How pronounced is the U-curve? Revisiting income inequality in the United States, 1917-1960

How pronounced is the U-curve?

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Abstract: Piketty and Saez (2003) found a pronounced U-curve pattern of American income inequality since 1917, displaying a precipitous decline during World War II to a level that would hold until 1980. We offer revisions to their income inequality estimates prior to 1960 with three important findings. First, Piketty and Saez overstate inequality levels in this period. Second, the decline during WWII was smaller than depicted. Third, the Great Depression, rather than WWII, played the more significant role. These findings indicate a

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need to reevaluate commonly held assumptions about the evolution of inequality during the period of the 'Great Leveling,' as well as the nature of its posited relationship to tax policy.

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Dedicated to the memory of Germain Belzile

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1 Introduction

Interest in economic inequality has recently undergone a marked revival, owing in part to the efforts of Thomas Piketty and Emmanuel Saez (Piketty and Saez, 2003, 2007) (henceforth PS) to create continuous estimates of income inequality (through top income shares) for the United States from 1913 to today. Derived from tax records, their estimates inspired scholars to produce similar datasets for more than two dozen countries, measuring both income and the closely related distribution of wealth (Atkinson *et al.*, 2011).

The PS estimates have also become highly influential for their depiction of a century-long U-curve pattern: high inequality in the early twentieth century gave way to a mid-century trough during World War II, followed by a rebound from the 1980s to the present day. While this U-curve pattern is a commonality shared by almost all countries, the depicted shape for the United States is particularly pronounced. Using the PS estimates, top U.S. income

shares exhibited a significantly larger mid-century decline than most developed economies, and similarly rebounded at a faster rate (Atkinson *et al.*, 2011).

This article proposes substantial revisions to the PS series between 1917 and 1960 (i.e. the first half of the depicted U-curve).[1] Our revised series addresses discrepancies in the original tax records, improves upon assumptions undertaken in the PS series, and corrects accounting errors in the PS data construction.

Our revisions, which are depicted in Figure 1 alongside the PS estimates, produce three key results.[2] In their most recent update, PS find that top income shares peaked at very high levels around 1928, with the top 10, 5, and 1% of filers accounting for 49.3%, 38.6%, and 23.9%, respectively, of the total income share. Corresponding income shares declined to 32.5%, 22.7%, and 11.3% by 1944, then stabilized around this level through a mid-century trough of the U-curve. This implies a sustained drop of 16.8, 15.8, and 12.7 percentage points, which PS then attribute to the equalizing effects of increased federal tax rate progressivity during and after WWII. Our revisions show a different story. In 1928, the top 10, 5, and 1% of filers accounted for 42.5%, 32.7%, and 19.5%, respectively before gradually declining to 31.2%, 21.9%, and 10.8% by 1944. This implies smaller corresponding drops of 11.2, 10.8, and 8.6 percentage points from a lower 1928 peak. This comparison is representative of two of our key results. First, the level of inequality is lower. Second, the decline is much less pronounced as the size of PS overestimation errors get smaller over time. Per our revised findings, PS overstate the magnitude of the observed leveling in income concentrations by roughly one third.

[1] Our full calculations are available in online appendixes A and B.
[2] We only depicted the latest update from PS. They frequently post updates to their series published in 2003 and there are very minor differences to the pre-1998 figures.

In addition to reducing the overall level of inequality and the magnitude of its change over time, we also shift locus of the leveling pattern – our third important finding. PS depict a sharp, sudden drop occurring almost entirely between 1940 and 1944.[3] Our results point to a more gradual leveling that played out across the Depression and World War II periods. This pattern is more consistent with the occurrence of the "great leveling," (an expression borrowed from Lindert and Williamson [2016]), confirming that U.S. income inequality fell continuously between 1929 and the mid-century mark.[4]

These results have three important implications, which we elaborate on in section 6. First, they illustrate the importance of accounting for the complex data challenges affecting measurements of inequality. Although increasingly common for inequality studies, the use of tax records is not without difficulties. After the 1960s when Internal Revenue Service (IRS) microdata files become available, there are many large-scale surveys that are used to compare inequality measures drawn from different datasets. Investigations using these supplemental materials show important discrepancies within the right half of the PS U-curve (1960-present). These revisions generally dampen the level and the magnitude of the post-1980 rebound in income and wealth concentration in the PS series (Kopczuk *et al.*, 2010; Armour *et al.*, 2014; Kopczuk, 2015; Bricker *et al.*, 2016; Auten and Splinter, 2017; Smith *et al.*, 2019; Congressional Budget Office, 2020). Our corrections suggest a similar pattern of overestimated inequality applies before 1960 – a problem that is further exacerbated by limited records.

[3]This period accounts for 12.8 of the 16.8 percentage point leveling depicted in the PS top 10% estimates.
[4]The idea of a U-curve for the United States is well supported. There are, however, several reasons to expect a leveling started before the WWII era decline depicted in PS because of the modest closing of regional, racial and gender wage gaps that was underway (Mitchener and McLean, 1999; Margo, 2016; Goldin, 1990).

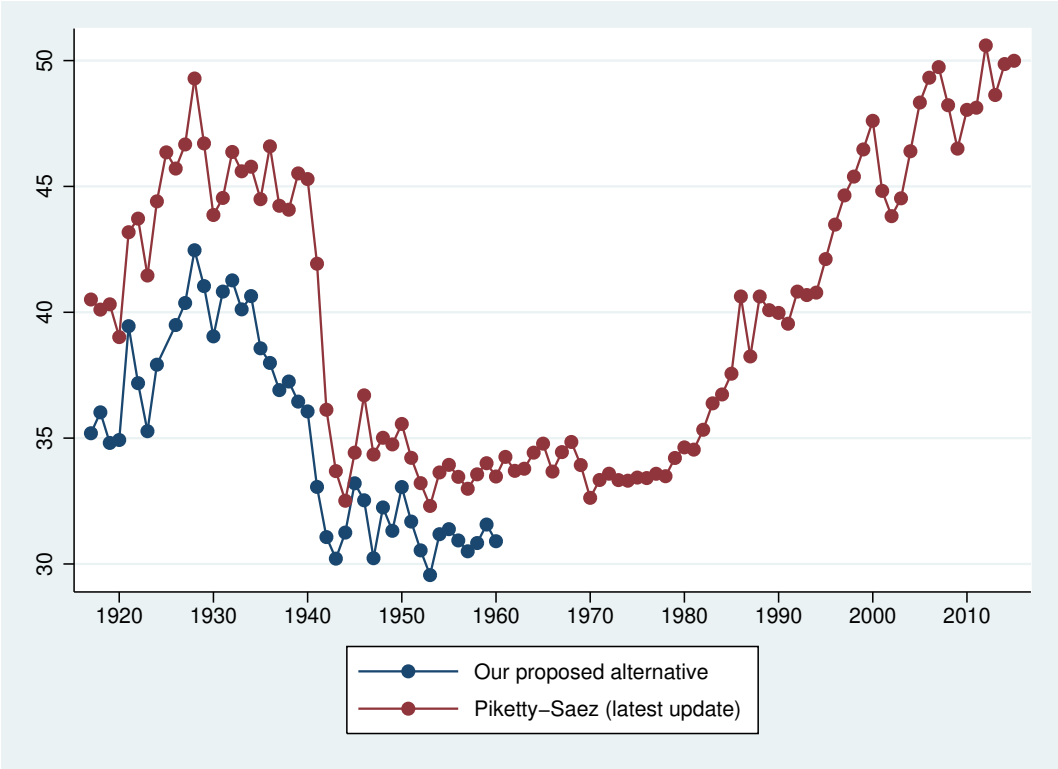


Figure 1. *Proposed corrections to top 10% income share compared with Piketty and Saez (latest update).*

Second, our findings draw into question the inferential claims of PS that wartime income tax policy and its subsequent entrenchment as a permanent feature of the mid-century tax system played a primary role in the observed leveling.

Finally, our corrections impose significant revisions to other empirical works on U.S. inequality patterns before 1960. Subsequent estimates of top wealth concentration (Saez and Zucman, 2016) and federal tax distributions (Piketty *et al.*, 2018; Saez and Zucman, 2019a,b) rely directly on the 1917-1960 portion of the original PS series as a baseline for their calculations. Improvements to the accuracy of income concentration data will accordingly transmit directly to the calculation top wealth shares (using the income capitalization approach) and federal tax distributions in the same period.

Our revisions employ the same sources as PS: the IRS's annual *Statistics of Income* (SOI) report. As they do, we create a numerator representing the total dollar amount of income earnings above a specified threshold (e.g. the top 1%). This is then divided by a denominator representing total personal income (built from national accounts), yielding an annual percentage share of income. Although this calculation is relatively simple, it requires extensive data construction to isolate the appropriate income percentiles and to ensure definitional consistency between the numerator and denominator over a period where the IRS accounting standards and tax collection underwent dramatic changes. Our corrections to the PS series are accordingly partitioned between problems with their data construction in their numerator and the denominator components. To keep the discussion manageable, we constrain our focus to the top 10%, 5%, and 1% income shares over time.[5]

[5]See online appendix B, for the full range of income levels, thresholds, and distributional fractiles.

Our revisions to the PS series begin by outlining the original data construction of PS in section 2. Then, in sections 3 and 4, we address two distinct issues that arise from how PS handle the SOI-based numerator. First, the number of tax filers dramatically increased during WWII as previously exempt low-income earners were incorporated into the federal tax rolls for the first time. These changes imply that unadjusted SOI data will tend to exaggerate top income shares prior to 1940 due to large amounts of unreported income near the minimum federal eligibility threshold. Second, IRS accounting standards changed over time, including a shift to Adjusted Gross Income (AGI) accounting between the 1943 and 1944 tax years. Pre-1943 statistics from SOI used a 'net income' accounting system, and must accordingly be harmonized to the AGI standard. PS give insufficient attention to the necessary adjustments in each case, thereby introducing unintentional distortions to their numerator that exaggerate top income shares in the interwar period while also obscuring the overall trend.

