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Abstract

Questions about the adequacy of the official poverty measure led to the development of the Supplemental Poverty Measure, designed to be released concurrently with the official poverty measure. We raise two concerns with the Supplemental Poverty Measure: a discontinuity in the economies of scale implied by the equivalence scale and the adjustment for local prices using only housing costs. We propose corrections for both issues that can be applied by anyone using the public use files of the Current Population Survey. The changes we propose would have the greatest effect on poverty rates for the elderly and would reduce the difference in poverty rates by metro status.

Keywords: supplemental poverty measure, equivalence scales, spatial price index.

JEL Classification: I32.

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1. Introduction

We offer two proposals for improving the Supplemental Poverty Measure (SPM). The first proposal corrects a discontinuity in the economies of scale implied by its equivalence scale for income receiving units of different size and composition. The second proposal replaces the adjustment for geographical price variation based on housing costs with more comprehensive regional price parities (RRPs) released by the U.S. Bureau of Economic Analysis (BEA) in 2014. Both proposals can be applied to data from the public use files of the Current Population Survey (CPS). We investigate the implications of these adjustments for the overall SPM poverty rate and for its composition by race, age, and metropolitan status.

2. Two Proposals

In response to the widely recognized and well documented [see, e.g., Ruggles (1990)] shortcomings of the U.S. official poverty measure (OPM), the National Academy of Sciences (NAS) created a Panel on Poverty and Family Assistance that offered guidelines for improving the measurement of poverty in the U.S. (Citro and Michael, 1995). This report prompted the U.S. Federal Government to establish an Interagency Technical Working Group (ITWG) in 2010 with the charge of developing a Supplemental Poverty Measure (SPM). In her detailed description of the SPM and comparison to the OPM, Short (2015, 2) notes that the SPM is based "largely on the NAS panel's 1995 recommendations" but also reflects ITWG (2010) suggestions. Appendix Table A replicates the Current Population Report (Short, 2014) comparison of the SPM to OPM. Our focus is on the threshold adjustments (in italics), those for cost of living differences, and those for family size and composition differences (equivalence scales).

Meyer and Sullivan (2012) also compare the OPM to the SPM and to a consumption-based poverty measure, and comment on a number of the assumptions built into the SPM. At the time of their writing, the ITWG planned to adopt a continuous equivalence scale proposed by Betson (2004) instead of the one recommended by the NAS (Hutto, *et al.*, 2011, 9), leading Meyer and Sullivan (2012, 116) to claim that the SPM scale, "exhibits diminishing marginal cost with each additional child or adult", unlike the OPM. As we will show, however, the actual equivalence scale implemented for the SPM does not have this property.

Our second proposal follows Renwick, *et al.* (2014) by exploring the possibility of adopting the BEA RPPs in place of the housing cost measures. We extend their work by recognizing that the SPM poverty thresholds (Short, 2015), defined by housing ownership status (owners without mortgages, owners with mortgages, and renters), are related to the different spatial distributions of the groups. The average housing-specific RPP in 2012, for example, was 0.9221 for owners without mortgages, 1.0024 for owners with mortgages, and 1.0528 for renters. Thus, only the second group lives in areas where housing costs are nationally representative.

The three SPM thresholds (T_s) include the cost of housing (H), food (F), clothing (C), and utilities and other miscellaneous goods (U). Hence, $T_s = H_s + F_s + C_s + U_s$. Multiplying and dividing the right side by T_s, we have $T_s = (\alpha_{Hs} + \alpha_{Fs} + \alpha_{Cs} + \alpha_{Us})T_s$, where $\alpha_{Hs} = H_s/T_s$, is an expenditure share and the shares sum to one. Thus, we can write $T_s = \alpha_{Hs}T_s + (1 - \alpha_{Hs})T_s$. In the SPM the first term in this expression is multiplied by a housing cost measure (Renwick, *et al.*, 2014, 4). This step is problematic, however, as α_{Hs} is calculated from consumer expenditure data in which spatial differences in housing and utility costs are already embedded. Furthermore, the SPM housing measure considers fewer differences in housing quality than the BEA housing-specific RPP and it is not normalized to 1.0.

To avoid these problems, we compute $T_s' = (\alpha_{Hs} T_s)/RPP_{Hs} + (1 - \alpha_{Hs})T_s$, where the RPP_{Hs} is one of the ownership status, housing-specific averages given above. For the owners with mortgages, $T_s' \approx T_s$, but the poverty thresholds change more substantially for the two other groups. We then adjust the full poverty thresholds by the *overall* RPP, $T_{ijs}' = RPP_{ij}(T_s')$, where i denotes the region and j denotes metropolitan status, as in Renwick, *et al.* (2014, 7). Note that the regional unit of analysis for the RPPs is the MSA for metropolitan areas and the state for all non-metropolitan areas. The item-specific RPPs, except for housing, are not available in the CPS public use files.

