IRP Discussion Paper

A Decade-Long View of Multidimensional Deprivation in the United States

Shatakshee Dhongde
School of Economics, Georgia Institute of Technology,
221 Bobby Dodd Way, Atlanta, GA 30332, USA
Shatakshee.dhongde@econ.gatech.edu

Robert Haveman
Department of Economics and Robert M. La Follette School of Public Affairs
University of Wisconsin–Madison
1225 Observatory Drive, Madison, WI 53706, USA
Haveman@Lafollette.wisc.edu

September 5, 2019

IRP Publications (discussion papers, special reports, *Fast Focus*, and the newsletter *Focus*) are available on the Internet. The IRP Web site can be accessed at the following address: http://www.irp.wisc.edu.

Abstract

This paper undertakes a comprehensive analysis of temporal trends in multidimensional deprivation in the United States. It provides, for the first time, estimates of multidimensional deprivation in the United States for an entire decade, from 2008 to 2017, which covers the Great Recession and the recovery following the recession when major policy changes such as the Affordable Care Act were implemented. We measure annual changes in deprivation levels, across states and among demographic groups by age, gender, income, and race. Multidimensional deprivation is estimated using individual data from the American Community Survey, the largest household survey conducted by the U.S. Census Bureau. We find that about 13.5 percent of the U.S. population was deprived in at least two dimensions. Deprivation was high among individuals having income just above the poverty line, among young adults (aged 18 to 24 years), and among Hispanics and foreign-born individuals. In the midst of the Great Recession, more than 15 percent of population was multidimensionally deprived, but deprivation consistently declined during the recovery period.

Introduction

Poverty has been traditionally regarded as an income shortfall of an individual. However, income levels do not always accurately signal the quality of life of an individual. Despite having income above a poverty threshold, an individual may still be deprived in other dimensions such as education, housing, or health. When an individual suffers multiple such deprivations at the same time, the consequences for quality of life far exceed the sum of each separate deprivation (Stiglitz, Sen, and Fitoussi, 2009). Hence the need to measure multidimensional deprivation. A multidimensional approach to poverty has become increasingly prevalent in the last decade or so. Since 2010, the United Nations Human Development Report has annually published a multidimensional poverty index for more than 100 developing countries. Several countries, including many in the Americas (Colombia, Costa Rica, Chile, Ecuador, El Salvador, Mexico), publish official estimates of multidimensional poverty along with those of income poverty. Multidimensional poverty is routinely estimated in countries in the European Union.

However, the United States has somewhat lagged behind in measuring multidimensional poverty among its population. Though the official poverty measure has been criticized for being outdated (Smeeding, 2006) and alternative measures such as the Supplemental Poverty Measure are published annually (Garner and Short, 2010), only in recent years have there been attempts at systematically measuring multidimensional poverty in the United States. Dhongde and Haveman (2017) were the first to estimate the extent of multidimensional deprivation in the United States since the onset of the Great Recession, from 2008 to 2013.[1] They found that the proportion of multidimensionally deprived was about 15 percent during the recession and exceeded the official

---

[1] Early on, there were studies which used U.S. data to demonstrate applications of multidimensional deprivation measures but these were limited to estimates from a single year (e.g., Alkire and Foster [2011], Mitra and Brucker [2016]).

income poverty estimate. Mitra and Brucker (2019) estimated deprivation during the recovery period from 2013 to 2017 and found that by 2017, the percentage of multidimensional deprived had declined to about 10 percent. Glassman (2019) estimated multidimensional deprivation at about 15 percent in 2017. Estimates of the incidence of multidimensional deprivation in the United States vary across studies, depending on the data and the indicators used to measure deprivation levels. The three previous studies estimated multidimensional deprivation using indices proposed by Alkire and Foster (2011; AF henceforth). AF proposed indices that are a multidimensional extension of the Foster, Greer, and Thorbeck (1984) indices and hence are easy to interpret. However, in a recent paper, Dhongde, Pattanaik, and Xu (2019) proposed an alternative framework and showed that the AF adjusted headcount ratio is a special case of a more general framework. In this paper, we estimate deprivation indices based on the new framework (Dhongde et al., 2019) as well as those based on the AF (2011) methodology. For ease of exposition and comparison with previous studies, we largely focus our discussion on the proportion of deprived in the population. For the first time, we provide estimates of multidimensional deprivation in the United States over the last decade, from 2008 to 2017, covering the period of the Great Recession as well as economic recovery. Deprivation is measured separately for regions and states and among population subgroups by age, gender, income, nativity, and race/ethnicity.

The remainder of the paper is structured as follows. Section 2 summarizes the data and the multiple indicators of well-being. In Section 3, we discuss various measures of multidimensional deprivation and provide time trends in deprivation over the last decade. In Section 4, deprivation experienced by different population groups is discussed. Section 5 contains some sensitivity checks on our estimates, and Section 6 summarizes the results.

2. Indicators of Deprivation

2.1. Data

There are two large surveys that have been used to measure multidimensional deprivation in the United States, namely, the American Community Survey (ACS) and the Current Population Survey (CPS).[2] Both are annual surveys conducted by the U.S. Census Bureau. Dhongde and Haveman (2017) and Dhongde et al. (2019) used the ACS, whereas Mitra and Brucker (2019) used the CPS to measure deprivation. The ACS has detailed data on housing conditions; the CPS does not have this level of detail. However, the only health data available in the ACS is on individuals' disabilities. In addition to data on disabilities, the CPS also asks individuals to self-assess their health ranking. Thus, there are advantages and drawbacks to using either one of the two surveys.

