

Income Inequality in the United States: Using Tax Data to Measure Long-Term Trends

SUPPLEMENTARY APPENDIX

Methodological Changes and Responses to Comments on Previous Drafts¹

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The Auten and Splinter income inequality paper has gone through multiple versions, each adding improvements to our analysis. In these versions and in other related papers, we have developed new methods, provided context for how our results compared to other estimates, and addressed comments and critiques of prior versions. The first version of this paper was posted in 2016 and revised versions were posted in 2017, 2018, 2019, 2022, and 2023. Our other research addressed issues in measuring the distribution of income, such as the distribution of underreported income. Below, we summarize our methodological updates to prior versions based on helpful comments, mostly from Saez and Zucman (2020a), as well as our prior responses to other requests and comments.

I. Methodological Updates

Audit study estimates and allocating underreported income

The 2022 version of our paper adopted an improved method of allocating underreported income.² Previously, we used the audit study results reported in Johns and Slemrod (2010). That approach, however, missed the variation in underreporting over time and within income groups. Auten and Langetieg (2020) addressed these limitations by providing detailed distributions of underreporting by and within reported income groups from IRS detailed audit studies (1988, 2001, 2006–2007, 2008–2009, 2010–2011, 2012–2013), as described in our online appendix (p. 20). Auten and Splinter (2021) introduced a method of using these data to allocate underreported income with the tax return data used for inequality estimates. This new methodology also addresses the DeBacker et al. (2020) critiques of the Johns and Slemrod (2010) use of four simple detection-controlled-estimate multipliers, which our earlier approach relied on.³ Our current allocation method using more detailed audit data also addresses the concern in Saez and Zucman (2020a) regarding the re-ranking effects of our prior method using the Johns and Slemrod (2010) approach. Our current approach is now consistent with the re-ranking patterns in the IRS detailed audit studies and accounts for the large share of underreporting from overstated business losses.

Our online appendix is updated to provide additional information regarding how this allocation of underreported income affects our distributions. Figure B6 shows that the addition of underreported

¹ The main paper is at davidsplinter.com/AutenSplinter-Tax_Data_and_Inequality.pdf, along with related documents.

² The IRS and national accounts use the term “misreporting” to include multiple kinds of taxpayer errors. The IRS includes cases where taxpayers reported income on the wrong line (by mistake or to avoid payroll taxes) and cases where taxpayers inappropriately reported income or deductions in the wrong year to reduce their tax liability. These situations generally result in no net changes in total income. Our concern is the amount of underreported income discovered in IRS detailed audits net of any overreporting.

³ The approach in Johns and Slemrod (2010) allocated undetected underreported income proportional to detected underreported income using four simple multipliers. DeBacker et al. (2020) pointed out this approach is inappropriate for use with microdata. In cases where the most aggressive auditors found the most underreported income, the simple multiplier approach overstates undetected underreporting, exaggerates re-ranking effects, and thereby allocates too much to the top of the distribution (Auten and Splinter 2021).

income and some other income gaps has only small effects on our top income shares—it decreases top 1% pre-tax shares an average of 0.1 percentage points and increases after-tax shares an average of 0.2 percentage points. This is similar to the Johns and Slemrod (2010) finding that adding underreported income had no effect on the top 1% share of fiscal income in 2001.⁴ Our small decrease in top pre-tax income shares from adding underreported income is because we account for non-filer underreporting, which is ignored in audit studies, and address the misuse of detection-controlled estimates, as discussed in Auten and Splinter (2021). Figure B5 shows that our approach matches the distributions of underreported income in prior studies.

Capital consumption adjustment

The allocation of underreported income was updated in the 2022 version of our paper to separately allocate the national accounts' capital consumption adjustment, which adjusts for the faster depreciation in tax data relative to national accounts, such as from expensing. Whereas these amounts were previously allocated using the audit data, they are now allocated by expensing and depreciation amounts observed in the tax return microdata. As noted in our online appendix (p. 18): “The capital consumption and residual adjustments have negligible effects because expensing pushes one down the reported income distribution.” This change was made in response to a comment in Saez and Zucman (2020a).

