

A Multidimensional Poverty Measure using the American Community Survey

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Abstract

This paper creates a multidimensional measure of poverty that takes non-income deprivations into account, allows people in the same family to have different poverty rates, and accounts for the intensity of poverty. This measure has seven dimensions: health, education, standard of living, consumption, economic security, housing quality, and neighborhood quality. This paper also demonstrates the wide variety of analysis one can perform with a multidimensional poverty measure using the American Community Survey. This analysis falls into three main categories. First, comparing the official poverty measure to the multidimensional poverty measure. Second, performing decompositions of the multidimensional poverty measure, which allow for the analysis of subgroup contributions to the poverty rate as well as each dimension's contribution to the poverty rate. Lastly, regressing the official poverty measure and the multidimensional poverty measure on demographic variables in order to determine the probabilities of being in poverty for different demographic groups.

Disclaimer:

This paper is released to inform interested parties of ongoing research and to encourage discussion of work in progress. Any views expressed are those of the author and not necessarily of the U.S. Census Bureau.

Introduction

Multidimensional poverty measurement is based on the idea that there are income and non-income based indicators that may identify people as impoverished. In other words, some non-income based indicators may capture a segment of the poor population that income based indicators miss. There has been increased interest in multidimensional poverty since Alkire and Foster published their dual-cutoff approach in 2011. This approach involves setting one cutoff to determine deprivation in a particular dimension and a second cutoff to determine in how many dimensions a person must be deprived in order to be considered poor.

The studies using the Alkire and Foster method differ in two main ways. The first difference is the number and type of dimensions used to create the multidimensional poverty indicator. In my review, I found papers that used as few as three and as many as seventeen dimensions (about seven dimensions on average). While there was a significant amount of variation in dimensions, they all can be placed in the following categories: health, education, standard of living, economic security, housing quality, consumption, and neighborhood quality.

The second difference is the dataset used in the analysis. Since the use of a single dataset is often used for the Alkire and Foster method, researchers generally chose a dataset that was the best fit to the indicators of deprivation they wanted to include in the measure. In my review, I found studies that used the American Community Survey (ACS), the Current Population Survey Annual Social and Economic Supplement (CPS ASEC), the Survey of Income and Program Participation (SIPP), the Panel Study of Income Dynamics (PSID), the General Social Survey, the National Health Interview Survey, the European Union Statistics on Income and Living Conditions, the Household Income and Labor Dynamics in Australia Survey, and the European Community Household Panel.

In 2008, the President of France created the Commission on the Measurement of Economic Performance and Social Progress in order to find more relevant measures of social progress. While the Commission did not focus on poverty, it did recommend eight dimensions for the measurement of quality of life in a 2009 report (Stiglitz/Sen/Fitoussi Report) which have been used to create multidimensional poverty measures. These include: material well-being (income, consumption, and wealth); health; education; personal activities, including work; political voice and governance; social connections and relationships; environment; and insecurity of an economic and physical nature.

The dimensions and the way I measure the dimensions of the poverty measure used in this paper are in Table 1. Two dimensions from the Stiglitz/Sen/Fitoussi report, political voice and governance and social connections and relationships, were not included in my definition of poverty due to measurement and data limitations. The seven dimensions of poverty included in this paper fit into the remaining six dimensions from the Stiglitz/Sen/Fitoussi report. To be considered poor, a person must be deprived in at least two of these dimensions.

Table 1: Components of Multidimensional Poverty		
Stiglitz/Sen/Fitoussi Report¹	Dimensions for this paper	To be considered deprived:
Health	Health	Person has at least two disabilities
Education	Education	Person, age 19 to 64, is without a high school degree (based on head of household's education level for those under 19)
Material well-being	Standard of living	Person is in poverty according to the official poverty measure (OPM)
Material well-being	Consumption	Person in a household is without at least 1 of the following: Toilet, sink, running water, refrigerator, stove, or bath; Or person lacks health insurance
Personal activities	Economic security	Person in a family which has zero workers (exceptions made for retirees and students)
Environment	Housing quality	Person lives in a house or apartment with more than one person per room
Insecurity of economic or physical nature	Neighborhood quality	Person lives in a census tract with greater than 20 percent poverty

Most of the studies I came across used official poverty status as the cut-off to determine if a person was deprived in standard of living. The Official Poverty Measure (OPM) only counts for deprivation in one dimension for any measure of multidimensional poverty. Therefore, it is possible for people to be considered poor according to the multidimensional poverty measure (MDPM), but not the OPM and vice versa.

I do three main things in this paper. First, I calculate a multidimensional poverty measure and compare it to the OPM using 2016 ACS 1 year data. I use ACS data because it has the health, consumption, and neighborhood quality variables that I include in my definition of MDPM, it is a large dataset that can be decomposed by demographic characteristics and geography, and it has not often been used in calculations of multidimensional poverty.

I examine the overlap between the OPM and the MDPM, how the OPM and MDPM change over time, the deprivations in each dimension of people in poverty according to the MDPM and according to the OPM, demographic differences between the OPM population and the MDPM population, and how the OPM and MDPM compare by region, state, and metropolitan statistical area (MSA).

Second, I perform decompositions of the multidimensional poverty measure, which allow for the analysis of subgroup contributions to the poverty rate as well as each dimension's contribution to the poverty rate. I decompose the MDPM by each of its seven dimensions in order to compare the contributions of each dimension to MDPM status over time, by region, by race, by age, and by rural and urban status. I also decompose the MDPM by race and age in order to determine each race and age groups' contribution to the multidimensional poverty rate.

¹ Stiglitz, Joseph E., Sen, Amartya, and Jean-Paul Fitoussi. 2009. "The Measurement of Economic Performance and Social Progress Revisited". Columbia University, IEP, OFCE Working Paper.

Third, I regress poverty status, separately for each measure, on demographic characteristics in order to determine the probabilities of being in poverty for different demographic groups.

Literature Review

There is a large amount of research on multidimensional poverty, which covers a wide variety of topics. However, I restrict my analysis of the literature in two ways. I focus only on papers in which empirical measures of multidimensional poverty were created for the developed world. Multidimensional poverty measures focused on the developing world are similar in form, but far different in concept and execution. Second, with a few exceptions, the majority of my focus is on papers published after Alkire and Foster published their dual-cutoff approach in 2011. In order to motivate a discussion, I focus on three areas in which there was significant differences in approaches in the literature.

The first major difference were the datasets used to create multidimensional measures of poverty. Since multidimensional poverty is about determining if an individual is deprived in a number of different ways, studies have mostly used a single data source. Choice of a data source is based on the country one is researching, the variables available in the dataset, and idiosyncratic preferences for a particular dataset.

In the U.S., people have used the National Health Interview Survey (Alkire and Foster 2011), the Current Population Survey Annual Social and Economic Supplement (Mitra and Bruckner 2016), the American Community Survey 1 year sample (Dhongde and Haveman 2016; Reeves et al. 2016), the Survey of Income and Program Participation (Short 2005), the Panel Study of Income Dynamics (Ciula and Skinner 2015), and the General Social Survey (Wagle 2014).

For studies in Europe, the European Union Statistics on Income and Living Conditions (Garcia-Perez et al 2016; Betti et al. 2015; Whelan et al. 2014; Coromaldi and Zoli 2011; Ayala et al. 2011) has mostly been used. Several studies used a related panel survey, the European Community Household Panel (D'Ambrosio et al. 2011; Dewilde 2008). The only data source in my review from outside the United States and Europe was the Household Income and Labor Dynamics in Australia Survey (Martinez Jr. and Perales 2015).

The second major difference were the number of dimensions included in the measure of multidimensional poverty. The number of dimensions ranged from three (Dewilde 2008) to seventeen (Ciula and Skinner 2015). On average for the papers I reviewed, seven dimensions were used. The determination of how many dimensions to use seems to be based largely on the availability of information in the data source and the author's preferences.

The third major difference, which was related to the number of dimensions, were the types of indicators that made up the dimensions. While there was a significant amount of overlap in the use of indicators (education, health, employment, poverty status), there were unique combinations of indicators even from researchers using the same data source. The variety of indicators are in the rows of Table 2 while the authors who used those indicators, represented by the first author, are listed in the columns, starting with this paper, Glassman, and ending with the last paper in my review, DeWilde. An X is in the appropriate box if the author used that indicator or something closely related to that indicator.

