2	0.143		0.317		0.410		0.383	
Obs.	26		26		26		26	
United States								
House prices	0.64***	(0.18)			0.43***	(0.10)	0.41***	(0.10)
Share prices			0.33***	(0.05)	0.29***	(0.04)	0.18**	(0.08)
MSCI world							0.11	(0.08)
Constant	0.81	(0.80)	-0.39	(0.62)	-0.46	(0.48)	-0.26	(0.49)
Adj. R^2	0.329		0.653		0.793		0.801	
Obs.	26		26		26		26	

Note: The table shows results for OLS regressions of percentage changes in wealth-income ratios on percentage changes in real house prices, real share prices, and real the MSCI world stock index, respectively, by country. We use house price (see Appendix A.10) and share price indices (see Appendix A.11) as published by the OECD in September 2020. Period of analysis are the years 1990–2018 or the latest year with available data (see Figure B15 for details on data availability by country). We regress the change in wealth-income ratios either on real house or share prices in the respective country (columns 1 and 2), on both (column 3), and on changes in the MSCI world share price index (column 4). Residuals in all models are stationary. Standard errors shown in parentheses, next to coefficients. * p<.1, ** p<.05, *** p<.01.

B.2 Additional Figures

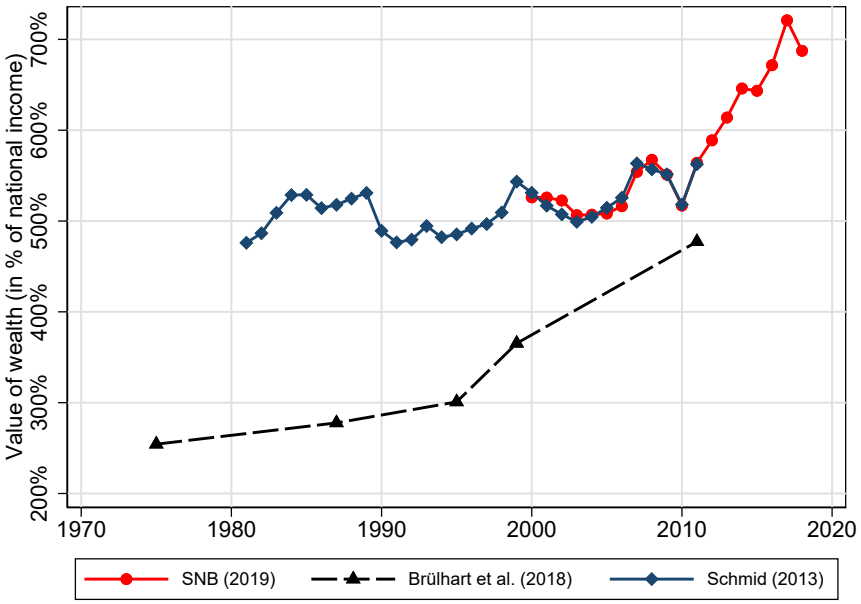
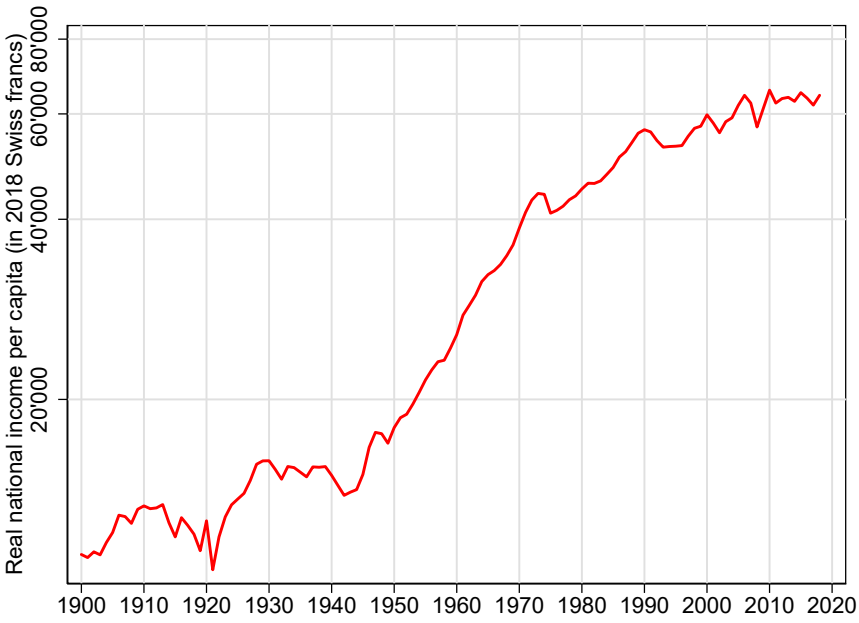
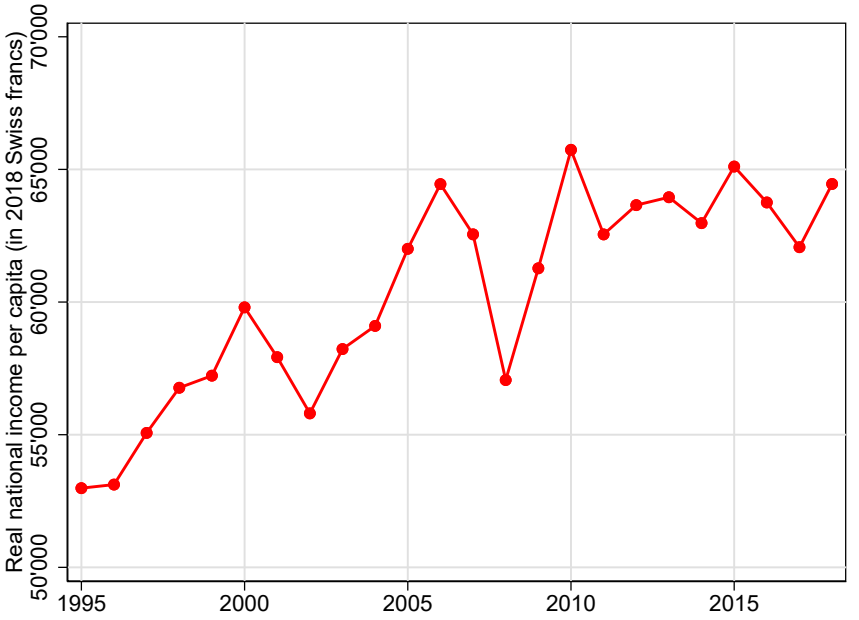


Figure B1: Different Private Wealth Estimates for Switzerland, 1975–2018

Note: This figure displays different estimates of private wealth measured in national income for Switzerland from 1975 to 2018. The red line shows the private wealth estimates at market value which are provided by the SNB in the context of the Swiss financial account. The dark blue line displays the aggregate net private wealth estimates submitted by Schmid (2013), who could rely on SNB internal data, which are partly gathered numbers from hardcopy prints of the relevant statistics and are not publicly available. Finally the black line shows net private wealth estimates of Brülhart et al. (2018), which are mainly based on wealth tax statistics.



