

# Reassessing Trends in U.S. Top Income Shares: The Role of Population and Productivity Growth

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October 27, 2016

PRELIMINARY - DO NOT CITE OR CIRCULATE

## Abstract

Rising inequality at the top of the US income distribution has recently been receiving a considerable amount of attention. Yet, as the US population has tripled over the course of the last century, the size and composition of top percentiles has changed. This paper extends the long-run analysis of top income shares by two different concepts. First, we compare top incomes across years by fixing the real thresholds one would have needed to exceed to belong to the top 0.1, 1 or 10% for a given year. We then assess which fraction of other years' population received an income that would have allocated them to the top percentiles. Subsequently, the income shares of these fractions are calculated. A second approach tracks a fixed number of top earners over time and decomposes their income shares into their sources. Our findings indicate somewhat differential trends at the top of the earnings distribution compared to previous results. While incomes at the very top of the distribution have experienced rapid increases since the 1980s, the effect is not as clear-cut for income earners just below the very top. Our calculations indicate that those just below the very top experienced not only less income growth than those above them, but also benefited less than the upper middle class located just below on the income distribution.

**Keywords:** Income distribution, inequality

**JEL-Code:** D31, D63, H31, N32

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<sup>\*</sup>This work was supported by the German Research Foundation sponsored Graduate School of Economic and Social Sciences of the University of Mannheim.

# 1 Introduction

Recently, rising income inequality in the United States has been receiving a considerable amount of attention. Especially the increase of the top 1%'s income share has given rise to numerous debates and calls for policy interventions such as higher top tax rates [see e.g. Diamond and Saez 2011]. Constructing a long-run historical data set of top income shares, Piketty and Saez [2003] detect a U-shaped curve of income shares for the top 1% over the last century. While top income shares have been declining throughout the first half of the twentieth century and stayed at a comparably low level during the 1950s to 1970s, they have seen a rapid increase since. Yet, the top 1% income share is just one representation of top income inequality. In this paper, we re-investigate long run trends in top income inequality by paying special attention to the role of population and (differential) economic growth.

These aspects are not explicitly accounted in the approach of Piketty and Saez [2003]. Firstly, the US population has grown threefold from 103 million in 1917 to 319 million in 2014<sup>1</sup>. Hence, the top 1% in 2014 encompass a considerably larger number of tax units than the 1917 top percentile. That is, while top percentiles contrast top incomes with lower income earners in each given year, they neglect that each fractile of the income distribution comprises about three times as many taxpayers in 2014 than one century earlier. Second, the development of income shares at the top might be driven by several different processes: While income shares of top fractiles may increase due to the richest individuals becoming even richer, the same effect on income shares might also be caused by income reductions in the lower part of the income distribution, even if top fractiles' incomes have not changed at all.

For these reasons, our analysis extends previous research by two different concepts. First, instead of comparing top incomes with incomes of lower earners for each given year, we strive to assess how incomes of top earners have changed compared to previous years. This is undertaken by fixing income thresholds that one would have needed to exceed in a given year to belong to the top 0.1, 1 or 10%. Our analysis then inquires how both the population and the income shares of taxpayers above those thresholds have changed over time. The results of the above setting are driven by both changes in the number of taxpayers above the thresholds and the income allocated to those taxpayers. In contrast, our second method aims to net out the effect of population growth by fixing a certain number of taxpayers. The income shares of these top taxpayers are then tracked over time. We subsequently decompose these income shares into labor, capital and entrepreneurial income. We

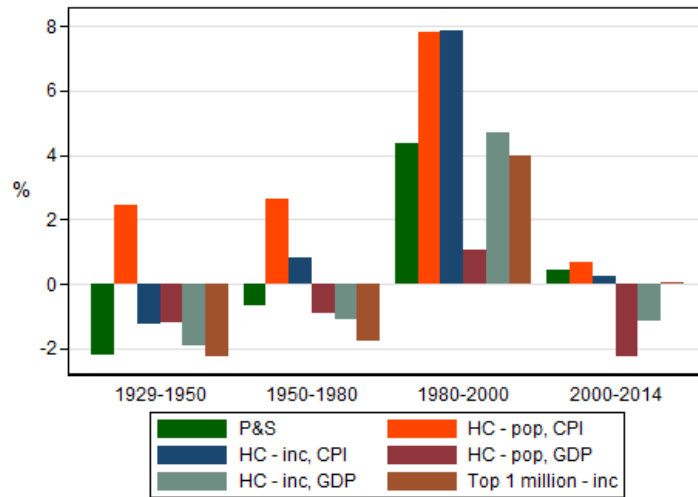
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<sup>1</sup><https://www.census.gov/popest/data/historical/>

hence supplement Piketty and Saez’s results by regarding top income shares from a different angle, shedding more light on the development of top incomes.

Figure 3 provides a first overview of our different measures for the top 1 percent. Averaging over selected time periods, it shows the average growth rates of the income share of the top 1 percent in the unadjusted baseline (P&S), headcount-related measures – the income share (HC - inc, CPI) and share of taxpayers (HC - pop, CPI) above the real (CPI-deflated) 2014 threshold, the income share (HC - inc, GDP) and share of taxpayers (HC - pop, GDP) above the growth adjusted (GDP-deflated) 2014 threshold –, as well as the income share of the uppermost one million taxpayers.

Figure 1: Different measures for the top 1 percent



The share of taxpayers above the CPI-deflated 2014 one percent threshold increases throughout the past century. This effect is both due to productivity growth – increasing real incomes over time – and to changes in the income distribution. In contrast, the share of taxpayers above the GDP-deflated 2014 top one percent threshold declines in all periods but 1980-2000. The increasing fraction of top taxpayers benefiting more than proportionally from economic growth hints at a dispersion of the income distribution in the latter period. Growth patterns are diverging between various income share measures, likewise indicating distributional shifts. This paper strives to shed more light on the underlying developments, and on how productivity and population growth contribute to the evolution of top income shares.

Numerous studies discuss the driving factors behind the decline, and subsequent rise of top income shares during the past three decades. For once, a differential development of top income shares has been attributed to the changing composition

of incomes at the top. The last decades have seen wage incomes increasingly playing a role at the top of the income distribution, while the importance of capital declined [Piketty and Saez, 2003]. At the same time, the contribution of entrepreneurial income to top incomes has been greatly expanding since an all-time low in 1980 [US income composition data, Alvaredo et al. [2016]]. Another explanation for the rapid increases of the top percentile's income share since the 1980s is provided by changes in tax policy [Feenberg and Poterba, 1993]. In particular the huge reductions in marginal tax rates in the 1980s are credited with much of the increase at the top [Feldstein, 1995]. Further studies attribute much of the development to demand-side effects on the labor market [Autor et al., 2006; Gordon and Dew-Becker, 2008]. In line with the 'superstar' hypothesis by Rosen [1981], globalization and (skill-biased) technological changes during the past three decades have allowed those with the highest abilities to obtain larger wages (and even extract rents), thereby explaining increased wage income shares at the top.<sup>2</sup> For instance, Bakija et al. attribute 60 % of the increase in the top percentile's income share from 1979 to 2005 to increasing incomes of high-salaried professions such as managers and financial professionals.

Yet, those studies do not clarify to what extent the increasing importance of salaries is attributable to the top percentile encompassing more and more taxpayers. Hypothetically, if there were a given number of capital income earners in a top percentile, followed by a fixed number of top wage income earners in the percentile below, the simple fact that the overall population is growing would shift many top wage earners into the top percentile. Even if incomes of top capital and wage income earners remained unchanged, one would witness both an increasing importance of wages at the top and an overall growth in top income shares over time. Now, while top salaries have indeed grown and this extreme case certainly does not apply here, population growth might nevertheless be responsible for part of the observed effects. This is especially the case if individuals newly entering the population are not evenly distributed along the income distribution but rather concentrated at lower parts.

This raises the question how the rapid population growth during the past century has affected the income distribution. A literature survey by Lam [1997] cites evidence for population growth's negative effects on wages, and positive effects on returns to capital. In addition, the past century has seen substantial waves of migration arriving in the US, which could conceivably have affected the distribution of income. Yet, most studies find that immigration only has a negligible effect on

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<sup>2</sup>In line with this, CEO pay has doubled several-fold since the 1980s [Gabaix and Landier, 2008; Frydman and Jenter, 2010]. Moreover, the composition of wage earners at the top has changed, while wage growth displayed a substantial degree of heterogeneity across occupations [Kaplan and Rauh, 2010; Bakija et al., 2012].

both native wages and overall income inequality [see Blau and Kahn, 2015, and Peri, 2014 for surveys].

Furthermore, growing income shares of the top 1% might be caused by two different processes: by top earners actually increasing their incomes, or by income reductions of lower earners, even if top incomes remain unchanged. In order to focus on developments at the top and abstract from changes in the bottom of the distribution, Atkinson and Piketty [2007] suggests a ‘shares within shares’ approach. That is, they set top income shares in relation to income shares of a broader group of taxpayers, such as the top 10%. While this approach successfully cancels out the effects of changes at the bottom, results depend on the – somewhat arbitrarily chosen – denominator. If top incomes simply fanned out over time, the development path of top shares within broader income shares would not be greatly influenced by whether the top 5% , 10% etc. are chosen as a reference group. This does not hold, however, if incomes at the very top follow a different time trend than incomes barely below the very top, whose growth path again differs from broader top income categories.

Our research confirms that incomes at the top do not grow equally. The literature has broadly discussed that the top 0.1 has experienced larger income increases than the top 1%, which has in turn seen greater increases than the top 10% [Atkinson, 2003]. Our findings point to a different development: Our analysis reveals that top incomes are subject to differential trends. In contrast to the pronounced income increases at the very top of the distribution since the 1980s, income earners just below the very top have experienced less income growth. Our calculations show that those just below the very top experienced not only less income growth than those above them, but also benefited less than the upper middle class located just below on the income distribution.

The remainder of the paper is structured as follows: Section 2 provides an overview of our data and describes our methodological approach. Results are presented in section 3. Section 4 subsequently concludes.