Table 2: Indicators used to create dimensions for Multidimensional Poverty Measures in the Literature															
Indicators	Glassman	Dhongde	Garcia-Perez	Mitra	Reeves	Betti	Ciula	Martinez Jr.	Whelan	Wagle	Alkire	Avala	Coromaldi	D'Ambrosio	DeWilde
Disabilities	X	X						X						X	
Reported health				X		X	X	X	X	X	X		X	X	
Health insurance	X	X		X	X		X				X				
Education	X	X		X	X	X	X	X		X	X				
Percentage of median income or housing > 50% of income		X					X	X		X				X	X
Poverty	X			X	X						X				
At least one worker/unemployment	X			X	X	X		X							
> 1 person per room	X	X													
Lack of space or light, the presence of leaks or damp						X	X					X	X		X
Area poverty > 20%	X				X										
Crime, violence, vandalism, pollution, noise						X	X	X	X				X		
Lacking toilet, sink, running water, fridge, stove, or bath	X												X	X	X
A person cannot afford: 1 week's holiday away from home, a meal with meat, chicken or fish every second day, a car, and keeping the house at an appropriate temperature			X			X	X		X			X	X	X	X
A person cannot afford: mortgage or rent payment, a telephone, a color tv, a washing machine			X			X						X	X	X	
Unexpected financial expenses			X			X							X		
Lacks computer or internet									X			X			
Ability to make ends meet						X							X	X	X
Social support, community participation								X		X				X	
Occupational prestige, electoral participation, and political activism										X					X

The only two indicators used in this paper that have not been used very often in previous research are the greater than one occupant per room indicator used to measure housing quality and the area poverty greater than 20 percent used to measure neighborhood quality. Previous research has used lack of space or light and presence of leaks or damp to measure housing quality. These variables are not available in the ACS, which is why a residence with more than one occupant per room proxies for poor housing quality. Similarly, previous authors have used crime, violence, vandalism, pollution, and noise to measure neighborhood quality. These variables are not available in the ACS, which is why living in a high-poverty neighborhood proxies for poor neighborhood quality. Finally, reported health and ability to take a vacation are commonly used indicators, but these are also not available in the ACS.

Methodology

In order to create a measure of multidimensional poverty, I used a dual-cutoff approach created by Alkire and Foster. The first cutoff is whether a person is deprived in a particular dimension. The second cutoff is the number of dimensions a person must be deprived in to be considered poor. To more formally lay out this approach, some notation is needed.

The number of dimensions, d , are each weighted by dimension weight, W_j . Let $C_{ij}=1$ if person i is deprived in dimension j and 0 otherwise. Then, $C_i = \sum_j W_j C_{ij}$ is the number of dimensions in which person i is deprived. K is the cutoff for number of dimensions at which a person is considered poor. Therefore, a person is considered poor, $q_i = 1$, if $C_i \geq K$ and a person is not considered poor, $q_i = 0$, if $C_i < K$. Finally, the total number of poor persons according to this measure is $q = \sum_i q_i$. The multidimensional poverty measure used throughout the majority of this paper is referred to as the headcount ratio and is defined as $H = q/n$, where n is the total population.

One problem with a unidimensional measure of poverty is that the poverty rate does not change if people in poverty become worse off or better off without moving out of poverty. In other words, the intensity of poverty is not taken into account. While the headcount ratio does not deal with this shortcoming, creating an adjusted measure does.

Let $C(K) = \sum_i q_i C_i$ be the total number of dimensions in which the poor are deprived. Then, the intensity of poverty can be defined as $A = C(K)/(qd)$, where (qd) is the maximum number of dimensions in which the poor could be deprived. If poor people become deprived in more dimensions, A will increase. The adjusted headcount ratio is calculated by multiplying the headcount ratio by the intensity of poverty, $M = HA$. Based on the definitions of H and A , $M = C(K)/(nd)$ as well.

Other than addressing the intensity of poverty, another advantage of the adjusted headcount ratio is that it can be decomposed in two ways: by dimension and by subgroup populations. I perform the decomposition calculations below because a review of the literature showed widespread use of decompositions without explanation of their origins. To see how the adjusted headcount ratio can be decomposed by dimension, I start with the total number of deprivations in which the poor are deprived and make a substitution:

$$\begin{aligned} C(K) &= \sum_i q_i C_i \\ &= \sum_i q_i \left(\sum_j W_j C_{ij} \right) \end{aligned}$$

If equal weighting is assumed, then $W_j = 1$ for all j . I break the statement in parentheses into two by removing people who are deprived in the first dimension.

$$\begin{aligned}
 &= \sum_i q_i (C_{i1} + \sum_{j \neq 1} C_{ij}) \\
 &= \sum_i q_i C_{i1} + \sum_i \sum_{j \neq 1} q_i C_{ij} \\
 C(K) &= C(K_1) + \sum_i \sum_{j \neq 1} q_i C_{ij}
 \end{aligned}$$

I used this information to substitute into the adjusted headcount ratio:

$$\begin{aligned}
 M &= C(K)/nd \\
 M &= C(K_1)/nd + (\sum_i \sum_{j \neq 1} q_i C_{ij})/nd
 \end{aligned}$$

Dividing by M gives the following equation:

$$1 = (C(K_1)/nd)/M + (\sum_i \sum_{j \neq 1} q_i C_{ij})/nd/M \quad (\text{equation 1})$$

This is an important result. $C(K_1)/n$ is the proportion of the overall population that is both poor and deprived in dimension 1. This is divided by the number of dimensions and the adjusted headcount ratio in order to calculate the contribution to the poverty rate made by people being deprived in the first dimension. These same calculations can be done to find the contributions of all other dimensions.

To see how the adjusted headcount ratio can be decomposed by subgroup populations, I start with the definition of the adjusted headcount ratio and assume two subgroups make up the population:

$$\begin{aligned}
 M &= \sum_i q_i C_i / nd \\
 &= \sum_a q_a C_a / nd + \sum_b q_b C_b / nd \\
 &= C(K_a) / nd + C(K_b) / nd \\
 &= C(K_a) / n_a d \times n_a / n + C(K_b) / n_b d \times n_b / n \\
 M &= M_a \times n_a / n + M_b \times n_b / n \\
 1 &= M_a / M \times n_a / n + M_b / M \times n_b / n \quad (\text{equation 2})
 \end{aligned}$$

M_a is the adjusted headcount ratio for subgroup a and n_a is the population of subgroup a . Therefore, the first statement on the right-hand side of the equation is the contribution to poverty made by subgroup a and it is calculated by dividing the adjusted headcount ratio for subgroup a by the adjusted headcount ratio for the total population and then multiplying by the population share of subgroup a . This can be generalized to any number of subgroups in a population.

Decision points

There are four main areas in which decisions had to be made in order for the creation of a multidimensional poverty measure to move forward: the dataset, the weighting scheme, the dimensions, and the cutoff points. These are explicitly discussed because different decisions in any of these areas would necessarily lead to significantly different results.

Data

The data in this paper comes from the American Community Survey (ACS) 1-year estimates for 2008 through 2016.² 2016 is the latest year available and 2008 is the earliest year available with the information needed to create each dimension (the ACS dates back to 2005).

The main advantages of the ACS are that it has the health, consumption, and neighborhood quality variables that I include in my definition of MDPM, it is a large dataset that can be decomposed by demographic characteristics and geography, and it has not often been used in calculations of multidimensional poverty. The main disadvantages are that there are only nine years of data and the income questions are significantly less detailed than in other surveys.

As discussed in the literature review section, many different datasets have been used to create multidimensional poverty measures. While any dataset has its advantages and disadvantages, the analysis I was able to do with the ACS data made up for some of its shortcomings.

Weighting scheme

There are four weighting schemes primarily used in the literature. The first is equal weights for each dimension. The second is weighting each dimension by the inverse of its prevalence in the overall population. In other words, a dimension in which a small number of people are deprived would be weighted more heavily because it is relatively unusual for people to be deprived in that dimension. Conversely, dimensions in which larger numbers of people are deprived would be weighted less heavily. The third method is hedonic weights. For this method, weights are found by regressing some measure of life satisfaction on the dimensions. The coefficients from the regression become the weights of each dimension. The fourth method is statistical weights using principal component analysis or factor analysis.

Decancq and Lugo did an overview of these four and other weighting schemes in a 2013 paper. They discussed the methodology of each weighting scheme and the advantages and disadvantages of each. What is made clear in their paper is that equal weighting is by far the most widely used weighting scheme in the literature and no weighting scheme is perfect.³

I used equal weighting of dimensions in this paper for three reasons. First, equal weighting of dimensions is easy to understand. Deciding to use an indicator as a dimension means that I find it important enough to stand on its own and not be combined with several indicators into a combination dimension. Second, equal weighting is defensible. Weighting one dimension as more important than another dimension involves a value judgement that may be true for some people in the population and not true for others. Third, if all weighting schemes are problematic and cause one to be concerned about the robustness of the results, I choose to go with the easiest and most straightforward method.

² Puerto Rico is not included in the analysis. Institutional group quarters are also excluded, but non-institutional group quarters are included.

³ Decancq, Koen and Maria Ana Lugo. 2013. "Weights in Multidimensional Indices of Well-Being: An Overview". *Econometric Reviews* 32: 7-34.

