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both? The Role of Population  
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# Richer or more Numerous or both? The Role of Population and Economic Growth for Top Income Shares

## Abstract

When measuring income inequality over long periods of time, accounting for population and productivity growth is important. This paper presents three alternative measures of top income shares that more explicitly account for population and income growth than the standard measure. We apply these measures to long-term income data from the United States and find that the U-shaped inequality trend over the past century holds up, but with important qualifications. Using measures that allow top groups to change not only in relative income but also in group size suggest more accentuated top income share growth since 1980 than when keeping top groups fixed. For earlier historical periods, our analysis shows that choice of income deflator (CPI or GDP) matters greatly. Using distributional national accounts data does not change these results. Altogether, our study's findings suggest that one may want to use several complementary top share measures when assessing long-term income inequality trends.

JEL-Codes: D310, D630, H310, N320.

Keywords: income distribution, inequality, top incomes, growth, measurement.

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# 1 Introduction

Income inequality is a multi-faceted concept, and no single measure can capture all its relevant aspects. When studying top incomes and their importance in the income distribution, the most commonly used measure is the income share of a fixed percentile of the population. This top income share measure meets many of the desired distributional criteria that a proper inequality measure should meet. However, it is sensitive to developments in the size of the underlying population or in the real economy. A growing population implies that the size of the top group grows regardless of whether the incomes of its top earners change in real or even relative terms. Productivity growth that lifts a majority of the population to welfare levels previously only enjoyed by the rich would not result in higher top income shares if this growth affects everybody equally, since the standard measure captures the income share of a fixed fractile of the population. Whether these properties are desirable for a top income inequality measure in times of population and economic growth or not depends on the research question. Nonetheless, it is important to notice that the standard top income share measure is only one of several ways of representing the relative status of top earners. The present study is the first to extend the scope of analyzing top incomes by proposing *alternative measures* of top shares that explicitly account for population and income growth. We apply these new measures to data from the United States for the period between 1917 and 2014 to analyze if and how long-run inequality trends differ when using different measures.

The starting point of our analysis is the seminal article by Piketty and Saez (2003), which was the first to compute top income shares for the US for the entire twentieth century.<sup>1</sup> In its aftermath, many studies have analyzed different aspects of top incomes in the US and largely corroborated the main findings of Piketty and Saez.<sup>2</sup> However, this literature has paid little attention to how secular trends in real incomes, productivity and the population size have influenced top income shares. As over the past century, the US population has tripled and real per capita GDP has increased more than fivefold (see figures A.1 and A.2 in the Appendix), it may be of first-order relevance to analyze how these factors influence inequality trends. To be able to conduct such analyses, alternative inequality measures are necessary as complements to the standard approach.

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<sup>1</sup>This work built on previous studies of the long-run evolution of top incomes in the US by Kuznets (1955) and Feenberg and Poterba (1993, 2000).

<sup>2</sup>See, e.g., Wolff (2002), Kopczuk et al. (2010), Atkinson et al. (2011).

We propose three alternative ways to compute top income shares, all aimed at reflecting different aspects of the influence of economy-wide real income growth and population growth, and then compare these with the baseline series of Piketty and Saez (2003).<sup>3</sup> The first measure fixes an income threshold corresponding to a certain top fractile – say, the top 1 percent – in a given year, then deflates that threshold to all other years using consumer price (CPI) deflation to finally compute income shares and the number of earners each year. The second measure uses the same approach but instead takes GDP to deflate the fixed income threshold to the other years. The third measure, finally, takes a fixed number of households, for example, the top million earners, and tracks their income shares over time.

The idea behind using these alternative measures is that they capture different relevant aspects of top income inequality that the standard top income share measure may not be able to. By fixing a real top-income threshold above which all individuals are counted as top-income earners, we acquire a measure that allows both higher average incomes and larger groups of earners to contribute to the top income share. If the economy grows such that more people can consume the same amount of welfare (in constant consumer prices or in overall output levels) as previous top income earners could, the economy produces more top income earners. The two alternative top income measures using either CPI- or GDP-deflated top-income thresholds thereby allow us to answer new top inequality questions, such as “*Have the income-rich become more numerous?*”. This question could not be answered by the standard top share measure since it mechanically fixes the top group size to the size of the whole population.<sup>4</sup> By fixing the number of top earners, as in our final alternative measure, we remove the impact of population growth on the top income share. In the standard measure, top shares may increase as the population grows simply because the size of the top group has increased (since it is a fixed share of the total). Of course, the population growth effect can be either positive or negative for the top share depending on the structure of incomes. A positive effect would arise if the population growth occurs only in the bottom, perhaps due to immigration of low-skilled people, which would make the top group expand by including more and more relatively well-paid individuals. The standard top share measure could thus

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<sup>3</sup>We also compare our results with the new series using distributional national accounts (DINA) using the data from Piketty et al. (2018) that are available since 1960 (c.f. section 4.3).

<sup>4</sup>These measures are thereby related to the headcount measures commonly used in poverty analysis. See Peichl et al. (2010) for a comprehensive discussion and analysis of such measures in analyzing affluence.

increase even if real incomes at the top have not changed at all.

Our empirical applications on the the US income distribution show that the stark U-shaped pattern documented by Piketty and Saez, with a decline in top shares until the 1980s and rising shares thereafter, is also apparent in the three alternative measures, but there are also some important differences. In particular, the post-1980 period exhibits *larger* increases in top income shares when using the fixed real-income threshold measures, which is primarily explained by an increase in the group size of top earners. Using GDP-deflated incomes, the top 1 percent has doubled in size since 1980 and using CPI-deflated incomes it has more than tripled. However, in addition becoming more numerous, our measures show that the average income of the top has also increased faster than the population average. The large increase when deflating by CPI reflects the historical price stability seen in the past years. The steeper top income share trend when using GDP-deflated incomes suggests that the productivity growth in society has been disproportionately reaped by top earners.<sup>5</sup> Looking at the measure using a fixed number of top earners, the share is actually lower than the standard measure, reflecting a relative shrinkage of this group.

We also find interesting patterns for the top groups just below the highest percentile, suggesting that influences from population and economic growth are not homogeneous within the top tail of the income distribution. In contrast to the expanding group size observed in the top percentile, we observe rather stable population shares in lower top brackets using the two fixed-income threshold measures (the fixed number of earner-measure is, of course, unchanged). Their average incomes are also relatively similar to the standard top measures, and the end result is this limited growth, or even slight decrease, in the income share of these groups. In other words, the proportion of individuals with above-average productivity gains are found almost exclusively in the highest-earning percentile, not in top groups lower down the distribution.

We subsequently decompose the different top percentile measures' post-1980 growth into its underlying factors. This allows us to more precisely identify to which extent the development of top income share measures is driven by changes in average top incomes, changes in the number of taxpayers and changes in the lower part of the earnings distribution. Notably, the number of taxpayers who increase

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<sup>5</sup>See Dew-Becker and Gordon (2005) for an early discussion of the distribution of US productivity growth.

their real income, as well as the number of taxpayers who benefit more than average from economic growth, increase at faster rates than the overall population.

Finally, when running the analysis across income sources, we can investigate the extent to which the increasing importance of wage income is attributable to increasing numbers of taxpayers belonging to the top percentile. While the baseline results show an increasing importance of wage incomes at the top, our results point to a more nuanced development. We find that for the very top (top 500,000 taxpayers) – despite growing wage income – the relative importance of wages vis-à-vis capital and entrepreneurial income has even been slightly declining over the past three decades.

The contributions of our study are directed primarily at the income inequality literature. While we are not the first to examine how different measurement approaches influence top income share trends, previous studies have focused on the concept of income, for example the effect of subtracting taxes and adding unrealized capital gains (Armour et al., 2013), on changing the computation of business income (Alstadsaeter et al., 2017) or on using national accounts-equivalent income measures (Piketty et al., 2018). The recent literature on distributional national accounts (DINA) is of particular relevance for our analysis because it explicitly examines the distributional effect of including the entire national income instead of only the fiscal income concepts used so far in the top income literature. For this reason, we include a particular analysis of how our measures perform when using DINA-incomes rather than fiscal incomes.<sup>6</sup> In addition, Auten and Splinter (2018) re-estimate top shares accounting for tax base changes, income sources absent from tax records and changing marriage rates. With their methodology, income shares are shown to increase at a much lower rate. By contrast, our analysis keeps the income concept unchanged throughout and instead focuses on different statistical measures of top shares and their composition.

Our findings also add to the research literature assessing long-run trends in top income shares in the Western world, specifically in the US. Most of these studies use the baseline definition of top income shares (Piketty and Saez (2003), Atkinson and Piketty (2007, 2010), Leigh (2009), Atkinson et al. (2011) and Waldenström and Roine (2015)), but in some cases, they use other data sources to compute the

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<sup>6</sup>There is a current debate about how to compute DINA incomes, for example, in the US case (Auten and Splinter, 2018). While our analysis is about the relative performance of different top share measures rather than which underlying income one wishes to use, we nevertheless apply our methodology to both standard and DINA top income shares.

top share (Burkhauser et al. (2012)). Our series complement these studies by asking how the picture would change if one considers further aspects, such as the variation in the size of top groups (as in the fixed threshold measures). Using different types of top share measures and the richer compositional analysis that comes with it could also provide insights on cross-country comparisons of the historical evolution of inequality.

## 2 Empirical approach

### 2.1 Methodology

Following Piketty and Saez (2003), the literature typically uses top income shares, i.e. the share of total income going to the top  $x$  percent of the population, as inequality measures for the top of the income distribution. This standard top income share measures the amount of income of a fixed fraction of the population but without accounting for changes in the composition of the population or in the distribution of income among the rich.<sup>7</sup> In order to investigate the impact of population and real income growth on top income inequality, different measures are necessary to complement the standard approach. Therefore, we propose three alternative ways to compute top income shares. Our main analysis then consists of comparing the trends in top shares for the different measures. Comparing the differences between the four measures allows us to single out the contributions of population and economic growth to the observed inequality trends. The purpose is not only to obtain a picture of the sensitivity of these trends to these variations but also to explicitly account for the growth of the population and the overall economy.

We compute top income shares for four different top groups that differ in whether their population share and group size are variable or fixed:

- A) *Standard measure*: Top income share used in Piketty and Saez (2003): fixed population share, variable group size (in number of earners).
- B) *CPI-deflated threshold*: Top income or population share of those earning above CPI-deflated income threshold: variable population share, variable group size.

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<sup>7</sup>See Peichl et al. (2010) for a comprehensive discussion of alternative measures to analyze top income inequality.



- C) *GDP-deflated threshold*: Top income or population share of those earning above GDP-deflated income threshold: variable population share, variable group size.
- D) *Fixed group size*: Constant number of top earners: variable population share, fixed group size.

Measure A is the baseline definition that has been used in the top income literature. It is defined as the share of total incomes earned by a fixed fractile (e.g., top decile or top percentile) of the population.

Measure B refers to income earners with an income above a level that is linked to an income threshold of a certain top group (e.g., the 99th percentile threshold for the top percentile group) in a specific year. We deflate this threshold using the CPI, where the base year is either the year 1980, which serves as a focal point in the inequality literature due to the substantial tax reforms implemented in the early 1980s, or the first or the last year in our sample, 1917 and 2014, respectively. Since this measure varies in both income and population shares, we compute both top income shares and top population shares (headcount ratios).

Measure C top shares are computed in the same way as those for measure B, except that we deflate the income thresholds using per capita GDP instead of CPI to capture the overall productivity growth in the economy. This step helps investigate the extent to which top incomes have grown more quickly than the overall economy.<sup>8</sup> If increases in top real incomes were attributable solely to economic growth and not to changes in the income distribution, income and population shares above the GDP-deflated thresholds should remain roughly constant over time.

Finally, measure D is the top income share of a constant number of top earners, such as the top one million earners in the distribution. We include this measure since rising income shares of measures B and C may reflect two effects: a rising number of taxpayers above the fixed income thresholds and rising incomes of these earners. By fixing a number of high-earning taxpayers, we isolate the latter effect.

**Decomposition analysis.** We conduct two different decomposition analyses of the top share measures in order to gain further insight into the forces driving them. The first is to decompose changes in the top percent income share into the contributions of population size, group size (for measures B and C), overall income and

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<sup>8</sup>Per capita growth is chosen instead of overall growth to net out the growth effect of the changing population size.

average income growth in the top and bottom groups. 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  $\bar{Y}$  ( $\bar{Y}_i$ ) indicates average income (in fractile  $i$ ) and  $N$  ( $N_i$ ) indicates the number of tax units (in fractile  $i$ ).

This decomposition allows us to more precisely identify the extent to which changes in top income share measures are driven by changes in average top incomes, changes in the number of taxpayers, and changes in the denominator, i.e., in the incomes and size of the remaining population.

