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A MULTIDIMENSIONAL POVERTY INDEX FOR THE UNITED STATES

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A MULTIDIMENSIONAL POVERTY INDEX FOR THE UNITED STATES

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DISSERTATION

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A dissertation submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy in the Graduate School at the University of Kentucky

By
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Lexington, Kentucky

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ABSTRACT OF DISSERTATION

A MULTIDIMENSIONAL POVERTY INDEX FOR THE UNITED STATES

A multidimensional poverty index for the United States is designed, evaluated, and defended as a useful measurement tool for policymakers to evaluate poverty. Chapter 1 presents a normative case for the index. Chapter 2 reviews the literature on poverty measures. Chapter 3 constructs the proposed index. Chapter 4 is a statistical examination of the internal structure of the index. Chapter 5 explores the index across states, over time, and among population subgroups, as well as presenting policy applications.

KEYWORDS: Multidimensional Poverty, Index, Poverty, United States, Policy

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April 18, 2018

A MULTIDIMENSIONAL POVERTY INDEX FOR THE UNITED STATES

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Dedication

To Raley

Acknowledgments

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Introduction

This dissertation presents an argument for the use of a multidimensional poverty index to measure poverty in the United States. The trend in dissertations has been to focus on causal identification and analysis. By contrast, the focus on this dissertation is entirely on measurement. The questions that motivate it are broad:

- What is poverty?
- How many people are poor in the United States?
- How does poverty vary across groups of people and over time?

Of course, in discussing poverty, another natural question arises: "How can we reduce it?" The first step is to measure poverty as accurately as possible. The policy implications arising directly from the measurement work are preliminary, but many are fairly straightforward. One observation coming from the proposed change in measurement strategies is that poverty measures that focus only on income undercount deprivation among Hispanics. Aside from group level comparisons, the individuals that are classified as poor across several dimensions are not always the same individuals that are poor in terms of a single metric—i.e., income. By implementing a more accurate poverty measure and studying this systematic undercounting, resources can be allocated to communities and/or individuals who are currently experiencing the most deprivation.

Like most contributions to academic literature, this dissertation does not settle the answers to the questions it raises once and for all. The goal is to provide a better answer than was previously available and so to contribute to ability of the poverty research

community to eventually reach a new consensus on the question of poverty measurement. I sincerely hope that this research will lead to rich discussions about poverty and poverty measurements, and I do not expect the results of those discussions to simply accept all the findings and conclusions of this dissertation. Although I have invested considerable thought, time, and effort into my recommendations for defining poverty, my hope is that this research will contribute to a much needed and larger discussion on the measurement of poverty.

1. Why a multidimensional poverty index?

Multidimensional poverty indices have become popular in international development research (See chapter 2 for a full literature review). At their core, the idea is to expand the definition of poverty beyond just lacking income and move it to a more appropriate measurement strategy that incorporates multiple forms of deprivation. The index proposed here looks at the three dimensions of deprivation: Education, Health, and Economic. The three dimensions are captured by nine total indicators and then combined into an index. Details of the indexing method and indicator selection are in Chapter 3, but the basic structure of the index is as follows:

1. Economic
    a. Income
    b. Employment
    c. Housing Costs
2. Health
    a. Health Insurance
    b. Disability
    c. Overcrowding
3. Education
    a. High School Degree
    b. Internet Access
    c. Linguistic Isolation

There are several ways in which a multidimensional poverty index can be justified. The key authors of the multidimensional poverty index most widely used in international development have written a handbook on multidimensional poverty, and note (Alkire, Foster, et al. 2015) :

> …multidimensional poverty measurement can seem rather bewildering at first because justification may draw on axiomatic, statistical, ethical, data-related, deliberative/participatory, policy-oriented, political, and historical features. But in practice, poverty measurement is considerably more concrete (Anand and Sen 1997, Alkire 2002b). The available resources and actual constraints – from timing to data to funding to political demand – for a given exercise often provide considerable structure and guidance. Thus, although normative engagement is required to coordinate various considerations, 'there is no general impossibility here of making reasoned choices over combinations of diverse objects' (Sen 2009: 241) .

Each chapter of this dissertation contains more than just the justifications for MPI (full chapter structure is laid out at the end of the introduction) but in relationship to the various reasons for justifying an MPI ethical considerations are explored in chapter 1, axiomatic features in chapter 2, data-related in chapter 3, statistical in chapter 4, and policy-oriented in chapter 5.

In light of all the possible ways to measure poverty and possible justifications for each measurement strategy, it can be useful to have a set of criteria for poverty measurement. Of course, one difficulty is that there is no current consensus on what those criteria should be. Nonetheless, a useful set of criteria was developed when the Mexican government was developing a multidimensional poverty index for Mexico. A group of experts, including James Foster (for whom the Alkire-Foster indexing methodology that will be introduced later in this paper is named) came up with the following criteria (Alkire, Foster, et al. 2015):

- It must be understandable and easy to describe
- It must reflect 'common-sense' notions of poverty
- It must fit the purpose for which it is being developed
- It must be technically solid
- It must be operationally viable – e.g. in terms of data requirements
- It must be easily replicable

Of course, these criteria are somewhat vague, but provide a baseline to consider what is desirable in a poverty measure. More specific axioms from which to build a viable poverty measure are considered in Chapter 2.

2. Epistemology of Science

The dominant epistemology of science in social sciences is Popperian falsification. Thus, readers should know at the outset that it is not an epistemology to which this dissertation subscribes. I am not attempting to falsify one hypothesis in order to advance another one. Instead, the approach to knowledge is Kuhnian in nature. Kuhn's

focus in scientific epistemology is on paradigms, not falsifiable hypotheses. The connection between hypotheses and the lenses through which we see and interpret the world is indirect. No individual hypothesis by itself can confirm or refute a paradigm.

Two examples from mathematics may help. Within geometry, Euclidean and hyperbolic geometry are both internally consistent and can be built from 5 axioms. There is, however, no mathematical criteria that can be given for preferring one over the other. The only way to judge is through pragmatic criteria, and setting those criteria depends on the consensus of the relevant community as to which geometry is more useful. Within statistics, Bayesian and frequentist statistics differ in axiomatic assumptions about the nature of probability. Both are internally consistent and both can be useful. There are no statistical criteria we can use to judge between them, because developing those criteria would first require us to make a choice of whether to be Bayesian or frequentist.

In *Statistical Rethinking*, Richard McElreath (2016) provides an excellent summary of the Kuhnian objection to falsification (Kuhn's philosophy of science is considered in more detail in both chapters 2 and 4). Start by considering that some hypotheses are easier to test than others. It is easy to prove that not all swans are white – a single observation of a black swan will suffice. A more difficult question is to estimate the percentage of swans that are white. A starting hypothesis could easily wind up being as vague as, "black swans are rare." McElreath writes:

> You might object that the hypothesis above is just not a good scientific hypothesis, because it isn't easy to disprove. But if that's the case, then

> most of the important questions about the world are not good scientific hypotheses (p. 9)

Questions primarily about measurement (e.g. “What percentage of swans are black? What percentage of the U.S. population is poor?”) are not well-suited to the hypothesis falsification model. Of course, paradigms do shift over time and some hypotheses – even vague ones – are eventually regarded as false. McElreath writes:

> “The scientific community does come to regard some hypotheses as false. The caloric theory of heat and the geocentric model of the universe are no longer taught in science courses, unless it’s to teach how they were falsified. And evidence often – but not always – has something to do with such falsification.
>
> But falsification is always *consensual*, not *logical*. In light of the real problems of measurement error and the continuous nature of natural phenomena, scientific communities argue towards consensus about the meaning of evidence. These arguments can be messy. After the fact, some textbooks misrepresent the history so it appears like logical falsification. Such historical revisionism may hurt everyone. It may hurt scientists, by rendering it impossible for their own work to live up to the legends that precede them. It may make science an easy target, by promoting an easily attacked model of scientific epistemology. And it may hurt the public, by exaggerating the definitiveness of scientific knowledge.” (p. 9-10).

The fact that judgments between paradigms, including between income poverty and multidimensional poverty, are always judgments made by the consensus of the relevant community and not by a logical proof is the reason it is important to consider the dissertation as a thoughtful entry into a much larger deliberation over poverty measurement.

3. Multidimensional poverty influencing policy in Louisville.

Multidimensional poverty measures are relatively new, particularly in developed countries. The two best attempts at constructing a multidimensional poverty index for the U.S. were both published within the last two years (Reeves, Rodrigue, and Kneebone 2016; Dhongde and Haveman 2017). This means there is not much history of use of multidimensional poverty indices to guide policy. However, there is some evidence from Louisville that suggests that the idea of multidimensional poverty and the use of indices to measure it will be embraced by policymakers.

In 2015, the Greater Louisville Project produced a report on multidimensional poverty (I was one of the authors). The report led to two concrete changes and substantial additional attention. It is detailed here as an empirical example of the potential uses of a multidimensional poverty index. The two largest changes were:

1) The Community Foundation of Louisville built its Fund for Louisville grant making process around prioritizing multidimensionally poor areas in Louisville ("Fund for Louisville" n.d.).
2) Dare to Care Food Pantry analyzed the current reach of its distribution centers using multidimensional poverty as a proxy for need and opened a new food pantry based on that analysis ("Food Pantry Opening to Tackle Hunger in Russell Neighborhood" 2017).

There was also substantial media attention for the report.

- Mayor Greg Fischer cited the report in his State of the City Address
- President of the Urban League Sadiqa Reynolds cited the report in her State of Black Louisville Address
- The report was covered by the Courier-Journal (Bailey 2016), Insider Louisville (Meece 2016), Louisville Business First (Weaver 2016), WFPL local public radio (Ryan 2016), and the local CBS affiliate, WLKY (Maher 2016).
- The report was later cited by WFPL (two times on radio, three times online), the Courier-Journal and WDRB (Greater Louisville Project *A Focus on Poverty* Measures of Success).

- Both Metro United Way and the Humana foundation used the report for a poverty simulation exercise.
- *ForGood* magazine ran a cover story *Moving Beyond Poverty* focusing on multidimensional poverty ("Moving Beyond Poverty: Helping Individuals and Families Advance" 2018)

ForGood magazine has a circulation of approximately 6,000. More notable than the circulation quantity, is that the circulation includes almost all philanthropic organizations in Louisville.

The report itself also had substantial circulation, including all of Louisville's major foundations, the Jefferson County Teacher's Association, The chamber of commerce, the Office of Safe and Healthy Neighborhoods, Louisville Metro Housing Authority, and a large number of smaller nonprofits. It is fair to say that multidimensional poverty was introduced to the vast majority of the government, nonprofit, and philanthropic community in Louisville.[1]

In the process of working with Louisville foundations, nonprofits, and government officials on analysis relating to multidimensional poverty, I have been struck by how quickly the idea has been embraced. The reaction has been to adopt the new measure of poverty as a more accurate measure of deprivation and human need and to begin seeing how their own programs can help to alleviate poverty. Although the index can be decomposed in many interesting ways (covered in Chapter 5) its primary goal is simply to be a more accurate overall measure of poverty. Of course, being popular with

[1] The reach actually extended beyond Louisville. Florida Kids Count was (and is) interested in using a similar multidimensional poverty index for their work, and reached out to me about constructing it. The Community Foundation also presented the Fund for Louisville grants strategy at a global conference of community foundations – although I have not yet heard of any follow-up actions from that presentation.

policymakers and philanthropists is no assurance of quality research and is mentioned only to demonstrate the practical viability of a multidimensional index as a tool for policy and for targeting anti-poverty funds from the philanthropic community.

4. Structure of the dissertation

The dissertation itself is structured to go from broad themes to narrow ones. Chapter one covers the ethical framework for multidimensional poverty measurement. Chapter two reviews the empirical literature on poverty measurement. Chapter three presents the proposed index. Chapter four offers robustness checks. Chapter five decomposes the index to show how each indicator contributes to the overall poverty rate and offers preliminary policy suggestions.

Chapter 1. Comparative Injustice, a policy analysis framework for incomplete information

> "The problem of discovering what factors are, and what are not, important in any given situation is quite as essential to correct choice as a knowledge of the empirical laws governing those factors that are finally selected." – Herbert Simon, 1976, p. 83

Public policy is produced in an information-rich environment, in which the task of the policy-maker is more often to winnow through information than to seek out new data(Jones and Baumgartner 2005). Policy analysts play a vital role in determining what information is collected, analyzed, and presented to policymakers. Because information is not neutral (Hale 2011; Sen 1999), this puts the analyst in the position of making value judgments. As Herbert Simon wryly noted decades ago, "Unfortunately, problems do not come to the administrator carefully wrapped in bundles with the value elements and the factual elements neatly sorted." (Simon 1976, 5). Facts and values are consistently entangled both philosophically (Putnam 2002) and psychologically (Lodge and Taber 2013). The difficulty that this poses to the policy analyst should not be understated. Theories of justice ranging from libertarianism to utilitarianism can be effectively summarized almost entirely by what information they take to be relevant (Sen 1999).

This Chapter introduces an approach to policy evaluation - the comparative injustice approach - that is designed explicitly for use in an environment in which information is both abundant and value-laden. The comparative injustice approach seeks to allow

policy analysts to answer the question, “Is policy A better than policy B?” even when there is not enough information to determine what policy is optimal.

Section 1 reviews two existing non-optimizing strategies for choosing among policy options, satisficing and incrementalism, and contrasts them with the optimizing approach. Section 2 argues that facts and values are both philosophically and psychologically entangled and explores the ethical implications of this entanglement. Section 3 introduces the comparative injustice approach by bringing satisficing, incrementalism, and ethical judgment together, as well as examining the implementation of a comparative injustice framework. Section 4 compares the comparative injustice approach to other policy analysis frameworks. Section 6 concludes.

1.1 Satisficing, Incrementalism, and Optimization

1.1.1 Satisficing

Herbert Simon’s research was largely an attempt to answer the question: “How do human beings reason when the conditions for rationality postulated by the model of neoclassical economics are not met?” (Klahr and Kotovsky 2013, 377) Simon did not suggest that human beings are irrational; rather he suggested a different form of

rationality than the optimizing rationality of the economic model.[2] Human beings instead are reasonable actors who choose a procedure for making decisions based on a combination of their situation and the realistic limits of their ability to gather and process information. Because optimizing requires an extremely costly (and likely impossible) amount of information and computation in all but the simplest of cases, the reasonable human may instead choose to select an option that is satisfactory rather than optimal. Simon argued that, "Parsimony recommends that we prefer the postulate that men are reasonable to the postulate that they are supremely rational when either one of the two assumptions will do our work of inference as well as the other." (Simon 1978, 8).

Under an optimization rule, deciding when to stop searching for information poses a logical puzzle. For any given public policy, the optimal amount of information to gather is unknown. The decision-value of the next piece of information to be gathered is unknowable precisely because the next piece of information is not currently known. Thus, in an optimizing framework, there is no defined stopping point in the search for information. By contrast, a satisficing rule searches through options until it finds an option that meets satisfactory criteria (Gigerenzer and Gaissmaier 2011). In a complex

[2] One of the papers that laid out the satisficing model was called, "A behavioral model of rational choice" (Simon 1955), indicating Simon's commitment to building a behaviorally accurate model that was nonetheless still a rational choice model.

world, given a choice between an optimizing strategy and satisficing heuristic, Gigerenzer and Gaissmaier (2011) show that the more successful strategy is to satisfice.

1.1.2 Incrementalism

In "The Science of Muddling Through," Charles Lindblom (1959) also proposes an alternative to the rational-comprehensive method of analysis. Lindblom notes that proper policy analysis in that model would require three steps. First, all related values and their relative weights would have to be determined. Second, all policy outcomes must be rated across all possible values. Third, all possible policy alternatives must be related to the outcomes that maximize the (weighted) values. As an alternative, Lindblom suggests incrementalism in the form of successive limited comparisons.

There are three features of Lindblom's successive limited comparisons that help to lay the groundwork for the comparative injustice approach. First, Lindblom rejects the idea of analysis as being only concerned with finding the best ends to a pre-determined means. Lindblom argues that, "evaluation and empirical analysis are intertwined; that is, one chooses among values and among policies at one and the same time. Put a little more elaborately, one simultaneously chooses a policy to attain certain objectives and chooses the objectives themselves." (Lindblom 1959, 82). This point will be elaborated on in section 2.