Dimensions

As discussed in the literature review, a wide variety of numbers and types of dimensions have been used. For the multidimensional poverty measure in this paper, seven dimensions are used. The description of each dimension is discussed in detail below.

1. Education

A person was considered deprived in education if that person was between 19 and 64 years of age and was without a high school degree or GED. Limited education is a deprivation because it may limit a person's opportunities, may decrease a person's attachment to the labor force, and may make it significantly more difficult to increase one's social or economic standing. People over age 64 are excluded because they are unlikely to be attached to the labor force and a high school degree is unlikely to affect their prospects. Since people under age 19 are likely to still be in school, head of household education is substituted. Therefore, a child under age 19 is deprived if the head of household lacks a high school degree and GED. The percent of people deprived in education has steadily decreased each year since 2008 (Figure 1).

2. Standard of living

Following the standard in the literature, I used the official poverty measure (calculated using the ACS) as an indicator of standard of living. While not a perfect measure of the impoverished, it does offer a standard value against which all incomes of people in the United States can be judged. A person was considered deprived in standard of living if their family's income was below 100 percent of the federal poverty level. The percent of people deprived in standard of living increased from 2008 to 2011 and then began decreasing starting in 2014 (Figure 1).

3. Consumption

One of the major indicators missing from most singular measures of poverty is consumption. A person's income may be above a poverty threshold, but with expenses that person may not be able to afford basic necessities. Similarly, a person may have low income currently but may have had higher income in the recent past or other assets that they can draw from that allows for the purchase of consumption goods. The ACS does not have a lot of information on consumption purchases, but it has enough to determine if a person is deprived. A person was considered deprived in consumption if he or she was without at least one of the following: a toilet⁴, a sink, running water, a refrigerator, a stove, or a bathtub/shower.

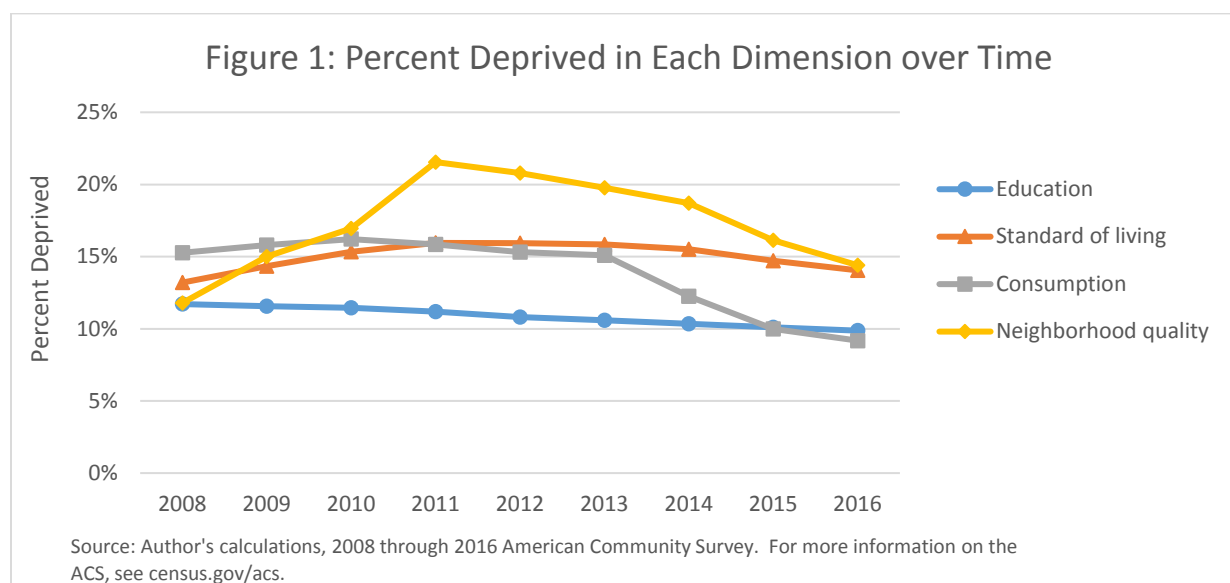
Furthermore, a person was considered consumption deprived if he or she did not have health insurance. Health insurance is included in this section for three reasons. First, a person not having health insurance is an indicator that the person had to make difficult choices about where to spend her money. Second, even if a person made the rational choice to not buy health insurance when she could afford to do so, this is an indicator of financial risk and possible future consumption deprivation. Third, lack of health insurance has been included in previous multidimensional poverty measures which also included reported health (Mitra and Bruckner 2016; Ciula and Skinner 2015; Alkire and Foster 2011) or

⁴ In the 2016 ACS, the question about the household having a toilet was removed.

disabilities (Dhongde and Haveman 2016) as separate measures. Consumption deprivation has decreased each year since 2010 (Figure 1).

4. Neighborhood quality

The ACS does not ask any questions about crime, social interactions, environment, or the quality of the neighborhood a person lives in. However, I proxy for these issues by calculating the poverty level for each census tract. Due to the small size of census tracts, I replace census tract poverty with county poverty if there were less than 30 households sampled from the census tract. A person was considered deprived in neighborhood quality if the person lived in an area with poverty greater than or equal to twenty percent. Neighborhood quality deprivation increased until 2011 and then decreased steadily (Figure 1).



5. Health

In the literature, researchers have used whether or not a person has health insurance, disabilities, or reported health status as an indicator for the health dimension. Reported health status was not used because it is not included in the ACS. Health insurance status was not used because it is considered as a measure of consumption consistent with much of the recent literature.

I used reported disabilities as a measure of health because, although it may omit some forms of poor health, it includes categories that would make working and enjoying life more difficult. There are four possible disabilities a person can report in the ACS: vision difficulty and difficulty dressing; hearing difficulty and difficulty remembering; difficulty going out; and physical difficulty.⁵ These disabilities may or may not limit working ability. For a person to be considered deprived in health, he or she must have

⁵ Grouping of vision difficulty and difficulty dressing and hearing difficulty and difficulty remembering is consistent with previous research.

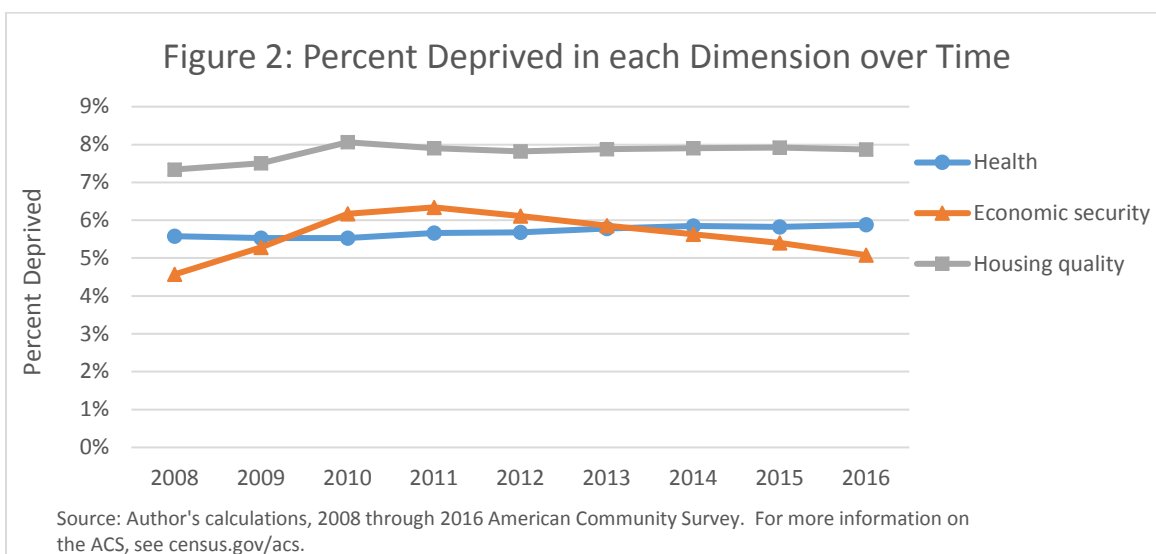
at least two of the four disabilities listed. The percent of people deprived in health has either not changed significantly or increased each year since 2008 (Figure 2).

6. Economic security

For a working age person to have economic security, ideally they would have a job. Not only does this provide income, but it allows for social interaction, provides meaning to daily life, and improves future labor market prospects. However, not everyone in a household needs to be working in order to avoid deprivation (i.e., children, students, caregivers, the retired). Therefore, a person was considered economically insecure if he or she was in a family with no workers unless all members of the family were age 65 or over, students, or some combination of the two. Similar to standard of living, deprivation in economic security increased until 2011 and then decreased after 2011 (Figure 2).