## 2 Empirical approach

### 2.1 Data

Our estimates are based on the World Wealth and Income Database<sup>3</sup> and encompass the years 1917 – 2014. Incomes correspond to all income items before tax and other

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<sup>3</sup><http://www.wid.world/>

deductions. These data were generated from IRS tax return data, to which certain adjustments were effectuated, notably to account for changes in tax law [Piketty and Saez, 2003]. We make use of the data base’s information on income thresholds (such as the income level one needs to attain to belong to the top 1%), the overall income shares of tax units above these thresholds, and the composition of these incomes. Thresholds and annual incomes are computed in real terms to ensure their comparability across years. As capital gains are realized intermittently, overall incomes can be subject to larger fluctuations over time. Therefore, the literature at times assesses the development of top incomes net of capital gains. While our main focus is on analyzing the evolution of overall incomes, we also check whether the same trends persist when assessing incomes net of capital gains.

As it is common in this literature, the units of analysis are tax units, which are set in relation to the total number of potential tax units, calculated from census data. Based on these adjustments, Piketty and Saez [2003] approximate the distribution of income shares using a Pareto distribution. Here, we follow the same approach and use the Pareto distribution to approximate income shares. Income thresholds and shares are calculated including capital gains<sup>4</sup>. Note that while the Pareto distribution is commonly employed in the literature, it only approximates well the shares at the very top of the distribution [Cowell and Flachaire, 2014]. Hence, income shares of rather large percentiles - such as the upper ten percent - should only be regarded as rough approximations. Using other distributional assumptions however yields trends in the development of the income distribution that are in line with our findings of the Pareto distribution.

If needed, we supplement the data with Internal Revenue Service<sup>5</sup> tax statistics on larger income brackets than given in the World Wealth and Income Database. The corresponding data sets are available from 1986 onwards and capture the income shares and thresholds of rather broad income brackets. As Piketty and Saez’s computation procedure results in a slight divergence between World Wealth and Income data and IRS data, adjustments were made to ensure that the 10% threshold of the IRS data matched the 10% level of our base data set.

## 2.2 Methodology

We use several methodological approaches to account for the contributions of population and economic growth to the development of top income shares. We first

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<sup>4</sup>As a robustness check, we effectuated the same calculations excluding capital gains. Qualitative results did not differ by much.

<sup>5</sup><https://www.irs.gov/uac/SOI-Tax-Stats-Historical-Table-3>

contrast different measures for the top 1 percent and subsequently assess how different top fractiles compare for one measure. Our analysis addresses population growth and productivity growth by considering income shares above CPI- and GDP-deflated top income thresholds in a given year, as well as by following a fixed number of tax units over time.

**Log decomposition.** As a starting point, we decompose changes in the top 1 percent income share into the contributions of population, overall income and top income growth. More precisely, the income share  $S_i$  of top fractile  $i$  can be decomposed as

$$S_i = \frac{\bar{Y}_i N_i}{\bar{Y} N} \Leftrightarrow \Delta \ln S_i = \Delta \ln \bar{Y}_i + \Delta \ln N_i - \Delta \ln \bar{Y} - \Delta \ln N \quad (1)$$

where  $\bar{Y}$  indicates average income, and  $N$  the number of tax units in fractile  $i$  and the overall economy. When no further adjustments – such as below – are effectuated, this can be simplified to:

$$\Delta \ln S_i = \Delta \ln \bar{Y}_i - \Delta \ln \bar{Y} + \Delta \ln(iN) \quad (2)$$

Our analysis addresses the contribution of the different components to the development of the top one percent income share. While we compute the cumulative log changes to contrast overall trajectories over time, we use 5-year moving averages to showcase the growth patterns of these measures.

**Income shares above fixed income thresholds.** Instead of relating top incomes to overall incomes in the same year, we compare how people fared that had at least equally as much of a real income as the top 0.1, 1 or 10 percent in another year. Accordingly, we compute the CPI-deflated income thresholds that a taxpayer would have needed to exceed in a given year to belong to the respective top percentiles. We then follow both the share of taxpayers above those thresholds and their shares in overall income over time. As a reference point, we take the income thresholds of the first and the last year in the sample (1917 and 2014). This method depicts how many tax units are at least as well off as a certain top fractile in a preceding or following year.

**Growth adjustments: GDP-deflated income thresholds.** As previously stated, overall incomes have grown tremendously during the time period under consideration. Hence, even if all incomes grew at the same rate, both the numbers and income

shares of taxpayers above the real thresholds would exhibit an upward trend. To investigate to what extent top incomes have grown faster than the overall economy, real income thresholds are subsequently adjusted with per capita economic growth<sup>6</sup>. If increases in top real incomes were solely attributable to economic growth, and not to changes in the income distribution, income shares above the growth-adjusted thresholds should remain roughly constant over time.

**Constant number of top tax units.** Growing income shares above real and growth-adjusted thresholds can be driven by two effects: By changes in the number of taxpayers above those income thresholds, and by the changes in the income allocated to them. To isolate the latter effect, we subsequently fix a number of high-earning taxpayers and analyze how the income share of this given number of taxpayers evolves over time. As before, income shares are calculated using a Pareto approximation.

**Extrapolation.** Overall incomes have experienced large growth rates during much of the past century (see fig. 13 in the appendix). As the World Wealth and Income Database only includes data on the top 10%, broad income shares at some point exceed the maximum thresholds provided by the data set. Therefore, we supplement this data base with IRS data when more than 10% of tax units surpass these thresholds. These computations should be taken with a grain of salt as the Pareto distribution only describes well the distribution at the top. Nevertheless, computations using the Pareto distribution do not widely deviate from robustness checks with other distributions.

**Differential effects by income source.** In order to gauge more precisely which factors drive the above developments, we compute the contribution to income shares of wage, capital (dividends, interest and rents) and entrepreneurial income. As before, we strive to neutralize the effect of population growth by fixing a certain number of top taxpayers and tracking the development of their incomes over time. To do so, we take the same fixed numbers of taxpayers as above and calculate their average revenue derived from each income category. We approximate two variables: the share of each top taxpayer group's income attributable to each income category, and the share each group's income category has in overall national income.

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<sup>6</sup>Per-capita growth is chosen instead of overall growth to net out the growth effect of the changing population size.



## 3 Results

### 3.1 Different measures for the top 1 percent

As a starting point, we decompose the change in the top 1 percent log income share into the contributions of changes in the top 1 percent's average income, of changes in aggregate average income for the lower 99 percent, and of population growth<sup>7</sup> (see equations 1 and 2). As a reference, we also depict overall changes in aggregate incomes. Figure 2 (a) shows the cumulative log changes since 1917. By adding up the log changes since the baseline year 1917, it compares how the top one percent income share is driven by its different components over time. Subfigure 2 (b) focuses on the respective decomposition components' growth patterns, showcasing the 5-year moving averages of the log changes. I.e. for each year, we calculate the average log changes over the previous five years. Smoothing over 5 years reduces fluctuations, making developments more easily perceptible in the graph.

As evidenced by these figures, the relative contributions of the different drivers of the top 1 percent income share differ over time. While top incomes grow more than average incomes in the 1920, this reverses during World War II. Throughout the 1960s and 1970s, the lower 99 percent experience slightly larger growth in their average incomes than the upper percentile. From the 1980s onwards, the upper percent's average incomes grow faster, notably in boom years with larger economic growth. At the same time, the number of tax units substantially increases across the past century, acting as an important driver of top income shares. While the population is constantly increasing, population growth is comparatively larger in some periods such as the 1970s.

Across all periods, fluctuations in the top 1 percent average income are more pronounced than fluctuations for the lower 99 percent. This can be attributed to top incomes' higher sensitivity to the business cycle, e.g. due to the latter's effect on capital incomes and flexible wage components. Also, the magnitude of such fluctuations appears to be relatively larger in the early and the late 20th century.

To shed more light on the underlying developments, figure 3 displays the development of the top 1 percent's income share using the measures described in the previous section. Subfigure (a) shows the income shares of the top 1 percent in the unadjusted baseline, the income share above the real (CPI-deflated) 2014 threshold, the income share above the growth adjusted (GDP-deflated) 2014 threshold, the income share above the real (CPI-deflated) 1917 threshold, as well as the income share

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<sup>7</sup>As a reference point, the appendix displays Piketty and Saez's key results.

of the uppermost one million taxpayers<sup>8</sup>. From the 1980s onwards, the CPI-deflated 1917 threshold is approximated with IRS data. Subfigure (b) indicates the shares of taxpayers in each of the groups<sup>9</sup>. As a direct result of population growth, the share of top 1 million taxpayers in all tax units declines over time. In contrast, the share of tax units above the CPI-deflated 2014 one percent threshold increases throughout the past century. This effect is both due to productivity growth – increasing real incomes over time – and to changes in the income distribution. The share of taxpayers above the GDP-deflated 2014 top one percent threshold – which should follow a flat trajectory if tax units along the entire income distribution benefited similarly from productivity growth – is subject to different developments during the past century. This indicates distributional shifts.

As opposed to the baseline, our alternative measures for the top 1 percent income share in (a) do not all follow a U-shaped pattern. In particular, the income share above the 1917 top 1 percent threshold experiences a rather constant and rapid growth from the mid 20th century onwards<sup>10</sup>. This is most likely due to overall economic growth, lifting a substantial fraction of the population above the 1917 top 1 percent threshold in recent years. In contrast, the income share above the 2014 top 1 percent threshold does not grow at the same pace as the one above the 1917 threshold. Instead, it stays rather flat up to the 1980s and grows afterwards. This trajectory is more close to the U-shaped pattern from the baseline analysis. This points to top income shares of differing population sizes experiencing different time trends: Both measures are calculated based on a fixed real threshold, with the difference that the 1917 threshold encompasses a larger group of people. I.e. a substantially larger share of the population has substantially higher real incomes nowadays than the top one percent used to have in 1917. At the same time, the income share of those who have at least as much of a real income as the top one percent in 2014 has not increased as much and has only started to grow in the 1980s. The income share above the GDP-deflated 2014 threshold actually experiences a larger decline than the baseline top 1 percent income share up to the 1980s. This indicates that top earners seem to have benefited less from economic growth than earners below on the income distribution. This reverses from the 1980s onwards, with the income shares above both growth-adjusted thresholds following the baseline

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<sup>8</sup>In order not to overcharge the figure, the income share above the GDP-deflated 1917 threshold is not shown. Instead, income shares above the GDP-deflated 1917 thresholds are depicted in figure 5.

<sup>9</sup>For clarity purposes, the share above the real 1917 threshold – which increases to more than 15% – is not depicted here.

<sup>10</sup>Note that the Pareto approximation may suffer from some degree of imprecision for larger shares of the population, such as in the approximation with IRS data.

more closely.

