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Shelter Poverty in Ohio: An Alternative Analysis of Rental Housing Affordability

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ABSTRACT

In the United States, housing is most commonly considered unaffordable when a household spends more than 30% of income on housing and utilities. Although easy to calculate, it fails to account for how other categories of essential expenses affect income available to spend on housing. This article compares the ratio-based approach with shelter poverty, a measure that accounts for these elements, evaluating differences in results between the two methods among renters in Ohio. Shelter poverty identifies a higher rate of households in economic distress due to housing market conditions. Further, the average “affordability gap” is four times higher using the shelter poverty than with the 30% threshold. Relative to shelter poverty, the ratio method underestimates the unaffordability of rental housing in economically distressed areas, as measured by median household income, and modestly overestimates it in high-income areas.

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Introduction

The most common approach for evaluating housing need is a ratio-based measurement of housing affordability. Households spending more than 30% of income on gross rent (i.e., including utilities) are classified as cost burdened. This threshold has been adopted in many governmental and academic studies (e.g., Bolton, Bravve, Miller, Crowley, & Errico, 2015; Joint Center for Housing Studies of Harvard University, 2018; Watson, Steffen, Martin, & Vandenbroucke, 2017).

Whereas the ratio’s simplicity has propelled its widespread appeal, underlying issues compromise its accuracy and usefulness. Although easily quantifiable, the 30% threshold does not correspond to any specific theoretical definition. A ratio fails to account for the fact that expenses are often not scalable to income and vary based on geography and household configuration. A wealthy household can elect to pay a large amount of money for rent out of choice, whereas a poor one may be unable to afford any rent at all if its necessary nonhousing expenses exceed its income. Housing cost burden, tautologically, should measure whether (and how much) a household is burdened by its housing costs; there is reason, both conceptually and in extant literature, to think that the most widespread methods do not meet this challenge.

Stone (1993) and Kutty (2005) highlighted these challenges and proposed a residual approach, called shelter poverty, which evaluates housing affordability after accounting for the minimum costs for other essentials. These works were largely theoretical, however, in that they were more focused on theory and potential methods than on quantitative results. This article builds on their approach by empirically evaluating both measures, starting from the premise that housing need can be defined as the degree to which housing costs compromise the ability of households to

afford other essential goods. This research uses a computational residual approach to quantify and describe housing need (i.e., shelter poverty).

The central innovation of this research is the use of *The Self-Sufficiency Standard for Ohio 2015* (Pearce, 2015a) in the operationalization of shelter poverty. This work provides a detailed breakdown of expenditure levels required to compute shelter poverty by geography and household composition, that can be joined with 2012–2016 American Community Survey (ACS) microdata to calculate shelter poverty for each renter household in the sample. It is then possible to determine its prevalence or breadth as well as its depth (i.e., the amount of additional income a household would need to no longer experience shelter poverty, or the level of spending on basic non-housing needs that is forgone or provided by outside sources).

This work will address several key questions. What is the prevalence of shelter poverty among Ohio renters, and how does this compare with the rate of cost burden? What conclusions are drawn about the scale of economic distress caused by unaffordable housing using each measure? Last, how do the breadth and depth of distress vary with respect to where one lives within the state? These questions will be addressed before concluding with a brief discussion of policy implications.

Background

Housing affordability is a multifaceted issue that encompasses not only housing costs but also household income, family size and characteristics, and the availability of housing, among other things. As a result, measuring housing affordability has been fraught since at least the 1930s (von Hoffman, 2012); there is a long-standing debate regarding how this idea should be conceptualized and operationalized (Pelletiere, 2008).

The most commonly used measure of housing affordability is a ratio approach. One's housing is considered unaffordable if housing and utility costs exceed a certain percentage of gross household income (Schwartz & Wilson, 2008). In the United States, this ratio is often set at 30%, with several federal housing programs using this standard either directly or indirectly in setting maximum rents (Schwartz, 2015). Notably, however, this cap was originally set at 25% in 1969 by the Brooke Amendment to the Housing Act of 1937, before being raised to its current level by the Omnibus Budget Reconciliation Act of 1981 (McCarty, 2014; Schwartz & Wilson, 2008). In 2018, Secretary of Housing and Urban Development Ben Carson proposed increasing this level to 35% for many households (Jan, Dewey, & Stein, 2018). In short, the 30% threshold is, at least to a degree, a product of political wrangling rather than rigorous analysis.