In section 5, we turn our attention to the fiscal income denominator used to calculate top income shares. We show that PS adopted a denominator that is both persistently too low in the pre-WWII years, and insufficiently attentive to income accounting changes across the entire 1917-1960 period. We construct an improved tax-comparable denominator to be used in place of the pre-war PS denominator, and extend this approach to 1960 using a single consistent accounting basis in place of PS's linking of multiple different denominator calculations. The resulting revisions of sections 3 through 5 offer a more accurate empirical depiction of the "Great Leveling" period, allowing for greater precision in interpreting the complex underlying causes behind the decline and rise of top income concentrations in the United States.

2 How Piketty and Saez arrived at their estimates

PS use three interrelated steps to arrive at their top income shares. They begin by constructing a numerator, reflecting the annual income amounts above a specified earning threshold. The first step is to assemble distributional data from IRS' SOI reports by income class. From there, PS (2007, p. 195) use a Pareto interpolation technique to assess how income is distributed above the top 10% threshold by matching their estimates to the closest corresponding income class in the annual SOI tables. This technique also permits them to calculate further distributional shares for the top 5%, 1%, and 0.1%. They make no alteration to the IRS data in this initial step, which we refer to here as model 1. As such PS model 1 yields a "raw" unadjusted measure of the income distribution.

As PS recognize, the unadjusted model 1 is unsuitable for measuring year-to-year changes. Income under-reporting and low filing rates prior to World War II, changes in deductions eligibility in the tax code, and the IRS's shift to standardized AGI accounting after 1943 all create distortions that must be addressed before constructing a harmonized series.

The first adjustment made by PS, which we label model 2, corrects for changes to federal income tax eligibility over time. From the income tax's inception in 1913 until 1940, tax eligibility only applied to relatively high income earners. In some years during this period, fewer than ten percent of all taxable household units were required to pay federal income taxes.[6] To further complicate matters, the minimum tax eligibility requirements before the WWII era applied inconsistently-tiered thresholds to single and married filers, usually

[6]In the online appendix A we show the number of tax returns as a share of the total number of tax units. For 1917 and 1925 to 1935, less than 10% of tax units filed a return. In all other years prior to 1940, the proportion never exceeded 17.3%. By the end of WWII, expansion of the federal tax base extended income tax eligibility to roughly 90% of all tax units

varying with each revision to the tax code. As a result, pre-1940 figures from SOI often contain incomplete representations of income earnings, even among eligible filers.

To address this persistent under-count, PS take the ratio of married to single filers from income brackets sitting clearly above the minimum eligibility thresholds for a given year. PS make the crucial assumption the true ratio between married and single income earners is relatively stable across income classes. The observed ratio from the well-documented tax filings in upper income classes should therefore also hold for comparatively incomplete filings in lower income classes (typically incomes under $5,000). PS accordingly use the known married/single filer ratio in upper income classes to construct a multiplier that approximates the number of "missing" married filers in lower income classes due to incomplete tax reporting (Piketty and Saez, 2007, pp. 195-196).[7] This adjustment, which we refer to as model 2, applies to the PS income share estimates prior to 1940, and almost exclusively affects filers near the top 10% threshold (by contrast, the top 1% falls well within the threshold for both single and married filers).

Next, PS deal with changes to IRS accounting practices over time, and particularly those predating the shift to AGI accounting between the 1943 and 1944 tax years. AGI encompasses a more expansive definition of income than the "net income" standards used until 1943. This includes certain specified tax deductions-eligible earnings above net income, which also changed with frequent tax code revisions prior to the AGI standardization. Since not all income deductions are AGI-inclusive, accurately performing this conversion requires detailed distributional records for specific deductions categories.

[7] Married filers enjoyed a much larger exemption than single filers in most years; therefore the assumption is that single filer returns more accurately capture the share of tax filers in low-income classes.

PS's method of adjustment, which we refer to as model 3 (Piketty and Saez, 2007, pp. 195-196), consists in adopting an arbitrary set of stable and evenly-rounded multipliers to represent AGI-eligible deducted income in the pre-war period, which they then apply across the board to upwardly adjust the income share of each fractile until 1941. They then reduce these multipliers for 1942 and 1943 until they link the resulting series with the unadjusted AGI data after 1944. The result, in theory, is a harmonized series linking pre-1944 and post-1944 income definitions.

The multipliers applied by PS to each income share and year are depicted in Figure 2 while Figure 3 shows each level of data treatment (models 1, 2, 3) resulting from the successive PS adjustments.[8] The PS model 3 adjustment creates a sizable augmentation of pre-war inequality levels: it adds between three and six percentage points to the top 10% income share and between one to three percentage points to the top 1% income share. A key point that will be of relevance later is that the deductions adjustments in PS model 3 are assumed to scale upward across income classes while remaining a fixed constant over time within each income class. The resulting adjustment therefore assumes uniformity across affected years, simultaneously shifting the calculated distributions of the previous steps in a less-equal direction. They do not test whether historical deduction patterns align with these assumptions.

To complete their calculations, PS construct a total personal income earnings denominator in the same year. These data come from national accounts, although with varying

[8]We attempted in vain to identify the empirical basis of the PS model 3 multipliers. As best as we can tell, they are educated guesses. In their datasheet notes, PS indicated that they used what appeared to be "reasonable" adjustments. Concurring annotation may be found in their comp1398.xls file where the notes are in French : je me suis contenté de reprendre des valeurs raisonnables à partir des tabcomp reproduits sur la feuille Comp1665.

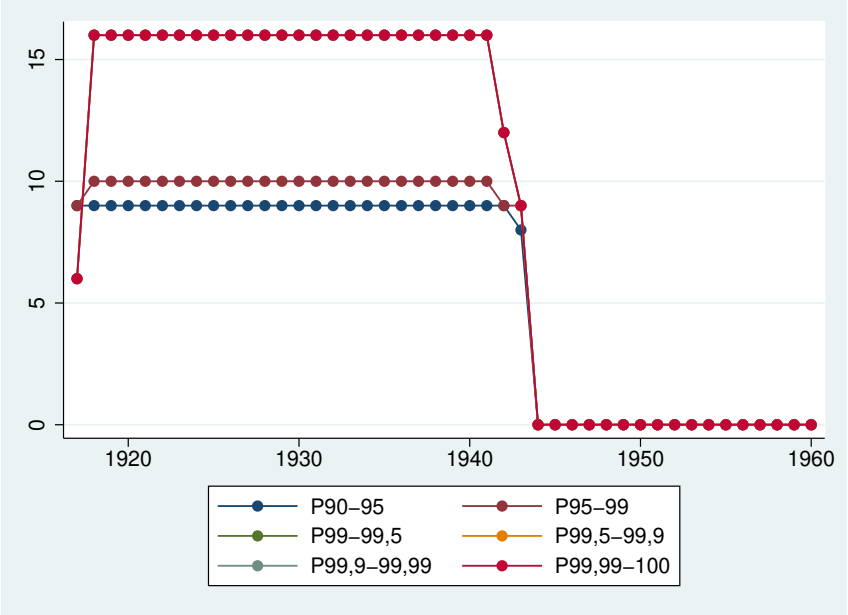


Figure 2. *Deductions-AGI multipliers (for PS model 3) used by PS, 1917–1960*

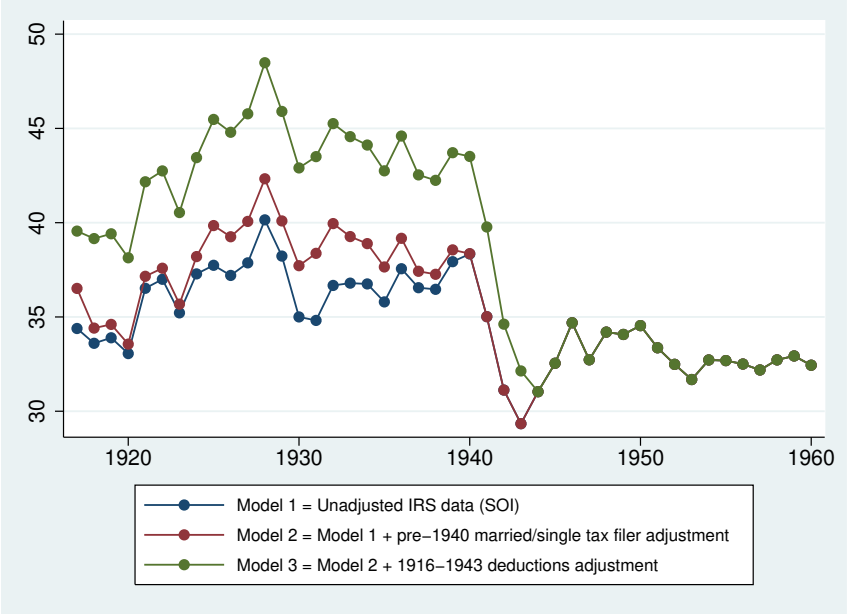


Figure 3. *Top 10% income share, SOI plus PS adjustments, 1917–1960*

methods depending upon available records. For the period of 1913-43, their denominator series is set equal to a fixed 80% of total personal income, excluding transfers. As the national account for personal income produced by the Bureau of Economic Analysis (BEA) begins in 1929, PS extrapolate the 1929 level backwards using the movements in an earlier series produced by Kuznets (1941; 1945). From 1944 onward, PS calculate their denominator by starting from the BEA's National Income and Product Accounts (NIPA) and imputing a fixed fraction of tax filer income onto remaining non-filers. The top income fractile numerators for each year are then divided by the combined denominator (1917-1943 and 1944-present), producing their associated total income share.

There are further adjustments made by PS to better incorporate capital gains incomes. However, since these adjustments are made after the distributional share calculations, any modifications to the steps in PS models 1-3 will automatically transfer to the capital gains-adjusted estimates as well. As such, we confine our revisions to models 2 and 3 as well as the denominator. In any case, we found no superior substitute to their treatment of capital gains.