Income of non-filers

The allocation of underreported income going to non-filers was updated in the 2022 version of our paper. Previously, we allocated 15 percent of underreported income (misreporting, capital consumption, and other reporting gaps) to non-filers. However, this amount appeared to be excessive because non-filer income reported on information returns is now already included. Our updated method allocates 5 percent of underreported income to non-filers. The online appendix (p. 6) explains the reason for still allocating some underreported income to non-filers: “Some non-filers and their income are likely missing. This would result from ‘under-the-table’ income that is not reported by employers or service-recipients on Forms W-2 or 1099-MISC or self-employment income that is not captured by information returns.”

High-income non-filers

The estimate of non-filer incomes was updated in the 2022 version of our paper. Previously, we followed the Piketty and Saez (2003) assumption that non-filers receive 20 percent of the average income of filers. This approach, however, misses the distribution of income within the non-filer population and the presence of high-income non-filers (Treasury Inspector General for Tax Administration 2020). Our updated approach uses nine IRS information returns (e.g., Forms W-2 submitted by employers) to estimate non-filer incomes across 56 demographic and income groups. This change was made in response to a comment in Saez and Zucman (2020a) and the findings of the TIGTA study.

Retirement income

The 2023 version of our paper uses administrative data to more accurately allocate defined contribution (DC) retirement wealth, including some accounts with very large balances. Previously, this was allocated based on DC retirement wealth estimates from the Survey of Consumer Finances (SCF). The updated approach links Form 5498 information returns at the

⁴ In contrast these small effects on top 1% income shares from including underreported income, Piketty, Saez, and Zucman (2018) state that they “attribute \$169bn extra to the top 1%, or 1.17% of the \$14.445tr national income in 2013.” (PSZ online appendix, p. 35).

microdata level to have each tax return's total IRA wealth, which represents a large share of total DC wealth. We still use the SCF for other DC wealth because some types of accounts are not available in the tax data. The new Table B2b shows that our updated approach using Form 5498 data produces overall results not too different to the SCF-only approach while more accurately measuring the largest retirement accounts of wealthy taxpayers.

Business taxes

The 2022 version of our paper updated the allocation of business taxes. Previously, we allocated no passthrough business taxes to wages. Our updated method allocates five percent of these taxes to wages, following the Joint Committee on Taxation approach. This responds to a comment in Saez and Zucman (2020a). For corporate taxes, however, we note that the Piketty, Saez, and Zucman (2018) approach deviates from empirical evidence and standard allocations. For example, their 2018 approach ignored the incidence of corporate taxes on labor income and their updated approach ignores incidence on anyone besides corporate shareholders. Their updated approach should have the effect of increasing top income shares, especially in the 1960s. Kopczuk (2019, p. 10) described their updated approach as “based on highly unusual incidence assumptions...contrary to the literature and the standard practice (including their own earlier work)...”

Including all national income

The 2016 version of our paper did not include all national income. Piketty, Saez, and Zucman (2018, online appendix, p. 33) wrote that “the bottom-up approach of AS is likely to always retain a large residual discrepancy with national income.” To address this concern, we expanded our income definition to match national income for a sensitivity test in the 2017 version. Since the 2018 version, we have included all national income in our income measures.

II. Responses to Comments

Response to Piketty, Saez, and Zucman (2019)

In Auten and Splinter (2019, [appendix](#), pp. 4–5), we responded to comments in Piketty, Saez, and Zucman (2019, hereafter PSZ19). We explained that PSZ19 “propose a ‘simplified’ method for allocating non-taxable income and imply that in 2015 we only allocate about 10% of non-taxable/non-retirement capital income to the top 1%...In fact, our top 1% receives about 40% of this income (excluding imputed rents from owner-occupied housing).” We discussed three limitations of their “simplified” method: “(1) going back to using tax units to set income groups rather than individuals or adults retains the upward bias from failing to account for lower marriage rates outside the top of the income distribution, (2) allocating 16% of employer-sponsored insurance and payroll taxes (or alternatively Social Security benefits) to the top 1% rather than the more appropriate and equal shares of 2% and 4%, (3) treating owner-occupied imputed rent like other concentrated capital income, hence allocating 53% of imputed rent to the top 1% rather than the more appropriate and equal share of about 9%.” Thus, it is inappropriate to use their simplified method to make comparisons with our results, or to follow their suggestion that this approach would be appropriate for international comparisons.

