Presence and Persistence of Poverty in U.S. Tax Data

Abstract

This paper presents new estimates of the level and persistence of poverty among U.S. households since the Great Recession. We build annual household data files using U.S. income tax filings between 2007 and 2018. These data allow us to track individuals over time and measure how tax policies affect poverty trends. Using an after-tax household income measure, we estimate that while roughly 1 in 10 people are in poverty in any given year, over 4 in 10 people spent at least one year in poverty between 2007 and 2018. This implies substantial mobility in and out of poverty—for example, 41 percent of those in poverty in 2007 were out of poverty in the following year. Others spend multiple years in poverty or escape poverty only to fall back into it. Of those in poverty in 2007, one-third were in poverty for at least half of the years through 2018.

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I.   Introduction

Over 38 million people, or 11.8 percent of United States residents, were living in poverty in 2018 based on the Census Bureau's official poverty statistics (Semega et al., 2019). For some poverty represents a temporary setback; for others poverty persists for years or decades. Understanding the persistence of poverty, along with the poverty level at any point in time, is essential for designing and evaluating anti-poverty programs.[1] This paper produces new estimates of the level and persistence of poverty in the United States between 2007 and 2018 using a new panel of household-level incomes in tax record data.

To explore the persistence of poverty, we build a population panel of household-level tax records to evaluate poverty dynamics from 2007 to 2018. By aggregating tax data to the household level and incorporating non-filers using income data from their information returns—such as Form W-2 and the 1099 series—we estimate household-level incomes, income distributions, and poverty levels in each year. Additionally, since the Internal Revenue Service (IRS) receives tax records annually for almost all adults, these data provide a naturally occurring population-level panel. We use the panel nature of these data to evaluate the persistence of poverty and analyze the characteristics of individuals experiencing short-term poverty compared to those experiencing persistent poverty.

We first compare the levels and trends in cross-sectional poverty in the tax data—both pre-tax and after-tax—with the Census Bureau's Official Poverty Measure based on the Current Population Survey Annual Social and Economic Supplement (CPS). The levels of poverty differ across the two sources due to differences in income concepts and reporting accuracy. To avoid having these inherent differences in levels affect the trend estimates, we anchor poverty rates in

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[1] For example, the effects of time limits on social welfare programs (e.g., Temporary Assistance for Needy Families) will depend greatly on whether most poverty is transitory or persistent in nature.

the tax data at the level estimated using the CPS in 2007. Next, we estimate poverty persistence as the number of years an individual is in poverty conditional on being in poverty in a given base year. Finally, we estimate the share of people experiencing poverty at some point over a multi-year period.

In doing so, we build off the extensive survey-based literature considering these topics based on data such as the Panel Study of Income Dynamics (PSID) and the Survey of Income and Program Participation (SIPP), which re-interview the same individuals over time. This survey-based research has typically found that most poverty spells are relatively short, with approximately half of poverty spells lasting just one year (see e.g., Duncan et al., 1984; Bane & Ellwood, 1986; Stevens, 1999). Nevertheless, those in chronic poverty make up a substantial share of those in poverty at any point in time. For example, Stevens (1999) observes that over one-third of people who experience poverty in a given year will be poor for at least 5 years over the subsequent decade. However, survey-based estimates of income dynamics have measurement error in income (Gottschalk & Huynh, 2010) and non-representative attrition (Fitzgerald, Gottschalk, & Moffit, 1998; Dynan, Elemendorf, & Sichel, 2012; Jenkins & Van Kerm, 2017), each of which could potentially bias estimates of mobility and poverty persistence.

The administrative tax records data we use generally do not have the same concerns. Since nearly all individuals are listed on tax returns or have income have information sent to the IRS on their behalf (Cilke, 2014; Larrimore, Mortenson, & Splinter, 2019), results based on these data generally do not suffer from survey attrition bias. Similarly, since there is a potential financial penalty for misreporting income on tax records, these data are frequently considered to provide more comprehensive reporting of income from taxable sources (Bee & Rothbaum, 2019). Although administrative survey data are not without error and miss some earnings captured in

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surveys (Abowd & Stinson, 2013), these data are likely less prone to measurement error than survey records. Consequently, we are able to provide more robust estimates of the persistence of poverty in the U.S. than can be achieved using survey data alone. Nevertheless, despite their substantial advantages in coverage and income reporting, these data lack important demographic information such as race and ethnicity (Akee, Jones, & Porter, 2019; Chetty et al., 2019).

Several papers have used U.S. tax data to measure income volatility (see e.g., Auten & Gee, 2009; Larrimore, Mortenson, & Splinter, 2016; Splinter, 2019) or persistence of program receipt (Dowd & Horowitz, 2011). Additionally, outside of the U.S., Finnie and Sweetman (2003) used tax records to explore poverty rates in Canada. To our knowledge, however, this paper is the first to consider poverty rates or the persistence of poverty directly in U.S. tax data.

In general, our results on poverty dynamics are consistent with previous findings from survey data, although the levels and trends of poverty rates differ from those measured using the CPS. We observe somewhat greater stability in poverty rates using pre-tax income over the period from 2007 to 2018 than is found using CPS data. This is in part due to underreporting of unemployment insurance benefits in the CPS data at the height of the Great Recession. When measuring poverty on an after-tax basis, we similarly observe that the substantial temporary tax reductions implemented to combat the recession largely alleviated the increases in poverty that are evident between 2007 and 2011 in the pre-tax data.

A large share of the population will experience poverty at some point. While just over 1 in 10 people are in poverty in any single year based on after-tax income, 4 in 10 spent at least one year in poverty over the 12-year period from 2007 through 2018. Among those who were in poverty at any point during this period, the average time spent in poverty is about 3 years (not necessarily continuously), or one fourth of the time.

Although some poverty is transitory, we also find substantial levels of persistent poverty, consistent with Stevens (1999). Fifty-seven percent of people in poverty in the 2007 tax data remained in poverty one year later and 28 percent were in poverty ten years later. However, for many this includes an intervening period where they were not poor, as only 9 percent were poor for at least 10 of the 12 years through 2018. One-third of people who were in poverty in 2007 are subsequently poor for at least half of the 12-year period through 2018. These findings suggest that despite substantial mobility in and out of poverty, many who experience poverty either spend several consecutive years in poverty or escape poverty only to return in a future year.

II.   Data and Methods

A. Data

This paper uses a one percent sample, based on individual taxpayer identification endings, from the Tax Household Data, which is built from Internal Revenue Service (IRS) tax records. Larrimore, Mortenson and Splinter (2019) developed the Tax Household Data for tax year 2010. We extend these data to cover the 12-year period from 2007 through 2018. Prior to 2007, address data is less complete in the IRS data, which currently limits our ability to extend the panel to earlier years.

The Tax Household Data starts with the universe of IRS tax data for individual taxpayers, including annual tax returns (such as Form 1040) and information return forms that are submitted to the IRS by third parties (such as Forms W-2, 1099-SSA, and 1099-INT for various income sources and Form 1098-T for college attendance, see appendix for details). Using the address fields that appear on IRS tax forms, the Tax Household Data links individuals residing at the same address, even if they are not listed on the same tax return. By doing so, we treat all individuals living together as a joint economic unit.

Recognizing that extremely low-income individuals are not required to file a tax return, a crucial question in using tax data for the purpose of poverty measurement is whether they systematically miss low-income individuals. Were we to only include people who file tax returns, this would be a substantial concern, as almost 15 percent of adults do not appear on annual tax returns (Auten & Gee, 2009; Molloy, Smith, & Wozniak, 2011). However, the IRS also receives information returns, which include address data along with income information, from almost all major taxable sources of income for both filers and non-filers. Additionally, Larrimore, Mortenson, and Splinter (2019) show that the distribution of information return income closely mirrors that for tax return income among filers in the lower half of the income distribution. Consequently, tax data can capture nearly the entire U.S. population and observe incomes from taxable income sources (and some non-taxable sources) even among non-filers.[2] Nevertheless, as described further below, we incorporate an adjustment to incorporate people who have zero incomes into the data.

The first three columns of Table 1 show the annual population count in our data, in the American Community Survey (ACS) data, and in the Current Population Survey (CPS). The ACS data is our preferred comparison for the overall population, as it includes institutionalized populations, those on military bases, and those living in group quarters. In all years before 2018, the population count in the IRS data is within 2 percent of that seen in the ACS. The population count in the tax records data is lower in 2017 and 2018 (between 2.0 and 2.5 percent below ACS estimates), consistent with dependents of some late filers not yet appearing in the data. The CPS data used for the Official Poverty Measure excludes institutionalized populations and those living on military bases. Hence, the CPS estimates a smaller population than the ACS.

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[2] For ease of exposition, we collectively refer to all sources that appear on tax returns as taxable income, although some, such as the non-taxable portion of Social Security income and non-taxable interest, are not always taxed. Hence, discussions of taxable income should not be confused with individual-level taxable income amounts as reported on Form 1040.

The high coverage rate of tax data confirms that while there are some people who do not appear in the IRS data, in general these data are nearly as comprehensive as the CPS used for the Official Poverty Measure. However, we recognize that the IRS data will miss those who have no reportable income or activity generating an information return, while the CPS will miss homeless populations not captured by the survey's household-based sampling frame, as well as institutionalized populations who are also excluded from the sample.[3] As a result, both the IRS and CPS data represent an undercount of the overall U.S. population.