3. Implications of the Proposals

In this section, we examine the consequences of changing the equivalence scales, spatial price adjustments, and the interaction of both together to explore the effects of all our proposed changes to the SPM. We take as given the SPM resource measure, which is broader than the official resource measure (see Table A in the Appendix for comparisons of the two measures). Table 1, column 1, shows the current SPM equivalence scales, normalized to a single adult. We show the marginal cost of each additional person implied by each scale in brackets. Note that the SPM scale implies a discontinuity in marginal cost between the second (0.41) and third adult (0.75). The NAS (column 2) does not imply any discontinuity. In column 3 we show a modified version of the SPM scale that removes the discontinuity while preserving the declining marginal cost of children after the first child (c.f., Bishop, *et al.*, 2014).

Table 1: Alternative equivalence scales for poverty measurement*

Family Composition	Supplemental Poverty Measure[1] (1)	National Academy of Sciences[2] (3)	SPM With No Discontinuity[3] (4)
1 Adult	1.00	1.00	1.00
2 Adults	1.41 [0.41]	1.62 [0.62]	1.62 [0.62]
3 Adults	2.16 [0.75]	2.16 [0.54]	2.16 [0.54]
4 Adults	2.64 [0.48]	2.64 [0.48]	2.64 [0.48]
1 Adult, 1 Child	1.51 [0.51]	1.45 [0.45]	1.51 [0.51]
1 Adult, 2 Children	1.79 [0.28]	1.85 [0.40]	1.79 [0.28]
2 Adults 1 Child	1.90 [0.49]	2.00 [0.38]	2.05 [0.43]
2 Adults 2 Children	2.16 [0.26]	2.36 [0.36]	2.31 [0.26]

* The numbers is brackets are the marginal cost of an additional person.

Notes:

1. SPM (Short, 2015): for one and two adults, $scale = (adults)^{0.5}$; for single parents, $scale = [adults + 0.8(first\ child) + 0.5(other\ children)]^{0.7}$; for all other families, $scale = [adults + 0.5(children)]^{0.7}$
2. NAS (Citro and Michael, 1995): $scale = [adults + 0.7(children)]^{0.7}$
3. Modified SPM: $scale = [adults + 0.8(first\ child) + 0.5(other\ children)]^{0.7}$

Table 2 presents the effects of our proposed adjustments on several SPM poverty rates: overall, by age group (elderly and children), by race (Black and Hispanic), and by geographic residence (metro and non-metro). Table 2.a replicates the current OPMs and SPMs for 2012, providing a benchmark for our analysis. While SPM poverty is roughly one percentage point higher than OPM poverty overall, the most dramatic differences are in the poverty rates for the elderly (much higher under the SPM) and children (much lower under the SPM). Furthermore, Black and Hispanic poverty rates reverse rankings, with Black poverty higher under the OPM

and Hispanic poverty higher under the SPM. Finally, the metro and non-metro poverty rate comparisons show the effect of housing cost adjustments in the SPM.

Table 2: Supplemental Poverty Measure with alternative equivalence scales and spatial price adjustments, 2012

Poverty measures	Overall	Elderly	Children	Black	Hispanic	Metro	Non-metro
2.a *Current measure*							
Official Poverty Measure	15.1	9.1	22.3	27.3	25.8	14.6	17.8
Supplemental Poverty Measure	16.0	14.8	18.1	25.9	27.9	16.4	14.0
2.b Single Threshold							
Single Threshold	16.1	16.7	17.7	25.5	27.4	16.4	14.8
2.c *With alternative equivalence scales*							
Orshansky scale	15.8	13.6	18.9	25.9	27.5	16.2	13.6
National Academy of Sciences scale	15.4	14.2	17.9	24.5	26.9	15.7	13.4
No discontinuity SPM scale	16.8	16.9	18.1	26.7	28.7	17.1	14.8
2.d *With spatial price adjustments (RPPs)*							
Housing-specific RPP correction	15.8	14.9	17.7	25.3	27.2	16.1	13.8
Complete RPP adjustment	15.2	14.4	16.9	24.4	25.6	15.4	14.1
2.e *With alternative equivalence scales and spatial price adjustments (RPPs)*							
National Academy Scale and RPP	14.6	13.6	16.7	23.2	24.6	14.7	13.7
No discontinuity SPM scale and RPP	15.9	16.5	17.0	25.2	26.3	16.1	15.0

Table 2.b collapses the multiple thresholds into a single threshold (of equal average value). The multiple thresholds are not a recommendation of the NAS, so we are curious to see its effect on the SPM poverty rates. The multiple threshold assumption has a large negative effect on the elderly poverty rate (more than one-half of the elderly are without mortgages, but only one-fifth of the non-elderly) and a positive effect on the non-metro poverty rate (non-metro areas also have a higher percentage of owners without mortgages).

