THE LEVELS AND TRENDS IN DEEP AND EXTREME POVERTY IN THE U.S., 1993-2016*

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ABSTRACT

Recently, there has been tremendous interest in deep and extreme poverty in the U.S. We advance beyond prior research by using higher-quality data, improving measurement, and following leading standards in international income research. We estimate deep (measured as less than 20% of medians) and extreme (measured as less than 10% of medians) poverty in the U.S. from 1993-2016. Using the Current Population Survey, we match the income definition of the Luxembourg Income Study and adjust for underreporting using Urban Institute's TRIM3 model. In 2016, we estimate 5.2 to 7.2 million Americans (1.6-2.2%) were deeply poor and 2.6 to 3.7 million (.8-1.2%) were extremely poor. While deep and extreme poverty fluctuated over time, including declines from 1993-1995 and 2007-2010, we find significant increases from lows in 1995 to peaks in 2016 in both deep (increases of 48-93%) and extreme poverty (increases of 54-111%). We even find significant increases with thresholds anchored at 1993 medians. Adding homelessness, deep poverty would be 7-8% higher and extreme poverty would be 19-23% higher in 2016, which suggests our estimates are probably lower-bounds. The rise of deep/extreme poverty is concentrated among childless households. Among households with children, the expansion of SNAP benefits has led to declines in deep/extreme poverty. Ultimately, we demonstrate that estimates of deep/extreme poverty depend critically on the quality of income measurement.

Many have recently called attention to deep and extreme poverty in the U.S. This literature is notable both for suggesting extreme and deep poverty are disturbingly high, and for the tremendous variation in estimates (Jencks 2016; Parolin and Brady 2019). In the most visible account, Edin and Shaefer (2015) claim that more than 4% of all households (HHs) with children – 1.5 million HHs with 3 million children – lived on less than \$2 per day in a month in 2011. Using a more comprehensive measure of income and including all HHs, Chandy and Smith (2014) find only slightly less \$2 per day poverty. With a higher threshold, Fox and colleagues (2015b) find that 5.3% – roughly 16.5 million people – was deeply poor in 2011. Deaton (2018) estimates that 3.2-5.3 million Americans have less than \$4 per day per person. Philip Alston (2018), the United Nations Special Rapporteur on extreme poverty and human rights, reports that 18.5 million Americans live in deep poverty. In contrast, the Heritage Foundation claims that only about 0.5% of the U.S. population is in deep poverty (Hall and Rector 2018). Meyer and colleagues (2018) conclude that only 326,000 Americans, about 0.11% of the population, were extremely poor in 2011.

Equally important, many claim that deep/extreme poverty has increased in recent decades. Edin and Shaefer (2015: xvii) claim, “The number of families in \$2-a-day poverty had more than doubled in just a decade and a half.” Including means-tested programs and all households, Shaefer and Edin (2013: 260) find that the percent of HHs in this form of extreme poverty increased 36.9% between 1996 and 2011. Several contend that increases in deep/extreme poverty resulted from the 1996 welfare reform and related social policy changes (Danziger 2010). Shaefer and colleagues (2015) find that \$2 per day (henceforth “\$2/day”) poverty is much less common if HHs receive Temporary Assistance for Needy Families (TANF). Because TANF receipt has declined (Danziger 2010; Moffitt 2015; Parolin 2019b), Edin and Shaefer (2015)

infer that the 1996 welfare reform contributed to the rise of extreme poverty. In response, a contentious debate has ensued about the levels, trends, and source of deep/extreme poverty (Jencks 2016; Meyer et al. 2018; Shaefer and Edin 2018; Winship 2016). For instance, Meyer and colleagues (2018: 1) conclude: “An implication of the low recent level of extreme poverty is that it cannot have risen substantially over time or due to welfare reform.”

Given the salience of the topic and the wide variation in estimates, there is a clear need for scientific scrutiny. Using improved measures, higher quality data, and several thresholds, and making many unique adjustments, we address three questions. First, what are the levels and trends in deep/extreme poverty in the U.S. from 1993 to 2016? Second, how has the composition, in terms of households with and without children, of the deep/extreme poor changed during this period? Third, how do our answers to the first two questions inform understanding about the changes to American social policy in recent decades? Throughout, we demonstrate that estimates of deep/extreme poverty depend critically on the quality of income measurement. We also demonstrate that deep/extreme poverty has become increasingly concentrated among childless households.

DATA

We use the 1994–2017 Annual Social and Economic Supplement of the Census Bureau’s Current Population Survey (CPS), which include reporting years 1993–2016. This is similar to Fox and colleagues’ (2015b) study of deep poverty, and unlike those using the Survey on Income and Program Participation (SIPP) (Meyer et al. 2018; Shaefer and Edin 2013). Although the SIPP has some attractive features, the CPS has a few advantages. First, the CPS has about twice as many HHs as the SIPP. Previous SIPP estimates rely on quite small counts of deep/extreme

poor people. Shaefer and Edin (2013) have only 256 households in extreme poverty in the first wave and 392 in the last wave. Meyer and colleagues (2018) have only 70 individuals in extreme poverty. Because rates of deep/extreme poverty are very low with any measure, a larger sample reduces the impact of measurement error and facilitates obtaining more reliable estimates. This is particularly true when disaggregating extreme poverty trends by household type or other demographic characteristic. Also, more efficient estimates improve assessments of over-time change. Relatedly, most previous estimates do not report confidence intervals.

Second, the CPS measures income over an entire year while the SIPP measures income on a quarterly basis. Shaefer and Edin (2013: 256) acknowledge the short-time horizon is “an important limitation”, are constrained by the SIPP weights, and conduct sensitivity analyses on a quarterly basis. Meyer and colleagues (2018) also use the SIPP to average income over 4 months. Still, Shaefer and Edin (2013: 261) find, “Fewer households experience extreme poverty for a calendar quarter when compared to a month.” While some argue that short time periods enable observation of extreme deprivation (e.g. Morduch and Schneider 2017) or better reflect an HH’s ability to cope with emergency expenses (e.g. Chen 2019), the annual time frame better captures more permanent economic resources and well-being (Brady et al. 2018). HH incomes smooth over time, short-term deprivation is more dependent on assets than just income, and longer-term HH income is higher and more equally distributed (Brady et al. 2018). As Meyer and colleagues (2018: 29) write, “Most of the literature on income and well-being has argued for looking over a full year given transitory fluctuations in income that may not be reflected in consumption or other outcomes.”

There are other advantages of the CPS over the SIPP when investigating deep/extreme poverty. As Winship (2016) notes, many of the perceived benefits of the SIPP have faded over

time: (a) imputation of transfers in the SIPP now matches or exceeds that of the CPS; (b) survey nonresponse has increased at a much faster rate in the SIPP than it has in the CPS; and (c) the representativeness of SIPP samples declines over time, particularly when the SIPP is used for cross-sectional estimates (as in Meyer et al., 2018). Relative to the SIPP, Meyer and colleagues (2018) find the CPS has fewer inconsistencies between reported earnings and reported hours working, including a much smaller share of HH's reporting zero earnings but positive reported hours worked (see fn. 2).

All analyses use weights to make the estimates representative of the U.S. population. We include all individuals in our primary analyses (Fox et al. 2015b; Meyer et al. 2018). We then decompose trends in deep/extreme poverty by household type, focusing on individuals in households with children (the focus of Shaefer and Edin [2013]) compared to individuals in households without children. Roughly half the U.S. population lives in either household type in 2016. The individual is the unit of analysis and we estimate the proportion of individuals who reside in deep or extremely poor households. This differs from Shaefer and Edin (2013), who mainly treat HHs as the unit of analysis and report the raw number and percent of HHs who are extremely poor.¹ For samples sizes, see Appendix I.

It is important to acknowledge that the CPS does not capture many of the most severely disadvantaged people (e.g. the homeless) or those residing in institutions such as prisons or military bases (Fox et al. 2015b). Therefore, our estimates could be lower-bound estimates and actual levels of deep/extreme poverty could be higher. As a result, below we estimate

¹ Shaefer and Edin's (2013) counts of the number of extreme poor HHs could increase simply because of population growth. Without standardizing by population, it is unclear how trends in raw counts should inform our understanding of trends in extreme poverty.

deep/extreme poverty after adding the national homelessness point in time counts (Corporation for National and Community Service 2018).