Before proceeding, we must point out a final assumption that accepts the general reliability of the IRS data. Any set of data that is self-reported, as is the case with tax records prior to automatic payroll deduction, will be affected by income under-reporting. Issues of avoidance, evasion, and simple inaccuracy were widely acknowledged and became a recurring theme of tax policy discussions, particularly during the comparatively lax enforcement period prior to 1943 (Smiley and Keehn, 1995).[9] The numerous and sizable changes in the tax regime created extensive challenges for enforcement that likely extend to the data quality

[9]Troiano (2017) estimates that the introduction of withholding, third-party information reporting, and information sharing between state and federal governments led to greater levels of measured inequality.

of self-reported income returns.[10] Addressing these additional problems exceeds the scope of the present study. However, as we point out in section 6, a proper consideration of these problems would probably further deflate the interwar levels of income inequality.

3 Adjustments for "Missing" Tax Filers

Following PS, we begin the construction of our series from the unadjusted SOI data as represented in their model 1.[11] Our first corrections pertain to the above-noted model 2 adjustment to account for missing tax filers under the pre-1940 tax code's disparate eligibility thresholds for single and married filers. An adjustment of this type is warranted to improve the accuracy of the raw SOI data, which otherwise only partially captures tax filers in the lower ranks of the top decile of earners. We therefore adopt PS's approach of using known ratios of single to married filers to extrapolate "missing" returns in the lower income classes (typically those below $5,000).

While necessary, the model 2 approach requires the selection of specific tax reporting years to establish a base for the multiplier, as well as the calculation of a suitable married/single male filer ratio. PS select 1924 and 1932 as their base years, extrapolating a multiplier share from both as an internal check on the estimates. Calculation of the married/single ratio requires a year in which reporting in both filer categories reliably exceeded the top decile's eligibility cutoff threshold, which limits the available options to the tax base expansions that occurred after 1940. PS select 1942 to calculate their ratio.

[10] The federal government enacted major income tax revisions in 1916, 1917, 1918, 1921, 1924, 1926, 1932, 1934, 1936, 1940, 1941, 1942, 1943, 1944, and 1945. These include large changes from top marginal tax rates in the high seventies to the mid-twenties and back up.

[11] Our starting point is conceptually identical to PS model 1, subject to minor updates to account for data discrepancies such as the addition of Form 1040A filers for the years 1941-43 that were inadvertently omitted from the original PS series.

The crucial assumption is that 1942 must be a reliable depiction of pre-1942 ratios of married to single filers. The problem is that 1942 was a war year marked by labour market disruptions caused by the massive enlistment of single and military-age men. It is therefore unlikely that the 1942 ratio accurately reflects the tax filing conditions of the previous two decades. Since the United States did not enter the war until mid-December 1941, this year is a better approximation of peacetime labour markets among an admittedly slim number of choices. Due to the large influx of filers from the ongoing tax base expansion, the IRS did not fully tabulate returns with net income under $5,000 after 1939 and instead estimated them by statistical sampling. Samples were especially pertinent for the new 1040A form, which allowed earners below $3,000 with no itemized deductions to file a simplified tax return. In selecting 1942, PS appear to have misread the IRS sampling methodologies for each year and erroneously concluded that the 1942 1040A sample was more comprehensive than the same for the previous year. The opposite is actually true.[12]

A comparison of married/single filer ratios for 1941 and 1942 make the wartime distortions on the labour market immediately apparent through a surge in single filers in the lowest income classes. Thus, we recalculated the married/single filer ratio using 1941 as our base year. The resulting missing income multipliers tend to be lower across the board than using 1942. The effects are most pronounced in the $1000-$2000 tax filing bracket, where a 1942 ratio produces an annual multiplier that is almost 50% higher, on average, than 1941. This finding is consistent with the expected effects of wartime labour market disruptions

[12]PS indicate their datafile annotations (Corrections1840.xls) that 1941 was "not used for extrapolations because form 1040A statistics based on a sample that is not fully representative (see SOI 1941 pp. 51-52)." This is incorrect, and points to a separate special tabulation of 112,472 1040A forms from six states. A more comprehensive set of aggregate 1040A data, however, is reported elsewhere in the 1941 SOI. It uses the IRS's standard sampling technique for all incomes under $5,000. The 1040A sample in 1941 consisted of 516,000 returns taken from all 64 IRS collection districts, or 5% of all 1040A forms (SOI 1941, p. 6). The 1942 sample used by PS is actually smaller (455,000 returns, or 3%) (SOI 1942, p. 7).

among lower income earners. Before examining the full effects of this adjustment though, we first need to address the handling of deducted income for the same years, inclusive of this correction.

4 Harmonizing Income Accounting Definitions

The next issue that needs to be discussed relates to how income was reported by the IRS up to 1943. As mentioned, the IRS moved from "net income" to an AGI accounting standard in 1944 (the former term encompassed a narrower definition of income than the latter). As such, the two sets of reported income figures are conceptually different and require harmonization - which is what PS attempt to do with their model 3 multipliers. However, their approach to harmonizing these accounting definitions overstates the difference between net income and AGI. As a consequence, their approach artificially inflates the level of inequality.

To understand the significance of these adjustments to the PS series, we must first look to the differences between net income and AGI. Roughly speaking, the IRS defined net income to mean total "gross income" (or total unadjusted income earnings) minus specific eligible tax deductions in a given year. Eligible deductions differed from year to year however, particularly as they concerned the treatment of reported property and capital asset losses and eligible work-related expenses. They nonetheless included a relatively stable subset of regular itemized deductions comprising the bulk of the difference between net income and AGI. As per the 1944 standards, AGI begins with gross income and removes "above the line" deductions for trade and business expenses, travel and lodging costs connected to employment, eligible rents and royalties, certain depreciation and depletion amounts allowed

in payment to life tenants and beneficiaries of property held in trust, and certain allowable losses from the sale or exchange of property. However, AGI still retains itemized deductions that are not reported in net income. These include charitable contributions, state and local tax payments, interest payments, and casualty losses for all years, as well as deductible medical expenses for the years 1942-1943.[13] Several complications arise from changes to the pre-war tax code that preclude simply adding total amounts of all claimed deductions to net income. Instead, an accurate deductions adjustment needs to differentiate these AGI-inclusive itemized deductions from the other deductions categories that comprise the difference between AGI and gross income.

IRS records of the deducted amounts are inconsistently reported in the pre-war period, varying by both category and year. Fortunately, full distributional data on charitable giving across income classes exist from 1922 onward. Remaining deductions records improve substantially after 1928 to include state and local tax payments and interest payments. A new AGI-inclusive medical expense deduction was also adopted into law for the 1942 and 1943 tax years. Combined, these deductions categories encompass the largest components of AGI-inclusive deductions. These and other changes in deductions eligibility and deductions reporting present substantial challenges for the task of harmonizing pre-1944 net income statistics to the AGI accounting standard.

Rather than attempting a direct adjustment to account for pre-1944 deductions, PS apply a tiered multiplier across all income classes that purports to encompass the difference between

[13] AGI-inclusive deductions are explained in detail on pp. 20-21 of the annual SOI report for 1944. The 1944 tax code changes that brought about this accounting shift also introduced the option of taking a standard deduction in place of these itemized AGI-inclusive categories. We further note from an accounting perspective that the shift to AGI and the accompanying standard deduction likely affected post-war tax planning patterns by incentivizing different deduction practices. These effects may explain residual fluctuations in estimated distributional shares during the war itself, relative to the years that preceded and that followed the 1943/44 accounting conversion.

net income and AGI. This approach comprises their model 3 adjustment, as described in the previous section. We have reason to believe that the PS model 3 multipliers are incorrectly tiered across income classes. As shown in Figure 2, PS held their multiplier levels constant from shortly after the start of their series until 1941. They then reduced their multipliers precipitously until connecting with the AGI transition in 1944. Furthermore, PS scale their multipliers upward toward the highest income fractiles, such that tax filers within the top 1%, are consistently assumed to deduct at a fixed rate that is higher than tax filers in the P90-95 and P95-99 groups. The justification offered by PS is that these deductions were small and primarily benefited the richest income earners (2007, p. 196). Observable patterns from IRS deduction records substantially complicate this assumption.

Contrary to the stable PS multipliers, recorded deduction patterns were volatile and uneven prior to the AGI accounting switch. As can be seen in Figure 4, which depicts a sample of years with complete deductions data, most income categories saw deductions fall as a percentage of total income. However, some income categories including those around the P95 threshold actually increase. Moreover, in some years like 1937, AGI-inclusive deductions represented a greater share (8.28%) of income for filers at the cutoff for the top 10% than those at the cutoff for the top 5% (5.80%).

As such, deduction patterns did not monotonically increase with income levels, as the PS model 3 multipliers assume. In Figure 5, we see a snapshot of these effects at the time of the net income/AGI accounting shift by comparing AGI in 1944 with net income in 1943 by income categories. If the PS assumptions are correct, then plotting the ratio of 1944 AGI over 1943 net income should follow a flat line with an uptick at the top of the income ladder. The data show the opposite: the adjusted gross income of taxpayers earning $1,500 or less

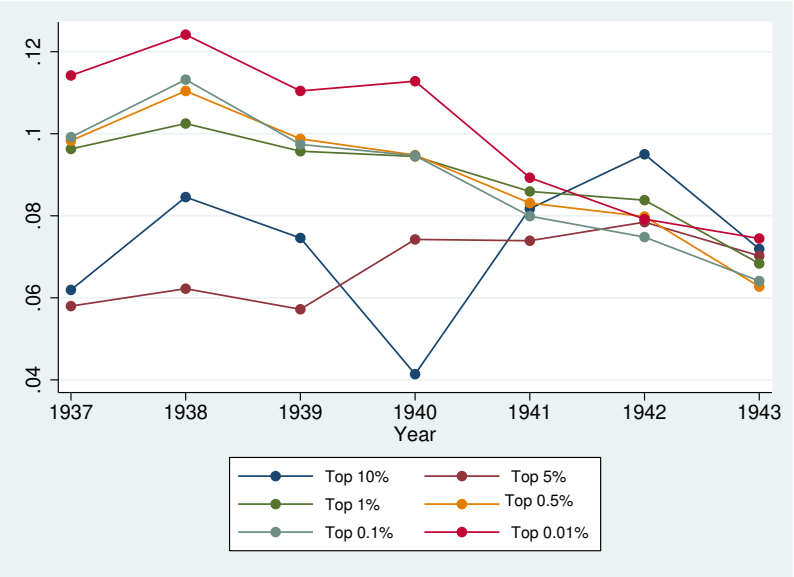


Figure 4. *Deductions as share of net income for different top income shares*

in 1944 was more than twice as high as the reported net income in these same income classes for the previous year - a ratio that falls as we move further up the income ladder. In other words, at the time of the shift to AGI accounting, deductions were becoming substantially more important among the lower income classes. The PS model 3 multipliers erroneously assume the opposite pattern, depicting a decline in deductions among lower income classes.