Table 1. Population counts in tax records data, the CPS, and the ACS, 2007–2018 (thousands)

Year	IRS Population Estimate (1)	CPS Population Estimate (2)	ACS Population Estimate (3)	Percent Difference from ACS [(1)-(3)]/(3)	IRS, Non-GQ Estimate (5)	IRS, Non-GQ + Zeros (6)	Percent difference from CPS [(6)-(2)]/(2)
2007	299,726	298,935	301,621	-0.6	292,284	296,243	-0.9
2008	301,754	301,356	304,060	-0.8	293,698	297,726	-1.2
2009	303,548	304,139	307,007	-1.1	295,600	300,288	-1.3
2010	306,308	306,435	309,350	-1.0	297,473	303,163	-1.1
2011	308,381	308,668	311,592	-1.0	299,707	305,219	-1.1
2012	310,037	310,936	313,914	-1.2	301,863	307,426	-1.1
2013	312,169	313,101	316,129	-1.3	304,064	309,291	-1.2
2014	313,731	315,988	318,857	-1.6	305,997	311,328	-1.5
2015	315,981	318,580	321,419	-1.7	308,403	313,350	-1.6
2016	317,669	320,026	323,128	-1.7	310,134	314,605	-1.7
2017	319,132	323,024	325,719	-2.0	311,916	316,529	-2.0
2018	319,049	324,204	327,167	-2.5	312,678	316,884	-2.3

Sources: IPUMS CPS (Flood et al., 2018), IPUMS USA (Ruggles et al., 2019), author's calculations using the IRS Tax Household Data.
Notes: As described in Semega et al. (2019), the CPS updated their population benchmark in 2010 and updated their questionnaire in 2013 and 2017. We report results using the revised questionnaire and updated processing system, excluding those living in group quarters. CPS results are provided for the income year, which are based on the survey collected in March of the following year. ACS results are based on the year in which the survey is conducted. IRS population estimates exclude individuals living outside the United States and those without a valid address. Group quarters in the IRS data include any household with 11 or more individuals. The 2017 and 2018 IRS populations are based on late-2019 data availability and therefore miss the dependents of late filers.

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[3] Each year since 2007 the Department of Housing and Urban Development estimates the homeless population on a single night of the year. Their estimate of the homeless population over this period has ranged from 550,000 to 647,000 people (HUD 2018). This reflects approximately 0.2 percent of the overall U.S. population.
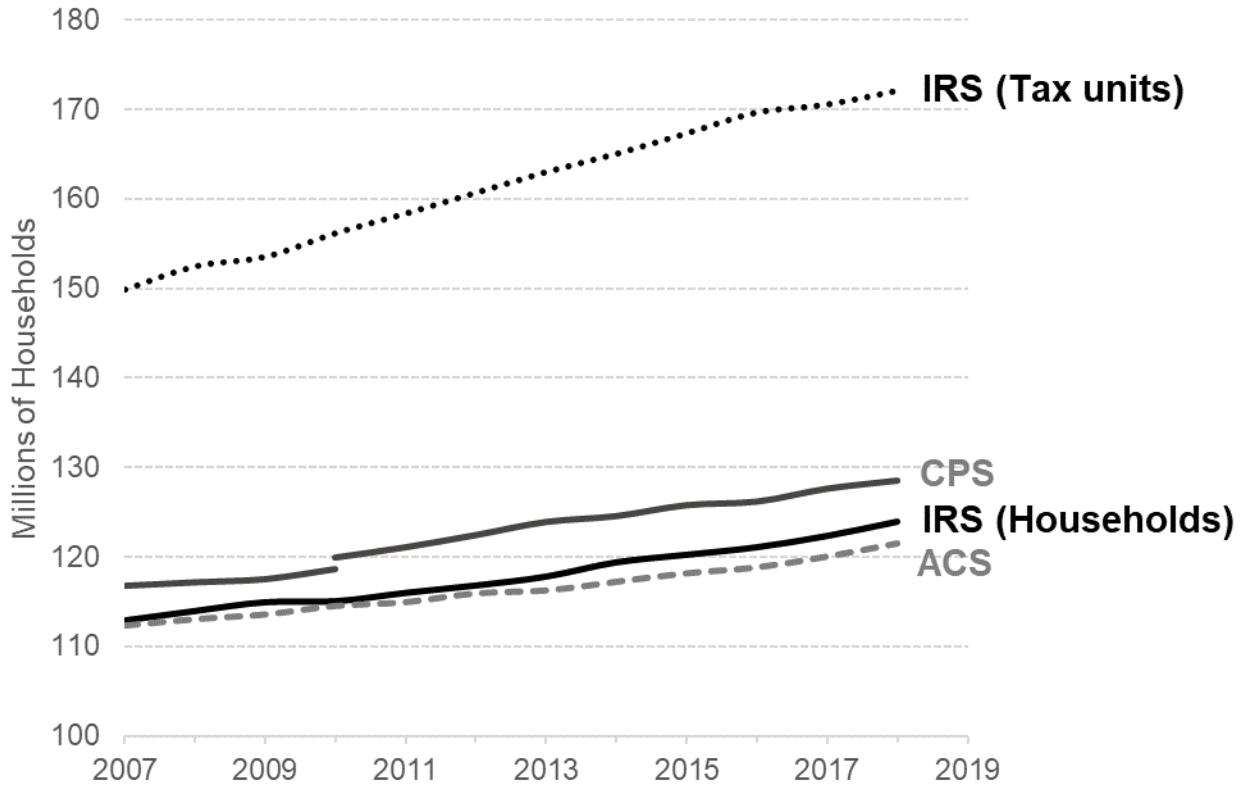
The Official Poverty Measure's approach using CPS data excludes institutional and group quarters populations from poverty estimates. These groups are not comparable to the rest of the population: they share resources differently with those at the same address and they receive substantial in-kind services (which can substitute for the income used in determining poverty). To provide more consistent measures, we follow this approach in our poverty estimates, excluding from the IRS data the approximately 8 million people each year who appear to live in households with 11 or more individuals (who we expect are frequently living in group quarters). This results in between 7 and 12 million fewer people in the data in each year than is estimated by the CPS (comparing column 2 and column 5 of Table 1).

One reason that the IRS population counts are likely lower than those in the ACS and CPS is that individuals who have zero income and do not appear on a tax return will not appear in IRS data. Although non-response and underreporting of some income sources (see e.g. Bee & Mitchell, 2017; Bee & Rothbaum, 2019; Bollinger et al., 2019; Meyer et al., 2019) likely results in the CPS overstating the number of people in households with zero income, the lack of tax reporting requirements for those with zero income also suggests that the IRS data understate the zero-income population. To address this concern, for our main estimates we take an upper bound by adding to our population the difference between the number of people in households with zero incomes (from income sources appearing on tax forms) in the CPS data and the number observed in the IRS data.[4] This is consistent with the approach by Chetty and Hendren (2018), who assumed that missing observations in tax data were true zeros. Including these imputed individuals in households with no income adds about 4 to 6 million people to our IRS population estimate—with the largest increases occurring between 2010 and 2012 in the aftermath of the Great Recession. After the

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[4] Poverty estimates without the imputation of missing individuals living in zero income households are available in Appendix Figures A1 and A2.

adjustment for group quarters, and adding imputed zeros, we estimate a population that is approximately 1 percent below the CPS population in most years.

Figure 1. Household counts in tax records data, the CPS, and the ACS, 2007–2018

In addition to reasonably well approximating the population estimates in these two Census surveys, the Tax Household Data also well approximates the number of households in these surveys. In all years since 2007, the Tax Household Data estimate of the number of households is between the household count estimated in the CPS and that estimated by the ACS (Figure 1). Each of these are well below the count of tax units in the IRS data. For example, in 2018, we estimate using the Tax Household Data that there are 124 million households in the United States (not

including the additional imputed zero income households) compared to 172 million tax units. This is about 2 percent above the 122 million households estimated in the ACS and less than 4 percent below the 129 million households estimated in the CPS. These estimates are consistent with the suggestion by McCue, Masnick, and Herbert (2015) that the CPS overestimates the number of households while the ACS underestimates the number of households.

B. Income and sharing unit differences from the Official Poverty Measure

Although CPS and IRS data both collect annual incomes, there are several notable differences in income concepts between these data sources that prevent us from directly replicating the Official Poverty Measure using IRS data. Three major income measurement differences are the coverage of transfer income for low-income individuals in the CPS (and lack of coverage in tax data), tax credits for low-income individuals in the tax data (and lack of coverage in the CPS), and private retirement income in the tax data (and limited coverage in the CPS). The first two are most relevant for this analysis.

The CPS income measure used for the Official Poverty Measure includes all pre-tax cash income. This includes cash transfers from workers' compensation, cash welfare programs such as TANF, veterans' benefits, child support, financial assistance from friends or family, and educational assistance. All of these are untaxed and do not appear on IRS tax forms.[5] On the other hand, the CPS does not ask about, and the Census Bureau excludes from the Official Poverty Measure, tax liabilities and tax credits that IRS records accurately capture.[6] Henry and Day (2005)

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[5] Educational assistance may be taxable in limited circumstances, such as scholarship income used for expenses other than tuition and fees, although we assume that this income is typically untaxed and not reported on tax forms.
[6] Although tax liabilities and credits are excluded from the Official Poverty Measure, they are imputed in the CPS for alternative income measures and for constructing the Supplemental Poverty Measure.

provide a broader discussion of differences between CPS and IRS income concepts, including how specific sources are captured in the two datasets.

When using the IRS data to estimate poverty trends, we first consider *pre-tax income* in the IRS data, defined as all taxable income plus non-taxable income that is observable on IRS tax forms (primarily Social Security income, Disability Insurance, and tax-exempt interest). Although this is narrower than the Official Poverty Measure's income definition because it misses certain cash transfers not reported in tax data, it is directly comparable to pre-tax income from the same sources captured in the CPS and can therefore isolate how changing data source affects poverty estimates. For our main estimates, however, we focus on *after-tax income*, which deducts federal individual income taxes and payroll taxes, and includes refundable tax credits such as the Earned Income Tax Credit and the Child Tax Credit (see appendix for details). These tax credits, which are refundable subject to various earned income requirements, represent some of the largest anti-poverty programs in the United States. The shift over time in social welfare programs from direct cash-based transfers to transfers administered through the tax code means that, despite their exclusion from the Official Poverty Measure, tax-based programs are extremely important for understanding poverty trends.[7]

Our other deviation from Official Poverty Measure's income definitions is the choice of sharing unit and the equivalence scale. The Official Poverty Measure uses a family sharing unit concept, which includes all people "related by birth, marriage, or adoption and residing together" (Census Bureau, 2019).[8] But the information needed to replicate the Census Bureau's family

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[7] As discussed by Burkhauser et al. (2019), there also has been an increase in in-kind (non-cash) transfers since the inception of the Official Poverty Measure in the 1960s. Despite the importance of these programs to the financial resources of low-income families, we do not attempt to include in-kind transfers in our poverty measures since these transfers are not captured in the tax data. For an analysis of state-level heterogeneity of the effect of taxes and transfers on poverty, see Bruch, Gornick, and van der Naald (forthcoming).