THE MEASUREMENT OF INCOME

In the 1990s, the United Nations convened “The Canberra Group” to identify best practices in income measurement (United Nations Economic Commission for Europe 2011). As a result, a consensus emerged on how to measure income (Brady 2009; Brady et al. 2013; Brady and Burton 2016; Brady et al. 2018; Duncan and Petersen 2001; Parolin and Brady 2019; Rainwater and Smeeding 2003; Smeeding 2016; Smeeding and Weinberg 2001). Among the leading international standards, measures of income should be: (1) as comprehensive as possible incorporating taxes and transfers (i.e. be “post-fisc”); and (2) equivalized for HH size. People live, consume, manage volatility, and maintain well-being by sharing expenses and resources with others in HHs, by accessing transfers, and based on disposable income after taxes and transfers (Bitler and Hoynes 2016; Brady et al. 2018; Gundersen and Ziliak 2003; Hoynes et al. 2016; Shaefer and Gutierrez 2013).

Incorporating Taxes and Transfers

Shaefer and Edin’s “headline results” – in the 2013 article abstract, in the 2015 book, and in the media – are based on cash income only. As others note (Meyer et al. 2018; Winship 2016), their measure omits near-cash transfers (e.g. the Supplemental Nutrition Assistance Program [SNAP], housing vouchers, rent and heating subsidies) and taxes and tax credits (e.g. the Earned Income Tax Credit [EITC]). Edin and Shaefer (2015: xviii) argue that including SNAP would be, “A problematic assumption because SNAP cannot legally be converted to cash, so it can’t be used to pay the light bill, the rent, or buy a bus pass.” On balance, Shaefer and Edin’s (2013)

report some results with alternative income definitions and note the increase is more modest with these alternatives. For instance, including welfare transfers and tax credits, Shaefer and Edin (2013: 256) conclude that only 1.6% of HHs with children were extremely poor – less than half of their estimate of more than 4% of HHs with children.

By contrast, we contend it is essential to incorporate SNAP, the EITC, and any taxes and transfers (Brady 2009; Citro and Michael 1996; Ziliak 2006; Moffitt and Scholz 2009). Much evidence shows SNAP plays a crucial role in smoothing and stabilizing the consumption of low-income HHs (e.g. Gundersen and Ziliak 2003). SNAP and other transfers are also essential to families' ability to offset the turbulence of economic recessions (Bitler and Hoynes 2016), and access to SNAP significantly improves short and long-term well-being (Hoynes et al. 2016). Shaefer and Gutierrez (2013) find SNAP significantly reduces both HH food insecurity and nonfood material hardships. Since the 1990s, the EITC has grown into the largest social assistance programs for families with children in the U.S. and SNAP receipt has grown substantially (Danziger 2010; Moffitt 2015; Tiehen, Jolliffe, and Smeeding 2016). In turn, over-time trends are likely biased by the omission of these programs (also see Appendix V).

A few in this literature incorporate taxes and transfers (Chandy and Smith 2014; Fox et al. 2015b). However, the key limitation of most is the use of survey data that systematically underreports the receipt of welfare transfers. As even Shaefer and Edin acknowledge (2013, 2018), there is convincing evidence that the incomes and welfare transfers of low-income HHs are underreported in most HH surveys (Meyer et al. 2015; Meyer et al. 2018; Meyer and Mittag 2015; Winship 2016).²

² Below, we also examine the potential underreporting of earnings. See Appendix VI.

We improve on the income definitions applied in prior studies in several ways. First, we follow leading international standards and employ the Luxembourg Income Study's (LIS, 2017) income measurement framework to construct different measures of household income. We begin with cash income, which includes labor market earnings, plus income from Social Security, TANF, General Assistance, Unemployment Insurance, retirement, interest, dividends, rent, Workers Compensation, veterans' benefits, survivors' assistance, disability assistance, education assistance, alimony, child support, and other sources not specified.

Second, we address undercounting of means-tested welfare transfers such as SNAP and Temporary Assistance to Needy Families (TANF) by employing the Urban Institute's (2017) TRIM3 program (Meyer et al. 2015; Parolin 2019a; Shaefer and Edin 2018). TRIM3 matches administrative records on TANF/SNAP caseloads across states to impute benefits back into the survey data. Whereas the uncorrected CPS survey data misses about half of TANF/SNAP cash transfers (Meyer and Mittag 2015), the augmented data comes much closer to capturing the full amount of cash assistance identified in administrative data.³ The first year that the TRIM3 model is available is 1993 and the last year is 2016. This explains our temporal scope.

Third, most analyses include TRIM3-corrected SNAP benefits. In some analyses, we only add 50% of the SNAP benefits because Edin and Shaefer (2015) argue SNAP benefits are not as liquid and useful as cash benefits. Nevertheless, we doubt SNAP has zero value and monetize SNAP at 50 cents on the dollar as a lower bound of the actual cash value of SNAP. This is consistent with Edin and Shaefer's (2015) estimates of the underground exchange rate at 50-60 cents on the dollar. This is more conservative than the estimates of Whitmore (2002), who

³ Although Shaefer and Edin (2013: 257) claim the underreporting of income and welfare transfers is smaller in the SIPP than the CPS, the problem is still present in the SIPP.

finds that recipients value food stamps at roughly 80 percent of their value. By reporting results with 50% and 100% of SNAP, we show a lower and upper bound of the value of SNAP.

Finally, we apply the LIS measure of disposable household income to incorporate tax liabilities, tax credits (EITC, CTC, ACTC), temporary benefits (stimulus credit, Make Work Pay tax credit), housing allowances, energy assistance (LIHEAP), and the Women, Infants and Children (WIC) programs.⁴ By incorporating taxes, we differ from Meyer and colleagues (2018), who only include the EITC and omit other tax credits and liabilities. We use the Census simulations to subtract taxes from and add tax credits to HH income.⁵ This definition is disposable “post-fisc” (i.e. after taxes and transfers) HH income, and is widely viewed as high quality (Brady 2009; Brady et al. 2013; Rainwater and Smeeding 2003; Smeeding 2016).

Unlike Meyer et al. (2018), we do not incorporate assets or real estate equity into our definition of household income, though we do include income from dividends and rents. We also do not monetize the value of health benefits (Winship 2016). If a household has a level of disposable income small enough to qualify as living in deep/extreme poverty, but has access to health insurance, we maintain that the household is still deeply/extremely poor.

⁴ We improve on the LIS protocol by including state EITCs, which are not included by the LIS. However, we acknowledge the CPS assumes full take-up of the EITC and ACTC, whereas the actual take-up rate is estimated around 80 percent of eligible earners (Jones 2014). Housing allowances are measured in the CPS as the value of federal housing assistance received by members of a family as estimated using matched administrative data.

⁵ The Census tax simulation appears to over-correct at times. In 1993-1994, the simulation recodes some high gross income households into low incomes. In 1993, for example, 415 individuals in the CPS have zero disposable income (i.e. their tax liability exceeds their gross incomes), but have gross income of \$100,000+. There are only 10 such individuals in the 1995 sample. Although 415 is a small share of the 1993 sample of 150,943, this could bias the very low estimates of extreme poverty. Therefore, we imposed a decision rule that if gross income was above the median, we do not code these households as deeply or extremely poor regardless of the tax simulation.

Finally, Meyer et al. (2018) also adjust the wages of self-employed workers to be the higher value of the reported wage or the reported number of hours worked multiplied by the minimum wage. This adjustment assumes that hours worked are reported accurately, but self-employment earnings are not, and that self-employed individuals do, indeed, receive earnings at the minimum wage level or higher. In contrast, Bollinger (1998), Hoyakem and colleagues (2015), and Bollinger and colleagues (2014) demonstrate that over-reporting of earnings, rather than underreporting, is a much larger concern at the bottom of the income distribution. Nonetheless, a sensitivity analysis in Appendix VI mimics Meyer and colleagues' (2018) strategy for adjusting wages. For any survey respondent who recorded no earned income but at least one hour "usually worked," we replace the earnings value with the product of the reported hours "usually worked" per week and the minimum wage in the respondent's state-year. We then recalculate poverty rates. Even with this wage imputation, our primary findings hold.⁶

Adjusting for Household Size

HHs have economies of scale such that there is a declining cost to an additional person. Several adjustments for HH size are available. The literature suggests that it is less consequential which equivalence scale one uses, but it is essential to use an equivalence scale (Brady et al. 2018; Rainwater and Smeeding 2003). We equalize income for HH size by dividing by the square root of HH members.⁷ By contrast, Shaefer and Edin's (2013) main results do not adjust for HH size (also Meyer et al. 2018: 12). The World Bank's metric of \$2-a-day that they apply assumes there are zero economies of scale as each additional HH member requires a proportional

⁶ Our results also hold when removing workers with imputed earnings. See Appendix VI.