(a) 1900–2018



(b) 1995–2018

Figure B2: Real Net National Income per Capita in Switzerland

Note: This figure shows Switzerland's real per capita national income. Nominal net national income is deflated by the Swiss CPI (A.6) and divided by the total population of Switzerland (A.5) in the corresponding year. Thus, the figure displays the average real net national income of Switzerland, expressed in 2018 Swiss francs.

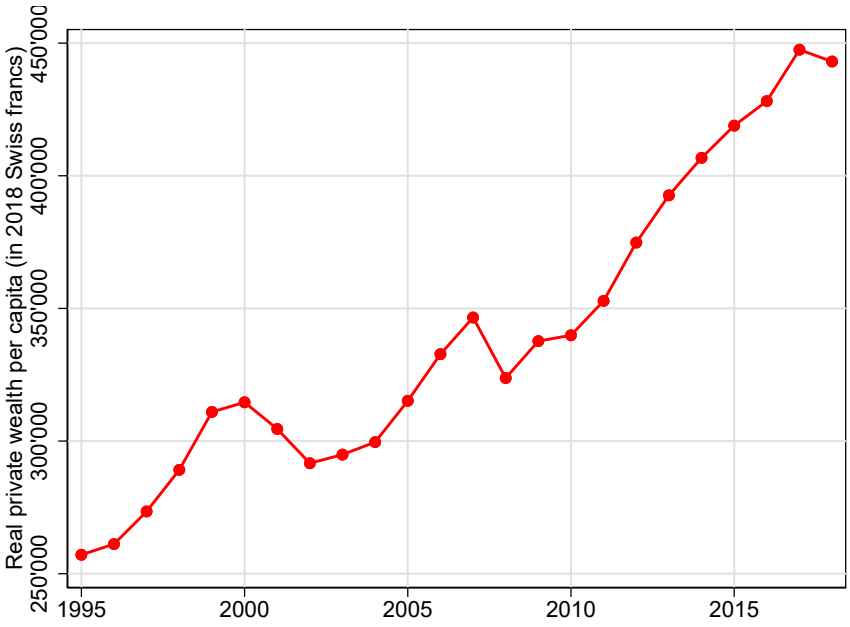


Figure B3: Real Private Wealth per Capita in Switzerland, 1995–2018

Note: This figure displays the evolution of real private wealth per capita in Switzerland between 1995 and 2018. The total nominal private wealth series is deflated by the Swiss CPI (A.6) and divided by the total population of Switzerland (A.5) in the corresponding year. Thus, the figure shows the average real net private of wealth of Switzerland, expressed in 2018 Swiss francs.

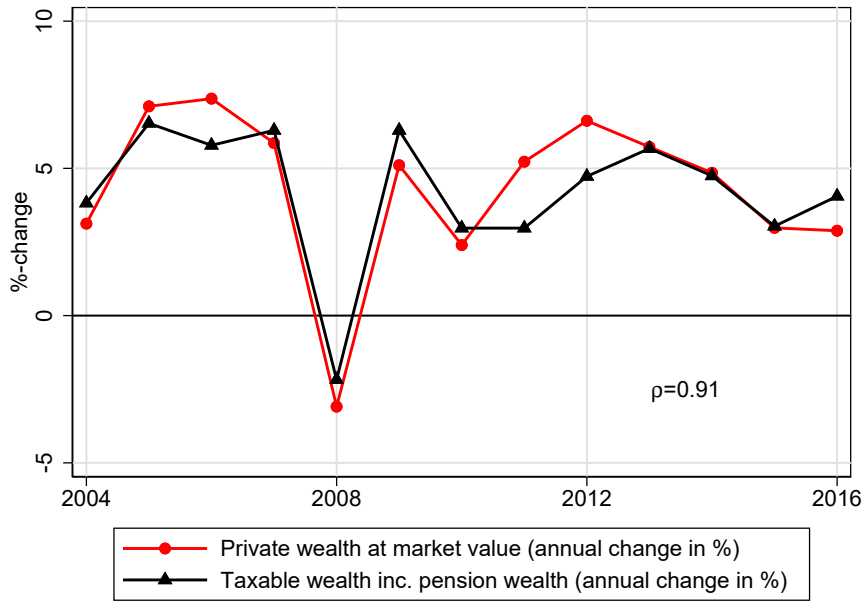


Figure B4: Annual Percentage Change in Taxable Wealth (including Pension Wealth) and Total Private Wealth at Market Value, 2003–2016

Note: This figure shows the annual change in total wealth at market values published by the SNB (red line with circles) and taxable wealth plus private pension wealth (black line with triangles) for the years where the two wealth series overlap. While these wealth series differ in levels, the figure shows that their annual growth rates are very similar.

