Comparing the Performance of Monthly Poverty Measures

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Summary: Official poverty estimates for the United States are presented annually and are reported with a considerable lag. The COVID-19 pandemic highlighted the problematic nature of this lag, prompting researchers to develop methods to provide more timely estimates of poverty that could be used to understand economic need, and the impact of the government's response, in closer to real time. One monthly poverty measure, introduced in Parolin, Curran, Matsudaira, Waldfogel, and Wimer (2022; hereafter PCMWW), provides monthly estimates of poverty based on a family unit's likely *monthly* income. A separate measure, introduced in Han, Meyer, and Sullivan (2020; hereafter HMS), produces monthly updates of *annual* poverty estimates based on a survey question asking individuals about their families' total cash income over the past 12 months.

Trends in the two measures do not always align, prompting two questions: what explains the divergent trends, and which measure more reliably represents monthly variation in the well-being of households in the U.S.? This paper investigates these questions. We discuss differences between the PCMWW and HMS measures, and we compare the monthly estimates from the two measures to external benchmarks such as monthly levels of food insufficiency, mental health, and employment outcomes. Our analysis produces three primary findings.

First, the PCMWW monthly poverty estimates closely align with monthly levels of eight different material hardship and mental health measures. Monthly estimates from the HMS annual measure, in contrast, are negatively associated with all eight measures of material hardship and mental health challenges. That is, when the PCMWW monthly poverty estimates are lower, so too are levels of material hardship and mental health challenges. When poverty is lower under the HMS measure, by contrast, rates of hardship and mental health challenges are higher. This suggests that monthly movement in the HMS annual measure misrepresents changes in well-being that a poverty measure is meant to track. The HMS measure particularly misrepresents monthly variation in living conditions for families with children and Black individuals of all ages. Tracking monthly employment rates offers a more reliable tool than the HMS estimates for understanding monthly variation in material hardship and mental health. In contrast, the PCMWW estimates generally outperform monthly employment rates in explaining trends in hardship and mental health.

Second, we demonstrate empirically that the differential performance of the two measures is due to the PCMWW's inclusion of (and HMS exclusion of) benefits from SNAP, the Earned Income Tax Credit, and the Child Tax Credit, three of the largest anti-poverty programs in the U.S. We show that a modified HMS measure that includes these benefits strongly outperforms the original HMS measure in aligning with trends in hardship and well-being.

Third, we identify shared shortcomings in both the PCMWW and HMS measures and recommend several practical steps to improve the measurement of sub-annual poverty estimates moving forward.

INTRODUCTION

Since the onset of the pandemic, household incomes have risen and fallen dramatically from month to month due to changes in the labor market and to government policy. At the onset of the pandemic, however, there was no framework in place to understand how this economic volatility translated into changes in the national poverty rate. This is because official poverty statistics are reported with a substantial lag *and* because official statistics are designed to track changes from year-to-year, not from month-to-month.

In response to the economic volatility brought on by the COVID-19 pandemic, different researchers developed methods to produce estimates of poverty that were timelier and representative of these month-to-month fluctuations. Two such measures include one introduced in Parolin, Curran, Matsudaira, Waldfogel, and Wimer (2022; hereafter PCMWW) and another in Han, Meyer, and Sullivan (2020; hereafter HMS). The two measures employ different methodologies: PCMWW produce monthly estimates of poverty based on projections of family units' monthly incomes. The HMS framework produces a monthly-adjusted annual poverty measure, using a categorical measure of pre-tax cash income received in the prior 12 months. As such, the two measures yield different monthly estimates of poverty.

This paper examines how these two frameworks compare when it comes to providing timelier estimates of poverty that reflect month-to-month fluctuations in economic well-being. We do so first by outlining the structure of each measure and delineating the basic differences between the two measures. We then compare how changes in the monthly poverty rate under the PCMWW and HMS measures align (or fail to align) with changes in other indicators of economic wellbeing – including rates of material hardship, poor mental health, and employment rates. We then explain how specific methodological choices result in estimates that align more or less closely with these other indicators of economic need.

DIFFERENCES IN THE TWO POVERTY MEASURES

The PCMWW and HMS measures share several commonalities. Both use a combination of the Annual Social and Economic Supplement to the Current Population Survey (CPS ASEC) and the Basic Monthly files of the CPS. And both are meant to provide policymakers and the general public with near-real-time evidence on the economic well-being of individuals across the country. However, the measures also feature several fundamental differences.

The PCMWW framework produces a monthly measure of poverty within the ASEC by incorporating the most recent policy changes to income transfer programs, then imputing the likelihood of poverty in the latest Basic Monthly file using shared observables between the two files. In other words, the PCMWW measure can directly estimate the anti-poverty impact of new or expanded income transfers, such as the Economic Impact Payments (EIPs, or stimulus checks) or the advance Child Tax Credit (CTC) payments in 2021. The measure applies the principles of the Supplemental Poverty Measure (SPM), which are intended to capture the full array of resources that families have at their disposal month by month. The PCMWW measure is a measure of *monthly* poverty in that it focuses on income that a family unit received in the given month; if a family unit receives income transfers in June, but not July, the income transfers only count as income in the month of June. The authors argue that the measure of monthly poverty should be viewed as a "supplement to, rather than substitute for, the standard, annual poverty measure" (Parolin et al., 2022). The PCMWW uses SPM poverty thresholds, which vary geographically based on local living costs.

The HMS approach, in contrast, primarily uses a single, categorical income variable (available in both the ASEC and Basic Monthly files) that captures "money from jobs; net income from business, farm or rent; pensions; dividends; interest; Social Security payments; and any other monetary income received by family members." The income measure is most comparable to the Census Bureau's "pre-tax money income" definition used in production of

the official poverty measure (OPM, in contrast to the SPM); as such, it generally excludes benefits from refundable tax credits (including the CTC) and the Supplemental Nutrition Assistance Program (SNAP). The HMS income component is categorical, measuring whether resources over the prior 12 months are under $5,000, or within $5,000 intervals ranging from $5,000 - $9,999 to $35,000 – $39,999, or within $40,000 - $49,000, $50,000 - $59,000, $60,000 - $74,999, $75,000 - $99,999, $100,000 - $149,999, or greater than $150,000. HMS then "convert this categorical response into a continuous measure by randomly selecting values of family income from families in the CPS ASEC from the same survey year who have incomes that fall in that same income range and who have some similar demographic characteristics" (Han et al., 2020, p. 9). They compare these income values to OPM poverty thresholds, which are generally lower than SPM thresholds and do not vary geographically.

Figure 1 present trends in poverty estimates from both measures, for the full population, from January 2020 through May 2022, the latest estimates available at time of writing. Estimates of child poverty by month and measure are presented in Appendix A. Levels and trends vary between the PCMWW and HMS measures, which is unsurprising given their different income definitions, income accounting periods, poverty thresholds, and more.

The PCMWW measure features more intra-year variation given its focus on monthly income; particularly in March and April in each year, when many low-income families receive their refundable tax credits, monthly poverty rates fall sharply. The estimates from the PCMWW are also more responsive to the payment of stimulus checks, as well as the monthly payment of the CTC benefits. As Appendix A shows, child poverty rates also decline notably from July through December 2021 in the PCMWW measure, attributable to the advance CTC payments (Parolin, Collyer, et al., 2021).

Figure 1: Trends in poverty rates by month and measure, January 2020 – May 2022
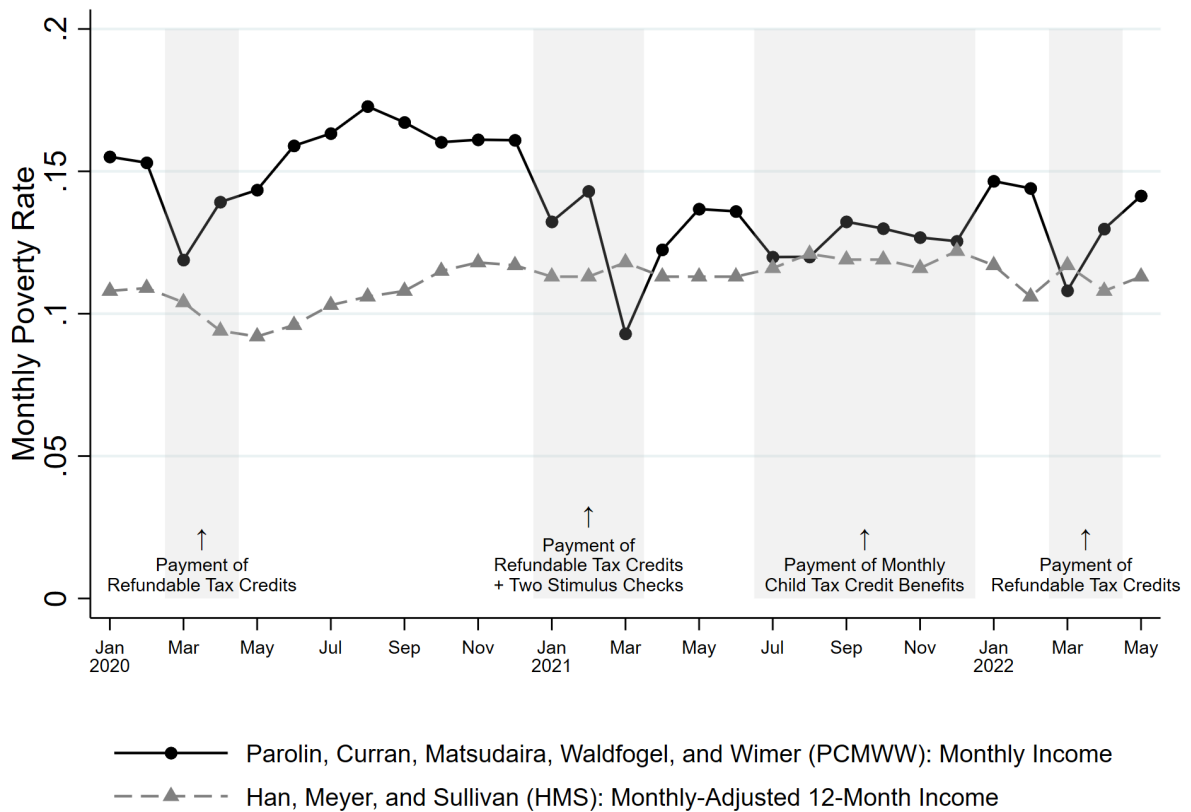
Note: The monthly estimates from Han et al. (2020) are from "Real-time Poverty Estimates During the COVID-19 Pandemic through May 2022" accessed in July 2022. The monthly estimates from Parolin et al. (2022) are from the Columbia University Monthly Poverty Data accessed in July 2022.