⁷ In sensitivity checks, we re-estimate all poverty rates using the modified OECD equivalence scale, and the results are quite similar. The direction of the trends are unchanged, though in some years, the levels of extreme poverty are slightly lower when measured with the modified OECD equivalence scale rather than the square root scale.

and linear increase in resources.⁸ Shaefer and Edin (2013: 261) also note results with our equivalence scale. Doing so, they find a lower level of extreme poverty, but a similar increase.

THE CONCEPTUALIZATION OF POVERTY

We define poverty with the classic, simple conceptualization of a shortage of resources compared to needs (Smeeding 2016). Following the discussion of income measurement, resources should be measured as comprehensively as possible. This simple definition clarifies that poverty is always based on some standard of needs. We make this transparent to emphasize that none of the literature defines the standard of needs in an objective and scientific way. All are at least somewhat arbitrary.

We acknowledge the temptation to think of deep/extreme poverty in absolute terms. Such an image of absolute deprivation is certainly present in debates on deep/extreme poverty (Alston 2018; Deaton 2018; Edin and Shaefer 2015; Meyer et al. 2018). To the best of our knowledge, however, no physiological data, caloric requirements, or objective budget of basic necessities has been linked to a standard of needs employed in deep/extreme poverty measures. Despite common impressions, the U.S. official poverty measure (OPM) is not actually based on an objective standard of needs and has many problems undermining its reliability and validity. For brevity, we detail the problems with the OPM in Appendix II.

The fact that there is no absolute standard of needs in the deep/extreme poverty literature is one of the major reasons that international poverty scholars overwhelmingly use relative

⁸ To the best of our knowledge, the World Bank never justified this measure's zero economies of scale. Indeed, there was never much scientific basis for the \$2-a-day threshold even in developing countries (Smeeding 2016). It appears to have always been a politically constructed measure that was not based on any scientific absolute measure of deprivation.

measures (Brady et al. 2013; Brady and Burton 2016). A relative measure defines poverty as a shortage of resources *relative* to needs defined by the prevailing standards of a given time and place. Relative measures better predict well-being, health, and life chances; are more valid for leading conceptualizations of poverty (e.g. capability deprivation and social exclusion); are more reliable for over-time and cross-place comparisons; and are justified because of the absence of defensible absolute alternatives with fewer problems (Brady 2009; Fox et al. 2015a, 2015b; Rainwater and Smeeding 2003; Smeeding 2016). Therefore, we apply a relative measure of poverty in our primary analyses. To say individuals are in “deep” or “extreme” poverty simply means the gap between resources and needs is deeper or more extreme.

THRESHOLDS FOR DEEP/EXTREME POVERTY

For transparency about the concrete dollar amounts needed for the various poverty thresholds, we report the real dollar amounts in Appendix I. Also, Appendix I reports how these thresholds translate to real gross domestic product per capita. It is unfortunately common for scholars to not report the thresholds, however doing so is essential for readers to assess poverty rates. Appendix I lists the national poverty thresholds for each year (state-specific poverty thresholds available upon request). Our view is that there are several defensible thresholds and we aim for general conclusions across thresholds.

We employ both relative and anchored poverty thresholds (Brady et al. 2013; Smeeding 2016). We set the poverty threshold for our relative deep/extreme poverty measures based on a percentage of the median in each year for the entire U.S. To account for the meaningful differences in the cost of living and standards of needs across the U.S., we also present a measure of deep/extreme poverty based on the median in each state in each year. Because the CPS is not

necessarily large per state-year, we pool three years ($t-1$, t , and $t+1$) for each state to estimate the median. The advantage of state-specific thresholds is an even more precise definition of relative poverty that incorporates more local living standards, costs, and needs. We acknowledge, however, that differences in costs of living may also represent geographical differences in amenities, productivity levels, and wages.

To assess poverty at the same threshold over time, we also present measures using anchored poverty measures (Brady et al. 2013). Anchored measures adjust HH income for inflation with the PCE deflator, and fix the threshold to one time point (Smeeding 2016).⁹ While a relative measure may be less sensitive to the business cycle and economic development (or, as in the 2008 recession, overly sensitive; see Appendices II-III), an anchored measure is responsive (Brady et al. 2013).

We draw an explicit distinction that is often implicit between the more moderate “deep” poverty and the much worse “extreme” poverty. To measure deep poverty, we employ three thresholds. First, we estimate the proportion with less than 20% of the national median in each year.¹⁰ Second, we estimate the proportion of the population with less than 20% of the median in

⁹ Trends in our anchored poverty measures are comparable if we apply the CPI-U or CPI-U-RS deflators rather than the PCE. We use the PCE in our primary analysis as it is the most conservative. Thus, if anchored poverty increases with the PCE, it will (and does) also increase with the other two deflators. There are concerns that the CPI-U overstates inflation relative to the PCE (Winship 2016), but that dispute remains unsettled, as the consumption patterns of low-income households may not be well reflected in the PCE indicator. Our relative measures of poverty are, of course, not affected by choice of income deflator.

¹⁰ All our estimates are based on “headcount” measures of the percent below the threshold. Unlike intensity or ordinal measures, headcount measures neglect the depth of poverty below the threshold (Brady 2009). However, given the few cases at the very bottom of the distribution and the low poverty thresholds used in this study, we would be cautious with analyses of the depth of extreme poverty. Headcount measures require confidence that a given HH’s income is below a threshold, but it requires a higher level of confidence in income data to utilize the exact values of HH income for those below the threshold.

each state and year. Third, we estimate the proportion with less than 20% of the inflation adjusted 1993 national median. To measure extreme poverty, we again employ three thresholds. We estimate the proportion with less than 10% of the national median in each year, 10% of the median in each state-year, and 10% of the inflation adjusted 1993 national median.

Again, we are transparent and explicit that there is no objective scientific justification for thresholds of deep poverty at 20% of the median and extreme poverty at 10% of the median. One could define deep poverty at 25% of the median and extreme poverty at 5% or 15%.¹¹ For comparison, we also report trends at 30% and 50% of medians (see Appendices II-III).

As Appendix I shows, even at our highest national threshold (20% of median), being deeply poor implies a very low income. To be deeply poor in 2016, an individual had less than \$7,285 annually or \$607 per month in 2017 dollars. To facilitate replication, we provide Stata code for augmenting the CPS data, and for calculating thresholds and poverty rates (see Appendices V and VIII; Parolin 2019a; Parolin and Brady 2019).

Our approach for extreme poverty differs with Shaefer and Edin's (2013) thresholds of \$2/day. Their threshold is "absolute" in that it defines extreme poverty according to a predetermined threshold of basic needs regardless of time and place. For example, their threshold for a family of three would be \$2,190 (i.e. $\$2 \times 3 \times 365$) in 2015, or \$2,323 in 2017 dollars. This is much lower than our thresholds for extreme poverty. In 2016, for a family of three, 10% of the national equivalized median would be \$6,309 in 2017 USD. Below, we replicate their estimates alongside a series of alternatives that improve on their measures in steps. With each improvement, it becomes clear how the results differ from Shaefer and Edin (2013).

¹¹ That said, we would be cautious about setting the threshold lower than we do. The reason is that the sample sizes (even in the CPS, which are much larger than the SIPP) get very small, so it may be difficult to discern trends.