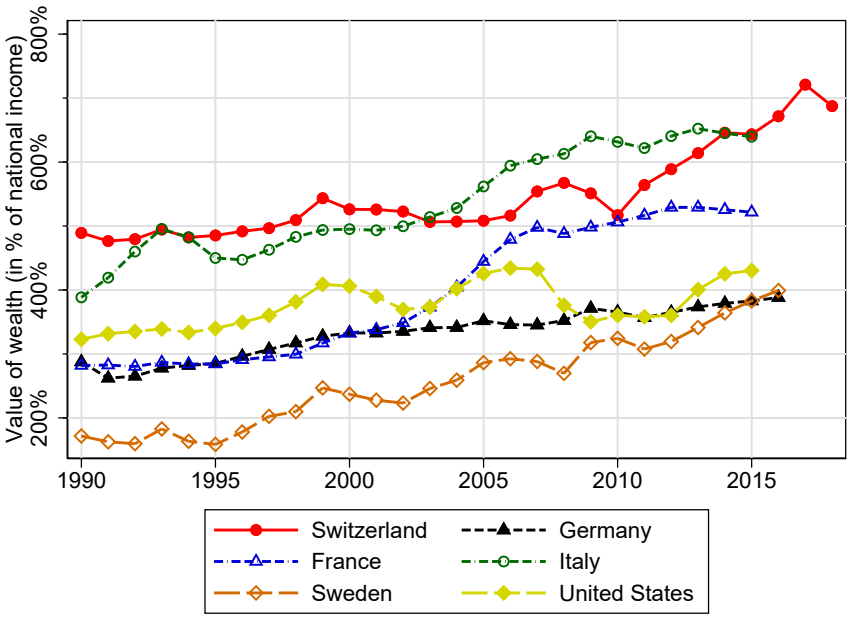
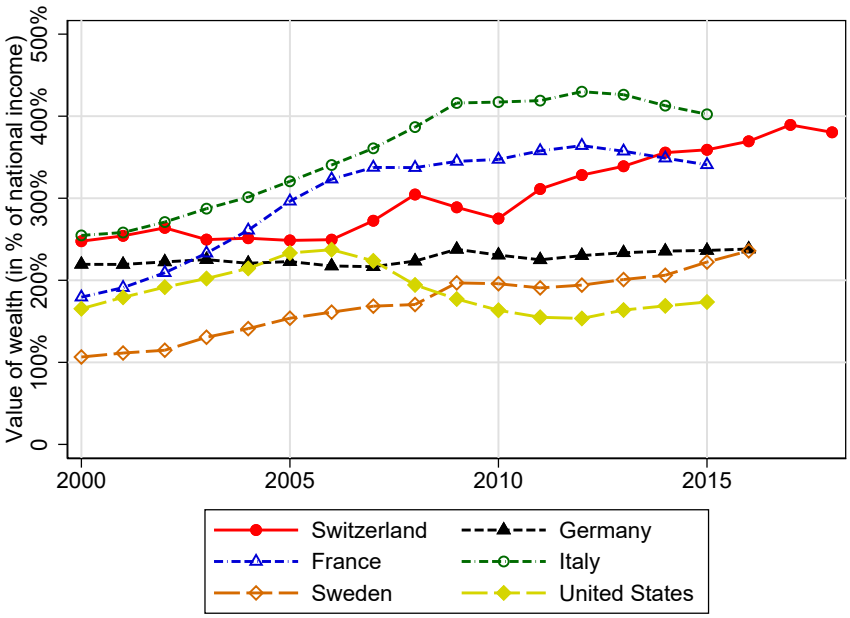
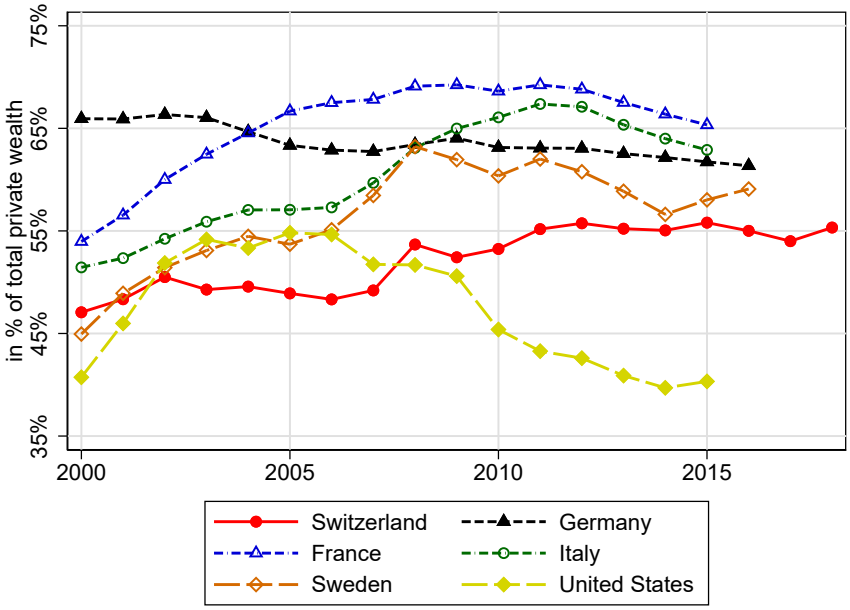


Figure B5: Private Wealth-Income Ratios in International Comparison, 1990–2018

Note: This figure shows the evolution of the private wealth-income ratio β_{pt} for several countries from 1990 to 2018. β_{pt} is derived by dividing total net household wealth—i.e., the sum of private non-financial assets (consisting only of housing wealth) and financial assets minus financial liabilities—by national income, Y_t. The data sources for Switzerland are described in detail in Appendix A.1. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.



(a) Housing Wealth-Income Ratio



(b) Housing Wealth as Share of Total Net Private Wealth

Figure B6: Housing Wealth H_{pt} in International Comparison, 2000-2018

Note: Panel a) displays the evolution of the housing wealth H_{pt} measured in national income Y_t for the countries indicated from 2000 to 2018. Where the private housing wealth-income ratio is derived by dividing total gross housing assets of private households by national income. Panel b) shows the development of housing wealth H_{pt} as a share of total private wealth W_{pt} for the same period and countries. The data sources for Switzerland are described in detail in A.1. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