Estimates from the HMS, in contrast, are less volatile given their focus on income over a rolling 12-month period and exclusion of large, once-per-year refundable tax credits. Consistent with expectation given its use of a "pre-tax money income" definition of resources (defined above), the HMS estimates are generally unresponsive to the payment of refundable tax credits, the monthly CTC payments, and the final two stimulus checks.

EVALUATING THE PERFORMANCE OF THE MONTHLY POVERTY MEASURES

That the two measures feature different levels and trends in poverty makes sense given their different income definitions (the PCMWW measure includes all taxes and transfers while the HMS measure excludes SNAP, EITC, and CTC benefits), income accounting periods (one month in PCMWW versus 12 months in HMS), and poverty thresholds (SPM in PCMWW

versus OPM in HMS). However, their divergence raises a fundamental question: which measure of monthly poverty better reflects month-to-month variation in the well-being of the U.S. population? The remainder of this paper investigates this question.

To do so, we compare trends in the monthly poverty measures to monthly trends in eight outcomes from the Census Household Pulse Survey (Pulse): food insufficiency, falling behind on rent or mortgage payments, frequent anxiety, frequent feelings of being down, frequent feelings of lacking interest, frequent anxiety, lack of confidence in making rent payments, and difficulty meeting basic expenses.[1] We provide detail on the Pulse and precise wording of each of the eight hardship and mental health questions in Appendix B. We discuss concerns of measurement error in the Pulse in Appendix C. We also compare trends in the monthly poverty measures to monthly employment data from the CPS. Our underlying assumption is that a reliable measure of poverty should generally track trends in hardship and well-being; if a measure of poverty consistently declines when food hardship increases, for example, we should strongly question the reliability of such a measure.

Our findings show that estimates of the PCMWW consistently out-perform the HMS estimates and generally out-perform monthly employment rates in aligning with monthly variation in the material hardship and mental health outcomes. This is true for all eight hardship and mental health outcomes across all five demographic groups observed.

In contrast, HMS estimates of poverty are negatively associated with estimates of all eight material hardship and mental health challenges. In other words, in months in which the estimates from the HMS measure are lower, the prevalence of food hardship and other challenges tends to be higher, and vice versa. The HMS particularly misrepresents living conditions for families with children and Black individuals of all ages. Simply tracking
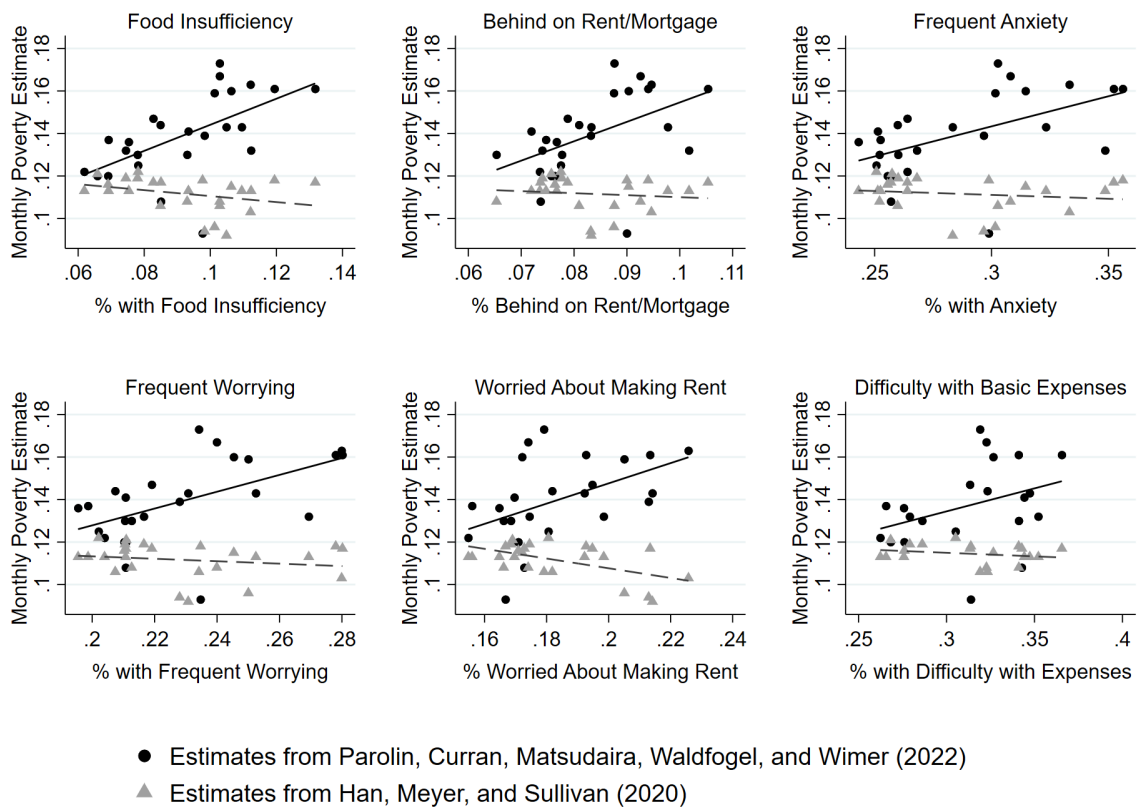
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[1] To ensure that we are consistently measuring financially-enforced food insufficiency, we limit our positive responses to those who report that they are food insufficient primarilily due to an inability to afford sufficient food (rather than fear of visiting the store during a pandemic or a lack of the types of food that respondent desires). Our conclusions are consistent if we do not impose this restriction.

monthly variations in employment rates offers a better portrait of economic well-being than the

HMS estimates. To illustrate and explain these conclusions, we organize the remainder of this

paper into six central findings, which we discuss in turn.

Finding 1: The PCMWW monthly poverty measure closely aligns with monthly patterns of material hardship and mental health. Trends in poverty from the HMS measure are inversely related to monthly patterns of material hardship and mental health.

Figure 2 documents the association of the monthly estimates of poverty and our

hardship and mental health measures. For readability, we feature six of the measures in Figure

2, but list the correlations for the other two measures in the notes directly beneath the figure.

In each panel, the black circles represent the point estimates from the PCMWW measure for a

given month, with the solid black line representing the line of best fit. The gray triangles, and

dashed gray line of best fit, represent the monthly point estimates from the HMS measure in

relation to the hardship and mental health outcomes.

Figure 2: Association of monthly poverty estimates with monthly levels of material hardship and mental health, April 2020 to May 2022

- ● Estimates from Parolin, Curran, Matsudaira, Waldfogel, and Wimer (2022)
- ▲ Estimates from Han, Meyer, and Sullivan (2020)

Note: The monthly estimates from Han et al. (2020) are from "Real-time Poverty Estimates During the COVID-19 Pandemic through May 2022" in July 2022; these estimates take into the small changes in methodology that the authors introduced in prior versions of their work. The monthly estimates of the material hardship and mental health indicators are from the Census Household Pulse Survey (see Appendix). The "difficulty with basic expenses" was first introduced in the Pulse in August 2020 and thus features four fewer observations. Not depicted: the association of the Han et al. (2020) measure with "feeling down" (-0.14) and "lacking interest" (-0.21) and association of the Parolin et al. (2020) measure with "feeling down" (0.48) and "lacking interest" (0.47).

The figure shows a positive association between the monthly estimates from the PCMWW measure and monthly levels of each of the hardship and mental health indicators. In other words, PCMWW and external hardship and mental health indicators move in the same direction: in months in which the PCMWW monthly poverty rate is higher, levels of food hardship and other challenges also tend to be higher. This is not the case for the HMS measure: for each of the hardship and mental health indicators, the HMS trendline slopes downward. In other words, when HMS estimate of poverty are lower, hardship and mental health challenges tend to be greater. These results hold when excluding all observations to the time points either before or after the Pulse's switch to biweekly data collection (see Appendix C).

Finding 2: The PCMWW measure reliably captures monthly variation in how families fare across population groups. The HMS measure particularly misrepresents monthly variation in living conditions of families with children and Black individuals of all ages.

Figure 2 presented associations between poverty and hardship across the full population. In contrast, Table 1 narrows in on the associations for different racial/ethnic groups and for households with children and adds in an additional comparison to monthly employment data. Doing so allows us to compare how the two measures perform in tracking hardship, mental health, and labor market changes among specific parts of the U.S. population.

In Table 1, we also compare the performance of the measures to that of a commonly-applied metric of economic performance: the employment rate, as calculated using the Basic Monthly CPS. To keep the expected signs consistent with our poverty measures (higher poverty being associated with higher hardship), Table 1 presents findings using the *non-employment* rate, which is simply one minus the employment rate.[2] Evaluating the association of group-specific non-employment rates (i.e., the non-employment rate among working-age White individuals, or working-age Black individuals, etc.) with hardship and mental health outcomes provides a useful external benchmark to which we can compare the performance of the two poverty measures. Moreover, the addition of non-employment rates provides a useful validity test of the Pulse outcomes: if higher joblessness were to be consistently associated with less hardship, this could be a sign that monthly variation in Pulse outcomes is subject to considerable measurement error. (The primary exception would be from April to July 2020, when the $600 per week supplements to unemployment benefits were provided. However, these months make up a small share of the overall timeframe examined.) However, Table 1 shows that non-employment rates are consistently, positively associated with hardship and mental health challenges (when non-employment rates are higher, so too is hardship).