The distribution of income not reported on tax returns has become more equal over time

The share of national income missing from tax returns (i.e., fiscal income) increased from an average of 34% in the 1960s to 40% in the 2010s. The distribution of this missing income has become more

equal. To clarify this point, we added Figure B16, which accounts for excluded income sources.⁵ The share of excluded national income going to the top 1% *decreased* two percentage points and the share going to the bottom 90% *increased* ten percentage points. These equalizing changes resulted from relative declines in corporate income and increases in tax-exempt employee compensation. This shows why pre-tax national income is now more equally distributed than tax-return-based income.

Audit studies: Response to Saez and Zucman (2020a)

IRS detailed audit studies in the National Research Program show that about 40 percent of underreported business income is from those reporting business losses (Auten and Langetieg 2020). Piketty, Saez, and Zucman (2018) ignore the audit study data and instead allocate these amounts only by *positive* reported business income. This fails to allocate any underreported income to those with reported business losses, thereby reallocating these amounts to the top of the distribution of reported income and overstating top income shares.

We responded to comments in Saez and Zucman (2020a, hereafter SZ) about our use of the audit study data in Splinter (2020b, pp. 2–3) as well as many of these points in Auten and Splinter (2020). The AS approach conforms with IRS special audit studies, while the PSZ approach is inconsistent with them. First, AS allocated a portion of underreported income to filers with negative reported income discovered in the special audit studies, while PSZ allocated no underreported income to negative incomes from overstated business losses. Second, AS average ratios of underreported to reported income decrease for higher reported incomes to conform to audit study patterns, but these ratios are assumed to be constant with respect to positive income for PSZ. Third, the AS accounts for the variation in underreporting rates in each reported income class, while the PSZ approach has no allowance for this variation.

As a result of their problematic allocation approach, PSZ results are inconsistent with the special audit studies. The PSZ approach overstates underreporting at the top of the distribution, thereby significantly increasing top income shares while the AS allocation has only a small effect on top income shares. This is a result of PSZ allocating no underreporting to negative income amounts from overstated business losses and to a lesser extent from their allocating underreporting by a constant ratio. In addition, while the AS allocation results in significant re-ranking as indicated by audit studies, the PSZ proportional allocation results in little re-ranking.

Audit studies: Response to Saez and Zucman (2018)

As discussed above, we use the detailed IRS audit studies to allocate underreported income. Piketty, Saez, and Zucman (2018, hereafter PSZ) allocated underreported business income by positive reported business income. This ignores the special audits studies used to include this income in national accounts and relies exclusively on a biased subset of reported incomes. PSZ viewed their allocation of underreported income as different from that of the audit studies: “AS argue that their allocation is preferable because it is consistent with the distribution of tax evasion estimated by IRS random audit studies...We believe, however, that our treatment is better justified...” (PSZ online appendix, p. 35)

⁵ These excluded sources account for about two-thirds of the fiscal income missing from national income. The remaining third is primarily underreported income and sales taxes, for which top 1% shares are relatively constant over time in our approach.

The PSZ deviation from audit studies is also clear from their own calculations. Johns and Slemrod (2010) estimated no effect on top 1% income shares from adding underreported income (similar to our approach, as seen in Figure B6), but the PSZ approach results in a large increase in the top 1% share. As discussed above, PSZ's estimate indicates their approach increased the top 1% share by 1.2 percentage points in 2013 (PSZ online appendix, p. 35). Relative to our baseline, our estimates suggest the PSZ increase in top 1% shares from including underreported income is larger in recent years.

The PSZ justification for ignoring the audit data was to effectively assume the audit data are wrong and miss underreporting by high-income taxpayers. Besides offshore income (which we show has only modest effects), the evidence does not indicate this is a significant issue in the audit data once adjustments for undetected income are included (as done in national accounts and in our approach). For example, PSZ argued that audits studies miss underreported partnership income because “30% of partnership income (which is highly concentrated) is not traceable on individual tax returns (Cooper et al., 2016).” (PSZ online appendix, p. 36). But Love (2022) was able to identify the ultimate owners receiving 99% of reported partnership income, leaving only 1% not traceable. The previously “missing” amounts in Cooper et al. (2016) were from failed matches of Taxpayer Identification Numbers, such as Social Security numbers. Therefore, the previous partnership income gap was from incomplete matches—not evasion, as claimed by PSZ.