Second, Lindblom argues that the space for evaluation should not be an abstract theoretical conflict, but actual agreement on the policy being considered, even if the agreement is arrived at from very different evaluative standpoints. "For the method of successive limited comparisons, the test is agreement on policy itself, which remains possible even when agreement on values is not." (p. 83)

Third, Lindblom (Lindblom 1979) argues in a follow-up article that an additional advantage of incremental analysis is “its concern with identifiable ills from which to flee rather than abstract ends to be pursued – and what appears to be the mind’s need for a broad (and some would say ‘higher’) set of lasting ambitions and ideals.” (p. 519)

Accepting that policymakers and administrators satisfice and adopt incremental strategies implies that the information that is first encountered is given more weight. Unlike an environment in which all available information is carefully scrutinized, the policy analyst is thus required to fill a normative role in determining what information is most readily available to policymakers.

1.1.3 Contrasting satisficing, incrementalism, and optimization: a simple example

Let us suppose that I wish to buy a new dress shirt. I value three things in a dress shirt: the price, the style, and the level of comfort. For rational-comprehensive analysis (optimizing my choice of shirt) I would have to:

1. Determine all the values that matter in a shirt (price, style, comfort) and their relative weights.

2. Determine how the various outcomes are rated across the values. (i.e. which style ranks first, second, etc.)
3. Evaluate all possible alternatives, map them onto the outcome values and maximize the weighted values.

Apart from this being a very extensive process, we are also immediately faced with the impossibility of finding all possible alternative shirts. To know whether or not I have found the optimal shirt, I would literally have to look at every shirt in existence. Information about shirts does not come in the form of a continuous and differentiable function, so optimizing as a tool falls somewhere between unwieldy and impossible in its application to this shopping problem.

The satisficing approach can help to solve the problem while requiring far less information. To choose a satisfactory shirt I would need to set minimum criteria along my three values. The shirt should cost less than X, be at least as comfortable as Y, and as stylish as Z. I then proceed to search for a shirt, and as soon as a shirt is found that meets all three criteria, I declare that shirt satisfactory and I buy it. This shirt is unlikely to be the optimal shirt I could have bought – perhaps there was a better shirt at the next store I would have shopped at. The problem is there is no stopping rule to how many shirts and how many stores I would have to look at if I were to set my goal as finding the optimal shirt, and thus I have solved the question of how much information I need to gather before buying a shirt by stopping my search once I find one that satisfies my criteria.

The incremental approach is slightly different and can be motivated two ways. First, suppose I decide I am going to go to one store and buy a shirt. This greatly limits my range of shirts, but allows me to directly compare each shirt to the other shirt, and pick the best one. I do not need to know what the optimal shirt for me would be, or even what my minimum criteria for shirt buying are. All I need to be able to do is compare two shirts to each other. I may even find that as I look at the shirts I am re-evaluating what matters to me in choosing a shirt. This is what Lindblom was referring to when he suggested, "one simultaneously chooses a policy to attain certain objectives and chooses the objectives themselves." (Lindblom 1979, 82).

Second, suppose I have a shirt-buying committee (this is clearly quite silly in this example, but in reality policy decisions are frequently made by committee). Different members of the committee have brought back shirts (presumably either by satisficing or by a first round of incrementalism) and the committee now must decide on one among the available options. If only one of the shirts meets everyone's minimum criteria, we could satisfice. However, if more than one shirt is satisfactory, satisficing gives us no way to choose among them.[3] Since there is now a limited number of concrete, available options to choose from, one can directly compare them to each other. Incrementalism also allows the criteria to potentially change when faced with a choice between two or more options that are satisfactory. If multiple shirts satisfice along cost, comfort, and style, the incrementalist rule might be to pick the cheapest one. Alternatively, it could

[3] This is because when only one individual is searching they will stop their search after finding one satisfactory option.

be to gather more information about those particular shirts. Once options have been limited it becomes possible to consider more information per option.

Both satisficing and incrementalism provide methods to limit the amount of information that is required to make a decision. The information requirements for choosing a shirt are substantially lower than for most policy questions, and still overwhelmed the rational-comprehensive method of analysis. While the rational-comprehensive method of decision making may be desirable, the reality is that the adoption of heuristics to aid in decision-making is unavoidable. The question is if we will continue to use unknown and unspecified heuristics to determine what information is included in our applications of the rational-comprehensive model (since the actual inclusion of all information is impossible) or if we will continue to work on improving our heuristics and being transparent about the reasons for some information to be included in policy analysis while other information is excluded.

1.2 The philosophical and psychological entanglement of facts and values

Both Simon and Lindblom have suggested that in the practice of public administration it is not possible to maintain a sharp dichotomy between value elements and factual elements or between ends and means. More recent work has confirmed both the philosophical and psychological impossibility of dichotomizing facts and values(Putnam

2002; Lodge and Taber 2013).[4] Nor has this work been limited to the social sciences. The physicist Thomas Kuhn wrote in *The Structures of Scientific Revolutions (2012)*[5],

> But is sensory experience fixed and neutral? Are theories simply man-made interpretations of given data? The epistemological viewpoint that has most often guided Western philosophy for three centuries dictates an immediate and unequivocal, Yes! In the absence of a developed alternative, I find it impossible to relinquish entirely that viewpoint. Yet it no longer functions effectively, and the attempts to make it do so through the introduction of a neutral language of observation now seem to me hopeless. (2012, 125)

For Kuhn, normal scientific progress consisted of work within an already existing paradigm in order to solve the puzzles of the paradigm. While this is valuable work, Kuhn was also concerned with how scientific paradigms can change over time. Kuhn concluded that there were no definite criteria to choose among paradigms, as each paradigm argued for itself from within the paradigm. More importantly for the theory of how information influences policy, Kuhn noted that the paradigm determined the very definition of a problem to be studied. "A paradigm can, for that matter, even insulate the community from those socially important problems that are not reducible to the puzzle form, because they cannot be stated in terms of the conceptual and instrumental tools that the paradigm supplies." (2012, 37)[6]

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[4] The collapse of the positivist school of philosophy can at least partly be traced to Quine's "Two Dogma's of Empiricism" (1951). Although in philosophy the project of logical positivism essentially collapsed due to positivist philosophers themselves realizing irresolvable contradictions in positivism, its influence seems to remain quite strong in the social sciences. Key critics like Quine and Putnam then adopted a much more pragmatic approach to epistemology.

[5] Originally published in 1962

[6] As an example Kuhn notes that, "It is often said that if Greek science had been less deductive and less ridden by dogma, heliocentric astronomy might have begun its development eighteen centuries earlier than it did." (p. 75).

In *The Collapse of the Fact/Value Dichotomy,* Hilary Putnam (2002) draws on the pragmatism of John Dewey to discuss what methods of inquiry should be used once one rejects the idea of facts that are entirely separate from values.

> For [Dewey] "inquiry" in the widest sense, that is human dealings with problematical situations, involves incessant reconsideration of both means and ends; it is not the case that each person's goals are cast in concrete in the form of a "rational preference function" that is somehow mysteriously embedded in his or her individual mind, or that all we are allowed to do as long as we are "rational" is look for more efficient means to these immutable but idiosyncratic goals or values. Any inquiry has both "factual" presuppositions, including presuppositions as to the efficiency of various means to various ends, and "value" presuppositions, and if resolving our problem is difficult, then we may well want to reconsider both our factual assumptions and our goals….Dewey is really talking about learning through experimentation and discussion how to increase the amount of good in our lives.

Even if it were philosophically possible to disentangle facts and values, it would not be a psychologically realistic model of human information processing for most people under many circumstances. Taber and Lodge (2013) provide strong evidence for a likeability heuristic in which information stored in the brain is tagged with either positive or negative affect. External events (including primes and frames) then trigger an unconscious activation of associative pathways linking thoughts and feelings to related thoughts and feelings. This activation process then determines which thoughts come into the conscious mind for further consideration. Their claim is that, "all thinking is

suffused with feeling, and these feelings arise automatically within a few milliseconds (in our data as little as thirteen milliseconds)" (2013, Kindle Locations 596-598).

Critics of Taber and Lodge's work point out that even the original theory of motivated reasoning on which Taber and Lodge's work is based (Kunda 1990) acknowledges that while humans often engage in reasoning that is motivated by directional goals (i.e., to rationalize what they already believe), there are situations in which individuals are motivated by accuracy goals (Druckman 2012). Although there is ongoing debate over when humans will be motivated by directional goals or accuracy goals, there is little dissent from the basic idea that our psychology ties together both factual presuppositions and values.

This philosophical and psychological entanglement has direct consequences for theories of justice. Amartya Sen brings back the normative implications of the entanglement of facts and values, arguing that, "the real 'bite' of a theory of justice can, to a great extent, be understood from its informational base: what information is – or is not – taken to be directly relevant." (1999, p. 57). The very name of the four best known philosophical schools of thought about justice comes from the information they consider relevant - utility for utilitarians; liberty for libertarians; equality for egalitarians; and community for communitarians. When not all information can be collected and analyzed, let alone reported, the decisions of the analyst about which data merits inclusion has normative implications. As Sen writes, "the priorities that are accepted,

often implicitly, in the different approaches to ethics, welfare economics, and political philosophy can be brought out and analyzed through identifying the information on which the evaluative judgments rely in the respective approaches." (1999, 85)

The fact/value entanglement increases the difficulty of research, but it does not suggest that research and reason are either unimportant or so irredeemably biased as to be merely a matter of rationalized feelings. As will be elaborated on in the next section, rejecting the enlightenment view of facts as separable from moral reasoning does not involve a headlong slide into relativism. If anything, it brings moral reasoning back into the realm of ideas that are evaluated by their ability to withstand critical reasoned scrutiny. As Simon noted, "To assert that there is an ethical element involved in every decision is not to assert that decisions involve only ethical elements." (1976, 48)

1.3 Comparative Injustice

1.3.1 From Comprehensive to Comparative

Although the criticisms of dichotomizing facts and values are not new, no alternative approach that allows more explicitly for their entanglement has been found satisfactory. As Kuhn has noted, in the history of scientific thought paradigms are not rejected unless there is a competing paradigm to replace them (1963). Attempts to put together comprehensive theories of the values that make up a conception of the good have met with failure. As Gutman and Thompson note in their introduction to deliberative democracy (2009, 91):

> The quest for agreement on a conception of the good (the aim, for example, of some communitarian theories) underestimates the significance and legitimate persistence of fundamental moral disagreement. In a pluralist society, comprehensive moral theories neither can nor should win the agreement of all citizens. A public philosophy for such societies must reject the unqualified quest for agreement because it must renounce the claim to comprehensiveness.

Comparative injustice attempts to find a middle ground in which no claim of a comprehensive ideal of the good is made, but normative values still are allowed to guide in the process of inquiry. The theory is comparative instead of comprehensive, a distinction that Sen has explained as switching from the (comprehensive) question, "what would be perfectly just institutions" to the (comparative) question, "how would justice be advanced" (2009, p. 9). This mirrors Lindblom's stance that rather than relying on an abstract theory to guide our policy progression the measure of good policy rests on a direct comparison between the policies themselves. The argument for a comparative injustice approach rests both on continuing Lindblom's argument that theory ought to be comparative – successive limited comparisons – rather than comprehensive in nature, and on showing that the focus of the comparisons ought to be on reducing injustices.[7]

One of the primary advantages of a comparative theory is that it requires less information. Under the satisficing of Simon or the incrementalism of Lindblom, the

[7] This concept is not entirely dissimilar from Lindblom's 'identifiable ills.'

ability to get by with less information is a substantial advantage. This is perhaps even more relevant in the nearly intractable field of moral philosophy. As Sen argues

> …in agreeing that the occurrence of a preventable famine is socially unjust, we do not also lay claim to an ability to determine what exact allocation of food among all the citizens will be 'most just,' The recognition of evident injustice in preventable deprivation, such as widespread hunger, unnecessary morbidity, premature mortality, grinding poverty, neglect of female children, subjugation of women, and phenomena of that kind does not have to await the derivation of some complete ordering over choices that involve finer differences and puny infelicities. (1999, 254)

Comparative theories also have the benefit of being empirically and historically grounded. Comprehensive theories of justice often suffer from abstracting themselves too far and losing applicability. As an example, Nozick's principle holds that, "Whatever arises from a just situation by just steps is itself just." (1974, 1510). But as David Hume noted centuries earlier, "there is no property in durable objects, such as lands or houses, when carefully examined in passing from hand to hand, but must, in some period, have been founded on fraud and injustice." (Hume, 1752, lines 389-391). While other comprehensive theories do not all go quite so far as Nozick in presuming an initial just situation, they still do not address the question of how to redress actual, historical injustices that have already occurred. In this sense, most 'comprehensive' theories of justice are both incomplete and inapplicable precisely because they are ahistorical.

While agreement on an idea of the good is difficult, if not impossible, it is far easier to agree on what is *not good.* Grinding poverty is no one's conception of the good life. By

empirically comparing two policies or sets of institutions to each other rather than aiming at a more abstract ideal, the focus is set back on redressing clear and ongoing social problems that prevent individuals from flourishing. Having argued for the advantages of a comparative theory over a comprehensive one, I now turn to a more direct argument for the priority of injustice.

1.3.2 Peter Singer and the Priority of Injustice

No human is free from normative priors which are inevitably entangled in their research. Thus, it is necessary for me to be clear in why I believe a policy analysis framework ought to prioritize injustice. The most compelling case for the priority of injustice comes from Peter Singer's *Famine, Affluence, and Morality* (1972). Singer's argument is based around two simple principles. First, "suffering and death from lack of food, shelter, and medical care are bad." (p. 231) This is relatively uncontroversial, but arguing for it would be quite difficult, so Singer takes it as a given. The second principle is that "if it is in our power to prevent something bad from happening, without thereby sacrificing something of comparable moral importance, we ought, morally, to do it." (p. 231). This too, seems uncontroversial. It does not require us to identify what is good and do it, but only to prevent what is bad, the injustices of the comparative injustice approach. In fact, even then we are only required to prevent bad things if it does not involve sacrificing something of comparable importance.

Singer makes this case more concretely with a now famous example: “if I am walking past a shallow pond and see a child drowning in it, I ought to wade in and pull the child out. This will mean getting my clothes muddy, but this is insignificant, while the death of the child would presumably be a very bad thing.” (p. 231). Although the two principles seem innocuous at first reading, Singer notes that if people were to act upon it, “our lives, our society, and our world would be fundamentally changed.” (p. 231).

There is no limit in the second principle for distance. The fact that I can see the child who is drowning while I cannot see the child who is starving a few miles down the road or thousands of miles across the ocean is morally irrelevant. Second, the principle makes no distinction between situations where I am the only one who can help and where others might also be able to help. Suppose there are others who are closer to the drowning child and could help. While this would make a psychological difference, it would not reduce my moral obligation to save the child. Acting on Singer’s principle would require that each time I can give money to an organization that combats poverty and deprivation without sacrificing something of comparable moral importance, I ought to do so. Accepting Singer’s principle turns charity and petitioning for justice from optional to obligatory.

Although the argument begins with an example of personal charity, Singer also explicitly extends his argument to actions taken through government and to acting in order to cause governments to increase their efforts to alleviate suffering. The argument is not

that we must correct all injustices because they are unjust, but rather, the simpler argument that we should alleviate suffering whenever we have the power to do so without causing suffering of a comparable significance. For the policy analyst, this involves, at a minimum, asking questions and collecting data about where and why suffering is occurring and any history of successful approaches to alleviating it.