Table 2.c reports the effects of three alternative equivalence scales. First we combine the SPM income concept and poverty thresholds with the OPM (Orshansky) equivalence scale. In this comparison, the overall poverty rates are similar (16.0 vs. 15.8). Like the current SPM, but unlike the OPM, combining the SPM income concept and the OPM equivalence scale results in higher Hispanic poverty relative to Black poverty. This result shows that the change in income concept, rather than the change in equivalence scale, is responsible for reversing the Black-Hispanic poverty rankings as we move from the OPM to the SPM.

Table 2.c also reports poverty rates for the NAS equivalence scale and the modified (no discontinuity) SPM scale. Using the NAS scale reduces the overall poverty rate (from 16.0 to 15.4) and reduces poverty rates by age, race, and metro status relative to the SPM poverty rates. Using the modified SPM equivalence scale increases the overall poverty rate (16.0 to 16.4) and increases poverty for all groups except children. Most significantly, elderly poverty rises by 2.1 percentage points when we remove the discontinuities embedded in the current SPM equivalence scale.

These results lead us to investigate why the poverty rates for the elderly are so sensitive to the assumptions built into the SPM. Notice first that replacing the OPM with the SPM results in a dramatic 62 percent increase in elderly poverty in Table 2.a (from 9.1 percent to 14.8 percent).

Furthermore, if we relax *either* the multiple thresholds or the equivalence scale discontinuity – neither of which are called for in the NAS recommendations – the resulting elderly poverty rate is 85 percent higher than the OPM rate. Figure 1, which shows cumulative distribution functions (CDFs) for elderly and nonelderly incomes, reveals why the elderly poverty rates are so sensitive to modest changes in poverty measurement methodology. The elderly CDF rises much faster, so small changes in poverty thresholds will have large effects on the elderly poverty rates.