Underreported income of S corporations also appears to be fully captured by our approach. Based on a special audit study of S corporations, the IRS (2008, p. 14) concluded that the underreported income amounts we use (i.e., after scaling up to account for undetected underreporting) from the standard audit data “likely account for more misreporting of S-Corporation income than was detected in the S-Corporation study. Based on these findings, no additional adjustment is presently recommended to the Schedule E partnership and S-Corporation tax gap estimate...” In addition, the S corporation audit study showed that underreporting rates declined at higher asset levels. That is, smaller asset S corporations had higher detected underreporting rates (Auten and Splinter 2021).

Differences from Congressional Budget Office (CBO) estimates

Our estimated changes in overall income inequality and top 1% shares are similar to those of CBO, which also uses tax data but an expanded fiscal income definition. Our top 1% share levels differ from CBO's for reasons discussed in Auten and Splinter (2019, p. 309). “In 2014, AS top 1 percent income shares are 3.6 pp lower than CBO estimates. This reduction is due to: 0.7 pp from expanded social insurance benefits and employer-sponsored insurance [Note: CBO excludes many retired people and parts of health-insurance costs], 0.7 pp from different corporate tax allocations [Note: CBO ignores the half of corporate ownership in more equally distributed retirement accounts], 0.5 pp from including state and local taxes, 0.4 pp from including underreported income and imputed rents, and 1.8 pp from replacing realized capital gains with retained earnings. These reductions are offset by 0.7 pp from differences in size adjustments.”

U.S. taxes are progressive & tax progressivity increased

Saez and Zucman (2019) presented estimates based on PSZ suggesting that U.S. taxes were regressive, that is, average tax rates fall as incomes increase. Splinter (2019a) showed this was due to deviations from standard approaches. All other estimates of which we are aware show U.S. taxes are progressive: including estimates in Piketty and Saez (2007), the OECD, the CBO, Treasury's Office of Tax Analysis, the Joint Committee on Taxation, and the Urban–Brookings Tax Policy Center (see review in Splinter 2020).

Moreover, tax progressivity has increased in both our estimates and those of other researchers. CBO data imply federal tax progressivity increased significantly since the mid-1980s (Splinter 2020). For example, individual income tax progressivity increased due to expanded refundable tax credits (Splinter 2019b). In response to claims about our tax rate calculations in Saez and Zucman (2021), our main paper explains that we use a conventional transfer-inclusive income definition for estimating average tax rates and our online appendix notes that “in 2019, the top one percent average tax rate is unchanged when replacing retained earnings with capital gains.” (p. 38)

Size-adjustment effect: Response to Saez and Zucman (2020a)

We follow the CBO approach of ranking observations by size-adjusted income. Saez and Zucman (2020a, p. 32) claimed that this has the effect of “increasing the bottom 99% income share.” Starting in the 2018 version of the paper, however, we explained that ranking by size-adjusted income increases top 1% income shares (i.e., decreases bottom 99% shares) about one percentage point in recent years. To make this point clearer, we showed the effects of this adjustment in Table 1 beginning with our 2022 version. In addition, note that in a previous step, our sample of tax returns was cleaned to represent independent economic units in the U.S. resident population. In contrast, the PSZ study retains tax returns of many dependents and non-resident filers. In 2019, this exaggerates inequality because the 5 million dependents over age 20 filers have disproportionately low incomes, while the one million non-resident tax returns have disproportionately high incomes.