There is a great deal of support for this methodology due to its simplicity and ease of application across time periods and geographies (Pelletiere, 2008). Recent reports quantifying housing unaffordability have employed the 30% threshold to highlight the breadth and depth of distress across the nation as a whole and within subpopulations such as extremely low-income households and racial minorities (Bolton et al., 2015; Joint Center for Housing Studies of Harvard University, 2018; Watson et al., 2017).

Other versions of the ratio approach have been developed. Feins and Lane (1981) used household budget data from the U.S. Bureau of Labor Statistics (BLS) to demonstrate that housing consumption as a percentage of income varies widely based on characteristics such as age, size, income, and geography. The authors proposed setting the ratio threshold at the percentage of income of BLS's lower budget, which estimated the minimum amount of money to cover all essential household expenditures, for the relevant household. Based on 1977 data, the ratio would be, for example, 19% for a family of four in an urban area or 36% for a retired couple, changing as housing's share of essential household expenditures varies. This approach accounts for the fact that raising children, among other household circumstances, imposes additional expenditures that ought to be built into a measure of housing affordability.

However, all ratio approaches, even with such adjustments, assume that households earning less income also require proportionately lower levels of expenses for nonhousing needs; whereas this may be true for households at higher levels of consumption, this is not true at the other end of the spectrum (O'Dell, Smith, & White, 2004; Stone, 2006). There is a fixed level of household spending that is simply necessary for survival and functioning as a healthy member of society. Many low-income households may be left with no money for housing expenses after accounting for these other necessities. This highlights the insufficiency of this ratio approach to give a more nuanced view of true housing burden.

An alternative is the residual income approach. A household has a housing affordability problem if it cannot meet its basic nonhousing needs after it pays for housing; regardless of how little a household earns, basic needs such as food require a minimum level of spending for the health and continued productivity of its members. Households that are pressed between income and housing cost so that they cannot meet their nonhousing needs are said to be experiencing shelter poverty (Stone, 1975). By recognizing nonhousing consumption, shelter poverty attempts to add more nuance to fully identify households with affordability problems.

It may be useful here to underline the differences in terminology. Throughout this article, cost burden refers to housing unaffordability as calculated relative to the 30% threshold (i.e., the ratio method used in much of the extant literature). This contrasts with the shelter poverty approach (i.e., the residual method), which was developed by Stone (1975) and is being refined in this work. This is summarized in Table 1 below.

Stone (1975) was instrumental in the proliferation and early consideration of shelter poverty, which used the same BLS expenditure surveys as Feins and Lane (1981) did to estimate essential nonhousing expenditures. The BLS lower budget, however, has not been produced since 1981. Stone (2006) accounted for this by adjusting for inflation in the intervening years, but this assumes that extrapolating from a fixed 1981 consumption bundle is reflective of household expenditures decades later.

Kutty (2005) modified Stone's (1990) original operationalization of shelter poverty, using the federal poverty level (FPL) as the underlying basis for computing budgets. Kutty (2005) simplified the process by setting essential nonhousing spending at two thirds of FPL; thus, a household for whom housing expenses plus essential nonhousing spending exceeds their total income is said to be in a state of housing-induced poverty.

Whereas this avoided Stone's extrapolation process, Kutty (2005) conceded that the federal poverty measure suffers from a similar critique, as it has not fundamentally changed since 1969—aside from Consumer Price Index (CPI)-based cost-of-living increases. Using the widely referenced poverty level rather than a defunct BLS report makes the measure more easily understood. The problem with Kutty's (2005) approach is that it lacks a compelling alternative budget baseline, using two thirds of FPL as a stopgap in lieu of more detailed work like the 1981 BLS budget.

Kutty (2005) is one of only a few to pursue Stone's idea of shelter poverty. Whereas it has been used in international contexts (e.g., Stephens & van Steen, 2011; Yang & Shen, 2008) and cited as an alternative to the ratio measure in key works (e.g., Belsky, Goodman, & Drew, 2005; Pelletiere, 2008), it has largely been addressed in the abstract. The literature applying this method to the question of rental affordability in the United States is virtually nonexistent, with nearly all such analyses content to use the ratio approach.