1.3.3 Reasoned Scrutiny and Comparative Injustice

Even if the preceding arguments for comparative theories instead of comprehensive theories and a focus on injustice are found to be compelling, it can reasonably be asked how anyone would be able to know if they are correct. Kuhn (1962) observed that there is no clear way to judge between paradigms since each paradigm evaluates itself on its own terms.[8] Amartya Sen has argued that in resolving such disputes, one holds reason to be the judge, for even in arguing against giving reason the final judgment one would have to give reasons. This approach to finding partially objective knowledge has been used fairly widely within philosophy. Sen writes,

> Despite the differences in the distinct types of arguments presented by Smith, Habermas, and Rawls, there is an essential similarity in their respective approaches to objectivity to the extent that objectivity is linked, directly or indirectly, by each of them to the ability to survive challenges from informed scrutiny coming from diverse quarters. In this work too, I will take reasoned scrutiny from different perspectives to be

[8] This does not mean that decisions between paradigms are not made. Kuhn (p.94) compares the choice between competing paradigms to a choice between competing political institutions. For Kuhn there is still reasonable judgment between paradigms –but it is not made by scientific means. "As in political revolutions, so in paradigm choice – there is no standard higher than the assent of the relevant community." (p. 94)

> an essential part of the demands of objectivity for ethical and political convictions.
>
> However, I must add here - indeed, assert here - that the principles that survive such scrutiny need not be a unique set. (2009, 45)

Adam Smith's moral philosophy rested on the idea of an impartial spectator who could offer both a neutral and a non-parochial opinion. (Smith 2014). Comparative injustice must face criticism not only from economists and political scientists, but also from sociologists, psychologists, philosophers, and interested non-specialists. By making more restricted claims than comprehensive theorists, it has thus far handled scrutiny well. Nonetheless, like any theory – ethical or scientific - the most that can be said for it is that it has, thus far, stood up well to reasoned scrutiny.

1.3.4 Implementation of Comparative Injustice

The comparative injustice approach calls for research that:

1. Focuses on observed empirical injustices.
2. Allows for a direct comparison of relevant policy alternatives
3. Is explicit in its ethical assumptions.

In contrast to more abstract and comprehensive theories of well-being, comparative injustice research starts with an identifiable ill (to use Lindblom's phrase) or an injustice (injustice here can be either a case of procedural injustice or distributive injustice). Once an identifiable ill is documented, research focuses not necessarily on an ideal solution, but on the evaluation of potential policy alternatives. Those policy alternatives are compared not to a theoretical ideal solution, but directly to each other and to the status

quo policy.[9] Finally, recognizing the value-laden nature of what information is considered in the identification of the injustices to be addressed and the policy alternatives put forth, comparative injustice research is explicit in the values it puts forth.

The construction and use of multidimensional poverty indices (MPIs) is an excellent example of research using the comparative injustice approach. The remaining chapters of this dissertation are about producing a multidimensional poverty index suitable for use in the United States. This is a direct result of the theory laid out in this chapter. MPIs focus directly on empirical injustice (names multiple dimensions of human deprivation), they allow a direct comparison of two different states of the world via the use of an index, and they are explicit in their ethical goals and in the values (and corresponding index weights) that go into their construction.

The Oxford Poverty and Human Development Initiative maintains a widely-used international multidimensional poverty index. MPIs exist because income has been widely criticized as being insufficient as a measure of economic development by itself. Only paying attention to income means failing to include such important things as health, education, and living standards (i.e. leisure, infrastructure and other aspects of living standards that are not included when only income is reported) (Sen 1999; Stiglitz, Sen, and Fitoussi 2010). The MPI was developed as an alternative to income-based methods of measuring poverty in developing countries and is based on Sen and

[9] This is the same as saying that doing nothing is always one of the policy alternatives being evaluated.

Nussbaum's capabilities approach to measuring deprivation (Sen 1999; Nussbaum 2006; Sen 2009). The capabilities approach is rooted in an Aristotelian idea of human flourishing. To the extent that human beings are deprived of basic capabilities they are unable to flourish. The idea that anything that prevents human beings from flourishing is harmful is the explicit ethical reason given for widening the information base from an income-based measure into a multi-item index designed to measure the existence of barriers to flourishing.

The Oxford multidimensional poverty index is built on the philosophical foundation of the capabilities approach and operationalized by measuring indicators of health, education, and living standards. Health is measured by nutrition and child mortality. Education is measured by years of schooling and school attendance. Living standards are measured by cooking fuel, sanitation, water, electricity, type of floor, and assets. For each of the ten indicators there is a minimum level that is defined as poverty in that particular area. Using the Alkire-Foster method of indexing (Alkire and Foster 2011), the data can be used to construct a poverty line by defining as poor those who live below that specified minimum threshold in one-third or more of the indicators. The idea is that living below the threshold on one-third or more of the indicators suggests a level of poverty severe enough to interfere with human flourishing.

There have also been a few MPIs proposed for the U.S., and these are covered in detail in Chapter 2.

There are still two significant limitations to the MPI. First, the data on the global MPI is still relatively limited, existing in 110 countries for one year. Second, the MPI also says nothing about what happens above the poverty line. Nussbuam writes, “The capabilities approach is a political doctrine about basic entitlements, not a comprehensive moral doctrine. It does not even claim to be a complete political doctrine, since it simply specifies some necessary conditions for a decently just society.” (2006, p. 154). This is, in general, a limitation of the comparative injustice approach. It suggests that while we have enough information to focus on eliminating clear instances of injustice, we do not have enough information to decide what an optimally just society would look like. Nonetheless, given the unfortunate abundance of observed injustice presently in the world, this limitation does not prevent comparative injustice from being useful.

1.4 Other frameworks for policy analysis

It is not possible to give an in-depth treatment to each of the major frameworks for engaging in policy analysis. Nonetheless, in this section I address two major approaches, welfare economics and measures of subjective well-being, and two approaches that partially overlap with the comparative injustice approach, Bozeman’s public value failure and deliberative democracy.

1.4.1 Welfare economics

Thomas Hobbes’ social contract assumed at least a rough equality among participants and asked readers to imagine that men, “sprung out of the earth, and suddenly, like

mushrooms, come to full maturity, without all kind of engagement to each other." (Folbre 2010, 20). This convenient fiction of men waking and suddenly engaging in politics and economic trade as if they were fully-formed and already had fixed economic and political desires pervades much of enlightenment philosophy and is reflected in the mathematics of welfare economics. The very basis of welfare economics is that individuals have preferences, and when those preferences are satisfied they become better off. This assumes that preferences are external to the system being studied.

As it turns out, a great deal of research confirms that political and economic preferences are endogenous to political and economic systems. Samuel Bowles provides a comprehensive overview in the *Journal of Economic Literature* (1998). Markets are social psychological situations and thus have framing effects. Bowles reviews experimental evidence that finds that the more closely the experimental design resembles a perfect market (i.e. complete contracts) the less other-regarding behavior is observed. Later research on priming also suggests that being exposed to the prime of money – the normal way in which we conduct market transactions – does change individual behavior. Kahnemahn (2011) summarizes the evidence.

> Money-primed people become more independent than they would be without the associative trigger. They persevered almost twice as long in trying to solve a very difficult problem before they asked the experimenters for help, a crisp demonstration of increased self-reliance. Money-primed people are also more selfish: they were much less willing to spend time helping another student who pretended to be confused about an experimental task. When an experimenter clumsily dropped a bunch of pencils on the floor, the participants with money (unconsciously) on their mind picked up fewer pencils. In another

> experiment in the series, participants were told that they would shortly have a get-acquainted conversation with another person and were asked to set up two chairs while the experimenter left to retrieve that person. Participants primed by money chose to stay much farther apart than their non-primed peers (118 v 80 centimeters). Money-primed undergraduates also showed a greater preference for being alone.

Kahnemahn concludes, "living in a culture that surrounds us with reminders of money may shape our behavior and our attitudes in ways that we do not know about and of which we may not be proud."

In addition to the framing and priming effects of markets, there is also solid evidence that monetary incentives can crowd out other-regarding incentives. Parents who were charged a fee for being late at a daycare center actually became even later after it was implemented, and Swiss citizens who were offered money to have a nuclear waste burial site near their town were actually less likely to favor the proposal. Those are only two of the litany of examples that have accumulated in the literature (Frey and Oberholzer-Gee 1997; Frey and Jegen 2001; Ariely 2009).

Markets also can change the development of social norms. Kenneth Arrow explains a popular view of the role of ethics among economists (Arrow 1972, 354–55), "Like many economists, I do not want to rely too heavily on substituting ethics for self-interest. I think it best on the whole that the requirement of ethical behavior be confined to those circumstances where the price system breaks down." This is a reasonable view, along the lines of Hume's idea that one should design a political system for knaves even if one does not believe that most people are knaves (Hume, 1741). This makes sense if and only if altruism is a scarce resource and the number of knaves is exogenously

determined. But what if a system designed for knaves actually caused people to behave like knaves?

If virtuous behavior is habit forming, as thinkers from Aristotle forward have suggested, then limiting the opportunity for individuals to exercise ethical behavior does not conserve ethical behavior, but instead diminishes it the way an unused muscle atrophies after long disuse. But is ethical behavior more like a scarce resource or more like a habit to be developed over time? The answer to the question hinges almost entirely on the question of endogenous preferences. If ethical behavior arises outside the system of study, then it is a scarce resource as nothing in the system of study will change the amount available. If, on the other hand, preferences, including for ethical behavior, are partially determined by the system of study – in this case the political and economic institutions of a society – then ethical behavior is not set at a fixed amount, but can be increased or decreased depending on the institutions selected. Bowles (2008) reviews evidence from economic experiments and finds evidence that policies that assume self-interest may crowd out moral sentiments. Bowles argues that this is partially due to a mistaken view that human behavior is solely about acquiring ends and not also about forming the self. “Behavior is not only acquisitive, however; it is also constitutive. People act also so as to be or to become a good person or one who is esteemed by others. When one’s person itself is the raw material and its transformation or affirmation is the objective, the presence of explicit economic incentives may have unintended effects.” (p. 1608)

The economic model also assumes the price one is willing to pay represents how much one values something. In reality, it reflects both value and ability to pay. Failure to make that distinction can lead to conclusions like Gary Becker's to reform how the U.S. deals with refugees fleeing political persecution by charging $50,000 to those fleeing persecution. In Becker's words, "For obvious reasons, political refugees and those persecuted in their own countries would be willing to pay a sizeable fee to gain admission to a free nation. So a fee system would automatically avoid time-consuming hearings about whether they are really in physical danger if they are forced to return home." (Becker and Posner 2009)

A recent NBER working paper attempted to evaluate the value of expanding Medicaid by studying the recent Medicaid expansion in Oregon provides an additional example (Finkelstein, Hendren, and Luttmer 2015). While the study is extensive and methodologically rigorous, the results still hinge on the assumption that the value of Medicaid is related to individuals' willingness to pay. As fellow health researchers Pollack, Gardner, and Jost (2015) write in critique:

> the most important limitation of the study stems from an assumption that many readers would be unlikely to notice. Finkelstein and her colleagues placed a very low value—$25,000—on a year of additional life for Medicaid beneficiaries. The typical threshold used in health services research is much larger, in recent studies far above $100,000 per additional year of (healthy) life. Yet because the median income of the Oregon study participants was about one-fourth of the median income in the United States, the researchers chose to value an additional life-year at about one-fourth of the usual threshold. This assumption powerfully frames everything that follows in this analysis. After all, if you start out by assuming that Medicaid beneficiaries' lives are worth very little, you will find that it is not worth spending much money to prolong them.

Conflating willingness to pay with value is troubling enough, but perhaps the most problematic part of this framework is the degree to which the ethical assumptions are hidden. Hiding the ethical framework does not make it disappear, it just makes it more difficult for readers to decide for themselves if they agree with the ethical assumptions made in the paper.

1.4.2 Subjective Well-being

As criticisms of GDP have become more widely acknowledged (Stiglitz, Sen, and Fitoussi 2010) there has been an increased interest in the use of subjective measures of well-being (Frey 2010). Subjective well-being has largely been found to correlate both with external evaluations of friends and family and with the objective indicators (unemployment, marriage, income, class status, etc.) that one would expect to determine well-being (Radcliff 2013). While subjective well-being is an important indicator for policymakers to track, it is still subject to the same problems of preference endogeneity described in the criticism of welfare economics. As Nussbaum writes,

> One thing we want to know is how individuals feel about what is happening to them, whether they are dissatisfied or satisfied. But we also want to know what they are actually able to do and to be. People adjust their preferences to what they think they can achieve, and also to what society tells them a suitable achievement is for someone like them. Women and other deprived people frequently exhibit such "adaptive preferences," formed under unjust background conditions. These preferences will typically validate the status quo. Satisfaction is one thing that is important, but it is surely not the only thing. (2006, p. 73)

1.4.3 Deliberative democracy

Deliberative democracy covers a wide range of theories. Gutmann and Thompson (2004, p.7) define deliberative democracy as: "…a form of government in which free and equal citizens (and their representatives), justify decisions in a process in which they give one another reasons that are mutually acceptable and generally accessible, with the aim of reaching conclusions that are binding in the present on all citizens but open to challenge in the future."

In this sense, deliberative democracy overlaps substantially with the idea that comparative injustices are validated by being able to withstand critical scrutiny. Deliberative democracy, however, is primarily concerned with the process used to reach a decision. While the process of good government and good policy should be correlated (it would make little sense to call a form of government good if it consistently produced bad policy) they are not identical. Sometimes bad governments will make good policies and sometimes bad governments will make good policies. The comparative injustice framework does include the idea that political exclusion is a form of injustice, and in that sense it share the concerns of deliberative democracy for open political discussion (Sen 2009).

1.5 Conclusion

In a complex world with an oversupply of information, the choice of an initial strategy for determining what information matters is a normative choice that plays a vital role in shaping policy outcomes. The comparative injustice framework offers several advantages.

First, it requires only a comparative and not a comprehensive theory of justice. By situating itself on a middling ethical ground between relativism and universalism it explicitly acknowledges its normative underpinnings without attempting to impose a universal and comprehensive view of the good life. Second, it allows for policy analysis on multiple dimensions of incommensurate values. Not all values are required to be reduced to a single metric such as income or utility. Instead, through the use of satisficing across multiple criteria or successive limited comparisons between already identified choices it is possible to compare policy options without reducing them to a single common metric. Third, it extends a single analytic framework to non-economic and non-efficiency related issues, which had often been dealt with in an ad hoc manner in the past. Fourth, it focuses attention on actual, observed human suffering. It is not an ahistoric or abstract theory, but instead responds to the pressing demands of human deprivation. Fifth, it expands policy considerations beyond only rational beings who are

able to enter contractual agreements to include the analysis of injustices based on disability, nationality, and species membership.[10]

The comparative injustice framework also entails a different role for the policy analyst. The analyst is to document the existence of injustice and deprivation and to find strategies that work to mitigate suffering. This is an explicitly normative role – but no matter what information the policy analyst chose to pursue it would still be a normative role. By being open about the normative nature of research, the analyst actually better fulfills their obligation to transparency about how their conclusions were reached and can simultaneously engage in reducing the injustices that are still present in our economic and political systems.

[10] This point is fully developed in Nussbaum (2006).

Chapter 2. Approaches to Poverty Measurement

> Poverty has many facets, not all reducible to money. (Orshansky 1965, 5)

> The fundamental normative motivation is to create effective measures that better reflect poor people's experience, so that policies using such measures reduce poverty. Such measures are needed, because empirically, income-poor households are (surprisingly) not well-matched to households carrying other basic deprivations like malnutrition; also the trends of incomes and non-income deprivations are not matched, and nor does growth ensure the reduction of social deprivations, which people experience and policies seek to address (Alkire, Conconi, et al. 2015)

2.1 Introduction

Poverty is the experience of deprivation, or of not having enough. It is common to measure not having enough in terms of income, but there are multiple ways in which poverty has been measured. This chapter gives an overview of poverty measurement in order to situate the reader within the broader field before narrowing to focus specifically on the type of index created in chapter 3, a multidimensional poverty index for the United States.