Figure 1

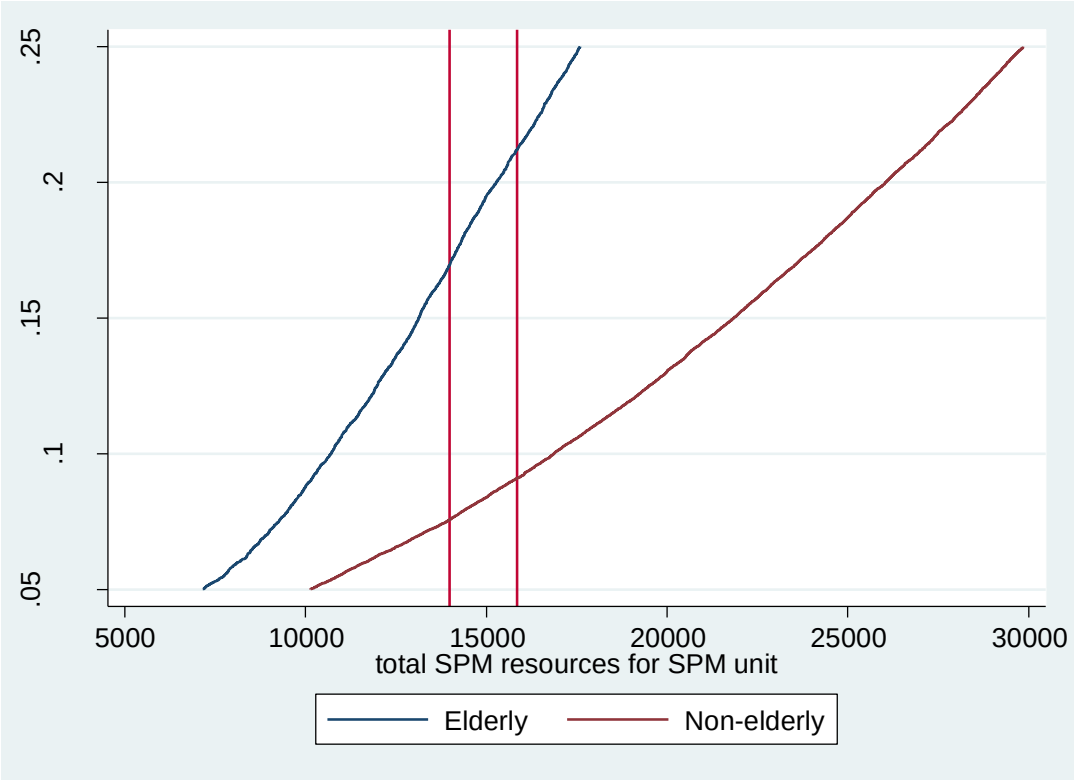

Table 2.d reports the effects of using the RPPs to adjust for spatial price differences. In the first row of Table 2d we make only housing-specific RPP corrections to housing expenditures for each group, which moves the poverty thresholds from T_s to T_s'. In the second row of Table 2c we

use overall RPPs to adjust the full poverty thresholds from T_s' to T_{ijs}'. With complete adjustment, the mean poverty thresholds (compared to the current SPM thresholds) increase from $21,400 to $21,717 for owners without mortgages, decrease from $25,784 to $25,763 for owners with mortgages, and decrease from $25,105 to $24,661 for renters.

In the first row of Table 2.d, where we adjust only the housing component of the poverty thresholds, the overall poverty rate falls slightly from 16.0 to 15.8 and the changes to subgroup poverty rates are all small. In the second row of Table 2.d, where we make the full spatial price adjustments, the overall poverty rate declines further (to 15.2 percent), the Hispanic poverty rate falls more sharply (to 25.6 percent), and the poverty rate gap by metro status narrows from 2.4 to 1.3 percentage points. The reduction in the overall poverty rate can be attributed largely to the difference in the mean housing cost indices in the SPM (1.02) and RPP (1.00).

Table 2.e combines the two proposals – applying alternative equivalence scales (NAS or SPM modified to remove the discontinuities) and RPP adjustment for local prices. When the combination involves the NAS scale, it reduces the overall poverty rate by 1.4 percentage points (16.0 to 14.6), lowers poverty rates for both age groups and for both racial groups, and narrows the metro-status gap from 2.4 to 1.0 percentage points. Using the modified SPM scale has little effect on the overall poverty rate, but it increases elderly poverty by 1.7 percentage points and increases non-metro poverty by 1.0 percentage point. The gap between the elderly and children shrinks to one-half a percentage point using the modified SPM scales. As with the NAS scales, using the modified SPM scale with the RPPs reduces the metro-status poverty rate gap.

Table 2.e also highlights the importance of the choice of the equivalence scale. The NAS and modified SPM scales differ on how they adjust for children--the NAS counts all children as 0.7 adults while the modified SPM scale counts the first child as 0.8 adult and additional children

as 0.5 adults. However, this seemingly small change results in a 1.3 percentage point difference in poverty rates between the NAS and modified SPM scales. For the elderly, the NAS scales generate a poverty rate 2.9 percentage points lower than the modified SPM.

An additional variable in the NAS and modified SPM equivalence scales is the choice of the economies of scale factor. The NAS panel recommends an economy of scale factor of between 0.6 and 0.8; the results reported above are based ITWG's choice of 0.7 for the SPM.