We use annual data from the ACS from 2008 to 2017, primarily because the ACS is the largest household survey in the United States. The ACS has much larger coverage with more than 3 million individuals compared with the CPS annual sample size of about 100,000. We use the annual Public Use Microdata Sample (PUMS) files, which provide data from areas with population of 65,000 or more.[3] Individual records are replicated using person weights. ACS data on individual records are matched with the same individual's household characteristics. We remove any individuals living in group quarters.[4] We focus on the non-elderly adult population (between ages 18 and 65 years; though we

---

[2] Mitra and Brucker (2016) test the feasibility of measuring multidimensional deprivation in the United States by comparing four datasets: the ACS, the CPS, the Survey of Income and Program Participation (SIPP), and the Panel Survey of Income Dynamics (PSID).

[3] ACS data in 2008 and 2009 are controlled to population estimates based on Census 2000 counts; data from 2010 onwards are controlled to estimates based on Census 2010 counts. We do not use data from previous rounds (2005, 2006 and 2007) since there were changes made to the ACS questionnaire for several subject areas in 2008. PUMS is a sample of population and housing unit records from the ACS; the 1-year ACS PUMS file represents about 1% of the total U.S. population.

[4] About 5 percent of the sample in the ACS lives in group quarters (GQs). GQs include such places as college residence halls, residential treatment centers, skilled nursing facilities, group homes, military barracks, correctional facilities, and workers' dormitories. Survey values for GQs are often imputed.

estimate deprivation for all age groups) because the indicators we choose (e.g., high school education, English fluency) are more relevant for this age group.[5]

Following previous studies in the United States, we choose deprivation dimensions based on the recommendations made by Stiglitz et al. (2009). Commonly used indicators in previous studies include incompletion of high school education, lack of health insurance, number of disabilities experienced by an individual, overcrowding, housing costs, and English fluency. We include all of these indicators yet differ from the literature in an important way. Unlike previous studies (Dhongde et al. [2019], Glassman [2019], and Mitra and Brucker [2019]), we do not use income as an indicator of the standard of living for individuals. This is mainly because we wish to identify the multidimensionally deprived distinct from the income poor and then compare these two groups. Instead of income, we use the ACS data on housing costs, i.e., monthly owner costs and gross rent. We consider an individual deprived if she experienced severe housing burden, i.e., housing costs in excess of 50 percent of household income.[6] Table 1 below lists the dimensions, indicators, their thresholds, and the average percentage of population deprived in each indicator. Note that out of the six indicators, data on disability, education, and health insurance are available at the individual level. Data on housing costs, English fluency, and rooms per person is compiled at the household level and assigned to individuals within a household.

---

[5] For measures of deprivation more relevant for children, see Ciula and Skinner (2015) and for the elderly, see Dhongde (2017).

[6] Schwartz and Wilson (2007) explain the different housing burden categories: There is no housing burden when less than 30 percent of household income is spent on housing costs; there is moderate burden when between 30 and 49.9 percent of income is spent on housing costs; and there is severe burden when housing costs are 50 percent or above.

Table 1. Indicators Used to Measure Multidimensional Deprivation in the United States

Dimensions	Indicators	Thresholds	Average % of pop. below threshold
Health	Disability	Two or more out of six disabilities: hearing, vision, cognition, ambulation, serious difficulty with self-care (e.g., bathing and dressing), or performing independent tasks (e.g., shopping)	4.6
Education	High school education	Not having received at least a high school diploma	10.4
Std. of living	Housing costs as a percentage of household income	Severe housing burden: monthly owner costs or gross rent in excess of 50% of household income	12.5
Economic security	Health insurance	Lack of any type of health insurance; public or private	17.8
Social connections	English fluency	Live in a household where no person, 14 and over, speaks English only or speaks a language other than English at home and speaks English very well	4.7
Housing quality	Number of persons per room in a housing unit	Overcrowding: unit has more than one occupant per room	6.2

2.2. Trends in Deprivation Indicators

In Figure 1, we display a dashboard of trends in deprivations by plotting the percentage of deprived population in each of the six indicators detailed in Table 1. The trends show that the incidence of deprivation in most indicators decreased over time. The biggest decline since 2014 is seen in the proportion of adults without health insurance. Between 2008 and 2013, more than 20 percent of individuals did not have any kind of health insurance. A majority of the provisions of the Affordable Care Act (ACA) were enforced in 2014. Since then, the proportion of individuals without insurance

decreased, from 20 percent in 2013 to 16 percent in 2014, and 12 percent in 2017.[7] The incidence of individuals with severe housing burden also declined significantly, from 14 percent in 2011 to 10.6 percent in 2017. The proportion of individuals with severe housing burden in 2017 was almost exactly equal to what it was in 2008, before the start of the recession. The long-term trend in high school dropouts has declined gradually from 11 percent in 2008 to 9 percent in 2017.

Compared with health insurance, housing costs, and education, a relatively lower proportion of the population was deprived in the remaining three indicators, namely, crowded housing, lack of English fluency, and disabilities. By the nature of these indicators, one would not expect deprivation in these indicators to vary significantly over time. This is confirmed in Figure 1. On average, about 6 percent of the population lived in a crowded house, about 4.5 percent had two or more disabilities, and 5 percent lived in households that lacked English fluency.