Poverty measurement has both normative and technical goals. There is also no current consensus on what criteria should be used to pick a poverty measure. As a starting point, some criteria suggested by the a group of experts including James Foster are (Alkire, Foster, et al. 2015):

- It must be understandable and easy to describe
- It must reflect 'common-sense' notions of poverty
- It must fit the purpose for which it is being developed
- It must be technically solid
- It must be operationally viable – e.g. in terms of data requirements
- It must be easily replicable

This is a good initial set of criteria, but there are still several approaches that are consistent with all six of these criteria. Designing a poverty measure requires a series of normative and technical decisions. This review is structured to begin broadly to give a feel for the scope of possible poverty measurements and then gradually narrow to cover the specific proposals for U.S. multidimensional poverty measurements at the end. Section 2 covers broad approaches to poverty measurement. Section 3 discusses concrete poverty measures including the official and supplemental poverty measures in the U.S. and international multidimensional poverty measures. Section 4 covers previous proposals for U.S. MPIs. Section 5 concludes.

2.2 Broad Approaches to Poverty Measurement

All approaches to poverty measurement require normative assumptions. The normative assumptions chosen in my approach to poverty measurement are detailed in chapter 1. Rather than attempt to catalogue and review all proposed poverty measures (see Alkire et al. 2015 for a fairly comprehensive list) this section focuses on the key decisions that must be made in deciding on an approach to poverty measurements

2.2.1 Absolute or Relative Poverty

Poverty measurement can either focus on an absolute standard (e.g. under X dollars for a family of size Y) or a relative standard (e.g. under half of the median income). Relative

measures have been critiqued as more properly thought of as measurements of inequality rather than poverty. However, the defense of relative poverty measurement can go back at least to Adam Smith, who argued that cultural standards matter when considering poverty.

As Smith put it:

> By necessaries I understand not only the commodities which are indispensably necessary for the support of life, but whatever the customs of the country renders it indecent for creditable people, even the lowest order, to be without. A linen shirt, for example, is, strictly speaking, not a necessary of life. The Greeks and Romans lived, I suppose, very comfortably though they had no linen. But in the present times, through the greater part of Europe, a creditable day-labourer would be ashamed to appear in public without a linen shirt, the want of which would be supposed to denote that disgraceful degree of poverty which, it is presumed, nobody can well fall into without extreme bad conduct. Custom, in the same manner, has rendered leather shoes a necessary of life in England. The poorest creditable person of either sex would be ashamed to appear in public without them. (Sen 1999, 73–74)

Even standards that are formally absolute are usually influenced by relative needs. For example, in the abstract of one of Orshanky's papers laying out the official U.S. poverty measure, she argues, "Because prices and standards tend to move with prevailing income, families remaining at the bottom of the heap will be outbid and outspent." (1963, 3) Orshansky would later describe her poverty measure as "relatively absolute" (Fisher 1992).

Relatively absolute may seem at first to be a contradiction in terms. An example that may be familiar to academics is the difference between writing a test that is designed to produce a certain grade distribution and curving the test after the fact to impose a certain grade distribution. Giving the top 15% of the class As is a relative standard.

Writing a test hoping that about 15% of the class will get As is technically an absolute standard – but it the instrument used to measure grades was designed with at least a loose reference to a relative standard. A test where 100% of students get As (or Fs) is probably not a very useful tool for measuring academic achievement. Similarly, most absolute poverty lines are designed so that rates of poverty can go up and down over time – but they're nonetheless set at levels intended to measure poverty in a useful way.

In a similar fashion, technically, the multidimensional poverty index proposed in this paper is an absolute measure, as it is not indexed to a standard like median income. However, items in the index are intentionally chosen based on current needs. In particular, the inclusion of internet access in the index is based on the same logic that Smith laid out. Living without internet did not put one at an educational disadvantage or in a state of social isolation prior to the existence of the internet. However, as culture has come to rely more on the internet for social interactions and education, it has become the case that lack of internet access constitutes a genuine disadvantage.

2.2.2 Income or Consumption

Arguments have also been made for poverty measures to be based on consumption rather than income. A wealthy individual who lives well by spending their wealth down at a sustainable rate could have no income coming in but still live quite comfortably.

Of course, someone could also choose to consume very little despite having substantial income, and in this sense a consumption-based measure would miss the underlying choice.

The multidimensional measure is closer to the consumption side, but does not attempt to measure consumption in terms of an overall dollar figure, but rather in terms of measuring the basic capabilities of life. The choice to focus on indicators other than the dollar value of items consumed is discussed in the next section.

2.2.3 Money or Multiple Indicators

Money is a flexible instrumental good. The defense of using money is not that money itself is good, but rather that money allows the owner to choose what they value out of a wide variety of things that money can be exchanged for. However, there are many goods that are not always directly purchased with money. Two important cases are education and health care. While both can be bought with money, in the U.S. (and elsewhere) public education and health insurance are quite common. An improvement in the local public school or the new availability of government provided health insurance clearly improve the lives of the poor, but those improvements would not be captured solely in dollar terms. Additionally, when attempting to measure the wellbeing of multiple household members, money may not be distributed evenly throughout the household. Measurements that inquire about the health insurance status of each individual are thus more accurate in assessing how many people actually have access to

health care. (Direct measures of health would be better, health insurance is used as a proxy due to data limitations, a decision that is defended in Chapter 3).

There tends to be substantial pushback to the idea of increasing measurement beyond the realm of money, as Sen notes:

> Since the preference for market-price-based evaluation is quite strong among many economists, it is also important to point out that all variables other than commodity holdings (important matters such as mortality, morbidity, education, liberties, and recognized rights) get - implicitly - a zero direct weight in evaluations based exclusively on the real-income approach. They can get some *indirect* weight only if - and only to the extent that - they enlarge real incomes and commodity holdings. The confounding of welfare comparison with real-income comparison exacts a heavy price. (Sen 1999, 80)

A comparison that may sit better with some economists is that that adding multiple indicators is in some sense analogous to writing a social welfare function. A multidimensional poverty index takes certain indicators as its arguments and returns a measurement of the level of social deprivation (or poverty). While income is flexible in the ends it can lead to, it is ultimately still a means to an end.

> There is danger in seeing poverty in the narrow terms of income deprivations and then justifying investment in education, health care, and so forth on the ground that they are good means to the end of reducing income poverty. That would be a confounding of ends and means (Sen 1999, 92).

2.2.4 Index or Dashboard

As more data becomes available, displaying multiple indicators at once in a dashboard has become a popular method of simultaneously displaying multiple data points. The difficulty with a dashboard is the level of aggregation. Dashboards that display

aggregate data (e.g. state-level unemployment next to state-level health insurance level) overlook the way those deprivations build on top of each other at an individual level (Alkire, Conconi, et al. 2015). The dashboard does not give any information about how much overlap there is in the deprivations.

2.2.5 Choosing a Threshold

There is no completely nonarbitrary way to choose a threshold. The current U.S. poverty threshold is three times the price of a minimum food basket in 1963 adjusted for inflation by the Consumer Price Index. The supplemental poverty measure is the mean of the 30th to 36th percentile spent on food, clothing, shelter, and utilities. The official poverty measure was designed by a government employee, while the supplemental one was subject to substantially more debate among researchers. Nonetheless, these are ultimately normative judgments (by either individuals or committees) about what constitutes poverty. Why choose the 30-36th percentile instead of the 23-28th percentile, for instance?

Mollie Orshansky – the creator of the current official poverty threshold -- addresses this directly, “The standard itself is admittedly arbitrary, but not unreasonable ” (Orshansky 1965, 4). The language is no accident, and is repeated later in the same article, “The measure of poverty thus developed is arbitrary. Few could call it too high. Many might find it too low.” (Orshansky 1965, 10)

2.2.6 Axiomatic Approaches to Poverty

The approach taken to poverty measurement in this paper is an axiomatic approach. The measure is designed to satisfy certain desirable axioms, or properties. The axioms are designed to answer important questions about how a poverty measure changes as the situation it is designed to measure changes:

> For example, should the poverty measure increase or decrease if the achievement of a poor person rises while the achievements of other people remain unchanged? Should poverty comparisons change when achievements are expressed in different units of measurement? Should the measure of poverty in a more populous country with a larger number of poor people be higher than the poverty measure in a small country with a smaller number of, but proportionally more, poor people?
>
> A policymaker seeking to ameliorate poverty should have a good understanding of the various normative principles that her chosen poverty measure embodies...
>
> The normative judgements embodied by a poverty measure are reflected in its mathematical properties, including its structure and its response to changes in its argument. (Alkire, Conconi, et al. 2015)

Formal mathematical definitions for each of the properties below are found in the Multidimensional Poverty Handbook (Alkire, Conconi, et al. 2015). The exposition here focuses only on a more intuitive understanding of what the properties are and why they are desirable properties for a poverty measure to have.

The MPI handbook classifies the axiomatic properties into four categories: invariance, dominance, subgroup properties, and technical properties.

2.2.6.1 Invariance Properties

- *Symmetry* is the property that switching achievement vectors (rows) across people does not change the overall index. Thus, if person A and D were to be switched there would be no change in the index. This property is desirable as it means individual identity is irrelevant, and people are given equal treatment by the index.
- *Replication Invariance* simply means that if we were to replicate our society (double the population) the poverty measure would be unchanged. This allows for comparisons across societies of different sizes.
- *Scale Invariance* means that changing the scale of any of the indicators makes no difference. For example, changing income from dollars to thousands of dollars will not affect the poverty measurement, as long as the deprivation cutoff is also scaled.
- *Unit Consistency* is a weaker version of scale invariance that holds that poverty comparisons (e.g. subregion A has a higher poverty rate than subregion B) - but not necessarily poverty values - should be unchanged by scale changes.
- *Poverty Focus* means the index does not change in response to changes in the wellbeing of the nonpoor, but only in response to changes in the wellbeing of the poor. Unlike a more general wellbeing index, a poverty index should reflect the situation of the poor only.
- *Deprivation Focus*, like poverty focus, is the index not changing in response to improvements in wellbeing in nondeprived dimensions. Thus, although person C

is poor, because person C is not deprived in education, additional improvements in education for C do not change the index. This is desirable because additional improvements in one area often do not make up for shortcomings in others. For example, in this case, no amount of additional education will make up for not having health insurance.

- *Ordinality* holds that the poverty measure will not be changed by transformations that are admissible for ordinal variables.

2.2.6.2 Dominance Properties

- *Monotonicity* means poverty decreases when a poor person experiences an increase in an indicator in which they are poor if other indicators remain unchanged.
- *Dimensional Monotonicity* means if a poor person increases achievement in a deprived dimension while other dimensions remain unchanged, poverty should decrease. This is one reason the intensity part of the adjusted headcount is important. It is normatively desirable that if person A goes from .6 weighted deprivations to .4 weighted deprivations, the poverty measurement decreases, even though person A is still poor.
- *Transfer* is satisfied if reducing inequality among the poor also reduces the poverty rate.
- *Rearrangement* is concerned with the distribution of deprivations among individuals. In general, poverty should decrease if poverty is less concentrated. For example, in a society of ten people where ten deprivations are experienced,

one possible arrangement is for two people to have five deprivations each. Another arrangement is for each person to have one deprivation each. Rearrangement holds if the poverty decreases when deprivations are less concentrated, as in the case where each person has only one deprivation. There are several more specific principles within the rearrangement category that are described in Alkire et al 2015.

2.2.6.3 Subgroup Properties

- *Subgroup Consistency* requires that if poverty decreases for one subgroup while remaining the same for others, overall poverty will decrease.
- *Population Subgroup Decomposability* allows the index to be broken down by age, gender, race, geographic region or other population subgroups.
- *Dimensional Breakdown* allows the contributions of each dimension (or indicator) to the overall poverty rate to be calculated.

2.2.6.4 Technical Properties

- *Non-triviality* means the poverty measure must be able to take on at least two different values, otherwise comparisons are impossible.
- *Normalization* is satisfied if the values lie within the 0-1 range (although this is often transformed to 0 to 100 for ease of communication).
- *Continuity* requires that the measure does not change drastically based on small changes in underlying achievements.

2.3 Current Poverty Measures and Proposals

2.3.1 Official and Supplemental U.S. Poverty Measures

The official U.S. poverty measure is widely recognized as flawed, which means a variety of proposals for improvement have been suggested. The most widely-used and recognized of these was adopted by the U.S. Census Bureau and is now released with other census data as the supplemental poverty measure.

2.3.1.1 The Official U.S. Poverty Measure

Poverty measurement in the U.S. arose out of a practical policy need. When President Johnson declared war on poverty, there had to be a way to measure poverty. In addition, this time-period saw a growth in means-tested programs which needed a standard of eligibility (Fisher 1992).

Around the same time, Mollie Orshansky, an economist in the Social Security Administration, had been working on standard budgets, a tool used in both financial planning and government statistics to determine basic standards of living (Orshansky 1959, 1960). In 1963, Orshansky published an article examining poverty in families with children (Orshansky 1963) that was later expanded to a general poverty measure (Orshansky 1965). It is important to note that Orshansky herself saw the article as part of continued progress towards a poverty measure, not as a measure that should continue to be used. She lays out the purpose of the proposed poverty thresholds in the article:

> Now, however, the nation is committed to a battle against poverty. And as part of planning the how, there is the task of identifying the whom. The initiation of corrective measures need not wait upon the final determination of the most suitable criteria of poverty, but the interim standard adopted and the characteristics of the population thus described will be important in evaluating the effectiveness of the steps taken. (Orshansky 1965, 3)

Orshansky's 'interim' poverty measure was based around the price of food because her own previous research had already revealed there were no suitable standards to use for nonfood budget categories. "There are in this country no commonly accepted standards of what constitutes an adequate or even a minimum level for any category of family living except food" (Orshansky 1959, 11)

Throughout her research, Orshanky was attempting to demonstrate inequality among various types of families. She lays this out clearly writing:

> It would be one thing if poverty hit at random, and no one group were singled out. It is another thing to realize that some seem destined to poverty almost from birth – by their color or by the economic status or occupation of their parents.
>
> …
>
> Today in large measure an automated economy demands an increasingly productive and skilled labor force.
>
> ….
>
> As the higher education and the increased skills called for in many modern-day jobs upgrade our labor force more and more, the ranks of the poor seem to be reserved for those families with heads not able or not permitted to qualify for the better-paying jobs – the retired, the women, and the nonwhites." (Orshansky 1963, 3–4)

Orshanky's poverty line was adopted by the Office of Economic Opportunity in 1965 and adopted with minor changes by the U.S. government as a whole in 1969. The difference between the farm and non-farm poverty line was reduced (later eliminated in 1981) and

the Consumer Price Index was used to adjust the poverty threshold starting in a base year of 1963. (Fisher 1992)

Orshansky herself had argued for a poverty line that was updated more frequently and commented at the time that the decision in 1969, "tends to freeze the poverty line despite changes in buying habit and changes in acceptable living standards." She had already begun writing years earlier about the difficulties of balancing the ability to compare poverty over time with a consistent standard and the realities of change:

> The difficulties in setting the poverty line are increased when the definition is to be used to measure progress over a span of time. Statistical nicety will be better served if the criterion selected remains invariant. The realities of everyday living suggest it cannot be – at least not for very long. Though the change in consumption patterns from any one year to the next might be minuscule, over the long run the upgrading that goes with the developing United States economy will be too great to be ignored. (Orshansky 1966, 22)

On the other end of pushback, Fisher notes that there was an objection to having the Census Bureau publish the estimates because "the Census Bureau had never before published data based on value judgments" (Fisher 1992).

Because no agency was in charge of poverty measurements but they were used by multiple agencies, any updates were subject to an ad hoc interagency process. In 1981 the farm/non-farm distinction was removed. In 1990, the National Research Council began a review that was published in 1995 and concluded:

> …the current poverty measure has weaknesses both in the implementation of the threshold concept and in the definition of family resources. Changing social and economic conditions over the last three decades have made these weaknesses more obvious and more consequential. As a result, the current measure does not accurately

> reflect differences in poverty across population groups and across time. We conclude that it would be inadvisable to retain the current measure for the future.
>
> …we conclude that the relevant question is not whether poverty thresholds should be updated for changes in real consumption, but whether they should be updated on a sporadic or on a regular basis. (Fisher 1992)

2.3.1.2 The Supplemental U.S. Poverty Measure

The supplemental poverty measure (SPM), first published in 2011, is an attempt to update the poverty measure – largely to address problems that Orshansky herself wrote about in her original paper as opportunities for further improvement to the poverty line. The supplemental poverty measure is only for statistical purposes and does not replace the official poverty line for determining program eligibility. (Renwick and Fox 2016).