We also acknowledge that some measure deep poverty at 50% of the OPM (Alston 2018). As explained in Appendix II, the problems with the OPM are so significant that we lack confidence in such measures. As well, some define deep poverty as a percentage of the Supplemental Poverty Measure (SPM) threshold (e.g. Fox et al. 2015a, 2015b; Iceland 2005). In sensitivity checks, we replicate our results using deep/extreme poverty thresholds derived from the Historical SPM data from Fox and colleagues (2015a). Specifically, we measure the share of the population living below 30% of the SPM threshold (roughly 22% of median income for the average person in 2015), and 20% of the SPM threshold (15% of median income for the average person in 2015). The trends in poverty using the SPM are quite consistent with our findings. We display the trends in the measures based on the SPM in Appendix VII.

LEVELS AND TRENDS IN DEEP POVERTY

Figure 1 shows the trends in deep poverty. We present annual estimates and 95% confidence intervals on those estimates. In all figures, the confidence intervals are fairly small, partly because the CPS provides a large sample. As a result, over-time comparisons can be made as the differences tend to be statistically significant.

In 2016, we estimate that 7.2 million (2.23% of the U.S. population) were deeply poor at 20% of the national median, 7 million (2.17%) were deeply poor at 20% of state medians, and 5.2 million (1.6%) were deeply poor at 20% of the 1993 national median.¹²

¹² All estimates are based on the WDI (2018) estimates of the U.S. population.

Figure 1. Trends in Proportion Deeply Poor in U.S., 1993-2016.

All three measures show substantial over-time variation. There were notable declines in deep poverty especially 1993-1996, 2006-2009, and 2014-2015. For all three measures, 1995 or 1996 exhibited the lowest rates of deep poverty and 2014 or 2016 exhibited the highest rates.¹³ While the over-time trend is not quite as stark comparing 1993 to 2016, all three measures show a significant increase in deep poverty since 1995.

In 1993, deep poverty measured as 20% of the U.S. median was 1.5%. This measure of deep poverty fell to 1.2% in 1995-1996 and then rose to hover near 2.0% in the 2000s. However,

¹³ Because all measures of deep/extreme poverty show a peak in 2014, we scrutinized the 2014 data, but found no major problems. In 2014, there was a decline in SNAP and TANF benefit levels, which explains part but not all of the trend. One factor is the end of the Emergency Unemployment Compensation program on Jan 1, 2014. UI benefits see a large drop from 2013 to 2014. Estimates without UI shows no increase from 2013 to 2014.

it increased to 2.18% in 2014 and 2.23% in 2016. From 1993 to 2016, deep poverty at 20% of the national median increased by 50%. From its low point in 1995-1996 to 2016, this measure of deep poverty increased by 83%. We find a similar trend with deep poverty measured at 20% of each state's median. This measure of deep poverty declined from 1.4% in 1993 to 1.1% in 1995, and reached 2.2% by 2016. Overall, deep poverty at 20% of state medians increased 60% from 1993-2016 and 93% from 1995-2016.

The bottom panel in Figure 1 shows the trend in deep poverty anchored by the 1993 U.S. median. Of the three measures of deep poverty, this measure should be least likely to show an increase as it should decline due to over-time increases in economic development. According to this anchored measure, about 1.5% were deeply poor in 1993. This rate fell to 1.1% in 1995-1996, and then rose steadily to 1.8% in 2014, before declining to 1.6% in 2016. From 1993 to 2015, anchored deep poverty increased about 9%. However, this conceals that the U.S. made some progress in reducing anchored deep poverty 1993-1996. From its low point in 1995-1996 to 2015, anchored deep poverty increased 48%.

Thus, even with a measure anchored in 1993, there was a significant increase in deep poverty. The increase in anchored deep poverty is even more striking as there was a decline in anchored poverty at 30% and 50% of the median (see Appendices III-IV). The declines in anchored poverty at 30% and 50% of the median should build confidence in the validity and reliability of our measures of income, and suggest that any increases at 10% and 20% are not simply artefacts of income measurement.

Figure 2 displays trends in deep poverty among individuals in households with children (black line) and individuals in childless households (gray line). The left panel shows trends in deep poverty (relative to 20% of federal median) for either household type. We see that much of

the reason for the rise in deep poverty in the U.S. is due to the increase among individuals in childless households. From 1993-2016, deep poverty rises from 1.67% to 2.81% (a 68% increase) for childless households. For individuals in households with children, the rise is much smaller: an increase from 1.35% to 1.65%, or a 23% increase.

Differences in the trends of the anchored thresholds (right panel) are even more pronounced. Individuals in households with children actually see a decline in deep poverty measured with the anchored threshold (1.35% to 0.99%, 1993-2016). However, individuals in childless households see a rise from 1.67% to 2.24%. The rise in anchored deep poverty for the total population, as displayed in Figure 1, thus appears to be primarily due to the rise in anchored deep poverty among households without children.

Figure 2. Trends in Proportion Deeply Poor by Household Type, 1993-2016.

LEVELS AND TRENDS IN EXTREME POVERTY

Figure 3 shows the trends in extreme poverty. In 2016, 3.7 million (1.15%) were below 10% of the national median, 3.5 million (1.08%) were below 10% of state medians, and 2.6 million (0.81%) were below 10% of the 1993 national median.

All three measures show over-time fluctuation, with high points in 1998, 2007, 2014, and 2016, and with low points in 1995, 1999, and 2010. Compared to deep poverty, there is even more temporal fluctuation. Still, there are statistically significant increases from 1993 to 2016 and from the low points in 1995 to high points in 2016.

Measuring extreme poverty at 10% of the national medians, 0.66% of the U.S. was below the threshold in 1993. This rate fell to a low of 0.54% in 1995, and then rose to a high of 1.15% in 2016. At 10% of the national medians, extreme poverty increased 73% from 1993-2016, and increased 111% from 1995-2016.

In 1993, 0.65% of the U.S. population was below 10% of each state's median. State-specific extreme poverty declined to a low of 0.52% in 1995 and then rose to 1.08% in 2016. Thus, extreme poverty at 10% of state medians increased 65% from 1993-2016 and 107% from 1995-2015. Anchoring extreme poverty at 10% of the 1993 national median, the over-time trend is less pronounced than with the two relative measures. This measure declined from 0.66% in 1993 to 0.53% in 1995. It then rose to 0.89% in 2014 and 0.81% in 2016. Still, this measure increased 22% over the entire period and 54% from 1995-2016.

Figure 3. Trends in Proportion Extremely Poor in U.S., 1993-2016.

Figure 4 shows that the trends again vary greatly by household type. For individuals in households with children, extreme poverty (relative to 10% of federal median) remains stable from 1993-2016 (around 0.50% in both years). For childless households, however, extreme poverty rises from 0.89% to 1.82%, a 105% increase. The anchored trends (right panel) show similar findings. Extreme poverty is on the decline for households with children (Parolin and Brady 2019), but has risen steeply for households without children. The rise in extreme poverty among individuals in households without children drives the observed upward trend among the total population.

Figure 4. Trends in Proportion Extremely Poor by Household Type, 1993-2016.

THE EFFECT OF INCOME MEASUREMENT AND SNAP ON DEEP AND EXTREME POVERTY

We argue that income measurement is essential to measuring deep/extreme poverty. One of the main reasons our estimates differ from prior research is that we utilize a more complete measure of income. Although our measure of disposable income includes all taxes and transfers, decomposing poverty trends by income concept shows that the inclusion of SNAP benefits, in particular, is critical in shaping levels and trends of poverty (Parolin and Brady 2019). To demonstrate this, we display two sets of results in Figures 5 and 6. Both demonstrate how incomplete measures of income bias estimates of and trends in extreme poverty.

Figure 5 shows what happens to extreme poverty anchored at 10% of the 1993 median with different definitions of income. The estimates from Figure 2 are shown in the bottom panel of Figure 5 for comparison. In the upper left panel of Figure 5, we estimate extreme poverty with cash income only. This definition does not correct for underreporting of TANF or SSI, and does not include near-cash benefits like SNAP. Moreover, it does not incorporate taxes paid, tax credits (e.g. the EITC) and some other benefits. Unsurprisingly, this income measure results in a dramatically higher rate of extreme poverty. Instead of the 0.81% reported for 2016 in Figure 2, the upper left panel of Figure 3 shows a 2.35% rate of extreme poverty.