In a second decomposition, we analyze the effect of different sources of income on overall income trends: wages, capital income (dividends, interest and rents) and business 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. Based on this calculation, we derive the share of each group's respective income categories in aggregate US income.

## 2.2 Data

Our estimates are based on the standard source of international top income data: The World Wealth and Income Database<sup>9</sup>. These estimates encompass income shares and percentile thresholds for the US over the years 1917–2014, using incomes from all sources before tax and deductions and most transfers. These data come from tax returns statistics compiled by the IRS and have been adjusted to consider changes in the tax law (Piketty and Saez, 2003). Thresholds and annual incomes are computed in real terms to ensure their comparability across years. Realized capital gains are not included in the baseline calculations, but we show in the appendix that our findings are not sensitive to the treatment of capital gains.

As is common in this literature, the units of analysis are the income tax units (single or married households) and they are related to the total number of potential tax units in the population calculated from census data. Income thresholds and

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<sup>9</sup>Source: <http://www.wid.world>. The data stems from different versions of the website downloaded in 2016-2018.

shares are calculated assuming a Pareto distribution to approximate income shares of top fractiles.

Due to the large income growth over the past century and the fact that the World Wealth and Income Database provides data on only the top income decile, we sometimes need additional data for those cases when more than 10 percent of tax units surpass a given threshold. If needed, we supplement the data with IRS SOI<sup>10</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.<sup>11</sup>

In addition, we contrast our findings with recent distributional national accounts (DINA) measures. These are based on different concepts for calculating top income shares and strive to capture the full scope of national accounts (Piketty et al., 2018).<sup>12</sup>

### 3 Top income share trends across measures

We start our empirical analysis with a broad comparison of the four different top share measures by analyzing both income and population shares of the top group and their long-run developments. In the next subsections, we analyze our new measures in more detail by looking at subgroups of the top 5 percent. In Section 4, we dig deeper by decomposing the various measures into their components as well as investigating differential trends by income source.

#### 3.1 The top 1 percent share

Figure 1 presents the evolution of the top 1 percent pre-tax income share in the US between 1917 and 2014 according to the four top income share measures presented above.<sup>13</sup> Since it commonly serves as a focal point in the literature, we use the year 1980 as a reference year (see figures A.10 and A.11 in the Appendix for reference years 1917 and 2014, respectively). Measure A, the standard measure (used by

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<sup>10</sup>Source: <https://www.irs.gov/uac/SOI-Tax-Stats-Historical-Table-3>

<sup>11</sup>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-percent threshold of the IRS data matched the 10-percent level of our base dataset.

<sup>12</sup>Source: <https://wid.world/>

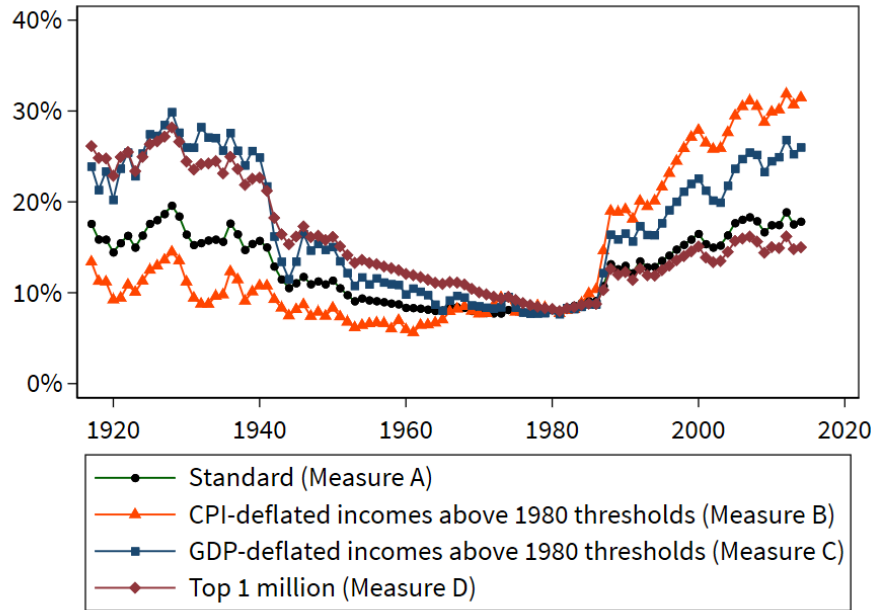
<sup>13</sup>Figures A.4 to A.7 in the Appendix show similar graphs for different parts of the top income distribution.

Piketty and Saez), exhibits the marked U-shaped pattern that has been described numerous times in the past literature, showing a share beginning high at 15-20 percent, decreasing to under ten percent and finally rising to prewar levels in recent years. Measure B, which shows the income share of earners with an income above the CPI-deflated 1980 income threshold (that is, the 99th percentile) looks different. It is much lower in the prewar era, hovering around ten percent, where it stays until the mid-1980s, when it rises rapidly, reaching over 30 percent in the 2000s. Measure C, the GDP-deflated 1980 income threshold is also different. This share drops drastically from over 30 percent in the interwar era to ten percent in the 1960s, a fall that is twice as large as in the baseline series. Moreover, while the share remains rather similar to the baseline until the mid-1980s, it displays a substantially higher growth rate afterwards and again reaches the level it had amounted to a century ago. Finally, measure D shows the income share of the top 1 million tax units – the approximate number of tax units in the baseline around 1980. This series is the most similar to the baseline, with deviations reflecting primarily the effect of differences in group size (being relatively larger before 1980 and relatively smaller afterward).<sup>14</sup>

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<sup>14</sup>Qualitatively, the results do not change by much when we analyze incomes including capital gains (c.f. figure A.12 in the Appendix).

Figure 1: Different measures for the top 1 percent



Notes: This figure plots income shares for the four different top inequality measures (as described in section 2.1): the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1980 income threshold, as well as the income share of the top 1 million taxpayers (D). The measures are constructed such that they equal each other in 1980 (see Appendix figures A.8 and A.9 for 1917 and 2014 as baseline year, respectively). The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

The main message in Figure 1 is that developments within shorter periods (though still several decades) are apparently sensitive to how one defines the top income shares.

Our analysis thus shows that having different types of top income share series provides new insights on the evolution of income inequality. The difference between the baseline and the fixed threshold series reflects that not only the relative incomes of top earners but also the size of their group matter. Deflating the threshold using GDP provides information about the distribution of the economy's overall productivity gains: from the 1930s to the 1950s, they went mostly to the bottom 99 percent, while they subsequently were roughly equally distributed between the top 1980 percentile and the rest till the late 1980s. From then onwards, they predominately accrued to the upper part of the earnings distribution. However, this

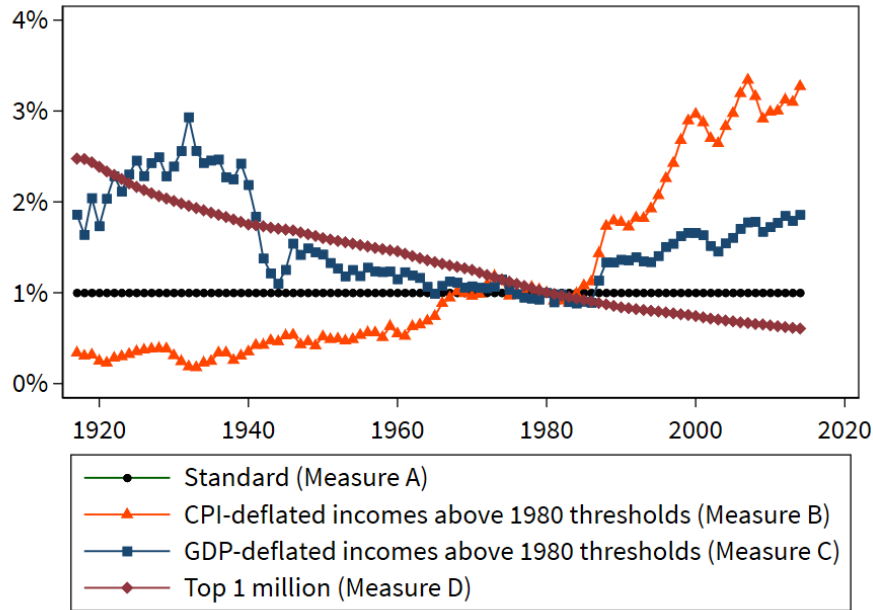
development is partly attributable to a rising fraction of individuals sharing the productivity gains above the GDP-deflated 1980 threshold.

Next, we examine the evolution of top *population* shares using the four different measures. This analysis differs from the analysis of top *income* shares and it addresses related but yet slightly distinct questions. For example, top population shares are informative regarding the degree of concentration among the rich (see also Atkinson (2008)) and the absolute number of high-earning individuals in an economy. Figure 2 shows the population shares of the top percentile income level for each of the four different measures. Measure A, the baseline, is by construction fixed at the one percent level and entirely uninformative about inequality trends. Similarly, measure D falls steadily along with population growth since the share of a fixed group size (the top 1 million) falls as the population grows.

By contrast, measures B and C are more informative. Their developments correspond relatively well with what was shown in Figure 1. The share of tax units above the CPI-deflated 1980 threshold (measure B) increases throughout the past century. This effect is due to both productivity growth – increasing real incomes over time – and changes in the income distribution. Between the 1980s and the 2000s, the top population share increased threefold, which reflects that top incomes increased more than consumer prices.

The share of taxpayers above the GDP-deflated 1980 top percentile threshold (measure C) – which should follow a flat trajectory if tax units along the entire income distribution benefit similarly from productivity growth – has been subject to different developments during the past century. The share decreases quite sharply in the first half of the twentieth century, and increases again from the 1990s onwards, albeit at a much lower level than the CPI-deflated shares. In other words, when requiring that a top percentile income should match the 1980 level deflated using GDP, less and less top earners have been able to make it to the top in the previous century. This group has again expanded in recent years.

Figure 2: Population share of top 1 percent earners across measures



Notes: This figure plots *population* shares for the four different top inequality measures (as described in section 2.1): the standard measure (A; equal to 1 percent by construction), the population shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1980 income threshold, as well as the population share of the top 1 million taxpayers (D). The measures are constructed such that they equal each other in 1980 (see Appendix figures A.8 and A.9 for 1917 and 2014 as baseline year, respectively). The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

Table 1 presents an overview of average annual growth rates of the top percentile share for the different measures during subperiods over the past century. The table distinguishes between the growth in income shares and the growth in population shares, where the latter correspond to zero for the baseline shares but are more meaningful for the other measures. Looking first at the income share growth rates, there is a fairly large correspondence in the signs of growth rates across measures within subperiods. In one cases, the sign differs: the CPI-deflated top share during 1950-1980 period shows a positive rate, while rates are negative for the other measures. However, the magnitudes of growth differ quite notably between the baseline and the other measures in several cases, especially during the postwar era. The largest growth rates are observed in the 1980-2000 period. Incomes above the GDP-

deflated threshold have exhibited a much higher growth rate than the underlying population share, while this gap is much smaller for the CPI-deflated threshold. This underlines that over this period, top earners have particularly benefited from economic growth.

Table 1: Average annual growth rates (in percent) of income and population shares for different top 1 percent measures

Annual growth in income and population shares								
Period	Standard (Measure A)		CPI-deflated top thresholds (B)		GDP-deflated top thresholds (C)		Top 1 million (D)	
	Income	Pop.	Income	Pop.	Income	Pop.	Income	Pop.
1917-1929	2.4	0	3.4	3.1	2.0	0.1	1.4	-1.6
1929-1950	-2.1	0	-1.8	3.0	-2.1	-1.4	-2.3	-1.1
1950-1980	-0.7	0	1.0	2.9	-1.1	-0.8	-1.8	-1.5
1980-2000	4.4	0	7.5	6.2	6.7	2.7	4.0	-1.5
2000-2014	0.4	0	0.6	0.5	0.7	0.0	0.0	-1.5

Notes: This table shows average annual growth rates of the top percentile share for the different measures during subperiods over the period of analysis. The four different top inequality measures (as described in section 2.1) are: the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1980 income threshold, as well as the income share of the top 1 million taxpayers (D). The measures are constructed such that they equal each other in 1980. The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

### 3.2 Top groups above fixed thresholds (measures B and C)

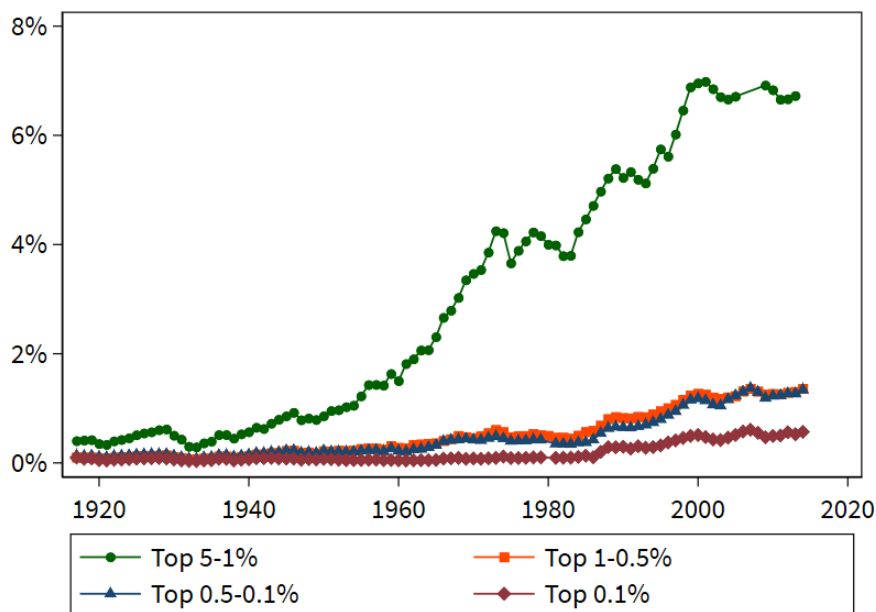
We now zoom in on the different alternative top share measures by taking a closer look at the long-run developments of different top fractiles and their income shares in the different top share measures.