Well-documented patterns in deducted donations to charity further confirm the problems with the PS model 3 multipliers. Between 1922 and 1926, charitable donations by filers with incomes below $1,000 represented between 4.18% and 8.34% of their net income.[14] In 1926 for example, filers in the $1,000 income class deducted a larger percentage of their income for charitable donations than all higher income classes. To further illustrate the distortions introduced by the PS model 3 multipliers, we isolated the effects of charitable giving, which

[14]There is a data break in 1927 for filers below $5,000, requiring an alternative estimation on which more is said below.

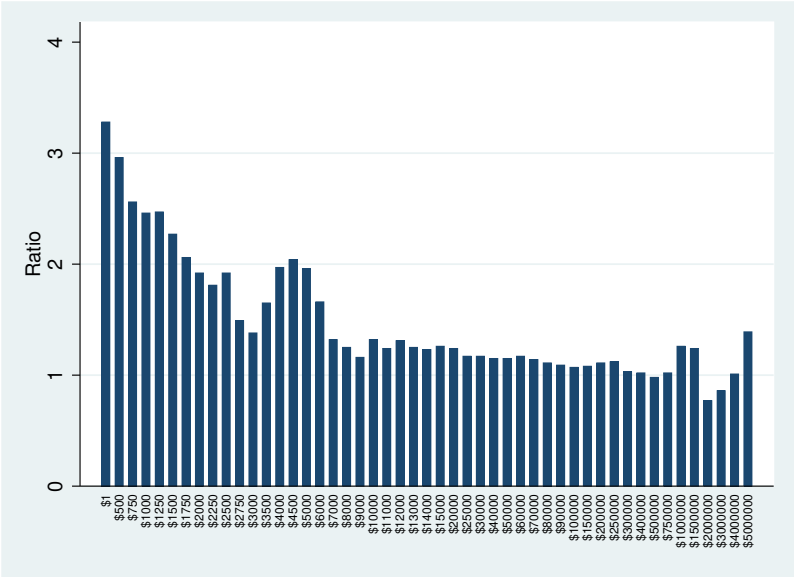


Figure 5. *Ratio of 1944 AGI to 1943 NI by income groups reported by IRS*

are reasonably well-documented across income classes. In Figure 6, we can see that applying a direct annual accounting adjustment for charitable giving to the "raw" SOI data of PS model 1 actually *lowers* the level of top income concentrations in most years where records permit direct comparison, *ceteris paribus*.

The cumulative severity of the distortions caused by the PS model 3 multiplier may be further seen by comparing their implied effects to the dollar amounts of eligible deductions prior to the 1944 accounting switch. The SOI report contains aggregate totals for eligible deductions by type in most years (1922 through 1927 and 1933 through 1943).[15] These figures can be compared to the total dollar amount of deductions that the PS model 3 multipliers imply (net of the separate PS model 2 adjustment discussed in the previous section). If the PS model 3 adjustments are valid, the two figures should match. However, this is not

[15]For 1928 to 1932, deductions for income classes below $5,000 are not included in cumulative totals for two of the three AGI-inclusive categories. We resolve this issue by imputation, as described in appendix A.

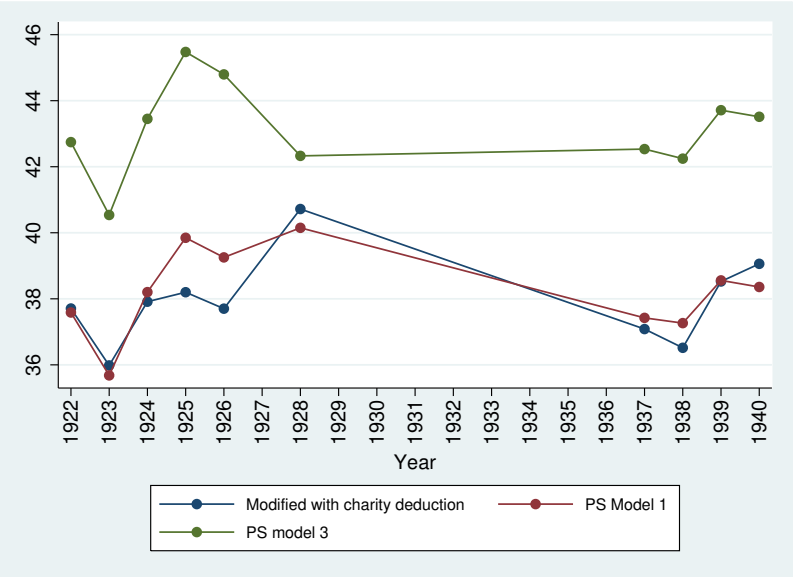


Figure 6. *Income Shares for Top 10%, Piketty-Saez AGI adjustment (model 3) vs. Charitable Deductions Adjustments*

the case as can be seen in Figure 7. Prior to 1940, the implied dollar amount of the PS model 3 multiplier surpasses all reported AGI-eligible deductions in most years. Indeed, the implied values of the PS model 3 income multipliers regularly exceed not only AGI but *total* reported income for the affected years - an accounting impossibility.[16] This pattern persists until the tax base expansions after 1940. As a result, the PS model 3 adjustment likely has the effect of biasing the distributional shares of top income earners upward in most years prior to 1940, essentially ensuring the pronounced drop in the U-curve during WWII as opposed to a longer multi-year trend. Moreover, after 1940, their multipliers likely misstate the changing deduction patterns of the war years. PS scale AGI eligible deductions for the

[16]We include a comparison of the implied value of the PS multiplier in excess over total, or unadjusted gross, income in our online appendix A file. These data show that the PS multiplier yields an accounting impossibility for every year between 1926 and 1939, the period in which full data on excludable income above AGI are available in IRS records. The PS multiplier frequently overshoots the true extent of deductions in the years when the IRS reported data about AGI, with the implied excess ranging between $32 million and $1.3 billion.

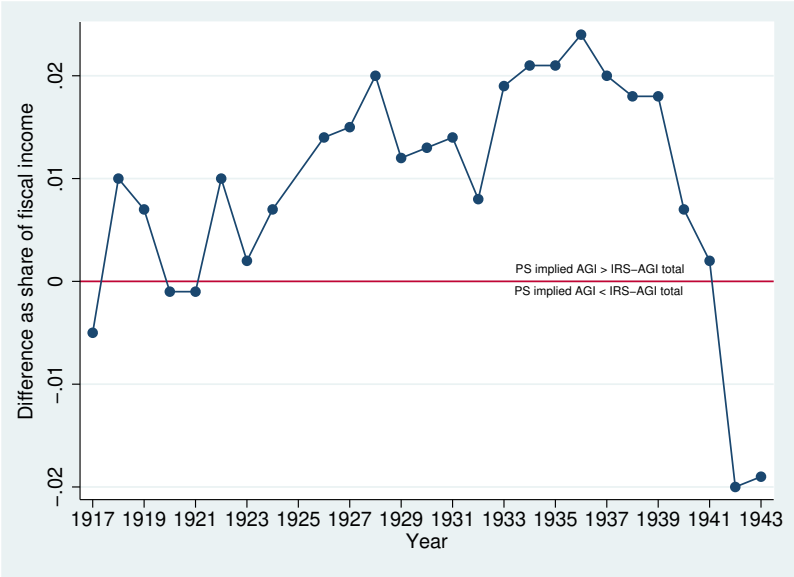


Figure 7. *Difference between implied deductions from PS model 3 multipliers and AGI-eligible deduction IRS totals*

richest percentile at 16%, 12% and 9% for the years 1940-41, 1942 and 1943. However, the itemized IRS data suggest that these figures were contracting from a lower level: from 9.45% in 1940 to 6.84% in 1943. A large share of this result came from making health care expenses eligible for deduction in 1942, thereby removing them from reported net income.

The foregoing findings suggest that the PS model 3 multipliers (a) systematically underestimate AGI-eligible deductions in lower income classes, while also (b) overestimating the total amount of AGI-eligible deductions in most years prior to the IRS accounting switch. Both effects contribute to the exaggeration of measured income concentrations among the top shares prior to 1944.