The upper right panel in Figure 5 uses this measure of cash income, but corrects for underreporting of TANF and SSI with the TRIM3 model. Instead of a rate of 2.35%, extreme poverty would be 1.95% in 2016. The second row left panel maintains the TRIM3 adjustment but adds 50% of SNAP benefits. With this measure, extreme poverty would only be 1.54%. Adding 100% of SNAP benefits to TRIM-adjusted cash income in the middle right panel, extreme poverty would be 0.92%. Finally, we show in the bottom panel that anchored extreme poverty would fall from 0.92% to 0.81% once we include tax liabilities, tax credits (EITC, CTC, ACTC), temporary benefits (stimulus credit, Make Work Pay tax credit), housing allowances, energy assistance (LIHEAP), and the Women, Infants and Children (WIC) programs. Hence, moving from a cash-only income definition to one that also includes SNAP results in a reduced estimate of anchored extreme poverty from 1.95% to 0.92% (i.e. 53% lower). After SNAP is included, adding in all other taxes and transfers only leads to an additional decline of 0.11 percentage points (i.e. 12% lower).

Figure 5. Extreme Poverty at 10% of 1993 U.S. Median With Different Income Definitions.

Figure 6 replicates Shaefer and Edin (2013) estimation of poverty at \$2/day while improving on their measure of income. The upper left panel uses their measure of cash income. Their threshold of \$2/day and does not equalize income for household size. Their measure results in an estimate of extreme poverty of 1.6% or 5.2 million people. Their measure increased 96% from 1993 to 2016, and 128% from its low in 1996 to its peak in 2014.

Figure 6. Estimates of \$2/Day Extreme Poverty With Different Adjustments.

The upper right panel of Figure 6 uses Shaefer and Edin’s income measure but equivalizes for household size. This reduces \$2/day poverty from 1.6% to 1.5%. The middle left panel builds on that, and adjusts for underreporting of TANF and SSI with TRIM3. With this income measure, \$2/day poverty declines to 1.36%.¹⁴ The middle right panel adds 50% of SNAP to income, and \$2/day poverty declines to 0.53%. This substantial reduction illustrates how

¹⁴ Recently, Shaefer and Edin (2018) use the CPS and TRIM3 to estimate \$2/day poverty 1995-2012 for children. However, they do not equivalize income for household size and continue to use cash income by omitting SNAP and other aspects of disposable income. They find 1.2 million children (1.6%) were poor in 2012. They also find a more than 300% increase in the raw count of children in extreme poverty 1995-2012. Even using the CPS and TRIM3, their estimates of the level and trend are much higher than ours. They (p. 26) write: “When we control for underreporting, we find that the downward spiral since 1995 is even more dramatic than previously reported.”

consequential even a lower bound value of SNAP benefits are to \$2/day poverty. The bottom left panel incorporates the full 100% of SNAP benefits and \$2/day poverty declines to 0.48%.

Finally, the bottom right panel uses disposable income. With this “best” definition of income, only 0.44% of the U.S. lived on less than \$2/day in 2016. Thus, instead of 5.2 million living on less than \$2/day with Edin and Shaefer’s definition, our estimate is approximately 1.4 million. With this measure, \$2/day poverty increased 16% from 1993 to 2016 and 82% from its low in 1996 to its peak in 2014.¹⁵ For both the levels and changes over time, the inclusion of SNAP proves to be critical in assessing \$2/day poverty. Moving from counting SNAP benefits at just 50% of their value to including all other taxes and transfers leads to no statistically significant difference in the level of \$2/day poverty.

We can again decompose the trends by households with and without children. Given that households with children are the primary target of SNAP benefits, and that SNAP benefits play a large role in reducing deep/extreme poverty, we might expect that the inclusion of SNAP into measurement of household income matters far more for households with children compared to those without (Parolin and Brady 2019). Figure 7 shows trends in deep poverty (20% of federal median) by household type and income definition. The left panel shows the trends for households with children. The top line shows trends in deep poverty when only cash income (pre-TRIM3) is measured, while the second line from the top shows trends when TANF and SSI are adjusted with TRIM3. The difference between the two estimates of deep poverty in 2016 is 0.68 percentage points.

¹⁵ We encourage some caution about the over-time increase in \$2/day poverty. The upper bound confidence interval in 1993 and the lower bound confidence interval in 2016 are both .41.

Figure 7. Deep Poverty (20% Federal Median) by Household Type & Income Definition

The third line from the top shows trends with SNAP is added into the income definition. Moving from *cash income* to *cash income plus SNAP* results in a decrease in deep poverty among households with children of 3.04 percentage points in 2016. After that, adding in all other taxes and transfers (the bottom, darkest line) contributes to an additional decrease of just 0.92 percentage points, less than a third of the decrease observed when adding SNAP to the cash income definition.

For individuals in households without children (the right panel), the variance in poverty trends across income definitions is far smaller. Taxes and transfers have a smaller effect on the poverty status of childless households. Still, adding SNAP into the income definition leads to the largest relative decline among the income definitions examined. Adding SNAP benefits to the

cash income with TRIM3 income definition results in a 0.67 percentage point decline in deep poverty among childless households in 2016. After SNAP benefits are included, the addition of all other taxes and transfers has a very small (0.31 percentage point) effect on the poverty rate.

Finally, Figure 8 shows the same patterns for extreme poverty (10% of national median). Again, the effect of taxes and transfers, and SNAP in particular, is far greater for individuals living in households with children (left panel). Adjusting for benefit underreporting in TANF and SSI contributes to a 0.77 percentage point (26%) reduction in extreme poverty among individuals in households with children. Adding SNAP into that income definition then leads to a 1.6 percentage point (71%) reduction. Moreover, adding SNAP changes the direction of the trend. If SNAP is excluded, there is an increase in extreme poverty among households with children from 1993 to 2016. When SNAP is included, however, there is a decline in extreme poverty over time. The different levels of extreme poverty around 2009-2010 also emphasize the importance of SNAP. When the recession hit in 2008-2009, extreme poverty measured before the addition of SNAP benefits increased sharply. This is clear in the upward spikes of the top two lines in Figure 8 during these years. In 2009, however, eligibility for SNAP and the program's maximum benefit levels were increased as part of the American Recovery and Reinvestment Act of 2009 (Shahin 2009). Accordingly, including SNAP into the income definition results in a *decrease* in the level of extreme poverty in 2009-2010 rather than the sharp increase observed in the pre-SNAP income definitions. In most years, the difference between the *cash income + SNAP* and *disposable income* measures of resources do not produce statistically significant differences in levels of extreme poverty. This is true for the childless households (right panel), as well.

Figure 8. Extreme Poverty (10% Federal Median) by Household Type & Income Definition

We emphasize that these findings are not just a matter of the order in which benefits are added into the income definition. If we take our definition of disposable household income and remove SNAP benefits, for example, the extreme poverty rate among children increases from 0.5% to 1.5% in 2016. Moreover, the trend in extreme poverty using this income definition increases between 1993 and 2016, in contrast to our measures that include SNAP. That SNAP benefits play a substantial role in reducing deep/extreme poverty is consistent with Parolin and Brady (2019), who find that the rise of SNAP take-up has been instrumental toward reducing extreme child poverty after the 1996/1997 welfare reform.

HOMELESSNESS & EXTREME POVERTY

The CPS does not include the homeless, which could be a salient segment of the extremely poor in the U.S. As a result, we propose that our estimates of extreme poverty are probably lower-bounds.¹⁶ The national point in time estimates suggest that 549,928 were homeless in the U.S. in 2016. The point in time estimates are only available since 2007, and the average annual (2007-2016) point in time estimate of homeless was 608,114. We conjecture that the homeless are likely to be extremely poor. In turn, estimates of extreme poverty that are far below the counts of homelessness raise questions about face validity (Hall and Rector 2018; Meyer et al. 2018). Moreover, it is worthwhile to estimate how much larger the extreme poverty would be if the homeless were added to our estimates. Figure 9 shows the trends 2007-2016 in extreme poverty with and without each year's count of homelessness.