Figure 1. Trends in Deprivation in Multiple Indicators of Deprivation
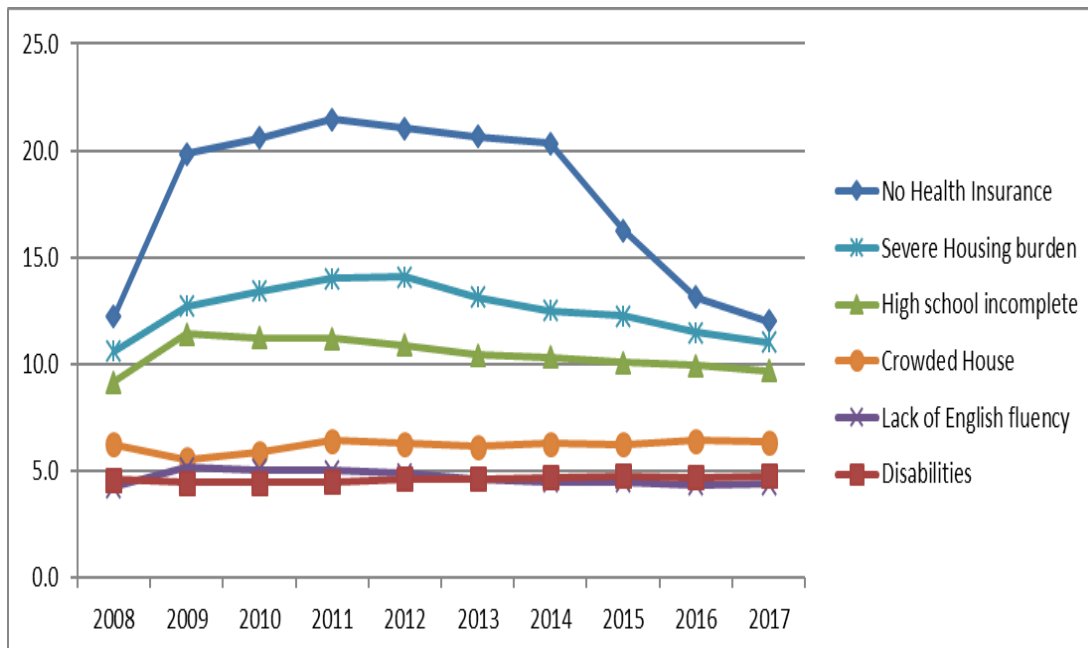
1. All values are given as percent of the non-elderly adult population (18 to 64 years)

---

[7] The ACS data say whether individuals are with or without health insurance; the survey does not gather data on the type of insurance, private or public.

3. Measuring Multidimensional Deprivation

3.1. Multidimensional Deprivation Indices

A dashboard of deprivations illustrated in Figure 1 gives the percentage of the population deprived in each indicator. However, when measuring multidimensional deprivation, we are interested in finding out whether individuals experience multiple deprivations simultaneously. Several multidimensional deprivation indices have been proposed in the literature (see Pattanaik and Xu, 2018, for a review) and the choice of an index often depends on the type of data available. The indicators discussed in the previous section are measured using different types of data. For example, having health insurance or not are binary data; education data are ordinal with multiple levels, such as less than high school, high school graduate, college graduate; housing costs are expressed as a percentage of income; and so on. In order to aggregate varied data in one measure, we convert data on all indicators to a binary (0-1) form. Below, we detail a class of indices proposed by Dhongde et al. (2019) particularly suitable for binary forms of data.

Let $F = \{f_1, \dots, f_M\}$ be a set of indicators $(j = 1, \dots M, M \geq 2)$ and $i = 1, 2, \dots N$ denote individuals. Let a_{ij} denote the achievement status of individual i in indicator j. If an individual's achievement in the jth indicator is below the threshold, then she is deprived in that indicator and $a_{ij} = 1$. If her achievement in the jth indicator is above the threshold, then she is not deprived and $a_{ij} = 0$. For instance, if the threshold for education is high school, then an individual who is a high school dropout is given a score of 1, if she is a college graduate, she is given a score of 0. Let $w_j, (w_j > 0)$ denote the weight of indictor j, and $\left(\sum_{j=1}^{M} w_j = 1 \right)$. In the benchmark case, we assume equal weights to all six indicators, $w_j = 1/6$. An individual i's overall deprivation is given by $\left(\sum_{j=1}^{M} w_j a_{ij} \right)$ and her overall achievement as $1 - \left(\sum_{j=1}^{M} w_j a_{ij} \right)$. An individual is identified as multidimensionally deprived,

if and only if her overall deprivation exceeds some threshold value $\left(\sum_{j=1}^{m} w_j a_{ij}\right) \geq t$. For instance, in the benchmark case, we set the threshold equal to $t = 2/6$ so that individuals with two or more deprivations are considered as multidimensionally deprived. Using this threshold, suppose we identify q individuals from among N individuals, as multidimensionally deprived. Then a multidimensional deprivation index for the society is based on the deprivation levels of those q individuals identified as deprived and is expressed as:

$$D = \frac{1}{N} \sum_{i=1}^{q} \left(\sum_{j=1}^{M} w_j a_{ij}\right)^{\alpha} \tag{1}$$

for some α ($\alpha > 0$), for all $i \in N$. The index shown in Equation (1) is closely tied to a multidimensional well-being index and satisfies axioms such as Normalization, Anonymity, Monotonicity, and Independence (see Dhongde et al., 2019).