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[2] We apply the non-employment rather than unemployment rate given concerns of misclassification of unemployment rates during the initial months of the pandemic. Results are consistent if we apply the group-specific unemployment rates.

Table 1: Correlation of monthly poverty rates with hardship and well-being outcomes by group from April 2020 through May 2022 (n=26 months per group)

	Parolin, Curran, Matsudaira, Waldfogel, & Wimer (2022)	Han, Meyer, & Sullivan (2020)	Group-Specific Non-Employment Rate
All Individuals			
Food Insufficiency	0.58	-0.31	0.42
Behind on Rent	0.48	-0.12	0.43
Frequent Anxiety	0.52	-0.16	0.46
Feeling Down	0.48	-0.14	0.36
Lacking Interest	0.47	-0.21	0.49
Frequent Worrying	0.54	-0.19	0.42
Worried about Rent	0.48	-0.54	0.66
Difficulty w/ Expenses	0.35	-0.24	0.08
White Individuals			
Food Insufficiency	0.57	-0.11	0.25
Behind on Rent	0.44	-0.15	0.44
Frequent Anxiety	0.46	-0.03	0.32
Feeling Down	0.38	0.03	0.20
Lacking Interest	0.34	-0.04	0.33
Frequent Worrying	0.48	-0.01	0.25
Worried about Rent	0.53	-0.30	0.49
Difficulty w/ Expenses	0.31	-0.10	-0.11
Black Individuals			
Food Insufficiency	0.58	-0.47	0.60
Behind on Rent	0.50	-0.29	0.47
Frequent Anxiety	0.51	-0.26	0.62
Feeling Down	0.53	-0.24	0.53
Lacking Interest	0.52	-0.19	0.53
Frequent Worrying	0.55	-0.29	0.58
Worried about Rent	0.48	-0.59	0.61
Difficulty w/ Expenses	0.51	-0.26	0.30
Hispanic Individuals			
Food Insufficiency	0.54	-0.19	0.42
Behind on Rent	0.42	0.08	0.37
Frequent Anxiety	0.53	-0.03	0.59
Feeling Down	0.60	0.02	0.45
Lacking Interest	0.56	-0.12	0.70
Frequent Worrying	0.55	-0.01	0.59
Worried about Rent	0.34	-0.04	0.70
Difficulty w/ Expenses	0.36	-0.13	0.35
Children / Respondents with Children*			
Food Insufficiency	0.63	-0.36	0.50
Behind on Rent	0.54	-0.15	0.49
Frequent Anxiety	0.50	-0.08	0.44
Feeling Down	0.51	-0.16	0.36
Lacking Interest	0.47	-0.18	0.51
Frequent Worrying	0.51	-0.16	0.40
Worried about Rent	0.52	-0.65	0.70
Difficulty w/ Expenses	0.45	-0.43	0.13

Note: Values represents the correlation of group-specific monthly poverty rates with group-specific hardship and well-being outcomes by group over April 2020 through May 2022 (n=26 months per group). Hardship and mental health data are from the Census Household Pulse Survey. Non-employment rates (one minus the employment rate) are from the Current Population Survey and are calculated among the age 18-64 year old populations for each group. *The two poverty measures estimate child poverty rates, while the Pulse provides hardship and well-being outcomes (and the CPS for non-employment rates) for adults with children present in the home.

Table 1 shows that the PCMWW estimates are positively associated with the material hardship and mental health outcomes for all 40 outcomes (five groups times eight outcomes each). In other words, when poverty is higher according to the PCMWW measure, food hardship and other hardship outcomes also tend to be higher. Moreover, for the vast majority of indicators, the PCMWW estimates are more strongly associated with the hardship and mental health outcomes than are the group-specific non-employment rates. In other words, the PCMWW monthly estimates of poverty provide a tool that generally surpasses the ability of monthly employment rates to describe the economic and subjective well-being of the U.S. population. This is true for White, Black, and Hispanic families alike, as well as for adults with children present in the home.

In contrast, the HMS poverty estimates are negatively correlated with 37 of the 40 outcomes evaluated. In other words, when the HMS poverty rate is higher, food hardship is generally lower, and vice versa. Moreover, monthly estimates from the HMS measure are inversely correlated with monthly estimates of food insufficiency for all five groups examined: the full population (-0.31), White individuals (-0.11), Black individuals (-0.47), Hispanic individuals (-0.19), and respondents with children present in the home (-0.36). In other words, the HMS estimates misrepresent monthly variation in well-being for all groups, but for Black individuals and for respondents with children in particular. For 39 of the 40 indicators, the group-specific employment rate offers a more reliable tool than the HMS estimates for tracking monthly variation in economic and subjective well-being (see rightmost column of Table 1).

To contextualize this finding further, we can consider trends in the two measures over a specific timeframe. Between July 2020 and July 2021, food hardship among Black individuals *declined* from 19.7% to 16%. During that same time period, the PCMWW estimates for Black individuals also *declined* from 24.7% to 17.3%. In contrast, the HMS poverty rate for Black individuals *increased* from 18.6% to 21.6% during that time period. This pattern, playing out consistently across outcomes, time periods, and subgroup, drives the HMS estimates'

misrepresentation of hardship, and the close alignment between the PCMWW estimates and hardship outcomes.

Though the findings above focus on outcomes from the Pulse, one should note that differences in validation tests extend beyond comparisons to material hardship and mental health measures. The peer-reviewed paper that describes the methodology of PCMWW, for example, includes several other validation tests of the PCMWW monthly poverty estimates: comparisons to historical data from the Survey of Income and Program Participation (SIPP), tests of the reliability of the estimates within and across states, and more. To the best of our knowledge, the data presented above are the first attempt to compare trends in the HMS monthly-adjusted annual poverty estimates to monthly trends in material hardship and/or mental health outcomes.

UNDERSTANDING DIFFERENCES IN THE PERFORMANCE OF THE MEASURES

To understand the different ability of the two monthly poverty measures to track monthly estimates of material hardship and mental health challenges, we narrow in on two key differences between the two measures: their income accounting periods and income measures.

Finding 3: Changes in the PCMWW estimate of monthly poverty reflect differences in poverty from the current month relative to the prior month. Changes in the HMS measure of poverty reflect differences in poverty from the current month relative to the same month from the prior year.

One distinction that may lead to disparate relationships with material hardship and mental health is the different income accounting periods that the two measures apply. As described previously, the PCMWW framework measures a family unit's monthly income when evaluating monthly poverty status, whereas the HMS framework measures a family unit's over the prior 12 months. There are advantages and disadvantages to both approaches. As Parolin, Curran, Matsudaira, Waldfogel, and Wimer (2022) describe, a monthly income accounting framework may understate the ability of family units to smooth consumption across months after an income shock; conversely, the 12-month accounting framework may overlook large

month-to-month volatility in income, particularly during the years of the COVID-19 pandemic. Poverty measures based on monthly and annual accounting frameworks are arguably best understood in tandem.

An important question remains, however, in how to interpret month-to-month changes in poverty using these two income accounting periods. Table 2 provides an example of the different accounting periods used in producing a monthly measure of poverty for December 2020 and January 2021 using the HMS framework and the PCMWW framework.

Table 2: Income accounting periods used for monthly poverty rate in December 2020 vs. January 2021 for the two monthly poverty measures

Poverty estimate for:	Accounting period includes data from:											
Han, Meyer, and Sullivan (2020) Framework												
December 2020:	Jan '20	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
January 2021:		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan '21
Parolin, Curran, Matsudaira, Waldfogel, and Wimer (2022) Framework												
December 2020:												Dec
January 2021:												Jan '21

Note: The listed months represent the months included in the respective measure of poverty when producing estimates for December 2020 (the top row for either measure) and for January 2021 (the bottom row). The Basic Monthly surveys are generally completed in the third week of the month; we follow Han et al. (2020) in including the reporting month as part of the given month's income.

The PCMWW framework captures resources received in a single month (only December 2020 for the December 2020 poverty measure). If the PCMWW measure of poverty increases from December 2020 to January 2021, this primarily reflects a decline in family resources (relative to the poverty threshold) in January 2021 compared to the prior month.

Table 2 shows that, applying the HMS measure, a change in the poverty rate from December 2020 to January 2021 reflects the difference in income received in January 2021 relative to the income received in January 2020. In other words, the HMS measure produces a monthly poverty estimate with a comparison lagged by one year rather than one month. This is because the same 11 months (February 2020 through December 2020) are in both the December 2020 and January 2021 poverty estimates using the HMS framework, as Table 2 visualizes.

Finding 4: Differences in trends from the PCMWW and HMS estimates of monthly poverty are primarily due to the PCMWW inclusion of (and HMS exclusion of) benefits from SNAP, the Earned Income Tax Credit, and the Child Tax Credit.

As described previously, the PCMWW measure of monthly poverty follows the SPM framework in incorporating all taxes and transfers. This includes SNAP benefits and refundable tax credits, which are not typically included in poverty estimates from the OPM. This also includes stimulus checks, expanded unemployment benefits, and advance CTC payments received through temporarily legislative changes passed in 2020 and 2021. Table 3 provides one example of the importance of capturing all taxes and transfers: it improves the reliability of a monthly poverty measure in tracking monthly variation in food insufficiency.