Measure B is based on CPI-deflated thresholds. Figure 3 shows the income shares and the corresponding shares of taxpayers for income brackets above the CPI-deflated 1980 thresholds. Comparing real incomes across years instead of comparing relative positions on the income distribution in a year constitutes one approach to accounting for population growth. We consider the top 5, 1, 0.5 and 0.1 percent

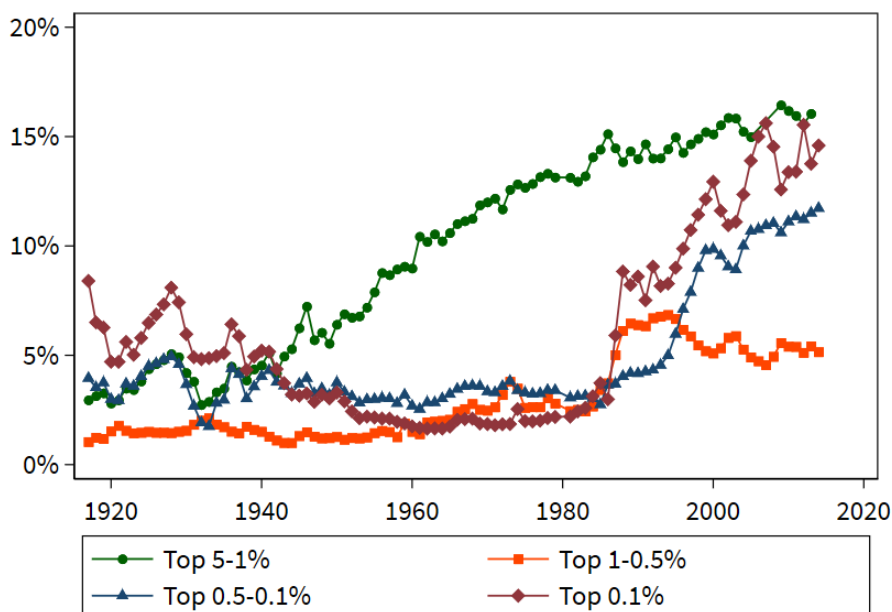


Figure 3: Top shares of those above CPI-deflated 1980 top thresholds (Measure B)

(a) Percentage of taxpayers above CPI-deflated 1980 top thresholds



(b) Income shares of taxpayers above CPI-deflated 1980 top thresholds



Notes: This figure plots population and income shares of those earning above the CPI-deflated 1980 income threshold (Measure B, as described in section 2.1). The measure is constructed such that it equals the standard top 1 percent share in 1980 (see Appendix figure A.10 for 1917 and 2014 as baseline years). The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

thresholds. In order to highlight differences along the top, shares are displayed for the brackets in between the thresholds. This analysis hence decomposes the top 1 percent shares reported in figures 1 and 2 into three groups: top 1–0.5, 0.5–0.1 and top 0.1 percent and additionally shows the group just below: top 5–1 percent.

Accounting for population growth reveals different developments than the well-known top fractile results (c.f. figure A.3 in the appendix). The respective trajectories follow different patterns, deviating from the familiar U-shaped one. The developments of income shares do not closely follow the growth of population shares above thresholds. Instead, the income share between the top 1-0.5 percent thresholds remains rather constant, with some growth in the 1990s. In contrast, the income share above the uppermost threshold has experienced a large increase since the 1980s, while declining and then remaining at a roughly constant level in previous decades. The income share of taxpayers between the 1 percent and 5 percent thresholds has almost continuously grown since the early 20th century. These developments cannot be fully explained by economic growth or 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 for all – not just some – upper thresholds. Instead, figure 3 points to a more nuanced development than one might infer from the evolution of standard top income shares. Possible drivers are discussed in more detail in section 4.2.

Measure C is based on GDP-deflated thresholds. The above results are driven partly by economic growth. We use per capita GDP-deflated thresholds (see figure A.2 in the appendix for GDP growth) to assess whether top income earners have more than proportionally benefited from economic growth. If economic growth is equally distributed across the income distribution, the population and income shares above the GDP-deflated thresholds should remain roughly constant over time.

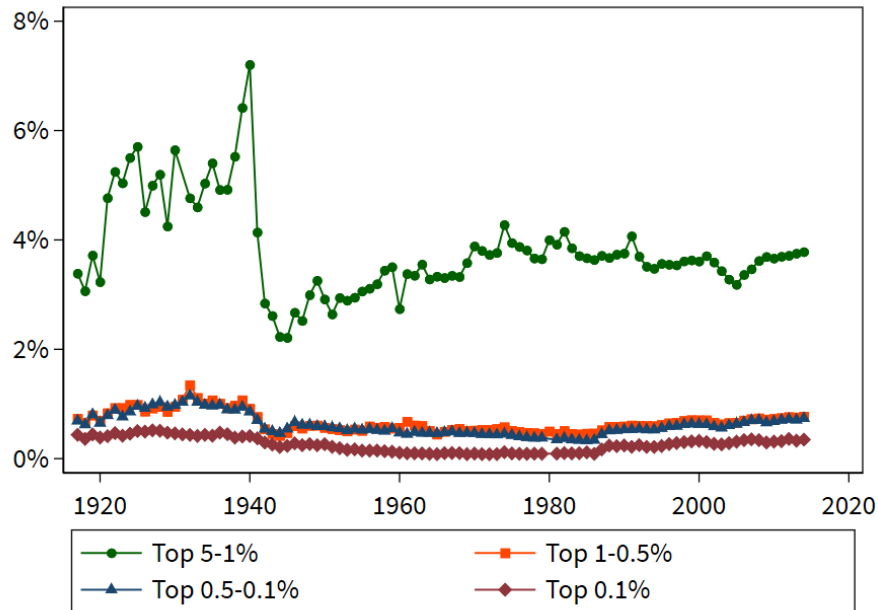
As shown in figure 4, such constant population and income shares cannot consistently be found in the data for GDP-deflated thresholds. As before, the figure depicts developments for the GDP-deflated top 5-1, 1-0.5, 0.5-0.1 and 0.1 percent 1980 thresholds.<sup>15</sup> Differing findings emerge over time and for rather narrow and larger GDP-deflated thresholds. As shown in subfigure (a), the percentage of tax units above all GDP-deflated top thresholds declined around World War II. The 1950s

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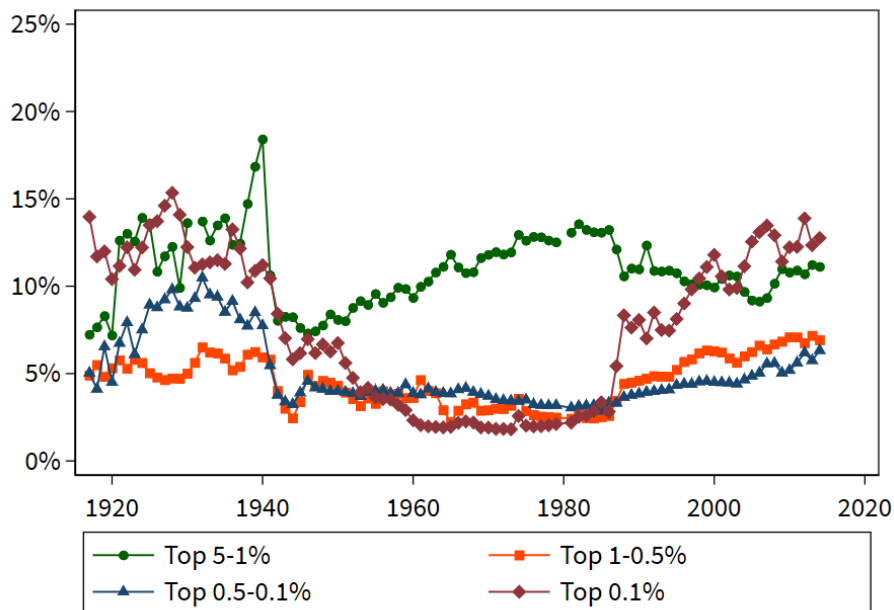
<sup>15</sup>Similar findings emerge for 1917 and 2014 thresholds. See figure A.11 in the appendix.

Figure 4: Top shares of those above GDP-deflated 1980 top thresholds (Measure C)

(a) Percentage of taxpayers above GDP-deflated 1980 top thresholds



(b) Income shares of taxpayers above GDP-deflated 1980 top thresholds



Notes: This figure plots population and income shares of those earning above the per capita GDP-deflated 1980 income threshold (Measure C, as described in section 2.1). The measure is constructed such that it equals the standard top 1 percent share in 1980 (see Appendix figure A.11 for 1917 and 2014 as baseline years). The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

and 1960s witnessed diverging developments: more and more tax units exceeded the GDP-deflated 5 percent threshold during the mid-twentieth century, whereas the fraction of taxpayers above the GDP-deflated top 0.1 percent threshold shrank. Hence, more and more people with high – but not extremely high – incomes have benefited more than proportionally from economic growth. As, at the same time, the percentage of tax units above very high income thresholds continued to decline throughout the mid-twentieth century, incomes at the larger top of the distribution became more equal. In the late 1970s, the result reverses. From then onwards, the share of tax units above the 5 percent threshold ceased to grow, whereas the number of tax units at the very top grew significantly.

For income shares, the picture looks a little different. In line with other findings in the literature, the income share of those above the GDP-deflated 1980 0.1 percent threshold – the highest in our computations – 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 share of the top bracket has been subject to even more pronounced fluctuations than the fraction of tax units above those thresholds. However, whilst decline and growth periods coincide with the baseline, the share develops at a much larger magnitude.

The income shares between the GDP-deflated top 1-0.5 and 0.5-0.1 percent brackets shrank in the first half of the twentieth century and began growing again in the 1980s. The time trend is substantially less pronounced than for the tax units above the top GDP-deflated threshold. In contrast, the decline of the 5-1 percent share halted after World War II, with the share then rising until the early 1980s. From the late 1980s onwards, it experienced a slight decline, only to remain roughly constant in more recent years. Hence, the dispersion of incomes does not evenly affect all high incomes.

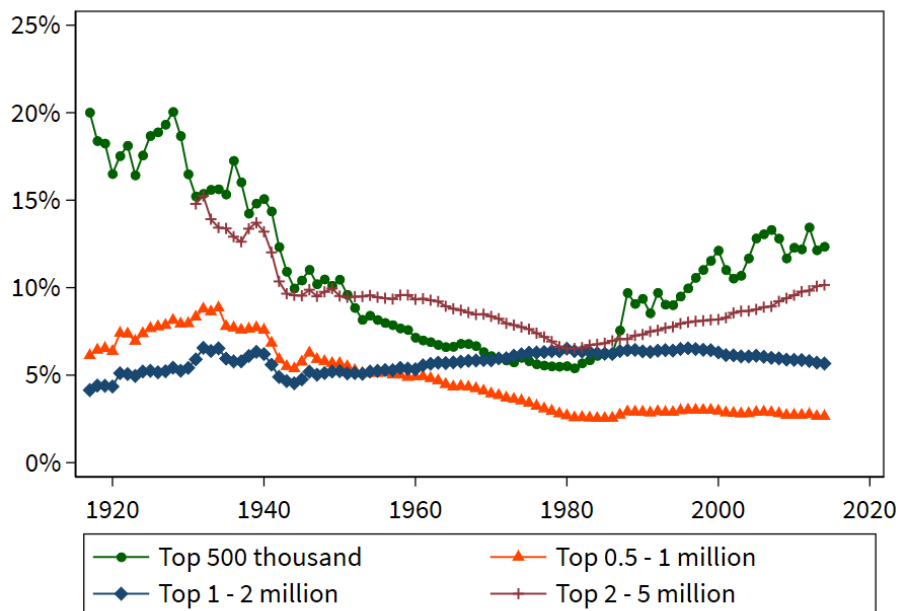
### **3.3 Constant number of top tax units (measure D)**

While the comparison of income shares above thresholds indicates a pronounced growth-exceeding increase 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 changes in the income allocated to them. Hence, from figure 4 alone, one cannot seamlessly infer which part is attributable to the presence of more

or fewer taxpayers exceeding 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 A.1 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 500,000, 500,000-1 million, 1-2 million, and 2-5 million taxpayers.<sup>16</sup> Splitting top income shares into brackets yields more thorough insights on the effects at work. 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 increase does not necessarily apply to the slightly lower tier of top income recipients.