Table 1. Housing unaffordability terminology.

Measure	Approach
Housing cost burden	Ratio method
Shelter poverty	Residual method

A notable recent exception to this is Herbert, Hermann, and McCue (2017), which assessed three metropolitan areas—Cleveland, Ohio; Phoenix, Arizona; and Los Angeles, California—using 2015 data. The authors find that lower income households have higher rates of shelter poverty than cost burden, but state that “burden levels from the more precise measures...produced by the residual income approach are not significantly different than those generated by the cruder 30 percent of income metric” (para. 16). This analysis, however, only evaluated housing affordability at the metropolitan scale, rather than in more refined geographies, and only addressed the depth of shelter poverty in general terms for just one of the regions in question. This article extends such analysis in these directions and others.

It is also worth noting that discussion of shelter poverty, and housing affordability in general, intersects with transportation costs. There is an inherent connection between expenditures for housing and those for transportation, a thesis with a lengthy background in urban economics (e.g., Alonso, 1964). This has a clear intuitive basis; housing demand is driven by proximity to employment centers and other amenities from which costs decrease with distance, but this decrease must be at least partially offset by an increase in transportation costs. This tradeoff is also emphasized in the transportation literature (e.g., Coulombel, 2017).

There are many ways to quantify this combined cost, among them the Center for Neighborhood Technology’s $H + T$ Index and the U.S. government’s Location Affordability Index (Renne & Sturtevant, 2016), both of which are based on extensions of the traditional ratio-based cost burden approach. There is a case for measuring these expenses jointly, as with housing and basic utilities (as is done here, with electricity, heating, water, and sewage being included in gross housing costs), but data on household transportation expenditures are not collected by the ACS, which provides microdata with identifiable sub-state geographies that are necessary to produce this sort of analysis.

Notably, this is not a hypothetical consideration. Residual income approaches for modeling transportation affordability, however, have emerged in France (e.g., Berry, Jouffe, Coulombel, & Guivarch, 2016; Mayer, Nimal, Nogue, & Sevenet, 2014). A complete exploration of this literature is beyond the scope of this article, but it is worth noting that this approach has been implemented to evaluate economic deprivation with respect to other categories of expenditures in the extant literature.

Data

As discussed earlier, this work leans heavily on the ability to generate a representative sample of renter households from the ACS. Seven data points are needed to calculate shelter poverty, of which six come from survey responses: (a) gross rent (i.e., including utilities), (b) household income, (c) the number of people in the household, (d) the ages of those household members, (e) the location of the home, and (f) the weight assigned to that household (i.e., the count of households that survey respondent represents in the overall population). The seventh is the level of non-housing expenditures that is necessary to sustain the household, which is provided by Pearce (2015c) and is contingent upon data points (c), (d), and (e). Age is necessary to assign a child to one of four groups (infant, preschool age, school age, or teenager) that dictate the level of essential expenditures needed to support the healthy development of the child, as well as whether and what level of childcare is required.

The complete file of 2012–2016 ACS microdata responses for Ohio was obtained from the Integrated Public Use Microdata Series USA (IPUMS-USA) database (Ruggles, Genadek, Goeken, Grover, & Sobek, 2018), which in its turn is based on public-use microdata survey files generated by the U.S. Census Bureau. The data included 588,491 individuals residing in 268,139 households, representing a 5% sample of the state population. Once homeowners and persons with indeterminate tenure were excluded, 147,143 individuals in 68,717 households remained in the data set. Household composition was processed to facilitate assignment of households to a combination for

which self-sufficiency standard data were available. This was possible for 67,706 households, or 98.5% of renters in the sample, which corresponded to one of the 472 configurations for which estimates were computed. These households represent the population to be analyzed in this article.

The operative geographic scale is the public-use microdata area (PUMA), of which there are 93 in Ohio; this represents the smallest geography at which household-level data are identified. To calculate shelter poverty, Self-Sufficiency Standard data—which are computed at the county level—were transformed to be used at the PUMA level. This was done using a crosswalk (Missouri Census Data Center, 2014) that employs weighted averages based on population counts to impute PUMA-level data. The number of renters sampled in a single PUMA ranged from 258 to 1,964, with a median of 653. To extrapolate from the IPUMS-USA sample to the general renter population, as described earlier, supplied household weights were used. Applying these weights yields a total of 1,556,901 renter households reflected in the data, ranging from 6,308 to 40,149 per PUMA, with a median of 15,003. Unless otherwise noted, figures in the remainder of this article will be based on weighted values.