7. Housing quality

The ACS does not have any information about whether a person's house or apartment is in disrepair. However, I proxy for the quality of housing for the people in the household by comparing the number of people in the household to the number of rooms in the house or apartment. If the house or apartment has more than one person per room, then each person in that household was considered deprived in housing quality.⁶ Housing quality deprivation increased each year until 2010, decreased from 2010 to 2011, and then has not changed significantly since 2011 (Figure 2).



Cut-off points

The first cut-off points among each dimension when using the dual cut-off approach are discussed in the dimension section above. The second cut-off point is the number of dimensions a person must be deprived in for that person to be considered poor. In this paper, as in much of the

⁶ This is a standard measure of overcrowding that had demonstrable negative effects. See U.S. Department of Housing and Urban Development. 2007. "Measuring Overcrowding in Housing". Office of Policy Development and Research Publication.

literature, the cut-off point is two. Therefore, a person is considered poor if that person is deprived in at least two dimensions. In several instances throughout the paper, however, I also report the percentage of people deprived in other numbers of dimensions.

Though the seven dimensions measure different areas in which a person can be deprived, there is a significant amount of overlap among dimensions. A correlation matrix of the dimensions is presented in Table 3. Some of the highest correlations are between standard of living and the other dimensions, while some of the lowest correlations are between health and the other dimensions.

Table 3: Simple Correlations of Deprivations in each Dimension - 2016							
	Education	Standard of living	Consumption	Neighborhood quality	Health	Economic security	Housing quality
Education	1	0.1831	0.1708	0.1177	0.0214	0.0776	0.2002
Standard of living		1	0.1097	0.1660	0.0654	0.2546	0.1536
Consumption			1	0.0652	-0.0215	0.0142	0.0842
Neighborhood quality				1	0.0289	0.0710	0.0965
Health					1	0.1030	-0.0161
Economic security						1	0.0034
Housing quality							1

Source: Author's calculations, 2016 American Community Survey. For more information on the ACS, see census.gov/ACS.

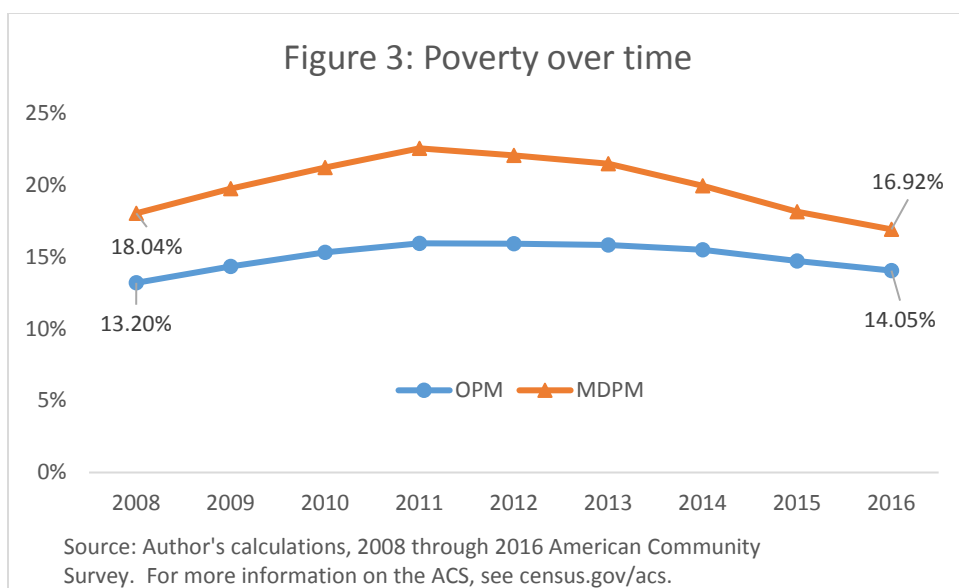
Results

1. OPM vs. MDPM

The official poverty measure (OPM) is both a dimension included in the multidimensional poverty (MDPM) measure and an important measure of the poor in the United States. Since the OPM is only one dimension of the MDPM, and people must be deprived in at least two dimensions to be considered poor, a person may be considered poor according to the OPM, to the MDPM, or to both.

The official poverty rate was 14.05 percent and the multidimensional poverty rate was 16.92 percent in 2016. There was a significant amount of overlap as 9.68 percent of people in the United States were considered poor according to both the OPM and the MDPM. The OPM, however, missed out on a significant portion of the population, 7.24 percent, who were deprived in multiple dimensions other than poverty. In other words, people who were not income poor, but faced significant hardships in other areas. There was also a significant segment of the population, 4.37 percent, who were considered income poor but were not deprived in any other dimension of the MDPM.

In Figure 3, the OPM and MDPM are plotted over time from 2008 to 2016. Four conclusions can be taken from this figure. First, the MDPM was consistently higher than the OPM over time. Second, the two poverty rates follow the same general pattern, but there was a steeper increase in the MDPM than in the OPM from 2008 to 2011 and a steeper decrease in the MDPM than in the OPM from 2011 to 2016. Third, there was less distance between the MDPM and OPM in 2016 than there was in 2008. Finally, while the OPM was higher in 2016 than it was in 2008, the MDPM was lower in 2016 than it was in 2008.



Another way to compare the OPM to the MDPM is to examine the percent of the population in poverty according to the OPM and the MDPM that was deprived in each dimension (Table 4). Excluding the standard of living dimension, a higher percentage of people in multidimensional poverty than in official poverty were deprived in each dimension.

	Total U.S. Population		The MDPM poor		The OPM poor		MDPM poor, but not OPM poor	
Dimension	Percent deprived	Standard error	Percent deprived	Standard error	Percent deprived	Standard error	Percent deprived	Standard error
Health	5.88	0.0164	17.97	0.0732	9.69	0.0551	23.18	0.1155
Education	9.87	0.0341	41.76	0.1039	23.38	0.1177	52.26	0.1611
Standard of living, OPM	14.05	0.0477	57.21	0.1111	100.00	N/A	0.00	N/A
Economic Security	5.08	0.0232	22.04	0.1117	18.92	0.1205	14.80	0.1090
Housing quality	7.87	0.0454	30.68	0.1593	18.10	0.1504	36.61	0.2132
Consumption	9.18	0.0324	32.84	0.0935	17.02	0.0731	43.73	0.1649
Neighborhood quality	14.4	0.0208	46.15	0.1282	28.82	0.1041	51.95	0.1907
Total people	315,165,470		53,334,273		44,268,996		22,822,543	

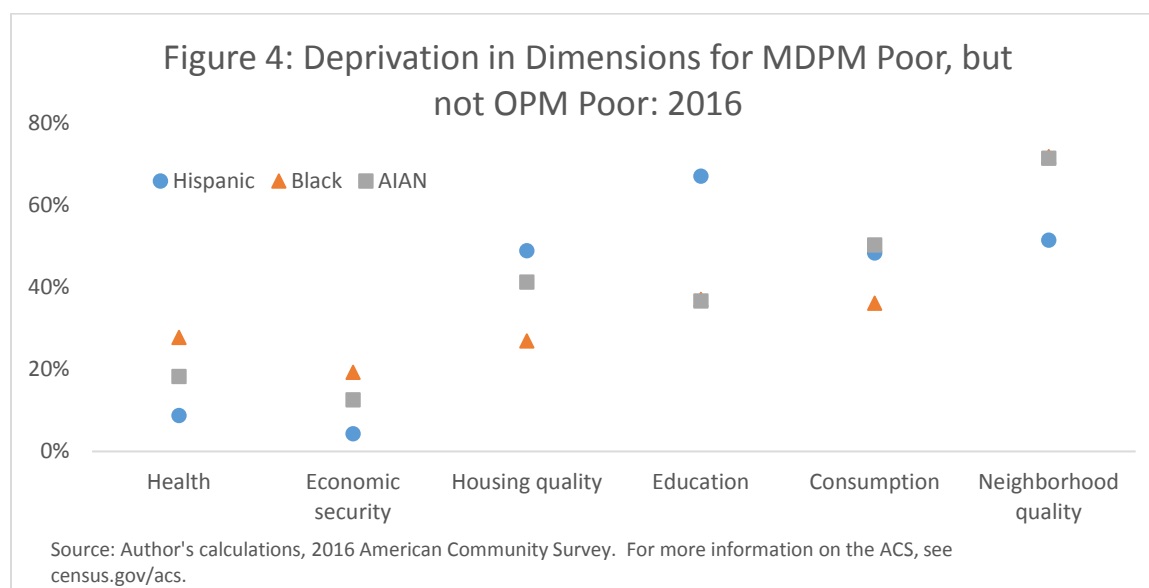
Source: Author's calculations, 2016 American Community Survey. For more information on the ACS, see census.gov/acs.

The last column in Table 4 shows the percentage of people deprived in each dimension for people who were considered poor according to the MDPM, but not the OPM. Almost 23 million people were deprived in at least two of the remaining six dimensions (after excluding standard of living). The MDPM captured a significant number of people who were deprived in education, 11.93 million, deprived in neighborhood quality, 11.86 million, and deprived in both education and neighborhood quality, 4.57

million, but who were not considered poor according to the OPM. Additionally, 2.78 million people were deprived in both housing quality and consumption, but were not considered poor according to the OPM.