Figure 5: Top shares of fixed numbers of earners (Measure D)



Notes: This figure plots income shares of fixed numbers of top tax units (Measure D, as described in section 2.1). The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

In line with previous research, the income share of the uppermost income group – here, the top 500,000 – sharply declined until 1980, when it began to substan-

<sup>16</sup>For the early 1900s, the income share of the top 5 million tax units cannot be calculated because they constituted more than 10 percent of all taxpayers in these years.

tially increase. A possible explanation is that the richest individuals derive a substantial share of their income from capital and entrepreneurial activities and 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 cycle 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 Great Recession. The picture completely changes for the top 0.5 to 2 million, who did not improve their income share over time. This starkly contrasts with the top 2 to 5 million, who, 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.

The above findings accentuate that the top 1 percentile (which would have encompassed several of the above groups in 2014) is far from being a homogeneous group. Instead, there seem to be differential forces at work that distinguish the top segments from one another. An explanation might well be found by differentiating why certain taxpayers belong to the top. In other words, 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? The decomposition in section 4.2 sheds light on this question.

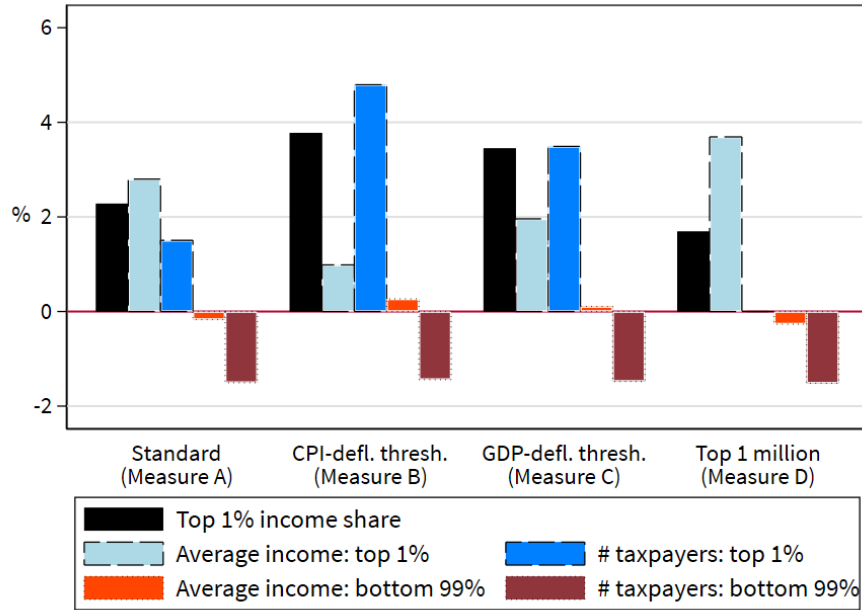
## 4 Decomposition analysis and robustness

### 4.1 The role of income and population changes

We now implement the decomposition analysis presented in section 2 (see equation 1), which decomposes changes in the log income share of the top percentile into changes in its average income, in the average income of the lower 99 percent, and of overall population growth. As a starting point, figure 6 depicts the average annual changes in log income shares over the 1980-2014 period for the previously discussed core measures: the Piketty and Saez baseline top 1 percent income share, the income shares above CPI- and GDP-deflated 1980 top 1 percent thresholds, and the top 1 million taxpayers. These changes are then decomposed into their contributions. That is, we display average changes in average incomes for the top 1 percent and for the bottom 99 percent measures and the changes in the number of taxpayers in the respective top 1 percent and bottom 99 percent. As indicated by equation 1, positive changes in average top incomes increase income shares, while increases in

the bottom 99 percent's average incomes lower income shares. At the same time, increases in the number of tax units above (below) the threshold have a positive (negative) effect on the top income share. Therefore, in order to be consistent with equation (1), increases in the bottom population and income share appear as negative numbers in the figure.

Figure 6: Decomposing the top percentile growth, 1980-2014



Notes: This figure plots the results from the decomposition analysis presented in section 2 (see equation 1), which decomposes changes in the log income share of the top percentile into changes in its average income, in the average income of the lower 99 percent, and of overall population growth (number of taxpayers in top vs. bottom). Results of this decomposition over the 1980-2014 period are presented for standard measure (A), the income shares above CPI- (B) and GDP-deflated (C) 1980 top 1 percent thresholds, and the top 1 million taxpayers (D). In order to be consistent with equation 1, increases in the bottom (top) population and income share appear as negative (positive) numbers in the figure. The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

The income share above the CPI-deflated threshold grows more on average than the unadjusted top income share. While average incomes above the threshold experience positive average growth, the effect is driven substantially by an increasing number of taxpayers exceeding the threshold. More precisely, the number of tax-

payers above the threshold experiences much faster growth than the overall number of taxpayers. That is, in both absolute and relative terms, an increasing number of taxpayers earned at least as much real income as the top 1 percent in 1980.

To a lesser degree, this also holds true for the income share above the GDP-deflated 1980 threshold. The growing income share is substantially driven by the increasing number of taxpayers at the top, again rising at a much faster pace than the overall number of taxpayers. Growing average income at the top also plays an important role. This development is however partly attributable to the threshold increasing with per-capita GDP, which *ceteris paribus* results in growing average income above the threshold.

By construction, the number of taxpayers in the top 1 million stays constant. The positive growth in their income share is thus driven entirely by the top 1 million experiencing substantially higher income growth than the rest of the population. Nevertheless, the remainder of the population was also able to increase their real incomes, albeit at a much smaller scope.

That is, not only do the various measures yield differing developments, but the factors driving these measures also vary. The number of taxpayers increasing their real income, and the number of those that benefit more than average from economic growth, grow faster than the overall population as reflected in the baseline.

## **4.2 Differential effects by income source**

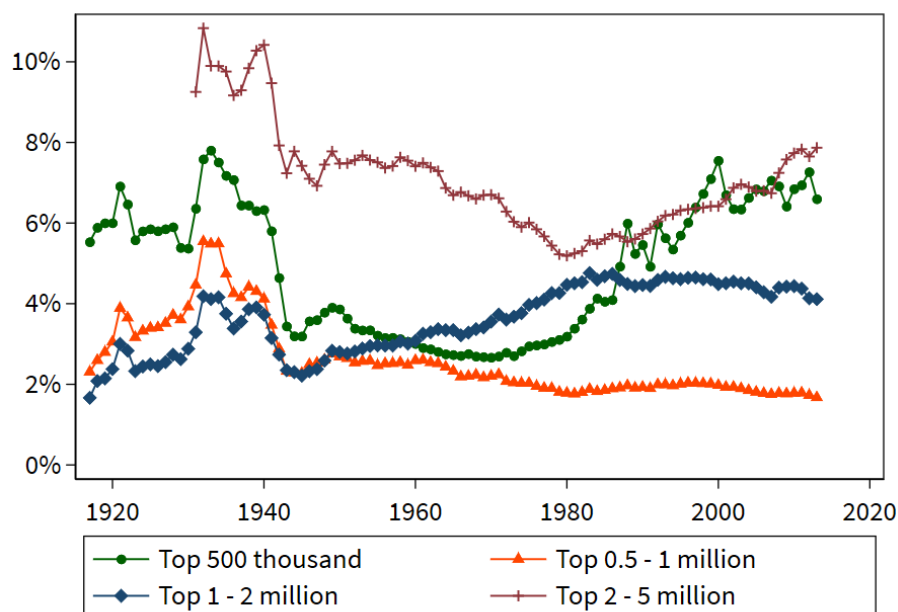
To further assess which factors drive the differential development of top income shares, we approximate the contribution to income shares of wages, capital (dividends, interest and rents) and entrepreneurial income. According to past research (cf. section 1), wage income became increasingly important for top percentiles in the second half of the twentieth century. At the same time, the relative importance of capital income declined. While these results have been widely discussed, our previous question also applies here: To what extent 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 a larger share of wage income on average – moved 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 1 or top 0.1 percentiles?



For this analysis, we track the same top 500,000, 1 million, 2 million, and 5 million taxpayers as above and decompose their incomes according to their sources. When the number of taxpayers in each income bracket is held constant, a different picture emerges than that 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 7 displays wage income’s share in the overall population’s aggregate income.

Figure 7: Wage shares of top income brackets (Measure D)



Notes: This figure plots wage income shares of fixed numbers of top tax units in aggregate income (Measure D, as described in section 2.1). The figure is based on authors’ calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

The shares of top income groups’ wages in aggregate income have grown since the 1980s for both the top 500,000, as well as for the top 2 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 2 million’s wages have not increased relative to overall income.

These findings diverge from the results computed with total income. While wages became increasingly important for earners at the very top and in the middle-upper class, a similar effect fails to manifest for income earners between these groups. Comparing wage income to entrepreneurial and capital income shares, though, the relative importance of wage income has even been slightly declining at the very top of the income distribution. Note, though, that while we track a constant number of top income earners, we cannot track individuals. Hence, salary increases for top-earning executives might have lifted them into a higher bracket, in turn shifting taxpayers who 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 be partly 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 and technological change, particularly 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 2 million.

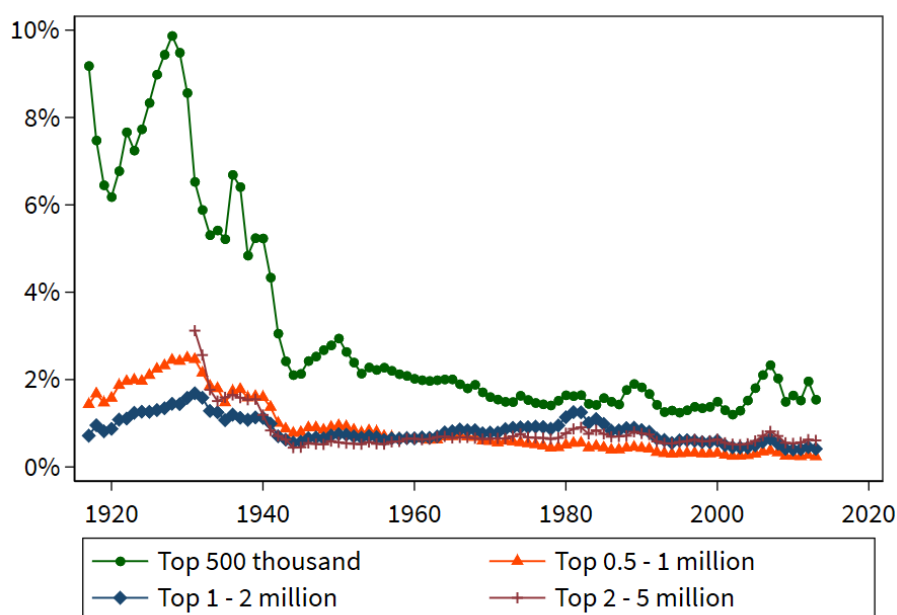
Another potential contributing factor to the rising importance of wages is the increased assortative mating that has occurred since the 1970s (Schwartz, 2010). Because income is measured at the tax unit level, the increased propensity to marry a spouse with a similarly high income should increase both the importance of wages and overall income shares over time.

Another popular explanation for this development are tax reforms, particularly the 1981 and 1986 Tax Reform Acts (Bargain et al., 2015; Feldstein, 1995; Auerbach and Slemrod, 1997; Hausman and Poterba, 1987). In addition to a broad range of measures, the 1986 TRA reduced top marginal tax rates from 50 to 28 percent but broadened tax bases. The 1980s constituted a tipping point in the development of top wage incomes. After the tax reforms, the shares of top wages in overall national incomes increased, but the previously increasing importance of wages relative to other income sources of top earners came to a halt. 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 have such pronounced

effects. Notably, the Omnibus Budget Reconciliation Act of 1993 increased top marginal tax rates from 31 to 39.6 percent but this increase can be associated at best with small fluctuations in wage shares.