BEA prototype estimates of S corporation income

Footnote 38 of our online appendix discusses prototype estimates from the BEA that suggest little impact on our top 1% income share estimates. “The Bureau of Economic Analysis recently released prototype estimates of S corporation profits, which are currently combined with C corporations. These prototype estimates are only for 2012 through 2017 and therefore cannot be used for our full analysis at this time. The estimates for 2016 suggest that the total corporate capital consumption adjustment is largely negative for C corporations but positive for S corporations. Based on these estimates, shifting a total of \$149 billion from C corporation profits to S corporation capital consumption adjustments (also accounting for depreciation of intellectual property products and other related amendments), would increase our pre-tax top 1% income share by only about one-tenth of a percentage point.” (online appendix, p. 21)

Distribution of economic growth: Impact of income mobility and volatility

Average annual percentage changes in income cross-sections between 1979 and 2014 are presented as representing the distribution of economic growth in Piketty, Saez, and Zucman (2018, PSZ). However, these measures ignore mobility across income groups over time. Splinter (2019c) first presents cross-sectional estimates similar to those in PSZ, which ignore income mobility and suggest economic growth was regressive. These data are then used for an alternative estimate that accounts for income mobility by following the same individuals over time. The results accounting for mobility suggest economic growth was progressive, as incomes increased most for those starting with the lowest incomes and declined for those starting with the highest incomes. Other studies also show that most individuals in the top 1% are only there temporarily. During the 2000s, only about one-quarter remained in the top 1% all of the following five years (Auten, Gee, and Turner 2013). From 1996 to 2005, Auten and Gee (2009) found that real median incomes declined more than 30 percent for the top 1% and by 67 percent for the top 0.01%. Thus, it is not the same people in the top of the income distribution all the time.

Deficits

There is uncertainty about how to allocate government deficits. We view our allocation of deficits by federal income and payroll taxes as consistent with historical changes in taxes, as discussed in our main paper (p. 31). “Ferriere and Navarro (2020) explain that historical government spending shocks were financed with higher tax progressivity; and Auten and Splinter (2020, p. 135) note that ‘federal surpluses have been followed by tax cuts (e.g., 1964 and 2001) and large federal deficits have preceded tax increases (e.g., 1982, 1984, and 1991).’ In contrast, the PSZ approach implies that deficits result in cuts to Social Security benefits, Medicare and Medicaid, and refundable tax credits, which is inconsistent with historical experience.”

Government consumption (non-transfer government spending on education, defense, etc.)

There is uncertainty about how to allocate government consumption. Recent evidence, however, appears consistent with our baseline assumption of allocating one half per capita. Riedel and Stichnoth (2022) conclude that public education spending, which is over one third of government consumption, should be allocated per capita. Some portion of other government consumption should also be allocated per capita. Our online spreadsheet presents robustness checks for alternative assumptions for government consumption (below in Table S1). These show top 1% share levels vary somewhat, but with little effect on trends. This responds to a comment in Saez and Zucman (2020b).

Table S1: Top 1% income shares: Alternative government consumption allocations

Government Consumption Allocation	1962	1979	2019	1979– 2019 Change	1962– 2019 Change
50% per capita/50% after-tax income (baseline)	8.6	7.4	8.8	1.4	0.2
25% per capita/75% after-tax income	9.0	7.7	9.2	1.5	0.2
75% per capita/25% after-tax income	8.3	7.0	8.4	1.4	0.2
100% per capita/0% after-tax income	7.9	6.7	8.0	1.3	0.1

References

- Auten, Gerald and Geoffrey Gee. 2009. “Income Mobility in the United States: New Evidence from Tax Data.” *National Tax Journal* 62 (2): 301–328.
- Auten, Gerald, Geoffrey Gee, and Nicholas Turner. 2013. “New Perspectives on Income Mobility and Inequality.” *National Tax Journal* 66 (4): 893–912.
- Auten, Gerald, and Patrick Langetieg. 2020. “The Distribution of Underreported Income: What We Can Learn from the NRP.” Working paper. Current version at www.irs.gov/pub/irs-soi/23rpdistributionunderreportednrp.pdf
- Auten, Gerald, and David Splinter. 2019. “Top 1% Income Shares: Comparing Estimates Using Tax Data.” *AEA Papers & Proceedings* 109: 307–311.
- Auten, Gerald, and David Splinter. 2020. “Top Income Shares and the Difficulties of Using Tax Data.” In Furchtgott-Roth, Diana (ed.), 125–152. *United States Income, Wealth, Consumption, and Inequality*. Oxford: Oxford University Press.
- Auten, Gerald, and David Splinter. 2021. “Comment: Tax Evasion at the Top of the Income Distribution: Theory and Evidence.” Working paper. www.davidsplinter.com/AutenSplinter-TaxEvasion.pdf.
- Cooper, Michael, John McClelland, James Pearce, Richard Prisinzano, Joseph Sullivan, Danny Yagan, Owen Zidar, and Eric Zwick. 2016. “Business in the United States: Who Owns It, and How Much Tax Do They Pay?” *Tax Policy and the Economy* 30: 91–128.