Methods

Although, at its most basic, this analysis simply merges two data sets together, it is necessary to highlight the work done to generate the estimates produced by Pearce (2015c). The Self-Sufficiency Standard seeks to produce budgets like those developed by BLS, as described in the literature review, using current information. As the name implies, the Self-Sufficiency Standard is designed to compute the minimum amount of income needed for a household to not require need-based government assistance or other aid while availing itself of applicable tax credits. Specifically, in Ohio, Pearce (2015c) computes budgets by county that identify minimum required spending for housing, childcare, food, transportation, health care, taxes, and other expenses.

Pearce (2015b) details how outside sources, mostly federal or state government publications, are used to quantify essential expenditures. For example, for food, the U.S. Department of Agriculture's Low-Cost Food Plan is used as the baseline, supplemented with expense data generated by Feeding America; estimates of childcare costs are drawn from a report commissioned by the Ohio Department of Job and Family Services. Pearce (2015b) uses several simplifying assumptions to generate Self-Sufficiency Standard estimates, which are highlighted in the methodology; for one, transportation costs are based on a statewide average commute distance, rather than more localized data from a source such as the Longitudinal Employer–Household Dynamics database.

Unfortunately, it is a notable limitation that intracounty, cross-PUMA variations in household expenditures are not captured by this method; this means that, for example, distressed urban neighborhoods and wealthy suburban subdivisions within a single densely populated county are assumed to impose equivalent resource requirements on their residents. Ideally, to have accurate estimates at the PUMA level, there would be an array of Self-Sufficiency Standard estimates for these geographies, but the underlying data sets used to build them do not provide such levels of detail. One alternative would be to simply ignore such boundaries and use the county as the unit of analysis in counties with multiple PUMAs; this clearly does not fix the underlying issue, however, instead merely obfuscating a potential source of error by hiding it within aggregated data.

Although unsatisfying, there is no clean solution here. Pelletiere (2008) suggests that the Self-Sufficiency Standard is perhaps the closest antecedent to the original Stone (1975) approach, with Feins and Lane (1981) and Kutty (2005) as primary alternatives, so it is not as though this is a data source ill-suited to the task. Were this article designed to provide authoritative, hyperlocal data on housing conditions, such a methodological gap would be alarming. Instead, this is an exploratory work presented to demonstrate the method of analysis and speak broadly to trends suggested by

the results. That being said, were shelter poverty to become a primary means of evaluating housing unaffordability, such issues would need to be addressed.

The actual determination of whether, and how much, a household is experiencing shelter poverty is a matter of simple arithmetic. Household-level shelter poverty is calculated by subtracting annual nonhousing expenditures, as assessed by the Self-Sufficiency Standard for the appropriate geography and household size and composition from annual income. If the resulting dollar amount is less than 12 times the monthly gross rent, the household is experiencing shelter poverty; the difference is a household's depth of shelter poverty—its affordability gap, expressed in dollars per year. In short, a household's affordability gap using this method (AG_{sp}) is computed thus, with a household experiencing shelter poverty if AG_{sp} is greater than zero:

$$AG_{sp} = \max(12 \times \text{monthly gross rent} + \text{nonhousing expenditures} - \text{annual household income}, 0) \quad (1)$$

It is worth highlighting here why the Self-Sufficiency Standard is so methodologically essential to compute shelter poverty. To determine whether a household is economically distressed, one of the three terms on the right side of the equation above must be based on an outside value rather than household-level data, or else (assuming away temporal consumption shifts, i.e., borrowing and savings) the affordability gap would always be zero regardless of circumstance, rendering the calculation nearly meaningless.

From a methodological standpoint, it is most convenient to choose nonhousing expenditures as the fixed parameter (for a given household), since the alternatives present substantial challenges. One could set an ideal maximum rent and evaluate whether actual nonhousing expenditures compromise the ability to pay that rent, but the ACS does not collect such data, and those that do lack the sample size and near-universal geographic coverage of ACS. It would also be possible to set an ideal minimum income, which is what the federal government's Supplemental Poverty Measure and others seek to do, but the ability to speak specifically to housing costs would be lost in an overall discussion of economic strain. Ultimately, in an evaluation of housing affordability, rent and income are the most important variables for public policy purposes; attempting to reduce housing unaffordability by lowering the cost of nonhousing goods is unnecessarily complex.