**Capital income.** Capital income is composed of rents, dividends and interest. The share of capital income followed a rather flat trajectory from the 1940s to the 1970s for the top 500,000 to 5 million. This holds for both the share in aggregate income and its importance relative to top earners' other income sources.

Figure 8: Capital shares of top income brackets (Measure D)



Notes: This figure plots capital income shares of fixed numbers of top tax units in aggregate income (Measure D, as described in section 2.1). The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

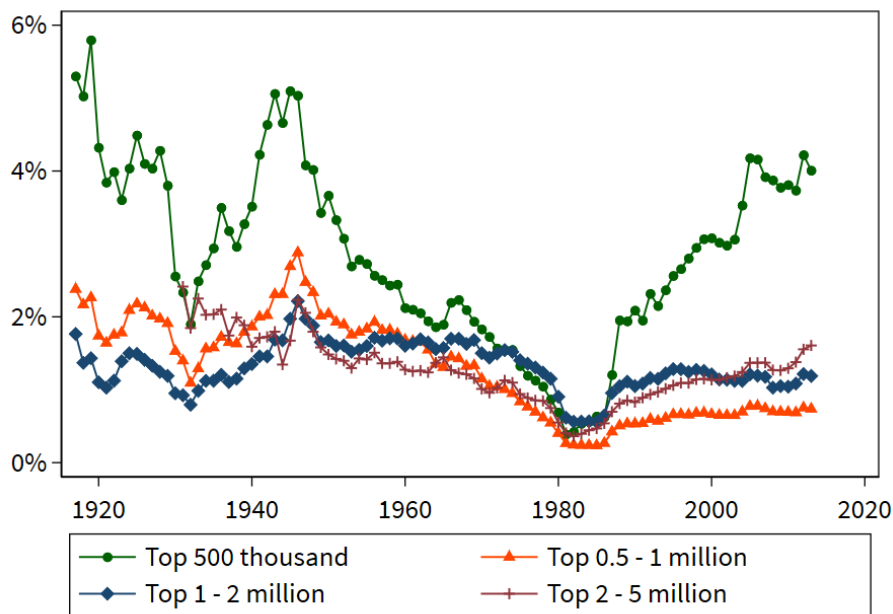
For the uppermost 500,000, however, capital income has increasingly contributed to their income in recent years. Nevertheless, the recent increase pales in comparison to the income shares that top earners obtained from dividends, interest and rents prior to World War II.

The spike in the early 1980s was accompanied by a sharp drop in business income (see figure 9). Part of this development may therefore 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 opportunities over time.

**Business 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 has the proportion of income generated by entrepreneurs multiplied, but overall entrepreneurial revenues have also contributed to overall US incomes at increasing rates for the top 500,000 and, to a much lower extent, the top 2–5 million. Strikingly, while entrepreneurial income has played less of a role for the top 500,000 than for taxpayers with incomes just below theirs, this relation reversed after 1980.

Figure 9: Measure D: Entrepreneurial income shares of top income brackets



Notes: This figure plots entrepreneurial income shares of fixed numbers of top tax units in aggregate income (Measure D, as described in section 2.1). The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

Much of the large jump in figure 9 may be attributable to reclassifications and incentives related to the 1986 Tax Reform Act (Feldstein, 1995; Auerbach and Slem-

rod, 1997; Hausman and Poterba, 1987). First, the abolition of the general utilities rule made C-corporations less attractive. Prior to the reform, such corporations had allowed for lower tax rates than the personal income tax. As a result of the reform, many C-corporations were converted into 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 was larger for the top 500,000 than for the subsequent high-income earners.

### 4.3 Using data from the Distributional National Accounts

Recently, Piketty et al. (2018) analyzed income distribution trends with broader measures that strive to capture the full scope of national accounts. Based on tax, survey and national accounts data, distributional national accounts (DINA) measures are more comprehensive than standard top share measures. In particular, the pre-tax national income measure corresponds to all income flows to capital and labor, accounting for pensions, unemployment and disability insurance. I.e., it captures income before government intervention.

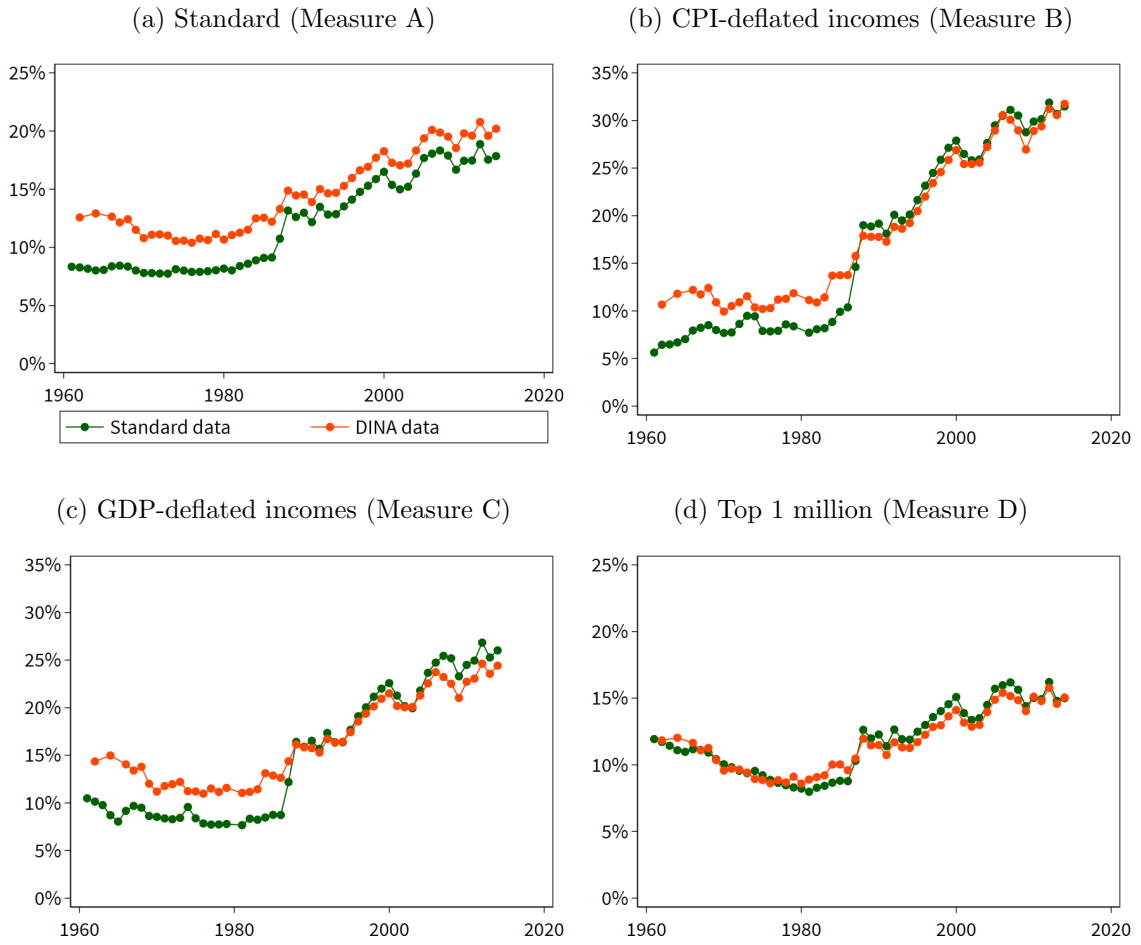
Our measures can likewise be applied to this income concept. As opposed to the standard top income share data, sufficient DINA data is only available from the 1960s onwards.<sup>17</sup> In addition to being more comprehensive, the DINA calculations differ in further aspects, which are attributable to differences in the data sets.<sup>18</sup>

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<sup>17</sup>Prior years lack information on top thresholds and only contain limited information on top shares. Calculating our alternative top share measures with a sufficient degree of precision is thus not possible.

<sup>18</sup>Instead of tax units, DINA considers individuals age 20 or older, between whom incomes are equally split within households. We correspondingly deflate thresholds by per adult GDP. Instead of the CPI, the data set also uses the national income price index rather than the CPI for deflating thresholds. Moreover, from the 1960s onwards, top thresholds and shares are available at a much finer grid than the standard top share data, with separate measures for every percentile and an even finer grid within the top percentile. We exploit this different data structure and use piecewise linear interpolation to obtain measures above thresholds.

Figure 10: Standard vs. DINA data



Notes: This figure compares income shares for the four different top income inequality measures using two different data concepts: standard data and DINA data. The four different top inequality measures (as described in section 2.1) are: the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1980 income threshold, as well as the income share of the top 1 million taxpayers (D). The measures are constructed such that they equal each other in 1980. The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is, respectively, pre-tax fiscal income, excluding capital gains, and pre-tax national income.

Despite the methodological differences, the DINA-based measures for the top percentile in figure 10 follow a very similar trajectory compared to the different top share measures using the standard data. Interestingly, the biggest difference between the two data sources can be found for the standard top income share measure. Both population and income shares above the CPI-deflated top 1 percent thresholds have

risen rapidly in the last three decades. Income and population shares above the GDP-deflated top 1 percent threshold follow a similar, but less pronounced trend.

The very high degree of similarity between DINA and standard measures grants further credibility to our measures and indicates that our measures can be applied to a wide array of income concepts.

## 5 Concluding discussion

The measurement of income inequality trends have been discussed extensively in the academic inequality literature. The recent top income literature has proposed using top income shares to capture inequality dynamics, and it has received tremendous attention and spurred much new research. However, little attention has been paid to the fact that the standard top income share measure is only one of several variants of top income share measures. By focusing on incomes earned by a fixed share of the population, this measure does not fully reflect changes in the economy that could make the top group either shrink or grow relative to the rest of the population.

Our study offers three alternative top share measures that try to address this aspect, focusing on the influences from real income growth and population growth. The first two measures define an income threshold in a certain year over which income earners are said to belong to the top (different thresholds refer to different top fractiles). Then this threshold is extended to later or earlier years, deflating either by CPI or GDP to reflect the relative influence of increased purchasing power or relative shares of overall productivity growth. The third measure fixes the top group in terms of number of earners, making it insensitive to overall population growth.

Our empirical application of these measures on the long-run trends in US top income shares show that these measures offer a broadly consistent picture as the one previously provided by Piketty and Saez. We find a decline in top shares in the first half of the twentieth century and a rise in the period after 1980. However, our findings point to several additional patterns, especially concerning top share measures that are anchored in the absolute level of income in one particular year and then deflated over time using either consumer prices or total output in the economy. Most notable are the differences between threshold levels in the CPI- and GDP-deflated measures. While groups at the very top are roughly similar to the baseline measures, trajectories of groups in the upper middle class vary a great deal.

It should be noted that these alternative measures are complementary to the standard approach. In fact, we believe that using them in parallel could offer a valuable strategy for the study of top incomes, and we think that our analysis of the US historical experiences shows this.

The analysis of the role of GDP-deflated real incomes relate to the recent studies of inequality outcomes using a broader income concept that includes all of national income instead of just tax return-based fiscal incomes (Piketty et al., 2018; Bozio et al., 2016; Auten and Splinter, 2018). We apply our alternative measures to these distributional national accounts incomes and find broadly consistent results. Again, our contribution is to offer alternative top income share measures, and these can be used on any underlying concept of income.

We hope that future research will continue working on refining the way income inequality is measured. Our alternative top income measures offer one way of approaching similar reassessments of top shares for other countries, and even of conducting cross-country analyses of the development of top income shares over time. This analysis could shed additional light on the multitude of factors driving the differing developments across and within countries.