When we restrict the value of α such that $0 < \alpha < 1$, then the individual's deprivation function satisfies an intuitively plausible property called Clustered Dimensional Deteriorations and Deprivation (CDDD). The property is based on the intuition that the total harm caused by two different dimensional deprivations occurring simultaneously is greater than the sum of the separate harms caused by those two dimensional deprivations occurring one at a time. On the other hand, when $\alpha = 1$, the deprivation index in (1) does not satisfy CDDD but is equal to the more known adjusted headcount ratio proposed by AF (2011). When $\alpha = 1$, the deprivation index in (1), can be expressed as the product of two indices. Let $MDI = q/N$, denote the multidimensional deprivation incidence, i.e., the proportion of multidimensional deprived q in the society N. The average intensity index is given by $A = \frac{1}{q} \sum_{i=1}^{q} \left(\sum_{j=1}^{M} w_j a_{ij}\right)$. Thus, when $\alpha = 1$,

$$D = \frac{1}{N} \sum_{i=1}^{q} \left(\sum_{j=1}^{M} w_j a_{ij}\right)^{\alpha=1} = \frac{q}{N} x \frac{1}{q} \sum_{i=1}^{q} \left(\sum_{j=1}^{M} w_j a_{ij}\right) = MDIxA \tag{2}$$

3.2. Trends in Multidimensional Deprivation

In Table 2, we provide estimates for the entire decade between 2008 and 2017, of multidimensional deprivation indices D when $\alpha = 0.5$ and when $\alpha = 1$, as well as MDI and A.

Table 2. Multidimensional Deprivation Indices

Indices[1]	Av.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
D ($\alpha = 0.5$)	0.030	0.033	0.034	0.036	0.035	0.033	0.032	0.029	0.026	0.024	0.023
D ($\alpha = 1$)	0.053	0.058	0.060	0.062	0.061	0.058	0.056	0.050	0.045	0.042	0.040
A	0.395	0.401	0.402	0.400	0.398	0.395	0.394	0.394	0.391	0.389	0.387
MDI	0.135	0.146	0.149	0.155	0.153	0.146	0.142	0.127	0.115	0.109	0.105

1. All values are given as percent of the non-elderly adult population (aged 18 to 64 years) deprived in at least two indicators.

The different deprivation indices in Table 2 show similar trends. Deprivation rose between 2008 and 2010 and then gradually declined. At the end of the decade in 2017, deprivation levels estimated by all indices were lower than what they were at the beginning of the decade in 2008. Deprivation indices D ($\alpha = 0.5$) and D ($\alpha = 1$) give the average of an individual's overall deprivation (or the square root of it, in the former case). The average value of D ($\alpha = 0.5$) is equal to 0.03 and that of D ($\alpha = 1$) is equal to 0.05. Note that D ($\alpha = 1$) is equal to the product of A and MDI. The index, A, gives the average deprivation experienced by the multidimensionally deprived (q). The average value of index A is equal to 0.4, which implies that on average, in the last decade, adults in the United States were deprived in 2.4 out of 6 indicators. The average MDI is equal to 0.135, which means that 13.5 percent of the non-elderly adult population was deprived in at least two of the six indicators. In the analysis that follows, we focus on the MDI as the deprivation index, since it has been widely used in the literature.

3.2. Multidimensional Deprivation and Income Poverty

In Table 3, we summarize estimates of the MDI (expressed in percentage terms), alongside estimates of the official poverty measure (OPM) and the Supplemental Poverty Measure (SPM). On average, about 13.5 percent of the non-elderly adult population was identified as multidimensionally deprived. This value of average MDI was comparable with average income poverty, with average OPM about 12.8 percent and average SPM around 14.6 percent. Although the multidimensionally deprived and income poor were comparable in size, there was not much overlap between the two groups. On average, 5.6 percent of the population was income poor as well as multidimensionally deprived. Thus, the extent to which income poor and multidimensionally deprived overlap is limited, confirming our intuition that income poverty often fails to capture deprivation in other dimensions affecting the quality of life.

Table 3. Multidimensional Deprivation and Income Poverty

Indices[1]	Average	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MDI[2]	**13.5**	14.6	14.9	15.5*	15.3*	14.6*	14.2*	12.7*	11.5*	10.9*	10.5*
OPM	**12.8**	11.7	12.9	13.7	13.7	13.7	13.6	13.5	12.4	11.6	11.2
SPM	**14.6**	14.4	14.4	15.2	15.5	15.5	15.4	15.0	13.8	13.3	13.2
MDI and OPM	**5.6**	5.4	5.9	6.4	6.6	6.4	6.2	5.7	4.9	4.5	4.2

1. All values are given as percent of the non-elderly adult population (18 to 64 years) deprived in at least two indicators.
2. The difference between MDI at time t and t-1 is statistically significantly different at 1%.

The MDI value in each year was statistically significantly different from the MDI value in the previous year. Figure 2 plots trends in the MDI alongside those in the two poverty measures, namely OPM and SPM. Suppose we divide the decade as follows: (i) Recession: 2008 to 2010[8], (ii) Short-term recovery: 2010 to 2014, and (iii) Long-term recovery: 2014 to 2017. During the recession, all three

---

[8] Although the recession officially lasted from December 2007 through June 2009, we consider 2010 as a recession period since monthly unemployment rates remained over 9% for more than two years after the official start of economic recovery.

indices peaked; the MDI and OPM peaked in 2010, whereas the SPM peaked in 2011. The short-term recovery period is the period immediately following the recession. The MDI started a downward trend almost immediately in 2011. However, the OPM and SPM remained more or less constant. During this period, the estimated proportion of multidimensionally deprived was between the two income poverty estimates. Finally, 2014 to 2017 is the long-term recovery period when all three measures decreased, but the MDI had the most rapid decline. The overlap between income poor and multidimensionally deprived (in Table 3) peaked at 6.6 percent in 2011 and gradually declined to about 4.2 percent in 2017.