To address these issues, we adopt the alternative approach of directly estimating the annual dollar amounts of AGI-eligible deductions by income class. We add these estimates

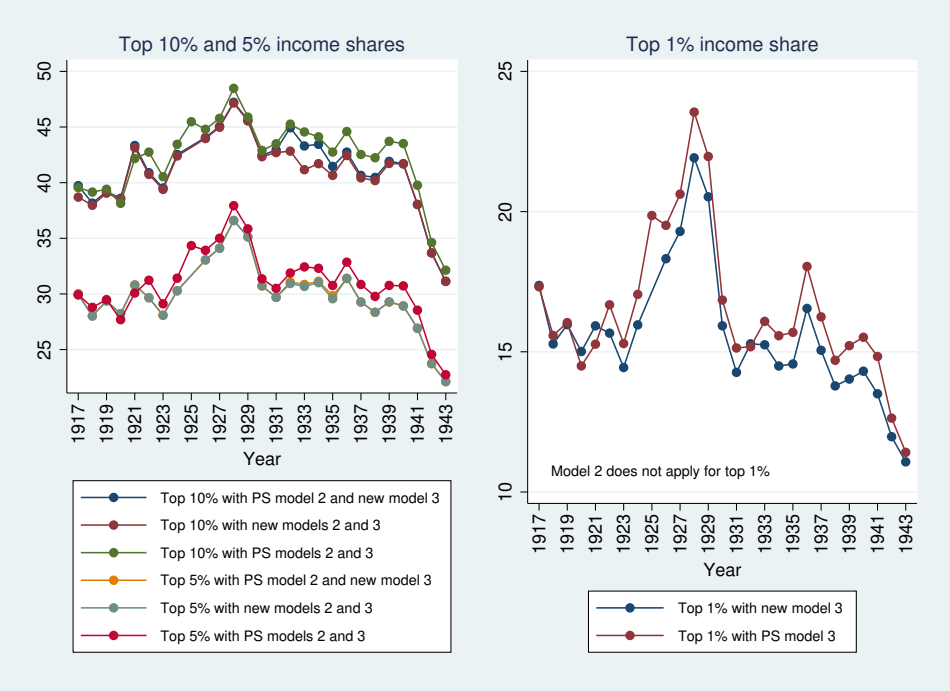


Figure 8. *Adjusting top income shares with new models 2 and 3 versus PS models (using the same income denominators as PS)*

directly to reported net income by class for available years prior to 1944, giving us an accounting definition that is consistent with AGI. Eligible deductions encompass charitable contributions, state and local taxes, and interest payments for all years prior to 1944, and medical care for 1942 and 1943. Collectively, these itemized categories account for most of the difference between net income and AGI, as well as the majority of all deductions claimed.

Due to sporadic and inconsistent reporting of AGI by the IRS, it is impossible to isolate the full range of AGI-inclusive deductions, particularly in less-commonly used categories. Recognizing these data limitations, we are nonetheless able to estimate and construct a consistent deductions adjustment for most pre-war years using the three aforementioned

categories as well as the late addition of medical expenses. To do so we begin by directly tabulating fully reported deductions from SOI records covering 1937 to 1943. For earlier years, the IRS consistently recorded charitable deductions from 1922-1936, state and local taxes from 1927-1936, and interest payments from 1929-1936. Taxes and interest payments prior to 1927 and 1929, respectively, were reported together as part of a "miscellaneous deductions" category dating back to 1922, and can be extrapolated for these years.[17] Finally, for the years 1917-1921, the IRS reported a separate "total income" tabulation that represented "gross income, less losses plus other deductions applicable" to specific categories such as business travel expenses. This tabulation included income from a separate "general deductions" category, encompassing the main deductible income sources that were later included in AGI. This supplemental tabulation accordingly functions as a precursor to AGI for these years, subject to minor accounting differences, and allows us to approximate a consistent income share estimate, including deductions, going back to 1917.

Together, these data allow us to reconstruct and estimate an AGI-inclusive deductions adjustment by income class from 1917 to 1943, excluding only 1925 due to insufficient IRS records for that year. We then integrate the distributional totals of eligible deductions into the reported income totals of their corresponding income classes, inclusive of our revisions to the PS model 2 "missing filer" adjustments discussed in the previous section by using 1941 as a base year. By integrating these figures into reported net income, we thereby obtain direct SOI-based estimates of the actual effect of eligible deductions by income class each year. The resulting aggregate gives us a functional approximation of the main AGI-inclusive deduction categories, capturing both their distributional skews and their yearly fluctuations

[17] Several steps were taken to extrapolate and harmonize a consistent series of AGI-inclusive deductions prior to 1937. We detail those steps in the online appendix.

in response to surrounding economic events and tax regime changes. We use this figure in place of the fixed model 3 multiplier from the original PS series, resulting in a deductions-responsive income distribution estimate that harmonizes pre-1944 data directly with AGI accounting standards.

Figure 8 above shows the effects of adjusting for deductions across the top 10%, 5%, and 1% income shares. This figure compounds the the effects of our new model 3 deductions adjustment with the married/single filer ratio adjustments of model 2. In cumulative, we find that the PS income shares are overstated on average by 1.31 percentage points for the top 10%, 0.95 points for the top 5% and 0.8 points for the top 1% prior to 1943. The greatest differences are concentrated during the period from 1932 to 1939, with the largest discrepancy reaching 3.4 percentage points in 1933 within the top 10% share.

5 Fiscal Denominators and Tax Units

5.1 Correcting Fiscal Denominators to 1943

The revisions to the numerator primarily address data construction issues arising from the SOI reports prior to 1944. To accurately calculate top income shares from these improved data, we must also ensure definitional consistency with the fiscal income denominator, measuring total earnings in the same period. An AGI-harmonized numerator taken from SOI must be reconciled to the AGI-eligible components of personal income from national accounts, forming the denominator. As with the numerator, data limitations from the early 20th century complicate the construction of an AGI-reconciled denominator.

The main difficulty arises from an observable gap between tax-reported income in the SOI reports and the personal income component of national accounts. Due to definitional discrepancies between the two, the sum of all incomes from tax records does not equal all personal income earned in the same year (Goldsmith, 1951; Goldsmith *et al.*, 1954; Goldsmith, 1957; Bureau of Economic Analysis, 1998; Ledbetter, 2004; Fixler and Johnson, 2014).[18] As such, complex adjustments to either the numerator or the denominator are necessary to bring the two terms into methodological alignment.

PS are aware of these issues, however their solutions lack a consistent methodological basis to link their two separately-constructed denominators across the WWII era accounting changes. To construct their denominator series, PS begin with the period from 1944 to the present. They state that they "imputed to non-filers a fixed fraction of filers' average income (50% in 1944-45 and 20% thereafter)" by linking it to the personal income component of national accounts, giving them what they call "tax return gross income" (Piketty and Saez, 2007, p. 169). Already, we find discrepancies between PS's explanation and the adjustments that appear in their calculations. Their datafile shows an adjustment equal to 50% for 1944, 60% in 1945, 25% in 1946 and 20% thereafter.[19]

There is nonetheless a plausible reason to begin their denominator construction in 1944. As PS explain, their post-1944 method of computing total income could not be extended to earlier years because of the high tax eligibility threshold before the war and the use of

[18] Differences occur because of imputed rent, interest and dividends received from pension plans, life insurance carriers, non-profit institutions, non-taxable employer and employee contributions to non-monetary forms of compensation, capital and inventory adjustments. An additional residual difference stems from low filing rates.

[19] The PS code files (see "AGI vs Personal" in their ComptaNat.xls) show that they used different proportions from their descriptive appendix. It is only from 1947 onward that the denominator sets the income of non-filers at 20% of filers' income. PS offer no indication for how they decided upon these percentages.

net income by the IRS. Construction of a pre-1944 denominator must therefore rely upon a workaround.

As a solution, PS point out that since 1944, "the ratio between total tax return gross income reported on tax returns and total personal income minus transfers estimated in national accounts has been fairly stable since the late 1940s (around 75–80%)" (Piketty and Saez, 2007, p. 169). Based on this observation and recognizing a residual gap between the two terms that derives from the small number of persons falling below the postwar tax eligibility threshold, they assume that the total income series from 1913 to 1943 is equal to 80% of total personal income minus transfers.

To justify the selection of a uniform 80% adjustment to pre-WWII NIPA, PS used the denominator produced by Kuznets (1953) for the years 1916 to 1948 as a comparison point. Rather than applying a similar fixed adjustment ratio, Kuznets constructed his own denominator by removing several categories of nontaxable income from national accounts on a year-by-year basis. This brings his national accounts series into closer definitional alignment with tax-reported income from the SOI reports, although imperfectly so. Kuznets's denominator ranges between 110% and 126% of the PS denominator for the years 1916-1948, thereby yielding generally lower levels of income concentration.

PS attribute this discrepancy to insufficient adjustments by Kuznets, producing a denominator that is consistently too large. PS base this contention on Kuznets's calculations for 1948, which implausibly suggest that the average non-filer's income exceeded the average filer's income in a year where almost all income earners filed returns.[20] Given the distribution of earnings by tax filers, PS intuitively conclude that they should display larger total

[20]PS deduct income from tax returns from the Kuznets denominator to arrive at an estimate of income earned by non-filers.

earnings than non-filers. They therefore assume a similar problem affects the remainder of Kuznets's denominator, including before WWII.

The PS criticism of Kuznets initially appears reasonable when limited to the postwar period, however it is not apparent that this justification holds prior to the 1943-44 tax code and IRS accounting revisions. From 1917 to 1941, the Kuznets ratio of the implied income of non-filers to filers' income varies between 27% and 46% (with an average of 39%). It is only in 1942 that the ratio starts increasing while remaining below 100% (at 86%) and in 1943 that it surpasses 100%.[21] The pre-1944 proportions for Kuznets are close to the post-1944 assumptions of PS regarding non-filer income (imputed at 50% of the average filer's income in 1944-45 and 20% thereafter).[22] As such, the Kuznets series still yields very plausible results for years prior to 1944 based on PS's own benchmark for imputing the income of non-filers.

The effect of denominator construction choices on the measurement of inequality is not trivial. In the online appendix A, we show that using an array of denominators that lie between those of PS and Kuznets results in income shares for the top 10% that are between 2.08 and 3.83 percentage lower than what PS depict for the 1917 to 1948 period. More importantly, available evidence suggests that a more accurate denominator does indeed lie between the PS and Kuznets denominators. In fact, some of that evidence is provided by PS themselves. For the period from 1944 to 1974, their ratio of fiscal income to personal income

[21] We subtracted reported income from tax returns *after* the model 2 adjustments to preserve comparability. We thank an anonymous referee for pointing this out. We can also compare this method to the PS denominator and our denominator (see more below). Between 1917 and 1943, the PS data suggest that the income of non-filers was equal to 25% of the income of filers as opposed to 34% with our denominator.