There were also significant differences in people who were considered poor according to the MDPM, but not the OPM by race and age group. In Figure 4, I examine how the Hispanic population compares with the Black population and the American Indian and Alaskan Native (AIAN) population.⁷ This figure shows that while about 79 percent of Hispanics were not income poor, 67 percent of these Hispanics lacked a high school degree or were minors with parents without a high school degree and 52 percent lived in poor quality neighborhoods. Furthermore, nearly 50 percent of these non-income poor Hispanics were deprived in housing quality and consumption.

Blacks who were not considered poor according to the OPM were less likely than Hispanics to be education deprived, but significantly more likely to live in a poor quality neighborhood. Blacks were also the most likely of the three groups to be deprived in health and economic security. American Indians and Alaska Natives who were not considered poor according to the OPM were more likely to be deprived in consumption than the other groups.



In Figure 5, I compare people under 18 (children), people 18 to 64 (the working age population), and people 65 and over. Similar to the results in Figure 4, there were significant differences by age group. Children were the most likely of the age groups to be deprived in housing quality and education, the working age were most likely to be deprived in health and consumption, and people age 65 and over were the most likely to be deprived in economic security and neighborhood quality.⁸

⁷ White and Asian are left out for clarity purposes.

⁸ By definition, people 65 and over cannot be education deprived.

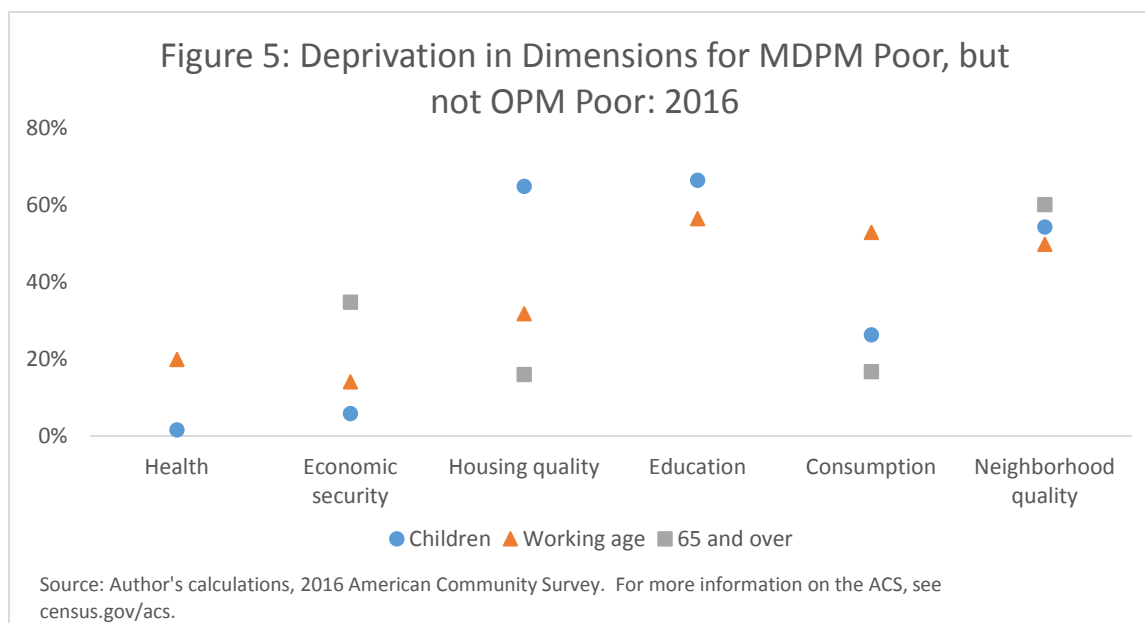


Table 5 lists the percent of people deprived in different numbers of dimensions. Over 40 percent of the U.S. population was deprived in at least one dimension in 2016. Over 34 percent of these people were considered poor according to the OPM. Approximately 1.73 percent of the U.S. population was deprived in four or more dimensions. While the vast majority of these people were considered poor according to the OPM, almost 9 percent of these individuals deprived across 4 dimensions were not considered income poor. Who are these people that are being missed by the OPM but captured by the MDPM?

Table 5: Dimensions of Multidimensional Poverty - 2016			
Number of deprivations	Percent deprived	Standard Error	Percent of the deprived in OPM poverty
At least one	41.1735	0.0682	34.11
At least two	16.9226	0.0532	57.21
At least three	6.1891	0.0278	76.21
At least four	1.7277	0.0144	91.04
At least five	0.2949	0.0050	98.69
At least six	0.0206	0.0031	99.50
Seven	0.0003	0.0001	100.00
Source: Author's calculations, 2016 American Community Survey. For more information on the ACS, see census.gov/acs .			

Table 6 answers this question by calculating the shares of the total population, the OPM population, and the MDPM population made up by different groups and comparing demographic shares among the three different populations. I find groups that were missed by the OPM by comparing the

OPM population to the MDPM population. With regards to race, both measures followed similar patterns. However, the MDPM captured more of the American Indian and Alaska native population as well as the other race population. Hispanics and the foreign born were represented significantly more in the MDPM population than in the OPM population. The OPM failed to capture the fact that Hispanics and the foreign born were deprived in areas other than just income.

Both the OPM and MDPM measures had overrepresentations of the young and underrepresentations of the old compared to the overall U.S. population. In both cases, a higher percentage of children and people 65 and over were in poverty according to the OPM than according to the MDPM. A higher percentage of working age people, however, were in poverty according to the MDPM than according to the OPM. A significantly larger share of married households and homeowners were in the MDPM population than in the OPM population. While homeowners and married people are not often thought of as income poor, the MDPM showed that they were deprived in other areas.

Table 6: Percent of each population type made up by each demographic variable - 2016						
Demographic variables	Total population	Std. Err.	OPM population	Std. Err.	MDPM population	Std. Err.
Black	12.44	0.0127	21.16	0.0847	19.54	0.0799
White	72.80	0.0215	60.21	0.1230	58.18	0.1232
Asian	5.46	0.0083	4.58	0.0447	4.39	0.0416
American Indian or Alaska Native (AIAN)	0.82	0.0064	1.53	0.0268	1.93	0.0256
Other race	8.48	0.0258	12.52	0.0990	15.96	0.0944
Hispanic	18.39	0.0067	27.33	0.1151	37.87	0.0915
Foreign born	13.70	0.0255	16.04	0.0660	23.48	0.0765
Under 18 years	22.99	0.0071	31.89	0.1008	27.41	0.0865
18 to 64 years	61.81	0.0057	58.11	0.0817	63.36	0.0771
Over 65 years	15.20	0.0041	10.01	0.0525	9.23	0.0394
Married household	59.56	0.0685	27.16	0.1230	40.08	0.1232
Female head of household	22.73	0.0495	44.03	0.1417	36.30	0.1273
Male head of household	11.13	0.0301	14.20	0.0871	14.27	0.0872
Nonfamily household	6.23	0.0273	12.91	0.0740	7.48	0.0515
Owners	64.55	0.1030	32.03	0.1580	37.65	0.1420
Rural	18.92	0.0514	16.51	0.0950	17.02	0.0788
Non-mover⁹	86.17	0.0393	78.13	0.1011	82.51	0.0975
Migrated from outside U.S.	0.64	0.0072	1.42	0.0323	1.25	0.0275
Migrated within U.S.	13.19	0.0382	20.45	0.0954	16.24	0.0941
Worker	52.76	0.0279	29.20	0.0787	33.16	0.0718
Not in labor force	20.34	0.0095	28.73	0.0986	24.55	0.0877
Non-worker	26.90	0.0243	42.07	0.0996	42.85	0.0889

Source: Author's calculations, 2016 American Community Survey. For more information on the ACS, see census.gov/acs.

⁹ People who did not change residences in the past year.