Figure 2. Trends in Poverty and the Multidimensional Deprivation Index
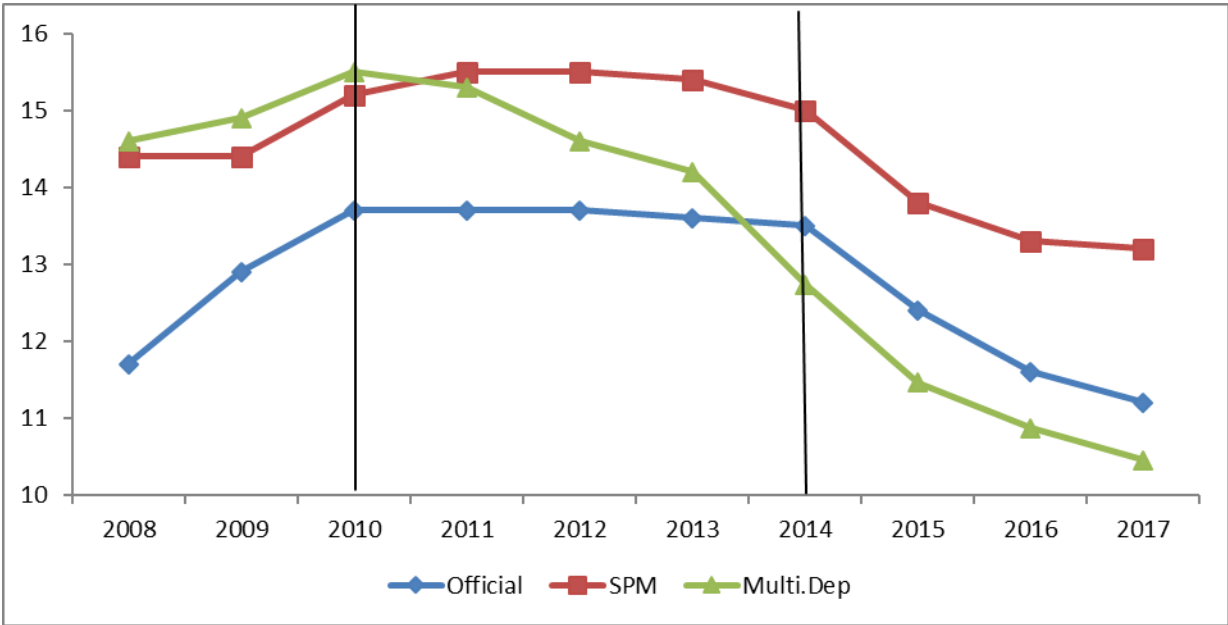
1. All values are given as percentage of the non-elderly adult population (18 to 64 years).

4. Variation in Multidimensional Deprivation

4.1 Deprivation by Demographic Groups

Of particular interest for policy purposes is how deprivation varies by age, income, class, gender,

race/ethnicity, nativity, and household type. Table 5 shows the average MDI and the MDI for each year

for different demographic groups.

Table 5 Multidimensional Deprivation Index by Population Groups

Categories	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Age Groups										
17-below	17.5	17.7	17.7	17.1	16.4	16.1	15.6	14.8	14.4	13.8
18 to 24	18.2	18.8	19.9	18.3	16.8	16.2	14.0	11.9	11.0	10.7
25 to 34	17.4	17.3	17.9	17.1	16.2	15.5	13.8	12.2	11.2	10.5
35 to 44	14.7	15.4	16.0	16.1	15.4	15.3	14.0	12.9	12.3	11.8
45 to 54	12.1	12.6	13.3	13.6	13.1	13.0	11.8	10.6	10.3	10.1
55 to 64	11.3	11.5	11.9	12.2	11.9	11.5	10.6	9.7	9.5	9.2
65-above	14.9	14.2	13.7	13.7	12.7	12.3	12.1	11.6	11.3	10.8
Income to Poverty Ratio										
< 50%	44.3	44.6	43.8	42.8	41.6	40.7	37.2	33.9	32.4	31.6
50-99%	48.5	47.8	48.1	48.0	46.1	44.2	41.4	37.9	36.7	36.1
100-199%	31.1	30.7	30.6	29.6	27.9	26.9	24.2	22.3	21.8	21.1
200-499%	9.2	8.7	8.6	8.0	7.6	7.5	6.6	6.4	6.4	6.4
499% <	1.6	1.4	1.4	1.2	1.2	1.3	1.1	1.1	1.1	1.1
Gender										
Female	14.3	14.1	14.8	14.6	14.0	13.7	13.2	10.9	10.4	10.0
Male	15.0	15.8	16.3	16.0	15.2	14.7	12.3	12.0	11.3	10.9
Race and Ethnicity										
White	11.7	11.9	12.4	12.2	11.7	11.4	10.3	9.3	8.7	8.3
Black	18.4	17.8	18.3	18.1	17.2	16.5	14.4	12.6	11.6	11.3
Asian	20.7	19.4	20.3	20.2	19.2	18.1	16.1	14.4	13.6	12.9
Hispanic[b]	42.6	42.6	42.1	40.3	38.4	37.2	33.7	30.6	29.2	27.3
Nativity										

Native Born	10.0	10.0	10.5	10.3	9.8	9.5	8.3	7.3	6.8	6.7
Forn. Born[c]	39.8	40.5	40.7	39.7	38.1	37.0	34.1	31.2	29.8	28.2
Marital Status									
Married	11.2	11.5	12.1	11.8	11.3	11.0	9.9	9.0	8.7	8.3
Male hd.[d]	26.5	27.2	27.6	26.4	24.4	23.7	21.2	19.1	17.6	16.9
Female hd.	23.2	23.9	24.4	24.0	23.1	22.1	19.8	17.7	16.4	15.8
Non-family	14.8	14.9	14.9	15.1	14.2	14.0	12.4	11.1	10.6	10.3
Benchmark	14.6	14.9	15.5	15.3	14.6	14.2	12.7	11.5	10.9	10.5

a. All values except for age are given as percent for the non-elderly adult population (aged 18 to 64 years) deprived in at least two indicators.
b. Includes Hispanic, Spanish, and Latinos.
c. Includes naturalized citizens and non-citizens.
d. *Male-headed* denotes male householder with no wife present, *female-headed* denotes female householder with no husband present, and *non-family household* includes male householder not/living alone and female householder not/living alone.