Extreme poverty would be much higher in every year if the homeless are added. For example, anchored extreme poverty in 2016 would be 1.05% of the U.S. population instead of our estimate of 0.81%. Unfortunately, the homelessness point in time estimates do not include confidence intervals so we cannot say if there are statistically significant differences between our estimates with and without homelessness. Taking the estimates as they stand, extreme poverty would have been 19-23% higher in 2016 and an average of 20-24% higher 2007-2016. Though not shown, deep poverty would have been 7-8% higher in 2016 and 9-11% higher 2007-2016 if the homeless were added. This provides evidence to reasonably suggest that estimates of

¹⁶ Of course, there are other ways our estimates could be undercounts. For example, the poor consume a much higher share of their income than the non-poor, and therefore sales taxes exert a greater cost on the poor. It would be very difficult to estimate what share of the poor's income is subject to sales tax and subtract state- and local-specific sales tax rates from that share of income. One would also need to apply such corrections to median HH income as this would affect the thresholds. Nevertheless, it seems reasonable to suggest that sales taxes disproportionately lower the poor's income relative to the median HH.

deep/extreme poverty that solely use the CPS (or any household-based survey) are probably lower-bound estimates.

Figure 9. Extreme Poverty Without (Solid Lines) and With (Dashed Lines) Homelessness.

Children in foster care institutions (not yet placed into households) and the incarcerated population are also excluded from the CPS. In contrast to the homeless, however, we are less comfortable assuming that most individuals in foster care institutions or prison are or would be extremely poor. More than 2.3 million people were incarcerated in 2013 (Glaze and Kaeble, 2014), and more than 50,000 children were living in group homes or foster care institutions in 2017 (Children’s Bureau, 2018). Including these individuals into our poverty count would again

reinforce our conclusion that the CPS can only provide a lower-bound estimate of deep or extreme poverty in the U.S.

CONCLUSION

This study presents levels and trends 1993-2016 in deep/extreme poverty in the U.S. We use uniquely augmented CPS data to adjust for benefit underreporting and construct measures of income that more comprehensively incorporate taxes and transfers. We report several measures of poverty, although even the highest thresholds presume a very low level of income. In 2016, we estimate 5.2 to 7.2 million Americans (1.6-2.2%) were deeply poor and 2.6 to 3.7 million (.8-1.2%) were extremely poor. Our evidence suggests that there has been an increase in deep/extreme poverty in the U.S. in recent decades. From low points in 1995 to 2016, deep poverty increased by an estimated 48-93% and extreme poverty increased by an estimated 54-111%. We find significant increases in deep/extreme poverty even with thresholds anchored in 1993. Contrary to prior research focused on deep/extreme child poverty, the increases appear to be concentrated among individuals living in households without children. For individuals in households with children, a rise in the receipt of SNAP benefits appears to have contributed to a decrease in extreme poverty over time (Parolin and Brady 2019).

Advancing beyond prior research, we demonstrate that it is essential for studies of deep/extreme poverty to incorporate leading international standards of income measurement. We show the value of measuring income comprehensively, of correcting for the underreporting of taxes and transfers, and of equivalizing for household size. We also examine a variety of thresholds and make several unique adjustments. In turn, we propose that our estimates of deep/extreme poverty are more credible than prior alternatives. Moreover, this study provides

methodological guidance and as an example for broader literatures on income and poverty (see also Brady et al. 2018; Parolin 2019a).

Our analyses can inform debates about the 1996 welfare reform (Parolin 2019b). On one hand, we find significant increases in deep/extreme poverty after welfare reform. At the same time, we do not find an increase at 30% or 50% of the median (see Appendices II-III). These results are consistent with claims that welfare reform shifted the poor towards deeper and more extreme poverty. On the other hand, our data reveal an increase in deep/extreme poverty for households without children and a decline for children and households with children. From 1993-1995, 31.6% of the extremely poor (<10% of U.S. median) and 44.6% of the deeply poor (<20% of U.S. median) were households with children. By contrast, in 2014-2016, only 16.4% of the extremely poor and 34% of the deeply poor were households with children.¹⁷ From 1993-1995 to 2014-2016, children as a share of those in deep poverty declined from 23.9% to 18.2% and in extreme poverty from 16.5% to 7.7%. These patterns contradict claims that welfare reform resulted in a greater concentration of children in deep/extreme poverty. Further, our results suggest it is changes to SNAP not changes to TANF that have most shaped deep/extreme poverty in recent years. The exclusion of childless HHs from SNAP is a key source of deep/extreme poverty, and the access of HHs with children to SNAP has reduced deep/extreme poverty (Parolin and Brady 2019).

We conclude by juxtaposing the levels and increases in deep/extreme poverty against the nation's high and rising GDP per capita (WDI 2018). In 2016, the U.S. GDP per capita in

¹⁷ In 1993-1995, 67.1% of the extremely poor and 54.6% of the deeply poor were households without children. From 2014-2016, 81.8% of the extremely poor and 64.5% of the deeply poor were households without children. The concentration of deep/extreme poverty on non-children would likely be even clearer if we include the homeless. In recent national point in time reports, individuals without families have grown to be more than 2/3rds of the homeless.

purchasing power parity was about \$59,000 (in 2017 dollars). As the highest threshold for deep poverty was about 12.4 percent of GDP per capita in 2016 (see Appendix I), it seems plausible that income redistribution could substantially reduce deep/extreme poverty. Moreover, real GDP per capita increased over 41% from 1993 to 2016 (WDI 2018). Given this rising economic affluence, it would be reasonable to have expected extreme poverty anchored in 1993 to have mechanically declined. That deep/extreme poverty increased as much as they did during a period where the nation was growing much richer is arguably the most important trend.

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APPENDIX I. Poverty Thresholds in 2017\$ in Per Person Equivalized Household Income for Various National Measures by Year and Sample Sizes (% of Real GDP Per Capita in Parentheses).

	<i>20% of Current National Median (as % of GDP PC)</i>	<i>20% of Real 1993 Median (as % of GDP PC)</i>	<i>10% of Current National Median (as % of GDP PC)</i>	<i>10% of Real 1993 Median (as % of GDP PC)</i>	<i>Sample Size</i>
1993	5377.4 (13.2)	5377.4 (13.2)	2688.7 (6.6)	2688.7 (6.6)	150,943
1994	5491.73 (13.1)	5377.4 (12.8)	2745.86 (6.6)	2688.7 (6.4)	149,642
1995	5669.67 (13.3)	5377.4 (12.6)	2834.84 (6.7)	2688.7 (6.3)	130,476
1996	5783.46 (13.3)	5377.4 (12.4)	2891.73 (6.7)	2688.7 (6.2)	131,854
1997	5933.14 (13.2)	5377.4 (12.0)	2966.57 (6.6)	2688.7 (6.0)	131,617
1998	6292.89 (13.5)	5377.4 (11.6)	3146.45 (6.8)	2688.7 (5.8)	132,324
1999	6496.21 (13.5)	5377.4 (11.2)	3248.1 (6.8)	2688.7 (5.6)	133,710
2000	6527.54 (13.2)	5377.4 (10.9)	3263.77 (6.6)	2688.7 (5.4)	128,821
2001	6607.07 (13.3)	5377.4 (10.9)	3303.53 (6.7)	2688.7 (5.4)	217,219
2002	6671.56 (13.3)	5377.4 (10.7)	3335.78 (6.7)	2688.7 (5.4)	216,424
2003	6781.7 (13.3)	5377.4 (10.5)	3390.85 (6.6)	2688.7 (5.3)	213,051
2004	6711.39 (12.7)	5377.4 (10.2)	3355.69 (6.4)	2688.7 (5.1)	210,612
2005	6766.27 (12.5)	5377.4 (9.9)	3383.14 (6.2)	2688.7 (5.0)	208,562
2006	6813.85 (12.3)	5377.4 (9.7)	3406.92 (6.2)	2688.7 (4.9)	206,639
2007	6888.56 (12.4)	5377.4 (9.6)	3444.28 (6.2)	2688.7 (4.8)	206,404
2008	6911.19 (12.7)	5377.4 (9.9)	3455.59 (6.3)	2688.7 (4.9)	207,921
2009	6728.44 (12.7)	5377.4 (10.1)	3364.22 (6.3)	2688.7 (5.1)	209,802
2010	6667.44 (12.4)	5377.4 (10.0)	3333.72 (6.2)	2688.7 (5.0)	204,983
2011	6631.94 (12.3)	5377.4 (10.0)	3315.97 (6.1)	2688.7 (5.0)	201,398
2012	6694.48 (12.2)	5377.4 (9.8)	3347.24 (6.1)	2688.7 (4.9)	202,634
2013	6664.91 (12.0)	5377.4 (9.7)	3332.46 (6.0)	2688.7 (4.8)	139,415
2014	6620.13 (11.7)	5377.4 (9.5)	3310.07 (5.8)	2688.7 (4.7)	199,024
2015	6846.6 (11.7)	5377.4 (9.2)	3423.3 (5.9)	2688.7 (4.6)	185,487
2016	7285.05 (12.4)	5377.4 (9.1)	3642.53 (6.2)	2688.7 (4.6)	185,914

Notes: State-specific annual thresholds available upon request. All thresholds can be generated with Stata code in Appendix VIII. PCE deflator applied. GDP Per Capita data from the World Bank WDI Database.