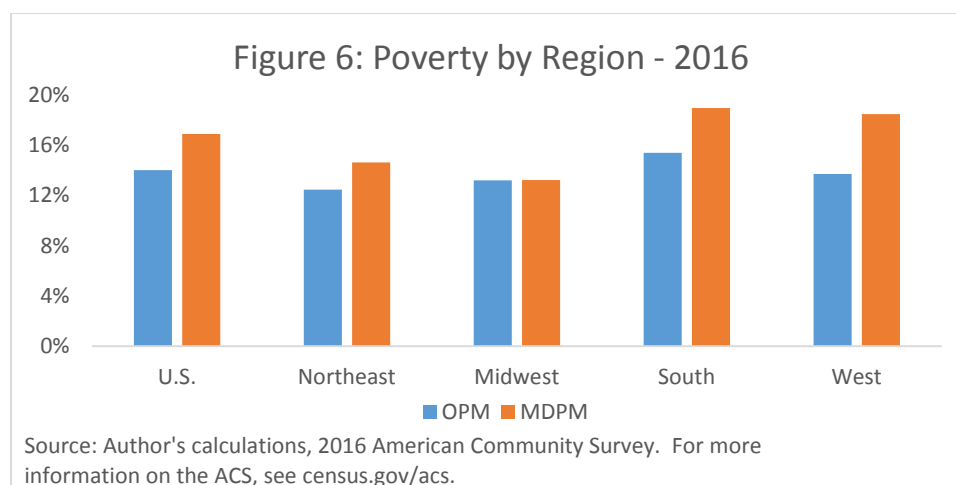
People living in rural areas and non-movers were more represented in the MDPM population than in the OPM population. Finally, the MDPM did a better job of capturing the working poor (working age person with a part-time or full-time job) than did the OPM.

In Table 5, the percentage of the population that were deprived in different numbers of dimensions were listed. In Table 7, four different categories of dimensions are shown over time. Just comparing 2008 to 2016, the percent of people deprived declined for each group over time. Comparing year-by-year, the percentage of people deprived in each number of dimensions was largest in 2011. While 41 percent of people were deprived in at least one dimension in 2016, this number was approximately 48 percent in 2011. For people deprived in at least four dimensions, there was more than one and a half times the proportion of the population deprived in 2011 as compared to 2016.

	At least one		At least two		At least three		At least four	
Year	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
2016	41.17	0.0682	16.92	0.0532	6.19	0.0278	1.73	0.0144
2015	42.74	0.0696	18.14	0.0556	6.85	0.0302	1.99	0.0153
2014	45.34	0.0604	19.96	0.0524	7.95	0.0327	2.43	0.0158
2013	47.25	0.0647	21.50	0.0533	8.75	0.0336	2.75	0.0195
2012	47.67	0.0589	22.06	0.0474	9.19	0.0287	2.95	0.0158
2011	48.48	0.0638	22.56	0.0519	9.55	0.0360	3.14	0.0190
2010	46.14	0.0707	21.22	0.0606	8.83	0.0361	2.87	0.0189
2009	44.16	0.0753	19.76	0.0568	8.04	0.0329	2.53	0.0180
2008	41.91	0.1115	18.04	0.0697	6.99	0.0330	2.11	0.0202

Source: Author's calculation, 2008 through 2016 American Community Survey. For more information on the ACS, see census.gov/acs.

All of the comparisons between the OPM and the MDPM discussed thus far are at the national level. However, significant differences existed regionally, by state, and by Metropolitan Statistical Area (MSA). As can be seen in Figure 6, both poverty measures differed by region. The difference between the OPM and the MDPM differed by region as well. In the Midwest, there was no statistical difference between the OPM and the MDPM, while there was nearly a five percent difference between the OPM and the MDPM in the West.



By state, there were larger variations than by region. In thirteen states and the District of Columbia, there was no statistically significant difference between the OPM and the MDPM in 2016, while in 26 states, the MDPM was higher than the OPM. Unlike regionally and nationally, there were 11 states in which the OPM was higher than the MDPM. There was a wide range of values by state as well. The MDPM in Mississippi was 1.73 times the national MDPM rate, while the MDPM in New Hampshire was 35 percent of the national MDPM rate. The range is not as great for the OPM. The OPM in New Hampshire was 52 percent of the national rate and the OPM in Mississippi was 1.48 times higher than the national rate.

Table 8: State differences - 2016

	OPM		MDPM			OPM		MDPM	
	Est.	Std. Err.	Est.	Std. Err.		Est.	Std. Err.	Est.	Std. Err.
United States	14.05	0.0477	16.92	0.0532	Missouri	13.99	0.2332	15.37	0.2094
Alabama	17.09	0.2997	19.39	0.2692	Montana	13.32	0.4650	12.48	0.4273
Alaska	9.89	0.5465	16.37	0.5519	Nebraska	11.42	0.3385	10.86	0.3476
Arizona	16.36	0.2493	23.11	0.2483	Nevada	13.79	0.3895	16.84	0.3948
Arkansas	17.22	0.3708	20.55	0.3517	New Hampshire	7.30	0.3612	5.92	0.3255
California	14.35	0.1052	22.22	0.1243	New Jersey	10.44	0.1999	12.99	0.2048
Colorado	11.05	0.2014	10.43	0.2004	New Mexico	19.83	0.4580	26.33	0.4451
Connecticut	9.77	0.2564	11.37	0.2328	New York	14.73	0.1221	19.26	0.1441
Delaware	11.67	0.5393	11.15	0.5181	North Carolina	15.39	0.1982	16.07	0.1726
District of Columbia	18.58	0.8509	20.11	0.7947	North Dakota	10.72	0.5132	8.06	0.3962
Florida	14.73	0.1460	16.56	0.1439	Ohio	14.58	0.1755	14.37	0.1566
Georgia	15.97	0.2088	19.94	0.2307	Oklahoma	16.29	0.2428	20.02	0.2443
Hawaii	9.33	0.4538	10.37	0.4936	Oregon	13.35	0.2732	12.16	0.2698
Idaho	14.37	0.5790	13.49	0.5046	Pennsylvania	12.87	0.1514	13.12	0.1442
Illinois	12.97	0.1721	13.27	0.1694	Rhode Island	12.79	0.5473	14.31	0.4922
Indiana	14.09	0.2174	15.72	0.2341	South Carolina	15.27	0.2936	14.51	0.2583
Iowa	11.76	0.2517	8.61	0.2302	South Dakota	13.25	0.4863	13.30	0.3479
Kansas	12.12	0.3094	12.30	0.2992	Tennessee	15.77	0.2419	17.33	0.2467
Kentucky	18.47	0.3405	21.82	0.3198	Texas	15.65	0.1339	23.89	0.1608
Louisiana	20.20	0.3482	25.99	0.4054	Utah	10.22	0.3077	9.46	0.2850
Maine	12.48	0.4719	12.77	0.4233	Vermont	11.89	0.5772	9.63	0.5864
Maryland	9.66	0.1775	10.16	0.1849	Virginia	10.99	0.2099	11.47	0.1915
Massachusetts	10.44	0.1884	10.70	0.1989	Washington	11.26	0.1904	10.51	0.1836
Michigan	14.96	0.1470	15.78	0.1460	West Virginia	17.93	0.4660	20.45	0.4340
Minnesota	9.88	0.1788	8.83	0.1801	Wisconsin	11.75	0.2132	10.40	0.1892
Mississippi	20.84	0.4493	29.34	0.4408	Wyoming	11.32	0.5931	10.44	0.4861

Source: Author's calculations, 2016 American Community Survey. For more information on the ACS, see census.gov/acs.

Note: **Bolded** estimates signify that the estimate is significantly greater for either the MDPM or OPM for that state.

Since there are 381 MSAs, summary measures are reported in Table 9 rather than values for all 381 areas. In 2016, the OPM was higher than the MDPM in about 24 percent of MSAs, while the OPM was lower than the MDPM in about 31 percent of MSAs. Due to the smaller geographical area than states, the MSA results had higher standard errors, which led to a significantly higher percent of areas with insignificant differences between the OPM and MDPM.

Looking at the results over time, there were three main conclusions. First, the percentage of areas that had higher OPM than MDPM increased over time, while the percentage of areas that had higher MDPM than OPM decreased over time for both states and MSAs. Second, the percent of states in which the OPM and the MDPM were not statistically different doubled from 2008 to 2016, while there was only a slight increase in the percent of MSAs that were not significantly different across measures. Third, there were significant differences in how the OPM and MDPM changed over time. As discussed above, the national OPM increased from 2008 to 2016 while the MDPM decreased for the nation as a whole. This pattern is the same for all four regions, but differs widely by state and MSA. The OPM increased from 2008 to 2016 in 28 states (55 percent) and decreased in 2 states (4 percent), while the MDPM increased in 6 states (12 percent) and decreased in 25 states (49 percent). Similarly, the OPM increased in 93 MSAs (24 percent) and decreased in 17 MSAs (5 percent), while the MDPM increased in 47 MSAs (12 percent) and decreased in 96 MSAs (25 percent).

Table 9: Number of states and MSAs in each category								
	2008				2016			
	States		MSAs		States		MSAs	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
OPM > MDPM	6	11.76%	43	11.29%	11	21.57%	92	24.15%
OPM < MDPM	38	74.51%	170	44.62%	26	50.98%	117	30.71%
OPM and MDPM not significantly different	7	13.73%	168	44.09%	14	27.45%	172	45.14%
Total (includes DC)	51		381		51		381	
Source: Author's calculations, 2008 and 2016 American Community Survey. For more information on the ACS, see census.gov/acs .								