- DeBacker, Jason, Bradley Heim, Anh Tran, and Alexander Yuskavage. 2020. “Tax Non-compliance and Measures of Income Inequality.” *Tax Notes Federal*, February 17: 1103–1118.
- Ferriere, Axelle, and Gaston Navarro. 2020. “The Heterogeneous Effects of Government Spending: It’s All About Taxes.” Working paper.
- IRS. 2008. “Preliminary Methodology for Estimating the TY2004 Tax Gap Associated with S-Corporations.” Draft version. August 22, 2008.
- Johns, Andrew, and Joel Slemrod. 2010. “The Distribution of Income Tax Noncompliance.” *National Tax Journal* 63(3): 397–418.
- Kopczuk, Wojciech. 2019. “Comment on ‘Progressive Wealth Taxation’.” *Brookings Papers on Economic Activity*. Available at www.columbia.edu/~wk2110/bin/BPEASaezZucman.pdf
- Larrimore, Jeff, and David Splinter. 2019. “How Much Does Health Insurance Cost? Comparison of Premiums in Administrative and Survey Data.” *Economics Letters* 174: 132–135.
- Love, Michael. 2022. “Where in the World Does Partnership Income Go? Evidence of a Growing Use of Tax Havens.” Working paper. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3985535
- Piketty, Thomas, and Emmanuel Saez. 2007. “How Progressive Is the U.S. Federal Tax System? A Historical and International Perspective.” *Journal of Economic Perspectives* 21 (1): 3–24.
- Piketty, Thomas, Emmanuel Saez, and Gabriel Zucman. 2018. “Distributional National Accounts: Methods and Estimates for the United States.” *Quarterly Journal of Economics* 133 (2): 553–609.
- Riedel, Lukas, and Holger Stichnoth. 2022. “Government Expenditure in the DINA Framework: Allocation Methods and Consequences for Post-Tax Income Inequality.” ZEW working paper.
- Saez, Emmanuel, and Gabriel Zucman. 2019. “Progressive Wealth Taxation.” *Brookings Papers on Economic Activity*. Conference draft.
- Saez, Emmanuel, and Gabriel Zucman. 2020a. “Trends in US Income and Wealth Inequality: Revising After the Revisionists.” NBER working paper no. 27921.
- Saez, Emmanuel, and Gabriel Zucman. 2020b. “The Rise of Income and Wealth Inequality in America: Evidence from Distributional Macroeconomic Accounts.” *Journal of Economic Perspectives* 34(4): 3–26.
- Saez, Emmanuel, and Gabriel Zucman. 2021. Letter available at <http://gabriel-zucman.eu/files/saez-zucman-jct>
- Splinter, David. 2019a. “U.S. Taxes are Progressive: Comment on ‘Progressive Wealth Taxation’.” Working Paper.
- Splinter, David. 2019b. “Who Pays No Tax? The Declining Fraction Paying Income Taxes and Increasing Tax Progressivity.” *Contemporary Economic Policy* 37 (3): 413–426.
- Splinter, David. 2019c. “Progressive Growth: Comparing Cross-Sectional and Panel Approaches.” Working paper.
- Splinter, David. 2020a. “U.S. Tax Progressivity and Redistribution.” *National Tax Journal* 73(4): 1005–1024.
- Splinter, David. 2020b. “Reply: Trends in US Income and Wealth Inequality: Revising After the Revisionists.” Working paper.
- Treasury Inspector General for Tax Administration. 2020. “High-Income Nonfilers Owing Billions of Dollars Are Not Being Worked by the Internal Revenue Service.” Report 2020-30-015.