Table 3: Association of monthly rates of food insufficiency and variations of the Parolin, Curran, Matsudaira, Waldfogel, and Wimer (2022) monthly poverty measure

	Monthly SPM Poverty, with COVID-19 Relief	Monthly SPM Poverty, without COVID-19 Relief	Group Non-Employment Rate
All Individuals	0.58	0.42	0.42
White Individuals	0.57	0.36	0.25
Black Individuals	0.58	0.46	0.60
Hispanic Individuals	0.54	0.34	0.42
Children*	0.63	0.38	0.50

Note: "COVID-19 Relief" includes temporary income support provided between 2020 and 2022, including but not limited to expanded unemployment benefits, stimulus checks, SNAP Emergency Allotments, and expanded Child Tax Credit payments. Values represents the correlation of monthly poverty rates with hardship and well-being outcomes by group over April 2020 through May 2022 (n=26 months per group). Hardship and mental health data are from the Census Household Pulse Survey. Non-employment rates (one minus the employment rate) are from the Current Population Survey and are calculated among the age 18-64 year old populations for each group. *The poverty measures estimate child poverty rates, while the Pulse provides hardship and well-being outcomes (and the CPS for non-employment rates) for adults with children present in the home.

Specifically, Table 3 shows that the variation of the PCMWW monthly poverty measure that best aligns with trends in food insufficiency is the measure that includes all taxes and transfers, including all COVID-era transfers distributed between 2020 and 2022. This post-tax and post-transfer measure of monthly poverty outperforms a measure of monthly poverty without the COVID-era relief. These findings are also a useful validity check of the methods used to incorporate these COVID-era income transfers into the PCMWW measure: the findings show that these additions to the measurement framework contribute to a more reliable

measure of monthly poverty, as should be expected if the simulations of the new income transfers are implemented with limited measurement error.

The HMS measure of monthly poverty, in contrast, more closely follows the OPM framework for measuring poverty. As noted, the HMS framework uses a measure of resources that includes "money from jobs; net income from business, farm or rent; pensions; dividends; interest; Social Security payments; and any other monetary income received by family members," similar to the pre-tax money income used in the OPM. Non-cash benefits, such as those from the SNAP program, are not included in the measure. The SNAP program, however, distributed more than $108 million in income support throughout 2021 alone, the largest amount in the program's history.

The HMS income measure also excludes refundable tax credits, including payments from 2021 expansion of the Child Tax Credit (CTC). The expanded CTC provided benefits of up to $3,600 per child, with half of value being distributed as monthly payments (of up to $300 per child per month) to most tax units with children between July and December 2021. Their remaining balance was distributed upon the filing of taxes in spring 2022. As a result of these monthly CTC payments, food insufficiency fell for low-income families with children between June 2021 and December 2021 (Parolin, Ananat, et al., 2021). The PCMWW measure shows a decline in child poverty during these months, consistent with the decline in food hardship (see Appendix A). However, estimates of child poverty from the HMS measure point to an increase in child poverty during this timeframe from 15.7% to 16.1%. Absent a compelling explanation as to why large, consistent income transfers to families with children should not reduce child poverty, the most likely explanation is that the HMS measure of income does not include the CTC payments, which would be consistent with the wording of the survey question.

Reflecting on their measure's lack of responsiveness to the CTC payments, Han et al. (2022) acknowledge that respondents might not be including the payments in their calculations of their pre-tax money income. However, the authors claim that this explanation should be

ruled out given that "the pattern of the Han et al. measure around the payment of the first round of [stimulus checks] in April and May of 2020 strongly suggests these [stimulus checks] were included in reports of family income" (p. 27). In other words, the authors argue that declining poverty rates after stimulus checks were distributed in spring 2020 suggest that respondents counted the stimulus checks as income, which suggests that respondents should also include the CTC payments as income. However, the logic is inconsistent: the HMS poverty estimates are not responsive to the CTC payments, which is the test that the authors applied to the first stimulus check payments to evaluate whether those stimulus checks were likely to be counted as pre-tax cash income. A more logically-consistent conclusion would be that CTC benefits are not included as pre-tax cash income, given that the HMS poverty rate is not responsive to the CTC payments.

As another possible explanation for their measure's lack of responsiveness of to the CTC, Han et al. (2022) emphasize descriptive evidence of a *relative* decline in employment for low-educated adults with children compared to childless adults. However, the authors do not acknowledge in their manuscript text that levels of employment among low-educated adults with children actually *increased* from July to December 2021 (and also from March to December 2021, the former month being when Congress passed the ARP).[3] The *relative* decline is merely because the employment rates happened to increase at a slower rate relative to childless adults. The authors do not offer any evidence on why an *increase* in employment rates among low-educated adults with children should offset the anti-poverty effects of additional cash support from the CTC payments. Moreover, the PCMWW measure also takes into account any changes in employment and work intensity, while still finding notable

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[3] The authors relegate these findings on employment levels to Appendix Figure A3. Their primary figure (Figure 5) and the manuscript text focus exclusively on *differences* in employment for adults with children relative to adults without children.

declines in poverty.[4] Note that several other studies also find no significant, negative consequences for employment outcomes between July and December 2021(Ananat et al., 2022; Roll, Hamilton, & Chun 2022; Lourie et al 2022; Karpman et al 2022).

As another potential argument, Han et al. (2022) suggest that declining transfers from family members, friends, and non-custodial parents may have declined during July to December 2021, offsetting the income gains provided through the CTC payments; however, the authors provide no evidence of such patterns, nor do they assume similar behavioral changes from other income transfers that showed clear effects on poverty rates.

Our fifth finding shows, instead, that the HMS poverty measure likely does not respond to the CTC payments because its income measure does not include the expanded CTC benefits. We show that when we modify their measure to include such benefits, its alignment with material hardship and well-being trends improves dramatically.

Finding 5: A modified HMS measure that includes SNAP, the Earned Income Tax Credit, and the Child Tax Credit strongly outperforms the original HMS measure in more closely aligning with trends in hardship and well-being.

The HMS measure of poverty, in short, is missing three of the largest income transfers available to low-income families (SNAP, the EITC, and the CTC), likely leading to its poor performance in tracking monthly trends in material hardship and mental health outcomes. To test this hypothesis empirically, and to rule out competing explanations, we reproduced both the HMS and PCMWW poverty estimates using the Han et al. (2020) framework for matching Monthly CPS respondents to ASEC respondents. We provide detail on the reproduction of the estimates in Appendix D. Here, we advance three points that clarify the source of variation in the two measures' estimates.

> 1) *The differing approaches to matching Monthly CPS respondents to values from the CPS ASEC do not meaningfully shape differences in the estimates from HMS and PCMWW.*

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[4] Han et al. (2022) incorrectly write that the PCMWW measure does not take into account changes in employment status or living arrangements. Parolin et al. (2022) clearly document that their measure does, indeed, take these into account.

To produce its estimates of monthly poverty, the HMS framework randomly draws income values from respondents of the CPS ASEC to assign to respondents of the CPS Basic Monthly with similar pre-tax money income bins and family characteristics. The PCMWW framework, in contrast, exports the conditional probabilities of poverty from the CPS ASEC to the CPS Basic Monthly based on common observables.

Figure 3: Reproduction of poverty estimates using the Han et al. (2020) approach to matching Monthly CPS respondents to CPS ASEC respondents based on family structure and categorical income bins
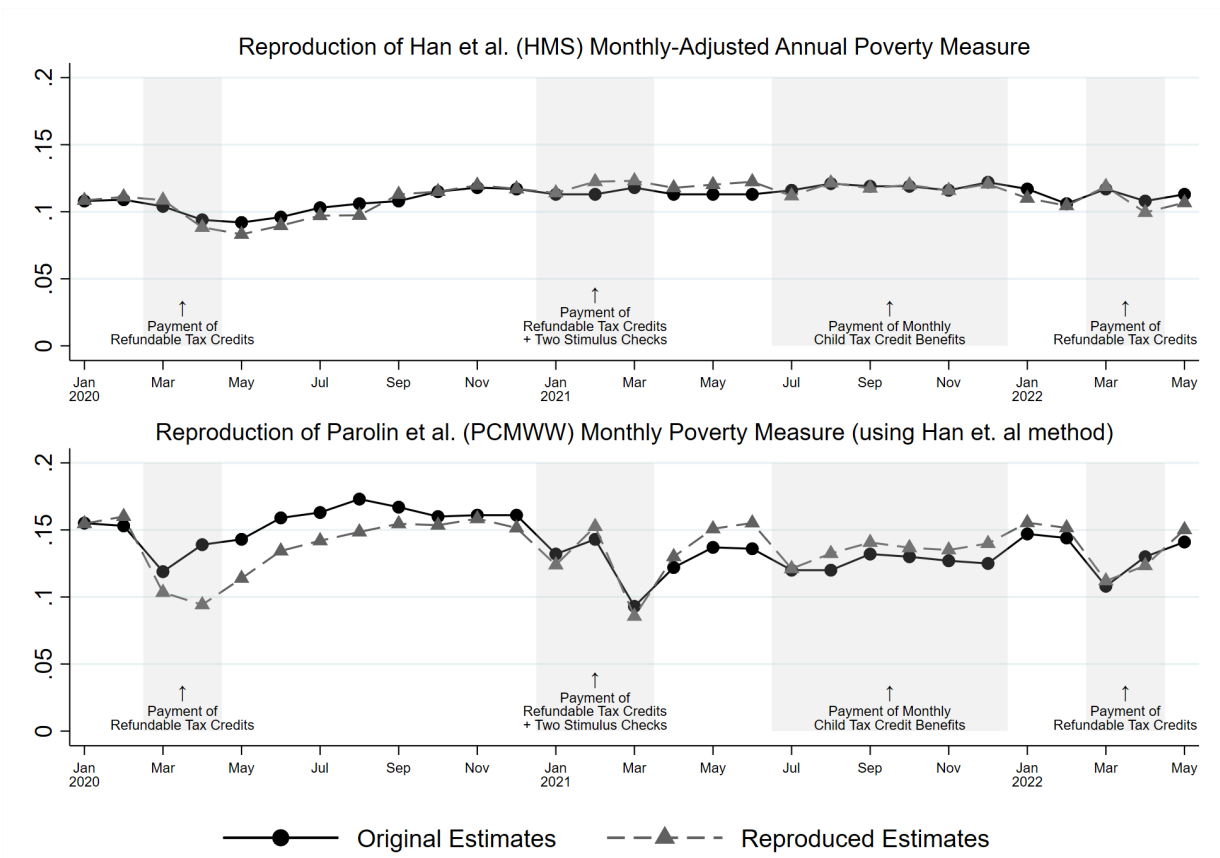

Note: See Appendix D for methodological details.