Like the official measure, the supplemental measure starts with observed data on family expenditures. However, it broadens beyond food to include food, clothing, shelter, and utilities as well as an extra amount for miscellaneous requirements. The data is based on 4-person households with 2 children in the 30-36th percentile of the most recent 5 years of the Consumer Expenditure Survey data. (Renwick and Fox 2016)

The SPM also aims for consistency in what counts as family resources for meeting the food, clothing, shelter, and utilities threshold. Government benefits that can help to meet the food, clothing, shelter, and utilities threshold (e.g. supplemental nutrition assistance program funds can be used towards food) are included as family resources. However, to be consistent with the threshold, necessary expenses that are spent on non-food, clothing, shelter, and utilities goods are not counted as family resources.

Table 2.1 is the Census Bureau's guide to the common additions and subtractions. The base is money income from all sources, from which the items in Table 2.1 are added or subtracted. (Renwick and Fox 2016) Starting with money income from all sources, families then add and subtract the following (Renwick and Fox 2016).

Table 2.1 Defining family resources for the Supplemental Poverty Measure

Add:	Subtract:
Supplemental Nutritional Assistance Program (SNAP)	Taxes (plus credits such as the Earned Income Tax Credit [EITC])
National School Lunch Program	Expenses related to work
Supplementary Nutritional Program for Women Infants and Children (WIC)	Child care expenses
Housing Subsidies	Medical Out-of-Pocket (MOOP) expenses
Low Income Home Energy Assistance Program (LIHEAP)	Child support paid

The supplemental poverty measure in effect acknowledges that there is not a good way to set a minimum adequate budget for medical and child care, and thus chooses to exclude them from calculations altogether. In essence, whatever a family spends on medical care (etc.) is what they spend, and then FCSU has to be met from what is leftover. Of course, a family could choose to skimp on medical care in order to meet food needs, and the SPM has no way to measure if expenditure on medical care is

adequate. Similarly, child care arrangements may be subpar based on economic necessity.

In terms of use, the SPM is designed in a way that makes it useful for large-scale program evaluation but not for determining program eligibility. If the goal of a poverty measure is to evaluate how programs like the Earned Income Tax Credit (EITC) or Supplemental Nutrition Assistance Program (SNAP) affect the overall poverty rate, then the SPM is an excellent measure. Even within the field of evaluation however, it's limited by not setting standards for minimum adequate medical and child care. Poverty could be reduced by policies like Medicaid expansion, but only to the extent that resources freed from medical expenses improve ability to meet FCSU – the SPM has no way to value the actual increase in healthcare availability.

The SPM shows a lower poverty rate for children and a higher poverty rate for adults over 65. Child poverty is reduced through programs like the EITC and SNAP (Bridges and Gesumaria 2015) while elderly poverty is increased because high out of pocket medical expenses mean less money is available for other FCSU needs (Bridges and Gesumaria 2013).

2.3.2 International Multidimensional Poverty Indices

Multidimensional Poverty indices are already in use in international development research. They are reported by the UN Development Program for over 100 countries and are officially used by the governments of Mexico, Columbia, Bhutan, and the Philippines (Alkire, Conconi, et al. 2015).

2.3.2.1 Uses of MPIs

The Oxford Multidimensional Poverty Handbook lists 8 uses for MPIs.

- to produce the official measures of multidimensional poverty
- to identify overall patterns of deprivation
- to compare subnational groups, such as regions, urban/rural, or ethnic groups
- to compare the composition of poverty in different regions or social groups
- to report poverty trends over time, both on aggregate and by population subgroups
- to monitor the changes in particular indicators
- to evaluate the impact of programs on multiple outcomes
- to target geographical regions or households for particular purposes
- to communicate poverty analyses broadly. (Alkire, Conconi, et al. 2015, 23)

2.3.2.2 The Global MPI

The Global Multidimensional Poverty Index is a project of the Oxford Poverty and Human Development Initiative. The Global MPI covers over 100 developing countries.

The Global MPI uses 10 indicators of poverty to cover 3 dimensions, as shown in Table 2.2.

Table 2.2 Dimensions and Indicators for the Global MPI

Dimension	Indicator
Health	Nutrition
	Child Mortality
Education	Years of Schooling
	School Attendance
Living Standards	Cooking Fuel
	Improved Sanitation
	Safe Drinking Water
	Electricity
	Flooring
	Assets

The Global MPI uses the Alkire-Foster indexing method to aggregate the dimensions and indicators into a poverty level. The mechanics of A-F indexing are explained in detail in Chapter 3 in the context of proposing my own MPI, but a brief overview follows to put the literature review in context.

For each indicator, a cut-off point is proposed, such that an individual is either deprived or not in that indicator. Each indicator has an associated weight, and if the sum of the weighted indicators is above the poverty line, then the individual is considered poor. In the case of the Global MPI, an individual who is deprived in one-third or more of the indicators is poor.

The dimensions do not play a mechanical role in the index, but in addition to analytical convenience, they often also play a role in determining weights. The Global MPI chooses to weight each dimension equally, not each indicator. So each dimension has 1/3 of the overall weight (which sums to one for convenience). Thus Nutrition has a weight of 1/6 as it has half the weight of the Health dimension as whole. By contrast, Cooking Fuel has a weight of 1/18 as it has $1/6^{th}$ of the weight of the Living Standards dimension.

2.4 Multidimensional Poverty Indices in the U.S.

There have been several attempts to apply the multidimensional poverty framework to the United States. Due to the importance of this literature for my paper, I trace these applications in chronological order.

2.4.1 Alkire-Foster

In setting out the Alkire-Foster indexing method for measuring multidimensional poverty, Alkire and Foster provide an example from the U.S. (Alkire and Foster 2011). They use data from the 2004 National Health Interview survey and come up with 4 indicators with associated cutoffs:

1) "Persons living in households falling below the standard income poverty line are considered deprived;
2) Those who reported 'fair' or 'poor' health are deprived;
3) Those who lack health insurance are deprived and
4) Those who lack a high school diploma are deprived" (Alkire and Foster 2011)

They use an overall cutoff of 2 or more dimensions. Theirs is also one of relatively few examples in the U.S. literature of authors taking advantage of the decomposability of the index. They produce a table comparing the percentage contribution of each

indicator to the overall poverty rate. In decimals is the percentage of each ethnic group that is both deprived in that indicator and multidimensionally poor (e.g. 0.200 of Hispanics are both deprived in income and multidimensionally poor). The percentage contribution to the overall index (M_0) is shown below in each "Percentage Contribution" row. The table is from Alkire and Foster (2011).

Figure 2.1. Alkire and Foster

Table 11: Decomposition of Ethnicity-specific M_0 by Dimension, Ordinal Variables, $k = 2$

Ethnicity	H_1 Income	H_2 Health	H_3 H. Insurance	H_4 Schooling	M_0
Hispanic	0.200	0.116	0.274	0.324	0.229
Percentage Contribution	21.8%	12.7%	30.0%	35.5%	100%
White	0.045	0.053	0.043	0.057	0.050
Percentage Contribution	22.9%	26.9%	21.5%	28.7%	100%
Black	0.142	0.112	0.095	0.138	0.122
Percentage Contribution	29.1%	23.0%	19.5%	28.4%	100%
Others	0.065	0.053	0.071	0.078	0.067
Percentage Contribution	24.2%	20.0%	26.5%	29.3%	100%

From this breakdown they conclude that the income poverty measure shows a substantively different picture of the poverty by ignoring – in particular – high levels of deprivation in health insurance and schooling in the Hispanic community.

2.4.2 Wagle

Udaya Wagle constructs a multidimensional poverty index for the United States using 2004 data from the General Social Survey (Wagle 2009). Wagle does not use Alkire-

Foster indexing. Instead, Wagle uses principal components analysis to divide indicators into 3 dimensions (Economic Well-being, Capability, and Inclusion). The indicators are:

Economic Well-being

- Log of income
- Log of equivalized family income[11]
- Satisfaction with financial situation

Capability

- Education
- Condition of Health
- Treated with Respect
- Occupational Prestige
- Employment Industry

Inclusion

- Work Status
- Weeks of Work
- Self employed
- Political Activism
- Voting in 2000 election
- Group membership
- Associational activity
- Personal contact
- Participation in social activities

The scores from the PCA across the three dimensions are then averaged into an overall poverty rating. Because the scores have no interpretable meaning, Wagle simply sets the poverty rate as a relative rate, with the bottom 10 percent of the distribution being in deep poverty and the bottom 30 percent in poverty. This indexing method also means scores cannot meaningfully be compared across time.

[11] Equivalized family income is family income adjusted for family size. Wagle is not clear on the adjustment factor used. OECD divides by the square root of the number of family members.

Wagle's MPI is notable for being the only one to use the general social survey and for its use of Principle Components Analysis instead of Alkire-Foster indexing.

2.4.3 Acevedo-Garcia et al

Acevedo-Garcia et al (2014) produce a child opportunity index that is related to multidimensional poverty, and so is included in this section. Unlike other indicators in this review, the child opportunity index is measured at the census tract level for the 100 largest metropolitan areas. They use three dimensions, each with multiple indicators

- Educational Opportunities
    - School poverty rate (eligibility for free or reduced-price lunch)
    - Student math proficiency level
    - Student reading proficiency level
    - Proximity to licensed early childhood education centers
    - Early childhood education participation
    - High school graduation rate
    - Adult educational attainment
- Health and Environmental Opportunities
    - Proximity to health care facilities
    - Retail healthy food environment index
    - Proximity to toxic waste release sites
    - Volume of nearby toxic waste release
    - Proximity to parks and open spaces
    - Housing vacancy rate
- Social and Economic Opportunities
    - Foreclosure rate
    - Poverty rate
    - Unemployment rate
    - Public assistance rate
    - Proximity to employment

The index is constructed using z-scores and the analysis is relative within urban areas. Tracts are compared to the regional average, rather than a U.S. average. Instead of a

poverty cut-off they divide tracts into quintiles based on the index and label the quintiles in terms of opportunity (very low, low, moderate, high, or very high).[12]

Their analysis then focuses on the number of children living in very low opportunity neighborhoods and the racial demographics of who lives in low opportunity neighborhoods. Consistent with other multidimensional analysis, they find that the barriers faced by Black and Hispanic children extend well beyond income.

2.4.4 Feridoon Koohi-Kamali and Ran Liu

Koohi-Kamali and Liu create a multidimensional poverty index for the state of Pennsylvania using American Community Survey data from 2006-2010 (Koohi-Kamali and Liu 2017). In addition to focusing on Pennsylvania, they also focus on the intersection of race, gender, and motherhood.

They use an Alkire-Foster dual-cutoff approach. The Alkire-Foster dual-cutoff approach is explained in detail in chapter 3, as it is the approach used for the proposed multidimensional poverty index as well. The focus here is on the other choices that go into the index. They use 4 dimensions with a total of 10 indicators and a cutoff point of being deprived in 30 percent or more of weighted indicators.

[12] I constructed a z-score multidimensional poverty index for Louisville and 16 peer cities that used a poverty cut-off of -1 standard deviations below the mean census tract. One advantage of this cut-off over quintiles is that it allowed variation from city to city, so cities where disadvantages were not clustered into tracts had fewer tracts where the poverty score fell below -1. This allows comparisons across cities. See http://greaterlouisvilleproject.org/reports/2015-competitive-city-update/ for the report.

- Educational attainment
    - If the head of household has less than a high school diploma
- Employment Status
    - If no spouse is working full-time
- Supportive Income
    - Receipt of yearly food stamp or SNAP benefits
    - Receipt of public assistance income
    - Receipt of supplemental security income
    - Income
- Living Standard
    - Household size to bedroom ratio of more than 2
    - Vehicle possession
    - Ownership of real estate

Following Alkire-Foster (2011) they find high levels of deprivation among Hispanic and African-American households. They also find that African-American and Hispanic female-headed households with children are the most deprived subgroups.[13]

2.4.5 Brookings Institution

Since the American Community Survey came out in 2005, U.S. MPIs have used it as a source (Both Wagle and Alkire-Foster use data from 2004). In 2016, the Brookings Metropolitan Policy Program released a multidimensional poverty index arguing that it is important to de-cluster disadvantages (Reeves, Rodrigue, and Kneebone 2016). They had one indicator per dimension. They use the cutoff approach for each indicator, but don't take advantage of the dimensional breakdown properties of A-F indices. Their indicators and cutoffs are:

[13] This finding may reflect a problem with using social assistance to proxy need. Social assistance programs are often not available or less available to childless adults.

1. Income under 150% of the poverty line
2. Lack of a High School Diploma (they exclude GED)
3. No Health Insurance
4. Living in a low-income area
5. Unemployment defined as living in a jobless family

They report on multiple thresholds, one or more disadvantages, two or more, three or more, four or more, but focus the analysis on two or more (since all indicators are equally weighted this implies a cutoff of 40% of weighted indicators).

Brookings also includes only adults ages 25-61. This means their index says nothing about child poverty or elderly poverty, a major limitation. In addition, low-income area is defined as living in a geographic area of 100,000 people (a Public Use Microdata Area) where the poverty rate is 20% or higher. Areas of 100,000 are far too large to actually point to poor neighborhoods.

2.4.6 Dhongde and Haveman

Dhongde and Haveman (2017) have produced the most complete U.S multidimensional poverty index available to date. Their analysis uses American Community Survey data from 2008 to 2013 and produces estimates for each year, making it the first U.S. MPI to cover trends over time. However, they only use the adult population (ages 18-64). They use the following indicators, each as its own dimension

- Health Insurance
- Disability Status
- Less than a high school degree
- English fluency
- Housing costs as a percent of income
- Overcrowding as having more than one person per room

The index is constructed using Alkire-Foster indexing and considers an individual deprived if they are poor in one third or more of the weighted indicators (the same standard used by the Oxford MPI). They show the MPI falling more rapidly than the Official Poverty Measure or Supplemental Poverty Measure during the recovery from the recession.[14] They also compare official poverty to their index and find that:

> The two groups are similar in size but different in composition. About 14.5% of the population was income poor and 15.3% of the population was multidimensionally deprived. However, the overlap between the two groups is not very high. Typically only 5 to 6 percent of the population was income poor as well as multidimensionally deprived (Dhongde and Haveman 2017, 12).

They also divide the MPI by race and gender, and like most of the literature note that lower rates of health insurance and high school degrees drive an increase in Hispanic scores on the Multidimensional Deprivation Index[15].

Dhongde and Haveman do significantly more testing of their index than the rest of the literature. They show that trends on the overall index are consistent when removing one indicator at a time. They also present a weighting scheme based on Multiple Correspondence Analysis.[16]

[14] They show this is due to declines in severe housing burden, lack of high school education, and health insurance.

[15] Dhongde and Haveman refer to their index as a Multidimensional Deprivation Index rather than a Multidimensional Poverty Index.

[16] The topic of Multiple Correspondence Analysis is addressed in Chapter 4, where I argue that it is a useful tool for organizing indicators into dimensions, but a poor choice for implementing a weighting scheme.

2.4.7 Overview of U.S. MPIs

2.4.7.1 Choosing indicators

There are several ways to choose indicators. In chapter 3, I will justify my indicator choices in terms of empirical research to well-being and theoretical relevance to poverty. Of course, justifying the inclusion of certain indicators is more straightforward than justifying excluding others. The honest answer in almost all cases and throughout the research is that other indicators were excluded because of data limitations. It will be the same for my index in Chapter 3, the indicators are chosen as the empirically and theoretically justified indicators that also appear together in a single survey with data available at the individual level.

Wagle justifies indicator choice saying:

> "While using more information would be desirable, an exceedingly large number of variables typically adds to the complexity of the analysis. Additionally, data derived from general-purpose surveys like the GSS do not often supply the exact information needed for specific analyses such as this. Therefore, considerable data constraints exist, limiting the scope of this analysis" (Wagle 2009, 7)

Avevedo-Garcia et al offer a justification similar to my own, writing:

> "All of the Child Opportunity Index indicators have been vetted for their relevance to child development based on empirical literature on neighborhood effects, conceptual frameworks of neighborhood influences on children, or both. The selection of the indicators was also guided by data availability." (Acevedo-Garcia et al. 2014, 1950)

Koohi-Kamali and Liu simply state (2017, 10), "They are what appear to us to be the most sensible indicators for Pennsylvania."