Now that affordability gaps have been computed for each household in the data set, one must determine how to distill this information into measures with policy meaning. The first step is to apply the household weights from the raw data, scaling the individual values such that the microdata reflect the totality of Ohio renters. Since the PUMA of residence is included, it is possible to sum the data to that level as well as statewide. From here, three measures of shelter poverty can be computed:

1. The percentage of renter households in a PUMA experiencing an affordability gap;
2. The sum of all affordability gaps for renter households in a PUMA;
3. The mean of all affordability gaps for renter households where $AG_{sp} > 0$ in a PUMA.

The first of these is simply the rate of shelter poverty. The second is the aggregate amount of shelter poverty (i.e., the amount of forgone essential expenditures, or the amount of money required to subsidize said expenditures), whereas the third is simply the second value divided by the number of households in shelter poverty.

Similarly, an affordability gap based on the 30% income ratio (AG_{30}) can be computed using the Equation below:

$$AG_{30} = \max(12 \times \text{monthly gross rent} - 30\% \times \text{annual household income}, 0) \quad (2)$$

Incidentally, it is possible to rewrite this equation in a way that makes clear it is doing the same work as shelter poverty, but without the contextual precision of a measure like the Self-Sufficiency Standard:

$$AG_{30} = \max(12 \times \text{monthly gross rent} + 70\% \times \text{annual household income} - \text{annual household income}, 0) \quad (3)$$

This is done for each of the 67,706 Ohio renter households in the raw, unweighted data set of survey responses for which shelter poverty status can be determined and analyzed concurrently. Again, it is possible to then take this information and use it to compute the three measures of cost burden corresponding to those for shelter poverty. This allows for a direct comparison between the two approaches. This comparison is facilitated by determining the arithmetic difference in housing unaffordability prevalence measured by the two methods, as well as geometric differences in aggregate and average affordability gaps. In each case, shelter poverty is the alternative to a cost burden baseline. Algebraically, the three measures are

$$M_1 = N_{sp}/N_t - N_{30}/N_t \quad (4)$$

$$M_2 = \sum_{i=1}^{N_{sp}} AG_{sp} / \sum_{i=1}^{N_{30}} AG_{30} \quad (5)$$

$$M_3 = \frac{\sum AG_{sp}/N_{sp}}{\sum AG_{30}/N_{30}} \quad (6)$$

where N_t is the number of households for which shelter poverty status is known in a given PUMA, N_{sp} is the count of households experiencing shelter poverty, and N_{30} is the count of households spending more than 30% of their income on gross rent. In other words, M_1 is the difference in rates of housing unaffordability, M_2 is the ratio of aggregate depth, and M_3 is the ratio of average depth.

Further, where appropriate, pairwise correlation coefficients (i.e., Pearson's r) were generated to further describe the data. Econometric analysis was conducted using Stata 13.1.

Findings

First, it may be instructive to discuss the interaction between shelter poverty and cost burden at the household level. [Figure 1](#) shows the relationship between affordability gaps as measured by the two metrics, with one dot for each of the 67,706 households in the microdata. In this chart, unlike in the underlying calculations, a gap can be negative, representing income a household has beyond what is required to cover its essential expenditures. Clearly, there is a strong positive correlation between the two measures ($r = 0.9039$).

Notably, however, the relationship is far from one to one; a bivariate ordinary least squares regression computes a best-fit slope of 3.16. This is roughly what one would expect, since a \$1.00 increase in household income can be entirely spent on housing if all other needs are met under the residual method, whereas only \$0.30 can be spent on shelter under the ratio method; hence, a rise of \$1.00 over a run of \$0.30 equates to a slope of 3.33.