We rule out here that these different techniques are the source behind the two measures different trends. Specifically, we replicate estimates from both the HMS and PCMWW measure using the Han et al. (2020) framework (see details in Appendix D). In doing so, we can closely replicate the poverty trends from the PCMWW measure, as visualized in Figure 3. Thus, the differing estimation techniques – the multiple imputation based on observables in

Parolin et al. (2022), and the matching based on categorical income bins in Han et al. (2020) –

do not appear to meaningfully contribute to variation in the two measures' estimates.

> 2) *The HMS measure can be extended to provide estimates based on monthly income, and can also be extended to take into account benefits from SNAP, the Earned Income Tax Credit, and the Child Tax Credit.*

The HMS measure, as noted, is a monthly measure of poverty with a lagged

comparison and excludes some of the largest income transfers targeted at lower-income

families. We argue that these features are not only conceptually unsound, but empirically

unnecessary. We produce two extensions of the HMS poverty measure to adjust these features;

we display the trends in Figure 4. For both measures, we employ the same set of methods used

in our reproduction of the HMS estimates in Figure 3; rather than transferring the annual pre-

tax money income of ASEC matches to the Monthly respondents, however, we transfer the (1)

monthly pre-tax money income and (2) monthly pre-tax money income with SNAP, EITC, and

CTC benefits included to the Monthly respondents (see Appendix D for more details). In other

words, we are still following the logic of the HMS estimation framework, but apply a more

complete measure of income and with an estimate of monthly (rather than annual) income.

Figure 4: Estimates of monthly poverty across three variations of the Han, Meyer, and Sullivan (2020) poverty framework
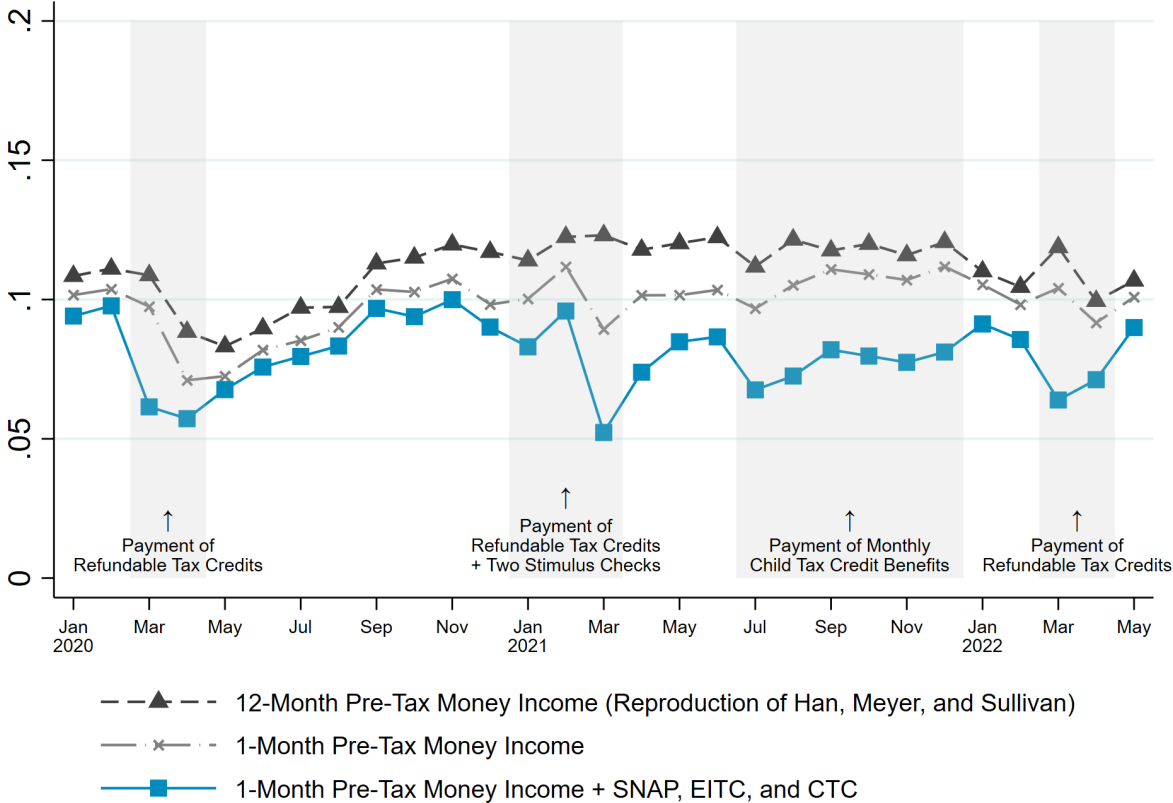
The top line in Figure 4 is the reproduction of the HMS measure, identical to the line in the Figure 3 before. The middle line with gray Xs applies the same definition of pre-tax money income, but adopts a monthly rather than annual income accounting period (following the Parolin et al. (2022) approach for converting annual to monthly income components). Given that this pre-tax money income definition does not include SNAP, the EITC, or the CTC – the latter two especially being the policies that drive intra-year variation in the PCMWW measure – the trend in this modified, 1-month poverty measure tracks trends in the standard, 12-month poverty measure relatively well. This provides further evidence that the Parolin et al. (2022) framework for converting annual to monthly income components is not generating meaningful bias in the trends any of the measures based on the 1-month income accounting period.

The bottom line marked with blue squares then adds SNAP, EITC, and the CTC to monthly income. As should be expected, the intra-year volatility of the estimates increases

when these transfers are added (similar to the volatility of the PCMWW estimates observed in Figure 1). Moreover, the estimates are now more responsive to the observed policy changes. When refundable tax credits or the monthly CTC payments are distributed, the monthly poverty rate tends to fall, as logic would suggest. The modified HMS measure with these transfers includes now closely tracks trends from the PCMWW measure (r = 0.95), suggesting that the exclusion of these transfers from the original HMS measure is the strongest source of difference between the two measures' estimates.[5]

3) *The HMS exclusion of SNAP, EITC, and CTC benefits explains the differential performance of the HMS and PCMWW measures.*

Finally, we show that the inclusion SNAP, EITC, and CTC benefits into the modified HMS measure strongly enhances the measures' alignment with trends in hardship and well-being. Table 4 repeats the analysis of the associations between poverty trends and hardship outcomes with each of the three variations of the HMS measure displayed in Figure 4.

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[5] This correlation refers to the association of year-month poverty estimates from the modified HMS measure and the estimates from the PCMWW measure when reproduced using the Han et al. (2020) framework. The correlation with the PCMWW estimates using the original Parolin et al. (2022) framework is 0.71.

Table 4: Correlation of hardship and well-being outcomes with modified versions of Han, Meyer, and Sullivan (2020) poverty measure (n=26 months per group)

	Baseline Han, Meyer, & Sullivan: 12-Month Income, Pre-SNAP/EITC/CTC	Alternative Han, Meyer, & Sullivan: 1-Month Income, Without SNAP/EITC/CTC	Alternative Han, Meyer, & Sullivan: 1-Month Income, With SNAP/EITC/CTC	Baseline Parolin, Curran, Matsudaira, Waldfogel, & Wimer (2022)
All Individuals				
Food Insufficiency	-0.31	-0.30	0.29	0.58
Behind on Rent	-0.12	-0.10	0.33	0.48
Frequent Anxiety	-0.16	-0.16	0.31	0.52
Feeling Down	-0.14	-0.15	0.32	0.48
Lacking Interest	-0.21	-0.21	0.27	0.47
Frequent Worrying	-0.19	-0.20	0.29	0.54
Worried about Rent	-0.54	-0.53	0.02	0.48
Difficulty w/ Expenses	-0.24	-0.16	0.30	0.35

Note: Values represents the correlation of group-specific monthly poverty rates with group-specific hardship and well-being outcomes by group over April 2020 through May 2022 (n=26 months per group). Hardship and mental health data are from the Census Household Pulse Survey. Non-employment rates (one minus the employment rate) are from the Current Population Survey and are calculated among the age 18-64 year old populations for each group. *The two poverty measures estimate child poverty rates, while the Pulse provides hardship and well-being outcomes (and the CPS for non-employment rates) for adults with children present in the home.

As demonstrated previously, trends in the original HMS measure are inversely related to trends in all eight hardship and well-being outcomes. Applying the modified version of their measure that measures monthly (rather than annual) income, but excludes SNAP, the EITC, and the CTC, does not perform much better. However, adding in these three transfers drastically alters the performance of the HMS measure. As the third column of results shows, this modified HMS measure is now positively correlated with – and therefore moving in the same direction as – all eight outcomes, in some cases even approaching the performance of the PCMWW measure (fourth column of estimates). Put differently, including income transfers from three of the largest anti-poverty policies in the U.S. into one's measure of poverty strongly improves the ability of that measure to track real-world hardship and well-being outcomes.

IMPROVING MONTHLY POVERTY MEASURES MOVING FORWARD

Our final finding focuses on opportunities to improve sub-annual poverty measures moving forward:

Finding 6: The PCMWW and HMS measures share several shortcomings that can be addressed in future data advancements.