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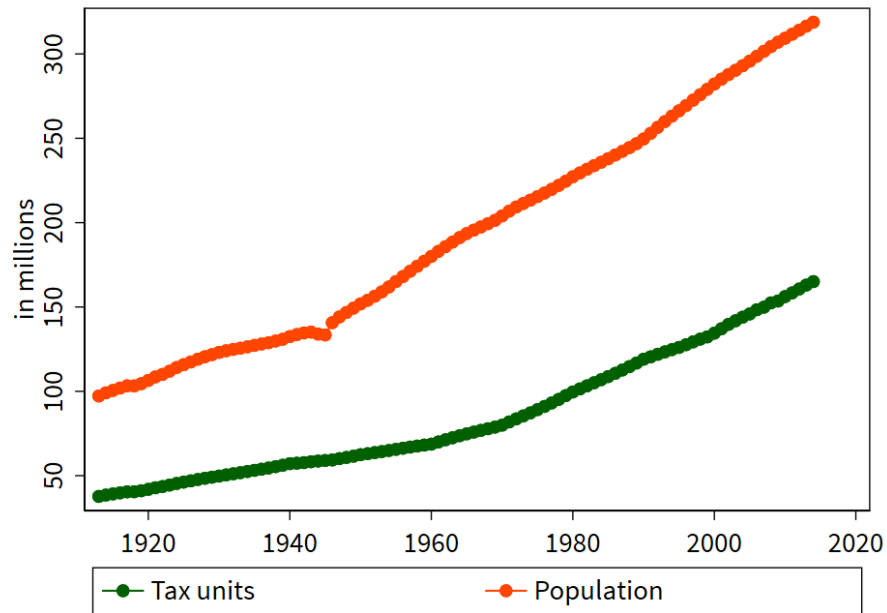
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# Appendix

**Population growth.** As depicted in figure A.1, 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.

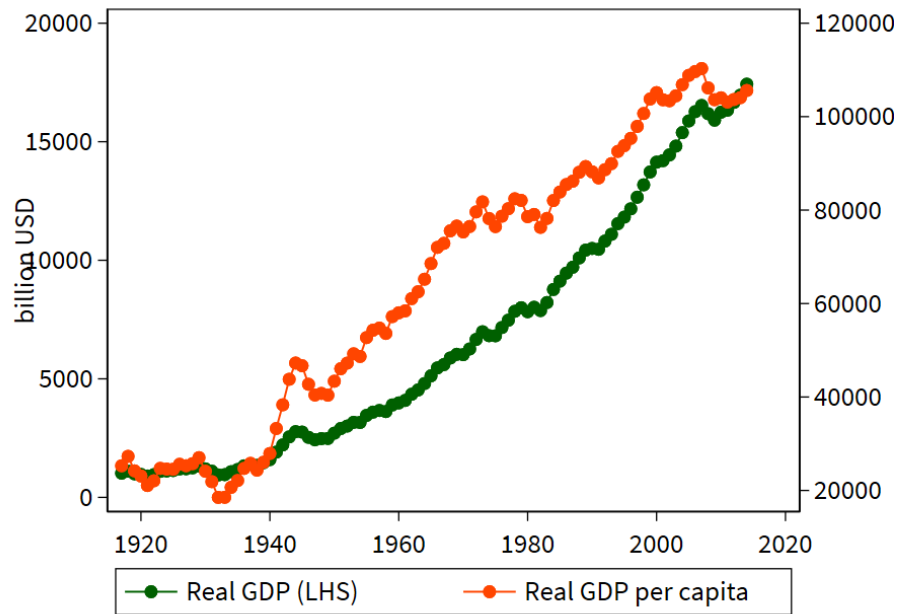
Figure A.1: Population growth



Notes: This figure plots the US population size and the number of tax units over time. The figure is based on data from the World Wealth and Income Database.

**Economic growth.** Figure A.2 displays the development of overall and per tax unit real GDP in 2014 terms. Data are taken from the World Wealth and Income Database and from Johnston and Williamson (2018).

Figure A.2: Real GDP growth

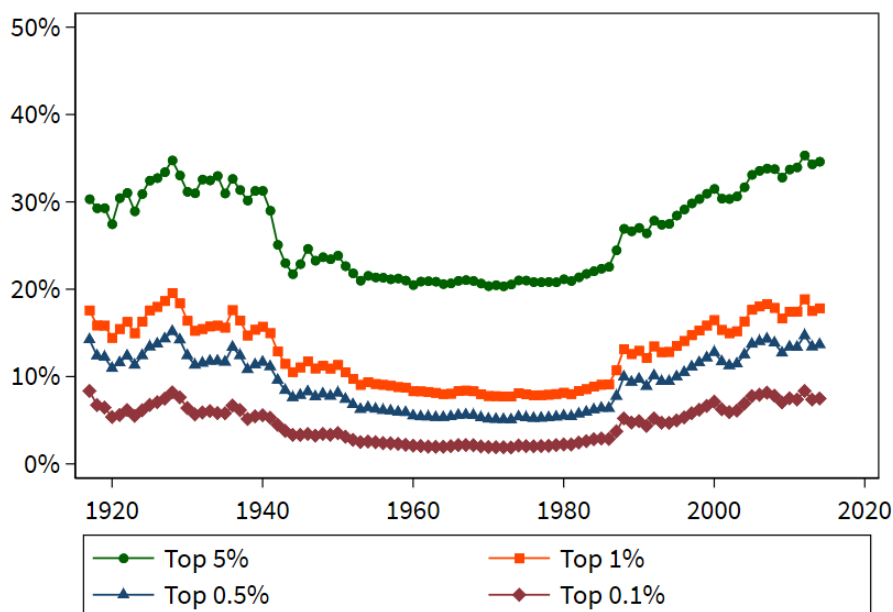


Notes: This figure plots real GDP and real per tax unit GDP in 2014 USD over time. The figure is based on data from the World Wealth and Income Database and from <http://www.measuringworth.org/usgdp/> (Johnston and Williamson, 2018).

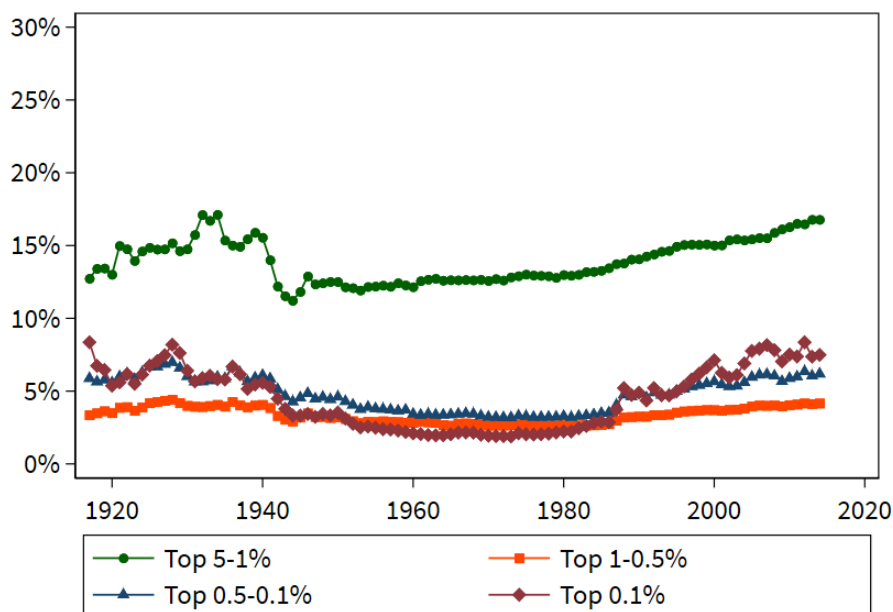
**The key results of Piketty and Saez.** As a baseline, figure A.3 displays the evolution of top income shares excluding capital gains over time. The upper figure depicts the unadjusted top income shares as in Piketty and Saez (2003) and Piketty and Saez (2006). As shown in the graph, top income shares 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 5-1 percent. This provides a benchmark against which the alternative measures can be compared.

Figure A.3: Measure A: Development of unadjusted top income shares

(a) Top income shares



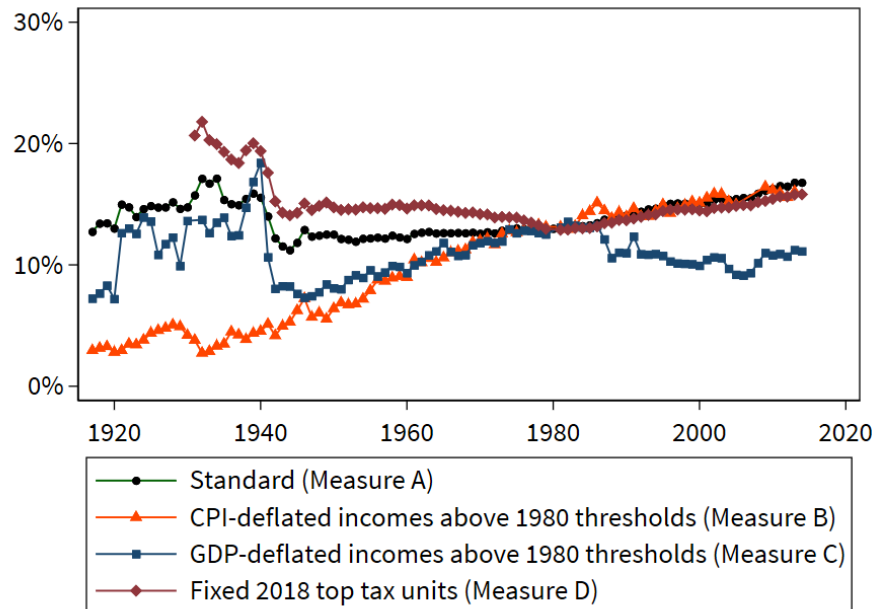
(b) Income shares of top income brackets



Notes: This figure plots standard top income shares (Measure A, as described in section 2.1). The figure is based on data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

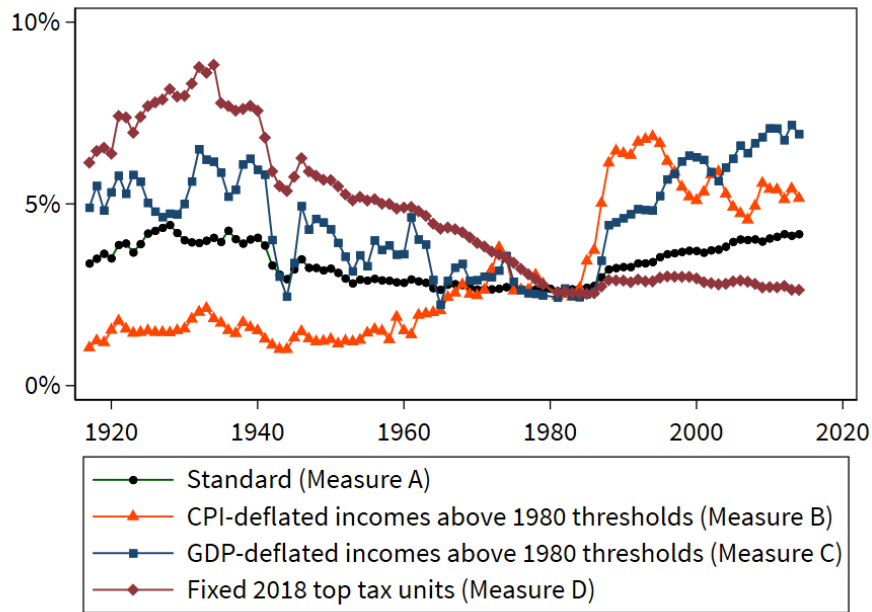
**Different measures for varying top percentiles.** Similar to figure 1, figures A.4 to A.7 compare top income shares for different parts of the 1980 top earnings distribution.

Figure A.4: Different measures for the top 5-1 percent



Notes: This figure plots income shares for the four different top inequality measures (as described in section 2.1): the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1980 income threshold, as well as the income share of a fixed number of taxpayers (D). The measures are constructed such that they equal each other in 1980. The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

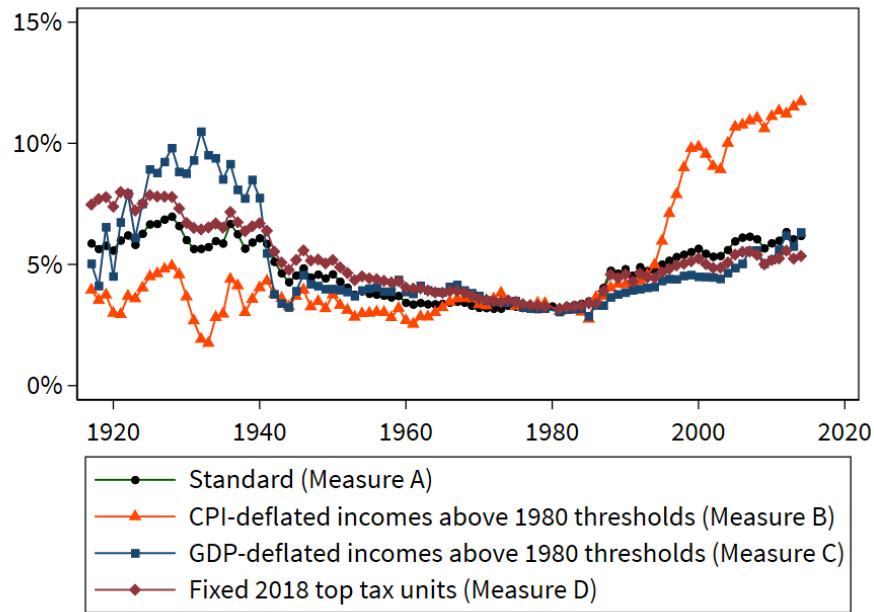
Figure A.5: Different measures for the top 1-0.5 percent