The Brookings Institution points to a connection between their indicators and the 1942 report *Social Insurance and Allied Services* by William Beverage (Reeves, Rodrigue, and Kneebone 2016, p 1).

> Beveridge identified "Five Giant Evils" that needed to be confronted and defeated once the war was won. These five evils were "squalor, ignorance, want, idleness, and disease." Beveridge believed that all five had to be addressed through concerted government action, with improved housing ("squalor"), universal secondary education ("ignorance"), income transfers to the poor ("want"), full employment ("idleness"), and a national health service ("disease").

The mapping from Beveridge to the available indicators in the data seems stretched in some places, particularly in using low-income areas as the closest corresponding indicator for improved housing.

Dhongde and Haveman refer to the Commission on the Measurement of Economic Performance and Social Progress, which identified eight theoretically indicated dimensions. While their justification is based on the theoretical work of a commission, their final index has six dimensions, not eight and they acknowledge the data limitations and judgments that are required (note, they use MDI to refer to their Multidimensional Deprivation Index) (Dhongde and Haveman 2017, p 482):

> In order to estimate the MDI, we require data on every indicator for each individual. The data has to originate from the same survey. Thus the choice of indicators is restricted by the availability of the data. Any particular set of indicators is unlikely to represent a society's deprivation in its entirety; the choice of indicators serves the practical purpose of informing efforts that seek to reduce multidimensional deprivation (Alkire et al, 2015). The selection of relevant dimensions of capability is a matter of judgment, as is the selection of weights and cutoffs (Sen, 1987, 1992).

2.4.7.2 Choosing the cutoff

The choice of a cutoff for poverty is also controversial. *Multidimensional Poverty and Analysis* (Alkire, Foster, et al. 2015) refers to this cutoff as k and suggests that it is a question of judgment that should reflect the standards of what is considered poor by the relevant population.

> Like the income poverty line, the final choice of k in most cases should be a normative one, with k describing the minimum deprivation score associated with people who are considered poor and consider themselves to be poor. (Alkire, Conconi, et al. 2015)

In some cases, the cutoff is mapped from expenditures at a certain income percentile. This in some ways derives an absolute cutoff from a relative measure of expenditures, but it only pushes the normative choice one level deeper as the relative measure still has to be chosen. (E.g. The supplemental poverty measure defines necessary spending on shelter as whatever the 33rd percentile of the population spends on shelter – but the justification for using the 33rd percentile is a normative choice based on intuitive or 'common-sense' notions of what it means to be poor).

2.4.8 Places to improve U.S. MPIs

The literature on developing MPIs in the United States is still in its early stages. There are several areas for potential improvement, and chapter 3 will present an index that offers substantial improvement in the following areas:

- Including all ages
    - None of the current indices allow comparison of children, elderly, and adult populations.

- More extensive use of dimensional breakdown
    - For example, Dhongde and Haveman report only that top-level multidimensional poverty rates are similar for men and women. However, an analysis of which indicators contribute to the overall poverty rate reveals that men and women are poor in very different ways.
- A stronger indicator list and dimensional structure
- Open code in an open-source and popular programming language
- Compelling data visualizations

2.5 Conclusion

There is no universal agreement on how to measure poverty. From the beginning, poverty measurement has faced the simultaneous challenges of normatively and technically coming to a practical, acceptable, and measurable definition of poverty. Orshansky's poverty measure adjusted a flat, one income-level poverty threshold to reflect differences in family size. Orshanksy herself was well aware of the limitations and viewed her research as steps in the correct direction of building a poverty measure. Recent years have seen an increased interest from the research community in defining poverty more broadly to encompass multiple forms of deprivation. There are currently multiple competing proposals. The next chapter introduces a new poverty index that has distinct advantages over the current pool of contenders.

Chapter 3: A Multidimensional Poverty Index

3.1 Introduction

The multidimensional poverty index constructed in this chapter and explored in the next two has its basis in the idea of measuring capabilities as discussed in the first chapter. While the concept is discussed more thoroughly in chapter 1, a brief overview here is necessary to provide context as to the criteria by which indicators were chosen to be included in the index.

Income is frequently used to measure poverty because income is an instrumental good through which other goods such as food, education, and health care can be purchased. As a general principle, it is desirable to measure the *ends* of a good life rather than the *means* whenever possible. While income is a means to a wide array of ends, measuring the ends directly is preferable. In addition, goods such as education and health care are often provided by the state rather than the market. This causes a measurement problem if the value of state-provided goods is simply not counted in the poverty measure. As Amartya Sen notes (1999, 92):

> There is a danger in seeing poverty in the narrow terms of income deprivation and then justifying investment in education, health care and so forth on the grounds that they are good means to the end of reducing income poverty. That would be a confounding of ends and means.

The multidimensional approach to poverty measurement is built on the Aristotelian philosophical tradition that views the purpose of human life as flourishing. While flourishing is a very broad idea, the key distinction here is that it is not synonymous with

maximizing pleasure while minimizing pain.[17] Instead, the concern is increasing human capabilities. Capabilities are to humans what functions are to other objects. Thus, in a key passage explaining Aristotle, Alasdair MacIntyre explains the relationship between factual measurements and ethical goals (MacIntyre 1984, 57–58):

> From such factual premises as `This is watch is grossly inaccurate and irregular in time-keeping' and `This watch is too heavy to carry about comfortably', the evaluative conclusion validly follows that 'This is a bad watch.' From such factual premises as `He gets a better yield for this crop per acre than any farmer in the district', He has the most effective programme of soil removal yet known' and `His dairy herd wins all the first prizes at the agricultural shows', the evaluative conclusion validly follows that he is a good farmer'.
>
> ...moral arguments within the classical Aristotelian tradition...involve at least one central functional concept, the concept of *man* [sic] understood as having an essential nature and an essential purpose or function...
>
> That is to say, `man' stands to `good man' as `watch' stands to `good watch' or `farmer' to `good farmer' within the classical tradition. Aristotle takes it as a starting point for ethical enquiry that the relationship of `man' to `living well' is analogous to that of `harpist' to `playing the harp well.'

[17] Flourishing holds that there is a difference in type, and not merely degree, among various sources of happiness. For example, watching a show on television may be pleasurable, but no number of tv shows watched compares to the experiences of finishing a dissertation, spending time with good friends, being part of a community, getting married, raising a child, or dozens of other uniquely meaningful human experiences. To attempt to contain these within some sort of utility integral seems to trivialize them in a way that most people would recognize as incorrect. In more technical terms, Amartya Sen (2009) would argue that the experiences are incommensurate and so cannot be directly compared in terms of a single unit like utils. However, this does not mean they cannot be compared - Sen notes that human beings do, in fact, make decisions among incommensurate options all the time. Even the common phrase used to object to judging between incommensurate objects 'comparing apples and oranges' is a bit odd, as most human beings have very little trouble making a decision about whether to eat an apple or an orange.

While a watch has a few clearly defined functions, a human being may have several different capabilities[18]. Amartya Sen is largely responsible for developing the capabilities approach, and defines capability in the following passage (Sen 1999, 75):

> A person's ``capability'' refers to the alternative combinations of functionings that are feasible for her to achieve. Capability is thus a kind of freedom: the substantive freedom to achieve alternative functioning combinations (or, less formally put, the freedom to achieve various lifestyles

The immediate difficulty is that living well is not the same to all people. People have varied tastes and interests and may wish to develop a wide range of different capabilities in themselves. Sen solves this difficulty by arguing that there is a minimum standard below which we can consider an individual deprived. Sen points to the example of food distribution. We do not need to know what a perfectly just distribution of food is in order to maintain that a world of widespread famine is unjust.[19] Rather than focus on the relatively intractable question of what it means to `live well' research should instead attempt to set out minimum standards below which human beings are clearly not living well (Sen 1999).

[18] Part of the argument for using capabilities is that human beings clearly do value not only experiences (which are counted in utility) but the ability to *be* certain things. For example, one may value being a good scholar or being a good parent. While one can shoehorn this into a utilitarian approach, this feels somewhat forced. Most parents value being good parents, not maximizing the net total of positive parenting experiences minus negative parenting experiences. The capabilities approach allows us to more accurately and intuitively talk about various things people wish to be rather than solely about experiences. Of course, as people wish to be a wide variety of things the measurement approach taken in the capabilities approach is to look at underlying capabilities that people can then use to achieve more individualized goals like being a scholar.

[19] Famine that was caused by drought and not political choices might be described as unfortunate rather than unjust. However, Sen's empirical work shows that all recent famines would have been avoidable by political action (1999).

In practice, the measurement of capabilities is subject to data constraints. Because a major goal of an index instead of a dashboard is to capture the joint distribution of poverty, the data needs to be at an individual level and cover a wide range of possible indicators. The General Social Survey and the American Community Survey (ACS) both are nationally representative surveys, however the American Community Survey is much larger and allows data to be aggregated at smaller geographic levels.

As the literature review showed, while one early attempt at a U.S. MPI used the General Social Survey, most researchers have used the ACS. The American Community Survey is broad, allowing for an index that covers health, education, and economic indicators. To cover those three dimensions, I use nine indicators, each with its own cutoff point for what counts as deprived. The indicators are assigned to each dimension on the basis of multiple correspondence analysis, which is used to group similar indicators together into dimensions (and is explained fully in chapter 4).

Section 2 introduces each of the indicators and the reason for their inclusion in the index. Section 3 explains the Alkire-Foster indexing methods. Section 4 presents results for the United States (Chapter 5 presents results for smaller geographic areas).

3.2 The Indicators

There are nine indicators covering health, education, and economics. In general, indicators attempt to come as close as possible to measuring the ends of human life rather than the means (see Chapter 1 for more on the theoretical basis of measuring human capabilities). While measuring outcomes would be ideal, data restrictions mean

that in some cases there are still some indicators that primarily reflect means (e.g. health insurance is a means to better health, but a direct measure of health would be preferable). Indicators are chosen to be as closely linked to outcomes as possible, so this section both defines the indicators and reviews the academic literature on how closely they proxy the outcomes that would ideally be measured. Due to the copious amount of literature that has been written on each of the dimensions, wherever possible I refer to recent literature reviews by experts in the field.

The Alkire-Foster indexing method is covered in section 3, but the method relies on each indicator having a cutoff between deprived and not deprived. This methodology corresponds to the philosophical choice outlined above to focus on measuring a wellbeing floor rather than attempting to measure levels of wellbeing directly. The cutoffs and the reason each cutoff point was chosen is also covered when discussing each individual indicator. The data is from the American Community Survey and retrieved from the Integrated Public Use Microdata database (Ruggles et al. 2015)

3.2.1 Health

The three indicators for health are lack of health insurance, self-reported difficulty taking care of oneself due to disability, and overcrowded housing.

Individuals are considered deprived in the health insurance indicator if they lack health insurance. This is a proxy for actual health, but research suggests there is a strong relationship between health insurance, access to health care, and health outcomes.

There is a real difficulty in estimating the impact of health insurance (Sommers, Gawande, and Baicker 2017, 4):

> ...assessing the impact of insurance coverage on health is complex: health effects may take a long time to appear, can vary according to insurance benefit design, and are often clouded by confounding factors, since insurance changes usually correlate with other circumstances that also affect health care use and outcomes.

Nonetheless, a thorough review in the New England Journal of Medicince concluded (Sommers, Gawande, and Baicker 2017, 5–6):

> ...evidence from multiple studies indicates that coverage substantially improves patients perceptions of their health...improved subjective well-being (i.e., feeling better) is also a primary goal for much of the medical care delivered by health care professionals. In addition, self-reported health is a validated measure of the risk of death. People who descripe their health as poor have mortality rates 2 to 10 times as high as those who report being in the healthiest category.
>
> Overall, the evidence indicates that having health insurance is quite beneficial....
>
> ...coverage expansions significantly increase patients' access to care and use of preventive care, primary care, chronic illness treatment, medications, and surgery. These increases appear to produce significant, multifaceted, and nuanced benefits to health. Some benefits may manifest in earlier detection of disease, some in better medication adherence and management of chronic conditions, and some in the psychological well-being born of knowing one can afford care when one gets sick...some of these changes will ultimately help tens of thousands of people to live longer lives.}

Although health insurance is a proxy for actual health, the empirical evidence suggests it is a reliable proxy. Increases in health insurance coverage indicate better health.

Individuals are considered deprived in the disability indicator based on an affirmative answer to either of two census questions. If ``the respondent has any physical, mental,

or emotional condition lasting six months or more that makes it difficult or impossible to perform basic activities outside the home alone.'' or if ``respondents have any physical or mental health condition that has lasted at least 6 months and makes it difficult for them to take care of their own personal needs, such as bathing, dressing, or getting around inside the home.'' (Ruggles et al. 2015).

Self-reported difficulty performing basic activities outside or inside the home is a clear measure of deprivation in a capability. Empirical research also suggests that disability causes a substantial drop in subjective well-being (Freedman et al. 2012). A study of older adults with disability (the study used the same definition of disability as the indicator, difficulty performing basic activities) found that most relied on informal care that was not always available (Freedman and Spillman 2014). This also implies that disability has a substantial and unmeasured cost not only on the disabled, but on the informal and unpaid caregivers as well.

Individuals are considered to live in overcrowded housing if there are more than two people per bedroom. Shelter is a basic human need. Affordable housing also offers several other benefits, some of which are measured in other indicators (e.g. improved educational outcomes) and some that are not directly captures (wealth accumulation, improved health outcomes other than insurance) (Agnew 2014). Overcrowding is included in health because it clusters with other health indicators in the multiple correspondence analysis presenting in Chapter 4, suggesting that overcrowding may be an important socioeconomic determinant of health.

3.2.2 Education

Education has three indicators: educational attainment, internet access, and linguistic isolation.

Educational attainment is defined differently for adults and children. Adults are considered deprived in educational attainment if they lack a high school degree or equivalent. Children are considered deprived in educational attainment if they are more than a year behind in school.

While formal education is well known to increase labor market value, it is included in the index not for its income-generating properties (as income is included separately in the index) but instead for its intrinsic value to human life.

As John Stuart Mill famously quipped, “It is better to be a human being dissatisfied than a pig satisfied; better to be Socrates dissatisfied than a fool satisfied. And if the fool, or the pig, are of a different opinion, it is because they only know their side of the question.'' (Mill 1863, 14).

The second education indicator is lack of internet access. Formal education is only one aspect of the broader goal of education as a capability. Access to resources and communities to continue education is also important. Internet access is assigned at the household level. A household is considered deprived if there is no internet access, or if there is none of the following computer equipment: laptop, desktop, notebook, smartphone, or other computer equipment (not including GPS or household appliances). Internet access increases social capital among the general population

(Bauernschuster, Falck, and Woessmann 2014) and can decrease loneliness among older adults (Cotten, Anderson, and McCullough 2013).

The third education indicator is Linguistic isolation. Linguistic isolation is an indicator constructed from Census data by the University of Minnesota Population center: “These are households in which either no person age 14+ speaks only English at home, or no person age 14+ who speaks a language other than English at home speaks English ‘Very well’.” (Ruggles et al. 2015). Thus a family that speaks a language other than English at home but has a person 14+ who speaks English very well is not linguistically isolated. Because there are strong non-English speaking communities in many geographies, not speaking English may not always be isolating. As was the case with health insurance, linguistic isolation is an inexact but still useful proxy whose effects have been studied. Linguistic isolation (using the same indicator construction) causes decreased social and economic capital (Nawyn et al. 2012).

3.2.3 Economic

There are three economic indicators: income, unemployment, and housing costs.