Parolin, Curran, Matsudaira, Waldfogel, and Wimer (2022) acknowledge several limitations of monthly poverty measures, as currently constructed, that could be addressed in future work. Perhaps the most important contributions would be advancements in data infrastructure: an ideal data environment would not require the assumptions made about converting annual to monthly income in Parolin et al. (2022), or the income components included in the categorical measure of resources applied in Han, Meyer, and Sullivan (2020). Monthly administrative or survey data on detailed income components received in the prior month, or recent months, would go a long way in improving monthly poverty measures.

Second, debate should continue regarding the most appropriate number of months over which to measure resources when evaluating a family unit's poverty status. Though 12 months is the norm, rising intra-year volatility of incomes arguably warrants smaller and more-frequent income accounting periods. Though Parolin et al. (2022) adopt a monthly income account period, arguments could be made for three-month or six-month income accounting periods, as well. Data advancements that allow for such measurements on a near-real-time basis would allow for greater evaluation of the advantages and disadvantages of different income accounting periods.

Finally, we recommend that the U.S. Census Bureau consider the possibility of formally measuring and releasing sub-annual estimates of poverty as a supplement to their annual estimates of poverty. Census is better equipped than most groups of academic researchers to produce the highest-quality estimates of poverty, given their ability to collect and access many types of income data. In moving toward sub-annual estimates of poverty, we

recommend that Census consider advantages and disadvantages of the varying approaches put forth by researchers in prior years, and to evaluate the validity of any sub-annual estimates in relation to a wide variety of external indicators of economic and social well-being.

CONCLUSION

The economic consequences of the COVID-19 pandemic demanded more frequent estimates of poverty to understand economic need, and the impact of the government's response, in close to real time. This study has compared the performance of two measures of poverty that have sought to offer monthly updates of the economic well-being of family units across the country: the monthly poverty measure introduced in Parolin, Curran, Matsudaira, Waldfogel, and Wimer (2022; PCMWW) and the measure introduced in Han, Meyer, and Sullivan (2020; HMS).

Specifically, this paper documented the differences between the PCMWW and HMS measures and compared their monthly estimates to external benchmarks such as monthly levels of food insufficiency, mental health, and employment outcomes.

We found, first, that the PCMWW monthly poverty estimates far out-performed the HMS estimates in tracking monthly variation in eight different material hardship and mental health outcomes. Trends from the HMS measure were inversely related to all eight outcomes across all five demographic groups examined; in other words, when the HMS measure of poverty was higher, hardship and mental health challenges were generally lower. By contrast, when the PCMWW monthly poverty estimates are higher, so too are levels of material hardship and mental health challenges. The HMS measure particularly misrepresents monthly variation in the living conditions for families with children and Black individuals of all ages. Moreover, we find that tracking monthly employment rates offers a more reliable tool than the HMS estimates for understanding monthly variation in material hardship and mental health. In contrast, the PCMWW estimates generally outperform monthly employment rates in explaining trends in hardship and mental health.

We then identified the primary sources of variation between the two measures'

performances. We largely ruled out that differences in poverty trends between the PCMWW

and HMS estimates can be meaningfully attributed to different techniques for merging

information from the CPS ASEC and Basic Monthly files, or to measurement error in

converting annual income components to monthly income components. Instead, differences

between the PCMWW and HMS estimates of monthly poverty are primarily due to the

PCMWW inclusion of (and HMS exclusion of) benefits from SNAP, the EITC, and the CTC.

We show that a modified HMS measure that includes these benefits strongly outperforms the

original HMS measure in tracking trends in hardship and well-being.

Finally, we acknowledged that both the PCMWW and HMS measures have

shortcomings that should be resolved, ideally through improvements in the data infrastructure

to measure monthly income components, in order to improve the measurement of sub-annual

poverty estimates moving forward.

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APPENDICES

APPENDIX A: Trends in monthly child poverty rates

Figure A1: Monthly estimates of child poverty by measure
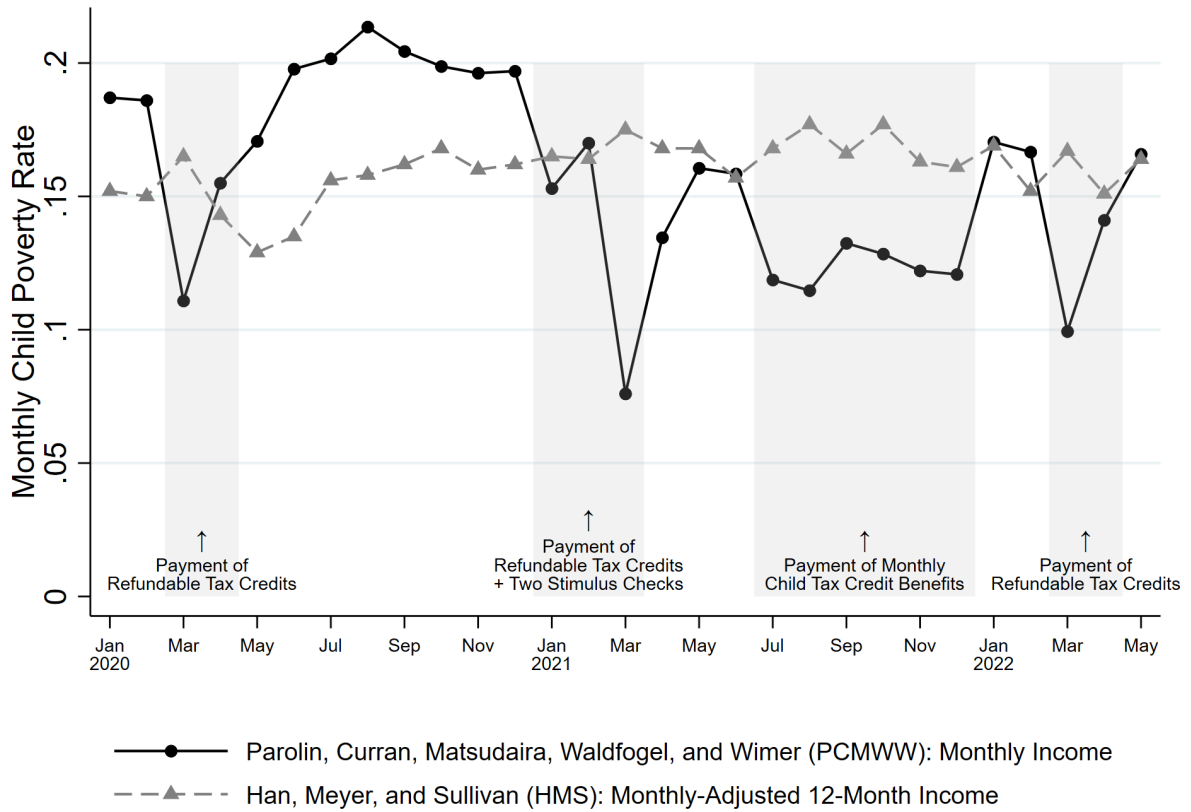
Note: The monthly estimates from Han et al. (2020) are from "Real-time Poverty Estimates During the COVID-19 Pandemic through May 2022" accessed in July 2022. The monthly estimates from Parolin et al. (2022) are from the Columbia University Monthly Poverty Data accessed in July 2022.

APPENDIX B: Details on the Census Household Pulse Survey

The Census Household Pulse Survey (Pulse) provides nationally-representative estimates of material hardship and mental health challenges from April 2020 through May 2022. The Census randomly selects addresses to participate in the Pulse, then sends either an email or a text message to the contact information associated with the household, prompting the recipient to participate in a 20-minute online survey asking questions related to education, employment, food security, housing, and more. Combined, the surveys include more than 1 million unique respondents. We convert the (bi-)weekly data to months to remain consistent with our other indicators. Most surveys are conducted within a given month; some, however, overlap slightly. For example, the Week 18 survey was conducted between October 28 and November 9. In these cases, we assign the week's data to the month that features the larger number of days (November, in this case). Table B1 presents the definitions for the eight hardship and mental health indicators that we incorporate into our validation test.

Table B1: Overview of material hardship and mental health indicators from the Census Household Pulse Survey

Type of Hardship	Prompt	Qualifying Responses
Food	In the last 7 days, which of these statements best describes the food eaten in your household?	*Sometimes* or *often* not enough to eat
Housing	Did you pay your last month's rent or mortgage on time?	No.
Anxiety	Over the last 7 days, how often have you been bothered by the following problems: Feeling nervous, anxious, or on edge?	More than half the days or nearly every day.
Worrying	Over the last 7 days, how often have you been bothered by the following problems: Not being able to stop or control worrying?	More than half the days or nearly every day.
Lacks Interest	Over the last 7 days, how often have you been bothered by the following problems: having little interest or pleasure in doing things?	More than half the days or nearly every day.
Feeling Down	Over the last 7 days, how often have you been bothered by the following problems: feeling down, depressed, or hopeless?	More than half the days or nearly every day.
Difficulty with Expenses	In the last 7 days, how difficult has it been for your household to pay for usual household expenses, including but not limited to food, rent or mortgage, car payments, medical expenses, student loans, and so on?	*Somewhat* or *very* difficult.
Worried about Making Rent or Mortgage	How confident are you that your household will be able to pay your next rent or mortgage payment on time?	*Not at all* or *slightly* confident.

Note: To ensure that we are consistently measuring financially-enforced food insufficiency, we limit our positive responses of "food insufficiency" to respondent that report that they are food insufficient primarily due to an inability to afford sufficient food. Our conclusions are consistent if we do not impose this restriction.

APPENDIX C: Potential Objections to the Comparisons of Validity

Potential Objection 1: Are trends in hardship and well-being from the Pulse reliable?