Table 1 presents the average annual growth rates for the different measures during specific time periods. Growth rates and time patterns largely differ between measures, again hinting at differential trends at the top. These are further investigated in the following sections, which analyzes the different measures for various top income fractile groups.

Period	Baseline (P&S)	Headcount over threshold (CPI-deflated)		Headcount over threshold (GDP-deflated)	
		1917	2014	1917	2014
		1917-1929	2.35	5.88	4.89
1929-1950	-2.18	-0.23	-1.23	-3.02	-1.90
1950-1980	-0.65	2.02	0.83	-1.05	-1.07
1980-2000	4.35	1.64	7.86	7.12	4.68
2000-2014	0.43	0.18	0.26	0.65	-1.14

Table 1: Growth rates of different top 1 percent measures

### 3.2 Income shares above fixed income thresholds: Contrasting percentile groups

The previous section shows that income shares of the top 1 percent do not all follow the same U-shaped pattern as in Piketty and Saez [2003]. We further investigate differential paths of different top fractile groups' income shares by contrasting our measures for a wider array of top income groups.

**Real income thresholds.** Figure 4 shows the percentage of tax units and the income shares for income brackets above the CPI-deflated 2014 thresholds. Comparing real incomes across years, instead of comparing relative positions on the income distribution in a year, this constitutes one approach for accounting for population growth. We consider the top 10, 1 and 0.5% thresholds<sup>11</sup>. Accounting for population growth reveals different developments than the well-known top fractile results (c.f. figure 11 in the appendix). The trajectories do not follow a similar U-shaped pattern. Neither do the developments of income shares closely follow the growth of population shares above thresholds. Instead, the income share between the top 1-0.5% thresholds remains rather constant, with slight growth since the 1990s. In contrast, the income share above the uppermost threshold has experienced a large

<sup>11</sup>The latter is chosen instead of the top 0.1% as in the early and mid 20th century only very few taxpayers received a higher real income than the top 0.1% in 2014.

increase since the 1980s, while declining and then remaining at a roughly constant level in previous decades. The income share of taxpayers between the 2014 1 and 10% threshold has almost continuously grown since the early 20th century. These developments cannot be fully explained by economic growth, nor by a simple fanning out of the income distribution. A proportional growth of all incomes, or an increased dispersion of incomes, would shift the tail of the distribution outward, leading to higher income shares above all, but not only some upper thresholds. Instead, figure 4 points to a more complicated development than one might infer from the evolution of standard top income shares<sup>1213</sup>. Possible drivers are discussed in more detail in section 3.4.

**Growth adjustments.** The above results are partly driven by economic growth. We use per-capita growth-adjusted thresholds (see figure 13 in the appendix for GDP growth) to assess whether top income earners have more than proportionally benefited from economic growth<sup>14</sup>. If economic growth was equally distributed across the income distribution, the population and income shares above the growth-adjusted thresholds should remain roughly constant over time.

As shown in figure 5, such constant population and income shares cannot consistently be found in the data for GDP-deflated thresholds. The figure depicts the percentage of tax units above the growth-adjusted 10-1, 1-0.1 and 0.1% 1917 thresholds<sup>15</sup>. Differing findings emerge over time and for rather narrow and larger growth-adjusted thresholds. As shown in subfigure (a), the percentage of tax units above all growth-adjusted top thresholds declined until World War II. The 1950s and 1960s witnessed diverging developments: more and more tax units have exceeded the growth-adjusted 10% threshold during the mid-twentieth century, whereas the fraction of taxpayers above the growth-adjusted top 1% threshold has been shrinking. Hence, more and more people with high, but not extremely high incomes have managed to benefit more than proportionally from economic growth. At the same time, the percentage of tax units above very high income thresholds has continued to decline throughout the mid-twentieth century. That is, incomes at the larger top of the distribution became more equal. In the late 1970s, this finding completely reverses. From then onwards, more tax units that are at the very top experience

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<sup>12</sup>Table 2 in the appendix additionally displays income shares and percentages of taxpayers for selected years and for each income bracket based on 2014 thresholds.

<sup>13</sup>Qualitatively, results do not change by much once we analyze incomes net of capital gains (c.f. figure 15 in the appendix).

<sup>14</sup>Since income shares net of capital gains experience approximately the same developments as overall income shares, our analysis only focuses on the latter here.

<sup>15</sup>Similar findings emerge for 2014 thresholds. See figure 14 in the appendix.

larger income growth than the overall population. Conversely, the upper middle class is shrinking in relative terms.

For income shares, the picture looks a little different. In line with other findings in the literature, the income share of those above the growth-adjusted 1917 0.1% threshold – the highest in our computations – has experienced a stark decline throughout the first half of the twentieth century. Remaining rather low until roughly 1980, this group’s income share has seen rapid increases over the past three decades. Since the beginning of the twenty first century, the income shares of the top bracket have been subject to even more pronounced fluctuations than the shares of tax units above those thresholds. Likewise, the income shares between the growth-adjusted top 1-0.1% brackets were shrinking in the first half of the twentieth century and have started growing again in the 1980s. The time trend is substantially less pronounced than for the tax units above the top growth-adjusted threshold. Surprisingly, the share of overall income allocated to slightly lower growth-adjusted income brackets does not seem to follow a pronounced time trend since the 1980s. After an increase and a subsequent decrease in the mid-20th century, income share of tax units between the growth-adjusted 1% and 10% thresholds seems to fluctuate around the same level in more recent years. Hence, the dispersion of incomes from the 1980s onwards does not evenly affect all high incomes.

### 3.3 Constant number of top tax units

While the comparison of income shares above thresholds indicates a pronounced growth-exceeding rise only for incomes at the very top, it is driven by two effects: First, by changes in the number of taxpayers above those income thresholds, and second, by the changes in the income allocated to them. Hence, from figure 5 alone, one cannot seamlessly infer which part is attributable to there being more or less taxpayers that exceed the threshold, and which is attributable to individual taxpayers above the threshold increasing their respective incomes.

To net out the effect of population growth (see figure 12 in the appendix) and separate these two effects, we analyze how the income share of a fixed number of taxpayers evolves over time. For this, we assess the income shares of the top 100,000, 500,000, 1 million, 1.5 million, 2 million, and 5 million taxpayers. Figure 6 displays the real 2014 income thresholds of these taxpayer groups, i.e. the income thresholds one would need to exceed in a given year to belong to, for example, the top-earning 100,000 taxpayers.<sup>16</sup> Increasing real thresholds are at least partly

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<sup>16</sup>For the early 1900s, the income share of the top 5 million tax units cannot be calculated as they constitute more than 10% of all taxpayers for these years.

driven by overall economic growth. While thresholds increase at a slow pace until the early 1980s, the highest top threshold more than triples over the course of the past three decades. As in previous calculations, the top threshold is subject to large fluctuations following the recent economic downturns. The bottom figure zooms in on the top 1-5 million thresholds. Trends are less pronounced for these groups. While all thresholds increase over time, the thresholds have been fanning out since the 1980s. I.e. the income threshold one would need to exceed to belong to the top 100,000 grew faster than the thresholds for larger groups. This again points to very top earners recently experiencing larger increases in income than the top taxpayers just below them on the income distribution.

Figure 7 sets the incomes of the above top earner brackets in relation to overall incomes. As shown on the upper graph of figure 7, the income shares of top earners decreased up to the late 1970s and have been increasing again since. The top income shares all move roughly in parallel, with much of their development being driven by the income shares of the top 100,000 tax units. The bottom graph of figure 7 yields a more thorough insight of the effects at work by splitting up top income shares into brackets. Most importantly, the different income brackets at the top do not seem to follow the same general trend. Instead, while incomes at the very top experience the widely-discussed increase since the 1980s, this does not necessarily apply to slightly lower top income recipients.

In line with previous research, the income share of the uppermost income group – here the top 100,000 – has sharply declined until 1980, before substantially increasing from then onwards. The large intertemporal fluctuations in income shares are partly attributable to differences in the realization of capital gains between years. Note however that such fluctuations still persist when capital gains are excluded from the analysis, albeit at a lower level. A second explanation is that the richest individuals derive a substantial share of their income from capital and entrepreneurial activities as well as from performance-tied compensation, e.g. via bonus payments and stock options. These sources of earnings are more volatile and more tied to the business cycles than wages in lower income brackets. In line with this, the spikes and troughs in recent years may be explained by the Dot-com bubble and the recent Great Recession. The subsequent top 100,000 – 500,000 follow the same trend, but to a less pronounced extent. However, the picture completely changes for the top 0.5 to 1.5 million, who did not improve their income share over time. This starkly contrasts with the top 2 to 5 million, which similar to the very top, have seen increasing income shares since the 1980s. General trends in the developments are

fairly robust to excluding or including capital gains <sup>17</sup>.

The above findings accentuate that the top 1% (which would have encompassed many of the above groups in 2014) are far from a homogeneous group. Instead, there seem to be differential forces at work that distinguish the top segments from each other. An explanation might well be found by differentiating why certain tax payers belong to the top. Otherwise put: to what extent are rentiers, who derive most of their income from capital, entrepreneurs, and supermanagers, who all receive rather high incomes, subject to different time trends?

### 3.4 Differential effects by income source

To assess which factors drive the differential development of top income shares, we compute the contribution to income shares of wage, capital (dividends, interest and rents) and entrepreneurial income. According to past research (cf. section 1), wage income has become increasingly important for top percentiles in the second half of the twentieth century. At the same time, the relative importance of capital income has declined. While these results have been widely discussed, our previous question also applies here: How much are these findings driven by changes in the denominator? As above, with the population increasing threefold over the course of the past century, taxpayers with comparably lower incomes – and hence on average a larger share of wage income – move to higher fractiles of the income distribution. Hence, to what extent is the increasing importance of wage income attributable to more and more taxpayers belonging to the top 0.01 or 1%?

For this analysis, we track the same top 100,000, 500,000, 1 million, 1.5 million, 2 million, and 5 million taxpayers as above and decompose their income into its sources. When the number of taxpayers in each income bracket is held constant, a different picture emerges than for top percentiles, which do not account for population growth. The following describes the developments by income source.