2. Decompositions

One of the major advantages of using the multidimensional poverty measure is that it can be decomposed into the contributions that particular subgroups made to the overall MDPM rate. The MDPM and the OPM are both headcount ratios. In other words, the rate is just the count of people who are poor divided by the total population. In order to perform a decomposition, the MDPM must be converted to an adjusted headcount ratio. The adjusted headcount ratio is defined as the headcount ratio multiplied by the intensity of poverty. The intensity is found by first calculating the average number of deprivations for people who are in poverty according to the MDPM. This number is then divided by the total possible number of deprivations, which is seven in this case. The results of these calculations by year are presented in Table 10.

Table 10: Adjusted headcount ratio						
	Headcount ratio	Standard error	Intensity	Standard error	Adjusted headcount ratio	Standard error
2016	16.92	0.0532	0.355	0.0003	6.01	0.0196
2015	18.14	0.0556	0.358	0.0003	6.50	0.0207
2014	19.96	0.0524	0.364	0.0003	7.26	0.0200
2013	21.50	0.0533	0.366	0.0003	7.87	0.0205
2012	22.06	0.0474	0.369	0.0002	8.13	0.0180
2011	22.56	0.0519	0.371	0.0003	8.36	0.0201
2010	21.22	0.0606	0.369	0.0003	7.83	0.0231
2009	19.76	0.0568	0.366	0.0003	7.23	0.0215
2008	18.04	0.0697	0.361	0.0003	6.52	0.0258
Source: Author's calculations, 2008 through 2016 American Community Survey. For more information on the ACS, see census.gov/acs .						

The MDPM can be decomposed in two main ways: into contributions made by each of the dimensions and into contributions made by population subgroups. First, in order to decompose the MDPM by its dimensions, I calculate the proportion of people who are both deprived in the dimension and in MDPM poverty. Then I divide this by the number of dimensions, seven, and then by the overall adjusted headcount ratio (equation 1). The results of these calculations are listed in Table 11 for the years 2008 and 2016 in order to examine how the contributions by each dimension have changed over time. Each estimate is the contribution that the dimension makes to the overall MDPM rate. In other words, it tells us the percentage of the MDPM rate impacted by each dimension. In both years, standard of living was the most important contributor to MDPM status, while health was the least important factor. Over time, health, standard of living, economic security, and neighborhood quality increased in importance while education and consumption deprivation decreased in importance.

Table 11: Decomposition by dimensions – The percentage of the MDPM rate contributed by each dimension						
	2008		2016		change	
Dimension	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Health	6.42	0.3109	7.23	0.2159	0.81*	0.3786
Education	18.86	0.7042	16.81	0.5270	-2.05*	0.8796
Standard of living	21.16	0.6783	23.01	0.6268	1.85*	0.9235
Economic Security	7.38	0.3261	8.87	0.3606	1.49*	0.4862
Housing quality	11.60	0.5614	12.34	0.5921	0.74	0.8159
Consumption	19.17	0.5120	13.22	0.4331	-5.96*	0.6706
Neighborhood quality	15.38	0.3651	18.56	0.3520	3.18*	0.5071
All 7 dimensions	100.00		100.00			
Source: Author's calculations, 2008 and 2016 American Community Survey. For more information on the ACS, see census.gov/acs .						
Note: * significant at the 90% confidence level						

The importance of these dimensions in determining poverty status differed significantly by region of the country (Table 12). Neighborhood quality was more impactful in the Northeast than in the other regions, health was more important in the Midwest than in other regions, consumption

deprivation was more important in the South than in other regions, and education and housing quality were more important in the West than in other regions.

Table 12: Decompositions by dimension by region, 2016

	Northeast		Midwest		South		West	
Dimension	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Health	7.68	0.5082	8.92	0.5080	7.24	0.2563	5.91	0.3253
Education	15.82	1.0820	15.55	1.2298	16.33	0.7299	18.87	0.8513
Standard of living	23.61	1.3899	26.02	1.3612	23.17	0.9261	20.56	0.8055
Economic Security	9.22	0.8115	9.92	0.8593	9.43	0.5485	7.08	0.5738
Housing quality	12.89	1.4689	9.05	1.1428	9.83	0.8013	18.10	1.0184
Consumption	9.89	0.8355	12.05	0.8147	15.84	0.7064	11.52	0.6002
Neighborhood quality	20.86	0.9941	18.48	0.8148	18.17	0.6032	17.94	0.7593
All 7 dimensions	100.00		100.00		100.00		100.00	

Source: Author's calculations, 2016 American Community Survey. For more information on the ACS, see census.gov/acs.

The importance of these dimensions in determining poverty status also varied significantly by race, age, and urban residency. In Table 13, the breakdowns by race are presented. Health was more impactful for Whites than for other races, standard of living was more impactful for Blacks than for other races, and neighborhood quality was more impactful for Blacks and AIAN than for other races.

Table 13: Decompositions by dimensions by race - 2016

	White		Black		Asian		AIAN	
Dimension	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Health	8.65	0.3283	7.00	0.3572	5.23	0.7049	5.52	0.9918
Education	17.01	0.7011	12.12	0.6647	16.38	2.1156	12.47	1.8227
Standard of living	22.73	0.8118	26.82	0.9928	22.82	2.0877	20.59	2.2855
Economic Security	9.34	0.4363	11.06	0.8557	6.42	1.1456	8.71	1.4178
Housing quality	11.38	0.7381	8.99	1.0175	19.09	2.1640	13.80	2.4064
Consumption	14.20	0.5982	9.75	0.5304	13.12	1.5413	14.92	1.7942
Neighborhood quality	16.68	0.5478	24.26	0.8864	16.94	1.7702	24.00	2.1205
All 7 dimensions	100.00		100.00		100.00		100.00	

Source: Author's calculations, 2016 American Community Survey. For more information on the ACS, see census.gov/acs.

The differences in the importance of each dimension of the MDPM for three age groups are presented in Table 14. Parental education, standard of living, and housing quality were more important contributors to child MDPM status than to the MDPM status of the other age groups. Consumption deprivation was more important in determining MDPM status for working age adults than for the children or those 65 and over. Finally, health, economic security, and neighborhood quality were more important in determining the MDPM status of those 65 and older than for children or working age adults.

Table 14: Decomposition by dimensions by age - 2016						
	Children (Under 18)		Working age (Between 18 and 64)		65 and Over	
Dimension	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Health	0.38	0.0670	7.20	0.2745	30.50	1.2962
Education	19.60	1.0197	17.75	0.4531	N/A	N/A
Standard of living	27.32	1.2706	21.27	0.4966	21.78	1.0167
Economic Security	9.86	0.6892	7.90	0.2974	12.87	0.8176
Housing quality	18.44	1.1174	10.48	0.4749	6.02	0.5898
Consumption	5.67	0.4700	17.49	0.5533	5.77	0.6557
Neighborhood quality	18.73	0.6473	17.90	0.3636	23.06	0.9415
All 7 Dimensions	100.00		100.00		100.00	
Source: Author's calculations, 2016 American Community Survey. For more information on the ACS, see census.gov/acs .						

In Table 15, the importance of each dimension to MDPM status are presented for people living in urban and rural areas. Housing quality and neighborhood quality were more important in determining MDPM status for people living in urban areas than for people living in rural areas, while health and economic security were more important in determining MDPM status for people living in rural areas than for people living in urban areas.

Table 15: Decomposition by Dimensions by urban residency				
	Urban		Rural	
Dimension	Est.	Std. Err.	Est.	Std. Err.
Health	6.77	0.2103	9.47	0.5434
Education	17.01	0.5214	15.75	1.1382
Standard of living	23.11	0.6246	22.53	1.2997
Economic Security	8.25	0.3951	11.89	0.8528
Housing quality	13.06	0.6024	8.78	1.0539
Consumption	12.98	0.4205	14.35	0.8313
Neighborhood quality	18.83	0.3691	17.24	0.8908
Source: Author's calculations, 2016 American Community Survey. For more information on the ACS, see census.gov/acs .				

Second, in order to decompose the MDPM by subgroups, the adjusted headcount ratio for the subgroup was divided by the overall adjusted headcount ratio. This number was then multiplied by the subgroup share of the total population (equation 2). The MDPM shares are the percentage of the MDPM rate contributed by that particular subgroup. The results of these calculations are presented in Table 16 for race and Table 17 for age groups. The population share column contains the subgroup's share of the total U.S. population and the MDPM share column contains the contribution that each subgroup made to the overall MDPM rate.

In Table 16, there are two main conclusions to note. First, Whites and Asians contributed less to the MDPM rate relative to their share of the population, while the reverse was true for Blacks, American Indian and Alaska Natives (AIAN), and other races. Second, Blacks contributed less to the MDPM rate over time, while Asians and AIANs contributed more over time.