As detailed in Appendix B, the Census Bureau introduced the Census Household Pulse Survey (Pulse) in April 2020 to provide high-frequency data on the economic and social well-being of individuals across the U.S. As a web-based survey with low response rates (averaging at 5.9 percent response across waves 1 through 47), the Pulse is prone to measurement error. Cross-sectional point estimates from any wave of the Pulse tend to suggest, for example, that vaccine uptake is higher than observed in reality (Bradley et al., 2021); moreover, point estimates of food insufficiency are not comparable to other surveys, given different sampling methods and question designs (Winship & Rachidi, 2020).

The important question for the present analysis, however, is the internal consistency of the Pulse across survey waves. The Pulse has consistently employed the same broad survey strategy since its inception in April 2020. There is no compelling evidence that wave-to-wave trends in estimates of material hardship or mental health suffer from measurement error that would bias the trends to being comparable with employment rates (from the Current Population Survey) and estimates of poverty from Parolin et al. (2022), while simultaneously pushing the trends toward being negatively associated with the Han et al. (2020) measure.

That said, there are some differences in sampling strategy across Pulse waves (or its three 'phases') that could affect internal consistency of the Pulse estimates (which would affect comparisons to both of the poverty measures evaluated here). Between Phase 1 (April to July 2020) and Phase 2 (August to October 2020) of the Pulse, the survey was changed from a weekly to biweekly format, while response rates increased from around 3 percent in Week 12 to 10 percent in Week 13. To address the possibility that these changes to the Pulse sampling strategy bias the conclusions reached in this study, Table C1 repeats the associations provided above, but when excluding Pulse Phase 1 (April to July 2020).

**Table C1:** Comparison of associations when excluding Pulse Phase 1

	All Pulse Phases (Apr 2020 to May 2022)		Without Pulse Phase 1 (Without Apr to July 2020)	
	Parolin et al. Monthly Pov.	Han et al. Monthly Pov.	Parolin et al. Monthly Pov.	Han et al. Monthly Pov.
All Individuals				
Food Insufficiency	0.58	-0.31	0.48	-0.08
Behind on Rent	0.48	-0.12	0.36	0.10
Frequent Anxiety	0.52	-0.16	0.41	0.09
Feeling Down	0.48	-0.14	0.44	0.01
Lacking Interest	0.47	-0.21	0.40	0.01
Frequent Worrying	0.54	-0.19	0.45	0.10
Worried about Rent	0.48	-0.54	0.60	0.11
Difficulty w/ Expenses	0.35	-0.24	0.36	-0.23

Narrowing the scope to Phases 2 and 3, with higher response rates and consistent biweekly sampling periods, leads to the same conclusions reached in Table 1. Moreover, any differences in the two sets of estimates are likely due to the omission of real patterns of material hardship and mental health observed from April to July 2020 rather than differences in response rates or sampling strategy across the three Pulse phases. These findings reinforce the fact that any change in response rates, or any persistent bias in estimates due to sampling frame or response

rate concerns, will affect comparisons to both the Parolin et al. (2022) and Han et al. (2020) measures. Thus, it is highly unlikely that any measurement error in the Pulse is the cause behind the Han et al. (2020) measure's consistently negative associations with hardship and well-being trends and the Parolin et al. (2022) measure's consistently positive associations. Recall from Table 1, as well, that employment rates from the Current Population Survey were, like estimates from the Parolin et al. (2022) measure, strongly and positively associated with the hardship and well-being outcomes.

As a separate test of the Pulse's internal consistency, Figure C1 compares monthly variation in employment rates according to the Pulse with monthly variation in employment rates according to the Current Population Survey (CPS) from April 2020 through May 2022.

Figure C1: Comparison of variation in monthly employment rates in Current Population Survey (CPS) and Census Household Pulse Survey (CPS), April 2020 – May 2022
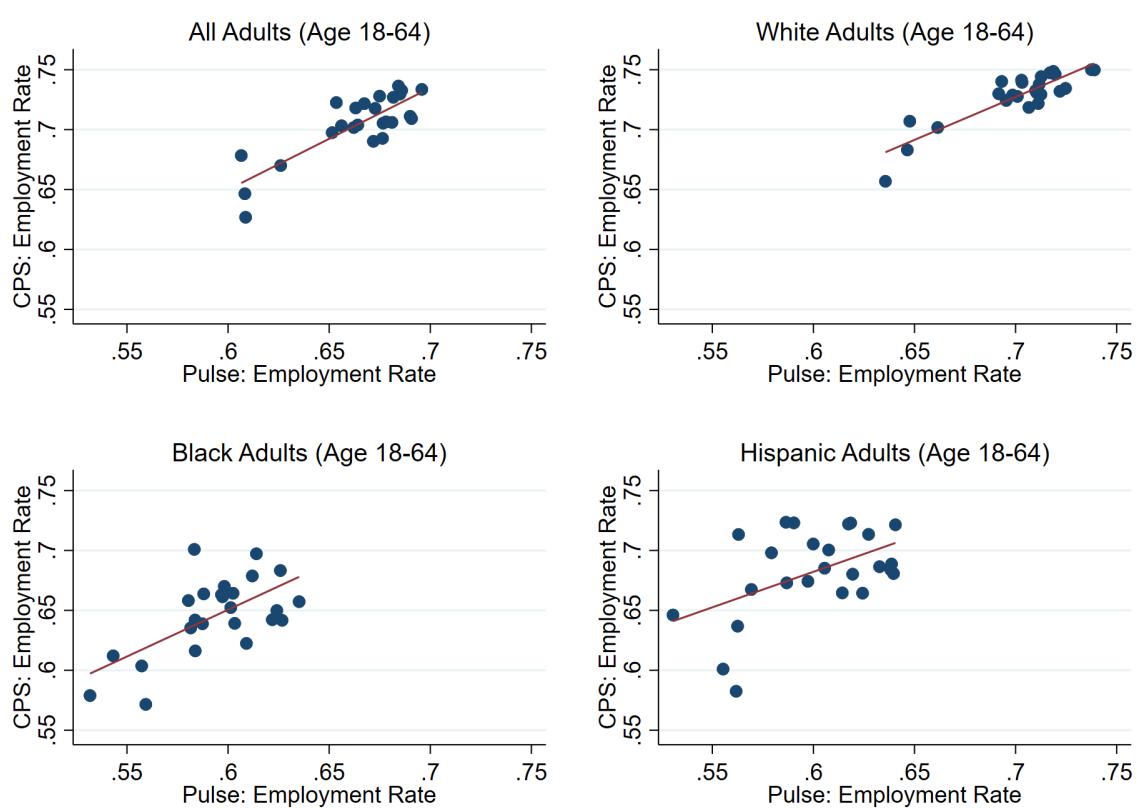
Note: The Pulse employment question asks: "In the last 7 days, did you do ANY work for either pay or profit?". The CPS employment measure also captures employment status in the prior week.

The upper-left panel shows strong consistency in trends in employment observed in the Pulse compared to trends in employment in the CPS (r = 0.83). While the Pulse generally features lower employment rates for any given months, month-to-month changes in unemployment nonetheless track well with the changes observed in the CPS. The subsequent panels show that trends in employment between the two surveys are more closely aligned for White adults (upper-right panel; r = 0.88) than for Black adults (r = 0.63) or Hispanic adults (r = 0.50). Thus, it may be that the Pulse sampling design affects the consistency of results more for Black and Hispanic respondents relative to White respondents.

Nonetheless, recall from Figure 1 and Table 1 that the positive associations of Parolin et al. (2022) poverty estimates with the Pulse outcomes, and the negative associations of the Han et al. (2020) estimates, are consistent whether examining results across the full population, within any single racial/ethnic group exclusively, or among respondents with children exclusively. This was also true regarding the positive associations of the CPS employment rates with the Pulse outcomes. Put simply: there is no reliable evidence to suggest that the conclusions reached in this paper are due to any wave-to-wave inconsistencies in Pulse sampling procedures or response rates.

Potential Objection 2: Poverty and material hardship are separate concepts.

A second potential argument is that trends in poverty should not generally align with trends in material hardship or subjective well-being. It is true that poverty and material hardship have long been treated as separate concepts in the poverty literature (Atkinson, 2019), and the two measures should not always align. One can face food insufficiency without being classified as in poverty; likewise, one can be classified as living in poverty without facing food insufficiency. Nonetheless, if trends in poverty and material hardship are consistently moving in opposite directions, it is reasonable to question the validity of one of the two indicators. Han et al. (2022) also note that "a key goal of poverty measurement is to identify deprivation" (p.31). But estimates of the Han et al. (2020) monthly poverty measure tend to be higher when estimates of hardship and well-being tend to be lower; this is true across 37 of the 40 group-outcome combinations that this study examined.

Potential Objection 3: Should an annual measure of poverty align with short-term measures of poverty?

A third potential objection is that a 12-month income period used in Han et al. (2020) should not necessarily produce a measure of poverty that aligns with questions related to the experience of food hardship (or other outcomes) from the past week. However, month-to-month variation in monthly poverty measures are meant to reflect month-to-month variation in living conditions, and even the 12-month income accounting period is comparing income received in one month to a past month (see Finding #3). Thus, it is fair to expect trends in a monthly poverty measure – even with a moving 12-month accounting period – to bear some resemblance to monthly trends in hardship or well-being.

Potential Objection 4: Does measurement error in the conversion of annual to monthly income estimates drive the findings?

As Parolin et al. (2022) acknowledge, the conversion of annual to monthly income components in the CPS ASEC "may bias the projected monthly incomes of family units who do not fit neatly within the assumptions" that their framework applies. Particularly for individuals who have switched from non-employed in the prior calendar year (say, 2019) to employed at the time of survey (say, March 2020), measurement error is likely: the respondent will have no earnings in the prior year from which to estimate current monthly earnings, likely resulting in an underestimate of the individual's (and, in turn, family unit's) monthly income. This limitation emphasizes the need, as discussed in this study, for direct information on monthly income components in order to improve monthly poverty measures moving forward.