Deprivation by Age Groups

Among all population groups, the average MDI was highest (16.1 percent) among children below age 18.[9] High deprivation levels are consistent with high poverty rates among children. In 2017, the U.S. Census Bureau estimated that 17.5 percent of children lived in poverty. During the recession, the percentage rise in deprivation was highest among the young adults (aged 18 to 24) than any other age group. In 2010, nearly one youth in every five youths was multidimensionally deprived. In fact, during the recession, deprivation increased among all age groups except the elderly (aged 65 years and above).

Deprivation by Income Categories

The ACS classifies individuals into income classes by taking the ratio of family income to the appropriate poverty threshold. In Table 5, we list the MDI for five different income-poverty categories. Average deprivation levels were high among individuals in deep poverty (incomes less than 50 percent

---

[9] In order to estimate deprivation among children below 18 years of age, we had to make some adjustments. For children, we assigned the average years of schooling of all adults in the same household. Disability data were missing for a majority of children; so we assigned the highest disability score among adults in the same household. For all other indicators, children and adults belonging to the same household were assigned the same values.

of the poverty threshold) and those just below poverty (incomes between 50 and 100 percent of the poverty threshold). However, surprisingly, more than a quarter of individuals with income just above the poverty threshold (100 to 200 percent of the poverty line) were also deprived. Only 1.5 percent of individuals with incomes more than 500 percent of the poverty threshold were identified as multidimensionally deprived. The decline in MDI over the years was robust across all income groups.

Deprivation by Gender and Marital Status

There was not much difference in the prevalence of deprivation by gender. However, compared with females, males experienced a significant increase in the MDI during the recession. Average MDI was high among single-parent households; it was almost double compared to married couples. On a positive note, the MDI decreased by almost 8 percent per year for single-parent households in the long-term recovery period.

Deprivation by Race, Ethnicity, and Nativity

On average, deprivation levels were lowest among Whites (10.8 percent), moderately high among Blacks (15.6) and Asians (17.5), and highest among Hispanics (36.4 percent). Interestingly, during the recession, deprivation increased only among Whites. In the long-term recovery period, deprivation declined the most among the Black population and the least among the White population—a finding also underscored by Dhongde et al. (2019). Average deprivation was four-times higher among foreign-born individuals (about 36 percent) compared with native-born individuals (about 9 percent). Over the decade, the MDI declined by about 4 percent per year in each group.

4.2. Deprivation by Regions and States

The incidence of deprivation was highest in the South and the West and lowest in the Midwest. In Figure 3 we show MDI values for each state, averaged over the decade, and classified in three broad

categories. Ten states had MDI values higher than national average (13.5 percent), most of which were in the South. Twenty-five states had MDI values in a moderate range (between 10 and 13 percent) and most of these states lie in the middle of the country. Finally, 16 states had low incidence of deprivation (less than 10 percent) and most of these states were in the North. Among all states, multidimensional deprivation was highest in California (21 percent), and second highest in Texas (20 percent). Both states have a greater percentage of Hispanic populations, a group with overall high levels of deprivation, as noted previously. New York was an exception in the North with high incidence of deprivation (15 percent). Iowa and Vermont had 6 percent and North Dakota had the least (5 percent) population deprived.

Figure 3. Multidimensional Deprivation Index across States

1. Color coding based on statewide estimates of multidimensional deprivation compared with national estimates, averaged over 2008-2017.

5. Sensitivity of Deprivation Estimates

Our estimates show that on average, the proportion of deprived was about 13.5 percent in the last decade. However, this estimate is based on certain assumptions. In this section, we re-estimate the deprivation index and provide a range of possible values the index may take when we modify certain assumptions.

5.1. Sensitivity to the Number of Indicators

In the benchmark case, we identify an individual as multidimensionally deprived if she is deprived in at least two of the six indicators. This cut-off is consistent with the global multidimensional poverty threshold (deprivation in at least 33 percent of indicators) as well as with thresholds used in the literature measuring deprivation in the United States. If we change this threshold, then we are able to see the severity of deprivation in terms of the number of indicators in which individuals were deprived (see Table 4). Suppose we count any individual deprived in at least one indicator as multidimensionally deprived (union approach), then as many as 38 percent of the population is deprived. Such a low threshold risks identifying all those individuals as deprived who may choose to be deprived in a given indicator (for instance, choose not to purchase health insurance) and hence tends to overestimate deprivation. On the other hand, when we raised the threshold from two to three indicators, then the percentage deprived decreases from 13.5 to 4 percent. This suggests that most of the multidimensionally deprived experienced deprivation simultaneously in two indicators; few experienced it in three or more indicators. In fact, there is not much overlap of deprivations beyond three indicators; less than 2 percent of the population were deprived in four or more indicators and less than 1 percent were deprived in five or six indicators.