Table 16: Each race's contribution to overall poverty						
	2008		2016		change	
Dimension	Pop. Share	MDPM share	Pop. share	MDPM share	Pop. share	MDPM share
White	75.24	57.70	72.80	57.43	-2.44*	-0.27
Black	12.14	20.74	12.44	19.81	0.3*	-0.93*
Asian	4.44	3.51	5.46	4.19	1.02*	0.68*
AIAN	0.80	1.88	0.82	2.09	0.02*	0.20*
Other race	7.38	16.14	8.48	16.50	1.10*	0.37
All races	100.00	100.00	100.00	100.00		
Source: Author's calculations, 2008 and 2016 American Community Survey. For more information on the ACS, see census.gov/acs . Note: * significant at the 90% confidence level						

In Table 17, the contributions of each age group to the MDPM rate are presented. People age 65 and over contributed less to the MDPM rate than their share of the population, while children and working-age adults contributed more to the MDPM rate than their share of the population. However, children and working-age adults contributed less to the MDPM rate over time, while people age 65 and over contributed more to MDPM rates over time.

Table 17: Each age group's contribution to overall poverty						
	2008		2016		change	
Dimension	Pop. Share	MDPM share	Pop. share	MDPM share	Pop. share	MDPM share
Children	24.58	28.50	22.99	28.00	-1.60*	-0.50*
Working-age adults	62.85	64.87	61.81	63.71	-1.04*	-1.15*
65 and over	12.56	6.61	15.20	8.30	2.64*	1.70*
All age groups	100.00	100.00	100.00	100.00		
Source: Author's calculations, 2008 and 2016 American Community Survey. For more information on the ACS, see census.gov/acs . Note: * significant at the 90% confidence level						

3. Regression

In this final section, I pool the 2008 through 2016 cross sections and regress the two poverty measures on demographic variables in order to determine the probabilities of being in poverty for the different groups and how these probabilities differ by poverty measure (Table 18). I use year fixed effects and state fixed effects along with robust standard errors. The following model was estimated using the linear probability model.

$$\begin{aligned}
Pov_{it} = & \beta_0 + \beta_1 Race_i + \beta_2 Hispanic\ origin_i + \beta_3 Nativity_i + \beta_4 Age_i + \beta_5 HHtype_i \\
& + \beta_6 Ownership\ status_i + \beta_7 Migration_i + State_{it} + Year + \epsilon_{it}
\end{aligned}$$

American Indian and Alaska Natives had the highest probabilities of being in multidimensional poverty, followed, in order, by Blacks, other races, Whites, and Asians. There were two interesting

differences between the MDPM results and the OPM results. First, American Indian and Alaska natives, Blacks, and other race groups were more likely to be in poverty than Whites and this difference across racial groups was higher for the MDPM than for the OPM. Second, Asians were less likely than Whites to be in poverty according to the MDPM, but more likely than Whites to be in poverty according to the OPM.

Hispanics, the foreign born, renters, and people living in rural areas were more likely to be in poverty as defined by the MDPM than non-Hispanics, the native born, owners, and people living in urban areas, respectively. Furthermore, each of these differences in probabilities of being in poverty were higher for the MDPM than for the OPM.

Children were more likely to be in poverty than working age adults and working age adults were more likely to be in poverty than people 65 and over when poverty was defined by the MDPM. The same pattern was true for the OPM, but there were two important differences. First, children were more likely to be in poverty than working age adults for both poverty measures, but these differences in probabilities of being in poverty were higher for the OPM than for the MDPM. Second, people 65 and over were less likely to be in poverty than working age adults for both poverty measures, but these differences in probabilities of being in poverty were larger for the MDPM than for the OPM.

Table 18: Probabilities of being MDPM poor and OPM poor: 2008 through 2016				
	MDPM		OPM	
	Estimate	Standard error	Estimate	Standard error
Black ¹	11.97	0.03045	6.86	0.02768
Asian ¹	-1.80	0.03929	1.11	0.03455
Other race ¹	4.84	0.03859	1.94	0.03428
American Indian, Alaska Native ¹	17.44	0.10508	8.37	0.09205
Hispanic ²	20.83	0.03024	7.33	0.02625
Foreign born ³	10.70	0.03201	2.35	0.0277
Children (under 18) ⁴	1.26	0.01937	7.30	0.0182
65 and older ⁴	-4.25	0.01839	-1.04	0.01634
Male head of household ⁵	7.28	0.02864	8.07	0.02582
Female head of household ⁵	11.38	0.02204	16.47	0.02069
Nonfamily household ⁵	7.05	0.04029	19.14	0.04199
Renters ⁶	13.75	0.02140	13.50	0.01957
Rural ⁷	3.77	0.01812	2.59	0.01615
Migrated from outside U.S. ⁸	5.42	0.12849	10.45	0.12599
Migrated within U.S. ⁸	0.50	0.02769	3.05	0.0264
Year fixed effects	Yes		Yes	
State fixed effects	Yes		Yes	
R squared	.1610		.1410	
Reference groups: ¹ White; ² Not Hispanic; ³ Native born; ⁴ Working age adults (Ages 18 and 64); ⁵ Married couple household; ⁶ Owners; ⁷ Urban; ⁸ Nonmover;				
Source: Author's calculations, 2008 through 2016 American Community Survey. For more information on the ACS, see census.gov/acs .				

When looking at types of households, there were three differences between the MDPM and the OPM. First, the most likely households to be in poverty by the MDPM definition were those head by females, while the most likely group to be in poverty by the OPM definition were nonfamily households. Second, households headed by males were the second most likely group to be in poverty according to the MDPM, while they were the third most likely group to be in poverty according to the OPM. Third, households head by males, households headed by females, and nonfamily households all had higher probabilities of being in poverty than married households by both poverty measures, but these differences in probabilities were all larger for the OPM.

Finally, people who moved within the last year were more likely to be in poverty than people who stayed in the same home according to both measures. Furthermore, people who moved from outside the U.S. were more likely to be in poverty than people moving within the U.S. according to both measures. However, the differences in probabilities between movers and nonmovers was significantly larger for the OPM than for the MDPM.

Conclusion

The purpose of this paper was twofold. First, to create a multidimensional poverty measure that can be used to describe income and non-income deprived individuals alongside the official poverty measure and the supplemental poverty measure. Second, to demonstrate the depth of analysis of multidimensional poverty that can be done using the American Community Survey.

The analysis of multidimensional poverty comprised three main areas. The first was a comparison of the multidimensional poverty measure with the official poverty measure using the American Community Survey. The MDPM was higher than the OPM for all years in the study, but the gap across the two widened from 2008 to 2011 and narrowed from 2011 to 2016. Furthermore, the demographic make-up of people in poverty differed significantly by poverty measure and there were significant differences between the OPM and the MDPM by region, state, and MSA.

The second was decomposing multidimensional poverty into contributions made by each dimension and into contributions made by population subgroups. For dimensional decompositions, health, standard of living, economic security, and neighborhood quality increased in importance over time, while education and consumption deprivation decreased in importance over time. However, the importance of a particular dimension differed significantly by region, race, age, and urban and rural residency. For subgroup decompositions, Blacks, American Indian and Alaska Natives, other races, children, and the working-age population all contributed more to the MDPM rate than their particular share of the population.

The third was a regression of the MDPM and the OPM individually on demographic variables in order to determine the probabilities of being in poverty for different groups and how these probabilities differ by poverty measure. Relative to their particular reference group, the probability of being poor according to the MDPM was greater than the probability of being poor according to the MDPM for Blacks, other races, American Indian and Alaska Natives, Hispanics, the foreign born, renters, and people living in rural areas. The opposite was the case for Asians, children, people age 65 and over, male headed households, female headed households, nonfamily households, and people who moved within the last year.

Next steps for this paper involves further exploring tradeoffs, weighting schemes, the supplemental poverty measure, and the use of other surveys. One issue not addressed in this paper or in much of the literature, is whether extreme deprivation in one dimension compensates for lack of deprivation in other dimensions. Or whether fairing overly well in one dimension can compensate for being deprived in others. In other words, can the dimensions be tradeoffs or substitutes for one another and how can this be integrated into the methodology.

A second issue which was briefly discussed in this paper and has been addressed in the literature is how to weight the different dimensions. I used equal weighting in this paper, but arguments can be made that certain dimensions may be deserving of higher weights than others. While different weighting schemes have been used in the literature, a comparison of multidimensional poverty measures using different weighting schemes has received little attention.

A final area to explore is the use of different surveys. This is interesting for several reasons. First, I can find the same or related variables from the multidimensional poverty measure in this paper with the Current Population Survey Annual Social and Economic Supplement (CPS ASEC). That would allow me to do comparisons between surveys. Second, I can use the supplemental poverty measure (SPM), which is only currently available with the CPS ASEC, to examine how the MDPM is related to the SPM and how the MDPM changes when the SPM is used in place of the OPM to measure standard of living.

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