[8] The Census Bureau only refers to individuals as part of a family if at least two relatives are residing together, referring to individuals living with no other relatives as "unrelated individuals." While technically Census does not

definition is not available in the tax data. Instead, we aggregate income to the household level. This includes all individuals living in the same household, even if not related by blood or marriage, and usually combines cohabiting partners and roommates into the same sharing unit.[9] Consequently, in 2010 there were approximately 14 million fewer households in the U.S. than Census families and unrelated individuals: 120 million versus 134 million (Semega et al., 2019). While we would prefer to estimate poverty dynamics using both sharing unit concepts, using households is common among researchers considering the duration of poverty and not unique to this study (e.g., Bane & Ellwood, 1986; Stevens, 1999; McKernan & Ratcliffe, 2005; Burkhauser et al., 2019). Moreover, the household is the recommended sharing unit of the Canberra Group (2011), which sets international standards for income measurement, and is frequently used as the sharing unit in international poverty estimates, including those by the OECD (Forster & D'Ercole, 2012). Previous research has also suggested that households provide a better approximation of the actual sharing of resources (Atkinson, Rainwater, & Smeeding, 1995; Smeeding & Weinberg, 2001; Congressional Budget Office, 2018; Aladangady, Feiveson, & Paciorek, 2019).[10]

In all calculations, we adjust household incomes for household size by dividing by the square root of the number of household members. The square root equivalence scale nearly replicates the average equivalence scales embedded in the official poverty thresholds. The use of the equivalence scale avoids the mechanical relationship between poverty rates and household size

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consider single individuals as families, for ease of exposition, we collectively refer to Census families and unrelated individuals as families.

[9] The Tax Household Data assigns individuals claimed as dependents to the address of the return claiming them because dependents provide less than half of their own expenses and hence are not fully independent economic units. For many college students living away from home, this assigns them to the address of their parent. Individuals living in group housing are removed in both the CPS and Tax Household Data. See Larrimore, Mortenson, and Splinter (2019) for details.

[10] A third potential sharing unit is the tax unit, which generally includes all individuals filing a tax return together and is narrower than either the household or Census family. In 2010, there were over 157 million tax units in the U.S. However, we are unaware of research suggesting that the tax unit is a preferable sharing unit to either the household or the Census family.

that would occur if estimating poverty rates without regard to household size.[11] Since poverty measures are often focused on families of four, in Figure 2 and Table 2 below, we rescale size-adjusted values to reflect four-person households.

III.   Results
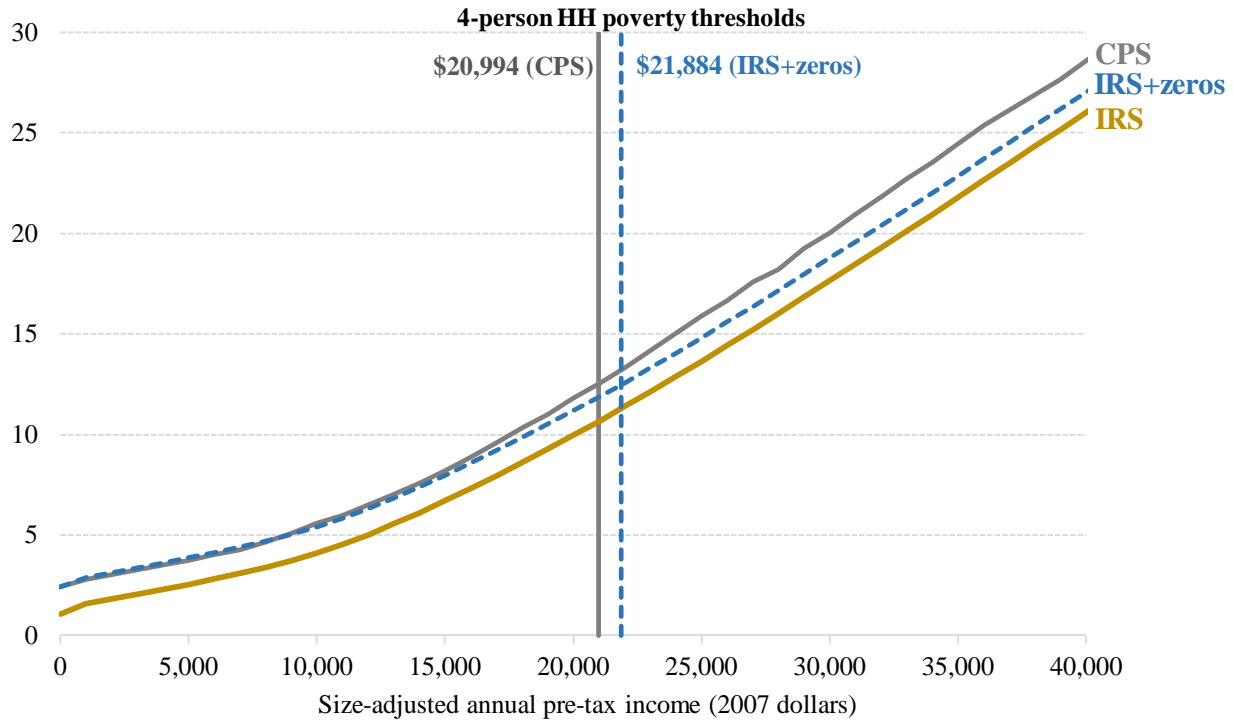
A. Annual poverty rates

We begin our analysis by comparing annual poverty rates in the CPS and the IRS data. Even after constructing an analogous measure of income in both data sets, we expect the levels of poverty to differ because the IRS data captures a larger amount of taxable income among low-income populations. This is likely because the CPS is comprised of survey responses while the IRS data is based on a combination of third-party reporting and self-reporting (with potential penalties for misreporting). Due to underreporting of income in the CPS, we observe higher source-specific (and overall) taxable incomes in the IRS data. This is consistent with that seen by Larrimore, Splinter, and Mortenson (2019) and observations about underreporting from Bee and Mitchell (2017), Bee and Rothbaum (2019), and Bollinger et al. (2019).

Figure 2 shows the bottom quartile of the size-adjusted household income distribution in 2007 (the first year of our sample). The income definition for all series only includes taxable sources observed in the CPS. The figure displays the CPS series as well as the IRS data with and without imputed individuals in zero-income households. At all percentiles of the income distribution, the IRS income without imputed zeros is to the right of the CPS distribution—reflecting the higher levels of income observed in the IRS data. When imputing zeros and assuming

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[11] The inclusion of an equivalency scale for the size of the sharing unit in poverty calculations was a key innovation of Orshansky (1965). In the earlier poverty estimates by the Council of Economic Advisers (1964), poverty thresholds only differentiated between single individuals, for whom the poverty threshold was $1,500, and those in families with two or more people, for whom the threshold was $3,000. See Fisher (1992) for additional details on the history of the poverty thresholds.

that the CPS accurately captures the number of households with zero taxable incomes, the gap between the two datasets closes, although the IRS distribution remains to the right of that observed in the CPS above the 8th percentile of the distribution (about $15,000 for a four-person household).

Figure 2. Percent of population with size-adjusted pre-tax income at or below level (2007)

Sources: Authors' calculations using the IPUMS CPS (Flood et al., 2018) and IRS Tax Household Data.

As previously discussed, the taxable income definition used here is narrower than that used by the Official Poverty Measure, although the sharing unit is broader. Given the National Academies of Sciences report recommendation that "any significant change in the definition of family resources should be accompanied by a consistent adjustment of the poverty threshold" (Citro & Michael, 1995, p. 11), it would therefore be inappropriate to estimate poverty using the Official Poverty Measure's thresholds. Instead, we upwardly adjust the thresholds to match the

12.5 percent Official Poverty Rate in 2007.[12] This is similar to the approach of Bane and Elwood (1986), which was later adopted by Iceland (1997), Grieger, Schoeni, and Danziger (2009), and others using the PSID to measure poverty. They found that the PSID also captured substantially more income than the CPS, and increased poverty thresholds by 25 percent for their calculations using PSID data, which resulted in similar poverty estimates to those from the Official Poverty Measure.

In doing so, the household-income poverty rate for taxable income in the CPS data that produces a 12.5 percent poverty rate in 2007 is $20,994, as shown in Figure 2. This is slightly below the $21,203 threshold used for the Official Poverty Measure in 2007. Were we to use the same $20,994 poverty threshold to measure poverty in the IRS data (against the recommendation of Citro & Michael, 1995), the greater levels of reported income would result in lower poverty rates. In 2007, 11.9 percent of people would be considered in poverty based on taxable income when including the imputed zero-income households (where the vertical CPS poverty threshold crosses the dashed blue distribution line in Figure 2). Excluding the imputed zeros would be an even lower 10.7 percent (where the CPS poverty threshold crosses the solid IRS distribution line). Recognizing that poverty thresholds reflect a policy decision, rather than an objective amount, it is not obvious whether better income reporting in the IRS should change the poverty rate in our base year.[13] We take the approach that the poverty rate in the CPS data at the start of our analysis period reflects policymakers views on poverty even if the CPS data measures taxable income

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[12] In their initial discussion of poverty rates, the Council of Economic Advisers (1964) similarly indicated that thresholds should be set in a manner consistent with the sources of income included. Our approach adopted here is similar to the anchoring approach that Burkhauser et al. (2019) use to match poverty rates using broader income definitions to the Official Poverty Rate in 1963, although we do so for 2007 which is the first year of our data.

[13] Suppose, for example, that the CPS data underreported income for individuals near the poverty threshold in all years back to the 1960s when the War on Poverty began. In that case, based on the description of the initial poverty thresholds from President Johnson's Council of Economic Advisers (1964), poverty thresholds would likely have been higher to maintain the same poverty rate.