Income is calculated at the family level and is whether or not the family is below the income poverty line. While income by itself is an inadequate measure of poverty, it does still help capture elements of capability deprivation that there is no way to directly measure. The other 8 indicators cover a fair number of capabilities, but having insufficient income would still be a problem even if the other indicators were met. Among other things, income can be used to buy food, and there is no direct way to

measure food consumption in the data. In a primarily market-based economy, income is still an important measure of an individual's ability to obtain necessary goods.

Unemployment is calculated at the household level. All individuals in the household are considered deprived if no one in the household is employed. There are a few exceptions. If the household has retirement income or investment income that is sufficient to lift them above poverty they are assumed to be voluntarily retired and not in need of a labor market connection. Sufficient farm income also results in the assumption that a formal labor market connection is not necessary. Employment is included separately because employment matters beyond the income that it generates. Sen writes (Sen 1999, 94)

> There is plenty of evidence that unemployment has many far-reaching effects other than loss of income, including psychological harm, loss of work motivation, skill and self-confidence, increase in ailments and morbidity (and even mortality rates), disruption of family relations and social life, hardening of social exclusion and accentuation of racial tensions and gender asymmetries

Households that pay more than 50 percent of their income in housing costs are considered cost burdened. The 50 percent threshold follow the definition of severe housing burden used by the Department of Housing and Urban Development. Shelter is a basic human need. Affordable housing also offers several other benefits, some of which are measured in other indicators (e.g. improved educational outcomes) and some that are not directly captured (wealth accumulation, improved health outcomes other than insurance)

Individuals who are not income poor but live in areas where housing is expensive may also be disadvantaged because the high cost of housing may leave insufficient remaining income for expenses like food.

3.3. Alkire-Foster Indices

The Alkire-Foster methodology is an application of the Foster-Greer-Thorbecke Index to a multidimensional setting (Foster, Greer, and Thorbecke 1984). Poverty measurement can be usefully divided into two main steps: identification and aggregation (Sen 1976). Aggregation is frequently overlooked, as dividing the number of those identified as poor by the total population (the headcount ratio) is the dominant approach. However, both the FGT and AF classes of indices employ an aggregation approach that incorporates depth of poverty. Normatively, this is desirable, as poverty measurement should reflect improvement when the lives of the poor are improved, not only when they cross over the line from poor to not poor.

3.3.1 Identification

The Oxford Handbook of Multidimensional Poverty Measurement and Analysis has a useful summary of the steps used to construct a multidimensional poverty index. Identification for the AF class of poverty measures involves six steps. Quoted from the handbook, they are (Alkire, Foster, et al. 2015, 3)

- Defining the set of indicators which will be considered in the multidimensional measure. Data for all indicators need to be available for the same person.
- Setting the deprivation cutoffs for each indicator, namely the level of achievement considered sufficient (normatively) in order to be non-deprived in each indicator.

- Applying the cutoffs to ascertain whether each person is deprived or not in each indicator.
- Selecting the relative weight or value that each indicator has, such that these sum to one.
- Creating the weighted sum of deprivations for each person, which can be called his or her `deprivation score.'
- Determining (normatively) the poverty cutoff, namely, the proportion of weighted deprivations a person needs to experience in order to be considered multidimensionally poor or not according to the selected poverty cutoff.

The first two steps were discussed when introducing the indicators. The third step is a mechanical step of applying the cutoffs to the indicators. The fourth step is weighting the indicators. I choose to weight all three dimensions equally. Each of the indicators is also equally weighted within the dimensions.

The need to explicitly determine weights (which is to say, to answer the question 'What Matters?') is often a point at which advocates of other approaches object. However, in reality, all approaches must at some point provide a normative answer to the question of what matters - choosing to pay attention to some things instead of others is implicitly deciding that those things matter. Rather than implicitly apply weights in order to shield them from criticism, the Alkire-Foster approach explicitly talks about the need for such choices, thus opening them to public discussion. As Sen argues (Sen 1999, 30):

> Valuations are, of course, involved in all such approaches (including utilitarianism, libertarianism, and other approaches, to be discussed in chapter 3), even though they are often made implicitly. Those who prefer a mechanical index, without being explicit about what values are being used and why, have a tendency to grumble that the freedom-based approach requires that valuations be explicitly made.

The final step is an overall cutoff. The cutoff represents the percent of all weighted indicators on which an individual must be deprived to be counted as poor. I use 30

percent (0.3) as the cutoff. In practice this means an individual who is deprived in any three indicators or in education and one other indicator is counted as poor. There are two reasons for assigning a poverty cutoff. One is that while indicator cutoffs are set at levels that most people would not choose to be below, some people might. However, being deprived in 3 or more (weighted) indicators is unlikely to be voluntary. The second reason is that having a dual cutoff approach (cutoffs for both indicators and overall poverty) allows the index to focus more directly on poverty. The way this is achieved is illustrated in the index aggregation section below, but the effect is an index that changes only when the lives of the poor are improved but not when the lives of the nonpoor are improved. (Of course, improving the lives of the nonpoor is an important goal, but it the point of a multidimensional poverty index is to measure poverty, so the index should be sensitive to changes in the lives of the poor and insensitive to changes in the lives of the nonpoor).

In order to explain the construction of the index it is useful to refer to a simple example. The Uncensored Deprivation Matrix displays a fictional matrix for a society of only five people. Each row is an individual while each column is an indicator. Each indicator is coded to 0 or 1, with 1 indicating the individual is deprived in that indicator. The 0-1 coding is based on the cutoffs for each indicator in the above section, and allows an index to be constructed across data that includes both ordinal (e.g. education level) and numeric (e.g. income) data.

Each individual also has a weighted average of deprivations ranging from 0 to 1. All indicators are weighted at (1/9).

Uncensored Deprivation Matrix

Persons	Indicators									
	Ins	*Dis*	*Edu*	*Inc*	*Une*	*HCo*	*HCr*	*Lng*	*Int*	*W.Avg*
A	0	1	1	1	1	1	0	0	0	(5/9)
B	0	0	0	0	0	0	1	0	0	(1/9)
C	1	0	0	1	0	0	0	1	0	(3/9)
D	0	1	0	0	0	0	0	0	0	(1/9)
E	0	0	0	1	1	0	0	0	0	(2/9)

Using the cutoff of ≥0.33 to identify poor individuals, in this hypothetical group of 5, persons A and C are poor. Many poverty measurements seem to stop with identification, because the actual aggregation step is simply $\frac{n_{poor}}{n_{total}}$, or the headcount ratio. However, while the data can be used to produce a headcount, the preferred aggregation index is the Alkire Foster Index M_0 that is explained in the next section.

3.3.2 Aggregation

The M_0 indicator is referred to as the adjusted headcount and is the product of the headcount ratio and the intensity of poverty. The headcount ratio is $\frac{2}{5} = 0.4$. The intensity (or breadth) of poverty is calculated as the average deprivation score among the poor. In the example given above where person's A and C are poor, the average score is $\frac{\frac{5}{9}+\frac{3}{9}}{2} = \frac{4}{9}$

making M_0 in our example $M_0 = 0.4 * \frac{4}{9} = 0.18$.

The adjusted headcount ratio has another interpretation that may be more intuitive. It is the ratio of deprivations experienced by the poor to the total number of deprivations that could be experienced if all people experienced all deprivations. In this example with five people, if all people experienced all deprivations, the weighted sum of deprivations would be 5. The deprivations experienced by the poor (persons A and C) have a weighted sum of 0.6 + 0.3 = 0.9, and so the adjusted headcount is $M_0 = \frac{0.9}{5} = 0.18$

3.3.3 Useful Index Properties

The goal of a poverty measure is to be useful to policymakers who wish to alleviate poverty. Although a poverty measure may seem to be primarily a technical issue, the way in which the measure changes in response to changes in people's living conditions is foundationally a normative concern. “The normative judgements embodied by a poverty measure are reflected in its mathematical properties, including its structure and responses to changes in its argument.” (Alkire, Foster, et al. 2015, 34)

Because the index is both technical and normative, it is important to be clear about the properties the index has in its response to different inputs. This is an axiomatic approach to poverty measurement, as the concern is that the measure satisfies certain axiomatic properties.[20] The adjusted headcount ratio satisfies the following properties (Alkire, Foster, et al. 2015, 56)

- *Symmetry* is the property that switching achievement vectors (rows) across people does not change the overall index. Thus, if person A and D were to be switched in our sample 5-person society, there would be no change in the index.

[20] Axiomatic approaches are covered in Chapter 2, and these property definitions are also found there.

This property is desirable as it means individual identity is irrelevant, and people are given equal treatment by the index.

- *Replication Invariance* simply means that if we were to replicate our society (e.g. duplicate our 5-person society into a 10-person society) the poverty measure would be unchanged. This allows for comparisons across societies of different sizes.
- *Scale Invariance* means that changing the scale of any of the indicators makes no difference. For example, changing income from dollars to thousands of dollars will not affect the poverty measurement, as long as the deprivation cutoff is also scaled.
- *Poverty Focus* means the index does not change in response to changes in the wellbeing of the nonpoor, but only in response to changes in the wellbeing of the poor. Unlike a more general wellbeing index, a poverty index should reflect the situation of the poor only.
- *Deprivation Focus*, like poverty focus, is the index not changing in response to improvements in wellbeing in non-deprived dimensions. Thus, although person C is poor, because person C is not deprived in education, additional improvements in education for C do not change the index. This is desirable because additional improvements in one area often do no make up for shortcomings in others. For example, in this case, no amount of additional education will make up for not having health insurance.
- *Dimensional Monotonicity* means if a poor person increases achievement in a deprived dimension while other dimensions remain unchanged, poverty should decrease. This is one reason the intensity part of the adjusted headcount is important. It is normatively desirable that if person A goes from .6 weighted deprivations to .4 weighted deprivations, the poverty measurement decreases, even though person A is still poor.
- *Population Subgroup Decomposability*} allows the index to be broken down by age, gender, race, geographic region or other population subgroups.
- *Dimensional Breakdown*} allows the contributions of each dimension (or indicator) to the overall poverty rate to be calculated.
- *Weak Deprivation Rearrangement* means that if inequality decreases among the poor (e.g. Person A goes from 0.6 to 0.5 weighted deprivations while Person C goes from 0.3 to 0.4 weighted deprivations) then the overall poverty measure should not increase.

3.4 The Constructed Index

The Multidimensional Poverty Index proposed here can be shown for several different populations. This is explored more thoroughly in Chapter 5. For now, the MPI for the United States in 2015 is shown. Table 1 provides the headcount, intensity, and adjusted headcount. For ease of interpretation, all numbers are presented on a 0-100 scale instead of a 0-1 scale.

Table 3.1 MPI Overview

Table 1: MPI Overview

	Value	Standard Error
Headcount	14.23	0.03
Intensity	39.88	0.02
Adj. Headcount	5.67	0.02

The individual indicators for the MPI are shown in Table 2.[21] The uncensored mean of each indicator shows the incidence in the general population. However, it is also useful to know how often the indicator is experienced by the poor. The censored mean is based on a matrix where all nonpoor are coded as nondeprived in all dimensions. A more intuitive interpretation is that it is the percentage of all people who are both MPI poor and deprived in that particular dimension.

[21] The incidence levels do not match the American Community Survey tables produced by the Census Bureau for two reasons. First, I have included individuals living in Group Quarters. Second, the Public Use Microdata sample is not identical with the raw data the Census Bureau uses. The Census Bureau provides PUMS estimates for user verification (https://www.census.gov/programs-surveys/acs/technical-documentation/pums/documentation.html). As I am able to replicate those using the same weights used throughout the analysis, the remaining differences are due to choices like including individuals in Group Quarters.

Table 3.2 Incidence

Table 2: Incidence

	Uncensored Mean	Uncensored SE	Censored Mean	Censored SE
health	8.87	0.02	3.90	0.02
disability	5.62	0.02	2.58	0.01
overcrowd	3.96	0.01	2.18	0.01
income_poverty	15.95	0.03	9.83	0.02
fam_emp	10.87	0.02	7.08	0.02
hcost_dep	17.18	0.03	8.96	0.02
education	20.96	0.03	8.51	0.02
computer_internet	10.84	0.02	5.36	0.02
lang_dep	4.60	0.02	2.67	0.01
mpi_poor	14.23	0.03	14.23	0.03

Dimensional Breakdown is an extremely useful property for policy analysis. The percent that each indicator contributes to the overall index can be calculated. The formula for each indicator is:

$$Percent\ Contribution = \frac{Censored\ Mean}{Adjusted\ Headcount} * Weight$$

Because all dimensions are equally weighted, the percent contribution is determined by how common each indicator is among the poor (this may be different than how common they are among the population as a whole). Table 3 shows the percent contribution for each indicator.

Table 3.3 Percent Contribution to Adjusted Headcount

Table 3: Percent Contribution to Adjusted Headcount

	per_contrib_vector
health	7.63
disability	5.05
overcrowd	4.28
income_poverty	19.25
fam_emp	13.85
hcost_dep	17.55
education	16.67
computer_internet	10.50
lang_dep	5.22

Dimensional Breakdown becomes even more useful when combined with Population Subgroup Decomposability. The variation among subgroups is explored in detail in Chapter 5, but the general usefulness of the index can be illustrated by comparing MPI poverty among men and women. Table 4 shows the incidence of each indicator in the population by gender, while table 5 shows the percent each indicator contributes to the MPI. The index shows men and women with similar overall levels of poverty (16.41 v. 16.35) but substantial differences in terms of the way in which they are poor.

Table 3.4 Indicator Incidence by Gender

Table 4: Indicator Incidence by Gender

	Female Mean	Female SE	Male Mean	Male SE
MPI Poor	16.35	0.04	16.41	0.04
Health Insurance	8.31	0.03	11.14	0.03
Disability	6.30	0.02	4.74	0.02
Overcrowding	3.39	0.02	4.61	0.02
Income	17.48	0.04	15.87	0.04
Employment	11.41	0.03	10.82	0.03
Housing Cost	19.17	0.04	16.50	0.04
Education	9.49	0.03	10.49	0.03
Internet	14.87	0.04	13.93	0.04
Linguistic Isolation	4.40	0.02	4.72	0.02

In the U.S. as a whole, male poverty is more likely to take the form of lack of education, overcrowded living conditions, and no health insurance, while female poverty is more strongly driven by income, disability and housing costs. Breaking down the index geographically reveals predictable patterns, like housing costs contributing more to poverty in urban areas than rural ones.

Table 3.5 Percent Contribution to Index by Gender

Table 5: Percent Contribution to Index by Gender

	Female	Male
Health Insurance	6.32	8.98
Disability	5.61	4.01
Overcrowding	3.58	5.40
Income	17.42	16.54
Employment	12.71	12.45
Housing Cost	14.77	12.62
Education	23.10	24.81
Internet	12.04	10.94
Linguistic Isolation	4.27	4.43

3.4.1 MPI Poverty compared to Income Poverty

Although the overall level of poverty as determined by the MPI and by the income poverty indicator are very similar, they do not identify the same people. As has been found for almost all MPI indicators before, there is a substantial population that is MPI poor but not income poor, and vice versa(Alkire, Foster, et al. 2015) In the case of this particular index at the U.S. level in 2015, 10.7 percent of the population was both income poor and MPI poor, while 5.7 percent was MPI poor but not income poor, and 6 percent was income poor but not MPI poor.