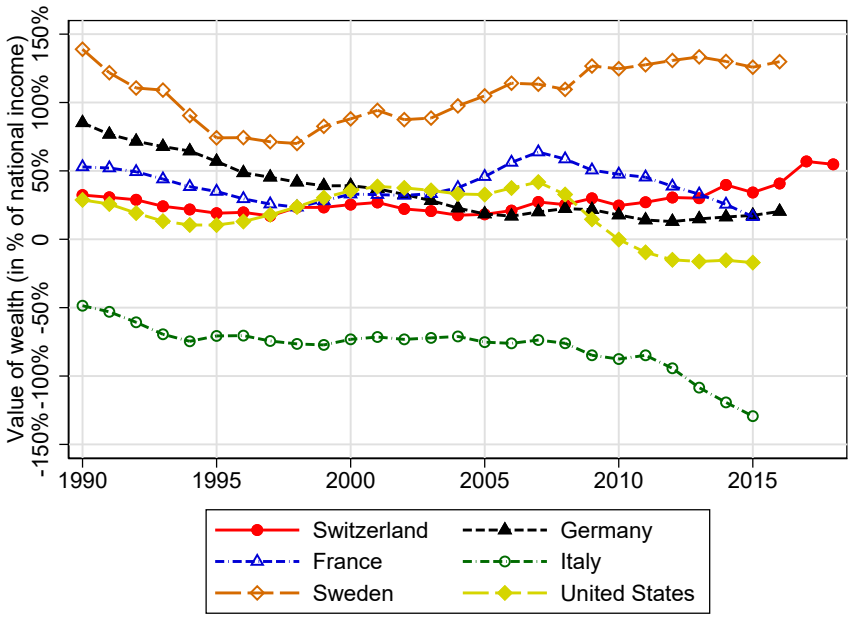
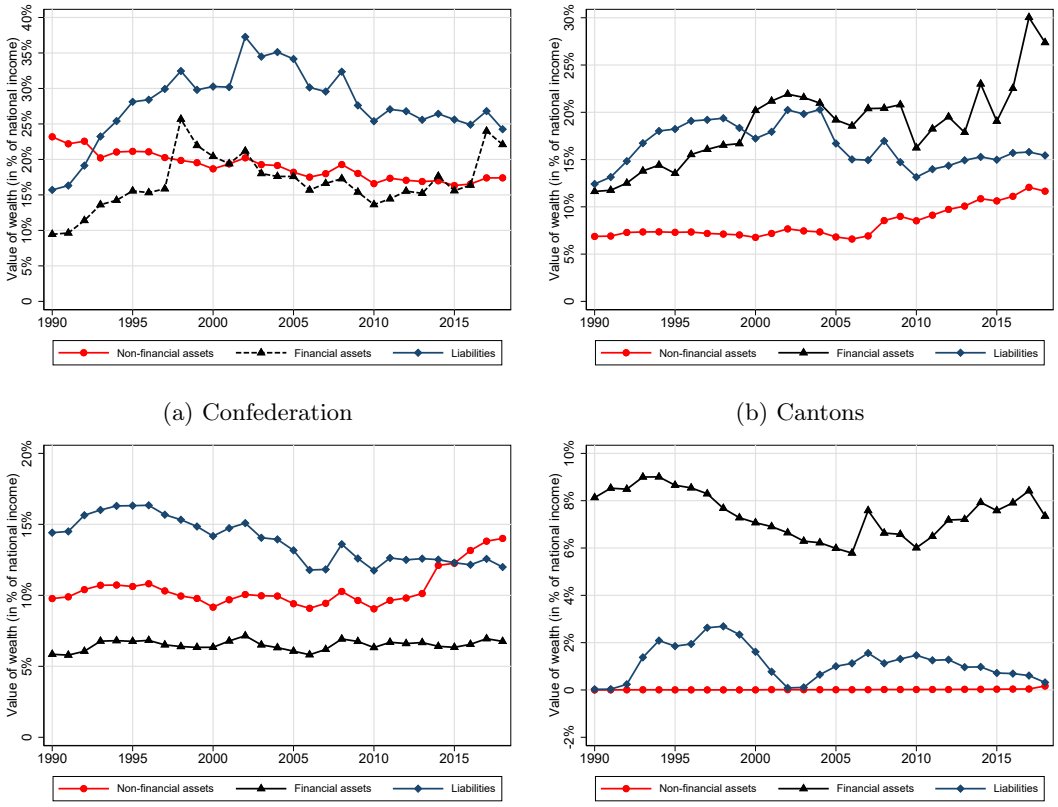


Figure B7: Public Wealth-Income Ratios, 1990–2018

Note: This figure displays the evolution of the public wealth-income ratio β_{gt} for the countries indicated from 1990 to 2018. Where β_{gt} is derived by dividing the sum of public non-financial assets K_{gt}, public financial assets F_{gt} minus public financial liabilities L_{gt} by national income Y_t. The data sources for Switzerland are described in detail in the A.2. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.



(a) Confederation

(b) Cantons

(c) Municipalities

(d) Social Security Funds

Figure B8: Decomposition of Public Wealth in Switzerland by Government-levels, 1990–2018

Note: This figure shows the development of three main components of public assets W_{gt}—Public non-financial assets K_{gt}, public financial assets F_{gt} and public financial liabilities L_{gt}—for the period 1990–2018 measured by national income Y_t separately for each government level. In addition to the three government levels of Switzerland—the federal level, the cantonal level (state level) and the municipality level—we display the evolution of the state-owned social security funds. Note that public financial liabilities L_{gt} are actually negative. To obtain net public wealth W_{gt} one has to subtract L_{gt} from the sum of K_{gt} and F_{gt}. The data sources are described in detail in Appendix A.2.

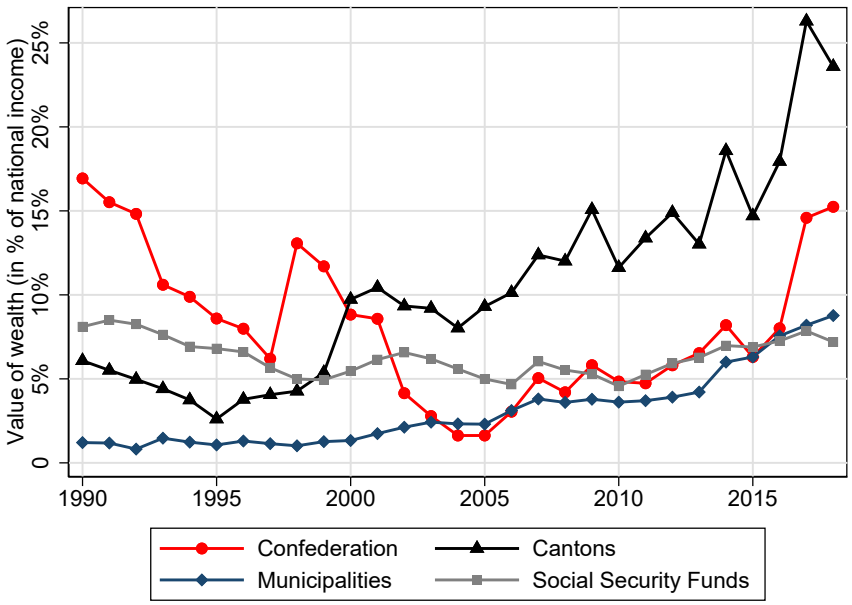


Figure B9: Public Wealth-Income Ratios in Switzerland by Government-level, 1990–2018

Note: This figure shows the evolution of net public wealth by the different government-levels of Switzerland expressed in terms of national income Y_t from 1990 to 2018. The data sources are described in detail in Appendix A.2.