Table 2. Definitions and thresholds to anchor poverty rates to the official poverty rate in 2007

Series	Data Source	Sharing Unit	Income Definition	2007 Anchored Poverty Threshold, Family of 4
Official Poverty Measure (OPM)	CPS	Family	Pre-tax cash income	21,203
CPS (OPM Income, Households)	CPS	Household	Pre-tax cash income	22,020
CPS (Pre-tax Taxable Income, Households)	CPS	Household	Pre-tax cash income, excluding workers' compensation, veterans' income, cash welfare, child support, educational assistance, and financial assistance from friends or relatives	20,994
IRS (Pre-tax Taxable Income, Households)	IRS	Household	Matches above	21,884 (23,508 without imputed zeros)
IRS (After-tax Income, Households)	IRS	Household	Matches above plus federal tax credits less federal tax liabilities	23,008 (24,500 without imputed zeros)

Sources: Authors' calculations using the CPS and IRS Tax Household Data.
Notes: All thresholds are set such that poverty in 2007 is 12.5 percent, the Official Poverty Rate in that year.

incompletely for low-income families. Hence, we use a pre-tax threshold of $21,884 (blue dotted line in Figure 2), which maintains the same 12.5 percent 2007 poverty rate from the Official Measure.[14]

The precise poverty thresholds for a family of four that preserve the 12.5 percent poverty rate in 2007 are shown in Table 2. In that year, the Official Poverty Threshold was $21,203. Shifting from a family sharing unit (row 1) to a larger household sharing unit (row 2) results in a

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[14] Poverty trends without re-anchoring the thresholds are available in Appendix Figures A1 and A2. Between 2007 and 2018, the pre-tax income measures average 2.9 percentage points less than the Official Poverty Rate (1.4 percentage points when imputing zeros). The after-tax income measure average 4.4 percentage points less than the Official Poverty Rate (3.0 percentage points when imputing zeros). In 2010, these gaps peak at 4.0 and 6.0 percentage points for pre-tax and after-tax income (2.3 and 4.3 percentage points when imputing zeros).
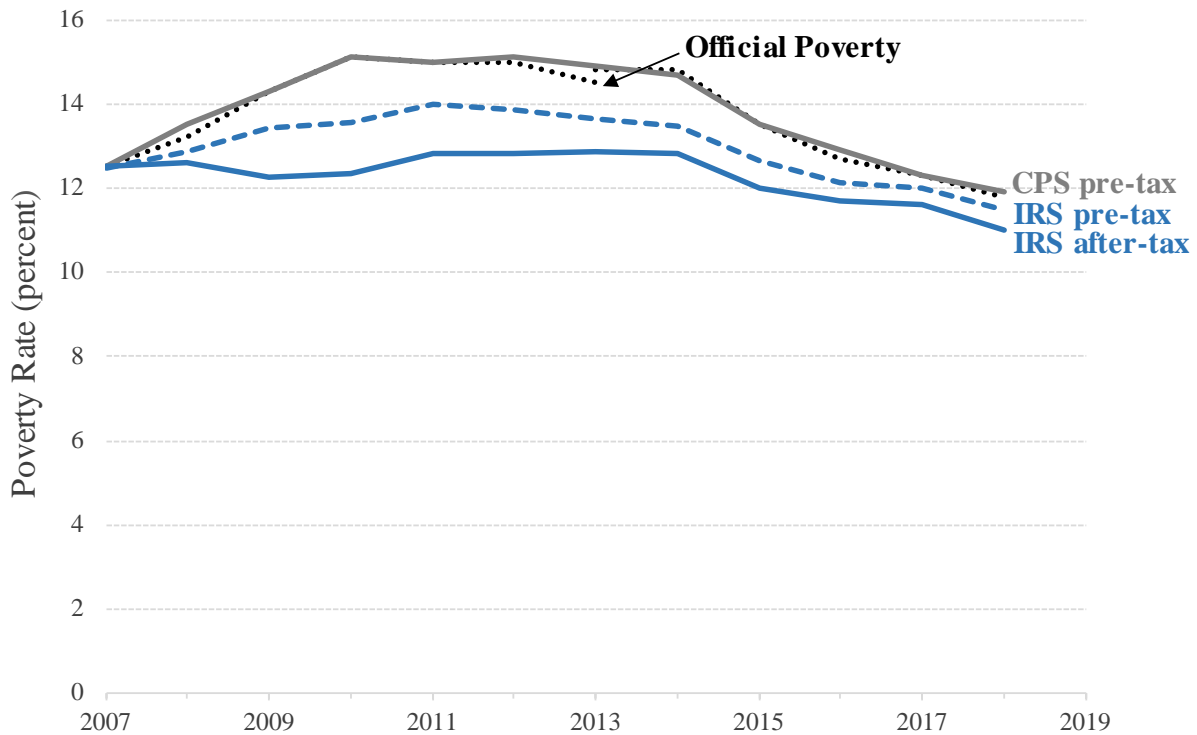
slightly higher poverty threshold to maintain the 12.5 percent poverty rate. Shifting from pre-tax cash income to pre-tax taxable income (row 3), which removes all non-social insurance transfers, results in the slightly lower $20,994 poverty threshold shown above in Figure 2.

Row 4 uses the same household sharing unit and taxable income definitions as row 3, but uses IRS data rather than the CPS. This increases the poverty threshold necessary to maintain the 12.5 percent poverty rate to $21,884.[15] The $890 (four percent) increase in the poverty threshold needed to maintain the same poverty rate is due to additional income reporting in tax records data relative to the CPS.

For individuals near the poverty threshold, the combination of tax credits, including the Earned Income Tax Credit and Child Tax Credit, frequently result in a net refund from income taxes (nearly always for those claiming children and with earned income). Additionally, this refund commonly exceeds payroll tax liabilities. Consequently, the after-tax household income for those near the poverty threshold is above the pre-tax income, so to continue maintaining the 12.5 percent poverty rate in 2007 when using after-tax data requires a further upward adjustment to the poverty threshold. This can be seen in Row 5 of Table 2, which incorporates federal tax liabilities and credits. Taken together, the after-tax household-income poverty threshold in 2007 that maintained the same 12.5 percent poverty rate as in the official measure is $23,008. This is approximately $1,800 above the 2007 Official Poverty Threshold. For years since 2007, we adjust these poverty thresholds for inflation using the CPI-U. We recognize that the CPI-U likely overstates inflation (see e.g. Meyer and Sullivan, 2012), although this is the inflation measure used for adjusting the official poverty threshold over time so we use it here for consistency with this measure.

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[15] Throughout this paper, we use the thresholds that maintains the 12.5 percent poverty rate in 2007 with the imputed zero income households. Were we to use IRS data without the imputation of missing zero income households, the threshold would be higher: $23,508 for pre-tax income and $24,500 for after-tax income in the IRS data.

Figure 3. One-year poverty rates in IRS data compared to CPS data, anchored to 2007

Sources: Semega et al. (2019), Authors' calculations using IPUMS CPS (Flood et al. 2018) and IRS Tax Household Data.
Notes: The break in the official poverty rate reflects the change in the CPS questionnaire with a split sample partially receiving the original questions, as described in Semega et al. (2019). For the after-tax IRS series, imputed zero pretax incomes are also zero income after-tax.

Using these poverty thresholds, Figure 3 shows the trend in annual poverty rates for the U.S. population using tax data compared to the trends observed in the CPS. As discussed above, by construction the poverty rate in 2007 was 12.5 percent, matching the Official Poverty Rate. Using the CPS data but switching to a pre-tax taxable income measure and tracking household income, rather than family income, results in nearly the same poverty trend as that seen in the official measure. In fact, this measure observed a 2018 poverty rate of 11.9 percent—almost the same as the 11.8 percent poverty rate from the official measure. The similarity of these two CPS-based trends indicates that while non-taxable income sources are important for households in poverty (as evidenced by the change in the anchored poverty threshold when excluding them in

Table 2), income receipt from these sources for those near the poverty threshold has not sufficiently changed since 2007 to substantially affect poverty trends.

Using tax data anchored to the 2007 Official Poverty Rate, we observe a similar level of poverty in 2018 as the official measure (11.5 percent in the IRS data versus 11.8 percent) although there were notable differences in the intervening years. We observe a smaller increase in poverty during the Great Recession, but also a smaller decline in poverty in the years since the recession ended. From 2007 through 2011, our tax-based poverty rate increased by 1.5 percentage points from 12.5 percent to 14.0 percent. This is about three-fifths of the 2.5 percentage point increase in poverty seen when using the same pre-tax household income definition in the CPS data over this period. Conversely, from 2011 through 2018 our tax-based poverty rate fell by 2.5 percentage points compared to a 3.1 percentage point decline seen in the CPS data during this period.

A notable departure between the two series, however, is evident between 2009 and 2010. In that year, the poverty rate for pre-tax household income in the CPS rose from 14.3 to 15.1 percent (and the Official Poverty Rate rose by a similar amount), while the poverty rate for a matching income definition in the IRS data only rose from 13.4 to 13.6 percent, a fifth of the CPS increase. About one-quarter of the divergence in this year appears to result from better coverage of unemployment insurance benefits in IRS data in that year. While the IRS information return totals from Form 1099-G, which we use as part of the income definition for non-filers, increased from $140.5 billion in 2009 to $149.1 billion in 2010, the CPS observes a lower level of benefits in all years and a decline from $98.7 billion in 2009 to $97.1 billion in 2010. When removing unemployment insurance benefits from both the CPS and IRS income definitions, the poverty rate increased in the IRS data by 0.3 percentage points in 2010 compared to a 0.8 percentage point increase in the CPS data. Hence, the 0.7 percentage point growth in the gap between CPS and IRS
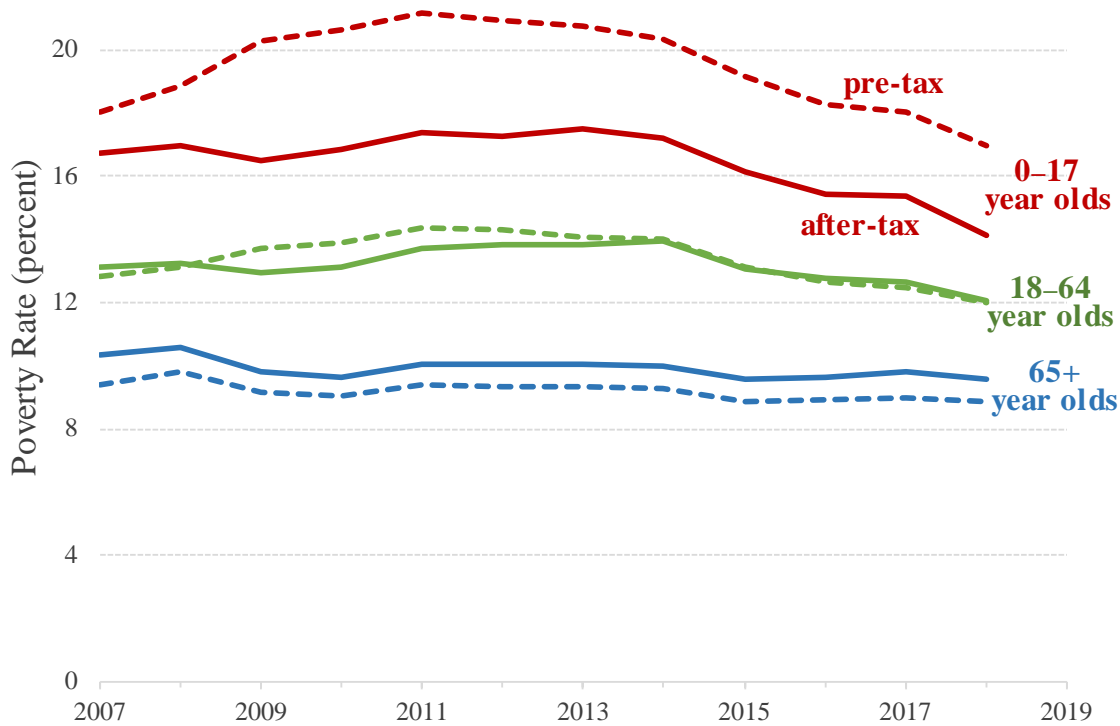
pre-tax poverty rates in that year shrinks by one-quarter (from 0.7 percentage points to 0.5 percentage points) once accounting for differences in unemployment insurance reporting.