**Wage income.** This category encompasses all income derived from dependent labor, i.e. wages, salaries and pensions. Figure 8 displays wage income's share in each taxpayer bracket's total income, as well as the share of each income bracket's wages in overall national income. While wages have been playing an increasing role for the top 2 million income earners from World War II until the early 1980s, wage shares in overall income have remained roughly constant ever since. For the

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<sup>17</sup>Figure 16 in the appendix displays the income shares once capital gains are excluded from our calculations. Table 4 in the appendix displays the income shares – including capital gains – for the same selected years as in previous sections. In addition, it shows each year's population size and number of tax units.

top 100,000 and 500,000, the relative importance of wages has even been slightly declining over the past three decades. In contrast, the share of wages in overall income has remained stable at about 80% for the top 2-5 million income earners.

The shares of top income groups' wages in overall nationwide income have grown since the 1980s for both the top 100,000 and 500,000, as well as for the top 1.5 to 5 million. In particular, the overall income shares of the uppermost category's wages have roughly tripled during the past three decades. In contrast, the top 0.5 to 1.5 million's wages did not increase relative to overall income.

These findings diverge from results computed with income percentiles. While wages become increasingly important for earners at the very top and in the moderate upper class, a similar effect fails to manifest for income earners in between. Note, though, that while we track a constant number of top income earners, we are not able to track individuals. Hence, top earning executives' salary increases might have catapulted them to a higher bracket, in turn shifting taxpayers that are less dependent on wage income, and therefore did not benefit from a similar increase, to a lower income bracket. Hence, the lack of an increase in the top 0.5 to 1.5 million's wage shares might partly be attributable to changing compositions of taxpayers at the top.

However, the recent growth at the very top is consistent with the 'superstar' hypothesis of Rosen [1981]. Globalization as well as technological changes, in particular in the realm of information and communication technologies, have led to expansions of scale during the past three decades. Hence, those with the very highest abilities have managed to obtain larger and larger rents. The reach of those with 'second-best' abilities, however, is limited by these 'superstars', explaining why the importance of wages has not risen for the top 0.5 to 1.5 million.

Another potential contributing factor to the rising importance of wages is increased assortative mating since the 1970s [Schwartz, 2010]. As income is measured at the tax unit level, the increased propensity to marry a spouse with a similarly high income should increase both the importance of wages as well as overall income shares over time.

Another popular explanation for this development are tax reforms, in particular the 1981 and 1986 Tax Reform Acts. In addition to a broad scope of further measures, the 1986 Act reduced top marginal tax rates from 50 to 28 percent, but broadened tax bases. The 1980s constitute a tipping point in the development of top wage incomes. After the tax reforms, the previous upward development of wage shares in overall incomes of top earners came to a halt. At the same time, the shares of top wages in overall national incomes increased. That is, while top earners



became relatively richer, and their wages grew over time, their earnings increases were driven by both wages – possibly driven by the developments described above – and other income sources. Other reforms of income tax rates did not evidence such pronounced effects. Notably, the Omnibus Budget Reconciliation Act of 1993 increased top marginal tax rates from 31 to 39.6%, but can be at best associated with small fluctuations of wage shares.

**Capital income.** Capital income is composed of rents, dividends and interest. In relative terms, capital income has followed a rather flat trajectory from the 1940s to the 1970s for the top 100,000 to 5 million. The top 100,000 saw larger fluctuations, with capital income making up for up to 40% of incomes. After a spike in the early 1980s – possibly attributable to the 1981 tax reforms, which, amongst other measures, reduced the corporate tax burden – capital incomes lost relative importance, despite a small spike in the mid-2000s.

For the most part, these trends are also reflected in the shares of top earners' capital revenues in overall income. For the uppermost 100,000, though, capital income has increasingly contributed to the highest earners' income since 1980. Nevertheless, the recent increase pales in comparison to the income shares that top earners obtained from dividends, interest and rents prior to World War II.

The spike in the early 1980s goes in hand with a sharp drop in entrepreneurial income (see figure 10). Part of this development may thus be related to reclassification of incomes in response to changing tax incentives. Some of the development may also be attributable to changing tax avoidance and evasion possibilities over time.

**Entrepreneurial income.** Revenues from entrepreneurial activities have been subject to large changes. While for all top income brackets, the importance of entrepreneurial income declined from World War II throughout the 1970s, it has seen a sharp rise since the 1980s. Not only the proportion of income generated by entrepreneurs has multiplied, but also overall entrepreneurial revenues have contributed to overall US incomes at increasing rates for the top 100,000 and 500,000 as well as the top 2–5 million. Strikingly, while entrepreneurial income has played less of a role for the top 100,000 than for taxpayers with incomes just below theirs, this relation has reversed after 1980.

Much of the large jump in figure 10 may be attributable to reclassifications and incentives related to the 1986 Tax Reform Act [Feldstein, 1995]. For once, the abolition of the general utilities rule made subchapter C corporations less attractive. Prior to the reform, such corporations had allowed for lower tax rates than the per-

sonal income tax. As a result of the reform, many C corporations were converted to subchapter S corporations. Thereby, previously excluded corporate income was included on personal tax returns, counting towards entrepreneurial income [Feldstein, 1995]. Top earners' higher capacity for tax avoidance might also explain why the effect is larger for the top 100,000 than for the subsequent high income earners.

## 4 Conclusion

Much of the recent inequality debate centers around income shares of the upper 1%. However, as the US population has tripled over the course of the last century, today's top 1% comprise a substantially larger number of taxpayers than in previous years. This paper has proposed two alternative methods to assess the evolution of top income shares, supplementing the analysis of Piketty and Saez [2003] and thereby enabling a better comparison of top earners across years.

Our first method compares top incomes across years by fixing the real thresholds one would need to exceed to belong to the top 0.1, 1 or 10% in a given year. Partly due to economic growth, more and more taxpayers surpass these income thresholds over time. Yet, the income shares allocated to these thresholds do not exhibit a similar trend, indicating that more than an overall economic growth process or a simple fanning out of the income distribution are at work. Instead, the upper middle class captured a larger part of growth during the mid-twentieth century, whereas income earners at the very top benefited most from the 1980s onwards. In contrast, income shares just below the very top remain rather constant over time. Compared to the baseline by Piketty and Saez, this method for accounting for population growth yields more strongly diverging developments between the respective top income brackets.

When adjusting these thresholds for economic growth, a slightly different picture emerges. While the income shares above the 1-0.1% and above the 0.1% threshold follow a U-shaped pattern, the development for the top 0.1% is more pronounced than in the baseline. At the same time, a smaller proportion of the population apports the income allocated to each bracket over time. A small number of top earners has thus more than proportionally benefited from economic growth in the past decades. Unlike the U-shaped baseline, the top 10-1% above GDP-deflated thresholds have increased both in population and in income shares in the mid-20th century, and incurred a decrease afterwards.

Second, we fix a number of tax units and track their income shares over time. These income shares are then decomposed into revenue stemming from capital, wages

and entrepreneurial activities. Our findings indicate that differential developments occur at the top. While the 100,000 largest earners – and to some extent the 500,000 – evidence the widely-discussed income growth at the top, the picture changes for the subsequent 0.5 to 2 million tax units, who have not been able to extend their shares in overall income during the past three decades. Conversely, the top 2 to 5 million do again display an increase. The decomposition of income shares attributes this effect to both increases in wage and in entrepreneurial income. Gains from both income sources have increased for the top 500,000 and 2 to 5 million, but stagnated for those in between. Conversely, only the uppermost 100,000 have seen recent increases in income from rents, dividends and interest.

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## Appendix

**The key results of Piketty and Saez.** As a baseline, figure 11 displays the evolution of top income shares including capital gains over time. The upper figure depicts the unadjusted top income shares as in Piketty and Saez [2003] and Piketty and Saez [2006], with the difference that we include capital gains in our calculations. As shown in the graph, top income shares stay roughly constant in the mid-twentieth century, but experience substantial increases since the 1980s, especially at the very top. The bottom figure shows the development of income shares in top income share brackets, such as the top 10-1%. This provides a benchmark against which the alternative measures can be compared.

**Population growth.** As depicted in figure 12, the US population has more than tripled over the course of the past century. The number of tax units has grown by a factor of four across the same time period. Data are taken from the World Wealth and Income Database.

**Economic growth.** Figure 13 displays the development of overall and per-capita real GDP in 2014 terms. As before, data are taken from the World Wealth and Income Database.

**Income shares and percentages above thresholds for selected years.** The following tables supplement the graphs in the text by providing the income shares and percentages of taxpayers above thresholds for the different measures. For early years of the sample, data are displayed at 15 year intervals. As significant fluctuations occur in more recent years, the tables then showcase results for the years at which the – most volatile – top 0.5% income share reaches its maximum or minimum. Table 2 depicts the income shares and percentages of taxpayers within the various income groups above 2014 thresholds. For 2000 and 2007, shares between the 10-5% 2014 thresholds cannot be calculated as the number of corresponding taxpayers exceeds the top 10% of income earners, whom data is provided on in the World Wealth and Income Database. That is, more than 10% of taxpayers in 2000 and 2007 were earning at least as much real income as the top 10% of 2014. Likewise, table 3 depicts calculated income shares and percentages of taxpayers between growth-adjusted thresholds. As calculations can be effectuated for more thresholds with 1917 data, growth-adjusted 1917 thresholds are chosen here. The years are chosen in alignment with table 2.

Year	Income shares and percentages above 2014 thresholds							
	0.5%		0.5-1%		1-5%		5-10%	
1917	8.13	(0.08)	2.19	(0.06)	3.74	(0.29)	2.24	(0.28)
1930	6.33	(0.05)	1.17	(0.06)	5.39	(0.33)	3.17	(0.36)
1945	3.78	(0.06)	2.29	(0.10)	5.37	(0.62)	4.77	(0.64)
1960	2.84	(0.05)	1.54	(0.09)	5.48	(0.81)	6.91	(1.09)
1975	2.41	(0.07)	2.03	(0.14)	9.82	(1.52)	6.97	(2.68)
1980	3.67	(0.11)	2.40	(0.17)	10.48	(1.69)	6.57	(3.00)
1986	10.76	(0.24)	2.70	(0.33)	12.67	(2.40)	8.94	(3.92)
1990	9.31	(0.25)	1.92	(0.27)	13.49	(2.36)	8.75	(3.73)
1995	10.18	(0.28)	2.49	(0.32)	14.84	(2.76)	10.06	(4.14)
2000	17.83	(0.53)	3.63	(0.46)	15.04	(3.92)	-	-
2002	12.36	(0.37)	3.24	(0.40)	15.47	(3.51)	11.52	(4.91)
2007	20.4	(0.58)	4.70	(0.54)	14.82	(4.23)	-	-
2009	13.46	(0.37)	3.42	(0.41)	16.19	(3.50)	12.09	(4.89)
2014	16.69	(0.50)	4.28	(0.50)	16.55	(4.00)	12.06	(5.00)

Table 2: Income shares and percentages of taxpayers (in parentheses) between top 2014 thresholds, including capital gains

**GDP-deflated 2014 thresholds.** While our main results focus on GDP-deflated 1917 thresholds as they allow computations for a wider range of fractiles than 2014 thresholds, similar findings emerge for growth-adjusted 2014 thresholds. Computations for larger growth-adjusted income thresholds (fig. 14) indicate that the income shares of lower income brackets (such as incomes in the top 5-1% of growth-adjusted 2014 income shares) have even been declining during the past three decades. Hence, not all high income groups have benefited more than proportionally from economic growth. While the richest group of taxpayers has become significantly richer since the 1980s and has obtained far more than an equal share in the benefits of growth, the effect is not that clear-cut for the middle upper class.