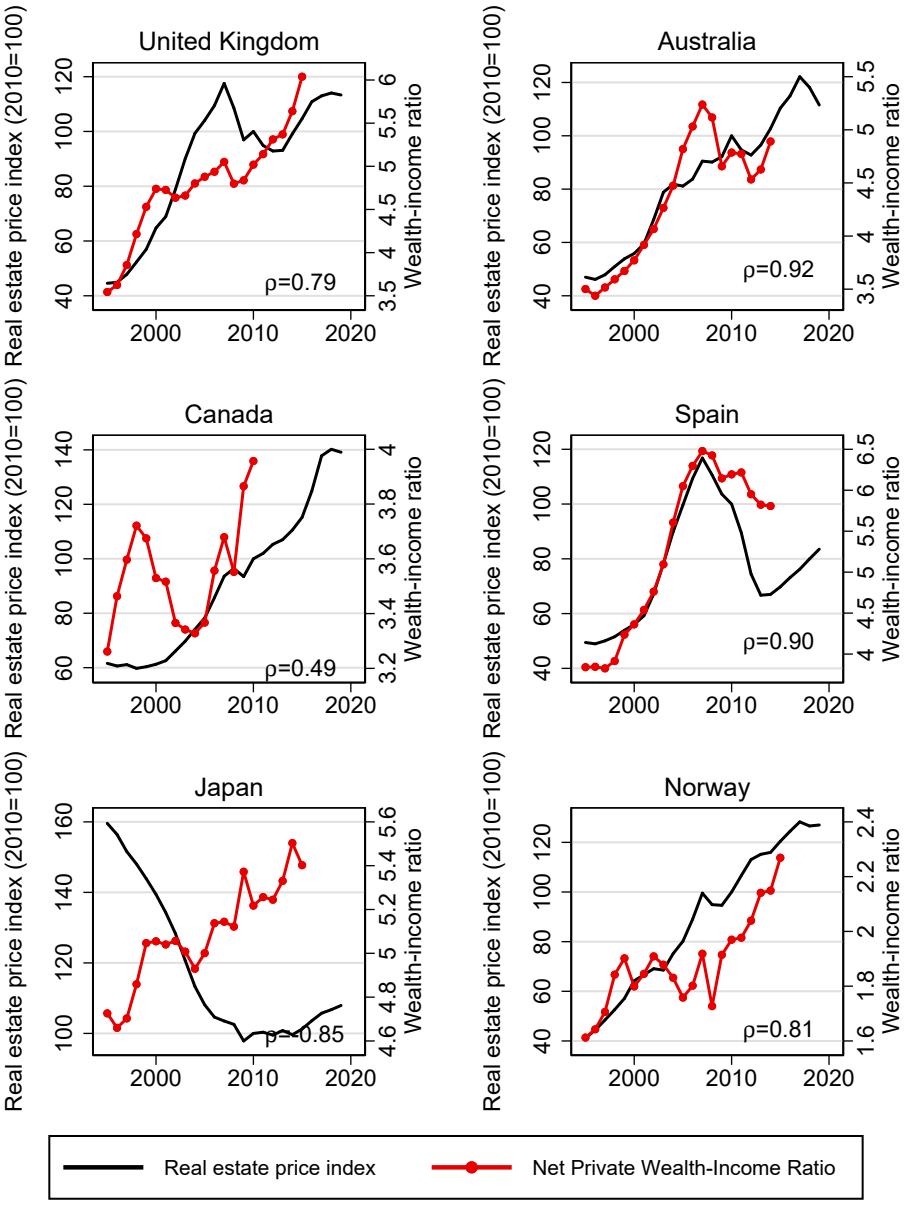


Figure B10: Wealth-Income Ratios and Real Estate Price Indices, 1995–2017

Note: This figure shows private wealth-income ratios in the U.K., Australia, Canada, Spain, Japan and Norway along with real house price indices of each of those countries. The price indices were obtained online from the OECD in September 2020. The data for the real house price indices are described in Appendix A.10. All international private wealth-income ratios data is available for download at https://wid.world.

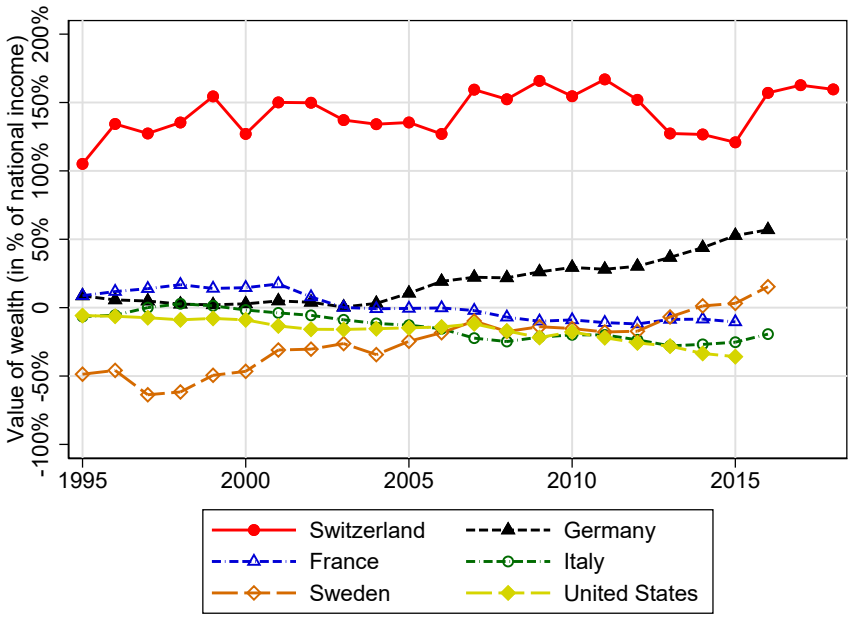


Figure B11: Evolution of Net Foreign Wealth, 1995–2018

Note: This figure displays the evolution of net foreign wealth NFA_{nt} expressed in terms of national income Y_t for the countries indicated from 1995 to 2018. The data sources for Switzerland are described in detail in the A.3. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