Comparing the pre-tax poverty rate and the after-tax poverty rate, the effect of taxes is largest between 2009 and 2012. This likely reflects temporary tax reductions enacted during those years. Larrimore, Burkhauser, and Armour (2015) summarize these tax provisions and show that they increased after-tax median incomes. These results suggest that they also increased after-tax incomes for those in or near poverty.[16] When measuring poverty in the tax data on an after-tax basis, the 12.8 percent poverty rate in 2011 was just 0.3 percentage points above the poverty rate in 2007 before the start of the recession. As temporary tax provisions enacted during the recession expired, the pre-tax and after-tax poverty trends re-converged. The after-tax poverty rate was 1.2 percentage points below pre-tax poverty rate in 2009, but by 2018 it was only 0.4 percentage points below.

The divergent trends in the pre-tax and after-tax poverty lines during the Great Recession and its aftermath is an indication of the importance of incorporating tax liabilities and tax credits in our measure of poverty. Switching from a pre-tax to an after-tax poverty measure has a notable effect on poverty trends during the recession, whereas removing non-taxable income sources does not (comparing the two CPS-based lines). This suggests that the exclusion of tax credits from the Official Poverty Measure is likely far more impactful for our understanding of poverty trends (although not necessarily levels) than is missing non-taxable income from the tax-based poverty measure.

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[16] Our after-tax income definition excludes, however, the 2008 recovery payments that were distributed based on information from tax returns. Including these amounts would cause a temporary decrease in poverty in 2008 at the beginning of the Great Recession. While the tax code also provides an automatic stabilization effect for most individuals, due to progressive income tax rates, this does not apply to those near the poverty threshold because many have non-positive income tax burdens (Splinter, 2019) and for those in the phase-in ranges of tax credits there can be an automatic destabilization effect (Larrimore, Mortenson, & Splinter, 2016).

Figure 4. Poverty rates by age in tax data: pre-tax and after-tax income

Sources: Authors' calculations using the IRS Tax Household Data.
Notes: Poverty is based on 2007 anchored poverty thresholds. Results include imputed zeros based on age-specific differences between IRS and CPS counts as described in the main text.

Incorporating tax credits and liabilities also has implications for annual poverty rates by age. Based on the Official Poverty Measure, the poverty rate among children is substantially higher than among working-age or elderly adults. This observation is confirmed when looking at pre-tax household income poverty rates in the tax records data. In 2018, for example, the pre-tax poverty rate in the tax data is 17.0 percent for children under age 18, compared to 12.0 percent for working age adults (ages 18 to 64) and 8.9 percent for elderly adults (Figure 4). These poverty rates by age are similar to the official poverty rates by age, which in 2018 were 17.5 percent for children under age 18, 11.2 percent for working-age adults, and 9.2 percent for elderly adults.[17]

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[17] Pre-tax poverty rates by age relative to the Official Poverty Measure are available in Appendix Figure A3. Note that the poverty rates by age in the IRS data are substantially closer to the Official Poverty Rates by age than they are to the pre-tax taxable household income poverty rates in CPS data. However, the standard household size adjustment we use does not account for age, whereas the Official Poverty Measure uses a lower threshold for the

This gap in poverty rates across age cohorts shrinks after including taxes and tax credits. Shifting from pre-tax to after-tax income lowers the 2018 poverty rates for children from 17.0 percent to 14.1 percent. Conversely, pre-tax and after-tax poverty rates are nearly the same for working-age adults and the after-tax poverty rates are slightly higher for the elderly. Consequently, while after-tax child poverty remains above that seen for older age groups, incorporating the effects of the tax system reduces the spread in poverty rates across age groups. This is consistent with the Earned Income Tax Credit and Child Tax Credits targeting households with children.

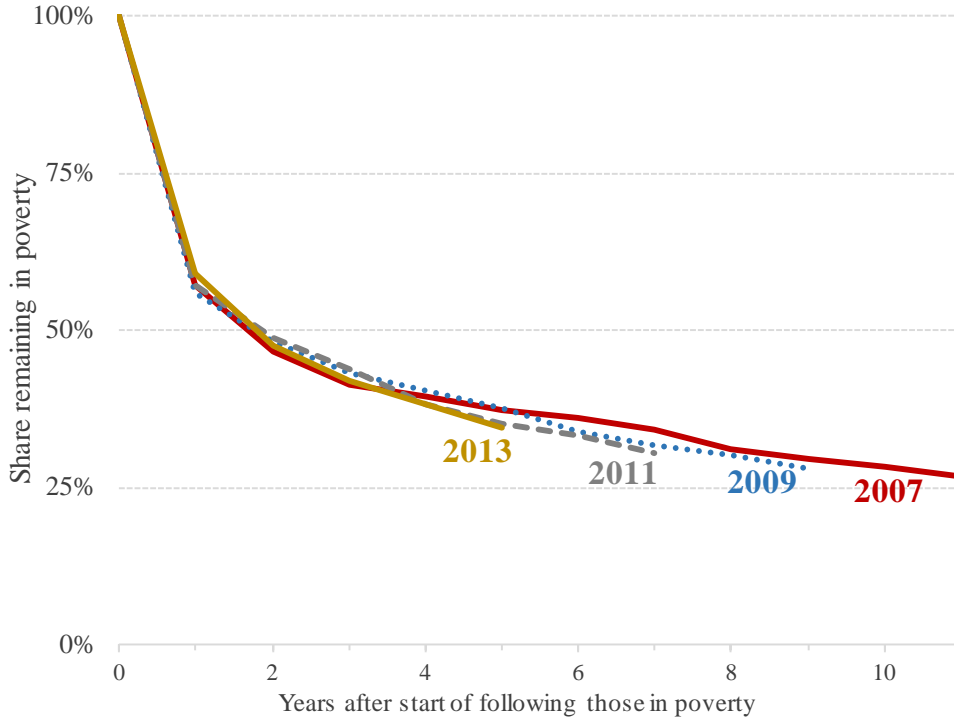## B. Poverty Persistence in IRS Data

In addition to better incorporating tax credits and tax liabilities into poverty estimates, the Tax Household Data is particularly advantageous for tracking transitions into and out of poverty. This is because tax records provide a naturally occurring population-level panel, so nearly all individuals in the data are observed year-after-year if they remain within the United States. Given the importance of tax credits in mitigating poverty during the Great Recession (seen in the previous section), in all subsequent results we use after-tax income as our measure of income.

Figure 5 shows the share of people who are in poverty in a base year (e.g., 2007) that are in poverty in subsequent years. Recognizing that people who at least occasionally struggle with poverty over an extended period may have annual incomes above the poverty threshold in certain years, we do not require poverty spells to be continuous. Instead, reflecting Stevens' (1999) recommendation to focus on "person-centric" rather than "spell-centric" measures, we start with the share of individuals in poverty in the base year and ask what share are poor in each subsequent

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elderly. Comparing anchored pre-tax taxable household income poverty rates across the two datasets (without the age adjustment used for the OPM thresholds), we observe 29 percent fewer elderly people in poverty in the IRS data in 2018 (8.9 percent in the IRS data vs. 12.6 percent in the CPS). For comparison, Bee and Mitchell (2017) observe 24 percent fewer elderly people in poverty using matched administrative-survey data than they observe using survey data alone (6.9 percent versus 9.1 percent).

year, even if they were not in poverty for one or more intervening years. For example, if someone is in poverty in 2007, not in poverty in 2008, but returns to poverty in 2009, we include them as part of the share in poverty in 2007 and 2009, but not 2008.

Figure 5: Persistence of poverty is robust to starting year of analysis

Sources: Authors' calculations using the IRS Tax Household Data.
Notes: Poverty is based on after-tax income and 2007 anchored poverty thresholds. For each year, missing observations (due to death, emigration, or a lack of tax records) and imputed zeros are excluded from the numerator and denominator.