**Fixed number of tax units.** Section 3.3 contrasted the income shares of fixed numbers of top earners. In addition, table 4 shows the income shares for fixed numbers of top income earners, as well as the population size and the number of tax units for the same selection of years as in the previous tables.

**Exclusion of capital gains.** As a robustness check, figure 15 displays income shares above 2014 thresholds excluding capital gains. As can be expected, income shares net of capital gains fluctuate less than those of overall incomes in figure 4. As for total incomes including capital gains, top income shares – in particular at the very top – start rising rapidly in the 1980s. The comparatively smaller increase in income shares of the very top brackets can be attributed to top earners having

<b>Income shares above growth-adjusted 1917 thresholds</b>										
<b>Year</b>	<b>0.1%</b>		<b>0.1-0.5%</b>		<b>0.5-1%</b>		<b>1-5%</b>		<b>5-10%</b>	
1917	8.40	(0.10)	5.94	(0.40)	3.39	(0.50)	12.90	(4.00)	9.87	(5.00)
1930	6.01	(0.040)	6.07	(0.28)	3.36	(0.39)	14.44	(2.83)	9.53	(4.00)
1945	1.18	(0.009)	4.83	(0.15)	2.63	(0.24)	9.85	(1.44)	4.17	(1.49)
1960	0.83	(0.005)	2.76	(0.11)	2.73	(0.21)	11.11	(1.90)	4.69	(2.37)
1975	0.35	(0.003)	2.02	(0.06)	2.18	(0.15)	10.97	(1.78)	6.34	(2.90)
1980	0.87	(0.006)	2.41	(0.07)	2.34	(0.14)	9.57	(1.46)	6.72	(2.39)
1986	4.92	(0.017)	3.76	(0.12)	3.34	(0.25)	10.66	(1.55)	5.82	(2.30)
1990	3.60	(0.017)	3.63	(0.12)	2.67	(0.18)	9.66	(1.29)	6.33	(1.79)
1995	3.74	(0.016)	3.92	(0.12)	2.85	(0.18)	10.99	(1.38)	6.26	(1.77)
2000	9.52	(0.04)	5.75	(0.20)	2.07	(0.24)	12.61	(1.59)	5.08	(1.83)
2002	5.24	(0.021)	4.03	(0.13)	2.76	(0.18)	10.78	(1.30)	6.33	(1.64)
2007	10.98	(0.04)	5.96	(0.19)	2.18	(0.23)	12.39	(1.50)	5.09	(1.65)
2009	6.17	(0.02)	3.91	(0.12)	2.88	(0.17)	10.87	(1.24)	6.70	(1.51)
2014	8.37	(0.029)	5.25	(0.15)	2.64	(0.20)	12.19	(1.34)	6.17	(1.52)

Table 3: Income shares and percentages of taxpayers (in parentheses) between per capita growth-adjusted 1917 thresholds, including capital gains

invested a larger share of their income in capital assets. Likewise, figure 16 displays the income shares of fixed numbers of tax units once capital gains are excluded.

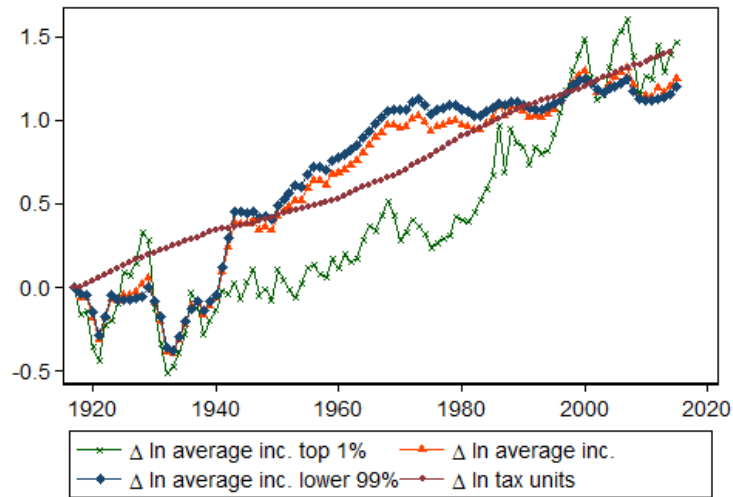


Year	Top earners' income shares						Pop (m)	TU (m)
	0.1m	0.1-0.5m	0.5-1m	1-1.5m	1.5-2m	2-5m		
1917	12.61	7.58	6.20	2.65	1.55	-	103	40
1930	10.49	6.81	8.00	3.44	2.01	-	123	50
1945	6.27	5.57	6.00	3.12	1.81	9.54	133	59
1960	4.42	4.40	5.04	3.44	2.07	9.34	180	69
1975	2.90	3.70	3.51	3.92	2.44	7.61	215	89
1980	3.42	3.75	2.89	4.11	2.55	6.51	227	100
1986	7.32	5.08	3.14	3.73	2.78	6.84	240	111
1990	5.69	4.90	3.01	3.43	3.00	7.30	250	119
1995	6.02	5.05	3.10	3.30	3.31	7.94	266	126
2000	10.54	6.18	3.29	2.99	3.53	8.18	282	134
2002	7.05	5.22	2.95	2.61	3.54	8.45	288	140
2007	11.78	6.43	3.08	2.22	3.8	8.72	302	150
2009	7.9	5.21	2.74	2.16	3.7	9.32	307	154
2014	9.68	5.89	2.77	2.42	3.30	10.03	319	165

Table 4: Income shares of fixed numbers of top earners, including capital gains

Figure 2: Contributing factors to changes in the top 1 percent income share

(a) Cumulative log changes



(b) 5-year moving average of log changes

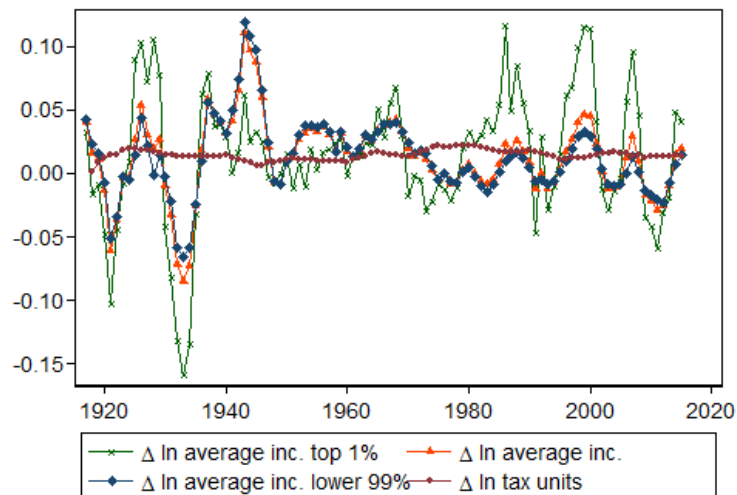
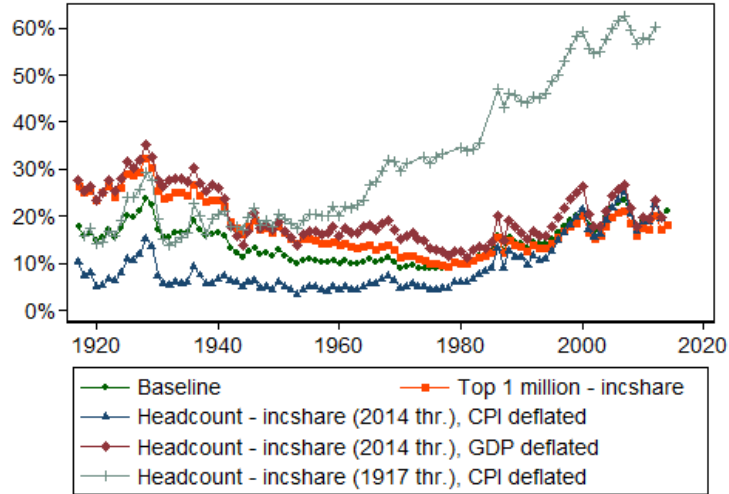
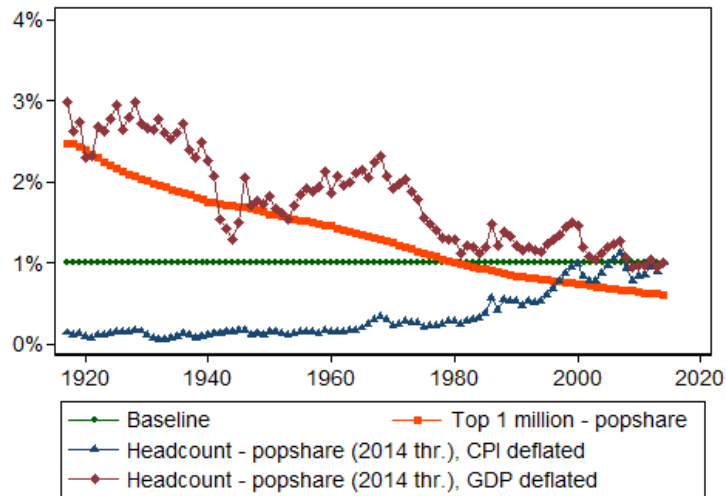