Table 4. Sensitivity of Deprivation to the Number of Indicators

No. of Indic.[1]	Av. MDI[2]	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	**37.7**	38.7	39.6	40.8	40.6	39.7	39.4	36.8	34.7	33.8	33.3
2	**13.5**	14.6	14.9	15.5	15.3	14.6	14.2	12.7	11.5	10.9	10.5
3	**4.0**	4.7	4.8	4.9	4.7	4.3	4.2	3.7	3.2	3.0	2.8
4	**0.9**	1.13	1.20	1.21	1.11	0.96	0.91	0.80	0.67	0.60	0.52
5	**0.1**	0.12	0.14	0.14	0.13	0.10	0.09	0.09	0.07	0.06	0.05
6	**0.0**	0.002	0.001	0.001	0.001	0.001	0.001	0.0004	0.0005	0.0003	0.0005

1. Deprived in at least these many indicators. 2. All values are given as percent of the non-elderly adult population (aged 18 to 64 years).

5.2. Sensitivity to Exclusion of Indicators

The downward trend in the MDI begins in 2011, right after the recession, when income poverty rates were stubbornly stagnant. This downward trend happened even before any of the ACA provisions went into effect. However, it is natural to wonder what impact the ACA had on deprivation levels, since more than 20 percent of the individuals between 2009 and 2014 were deprived of any health insurance (Figure 1). The other two indicators with a high incidence of deprivation were severe housing burden and high school incompletion. In the benchmark case, we assign equal weights to all indicators. Instead, we now assign 0 weights alternatively to each of the 3 indicators and re-estimate deprivation incidence. [10] In Figure 4, we show trends in the MDI when we alternately remove these indicators. Incidence of multidimensional deprivation reduces the most when we remove health insurance as an indicator. The average MDI is 13.5 percent whereas MDI-HI (without health insurance) averages about 8 percent. Instead, when we remove housing costs (MDI-HC) or remove high school completion (MDI-

---

[10] Dhongde and Haveman (2017) use other weighting schemes including multiple component analysis and test the sensitivity of deprivation incidence. They find the trend in deprivation between 2008 and 2013 to be robust to different weighting schemes. Since we use the exact same indicators as in Dhongde and Haveman (2017), we do not repeat the exercise here.

HS), then the average deprivation is about 9.5 percent. Note the drop in all MDI measures between 2013 and 2014, except for MDI without health insurance (MDI-HI), which remains almost constant, indicating the positive impact of the ACA in lowering deprivation.

Figure 4. Sensitivity of Deprivation to the Exclusion of Certain Indicators
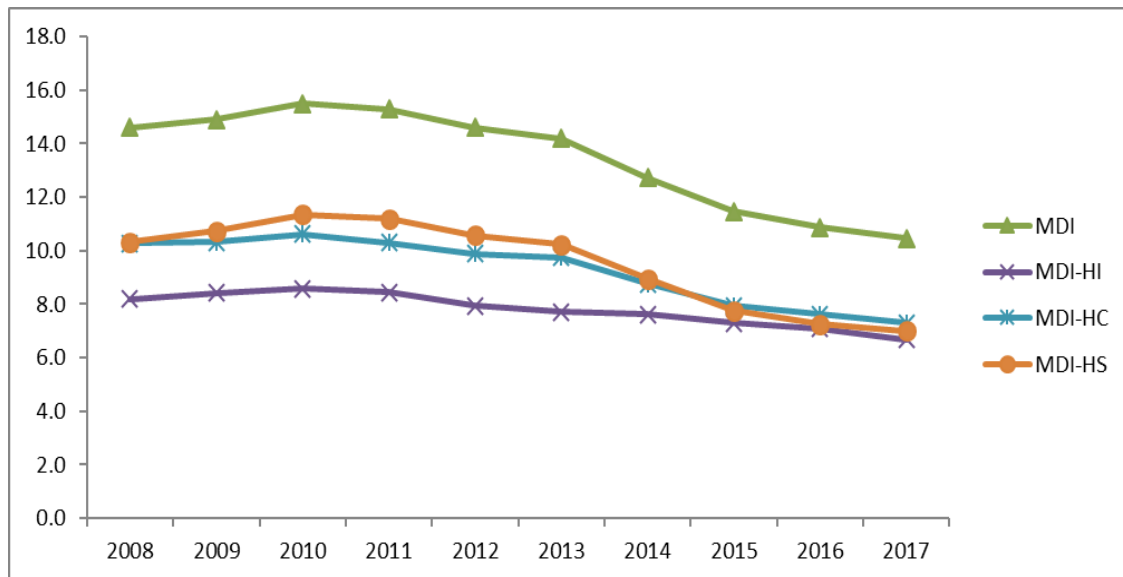
1. MDI measures deprivation using all six indicators, MDI-HI measures deprivation without health insurance, MDI-HC measure deprivation without housing costs and MDI-HS measures deprivation without high school education as an indicator.

5.3. Income Levels and Housing Costs

In the benchmark case, we consider an individual to be deprived if she has severe housing burden regardless of income level. Typically, no one earning more than $100,000 spends half their income on rent or a mortgage; however, there is evidence that a small percentage of households earning at least $50,000 per year are severely housing burdened, especially if they reside in high-cost neighborhoods in states such as California and New York (Montgomery, 2019). Housing cost is an important indicator in the MDI and is the only indicator among the six indicators that directly uses household income in its calculation. All other indicators are independent of income levels. We now introduce an income threshold while considering housing burden. The median annual household income during the decade

was between \$62,000 and \$72,000.[11] Suppose we consider only those individuals as deprived in the

housing dimension if their household income was less than \$75,000 and they experienced severe

housing burden. We re-estimate the MDI (see Table 5) and find that the MDI was, on average, lower

by 1 percentage point. Therefore, even when we remove individuals with severe housing burden but

having above-median incomes, we do not see a big change in the MDI estimate. Thus, our benchmark

measure does not include many households who have high housing costs but also have very high

incomes.