[22] In fact, the series are probably even closer together than above. PS offered their critique based on Kuznets' unadjusted personal income figures. Once we remove Kuznets' adjustments for imputed rent and tax exempt government employees, the ratio of the income of filers to non-filers moves closer to those of PS by 4 percentage points on average.

(excluding transfers) is equal to 82.7% on average.[23] After 1974, the ratio falls constantly to a low of just over 77% in the late 1990s. This is not what PS implied when they said that the ratio "fluctuates between 77% and 83%" (2007, p. 169). Rather, the data suggest a stable plateau (averaged in low eighties) from 1944 to 1974 and a transition to another regime (in the high seventies) up to the 1990s. If we applied the 1944-1974 ratio of 82.7% to the 1917-1943 period instead of the 80% used by PS, even this modest modification reduces the top 10% income share by 1.35 percentage points on average. This sizable reduction from such a small methodological change shows the extreme sensitivity of top income shares to the methodology of the income denominator.

Other sources confirm that the PS denominator is too low (even if Kuznets' is too high). In her study of the characteristics of the taxable income base of the 1940s, Selma Goldsmith (1951) made a series of accounting adjustments designed to align national accounts with IRS measures of fiscal income. Her approach was far more comprehensive than both the Kuznets retractions and the PS fixed ratio adjustment. Starting with national accounts, she removed all duplicated, nontaxable, and non-money income categories. This yielded an estimate of total fiscal income retained by consumers. Although they are geared for comparison with field survey data on consumer income, the adjustments she makes for 1941 illustrate parallel implications for tax-reported income accounting. Here Goldsmith begins from a comparable baseline to PS, reporting personal income exclusive of transfer payments at $91.6 billion (PS begin from $93.6 billion before the 80% adjustment). Goldsmith's accounting reconciliation reduces this number to $86.1 billion in consumer money income or 94.03% of the initial level

[23]The war-related years bring down this figure. From 1944 to 1946, they fluctuate between 78.7% and 79.9% before jumping 82.5% in 1947. From 1947 to 1974, the ratio is higher (83.04%).

of personal income minus transfers. Goldsmith's adjusted amount is some $11.3 billion above the PS denominator for 1941 after their 80% ratio adjustment, or $74.9 billion.

Given its comprehensiveness, we adopt and adapt Goldsmith's reconciliation approach to construct a new denominator for the full period of 1917 through 1948. In doing so we follow additional steps that Goldsmith devised to bring the NIPA series into comparison with tax-reported income from SOI.[24]

To extend the reconciliation approach to the pre-war period, we must also address two time-specific components of tax accounting that are omitted from PS. The first pertains to tax-exempt military pay subject to the Combat Zone Tax Exclusion. Not only was combat military pay (up to a specified threshold) exempted from taxation, but the IRS did not classify exemption-eligible pay as gross income in SOI for affected years. This exemption originated in 1918 as a World War I soldier pay benefit until being restricted in the 1921 tax year. The Military Pay Act of 1942 revived the policy, which persists to the present day as a feature of the tax code (Gould and Horowitz, 2011). At its peak in 1945, affected military pay amounted to $22.6 billion, or almost 14% of personal income minus transfers. As a result, that income needs to be removed from the denominator for reconciliation.[25]

The second issue stems from a quirk of two Supreme Court decisions that effectively exempted most state and local public employee salaries from federal income taxation until the Public Salaries Tax Act of 1939 (Blakey and Blakey, 1939). This exemption introduces a sizable segment of missing income that affects the SOI-derived portion of the PS series. As of 1937, the exemption affected 2.6 million state and local employees with $3.6 billion in untaxed earnings (by comparison the IRS received 6.3 million tax returns in the same year

[24]The list of items removed by Goldsmith (1951) is detailed and explained in the online appendix A.
[25]No distribution of soldiers earnings exist and so we were unable to include them in our changes to the numerator. Thus, we are forced to modify the denominator by excluding exempt military pay instead.

with unadjusted reported income at $23 billion) (House Committee on Ways and Means, 1939, p. 26).[26] Furthermore, income classes for eligible public employees appear to have clustered near the currently estimated cutoff level for the top decile income share, suggesting they may have implications for the position of the top 10% relative to other top income fractiles as well as the premises of the model 2 adjustment in PS. This concentration near the cutoff is important as evidence from state income tax systems suggests that income under-reporting at the federal level occurred disproportionately in income classes near the federal filing threshold (Geloso and Magness, 2020).

This also means that the SOI-derived numerator *excludes* these workers from the tax data while they are included in the total income denominator. Kuznets, aware of the issue, removed the compensation of these workers from his denominator. Had there been annual estimates of the earnings distribution of state and local government employees, Kuznets would have probably included them into his computations. Unfortunately the 1937 Treasury study is the only year for which distributional estimates by income class appear to exist. For all other years, total earnings and the number of state and local governments workers are the only available data. As such, there are two possible solutions to account for this exemption.

Ideally, public sector workers could be included in the income tax numerator by augmenting tax returns data from SOI with estimates of these missing workers. The downside with this approach is the lack of any breakdown of income data for state and local government employee pay, except for the aforementioned study of 1937. Thus, to make an adjustment, we must use the 1937 study and assume that the total earnings and employment numbers

[26]This problem likely grew from 1917 to 1938. In 1917, state and local government employees represented to 3.48% of all tax units in 1917. In 1929 and 1938 these proportions stood at 4.8% and 5.1% (Kuznets, 1953, p. 578–579). The notes provided by PS as well as our own replication of their calculations confirm that these workers are included in the PS tax unit population, even as their income is omitted from calculations.

followed the same breakdown from 1917 to 1938.[27] This approach is far from ideal as it assumes that public sector employees were all full-time appointments and none of them earned income through other activities. It nonetheless offers the most plausible basis to incorporate the exemption, given the data limitations.

A second solution is to follow Kuznets by excluding exempted public sector employees pay from the income denominator (and from the tax unit population to be consistent). This approach consistently adjusts the denominator's accounting, but comes with the drawback of intentionally excluding a sizable segment of income earners from the numerator. The first solution is presented in this section, and forms part of our revised series. The second solution is presented in the online appendix B and produces closely similar results in most years.

We construct our tax-reconciled denominators in two components covering 1929-1948 and 1917-1928. For 1929-1948 we begin with the published NIPA tables, remove affected non-taxable and non-money income lines directly, and add missing income sources that fall outside of national accounts as per Goldsmith (1951). Data for almost all terms are available with the exception of a handful of smaller categories where reliable estimates do not exist in this early period.[28] Goldsmith also includes an adjustment for net sales of capital assets and property within the reconciliation, however we separate this step from our calculations on account of the distinct treatment of capital gains in PS and reintegrate it at a later point so as to preserve and follow their steps for calculating average income, as used in obtaining top income fractiles.

[27] For example, in 1937, 39.7% of the 2.6 million state and local government employees earned less than $1,000. They represented 14.5% of the total earnings of $3.6 billion. In 1920, there were 1.7 million employees earning $1.9 billion. To use the 1920 totals for earnings and employment, we must assume that the two proportions from 1937 applied to 1920. See Section IV of our online appendix A for a full discussion.

[28] We adjusted for retained fiduciary income, non-profit property income, and imputed farm rents.

For 1917-1928, the reconciliation steps are conceptually identical, including adjusting for the effects of the Combat Zone Tax Exclusion for eligible years during and after World War I. In place of NIPA, which begins in 1929, we use the older Kuznets series to perform the adjustment. Corresponding data for the adjustments are available for most lines from Kuznets' work, although they are not as comprehensive as the NIPA series. Accordingly, we supplemented the Kuznets figures with additional data from the Department of Agriculture (farm inventories and products for consumption) and the Statistical Abstract of the United States. For remaining items where few records exist, we imputed estimates linked to reported amounts from the 1929 NIPA series.[29]

There is another definition problem in the denominator that must be addressed to reconcile tax filings from SOI to the population of personal income earners under NIPA. In their data files PS state that Hawaii and Alaska are not included in their tax unit numbers until 1949. The two territories are also not included in NIPA prior to attaining statehood in 1959. However, for the same years, Alaska and Hawaii are included in SOI reports.[30] As such, we have to adjust the tax units and the income denominator in order to be consistent with the numerator. This is the only methodological change that we implemented that increases, albeit modestly, the overall level of income inequality in this period.

To complete the denominator series, we harmonize the tax-reconciled 1917-1928 component with the reconciled NIPA series at 1929.[31] Once harmonized, these steps yield a national accounts-derived personal income baseline that is directly comparable to tax-derived income

[29]The specific steps taken to assemble component data for the Goldsmith reconciliation approach are included in the online appendix A.
[30]In their file "Pophouseholds.xls," PS state the "1900-1949 estimates exclude Alaska and Hawaii" without noting that their tax data from SOI include the income reported on tax filings in these territories. Take 1929 as an example. In the SOI report for 1929 (p. 60), there are 4,044,327 reported tax returns for all states in which Alaska is included as part of Washington state and Hawaii is reported as having 8,210 tax returns. That total number of tax returns is the same number as in the "Top1398.xls" file provided by PS.
[31]The harmonization adjusts the level for this period while retaining its year-to-year movements.