Appendix II. Summary of Problems with Official U.S. Measure of Poverty (OPM).

We encourage skepticism of any estimates based on the OPM. The OPM has serious validity and reliability problems that have been well-documented (e.g. Brady 2009; Brady et al. 2013; Fox et al. 2015a, 2015b; Iceland 2005; Katz 1989; O'Connor 2001; Rainwater and Smeeding 2003; Smeeding 2016). In fact, the impetus for the Supplemental Poverty Measure (SPM) was the widespread knowledge of the deep limitations of the OPM (Fox et al. 2015a, 2015b; Iceland 2005; Wimer et al. 2017).

A careful study of the historical research shows that the OPM was problematic from the beginning. The OPM is often attributed to Orshansky. However, because problems with the OPM were known soon after its implementation, Orshansky herself disavowed the OPM only a few years after it was adopted (Brady 2009; O'Connor 2001). O'Connor (2001: 184) explains, "No one was more surprised, though, than Orshansky herself, who had never meant her measures as official government standards. Concerned primarily with suggesting a way to vary the measure for family size, Orshansky took pains to recognize that her work was at best an 'interim standard,' 'arbitrary, but not unreasonable,' and minimalistic at best." Katz (1989: 116) quotes Orshansky as writing, "'The best that can be said of the measure,' she wrote, 'is that at a time when seemed useful, it was there.'"

We elaborate on two major problems that are particularly relevant to this study. In addition, unlike the SPM and our measures based on state-year medians, the OPM is held constant across the entire U.S., which further undermines reliability.

1) *The Standard of Needs and Threshold*

Despite popular impressions, the standard of needs underlying the OPM does not actually have a clear scientific basis (Brady 2009; Katz 1989; O'Connor 2001). There was never much scientific basis for multiplying food times three. Using data from the mid-1950s, there was evidence that food amounted to roughly one-third of expenses for typical households on average. The evidence was not clear that this applied to low-income households. Further, the Johnson administration ended up using the "economy food plan", which was about 25% below the "low-cost food budget" used by Orshansky (Katz 1989). The economy food plan was meant for emergencies and on a temporary basis. Also, the food budgets were not subsequently revised. A few years later, the government began updating the OPM thresholds using the consumer price index rather than calibrating the thresholds according to changing food budgets. This had the consequence of severing any tie to the food budget as a standard of needs. Indeed, Katz (1989: 116) quotes Orshansky as writing: "This meant, of course, that the food-income relationship which was the basis for the original poverty measure no longer was the current rationale." Moreover, and as is well known, food is certainly much less than 1/3rd of HH expenses today. As a result, the OPM effectively ignores the costs of important household needs like childcare and healthcare, which were less essential or much cheaper when the OPM was created.

2) *The Definition of Income*

The definition of income used in the OPM ignores taxes, tax credits (e.g. the EITC), and near-cash transfers (e.g. SNAP) that we include. As noted above, the EITC and SNAP have grown substantially in recent decades and far more receive either the EITC or SNAP than TANF (Danziger 2010; Moffitt 2015). Also, while the OPM includes Social Security transfers (e.g. Old Age Survivors Insurance and Unemployment Insurance), it ignores childcare vouchers, housing subsidies, any state taxes, and state and federal payroll taxes. Comparisons over time, across

states, and between age groups are therefore quite problematic. As our more comprehensive measure of income incorporates all taxes and transfers, it is inappropriate for us to utilize the OPM threshold with our income definition. For comparison, 50% of the OPM in 2015 would range from \$5,555 (for a single adult) to \$11,445 (for a family of four with two children) in 2018 real dollars. This translates to thresholds of \$5,555 - \$5,722 in equivalized HH income. That the OPM deep poverty thresholds in equivalized HH income differ depending on whether there are one or three people in the HH also illustrates how the OPM equivalence scale is not consistent. As others have shown, the OPM equivalence scale also did not have a scientific basis either (Brady 2009; Katz 1989; O'Connor 2001). Hence, as Appendix I shows, the OPM thresholds for deep poverty are lower than 20% of the national median.

Additional References:

Katz, Michael B. 1989. *The Undeserving Poor* New York: Oxford University Press.

O'Connor, Alice. 2001. *Poverty Knowledge* Princeton, N.J.: Princeton University Press.

Appendix III. Trends in Poverty at 30% of the Median.

Appendix IV. Trends in Poverty at 50% of the Median.

Appendix V. Adjustments to TRIM3.

Recent evidence suggests that TRIM3 may slightly over-allocate imputed SNAP benefits to households with zero gross incomes (Stevens, Fox and Heggeness 2018). During 2011-2015, for example, Stevens, Fox, and Heggeness (2018) find that, according to administrative records, an unknown amount below 5% of annual SNAP participation is concentrated among households with zero gross income. Conversely, our TRIM-adjusted CPS data suggests that 5.26% of SNAP participation is concentrated among zero-income households in those same years. To account for the possibility that the TRIM-adjusted SNAP allocations overcorrect at the very bottom of the income distribution, we conduct a sensitivity analyses that simulates the share of zero-income households receiving SNAP benefits. We assume that the reported SNAP participation in the unadjusted CPS is a lower-bound estimate of the true SNAP participation, and that participation in the TRIM-adjusted CPS is an upper-bound estimate. For each year, we then calculate the midpoint between the unadjusted and TRIM-adjusted SNAP participations rates among zero-income households, and remove SNAP benefits from households at zero income (using a random number generator) until participation rates reach the midpoint value. In 2015, for example, the unadjusted participation was 3%, the TRIM-adjusted was 5%; thus, we adjust the participation rate to 4%.

We then re-estimate all the \$2/day measures. As expected, the share of households living in \$2-per-day poverty increases slightly after these adjustments. Using our measure of equivalized disposable household income, the \$2 poverty rate increases from 0.4 % to 0.49 % in 2015. In these new estimates, the highest estimated rate of \$2/day poverty is 0.59 % in 2007 (versus our reported 0.55 % in Figure 4 above). The lowest estimated rate becomes 0.28 in 1996 (versus 0.25 in 1996 in Figure 4). Though the estimated levels of \$2/day poverty increase slightly in each year, the trends remain unchanged.

Additional Reference:

Stevens Kathryn, Liana E. Fox, and Misty L. Heggeness. 2018. *Precision in Measurement: Using State-Level SNAP Administrative Records and the Transfer Income Model (TRIM3) to Evaluate Poverty Measurement*. SEHSD Working Paper #2018-15; url: <https://www.census.gov/content/dam/Census/library/working-papers/2018/demo/SEHSD-WP2018-15.pdf>

Appendix VI. Trends in Poverty after Adjusting for Possible Earnings Misreporting.

Appendix VII. Trends in Proportion below 20% (Left) and 30% (Right) of Supplemental Poverty Measure, 1993-2016.

APPENDIX VIII. Stata Code.