Table 5. Sensitivity of Deprivation to the Number of Indicators

MDI	Av. MDI	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MDI Benchmark	13.5	14.6	14.9	15.5	15.3	14.6	14.2	12.7	11.5	10.9	10.5
MDI Modified[1]	13.4	14.4	14.8	15.4	15.2	14.5	14.1	12.7	11.4	10.8	10.4

1. Deprivation in housing is modified as having severe housing burden and household income is less than \$75,000.

6. Summary

This paper is the first attempt at systematically measuring the levels of and trends in multidimensional

deprivation in the United States. We found that over the last decade, from 2008 to 2017, about 13.5

percent of the working adult population in the United States was deprived in at least two dimensions.

The multiple dimensions such as education, health, housing, and so on, were chosen to measure an

individual's quality of life in addition to her income levels. Importantly, we estimated that about 5 to 6

percent of the population was both multidimensionally deprived as well as income poor. Among

individuals who were not income poor, deprivation was highest when individuals had incomes just

---

[11] The average household income was \$81,000 in 2008 and \$97,000 in 2017.

above the poverty threshold. Policies geared specifically towards reducing income poverty preclude those who are not identified as income poor. Yet these individuals suffered poor quality of life, especially during the recession. In the future, we need policies directed to help not just towards income poor but also those who are multidimensionally poor. On a positive side, though both income poverty and deprivation levels peaked during the previous recession, there was a faster recovery among the multidimensionally deprived than among the income poor. Deprivation levels were much higher among young adults (aged 18 to 24 years), Hispanics, and foreign-born individuals. Deprivation was more prevalent in the Southern states compared with the rest of the country. Among the multiple indicators of deprivation, having health insurance was an important indicator. At the peak of the recession, more than 21 percent of adults did not have any health insurance, but by 2017, this proportion had decreased to about 12 percent. We provided deprivation estimates by alternately removing/modifying certain indicators and their thresholds. By undertaking this exercise, we feel confident that our deprivation estimates do not include a large proportion of individuals who had high incomes and "chose" to remain deprived in certain dimensions. In fact, what the measure underscores is that it is important to monitor multidimensional deprivation, in conjunction with income poverty measures, to get a better idea of the quality of life and changes in it experienced by a country's population.

References

Alkire, S. and Foster, J. (2011). "Counting and Multidimensional Poverty Measurement," *Journal of Public Economics*, Vol. 95, No. 7–8, pp. 476–487.

Ciula, R. and Skinner, C. (2015). "Income and Beyond: Taking the Measure of Child Deprivation in the United States," *Child Indicators Research,* Vol. 8, pp. 491–515.

Dhongde, S. (2017). "A Multidimensional Analysis of the Elderly in the U.S.," in R. White (ed.)

Measuring Multidimensional Poverty and Deprivation, Palgrave Macmillan, pp. 255-270.

Dhongde, S. and Haveman, R. (2017). "Multi-dimensional Deprivation in the U.S.," *Social Indicators Research*, Vol. 133, No. 2, pp. 477-500.

Dhongde, S., Pattanaik, P. and Xu, Y. (2019) "Well-being, Poverty, and the Great Recession in the U.S.: A Study in a Multidimensional Framework," *Review of Income and Wealth*, DOI: 10.1111/roiw.12411.

Foster, J., Greer, J., and Thorbecke, E. (1984). "A Class of Decomposable Poverty Indices," *Econometrica*, Vol. 52, No. 3, pp. 761–766.

Garner, T., and Short, K. (2010). "Identifying the Poor: Poverty Measurement for the U.S. from 1996 to 2005," *Review of Income and Wealth*, Vol. 56, No. 2, pp. 237–258.

Glassman, B. (2019). "Multidimensional Deprivation in the United States: 2017," *American Community Survey Reports*, ACS-40, U.S. Census Bureau, Washington, D.C.

Mitra, S. and Brucker, D. (2016). "Income Poverty and Multiple Deprivations in a High-income Country: The Case of the United States," *Social Science Quarterly*, Vol. 98, No. 1, pp. 37-56.

Mitra, S., and Brucker, D. (2019). "Monitoring Multidimensional Poverty in the United States," *Economics Bulletin*, Vol. 39, No. 2, pp. 1272-1293.

Montgomery, D. (2019). "The Neighborhoods Where Housing Costs Devour Budgets," City Lab, https://www.citylab.com/equity/2019/04/affordable-housing-map-monthly-rent-home-mortgage-budget/586330/

Pattanaik P. and Xu, Y. (2018). "On Measuring Multidimensional Deprivation," *Journal of Economic Literature*, Vol. 56, pp. 657-72.

Schwartz, M., and Wilson, E. (2007). *Who Can Afford to Live in a Home? A Look at Data from the 2006 American Community Survey*, U.S. Census Bureau, Housing and Household Economic Statistics Division, Working Paper, Washington, D.C.

Smeeding, T. (2006). "Poor People in Rich Nations: The United States in Comparative Perspective," *Journal of Economic Perspectives,* Vol. 20, pp.69-90.

Stiglitz, J., Sen, A., and Fitoussi, J. (2009). "The Measurement of Economic Performance and Social Progress Revisited: Reflections and Overview," *Sciences Po Publication* No. 33, Sciences Po.