When tracking persistence of poverty, we cannot use the cross-sectional approach to impute zeros. This is because an individual may not appear in tax data either because they have zero income or because they were not living in the United States at the time. Consequently, here and in subsequent figures we exclude from the calculations individuals who do not appear in the tax data in a given year, either because they died, emigrated, or did not appear on any tax forms in that

23

year.[18] We acknowledge, however, that doing so excludes from persistence estimates those individuals who have no household income in one or more years.
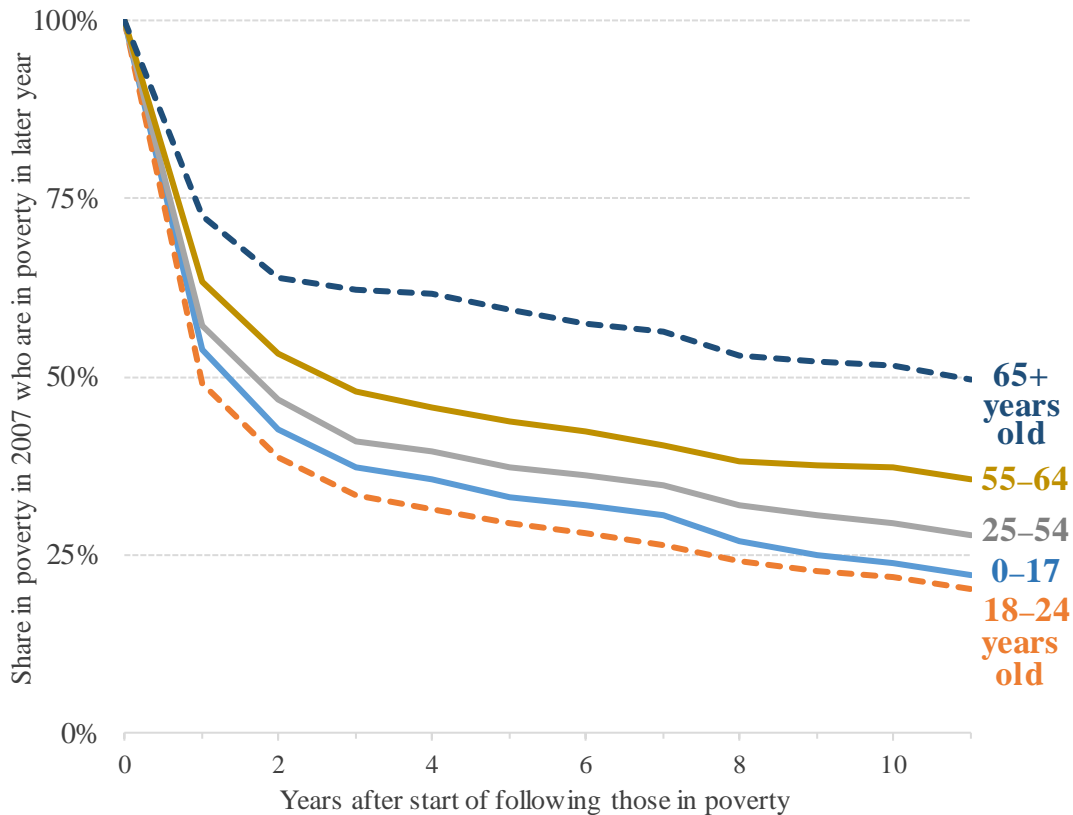
The persistence of poverty is remarkably similar when considering different years of the business cycle. For those in poverty in 2007, the top of the economic expansion, 57 percent were in poverty one year later and 31 percent were in poverty 8 years later—although this can include intervening years where they were not poor. For those in poverty in 2009, the depth of the Great Recession, 56 percent were in poverty one year later and 30 percent were in poverty 8 years later. Similar patterns of poverty persistence are also seen for 2011 and 2013. We emphasize, however, that this does not necessarily mean that nearly 40 percent of spells only last one year since the base year of this analysis will frequently be in the middle of a poverty spell (Bane & Elwell, 1986). Given the robustness of these persistence patterns by starting year, in subsequent analysis we only consider those in poverty in 2007 or 2008, the first years of our data, to show the longest trend possible (estimates for other initial years are available in the online data).

Poverty persistence among those who spend at least one year in poverty differs greatly by age. While the poverty rate in 2007 was highest among young adults aged 18–24 (16.0 percent), this age group had the least persistent poverty (Figure 6). Just under fifty percent of young adults in poverty in 2007 remained in poverty one year later and a smaller 31 percent were in poverty four years later (although they were not necessarily in poverty during the interim years). This is consistent with substantial life transitions occurring during these ages, as many poor young adults are students who exit poverty upon entering the full-time workforce. Nevertheless, even among

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[18] This approach is broadly consistent with the treatment of non-respondents in panel-based survey data considering similar questions. An alternate approach is to assume that individuals are in poverty if they are alive in a given year (based on showing up in the initial 2007 tax files and not subsequently appearing in the Death Master File) and have no associated tax records. However, according to estimates from the Social Security Administration (2019), between 2010 and 2018 an average of 582,000 people emigrated each year from the United States, of whom 267,000 were citizens or lawful permanent residents (LPRs). Consequently, this approach would treat all emigrants as in poverty and will overstate poverty persistence.

young adults there is a sizeable minority who appear to experience persistent poverty for extended periods, as one out of five people in this age range who were in poverty in 2007 were also in poverty ten years later.

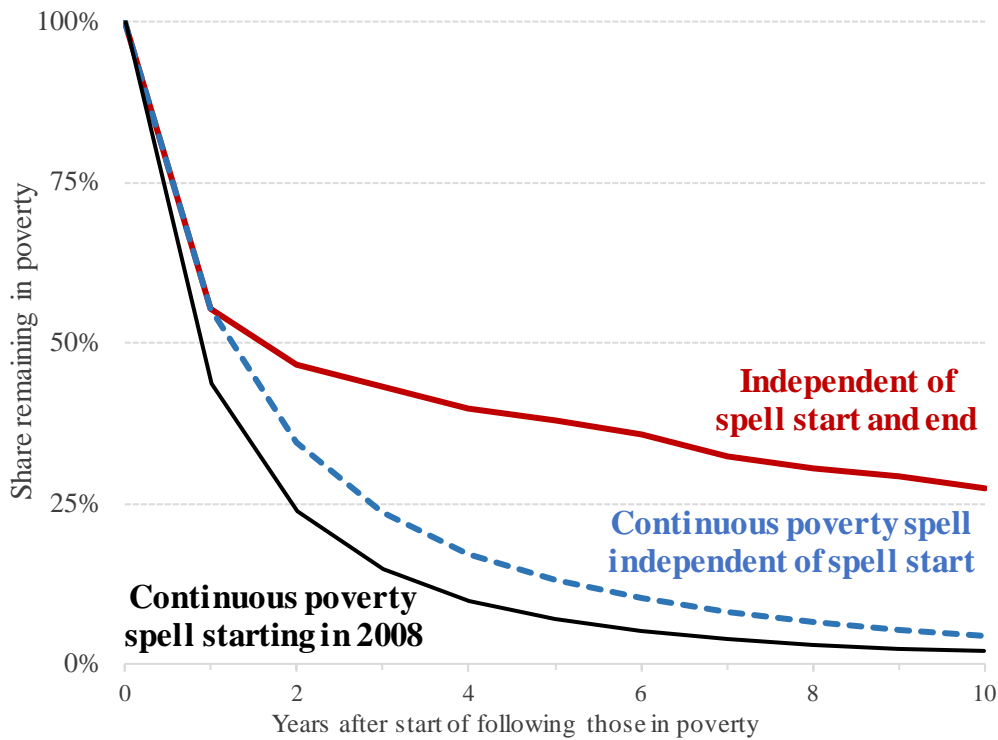**Figure 6: Persistence of poverty by age when in poverty in 2007**

In contrast to young adults, annual poverty rates are the lowest among elderly adults over age 65 and poverty is the most persistent. Approximately 9.5 percent of elderly adults were in poverty in the tax data in 2007. Seventy-three percent of them remained in poverty one year later and 62 percent remained in poverty four years later. This high persistence of poverty among the elderly is consistent with many living on fixed income sources.

Figure 7: Persistence of poverty since 2008 for spell and non-spell approaches

Sources: Authors' calculations using the IRS Tax Household Data.
Notes: For each year, missing observations (due to death, emigration, or a lack of tax records) and imputed zeros are excluded from the numerator and denominator. Poverty is based on after-tax income and 2007 anchored poverty thresholds. "Independent of spell start and end" is the non-spell approach of Figures 5 and 6.

One reason for the relatively high persistence rates seen in Figures 5 and 6 is that some people who escape poverty will, in future years, fall back into poverty. This is apparent in Figure 7, which displays continuous poverty spells (dashed blue line) along with the share of people who are (non-continuously) in poverty in later years as presented in Figure 5 (solid red line). While approximately half of people in poverty in 2008 were also in poverty in 2010 (including those not in poverty in 2009), roughly one-third were in a continuous poverty spell over the three years.

Similarly, while approximately one-quarter of people in poverty in 2008 were also in poverty 10 years later, roughly one in twenty were in a continuous poverty spell in all 11 years through 2018.[19]

Of course, when considering the length of the poverty spell, some in poverty in 2008 are at the middle, rather than the beginning, of a poverty spell. We therefore also consider the full duration of poverty spells by considering only those who entered poverty in 2008 after being out of poverty in 2007 (solid black line). When doing so, we observe that continuous poverty spells that just began are shortest. Only one-quarter of spells that started in 2008 lasted two years and only two percent lasted through 2018.

Given that some people cycle in and out of poverty, our preferred approach to track chronic poverty is to consider the number of years people spend in poverty over a period. This approach reflects that a one-year exit from poverty does not mean that the individual is permanently non-poor, while also acknowledging that re-entering poverty years later for a single year is far different than spending many years in poverty. In Table 3, we find that of those in poverty in 2007, four out of five spent at least one additional year in poverty and nine percent were in poverty for at least 10 of the 12 years in this period.[20] On average, people in poverty in 2007 spent 4.5 out of the 12 years between 2007 and 2018 in poverty. One-third of this group was in poverty for at least half of the period.

Consistent with the previous persistence results by age, the number of years spent in poverty differs for the young and old. On average, individuals aged 18 to 24 had the least persistent poverty, spending an average of 3.9 years in poverty between 2007 and 2018 (conditional on being

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[19] We focus on 2008, rather than 2007, as the base year in this figure to ensure we are considering spells that started in 2008. Were we to start in 2007, we could not distinguish between people who have newly started spells and those in the middle of a poverty spell.

[20] Since this measure tracks the number of years in poverty for individuals, rather than the share who are poor in any given year, individuals who do not appear in the data for one or more years are not counted as poor in those years. Consequently, to the extent that individuals are poor (not poor) in years that they do not appear in the data, these statistics slightly understate (overstate) the true level of poverty persistence.

in poverty in 2007). Young adults have lower rates of persistent poverty because they are less likely to end up in the right tail of the years-in-poverty distribution. Young adults are more likely to spend 2 to 5 years in poverty than are older age cohorts, but less likely to experience poverty for 10 or more years of the 12-year period. However, apart from children, the share of individuals for whom 2007 was their only year in poverty does not vary much across age ranges.