Figure 3: Different measures for the top 1 percent

(a) Income shares



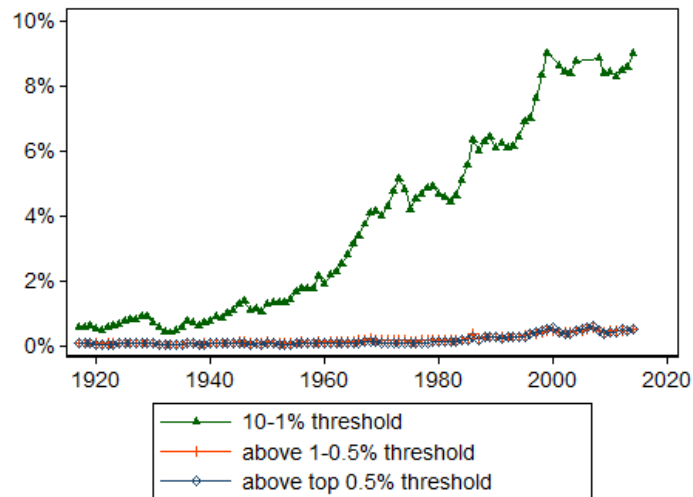
(b) Share of tax units



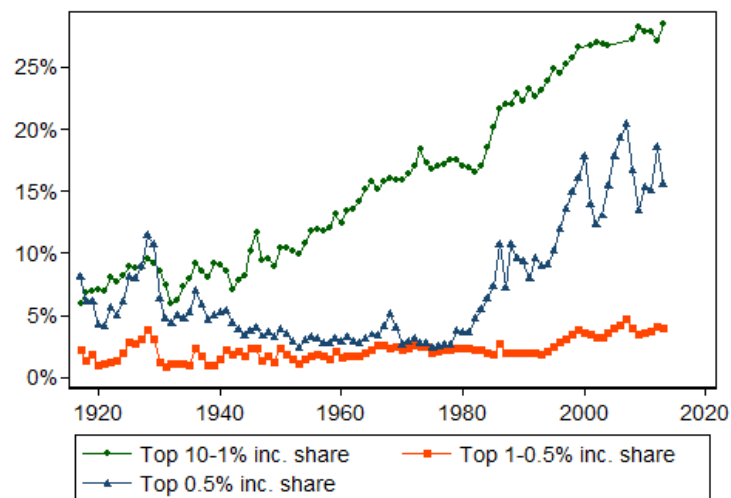
Notes: Figure (a) plots income shares above 1 percent thresholds for different measures, including capital gains. Figure (b) plots the percentage of taxpayers above real income thresholds. All sub-figures use data from the World Wealth and Income Database, supplemented with IRS data.

Figure 4: Percentage of taxpayers and income shares above real 2014 thresholds

(a) Percentage above 2014 thresholds



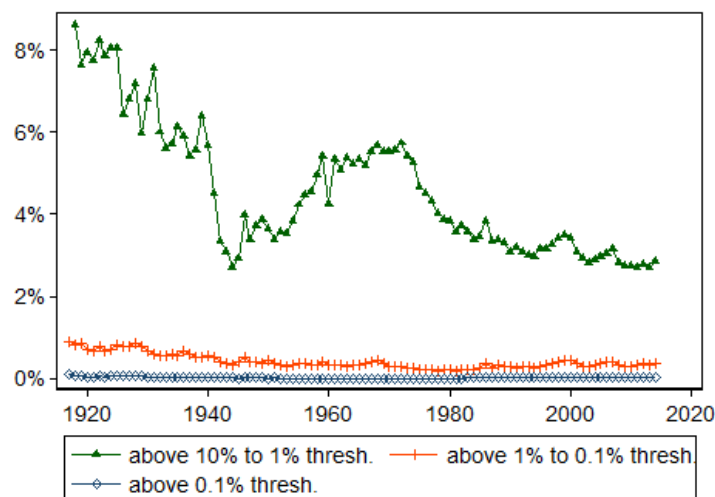
(b) Income shares above 2014 thresholds



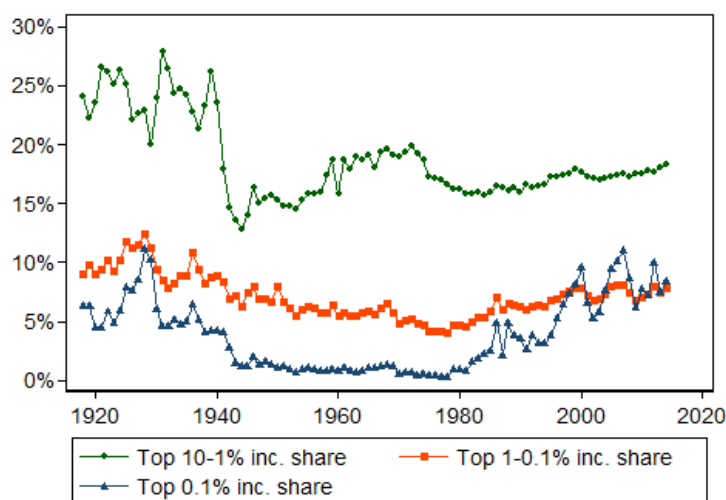
Notes: Figures plot the percentage of taxpayers and income shares above real 2014 thresholds including capital gains. All sub-figures use data from the World Wealth and Income Database.

Figure 5: Percentage of taxpayers and income shares above growth-adjusted 1917 thresholds

(a) Percentage above 1917 thresholds



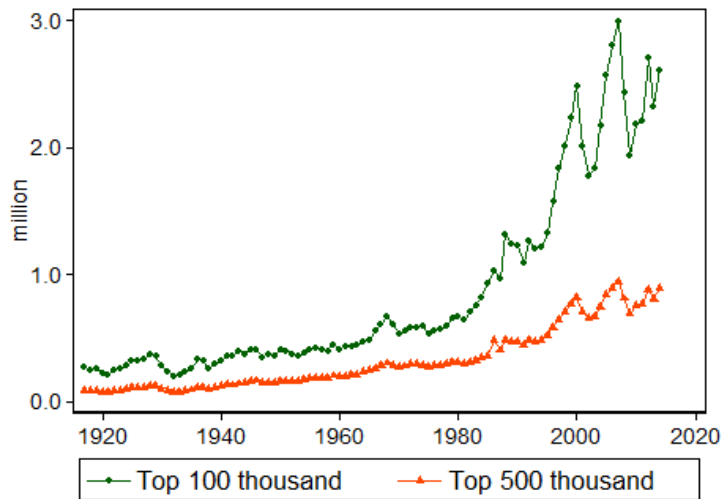
(b) Income shares above 1917 thresholds



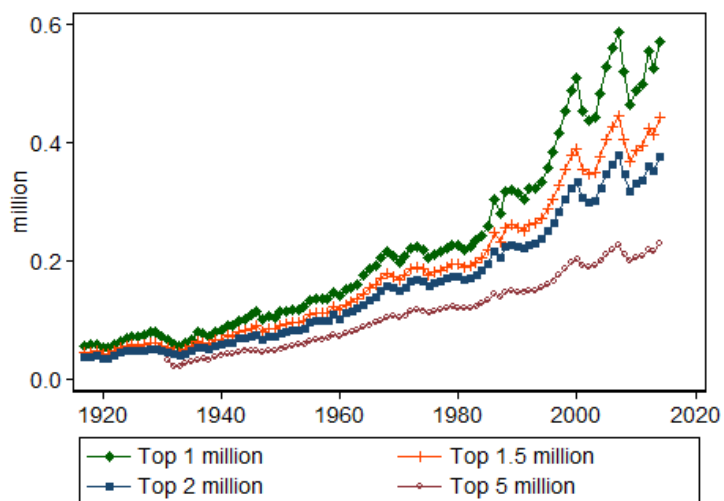
Notes: Figures plot the percentage of taxpayers and income shares above growth-adjusted 2014 thresholds including capital gains. Thresholds are adjusted with real per-capita growth rates. All sub-figures use data from the World Wealth and Income Database.

Figure 6: Thresholds of top income brackets

(a) Thresholds for top 100 and 500 thousand tax units



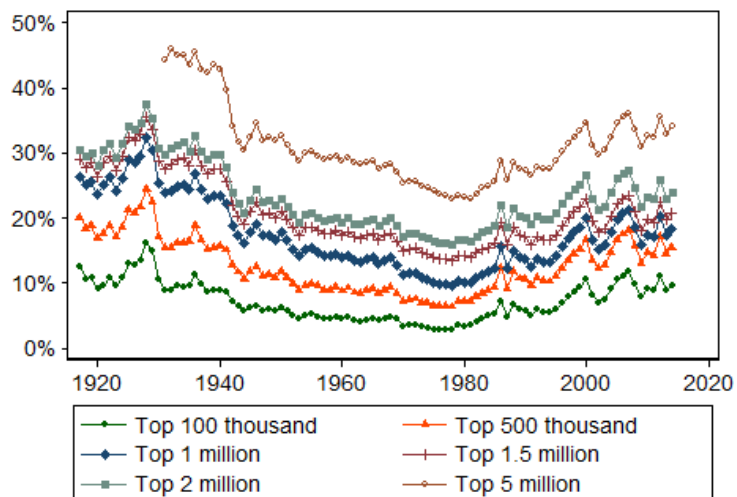
(b) Thresholds for top 1-5 million tax units



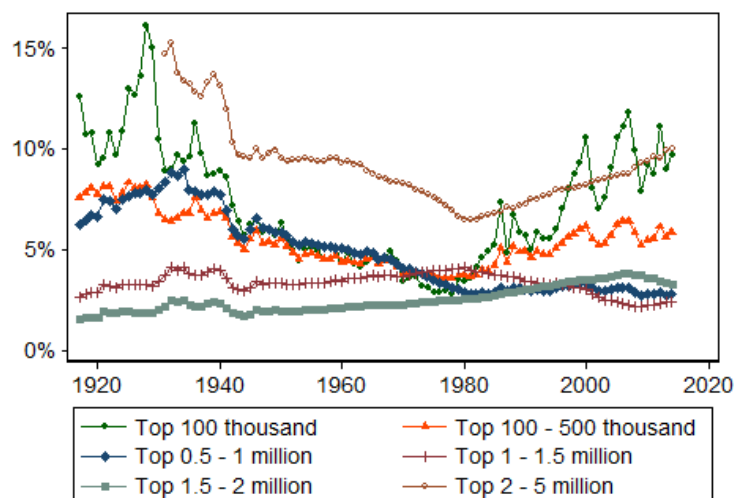
Notes: Figures plot real thresholds of fixed numbers of top tax units, including capital gains. All sub-figures use data from the World Wealth and Income Database.