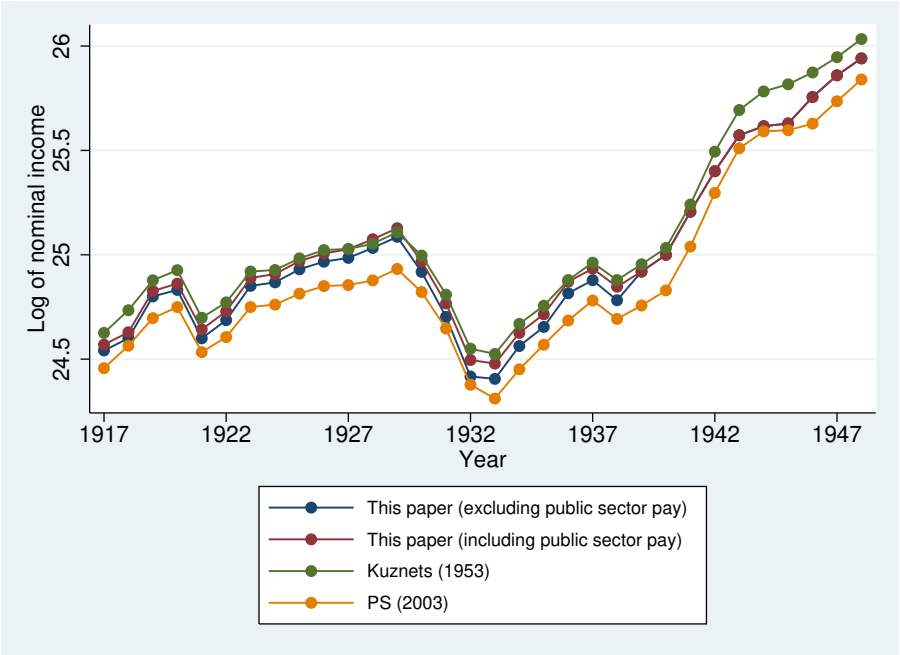


Figure 9. *Log of Different Income Denominators, 1917 to 1948*

from IRS records, covering 1917-1948. The results of the reconciliation illustrate that the PS 80% denominator is consistently too small across the entire pre-war period, and fails to accurately capture yearly variations within the denominator. For example, the directly comparable 1929-43 portion of the reconciled denominator varies between a low of 85.50% (in 1941) and a high of 95.88% (in 1934) of personal income minus transfers. The reconciled denominator does converge on the 80% ratio for a brief period in 1944 and 1945, but this is a direct effect of the aforementioned Combat Zone Tax Exclusion.[32]

When incorporated into distributional calculations, the larger denominator derived from the reconciliation approach generally reduces estimated top income shares albeit at different

[32]PS begin scaling their denominator differently from 1944-46 in the exact years the tax-reconciled figure comes closest to their 80% ratio, further indicating an acute distortion in their results caused by a problematic link between their pre-war and post-war denominator methodologies.



Figure 10. *Comparison of PS model 3 with cumulative effects of new models 2 and 3, denominator, and state & local government adjustments*

annual magnitudes. Figure 9 shows the differences between our AGI reconciled denominators, Kuznets, and PS. In figure 10, we show the cumulative effects of our modifications from the previous sections with the denominators produced here. For the top decile, our adjustments through this step remove an average of 4.97 percentage points between 1917 and 1943. For the top centile, the corrected level is lower by 2.55 percentage points. These are sizable differences that affect the evolution of inequality. One will notice that the Great Depression precipitates a larger decline in inequality than the PS series which depicts a stable plateau until 1940.

In table 1, we provide the breakdown of all components in our revisions, allowing for the assessment of each adjustment's effects. The majority of the difference on aggregate come from the denominator, followed by the missing filers and deductions adjustments.

Table 1. *Effect of Different Data Adjustments on Original PS Estimates at Model 3 (Selected Years)*

	1917	1929	1936	1939	1943
	Panel A: Top 10% Income Shares				
Piketty-Saez Model 3	39.6	45.9	44.6	43.7	32.1
New Models 2 and 3	-0.9	-0.3	-2.2	-2.0	-1.0
New Models 2 and 3 + Denominator Effects	-4.4	-4.9	-7.5	-7.9	-2.7
	Panel B: Top 1% Income Shares				
Piketty-Saez Model 3	17.3	22.0	18.0	15.2	11.4
New Model 3	0.0	-1.4	-1.5	-1.2	-0.3
New Model 3 + Denominator Effects	-1.7	-3.9	-3.9	-3.2	-0.9

5.2 Extending fiscal denominators to 1960

The PS denominator technique changes in 1944. PS switch from using 80% of personal income minus transfers to imputing to non-filers a fixed fraction of the income of the average filer (50% in 1944, 60% in 1945, 25% in 1946 and 20% thereafter). This approach appears uncontroversial at first glance, however its timing coincides with the heaviest distortions caused by the Combat Zone Tax Exclusion. [33]

The WWII era complications only affect years with important combat duty contingents. However, these years complicate the PS series after WWII as some military tax benefits continued until 1949 and resumed during the Korean War (1950-53). This period overlaps with the first decade of the low plateau of postwar inequality – i.e. the trough of the U-curve. To remedy these issues, a shift to a consistent denominator using the Goldsmith (1951) method appears suitable. The tax reconciliation technique that we used above, while requiring a line-item array of data from national accounts, has the distinct advantage of more accurately capturing conceptual differences between the NIPA series and tax-eligible

[33] We consider it doubtful that exemption-eligible combat pay equaled only 20% of the average filer income, and further note the exclusion of this pay from regular tax reporting in SOI during applicable years. As a result, PS's imputation choice for non-filer income is heavily distorted in wartime years, generally causing them to understate the size of the denominator. See online appendixes A and B.

personal income as reported in SOI, and tracking how each changes relative to the other over time. For these reasons, along with the necessity of additional adjustments to national accounts for Alaska and Hawaii in applicable years, the reconciliation method accounts for unaddressed discrepancies in the PS denominator after 1943. Our denominator corrections in the preceding discussion demonstrated the viability of this technique by closely aligning with Goldsmith's figures in overlapping years.[34]

An additional advantage comes from the consistency provided by the reconciliation method. In 1943-1944, PS face two important discontinuities in data structure: the IRS shift to AGI (affecting the numerator) and the changing method for calculating total income in their own series (affecting the denominator). Our corrections in the previous sections resolved problems associated with the numerator by making adjustments for deductions and missing filers. However, the change in methodology for measuring total income by PS appear to artificially inflate the denominator after WWII. By adopting the reconciliation approach in its place, we offer a single consistent denominator from 1917 to 1960 that is insulated from methodological changes. A consistent denominator allows us to continue to capture yearly effects of income accounting discrepancies omitted from the PS approach. We are therefore able to extend our full series beyond the effects of the war and into the mid-century trough portion of the "great leveling" or "great compression" (Lindert and Williamson, 2016; Goldin and Margo, 1992).

To extend the denominator corrections, we replicated the reconciliation approach for each year with line-item calculations taken from NIPA and the BEA. We then followed the same steps as PS for the numerator after 1943 to extend our full revised series to 1960.

[34]In online appendix A (section III), we provide a comparison of the PS denominator with those based on Goldsmith's tax reconciliation method as well as the BEA's augmented AGI measure (Bureau of Economic Analysis, 1998).

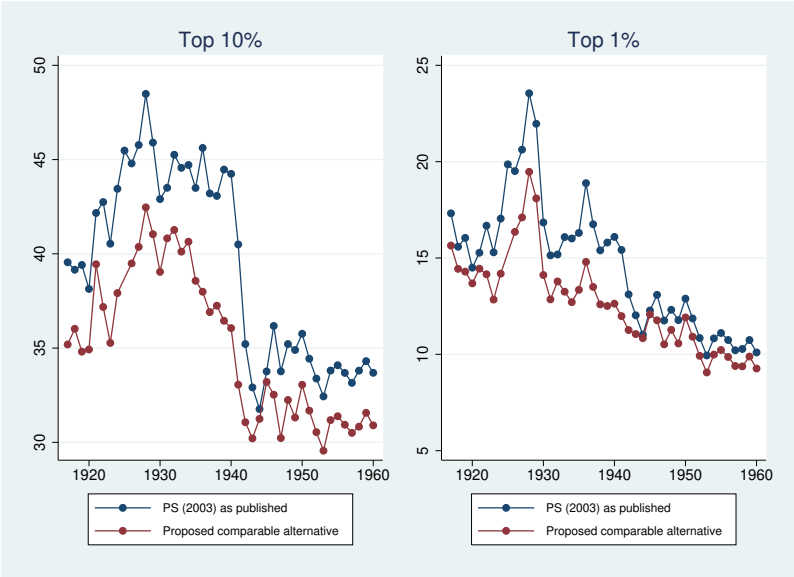


Figure 11. *Effect of Extending Denominator to 1960, comparable with Piketty and Saez (2003) published results, inclusive of capital gains.*

6 Final Results and Discussion

The cumulative results of our full numerator and denominator corrections may be seen in figure 11. Until now, we presented our adjustments by comparing them to the PS series after their model 3 adjustments. As noted, PS made a further adjustment to account for capital gains income in addition to calculating their initial top share fractiles. We directly apply the PS capital gains adjustment to our revised series, giving us income share estimates that are directly comparable with the published PS series. In table 2, we provide the values that underlie figure 11.

Our findings lend themselves to several interpretations. First, our revised series conclusively illustrates that PS substantially overstate top income concentration levels between 1917 and 1960 as a result of problematic data construction issues and accounting errors in

Table 2. *New top income shares (all corrections with full capital gains) comparable with PS published results, 1917–1960*

Year	**Top 10%**	**Top 5%**	**Top 1%**	**Year**	**Top 10%**	**Top 5%**	**Top 1%**
1917	35.19	26.77	15.64	1939	36.45	25.77	12.51
1918	36.02	26.57	14.44	1940	36.06	25.21	12.63
1919	34.81	26.29	14.29	1941	33.06	23.58	11.98
1920	34.93	25.76	13.68	1942	31.07	22.06	11.26
1921	39.45	28.12	14.45	1943	30.21	21.68	11.05
1922	37.18	26.95	14.16	1944	31.25	21.87	10.84
1923	35.27	25.07	12.84	1945	33.21	23.91	12.07
1924	37.92	27.02	14.19	1946	32.53	23.72	11.77
1925	-	-	-	1947	30.23	21.72	10.52
1926	39.49	28.58	16.36	1948	32.25	23.07	11.27
1927	40.37	30.40	17.11	1949	31.32	22.08	10.57
1928	42.47	32.68	19.47	1950	33.06	23.73	11.92
1929	41.04	31.17	18.09	1951	31.68	22.41	10.91
1930	39.04	27.54	14.12	1952	30.54	21.21	9.92
1931	40.82	27.20	12.85	1953	29.56	20.14	9.06
1932	41.27	29.52	13.78	1954	31.18	21.60	9.99
1933	40.12	28.04	13.25	1955	31.38	21.82	10.23
1934	40.64	30.51	12.71	1956	30.94	21.38	9.87
1935	38.57	27.10	13.35	1957	30.50	20.90	9.40
1936	37.99	27.87	14.80	1958	30.83	21.06	9.38
1937	36.91	26.34	13.50	1959	31.57	21.71	9.88
1938	37.25	25.85	12.59	1960	30.90	20.84	9.26

their series. We must nonetheless dispel any impression that PS systematically overstate inequality levels through all of their methodological choices. As figures 7 and 8 show, when adjusting only for missing filers and deductions there are a handful of years in which PS understate the level of income concentration (1920, 1921, and 1923 for the top 10% and 1917, 1920, 1921, and 1932 for the top 1%) based upon the numerator alone. Moreover, the inclusion of public sector workers in the numerator also slightly increases the PS series in some years. On net however, our revisions visibly dampen the height and overall change in the U-curve.