Remarks on the International Non-Financial Assets (K_{pt}) Data

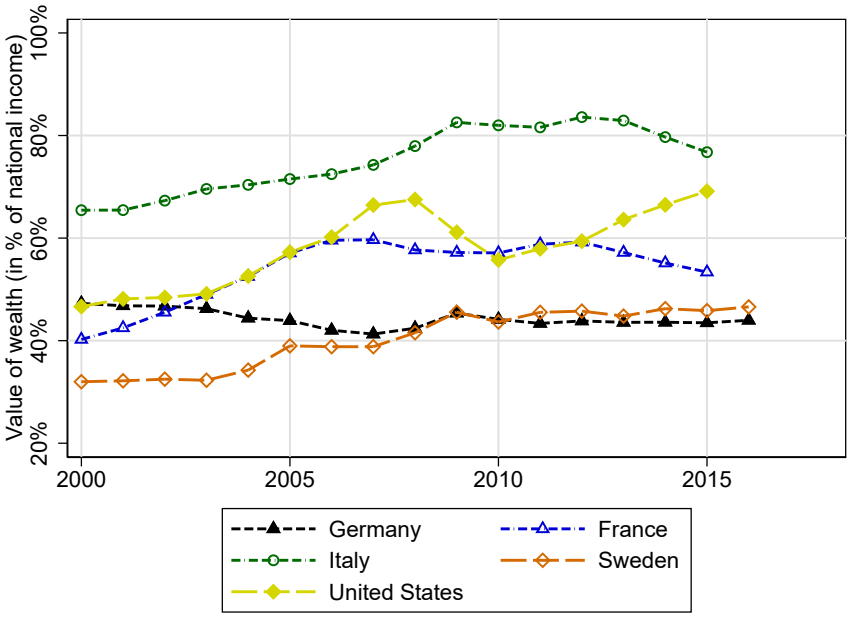


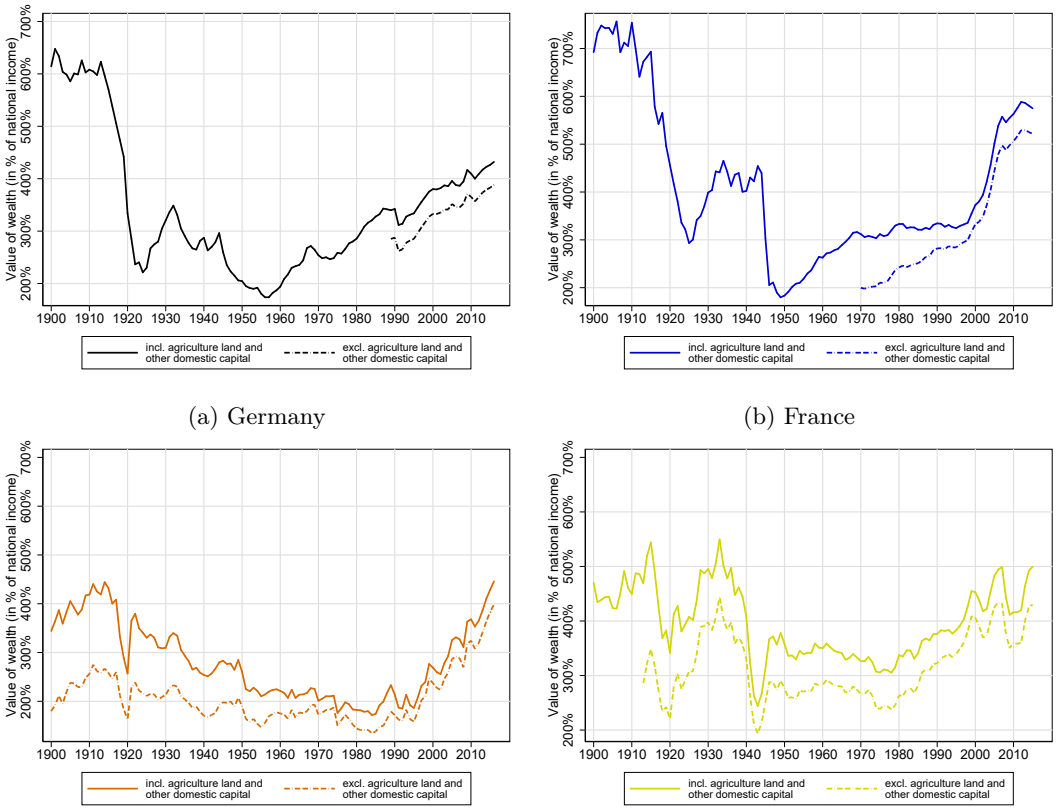
Figure B12: Agriculture Land & other Domestic Capital, 2000–2016

Note: This figure displays the evolution of the sum of agricultural land A_{pt} and other domestic capital D_{pt} in terms of net national income Y_t for the countries indicated from 2000 to 2016. We subtract this ratio from β_{pt} and β_{nt} in Section 6 in order to compare the evolution of these countries with Switzerland, where no data for A_{pt} and D_{pt} exist. The series for Germany, France, Italy and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

As described in the data section 4, there exist no estimates on the value of agricultural land A_{pt} and other domestic capital D_{pt} for Switzerland. Therefore, private non-financial assets K_{pt} consist only of housing wealth H_{pt}, such that $A_{pt} = D_{pt} = 0$. Since we want to compare Switzerland's total net private wealth W_{pt} with those of other countries in which private non-financial assets K_{pt} also include A_{pt} and D_{pt}, it seems plausible to deduct A_{pt} and D_{pt} from total private net wealth W_{pt} for the reference countries. Figure B12 shows the value of $A_{pt} + D_{pt}$ in terms of national income for the reference countries. Note that if we subtract $A_{pt} + D_{pt}$ from W_{pt} their net national wealth also decreases. This ensures that we actually compare like with like. We thus deduct A_{pt} and D_{pt} from net wealth W_{pt} of the benchmark countries for the period in which we are able to observe net private wealth for Switzerland at market value (Section 6).

In Section 5 we do not subtract $A_{pt} + D_{pt}$ from W_{pt}. This may seem odd at first glance due to the above explanations. The reason for this is that in Chapter

5, where we study the historical evolution of private wealth for Switzerland, we can no longer observe W_{pt} directly. Instead, we estimate net private wealth on the basis of growth rates from a combination of tax and pension wealth data. Reasonable to assume is that over the course of the 20th century agricultural land in particular has given way to other investment opportunities; this can be inferred at least from the observation from the reference countries (see Figure B13). This in turn means that, based on our estimation method (backward interpolation), we obtain an estimate of private net wealth at the beginning of the twentieth century, which includes, at least in part, also the value of agriculture land. Therefore, if we were to deduct $A_{pt} + D_{pt}$ from W_{pt} for the other countries over the entire period, Switzerland would look relatively wealthier in comparison in the first half of the 20th century. Moreover, the values for A_{pt} and D_{pt} are only available for Sweden and the United States over an extended period (see Figure B13).