With respect to unweighted responses, of the 67,706 surveys, the two measures of housing unaffordability agreed on 54,939 (81.1%) of them. Among the rest, 8,878 respondents (13.1%) experienced shelter poverty but not cost burden (i.e., the top left quadrant in [Figure 1](#)), whereas the reverse was true for 3,889 (5.7%; [Figure 1](#), bottom right quadrant). Whereas discrepancies were found in both directions, the former was more than twice as common as the latter, suggesting that the rate of shelter poverty in the general population should be higher than that of cost burden. Indeed, this is what the results show once extrapolated.

After weighting, 52.4% of Ohio renter households (816,228) experienced shelter poverty. This rate ranged widely among the state's PUMAs, from 23.7% to 72.4%, with a median of 48.6% (see [Table 2](#)). This compares with 45.6% of renters in the study population experiencing cost burden. The range by PUMA was substantially narrower using the ratio method, ranging from 26.9% to

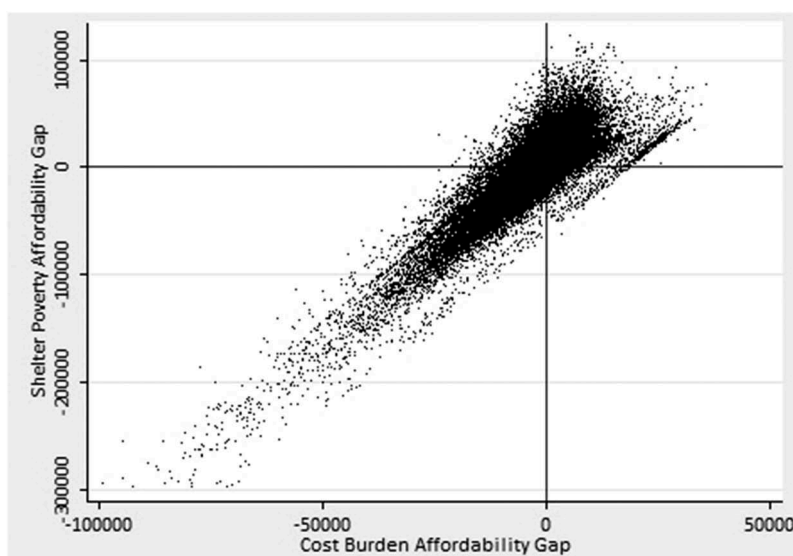


Figure 1. Relationship between shelter poverty and cost burden affordability gaps by respondent (excluding ultra-high income outliers).

Table 2. Descriptive statistics of housing unaffordability data.

Variable	Mean	SD	Min	Q1	Med	Q3	Max
Rate of shelter poverty (N_{sp}/N_t)	50.3%	9.8%	23.7%	42.7%	48.6%	57.4%	72.4%
Rate of 30% cost burden (N_{30}/N_t)	43.9%	6.5%	26.9%	39.3%	42.7%	47.2%	59.3%
Difference in burden rates (M_1)	+6.4%	5.8%	− 11.8%	+2.9%	+6.9%	+10.9%	+18.6%
Aggregate shelter poverty (ΣAG_{sp})	\$159.96	\$110.04	\$42.05	\$86.47	\$113.96	\$201.96	\$563.80
Aggregate 30% cost burden (ΣAG_{30})	\$34.81	\$19.98	\$11.68	\$20.35	\$28.57	\$44.36	\$109.85
Ratio in aggregate burden (M_2)	4.52	1.13	1.60	3.89	4.60	5.33	6.54
Average shelter poverty ($\Sigma AG_{sp}/N_{sp}$)	\$17,518	\$2,836	\$12,674	\$15,402	\$17,210	\$19,331	\$26,506
Average 30% cost burden ($\Sigma AG_{30}/N_{30}$)	\$4,589	\$944	\$3,109	\$3,960	\$4,384	\$4,913	\$7,618
Ratio in average burden (M_3)	3.91	0.71	2.02	3.50	3.96	4.25	5.48

Note. SD = standard deviation. Aggregate figures are in millions.

59.3%, with a median of 42.7%. These rates of housing unaffordability are highly correlated with one another at the PUMA level ($r = 0.8211$), and both measures identified the same PUMAs as having the highest and lowest rates of unaffordable rental housing.

The degree to which shelter poverty underidentifies or overidentifies economic distress among renters relative to the 30% threshold varies dramatically. Statewide, this difference (M_1) is 52.4% minus 45.6%, or +6.8 percentage points. Across Ohio's PUMAs, however, this figure ranges from − 11.8 points to +18.6 points, and the gap is highly correlated with the rate of shelter poverty itself ($r = 0.7681$).