Figure 7: Income shares of fixed numbers of top tax units

(a) Income shares of fixed numbers of tax units



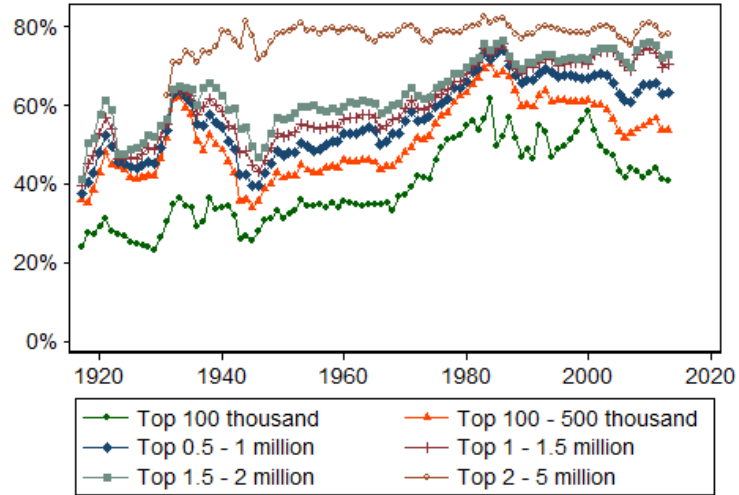
(b) Income shares of fixed top income brackets



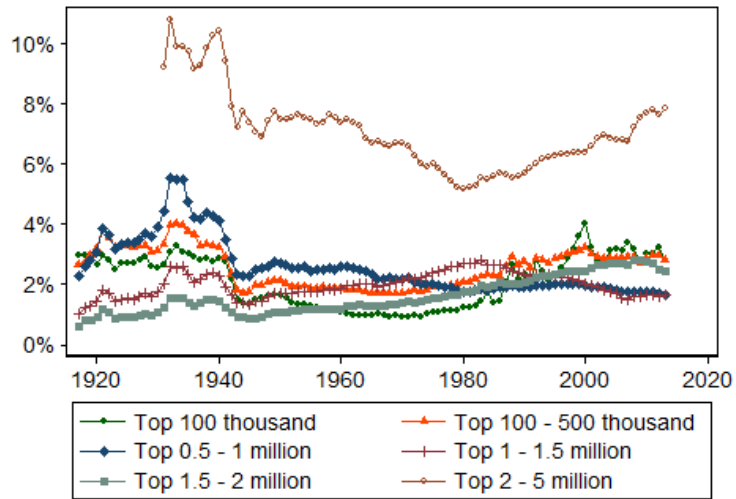
Notes: Figures plot fixed number of top tax units' income shares including capital gains. All sub-figures use data from the World Wealth and Income Database.

Figure 8: Wage shares of top income brackets

(a) Wage shares in income of fixed numbers of tax units



(b) Wage shares in overall national income

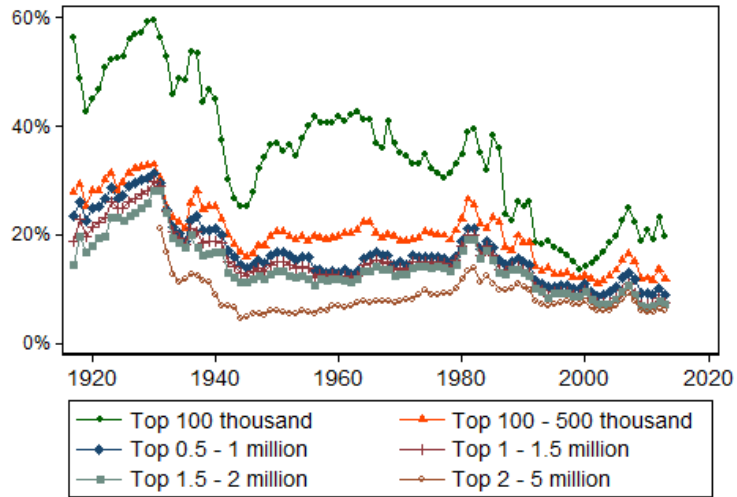


Notes: Figures plot fixed number of top tax units' wage shares, including capital gains in (a) their income and in (b) overall national income. All sub-figures use data from the World Wealth and Income Database.

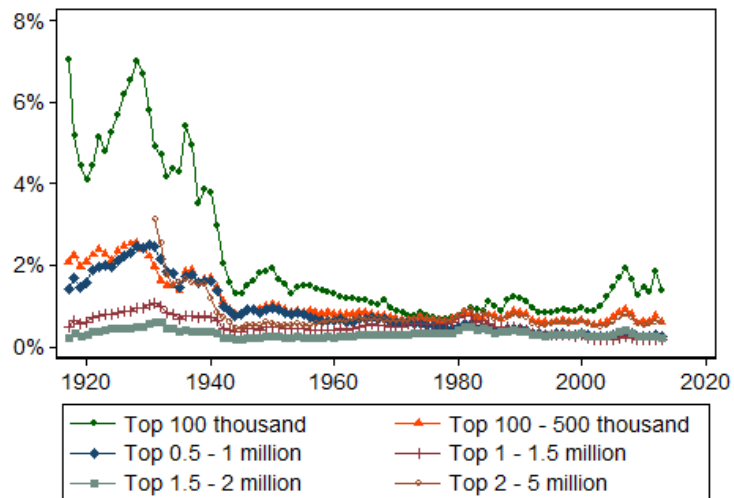


Figure 9: Capital shares of top income brackets

(a) Capital shares in income of fixed numbers of tax units



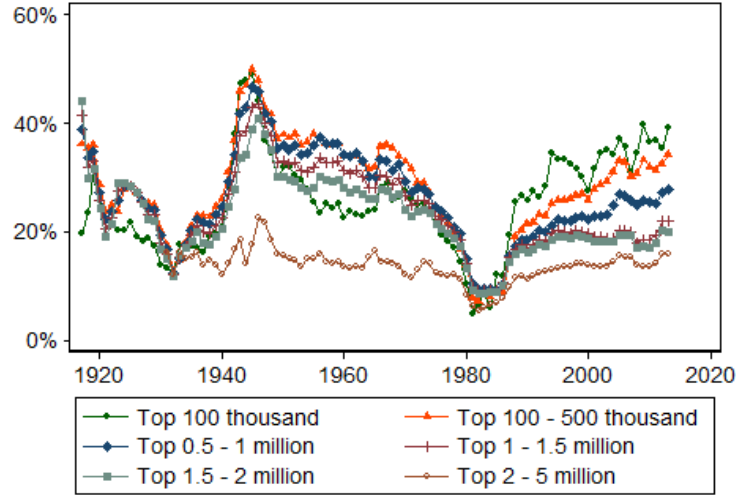
(b) Capital shares in overall national income



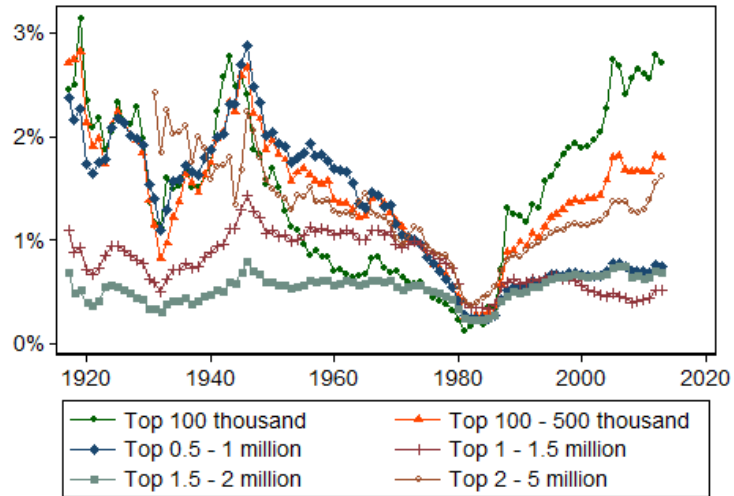
Notes: Figures plot fixed number of top tax units' capital shares, including capital gains in (a) their income and in (b) overall national income. All sub-figures use data from the World Wealth and Income Database.

Figure 10: Entrepreneurial income shares of top income brackets

(a) Entrepreneurial income shares in income of fixed numbers of tax units



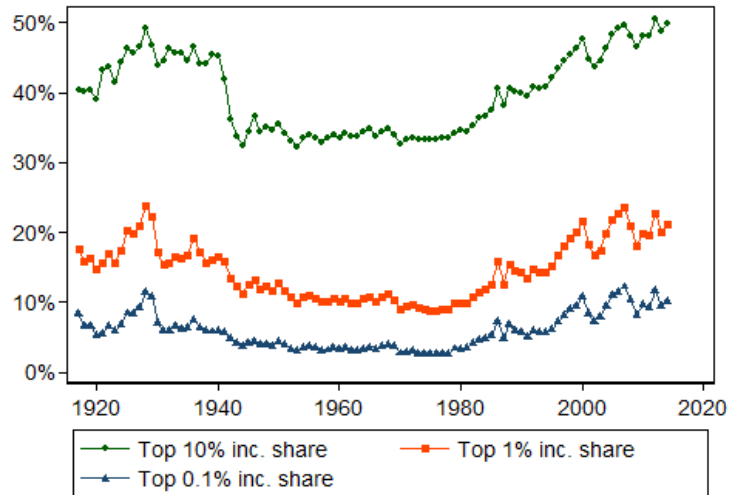
(b) Entrepreneurial income shares in overall national income



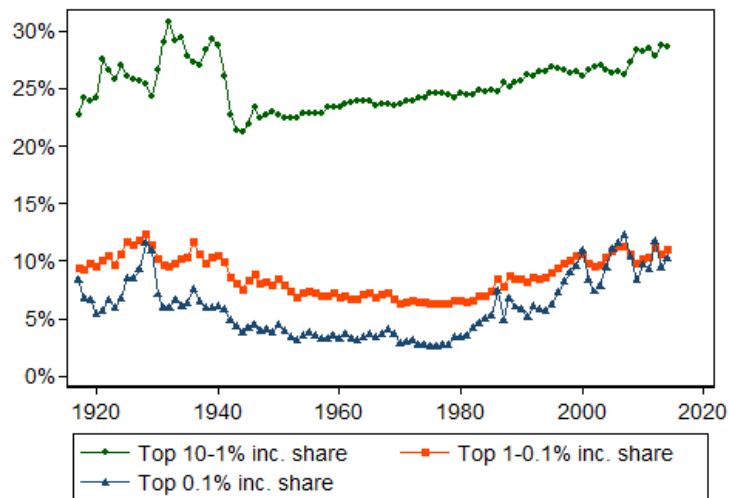
Notes: Figures plot fixed number of top tax units' entrepreneurial income shares, including capital gains in (a) their income and in (b) overall national income. All sub-figures use data from the World Wealth and Income Database.