**** Create Poverty Thresholds**

*** National Poverty Lines**

```
foreach x in 10 20 30 50 {
  foreach y of numlist 1993 / 2015 {
    cap gen fpovline`x' = .
    qui sum edhir [w=wtstsupp] if year==`y', de
    replace fpovline`x' = (r(p50)*(`x'/100)) if year==`y'
  }
}
```

*** State Poverty Lines**

```
levelsof statefip, local(levels)
foreach x in 10 20 30 50 {
  foreach y of numlist 1993 / 2015 {
    foreach z of local levels {
      cap gen spovline`x' = .
      qui sum edhir [w=wtstsupp] if ( year==`y' | year==( `y'-1 ) | year==( `y'+1 ) ) & statef==`z', de
      replace spovline`x' = (r(p50)*(`x'/100)) if year==`y' & statef==`z'
    }
  }
}
```

*** Anchored Thresholds**

```
foreach x in 10 20 30 50 {
  cap gen afpovline`x' = .
  qui sum edhir [w=wtstsupp] if year==1993, de
  replace afpovline`x' = (r(p50)*(`x'/100))
}
```

**** Removing high-income households with high tax liabilities from poverty.**

```
gen zerotaxed = 0
foreach x of numlist 1993 / 2015 {
  qui sum hhincome [w=wtstsupp] if year==`x', de
  replace zerotaxed = 1 if hhincome>r(p50) & year==`x'
}
```

*** Concept 1: Disposable Household Income, Equivalized**

```
replace edhir = 0 if edhir < 0
// edhir = equivalised disposable housing income in 2014 USD
gen realedhir= edhir * .95 // converting from 2014 USD to 2011 USD
gen twodollarpov=0 if realedhir!=.
replace twodollarpov=1 if realedhir<(730)
replace twodollarpov = 0 if zerotaxed
foreach x in spov fpov afpov {
  gen `x'10 = 0
  replace `x'10 = 1 if edhir < `x'line10
  replace `x'10 = 0 if zerotaxed
  gen `x'20 = 0
  replace `x'20 = 1 if edhir < `x'line20
  replace `x'20 = 0 if zerotaxed
  gen `x'30 = 0
  replace `x'30 = 1 if edhir < `x'line30
  replace `x'30 = 0 if zerotaxed
  gen `x'50 = 0
  replace `x'50 = 1 if edhir < `x'line50
}
```

```

replace `x'50 = 0 if zerotaxed
}

```

* Concept 2: Labor Market Income, Pre-TANF

```

replace emir = 0 if emir < 0
gen realmir = emir * .95 // 2011 USD
gen mi_twodollar pov=0 if realmir!=.
replace mi_twodollar pov=1 if realmir<(730)
replace mi_twodollar pov = 0 if zerotaxed
foreach x in spov fpov afpov {
    gen `x'10_mi = 0
    replace `x'10_mi = 1 if emir < `x'line10
    replace `x'10_mi = 0 if zerotaxed
    gen `x'20_mi = 0
    replace `x'20_mi = 1 if emir < `x'line20
    replace `x'20_mi = 0 if zerotaxed
    gen `x'30_mi = 0
    replace `x'30_mi = 1 if emir < `x'line30
    replace `x'30_mi = 0 if zerotaxed
    gen `x'50_mi = 0
    replace `x'50_mi = 1 if emir < `x'line50
    replace `x'50_mi = 0 if zerotaxed
}

```

* Concept 3: Pre-Tax Cash Income, with PRE-TRIM Cash Benefits (SSI, Child Allowances, TANF)

```

by year hseq, sort: egen hinctot = total(inctot)
replace hinctot = 0 if hinctot < 0
gen e_hinctot = hinctot / (sqrt(perhh)) / cpi
gen realhinctot = e_hinctot * .95
gen mic_twodollar pov = 0 if realhinctot!=.
replace mic_twodollar pov= 1 if realhinctot < (730)
replace mic_twodollar pov = 0 if zerotaxed
foreach x in spov fpov afpov {
    gen `x'10_mic = 0
    replace `x'10_mic = 1 if e_hinctot < `x'line10
    replace `x'10_mic = 0 if zerotaxed
    gen `x'20_mic = 0
    replace `x'20_mic = 1 if e_hinctot < `x'line20
    replace `x'20_mic = 0 if zerotaxed
    gen `x'30_mic = 0
    replace `x'30_mic = 1 if e_hinctot < `x'line30
    replace `x'30_mic = 0 if zerotaxed
    gen `x'50_mic = 0
    replace `x'50_mic = 1 if e_hinctot < `x'line50
    replace `x'50_mic = 0 if zerotaxed
}

```

** Concept 4: Pre-Tax Cash Income, with TRIM-CORRECTED Cash Benefits (SSI, TANF)

```

gen inctot_trim = inctot - incwelf - incssi + socassist + tanftrim_p + ssitrim_p
by year hseq, sort: egen hinctot_trim = total(inctot_trim)
gen e_hinctot_trim = hinctot_trim / (sqrt(perhh)) / cpi
gen realhinctot_trim = e_hinctot_trim * .95
gen mict_twodollar pov = 0 if realhinctot_trim!=.
replace mict_twodollar pov= 1 if realhinctot_trim < (730)
replace mict_twodollar pov = 0 if zerotaxed
foreach x in spov fpov afpov {

```

```

gen `x'10_mict = 0
replace `x'10_mict = 1 if e_hinctot_trim < `x'line10
replace `x'10_mict = 0 if zerotaxed
gen `x'20_mict = 0
replace `x'20_mict = 1 if e_hinctot_trim < `x'line20
replace `x'20_mict = 0 if zerotaxed
gen `x'30_mict = 0
replace `x'30_mict = 1 if e_hinctot_trim < `x'line30
replace `x'30_mict = 0 if zerotaxed
gen `x'50_mict = 0
replace `x'50_mict = 1 if e_hinctot_trim < `x'line50
replace `x'50_mict = 0 if zerotaxed
}

```

**** Concept 5: Pre-Tax Cash Income + SNAP, with TRIM-CORRECTED Cash Benefits (SSI, TANF) and CORRECTED SNAP**

```

gen inctot_trimsnaptrim = inctot - incwelf - incssi + socassist + tanftrim_p + ssitrim_p + snaptrim
by year hseq, sort: egen hinctot_trimsnaptrim = total(inctot_trimsnaptrim)
replace hinctot_trimsnaptrim = 0 if hinctot_trimsnaptrim < 0
gen e_hinctot_trimsnaptrim = hinctot_trimsnaptrim / (sqrt(perhh)) / cpi
gen realhinctot_trimsnaptrim = e_hinctot_trimsnaptrim * .95
gen mictst_twodollar pov = 0 if realhinctot_trimsnaptrim != .
replace mictst_twodollar pov = 1 if realhinctot_trimsnaptrim < (730)
replace mictst_twodollar pov = 0 if zerotaxed
foreach x in spov fpov afpov {
    gen `x'10_mictst = 0
    replace `x'10_mictst = 1 if e_hinctot_trimsnaptrim < `x'line10
    replace `x'10_mictst = 0 if zerotaxed
    gen `x'20_mictst = 0
    replace `x'20_mictst = 1 if e_hinctot_trimsnaptrim < `x'line20
    replace `x'20_mictst = 0 if zerotaxed
}

```

**** Concept 6: Market Income, w/TRIM-CORRECTED Cash Benefits (SSI, TANF), but CORRECTED SNAP at 50%**

```

gen inctot_trimsnaptrim50 = inctot - incwelf - incssi + socassist + tanftrim_p + ssitrim_p + (snaptrim * .5)
by year hseq, sort: egen hinctot_trimsnaptrim50 = total(inctot_trimsnaptrim50)
replace hinctot_trimsnaptrim50 = 0 if hinctot_trimsnaptrim50 < 0
gen e_hinctot_trimsnaptrim50 = hinctot_trimsnaptrim50 / (sqrt(perhh)) / cpi
gen realhinctot_trimsnaptrim50 = e_hinctot_trimsnaptrim50 * .95
gen mictst_twodollar pov50 = 0 if realhinctot_trimsnaptrim50 != .
replace mictst_twodollar pov50 = 1 if realhinctot_trimsnaptrim50 < (730)
replace mictst_twodollar pov50 = 0 if zerotaxed
foreach x in spov fpov afpov {
    gen `x'10_mictst50 = 0
    replace `x'10_mictst50 = 1 if e_hinctot_trimsnaptrim50 < `x'line10
    replace `x'10_mictst50 = 0 if zerotaxed
    gen `x'20_mictst50 = 0
    replace `x'20_mictst50 = 1 if e_hinctot_trimsnaptrim50 < `x'line20
    replace `x'20_mictst50 = 0 if zerotaxed
}

```