It may be helpful to narrow the focus here. Cuyahoga County contains 10 PUMAs, as shown in [Figure 2](#). Of these, three (00905, 00906, and 00908) are roughly coterminous with the City of Cleveland, four (00902, 00904, 00907, and 00909) are largely made up of inner-ring suburbs that are broadly working class, and three (00901, 00903, and 00910) consist of mostly outer-ring suburbs that are primarily middle or upper class.

In the three urban core PUMAs, the rate of shelter poverty is 11.2 to 14.4 percentage points higher than the rate of cost burden. In the four inner-ring PUMAs, shelter poverty is only marginally higher than cost burden (0.1–4.4 points). Last, in the three outer-ring PUMAs, the two measures are flipped, with cost burden being marginally higher than shelter poverty (0.5–4.8 points). Indeed, statewide, the difference between the two measures is strongly correlated with median household



Figure 2. Map of public-use microdata areas in Cuyahoga County, Ohio.

income within the PUMA as reported by the contemporaneous ACS ($r = -0.7455$) (U.S. Census Bureau, 2018); this suggests the results seen within Cuyahoga are not solely an artifact of the lack of intracounty variation in the Self-Sufficiency Standard. In short, relative to shelter poverty, cost burden overstates housing unaffordability in wealthy areas and understates it in economically distressed ones. These data are detailed in Table 3.

The disparity between the two measures becomes starker when evaluating aggregate affordability gaps. In total, Ohio renter households would need to earn \$14.9 billion more each year to close the rent gap as measured by the Self-Sufficiency Standard. This figure is dramatically higher than the corresponding \$3.2 billion figure generated using cost burden. Dividing the second figure into the first yields a state-level aggregate multiplier of 4.60 (M_2). Across PUMAs, this figure varies from 1.60 to 6.54 with a median of 4.60. As with M_1 , there is a strong correlation between this measure and the rate of shelter poverty ($r = 0.7636$).

Within Cuyahoga County, again, there is a clear pattern among PUMAs (see Table 4). Among the three Cleveland PUMAs, M_2 ranges from 5.13 to 6.03. Further out, M_2 values are between 3.36 and 4.41 in the four inner-ring PUMAs; last, among the three outer-ring PUMAs, M_2 ranges from 1.90 to 2.51. Whereas the aggregate affordability gap is higher under shelter poverty than it is under cost burden in all PUMAs in the county (and statewide), this disparity is much larger in poorer areas. Again, there is a strong correlation with median household income ($r = -0.7073$).

Finally, with respect to the mean affordability gap per household experiencing housing unaffordability, statewide figures are \$18,225 under shelter poverty and \$4,559 under cost burden. Dividing the latter into the former yields a state-level average multiplier of 4.00 (M_3). This figure

Table 3. Rates of housing unaffordability in Cuyahoga County public-use microdata areas (PUMAs).

PUMA	Shelter poverty rate (%)	Cost burden rate (%)	Difference (M_1 ; %)	Median household income (\$)
City of Cleveland PUMAs				
00905	65.0	53.8	11.2	34,667
00906	65.4	51.1	14.4	27,041
00908	72.4	59.3	13.1	22,417
Inner-ring suburb PUMAs				
00902	41.3	41.1	0.1	53,138
00904	46.1	43.2	2.9	51,097
00907	53.0	51.9	1.1	40,284
00909	58.4	54.0	4.4	42,061
Outer-ring suburb PUMAs				
00901	38.3	40.8	– 2.6	72,208
00903	32.5	32.9	– 0.5	77,328
00910	43.0	47.8	– 4.8	74,115

Table 4. Aggregate depths of housing unaffordability in Cuyahoga County public-use microdata areas (PUMAs).