Table 3. Frequency of poverty 2007 to 2018 among those in poverty in 2007

Demographic Characteristic	Share by years in poverty 2007–2018 if in poverty in 2007					Average years in poverty
	1	2	3 to 5	6 to 9	10+	
All Individuals	19	15	33	24	9	4.5
Age (2008)						
0–17	15	15	37	27	6	4.5
18–24	20	17	37	22	4	3.9
25–54	19	15	33	24	9	4.5
55–64	21	14	27	23	16	5.0
65+	23	13	25	21	17	5.0
Gender						
Male	20	16	34	23	8	4.4
Female	18	14	33	25	10	4.6
Marital and Parental Status (2008)						
Married, No Children	20	15	31	23	11	4.3
Married, Children	21	17	35	22	6	4.6
Single, No Children	16	14	33	26	10	4.1
Single, Children	17	16	38	25	5	4.8

Sources: Authors' calculations using the IRS Tax Household Data.
Notes: Years in poverty can include multiple spells of poverty. Poverty is based on annual after-tax income and 2007 anchored poverty thresholds.

C. Multi-Year Frequency of Poverty in IRS Data

In addition to the persistence of poverty, we are also interested in the share of people ever experiencing poverty. We do so by considering the share of people who spend at least one year in poverty over the 12-year period from 2007 to 2018. This approach, which has long been used in

Table 4. Frequency of poverty at any point between 2007 and 2018

Demographic Characteristic	Share in poverty at least once in 12 years from 2007–2018	Avg. years in poverty in 2007–2018 if ever in poverty during 12 years
All Individuals	42	3.1
Age (2007)		
0–17	45	2.9
18–24	54	2.8
25–54	39	3.2
55–64	29	3.7
65+	36	3.8
Gender		
Male	42	3.0
Female	41	3.2
Marital and Parental Status (2007)		
Married, No Children	27	3.2
Married, Children	34	2.8
Single, No Children	52	3.9
Single, Children	57	3.1

Sources: Authors' calculations using the IRS Tax Household Data.
Notes: Poverty is based on annual after-tax income and 2007 anchored poverty thresholds.

the survey-based literature on poverty dynamics, provides an intuitive measure (Coe, 1978; Rainwater, 1982; Gottschalk & Danziger, 1993; Cellini, McKernan, & Ratcliffe, 2008).

The share of individuals who experience poverty at least once over these dozen years is substantially higher than the share in poverty in any given year. Over the 12-year period from 2007 through 2018, 42 percent of people were in poverty for at least one year (Table 4).[21,22] On average,

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[21] This includes all individuals who appear in the dataset for at least one year from 2007 through 2018. Among those observed in all 12 years, a lower 30 percent spent at least one year in poverty. This alternate sample construction necessarily results in a sample with fewer children (since they must have been born by 2007), fewer elderly individuals (since they must not have died prior to 2018), no individuals who had years without any records submitted to the IRS, and no new immigrants or emigrants over this period.

[22] These results are based on an entire year of income, reflecting the annual nature of IRS income reporting. If measured on a monthly level, the frequency of ever experiencing poverty would likely be even higher. For example, Proctor, Semega, and Kollar (2016) estimated that 35 percent of individuals were in poverty for at least two months

those who are poor at any point during the 12-year period spend three years during the period in poverty. This is lower than the average years in poverty seen among those who were poor in 2007 because focusing on people who are poor in any single year increases the weight given to longer spells of poverty (Cellini, McKernan, & Ratcliffe, 2008).

Consistent with both the higher rates of annual poverty among children and young adults, and the lower rates of poverty persistence among young adults, higher shares of children and young adults are in poverty for at least one year over the 12-year period relative to older adults. There are also substantial differences in the likelihood of ever experiencing poverty by marital and parental status. Among people living in single-parent households in 2007, 57 percent spent at least one year in poverty between 2007 and 2018. This exceeds the poverty rates for those living in households without children or in households with one or more married couples.

IV. Conclusion

This paper provides insight into poverty trends and persistence of poverty among U.S. households since the Great Recession. We construct a new panel of households using the population of individual income tax returns and information returns. These data extend the usefulness of tax data to the bottom tail of the income distribution, which had previously been neglected due to the high prevalence of non-filing (almost 15 percent of adults) and the inability to link non-filers and tax units into households. We produce tax-based estimates of poverty trends from 2007 through 2018, taking advantage of the high-quality income reporting in the tax data and the accurate reporting of tax liabilities and credits. Additionally, utilizing of the panel nature of these data, we estimate the individual-level persistence of poverty over this period.

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between 2009 and 2012, which is similar to the 42 percent experiencing poverty over 12 years that we observe. Meanwhile, they observe that only 3 percent of people were in poverty every month for the entire four years.

When looking at annual poverty rates, the household-level tax data confirm observations from the CPS that poverty rates based on pre-tax income are substantially higher for children than for older age cohorts. On an after-tax basis, while poverty rates remain higher for children, the age-gap closes substantially. This reflects the substantial child-based tax credits available, including the Earned Income Tax Credit and Child Tax Credit. Moreover, we find that federal tax policy mitigated nearly all of the increase in pre-tax poverty during the Great Recession.

We also observe that despite the onset of the Great Recession in 2008, there remained high rates of mobility out of (and into) poverty in that year. Of people who were in poverty in 2007, more than 40 percent were no longer below the poverty line the following year. This transition rate out of poverty is nearly the same as the rate of transition out of poverty in subsequent years, indicating that the Great Recession did not dramatically change the likelihood that those in poverty in one year would exit poverty the next year.

Recognizing that many people move in and out of poverty each year, the share of people in poverty at any point over several years far exceeds the share in poverty in any single year. While annual after-tax poverty rates range from about 11 to 13 percent, three to four times more people (42 percent) spent at least one year between 2007 and 2018 in poverty. Those who were poor at any point during this 12-year period spent an average of 3 years in poverty during this time. The share who were poor at any point between 2007 and 2018 varies by demographic characteristics. One-quarter of people living in married households with no children in 2007 were ever in poverty during this period, while over half of those living in single-parent households spent at least one year in poverty.

While many people experience transitory poverty, we also find high rates of more persistent poverty. Of those who were in poverty in 2007, almost one-third of those in poverty in 2007 were also in poverty eight years later, and over one-fourth were in poverty ten years later—although

they may have escaped poverty for one or more years in between. Hence, many who experience poverty either spend several consecutive years in poverty or escape poverty only to fall back into it in a future year. Consequently, while there are substantial benefits to policies that alleviate economic hardships from short transitory poverty spells, many individuals still experience chronic poverty over many years.

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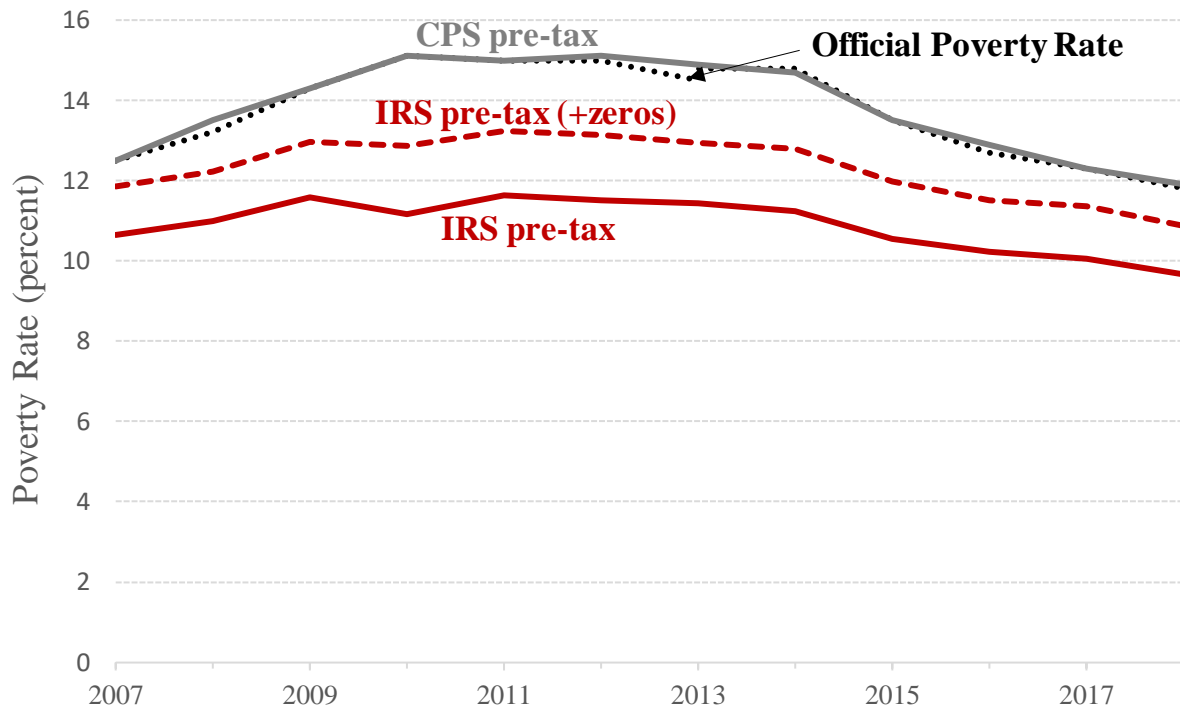
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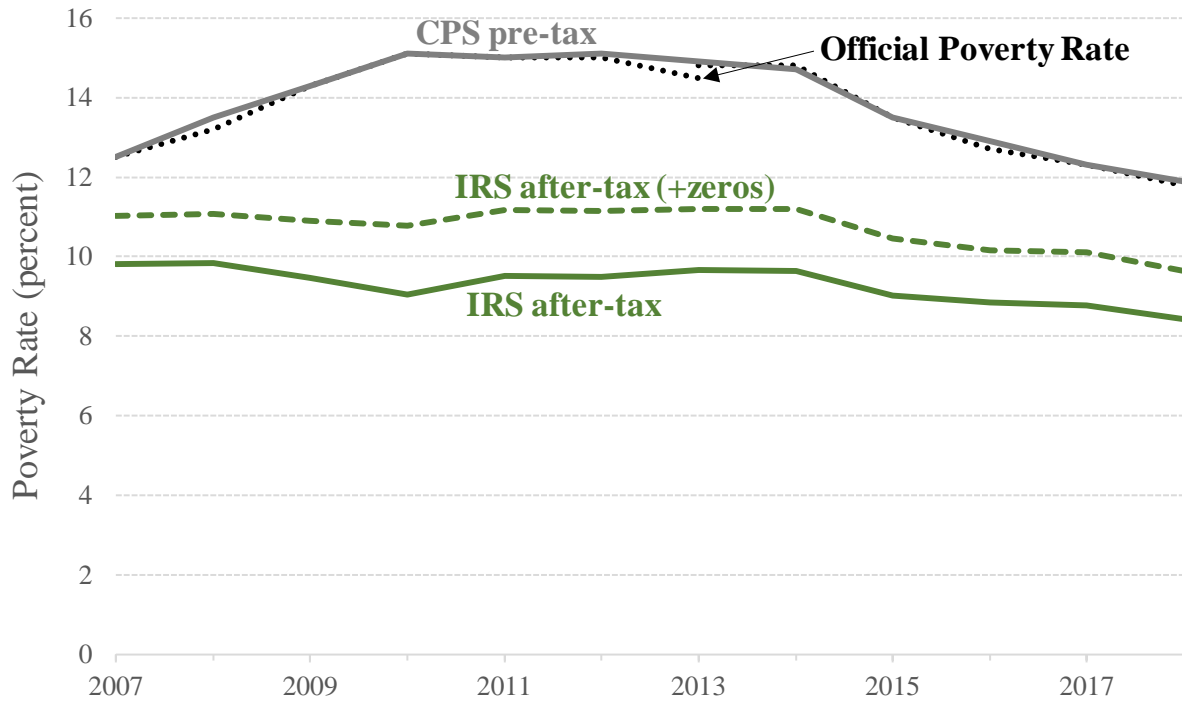
Appendix Figures