(a) Germany

(b) France

(c) Sweden

(d) United States

Figure B13: Private Wealth-Income Ratios including and excluding A_{pt} and D_{pt}, 1900–2016

Note: This figure displays the evolution of the private wealth-income ratio β_{pt} for the countries indicated from 1900 to 2016. Where the solid line shows the evolution β_{pt} including the value of A_{pt} and D_{pt}. The dotted line, on the other hand, shows the development of β_{pt} without A_{pt} and D_{pt}. In particular, the graph for the United States and Sweden show that the importance of agriculture land was greater at the beginning of the century. The series for Germany, France and the United States are based on Piketty and Zucman (2014), and from Waldenström (2017) for Sweden. All these have been updated and are available for download from https://wid.world.

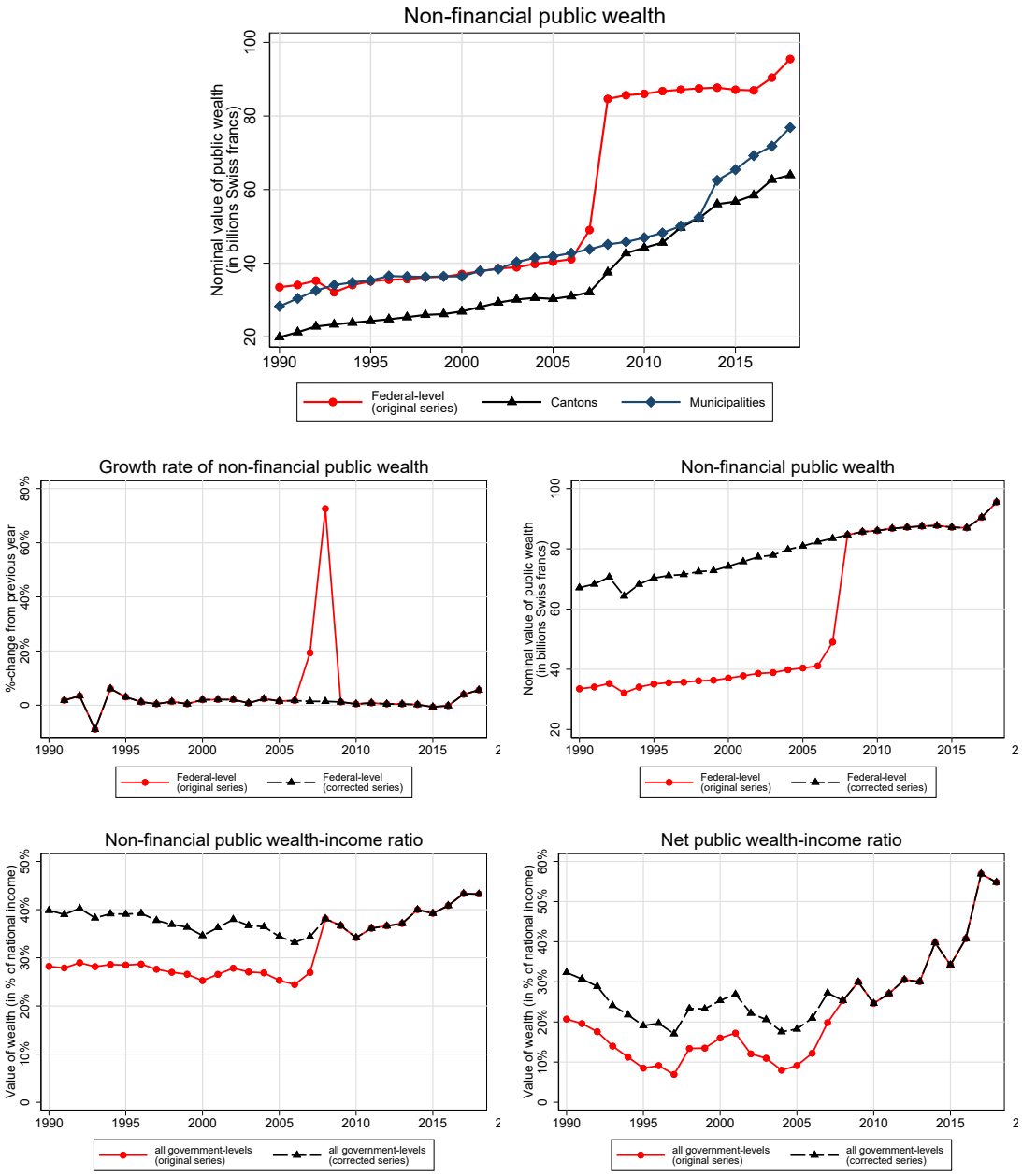
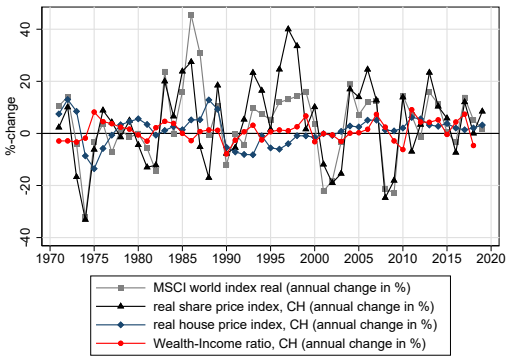
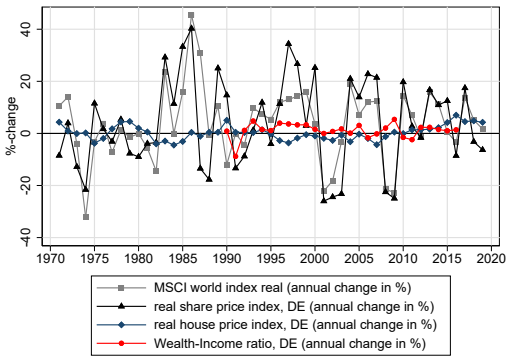


Figure B14: Correction of the non-financial public wealth series at the federal-level, 1990–2018

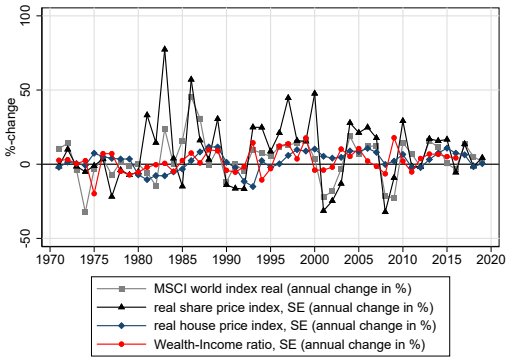
Note: Public non-financial assets K_{gt} usually grew at very modest rates except in 2007 (+19.3%) and 2008 (+72.6%). For these two years we corrected the series by applying the average growth rate of +1.4%. This leads to a more stable and plausible evolution of the public wealth income ratio.