Notes: This figure plots income shares for the four different top inequality measures (as described in section 2.1): the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1980 income threshold, as well as the income share of a fixed number of taxpayers (D). The measures are constructed such that they equal each other in 1980. The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

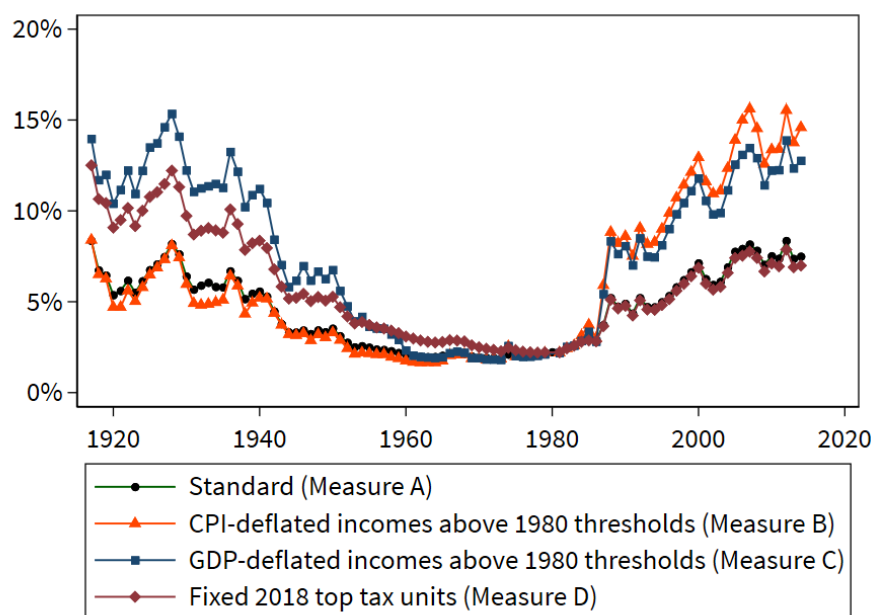


Figure A.6: Different measures for the top 0.5-0.1 percent



Notes: This figure plots income shares for the four different top inequality measures (as described in section 2.1): the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1980 income threshold, as well as the income share of a fixed number of taxpayers (D). The measures are constructed such that they equal each other in 1980. The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

Figure A.7: Different measures for the top 0.1 percent

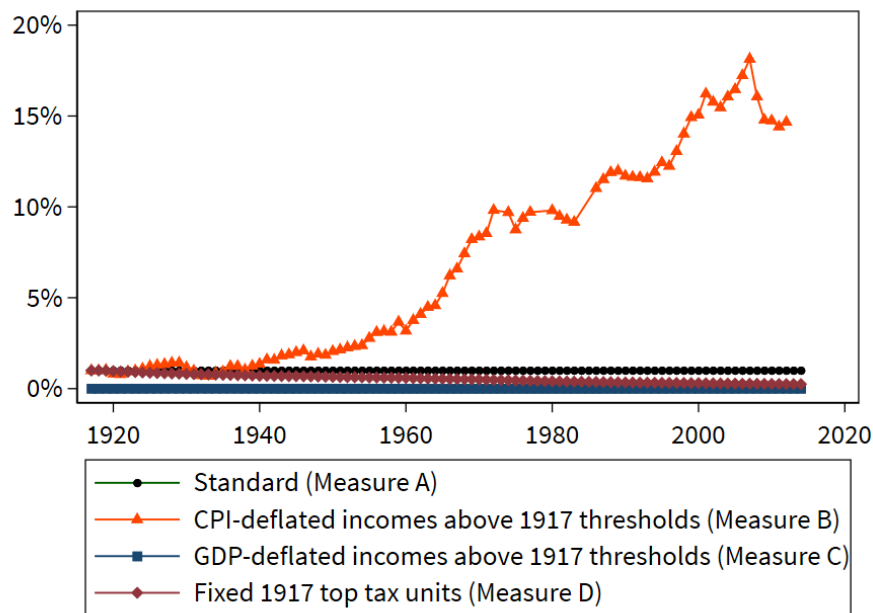


Notes: This figure plots income shares for the four different top inequality measures (as described in section 2.1): the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1980 income threshold, as well as the income share of a fixed number of taxpayers (D). The measures are constructed such that they equal each other in 1980. The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

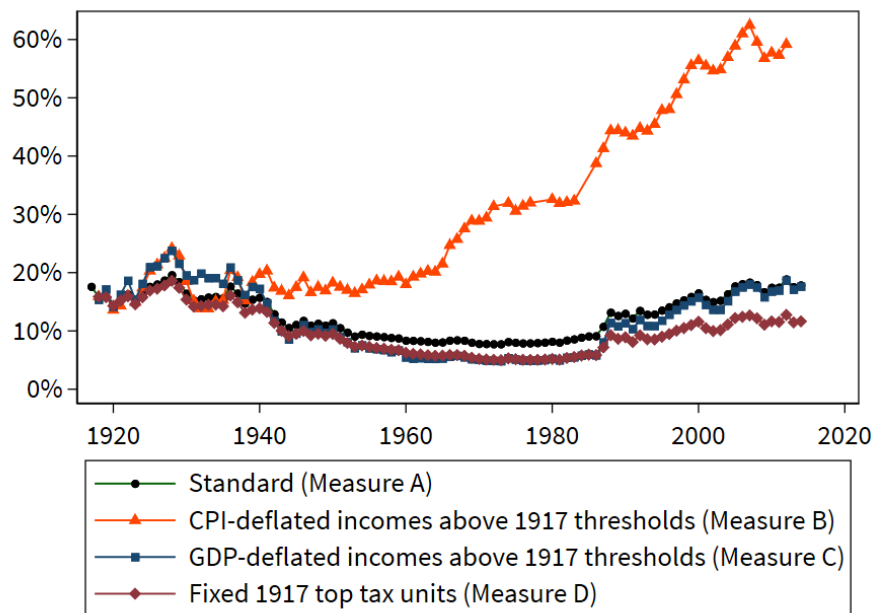
**1917 and 2014 thresholds.** While our main results focus on 1980 thresholds, similar findings emerge for CPI- or GDP-deflated 1917 and 2014 thresholds. Results for CPI-deflated thresholds (fig. A.10) and GDP-deflated thresholds (fig. A.11) fit well with the 1980 results. While the richest group of taxpayers has become significantly richer since the 1980s and has obtained more than an equal share in the benefits of growth, the effect is not that clear-cut for the middle upper class. Again, the groups that form the lower top (e.g. the 2014 top 5-1 percent) increase in size and gain larger income shares than those above them, but below the very top.

Figure A.8: Different measures for the top 1 percent: 1917

(a) Population shares



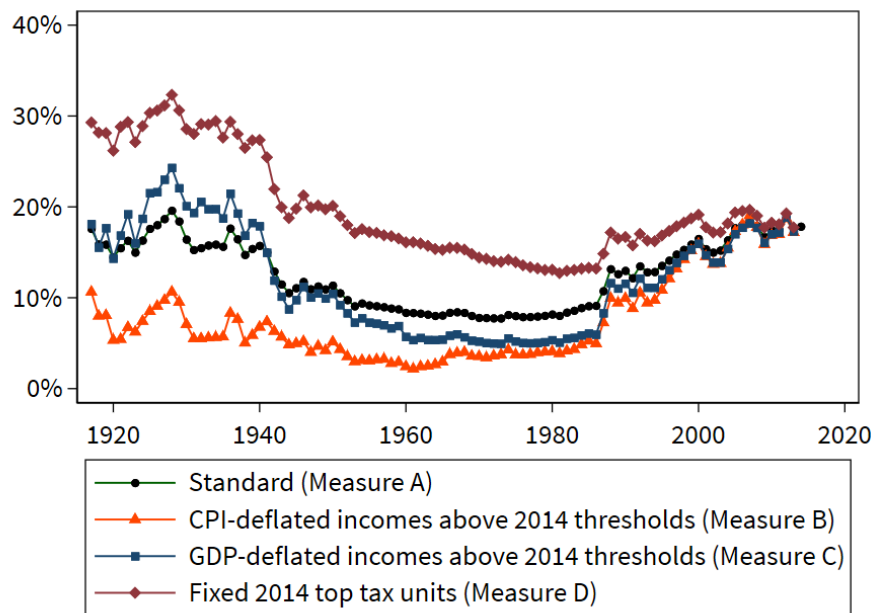
(b) Income shares



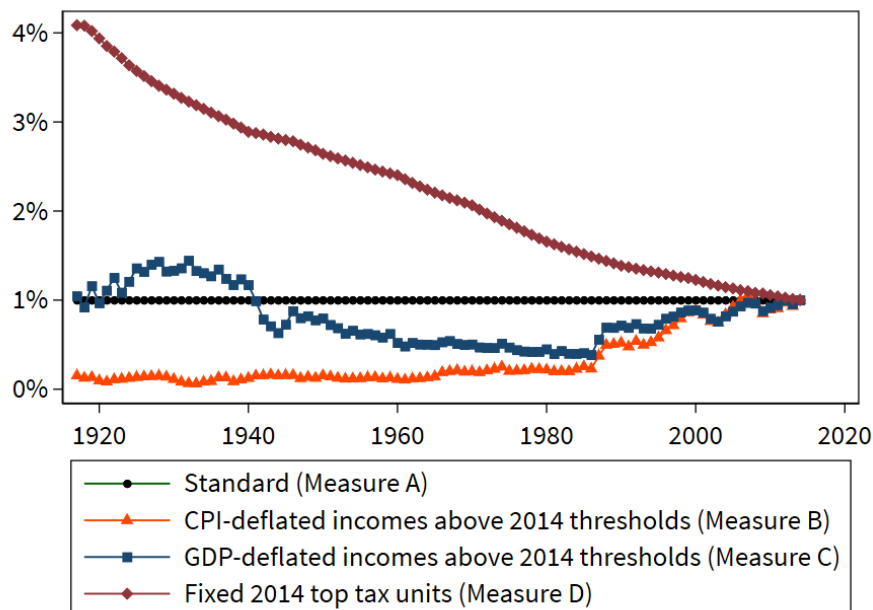
Notes: This figure plots population and income shares for the four different top inequality measures (as described in section 2.1): the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1917 income threshold, as well as the income share of the top 1 million taxpayers (D). Measures are constructed such that they equal each other in 1917. The figure is based on authors' calculations using data from the World Wealth and Income Database as well as IRS SOI data (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

Figure A.9: Different measures for the top 1 percent: 2014

(a) Income shares



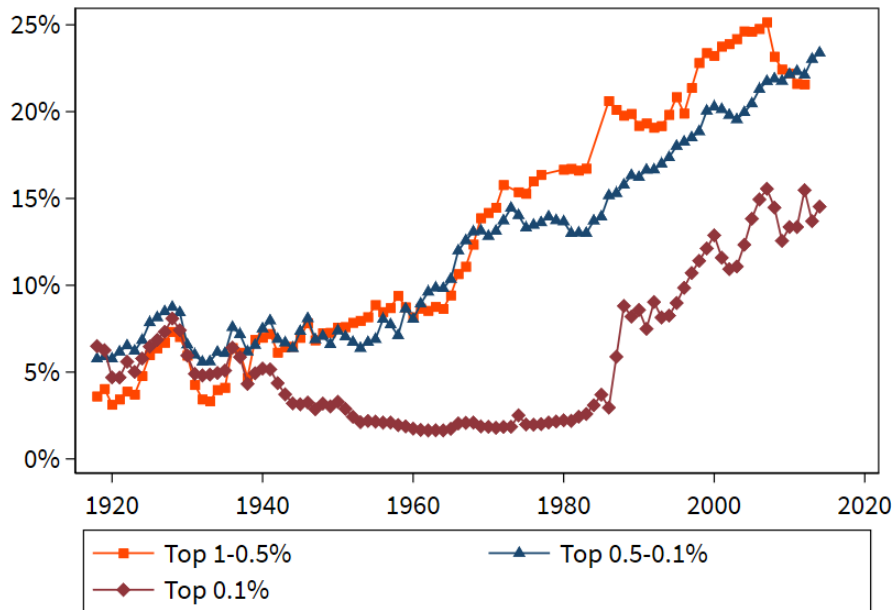
(b) Population shares



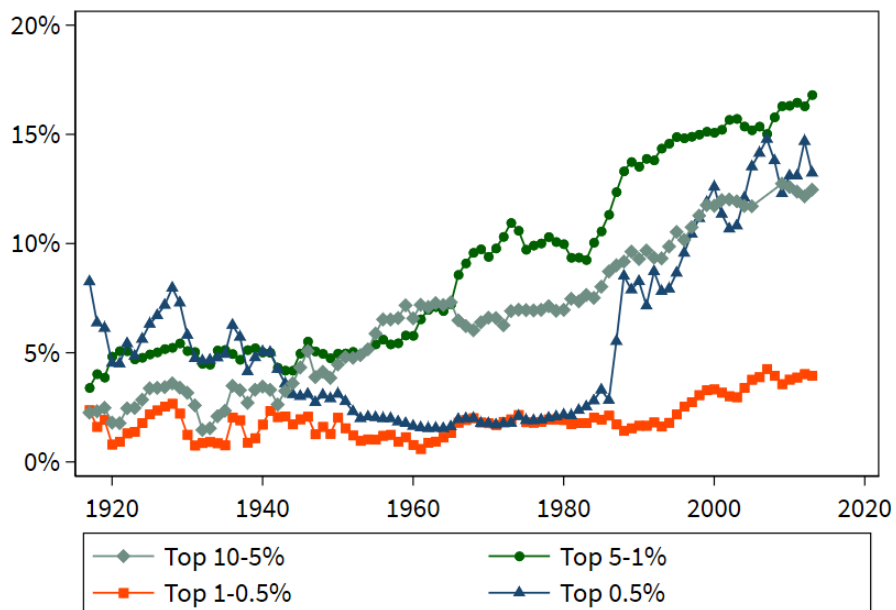
Notes: This figure plots population and income shares for the four different top inequality measures (as described in section 2.1): the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 2014 income threshold, as well as the income share of the top 1 million taxpayers (D). Measures are constructed such that they equal each other in 2014. The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