Appendix Figure A1. Pre-tax poverty rates without anchoring IRS data, with and without imputed individuals living in zero-income households.

Sources: Semega et al. (2019), authors' calculations using IPUMS CPS (Flood et al. 2018) and the IRS Tax Household Data.
Notes: The break in the official poverty rate reflects the change in the CPS questionnaire with a split sample partially receiving the original questions, as described in Semega et al. (2019). All series except the Official Poverty Measure use a poverty threshold for a 4-person household of $20,994.
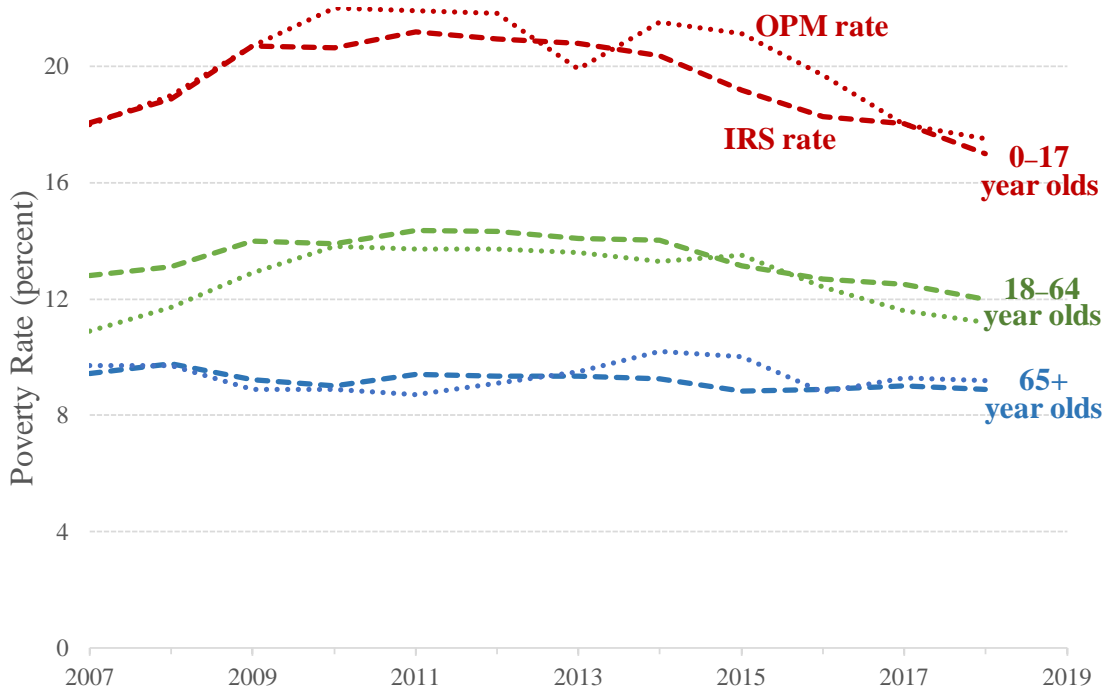
Appendix Figure A2. After-tax poverty rates without anchoring IRS data, with and without imputed individuals living in zero-income households.

Sources: Semega et al. (2019), authors' calculations using IPUMS CPS (Flood et al. 2018) and the IRS Tax Household Data.

Notes: The break in the official poverty rate reflects the change in the CPS questionnaire with a split sample partially receiving the original questions, as described in Semega et al. (2019). All series except the Official Poverty Measure use a poverty threshold for a 4-person household of $20,994.

Appendix Figure A3: Pre-tax poverty rates by age in IRS data compared to Official Poverty Rates

Sources: Semega et al. (2019) and authors' calculations using the IRS Tax Household Data.
Notes: Poverty in the IRS data is based on pre-tax income using 2007 anchored poverty thresholds.

Data Appendix

A.I. Sample Construction

This appendix describes the sample construction and income definitions. The data used in this paper is based on the Tax Household Data, whose target population is the annual resident population of the U.S. Currently, these data are available from 2007 to 2018. Because these are population-level files (not samples), individuals can be linked over time (even if they move between households). Individuals not in the data in all years might enter the data because they are born, immigrate to the United States, or have a tax record for the first time. Similarly, individuals might exit the panel due to death, emigration, or not having a tax record in a given year. Birth (death) and immigration (emigration) are much more likely causes for entrance (exit) than a first-time tax record. For example, Cilke (2014) and others find that roughly 99 percent of all individuals appear on a tax filing in a given year.

However, we make different adjustments based on our estimate of the reason an individual entered (exited). If the cause was birth (death), we do not adjust, and the panel is naturally unbalanced to remain representative of the U.S. population in a given year (which also has births and deaths). However, we make a special adjustment for individuals entering (exiting) the United States. To identify individuals missing in a given year because they are non-residents, we append non-resident individuals that are observed in the tax data, including excluded dependents with Individual Taxpayer Identification Numbers (ITINs). Note that all non-residents are removed for the analysis in this paper. For each year, we then extract an individual-level sample based on the last four digits of Taxpayer Identification Numbers (TIN), mostly Social Security Numbers. This is a standard approach for selecting a random sample of individuals in the tax data. Our sample includes 100 of 9,999 of these TIN endings, as none end in all zeros, resulting in a 1 percent sample that includes about 3 million individuals each year. These samples include household level income sources and some individual and household level characteristics.

Pre-tax income is mostly defined as in Larrimore, Mortenson, and Splinter (2019):

> For annual tax returns, this definition starts with the total income from line 22 of IRS Form 1040—which includes income from wages, salaries, taxable interest, dividends, alimony, business income, rents and royalties, taxable Social Security, taxable private retirement income, and unemployment compensation. Five adjustments are made to this income from the Form 1040: (1) non-taxable interest reported on Form 1040 is added, (2) realized capital gains (from Schedule D) are removed, (3) taxable Social Security benefits are replaced by total Social Security benefits reported on Form SSA-1099, (4) taxable private retirement income is replaced with gross private retirement income, which reflects retirement savings distributions less rollovers from Forms 5498 and 1099-R, and (5) incomes are bottom-coded at zero to limit the effect of business losses. This income measure is broader than the tax return income definition used by Piketty and Saez (2003), since it includes Social Security income and unemployment compensation. It also comes as close as possible to the pretax income measure from the CPS and used by the Census Bureau for their official income statistics. The primary difference between our income measure and the income measures used by the Census Bureau for their official income statistics is that we are not able to observe nontaxable cash transfer income such as public assistance and supplemental security income…these non-

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taxable cash transfers represent approximately 2.5 percent of income reported by the Census Bureau…

> For non-filers, pre-tax cash income is calculated as the sum of income reported on information returns that would be included in the income definition for filers were they to file a tax return. Following Mortenson et al. (2009), who also derive income for non-filers based on information returns, we include income from wages and salaries reported on Form W-2, unemployment benefits from Form 1099-G, Social Security and disability benefits from Form SSA-1099, interest income from Form 1099-INT, dividends from Form 1099-DIV, gross private retirement income as retirement savings distributions less rollovers from Forms 5498 and 1099-R, and self-employment income from Form 1099-MISC…However, for Form 1099-MISC we offset reported income by 70 percent to reflect that gross income from self-employment activities appear on the 1099-MISC information returns but the associated business expenses do not. This offset is necessary to convert gross self-employment income to net self-employment income.

We broaden the income sources for non-filers, adding income from Forms 1099-K (reduced by 70 percent to convert to net income and excluded if net greater than $10,000) and Schedule K-1 for Forms 1065 and 1120S to capture partnership and S-corporation shares of income, as well as accounting for unemployment income excluded from 2009 tax returns.

After-tax income deducts federal individual income tax and deducts federal payroll taxes. Federal refundable credits are added, including the EITC, the Additional Child Tax Credit (ACTC), and small amounts of other refundable credits (excluding 2008 recovery payments). Income taxes for filers are the total tax amount (line 60 on the 2010 Form 1040) less self-employment taxes and for non-filers the amounts withheld on Forms W-2 and 1099-MISC. Federal payroll taxes include Social Security and Medicare taxes withheld on Form W-2 and self-employment taxes less excess Social Security taxes withheld as reported on Form 1040.