PUMA	Shelter poverty total affordability gap (\$)	Cost burden total affordability gap (\$)	Ratio (M_2)
City of Cleveland PUMAs			
00905	267,672,123	51,055,311	5.24
00906	444,113,994	73,594,121	6.03
00908	563,801,485	109,846,257	5.13
Inner-ring suburb PUMAs			
00902	142,024,964	42,209,243	3.36
00904	124,400,747	28,220,210	4.41
00907	175,673,086	44,362,313	3.96
00909	298,401,614	76,647,524	3.89
Outer-ring suburb PUMAs			
00901	54,138,522	28,567,154	1.90
00903	43,119,617	17,204,928	2.51
00910	107,398,795	51,457,293	2.09

varies from 2.02 to 5.48 across PUMAs, with a median of 3.97. Again, this is highly correlated with the prevalence of shelter poverty ($r = 0.7636$). Within Cuyahoga County (see Table 5), Cleveland PUMAs have M_3 values between 4.20 and 4.71, compared with 3.35 to 4.13 among inner-ring PUMAs and 2.02 to 2.54 among outer-ring PUMAs. Again, strong correlations at the state level are found with respect to PUMA median income ($r = -0.6179$).

Implications

Shifting from a ratio measure to a residual shelter poverty one has a dramatic impact in measuring housing affordability. This article finds that ratio approaches substantially underestimate burden in low-income areas and overestimate burden in many high-income PUMAs. This suggests that the 30% threshold is in fact not a close approximation of household-level budget constraints and that measurement of housing affordability could be substantially improved through the adoption of shelter poverty methods.

Comparing these findings with Herbert et al. (2017), although the gap between rates of cost burden and shelter poverty may be small at the metropolitan level, it is clear that the ratio approach ignores substantial heterogeneity within these areas that correlates with income. Further, the depth of the affordability gap is starkly different between the residual and ratio methods. This gap in Ohio is 4 times deeper, on a per-renter basis (M_3), using the shelter poverty metric vis-à-vis the 30% threshold. This is explored to a degree in Herbert et al.'s (2017) assessment of residual income estimates for Los Angeles renters by income tier. Even if the overall rates between the two approaches were identical, the radically higher degree of economic distress

Table 5. Average depths of housing unaffordability in Cuyahoga County public-use microdata areas (PUMAs).

PUMA	Shelter poverty mean affordability gap (\$)	Cost burden mean Affordability gap (\$)	Ratio (M_3)
City of Cleveland PUMAs			
00905	18,555	4,276	4.34
00906	20,162	4,280	4.71
00908	19,395	4,615	4.20
Inner-ring suburb PUMAs			
00902	14,353	4,278	3.35
00904	17,423	4,221	4.13
00907	18,221	4,701	3.88
00909	17,447	4,843	3.60
Outer-ring suburb PUMAs			
00901	15,402	7,618	2.02
00903	14,041	5,523	2.54
00910	15,090	6,504	2.32

implied by the shelter poverty metric would be worth attention. The critiques of Kutty (2005) and Stone (2006), namely that the ratio measure is misleading as it pertains to poor households, are more strongly validated here.

It is also worth emphasizing that the aggregate affordability gap of nearly \$15 billion using the shelter poverty methodology represents the quantity of forgone economic activity among Ohio renters due to unaffordable housing, as the categories of spending covered by the Self-Sufficiency Standard are household needs either met by outside assistance or done without. As a public policy issue, this suggests that a lack of affordable housing affects a far broader group of people than just the households whose finances are directly impacted—which is still about half of Ohio renters under either approach.

Ultimately, the 30% standard is used in calculating rents for tenants receiving virtually all federal housing assistance, so moving away from it at an institutional level would require an act of Congress. That said, a shelter poverty analysis provides an alternate picture of the demand for subsidized housing for policymakers and advocates at all levels to consider. The decision of which is preferable depends on normative and methodological considerations, but these results imply the financial challenges faced by renters far outstrip what prior analysis would have suggested. This is both a cause for concern and an imperative to develop a more holistic view of poverty and how the housing market contributes to it and is affected by it.

The next step in extending this work is to evaluate the correlates of shelter poverty—or, more precisely, the degree to which shelter poverty is at odds with the 30% standard. Additionally, the Self-Sufficiency Standard has only been computed for 41 states (Center for Women’s Welfare, *n.d.*), and is in some cases many years out of date; further, as discussed, the data are somewhat coarse in terms of geographic detail and rely on extensive assumptions. This is to be expected for a metric that is only commissioned and updated on a contract basis, but having a complete and current national data set of Self-Sufficiency Standard estimates, ideally one that would cover subcounty geographies, would facilitate further examination of shelter poverty.

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