Figure A.10: Measure B: Income shares above CPI-deflated 1917 and 2014 thresholds

(a) Income shares above CPI-deflated 1917 thresholds

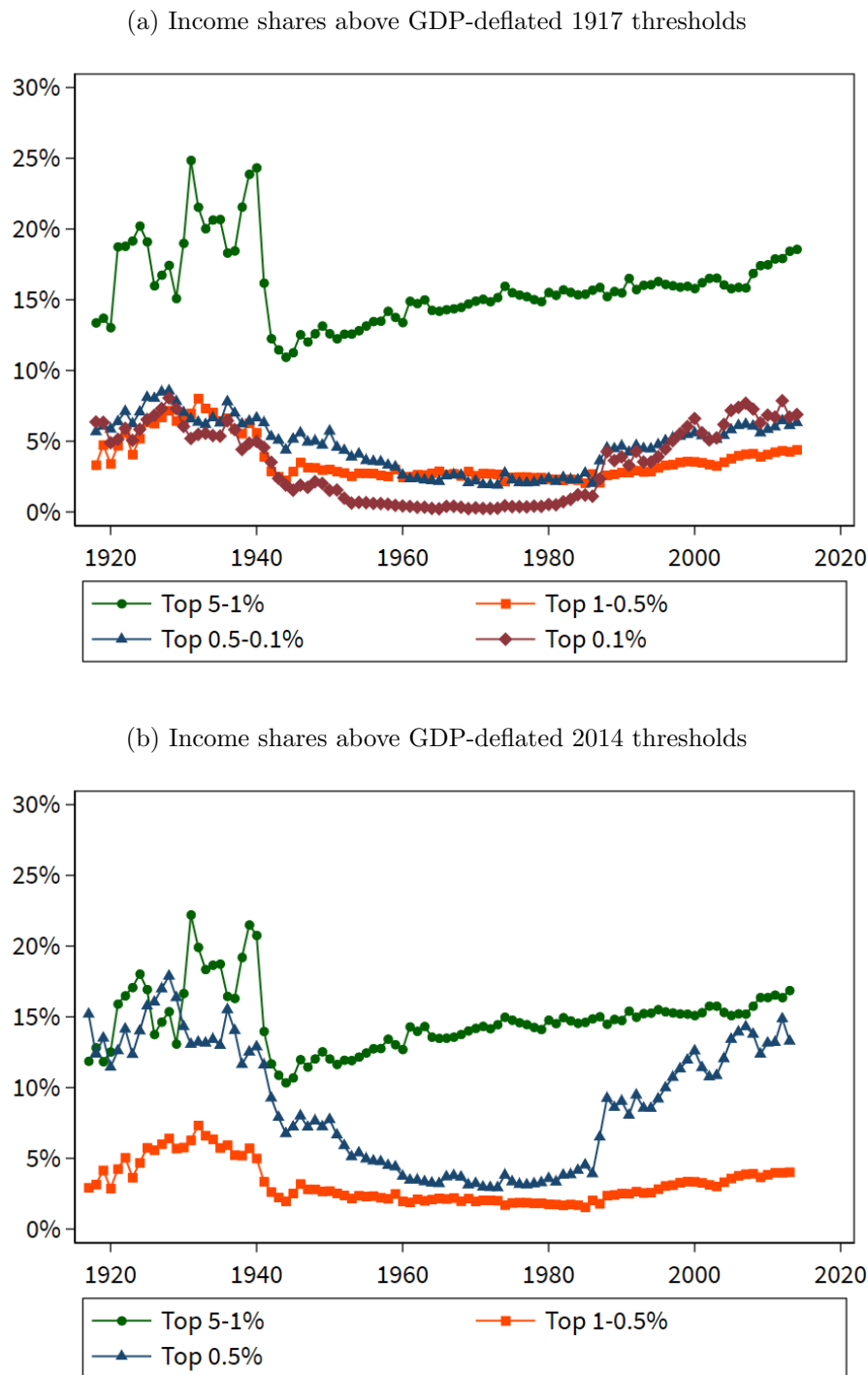


(b) Income shares above CPI-deflated 2014 thresholds



Notes: This figure plots population and income shares of those earning above the CPI-deflated 1917 and 2014 income thresholds (Measure B, as described in section 2.1). The measure is constructed such that it equals the standard top 1 percent share in 1917 or 2014. The figure is based on authors' calculations using data from the World Wealth and Income Database as well as IRS SOI data (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

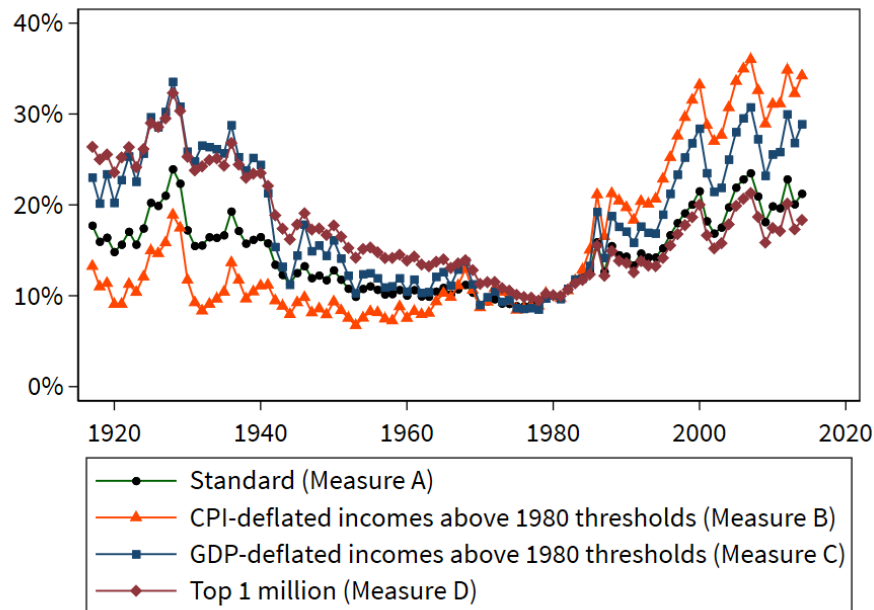
Figure A.11: Measure C: Income shares above GDP-deflated 1917 and 2014 thresholds



Notes: This figure plots population and income shares of those earning above the per capita GDP-deflated 1917 and 2014 income thresholds (Measure C, as described in section 2.1). The measure is constructed such that it equals the standard top 1 percent share in 1917 or 2014. The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, excluding capital gains.

**Inclusion of capital gains.** As a robustness check, figure A.12 displays top 1 percent 1980 income shares including capital gains. As can be expected, income shares including capital gains fluctuate more than those net of capital gains in figure 1. As for total incomes excluding capital gains, top income shares start rising rapidly in the 1980s.

Figure A.12: Top 1980 shares including capital gains

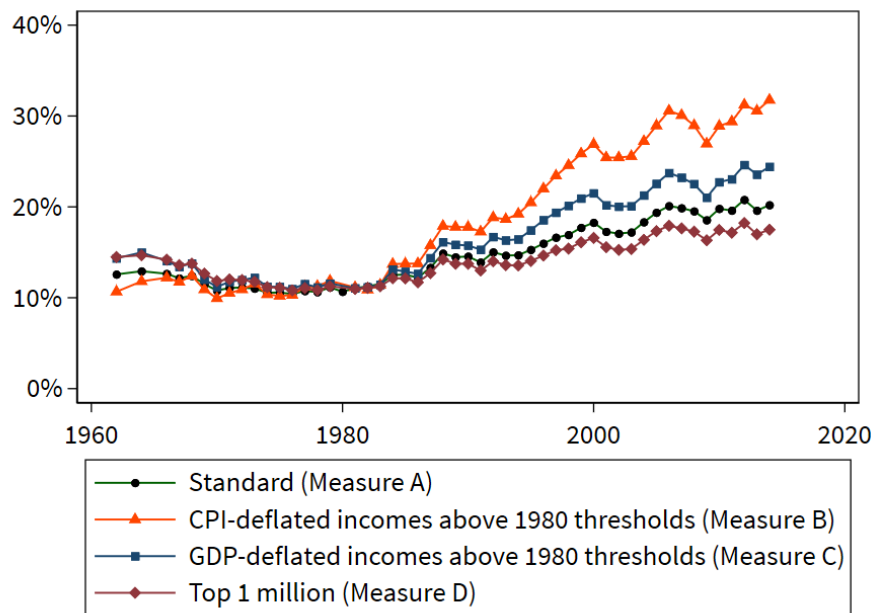


Notes: This figure plots income shares for the four different top inequality measures (as described in section 2.1): the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1980 income threshold, as well as the income share of the top 1 million taxpayers (D). The measures are constructed such that they equal each other in 1980. The figure is based on authors' calculations using data from the World Wealth and Income Database (see section 2.2 for details). The income concept is pre-tax fiscal income, including capital gains.

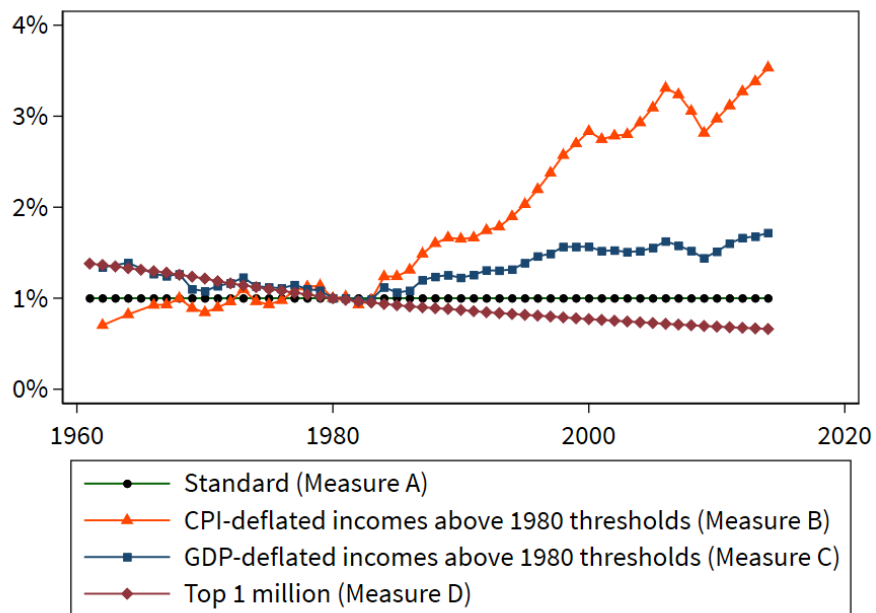
**DINA 1980 top shares.** As a further robustness check, figure A.13 shows the DINA equivalent to the top shares presented in figures 1 and 2.

Figure A.13: Top 1980 1 percent shares based on DINA

(a) Income shares



(b) Population shares



Notes: This figure plots income shares for the four different top inequality measures (as described in section 2.1) using DINA data: the standard measure (A), the income shares of those earning above the CPI-deflated (B) or GDP-deflated (C) 1980 income threshold, as well as the income share of the top 1 million taxpayers (D). The measures are constructed such that they equal each other in 1980. The figure is based on authors' calculations using data from the World Wealth and Income Database (see sections 2.2 and 4.3 for details). The income concept is pre-tax national income.