Secondly, the sum of our corrections does not alter the fact that there was a fall and then rise of inequality during the twentieth century. Our revised series confirms this downward trajectory, particularly following the events of 1929 (see online appendix B for supplementary

tables showing other fractiles). In doing so, it nonetheless reveals substantial imprecision in the overall shape of the PS series prior to World War II and offers a more nuanced alternative.

These differences invite a revision to the historical interpretation of inequality across the first half of the century. The U-curve depicted in the original PS series exhibits a sharp and sudden decline in income concentration among all top fractiles between 1940 and 1944, completely re-situating the trajectory of distributional estimates for the next three decades in a mid-century trough. Using the PS published estimates, the top 10%, 5%, and 1% income shares fell respectively by 12.48, 9.23, and 5.05 percentage points during WWII alone. This downward movement over a short period, and in a country largely removed from the physical destruction of fighting, stands out as an unusual feature of the PS series. Our corrections suggest that the wartime leveling in the US was not as pronounced as PS display. By comparison, our series shows reductions between 1940 and 1944 (4.9, 3.5, and 1.9 percentage points drops for the top 10%, 5%, and 1%) that are only half of those found by PS.[35] The differences are not discretionary. They stem from faulty methodological choices in PS that effectively create a statistical illusion of a rapid top income share decline between 1940-44.

While preserving the war's relevance, our revisions emphasize a more gradual story. They depict a modest rise in inequality before the 1929 stock market crash, followed by a gradual leveling across the Depression and war years. Importantly, this rise and fall appears to track general macroeconomic patterns, even prior to adjusting for capital gains realisation.

On the whole, the story depicted in our corrected series is more consistent with the long-posited leveling effects of the Great Depression and less consistent with the attribution

[35]In contrast, the reduction in income inequality for the top 1% in Canada, France, and Australia in those same years was respectively equal to 4.7, 6.8, 1.3 percentage points (WID.World, 2020).

to conscious fiscal policy designs or the introduction of highly progressive tax rates.[36] The downward slide in top income shares from their late 1920s peak precedes the entrenchment of highly progressive top marginal tax rates by several years, and the World War II era expansion of the federal income tax base by over a decade. The extremely steep marginal tax rate structure of the mid-twentieth century may accordingly play a lesser role in the leveling story than suggested by PS, who maintain that the federal tax system's progressivity was a primary cause of falling top income shares.

What do our findings entail for the whole twentieth century? Some post-1960 revisions to the PS estimates suggest an overestimated rise of inequality particularly after 1980 (Mechling *et al.*, 2017; Auten and Splinter, 2017). Ideally, we would want to link our results to these revisions and compare with PS. Several adjustments proposed in these studies rely on post-1960 IRS microdata files to further fine-tune the numerator. Mechling *et al.* (2017) modify the numerator exclusively in order to capture for income-shifting. Auten and Splinter (2017) make a greater number of modifications but most of them are to the numerator rather than the denominator. The methodological differences with these other revisions prevent us from directly linking with our series, drawn from pre-microdata SOI files, without also making extensive assumptions about the proper connection.[37]

Nevertheless, there is value in comparing those revisions with ours as well as the original PS estimates. This is especially true when we compare the two extremes of the U-curve. The main problem is in establishing a connection at 1960. However, prior to 1943, we modify both numerator and denominator just as Auten and Splinter (2017) do after 1960. This makes

[36]Indeed our pattern matches with that found by recent researchers who analysed inequality below the top centiles (Benguria *et al.*, 2018; Geloso and Magness, 2020).
[37]In online appendix A Section VII, we attempt to link our series with Auten and Splinter (2017) by isolating their changes to denominator alone, thereby preserving methodological consistency with our results.

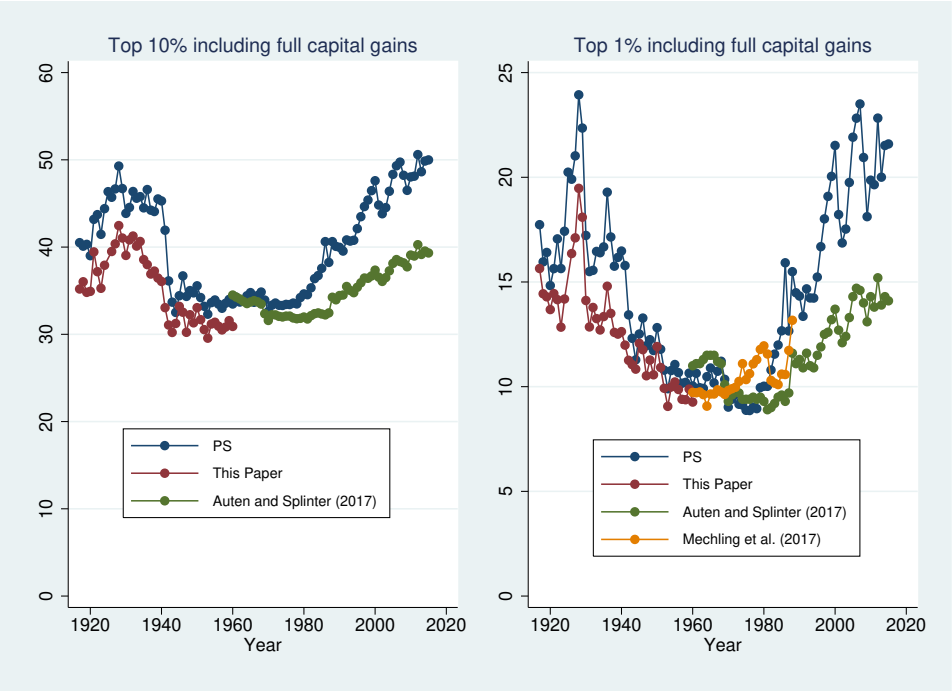


Figure 12. *Different Inequality Series, 1917–today*

our estimates more comparable with the post-1960 revisions. In Figure 12, we illustrate our revisions with those of Auten and Splinter (2017) and Mechling *et al.* (2017) alongside the original PS estimates. All series apply to pre-tax and pre-transfer incomes. The pattern that appears in these revisions shows a general lowering of the century-long U-curve, as well as a reduction in the magnitude of its tails.

While we were only concerned with the methodological choices made by PS, there is value in considering the issue of underlying IRS data quality, which suggests that the left side of the U-curve could be further flattened. Before 1943, the IRS faced considerable enforcement problems arising from self-reported tax returns. Under-reporting in this era was generally much more prevalent among lower-income classes where audit risks were minimal, suggesting

that SOI-derived measurements may further overstate top income concentration beyond what our methodological and accounting corrections to the PS series reveal.[38] Attempts to correct for this problem, using comparisons of the IRS data with the data from income tax systems of states with strong enforcement mechanisms from 1919 to 1945, suggest that the income share of the top 1% is overestimated by a factor of 1.18 (Geloso and Magness, 2020, p. 849).

7 Conclusion

The U-curve pattern of twentieth century American income inequality depicted by Thomas Piketty and Emmanuel Saez (PS) warrants revisions. Even as PS captured elements of the leveling pattern in this period, their calculations introduced a sizable overstatement of income concentration levels and trends. Our findings complement new work by other scholars (Armour *et al.*, 2014; Kopczuk, 2015; Bricker *et al.*, 2016; Auten *et al.*, 2016; Auten and Splinter, 2017; Mechling *et al.*, 2017) who propose similar adjustments, albeit on the latter half of the U-curve. When combined with the direction of revisions in these recent works, our own corrected estimates for the first half of the curve reveal a shallower and more nuanced pattern of shifting income concentrations. The more gradual decline of inequality also calls into question the posited link between the previously depicted U-shaped pattern and the highly progressive tax policies of the mid-century.

Our corrections are based only upon verifying the underlying assumptions behind the PS constructions. No questions were asked regarding further IRS data quality issues beyond these initial considerations. We leave this for future inquiry. There are obviously many

[38]Suggestive of this point, research by Smiley (2000) found that misreporting in the 1920s and 30s led to serious alterations to the movements of measured inequality.

points that future research should follow, notably to better control for the historical changes in tax regimes, their effects on the reliability and accuracy of self-reported income, and further adjustments to address the size of households, as Auten and Splinter (2017) attempt for post-1960 data. At minimum, other derivative estimates of income composition and top wealth shares that rely upon the original PS series warrant similar revisions to their pre-1960 data.

Our results should not be taken as the final word but rather the start of a discussion about the U-curve of income inequality. Echoing Sutch (2017), we note that altering the shape of the distributional series also changes the interpretation of what led to the mid-century leveling and what remedies, if any, we might employ against rising inequality. Difficulties of measurement are a recurring challenge of historical inequality studies that we must remain attentive to.

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A Online Appendix A

Online Appendix A contains supplementary details and information regarding the data sources used in this paper.

B Online Appendix B

Online Appendix B contains supplementary tables.

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