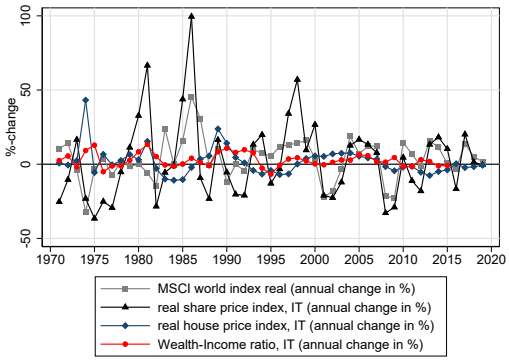
(a) Switzerland



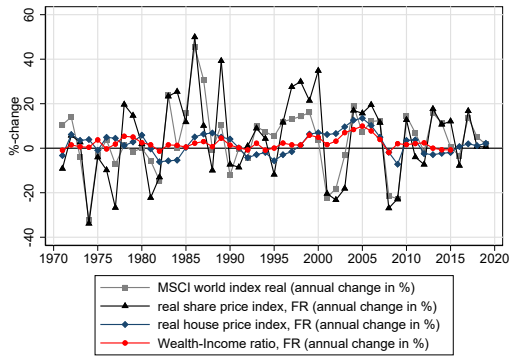
(b) Germany



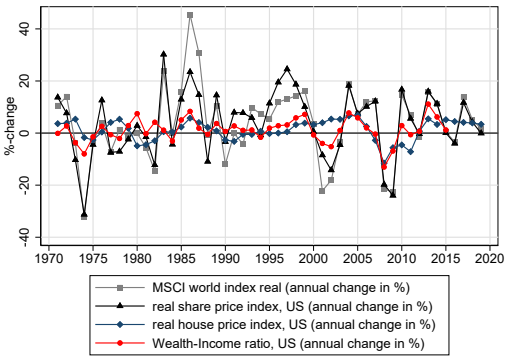
(c) Sweden



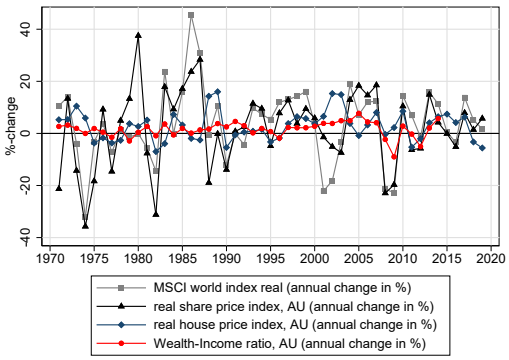
(d) Italy



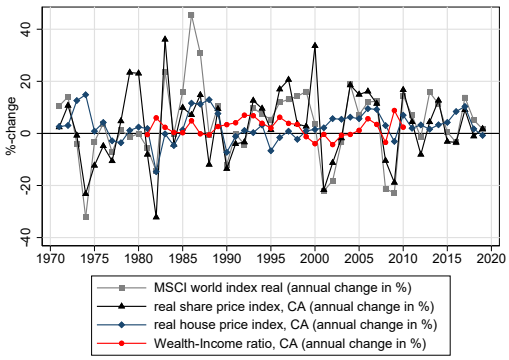
(e) France



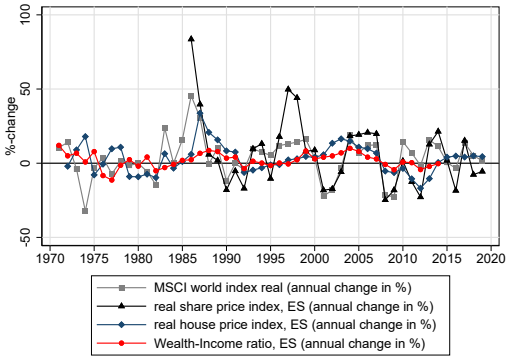
(f) United States



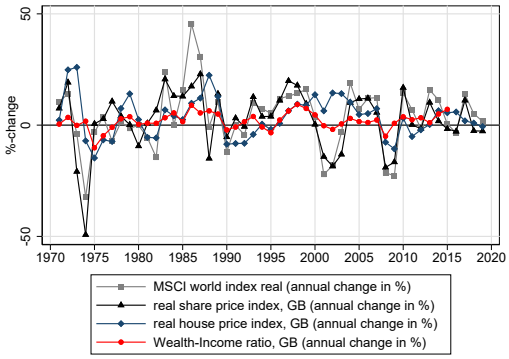
(g) Australia



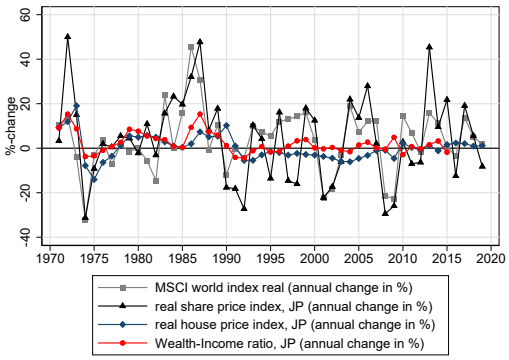
(h) Canada



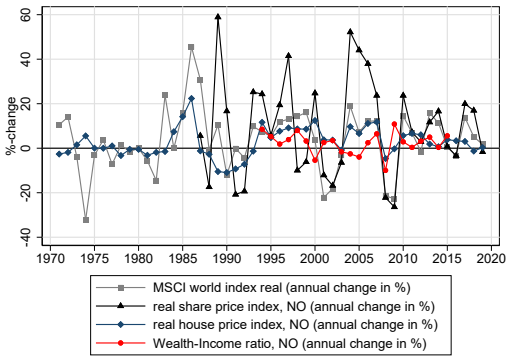
(i) Spain



(j) United Kingdom



(k) Japan



(l) Norway

Figure B15: Annual Changes in β_{pt}, Real House Prices and Real Share Prices

Note: This figure shows the data used for the regressions of wealth-income ratios on real share prices and real housing prices in Section 7.3. The price indices were obtained online from the OECD in September 2020. For the real house price indices, the data are described in Appendix A.10 and for the real share price indices in Appendix A.11. All international private wealth-income ratios data is available for download at https://wid.world.