Figure 11: Development of unadjusted top income shares

(a) Top income shares

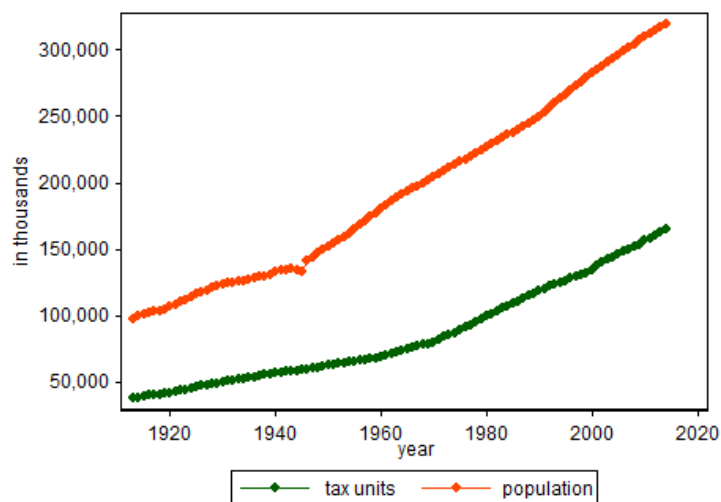


(b) Income shares of top income brackets



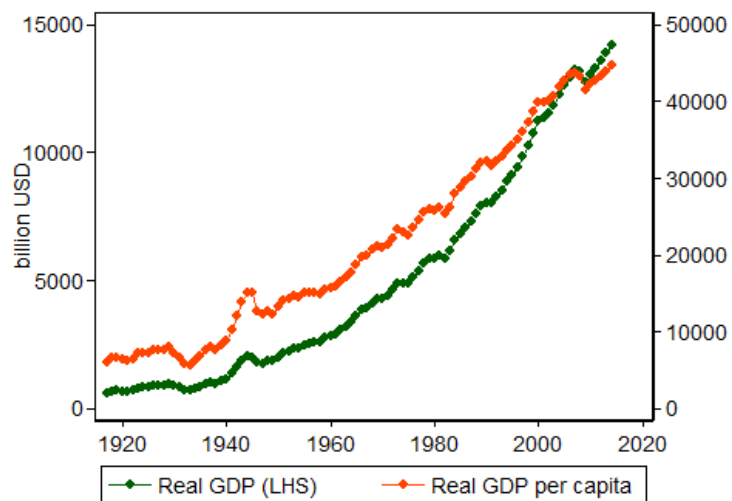
Notes: Figure plots unadjusted top income shares including capital gains. All sub-figures use data from the World Wealth and Income Database.

Figure 12: Population growth



Notes: The figure plots the US population size and the number of tax units over time, using data from the World Wealth and Income Database.

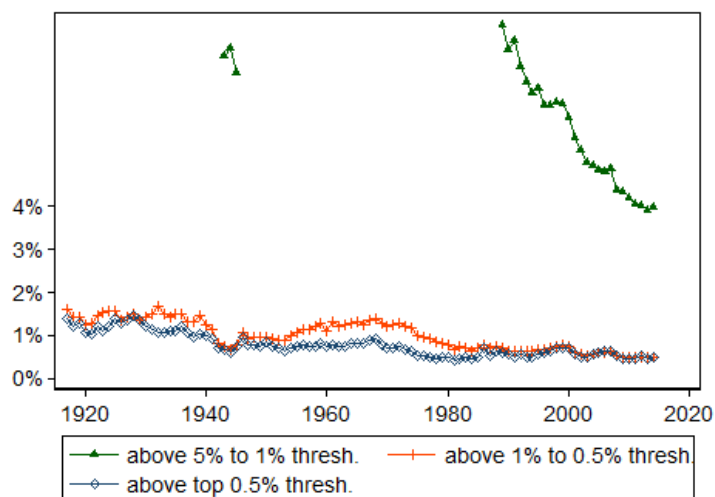
Figure 13: Real GDP growth



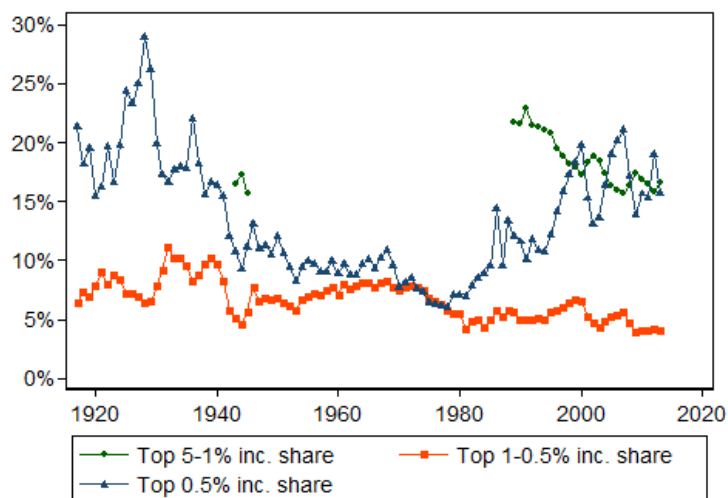
Notes: The figure plots real GDP and real per-capita GDP in 2005 USD, using data from the World Wealth and Income Database.

Figure 14: Percentage of taxpayers and income shares above growth-adjusted 2014 thresholds

(a) Percentage above 2014 thresholds

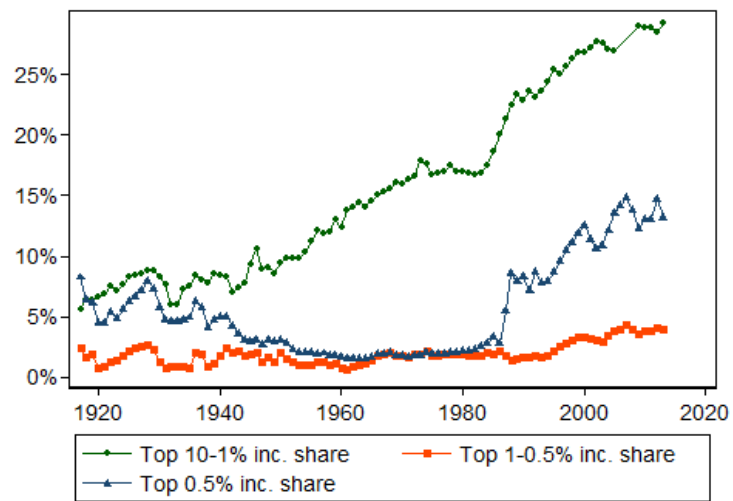


(b) Income shares above 2014 thresholds



Notes: Figures plot the percentage of taxpayers and income shares above growth-adjusted 2014 thresholds including capital gains. Thresholds are adjusted with real per-capita growth rates. All sub-figures use data from the World Wealth and Income Database.

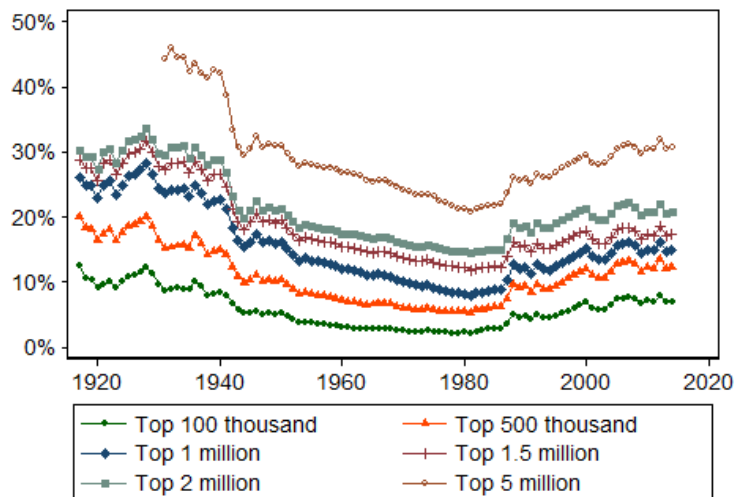
Figure 15: Income shares above 1917 thresholds, excluding capital gains



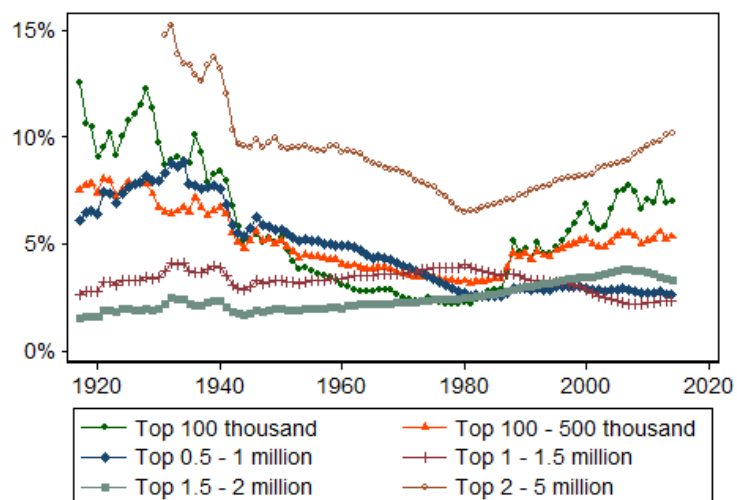
Notes: Figures plot the income shares above real income thresholds excluding capital gains. All sub-figures use data from the World Wealth and Income Database.

Figure 16: Income shares of fixed numbers of top tax units, excluding capital gains

(a) Income shares of fixed numbers of tax units



(b) Income shares of fixed top income brackets



Notes: Figures plot fixed number of top tax units' income shares excluding capital gains. All sub-figures use data from the World Wealth and Income Database.