Figure 2

SPM Poverty Rates by Scale Factor for NAS and Modified SPM Equivalence Scales

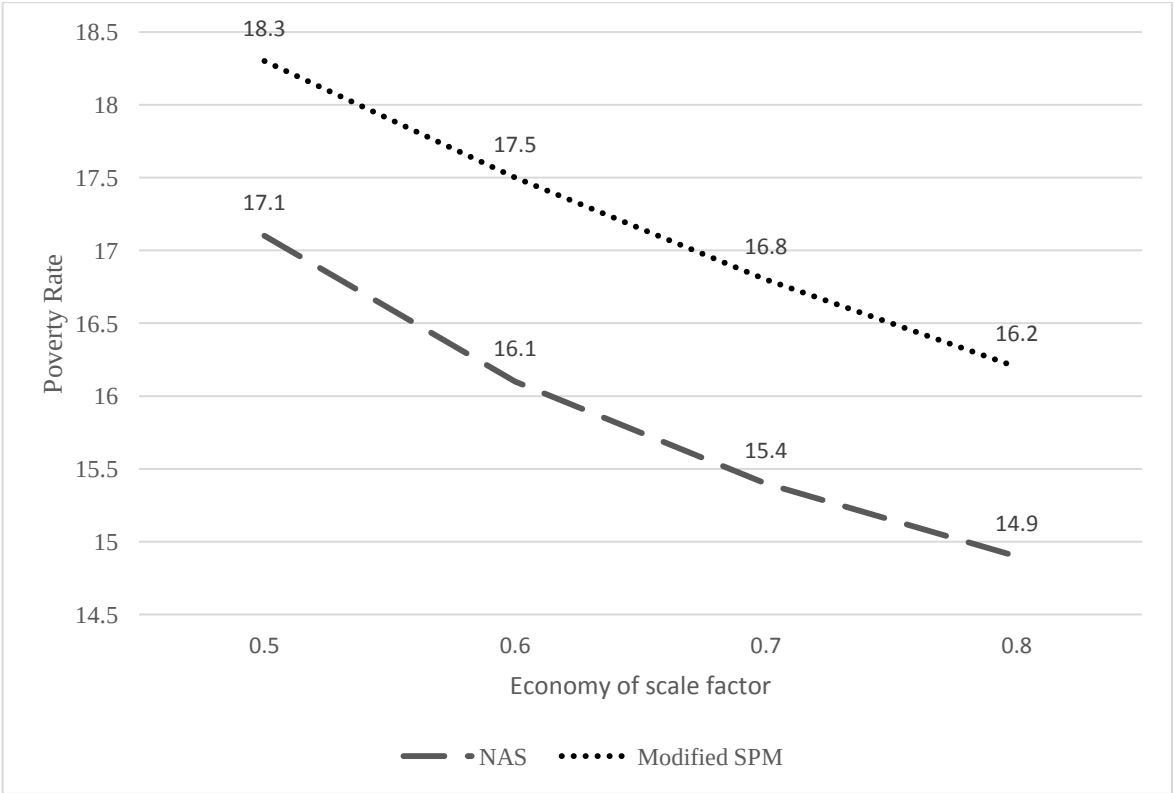

Figure 2 shows the change in poverty rates as the economies of scale factor varies from the square root (0.5) of family size to 0.8 power of family size. For both the NAS and modified SPM scales, the poverty rate changes by approximately two percentage points as the economies of scale factor changes from 0.5 to 0.8. Therefore, the choice of equivalence scale may be as important as using multiple thresholds or adjusting for RPPs. See Bishop, *et al.* (2014) for alternatives to "expert scales" like those reported here.

Conclusions

The Supplemental Poverty Measure is a notable improvement on the longstanding official poverty measure. Yet it is sensitive to some underlying choices, like all poverty measures. We have raised concerns about two of the choices: an equivalence scale that implies a discontinuity in the economies of scale and a narrow adjustment for local prices (only housing). We propose simple corrections for both issues, both of which can be applied to data from the public use files for the CPS.

Changing the way we measure poverty can alter the demographic characteristics of the poverty population, and by implication, how to alleviate poverty, as Edsall (2013) illustrates. The greatest effect of our proposed changes to the SPM would be to virtually close the gap in poverty rates between children and the elderly. This implication may be disconcerting to some economists (e.g., Holzer and Sawhill, 2013), who point out that the U.S. spends approximately two and one-half times more on the elderly than on children (Isaacs, 2009). These observers may prefer using the NAS scales, which would result in a three percentage point gap in the children's favor.

Appendix Table A

Poverty Measurement Concepts: Official vs. Supplemental		
	Official Poverty Measure	**Supplemental Poverty Measure**
Measurement Units	Families and unrelated individuals	All related and unrelated individuals who live at the same address.
Poverty Threshold	Three times the cost of a minimum food diet	The mean of the 30th to 36th percentile of expenditures on food, clothing, shelter, and utilities (FCSU).
Threshold Adjustments	*Vary by family size, composition, and age of householder*	*Geographic adjustments for differences in housing costs by tenure and a three-parameter equivalence scale for a family size and composition*
Updating Thresholds	Consumer Price Index: all items	Five-year moving average of expenditures on FCSU
Resource Measure	Gross before-tax cash income	Cash income + noncash benefits – taxes - work expenses - out-of-pocket medical expenses - child support paid

Source: Short (2014)

Abbreviations

Bureau of Economic Analysis (BEA)
cumulative distribution function (CDF)
Current Population Survey (CPS)
Interagency Technical Working Group (ITWG)
National Academy of Sciences (NAS)
official poverty measure (OPM)
regional price parity (RPP)
Supplemental Poverty Measure (SPM)

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