However, because this form of measurement error is small (around 1 percent of respondents report being employed despite not having earnings in the prior year) and only exists in the CPS ASEC file, rather than monthly CPS files, any error in projecting poverty status should be

small and should slightly affect *levels* across all months, but should not meaningfully affect *trends* in estimates. To demonstrate this point, Figure C2 below compares the observed poverty estimates from the PCMWW measure to a revised set of estimates that excludes family units in which an adult reports being employed in the present month, but lacks earnings information from the prior year to inform current earnings. Figure C2 shows that the monthly variation in the estimates is near-identical (r = 0.999), and the difference in levels between the estimates in any given month is less than a percentage point.

Figure C2: Association of PCMWW baseline estimates with alternative estimates that removes family units in which an adult employed in the prior week reports no earnings in the prior year
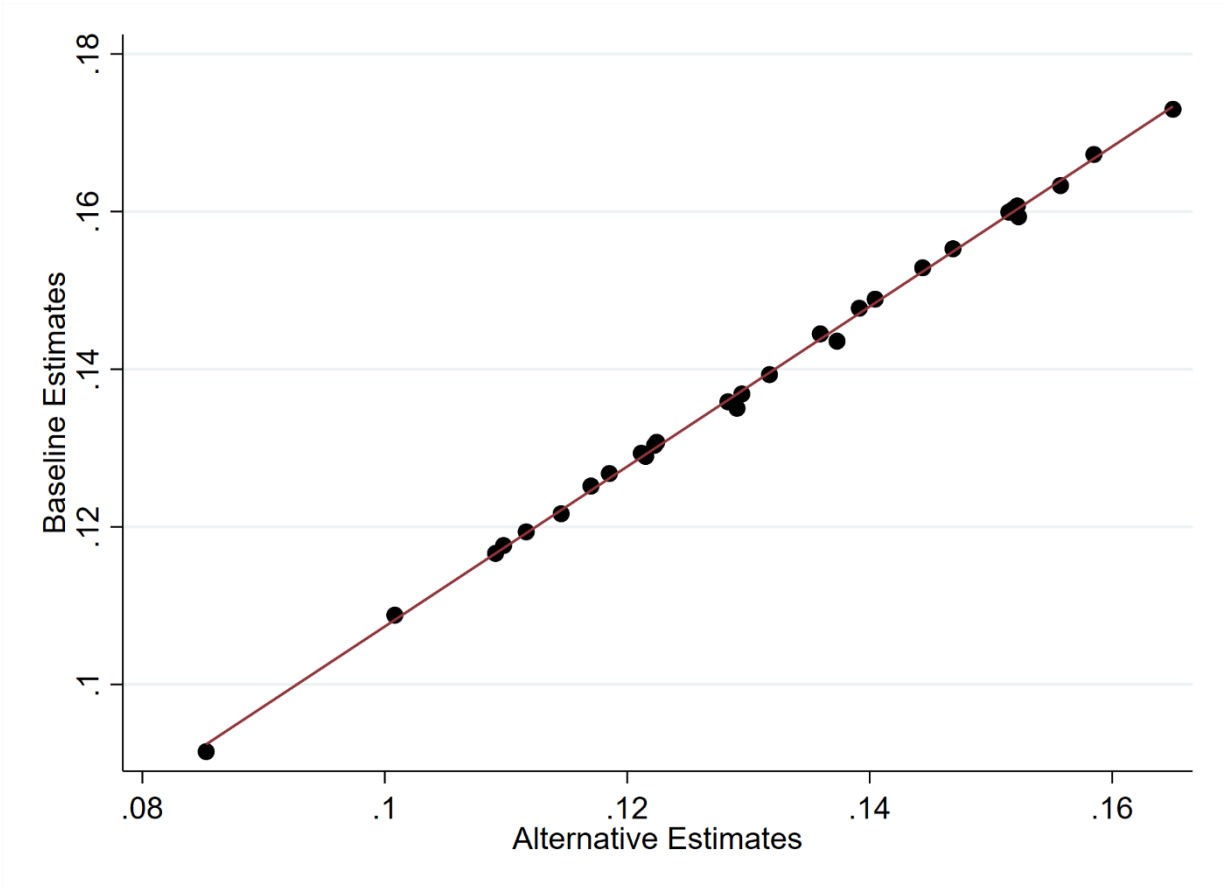
Note: Correlation of r = 0.999. The consistency of the trends also holds when imputing earnings based on median earnings of education, age, state, and gender cells.

APPENDIX D: Reproducing Monthly Poverty Measures

Figures 3 and 4 displayed reproductions of monthly poverty rates for both the HMS and PCMWW measures using the logic of the Han et al. (2020) framework. We produced these estimates using the following procedures:

In a given Monthly CPS file, we limit the sample to respondents with "month in sample" of 1 or 5. We drop respondents with an imputed value of total income over the prior 12 months. We drop individuals in households who are unrelated to the head of the household. We create indicators to measure: whether the head of the household is age 65 or older, the number of family members present in the household, and the number of children present in the household. We top-code family size at 9 individuals and number of children at 8 children to align with available poverty thresholds from the official poverty measure (OPM). We identify the family income of the householder over the prior 12 months ("faminc" in the IPUMS CPS files; this is a categorical variable with 16 income intervals). We then establish bins based on the 16 categorical income levels, the family size, the number of children, and whether the head is age 65 or older. Within each bin, we randomly rank all individuals, which we will use for matching with randomly-ranked individuals in the same bins in the CPS ASEC file.

Still within the Monthly CPS file, we produce OPM poverty thresholds for 2020 through 2022. We apply the 2021 OPM thresholds to months in 2022. (This differs slightly from the revised approach of Han et al. (2020), who now adjust the poverty threshold each month to account for inflation). To be able to replicate the PCMWW estimates, which are based on the Supplemental Poverty Measure (SPM) framework, we merge in the SPM threshold's geographic adjustments based on the metropolitan area of a given respondent. We then merge in the (non-geographically-adjusted) SPM thresholds based on the number of children and adults in the household. (Given different resource-sharing units identified in the SPM and OPM frameworks, this is not a true replication of the SPM poverty measure, but we proceed accordingly to reduce inconsistencies in the OPM-like and SPM-like measures to be produced from this exercise). We apply the thresholds for renters, given our inability to distinguish renters versus home-owners in the Monthly CPS files. We then create a final SPM-like threshold by adjusting the base thresholds for differences in cost of living using the geographic adjustments merged in previously.

In the CPS ASEC file, we identify the same covariates as created in the Monthly CPS file (age of head and family structure). We use the continuous measure of total family income from the prior calendar year ("ftotval") to create 16 categorical income groups that match the intervals from the Monthly CPS files ("faminc"). We again create bins based on categorical income level, family size, number of children, and whether the head is age 65 or older, and we again randomly rank all individuals within each bin.

Consistent with Han et al. (2020), our objective is to randomly transfer continuous family income values from the ASEC file to respondents within the same bin in the monthly file. This transferred measure of family income is then used to estimate poverty status within the Monthly CPS file. We complete this transfer this by matching the ASEC income values to the Monthly CPS based on the random ranks assigned to each respondent within each bin (in other words, respondents within the same grouping of categorical income, family size, number of children, and head who is 65 or older). We show in Figure 3 that this approach produces poverty estimates that near-perfectly match with published estimates from the HMS measure.

To extend this method beyond the original Han et al. (2020) approach, however, we make three extensions. First, in addition to transferring the total family pre-tax cash income from the prior calendar year ("ftotval") for respondents within a given bin, we also transfer the estimated monthly pre-tax cash income for the same set of merged respondents. We estimate the monthly income following the conversion process detailed in Parolin et al. (2022). We match the income definition used in the annual pre-tax money income measure, meaning that we exclude refundable tax credits, SNAP benefits, and so on. Assessing trends in this measure provides a first assessment of how the monthly versus annual income accounting framework affects trends in estimates (but with a pre-tax money income definition); the results are in Figure 4.

Second, we transfer a version of monthly income that also includes the monthly value of benefits from SNAP, the EITC, and the CTC; following Parolin et al. (2022), these estimates of monthly benefit values take into account any contemporary policy changes, such as the monthly CTC payments in the second half of 2021, but also benefit increases in SNAP over time (including through the use of Emergency Allotments in some states). In other words, we are adjusting the HMS measure simply to include benefits provided from these three large income transfer programs that are excluded from their income measure. The results are displayed in Figure 4.

Third, we transfer a version of monthly income based on the SPM income measurement framework, following Parolin et al. (2022). This includes all taxes, transfers, and deductions from the SPM framework, and is used to replicate the PCMWW trends in monthly poverty using the logic of the Han et al. (2020) methodology. This helps to rule out that differences in trends between the two measures are primarily a product of different methodologies for matching the ASEC information to the CPS Monthly; Figure 3 shows that reproducing the PCMWW estimates using this approach generates trends that are strongly consistent with the original estimates.

To clarify, we do not create new categorical income variables or bins based on these alternative income definitions; instead, we always match ASEC observations to the monthly CPS respondents using the annual family pre-tax money income variables ("ftotval" and "faminc"). The logic is that for a given family that matches based on their annual pre-tax money income (used to create the HMS estimates of poverty), we can also pass along income levels *for the same family* under different approaches to measuring income (capturing their estimated monthly income, or their income with additional income components added, etc.). Thus, we can show that making certain adjustments to the measurement of the same family unit's income leads to vastly different trends in poverty estimates.

Figures 3 and 4, and Table 4, present the results of these reproductions and demonstrates that the extended HMS measure that includes benefits from SNAP, the EITC, and the CTC more logically responds to real-world policy changes throughout 2020 to 2022, and far outperforms the original HMS estimates in aligning with trends in hardship and well-being.