Table 3.6 Income Poor v. MPI Poor

Table 6: Income Poor v. MPI Poor

	Income Poor	Not Income Poor
MPI Poor	9.83	4.40
Not MPI Poor	6.12	79.65

The overlap shrinks even more when accounting for the mechanical overlap between an index including income poverty and income poverty itself. When income poverty is removed from the MPI (and its weight stays within the economic dimension, thus doubling the weight place on the employment indicator) the relationship between MPI poverty and income poverty is reduced, as shown in Table 7

Table 3.7 Income Poor v. MPI Poor (MPI modified to not include income)

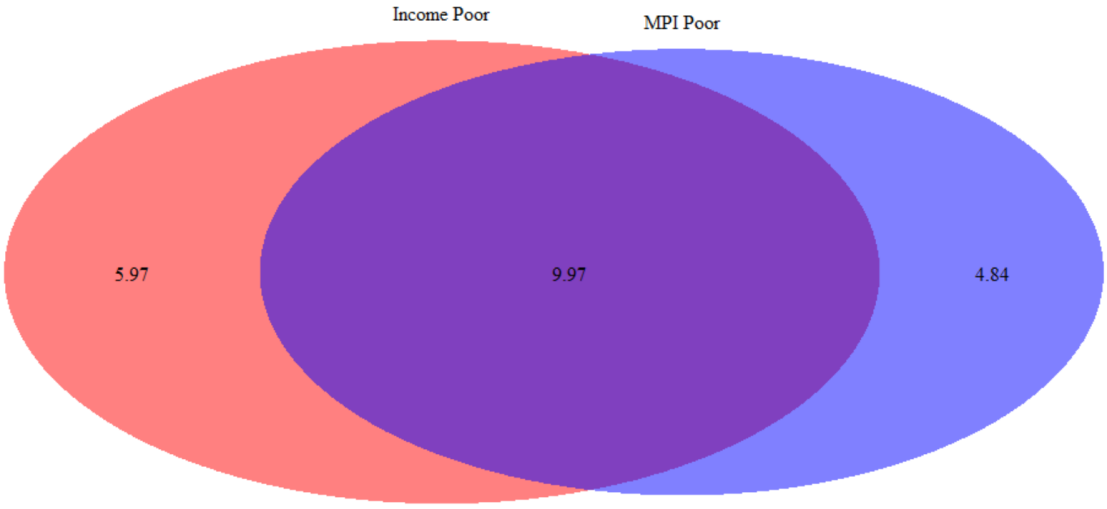
Table 7: Income Poor v. MPI Poor (MPI modified to not inlcude income)

	Income Poor	Not Income Poor
MPI Poor	9.97	4.83
Not MPI Poor	5.97	79.23

Figure 3.1 provides a visualization of the overlap between the MPI poor (with income not included in the index) and the income poor. Although both groups are roughly the same size, the question of which poverty measurement to use is consequential, as the MPI and the income poverty measurement identify different people.

Figure 3.1 Income Poverty v. Multidimensional Poverty

Figure 1: Income Poverty v. Multidimensional Poverty



The multidimensional poverty index proposed in this chapter can be an extremely useful tool for policymakers. The index can be constructed from already available data, reflects both the scope and intensity of poverty, reacts to changes in poverty in ways that make normative sense, and can be used to illustrate ways in which poverty differs for different populations.

Chapter 4: Index Evaluation

> "The normative choices inherent in monetary and multidimensional poverty design appear to cause consternation, particularly if measurement conventions have not been established." (Alkire et al. 2015, Ch. 6, p. 2)
>
> "Statistical approaches are relevant for multidimensional poverty measures, but Chapter 6 argued, value judgements also constitute a fundamental prior element. Thus, information on relationships between indicators is used to improve rather than determine measurement design. For example, if indicators are very highly associated in a particular dataset, that is not sufficient grounds to mechanically drop either indicator; both may be retained for other reasons-for example if the sequence of their reduction over time differs, or if both are important in policy terms. So the normative decision may be to retain both indicators, with or without adjustments to their weights, but the analysis of redundancy will have clarified their justification and treatment." (Alkire et al. 2015, Ch. 7, p. 16)

The use of a multidimensional poverty index to measure poverty is inherently more complex than a single dimension. Although the Alkire-Foster index is useful for simplifying the final output of the index in a way that is useful for policymakers, the index itself has many interrelated components. This chapter takes up the question of validating the index. It compares the index to its components and argues for the general robustness of the proposed multidimensional poverty index as a tool for measuring poverty.

There is no agreed upon method for validating a poverty index proposal. The most common technique is simply to compare it to previous poverty lines and note any differences in the populations covered. (Orshansky 1965; Bridges and Gesumaria 2015; Reeves, Rodrigue, and Kneebone 2016; Alkire and Foster 2011; Wagle 2009). A few

papers also perform a sensitivity analysis testing different weighting schemes (Koohi-Kamali and Liu 2017; Dhongde and Haveman 2017). For multidimensional poverty specifically, there are a few recommendations for tests of indicators in the Oxford Multidimensional Poverty Index handbook (Alkire et al. 2015).

In this chapter, all of the applicable techniques are applied. As in other chapters, the chapter moves from broader consideration of poverty indices and index validation to a more specific and detailed examination of the proposed index. Section 1 is a discussion of the move from the current poverty line to a multidimensional paradigm. Section 2 applies multiple correspondence analysis (similar to principle components, but for dichotomous variables) to the index to better understand its internal structure. Section 3 tests the index using Chi Square, Cramers' V, and a redundancy measure to see how the indicators correlate with each other. Section 4 discusses the advantages of the proposed MPI over other MPIs. Section 5 concludes.

4.1 Statistics and Paradigms

> "The competition between paradigms is not the sort of battle that can be resolved by proofs" (Thomas Kuhn, 147)

To suggest the use of a multidimensional poverty measurement instead of unidimensional is to suggest a paradigm shift – a change in the lens through which we view, measure, and talk about poverty. Although talk of a paradigm shift may appear immodest, I am referring to paradigms in the sense that Thomas Kuhn did, as a way of thinking about a particular area of research and providing a format for how that

research is to proceed. The shift in paradigms can be either good or bad – though hopefully a proposal to move to a worse paradigm than is currently employed in the research community would be rejected by that community.

The reason it matters that this is a suggested paradigm shift is that the way in which different paradigms can be compared to each other is fundamentally different than the way in which two competing research ideas within the same paradigm can be compared to each other. The accepted standards for comparing two ideas are accepted within paradigms, not between them. That is to say, a paradigm includes the standards for what constitutes good research. As Thomas Kuhn argues:

> "Like the choice between competing political institutions, that between competing paradigms proves to be a choice between incompatible modes of community life. Because it has that character, the choice is not and cannot be determined merely by the evaluative procedures characteristic of normal science, for these depend in part upon a particular paradigm, and that paradigm is at issue. When paradigms enter, as they must, into a debate about paradigm choice, their role is necessarily circular. Each group uses its own paradigm to argue in that paradigm's defense." (p.94)

This does not, however, mean that choosing between paradigms is hopeless or merely a matter of taste. Between mathematical proof and matters of taste lays the entire range of informed judgment. The math in this chapter is quite useful for examining the index – but it does not constitute any sort of proof that this index is better than another – the most it can do is provide supporting evidence. Judgment is then involved in weighing the best available evidence and coming to a conclusion about which poverty measure should be used to guide policymaking.

The need for judgment is not restrained only to areas like poverty with clear normative dimensions or only to social sciences, it is a part of the hard sciences as well. As Kuhn writes, “As in political revolutions, so in paradigm choice – there is no standard higher than the assent of the relevant community” (p. 94)

An inherent difficulty of choosing is that none of the choices are perfect. No single measure of poverty will classify all individuals ‘correctly’ nor will any of them be perfect for all research questions about poverty. The case for a multidimensional poverty index is that it solves important problems in poverty research. This is true for any new paradigm, as Kuhn writes, “Since no paradigm ever solves all the problems it defines and since no two paradigms leave all the same problems unsolved, paradigm debates always involve the question: Which problems is it more significant to have solved.” (p. 108)

Perhaps even more important than the ability to solve current problems in the field is the ability to provide fruitful new lines of research and productive ways of understanding the world. Kuhn concludes, “But paradigm debates are not really about relative problem-solving ability, although for good reasons they are usually couched in those terms. Instead, the issue is which paradigm should in the future guide research on problems many of which neither competitor can yet claim to resolve completely” (p. 156)

4.2 Confirmatory Factor Analysis

The Oxford Multidimensional Poverty Handbook notes in its discussion of CFA and related methods in the poverty index construction context:

> …the precise applications of statistical methods can vary a great deal, and seemingly minor or incidental methodological choices may affect the results. Relevant decisions include the selection of the statistical methodology, the number of components to retain, the method for combining components (multivariate or ad hoc), the selection of weights (e.g. proportion of variance, inverse of variance, or some other approach), and the functional form used to aggregate across individuals. Other choices that may affect the results include the selection of the unstandardized or standardized covariance matrix in PCA, the choice of the Burt or indicator matrix in MCA, and the choice of CFA rather than EFA, as well as methods used to rescale weights or generate factor scores, if relevant. The normative basis of such a multidimensional poverty measure could be difficult to ascertain. The reach of statistical properties could be greatly strengthened if the axiomatic properties were clarified, methodological choices were justified normatively, and the robustness of results to alternative justifiable implementation methods were routinely and transparently assessed. (Alkire et al. 2015, Ch 3, p. 37)

Multidimensional Poverty Measurement and Analysis summarizes the role of empirical analysis in forming dimensions (Alkire et al. 2015, Ch 6, p. 19):

> "Unusually, the selection of dimensions does not necessarily rely on empirical or technical analysis. Naturally sometimes analysts explore or confirm the extent to which dimensional groupings of indicators is corroborated statistically. Such statistical explorations should not determine the selection of dimensions or grouping of indicators; they may, however contribute to their justification and expose interesting relationships that should be considered."

Confirmatory factor analysis is used here to explore/confirm the proposed dimensional structure. Confirmatory factor analysis will not reveal if there are other dimensional structures that are a better fit. It also is limited to analyzing the correlations in the data. Unlike in a survey instrument (the most common use for CFA), these correlations are only observed in the data after some of them have been intentionally affected by policy. For example, providing health insurance to low income individuals (through Medicaid

and CHIP) reduces the correlation between lacking health insurance and having low income. It does not, however, change the underlying deprivations or the way in which – for those individual unfortunate enough to lack both – the deprivations interact with each other.

The nine indicators are all weighted equally, so the index is a tool for communication, as three dimensions with three indicators each is easier to conceptualize than nine indicators. Nonetheless, communicating results is a crucial part of the index and talk of a health dimension with three indicators should reflect there being a relationship among those indicators. The proposed structure is:

- Economic
    - Income
    - Employment
    - Housing Costs
- Health
    - Health Insurance
    - Disability
    - Overcrowding
- Education
    - High School Degree
    - Internet Access
    - Linguistic Isolation

The results from the confirmatory factor analysis are shown in Table 4.1. I use data from 2016. The relationships are all statistically significant, however significance is to be expected with a sample size of over three million. There are several available metrics to measure goodness of fit. The Chi square test is reported, but does not adjust for sample size, and so is significant with large samples. The root mean squared index of

approximation (0.108), comparative fit index (0.679), and standardized root mean squared residual (0.075). The goodness of a fit on any of these indices is determined by convention. The Cornell Statistical Consulting Unit published a handout reporting conventional values on the most common fit statistics which lists the cutoff for root mean squared index of approximation at less than 0.08, the comparative fit index at greater than or equal to 0.90 and the standardized root mean squared residual at less than 0.08 (Parry, n.d.). Using those cutoff points the model is a good fit by standardized root mean squared residual by not by the other two indicators.

The cutoffs were designed for latent variable construction in social psychology research, which is a different type of research. There is no consensus on how correlated multidimensional poverty indicators should be to be grouped into a dimension[22]. Given strong theoretical reasons to believe that these indicators are tracking similar forms of deprivation and that public policy may have reduced correlations that would otherwise exist (e.g. between health insurance and disability) they are left grouped into three dimensions of three indicators in this dissertation.

[22] Unlike a social psychology scale from a variable, the relationship between the variables is, in an important sense, not directly observed from the correlation in the population. Lacking health insurance and having a disability are clearly both health related deprivations. Disability is most common in the population over 65. The population over 65 is eligible for public health insurance (Medicare) which reduces the observed correlation between the indicators – but doesn't change the underlying relationship or nature of the deprivations. Ultimately, the framework is a heuristic for categorizing the indicators. Knowing how well the heuristic fits the data is useful, but is not the only criteria for judging its usefulness.

Table 4.1 Confirmatory Factor Analysis

Factor	Measurement	Coefficient	Standard Error	P-Value
Economic	Income	1	(constrained)	
	Intercept	0.137	< 0.001	< 0.001
	Employment	0.347	< 0.001	< 0.001
	Intercept	0.127	< 0.001	< 0.001
	Housing Cost	0.754	0.001	< 0.001
	Intercept	0.146	< 0.001	< 0.001
Health	Health Insurance	1	(constrained)	
	Intercept	0.076	< 0.001	< 0.001
	Disability	1.407	0.013	< 0.001
	Intercept	0.065	< 0.001	< 0.001
	Overcrowding	1.887	0.017	< 0.001
	Intercept	0.060	< 0.001	< 0.001
Education	High School Degree	1	(constrained)	
	Intercept	0.191	< 0.001	< 0.001
	Internet Access	0.490	< 0.001	< 0.001
	Intercept	0.102	< 0.001	< 0.001
	Linguistic Isolation	0.263	0.001	< 0.001
	Intercept	0.036	< 0.001	< 0.001
	Var(Income)	0.030	< 0.001	
	Var(Employment)	0.100	< 0.001	
	Var(Housing Cost)	0.075	< 0.001	
	Var(Health)	0.067	< 0.001	
	Var(Disability)	0.055	< 0.001	
	Var(Overcrowding)	0.454	< 0.001	
	Var(HS Degree)	0.114	< 0.001	
	Var(Internet)	0.082	< 0.001	
	Var(Linguistic Isolation)	0.032	< 0.001	
	Var(Economic Dimension)	0.088	< 0.001	
	Var(Health Dimension)	0.003	< 0.001	
	Var(Education Dimension)	0.040	< 0.001	
	Cov(Economic, Health)	0.003	< 0.001	< 0.001
	Cov(Economic, Education)	0.027	< 0.001	< 0.001
	Cov(Health, Education	0.004	< 0.001	< 0.001

Estimation method: Maximum Likelihood
Log likelihood: -4040077.6
Number of observations: 3,156,487
Likelihood Ratio test of model vs. saturated: Chi square (24) = 890632.06, p-value is < 0.0001
Root mean squared error of approximation: 0.108
Comparative Fit Index: 0.679
Standardized root mean squared residual: 0.075

4.3 Other Internal Validation Measures

4.3.1 Cramer's V

Dichotomous variables should not use Pearson's correlation coefficient. Tetrachoric correlation is one option, but the Oxford MPI handbook recommends using Cramer's V instead. Cramer's V is built based on cross tabulations of each variable pairing, so some notation is necessary before defining it.

For the cross tabulation,

Let $p_{11}^{jj'}$ be the percentage of the population experiencing both deprivations

Let $p_{10}^{jj'}$ be the percentage of the population deprived in j but not j'

Let $p_{01}^{jj'}$ be the percentage of the population deprived in j' but not j

Let $p_{00}^{jj'}$ be the percentage of the population deprived in neither

Further the percentages of the population that are deprived or not in individual indicators can be written as,

Let $p_{+1}^{j'}$ be the percentage of the population deprived in j'

Let $p_{+0}^{j'}$ be the percentage of the population not deprived in j'

Let p_{1+}^{j} be the percentage of the population deprived in j

Let p_{0+}^{j} be the percentage of the population not deprived in j

Cramer's V can then be written as

$$Cramer's\ V = \frac{(\mathbb{p}_{11}^{jj'} \times \mathbb{p}_{00}^{jj'}) - (\mathbb{p}_{10}^{jj'} \times \mathbb{p}_{00}^{jj'})}{\sqrt{\mathbb{p}_{+1}^{j'} \times \mathbb{p}_{+0}^{j'} \times \mathbb{p}_{1+}^{j} \times \mathbb{p}_{0+}^{j}}}$$

Cramer's V is thus a measure of the correlation between two variables built upon crosstabs of those variables. There are three things to keep in mind while interpreting the table. First, the values for Cramer's V are lower than for a Pearson's correlation coefficient. For example, the well-known correlation between education and income registers at 0.18 in this specification (see table 4.6). Second, the correlations are at an individual level. Section 4 examines the MPI at different poverty thresholds, and shows that about half of the U.S. population is deprived in at least one indicator. However, only 27 percent are deprived in two or more dimensions. Only two percent are deprived in five or more dimensions. This means that it is quite common for an individual to experience any given deprivation while not experiencing any others. Third, while it is useful to see which indicators are most closely correlated, the larger concern in constructing a multidimensional poverty index is that some indicators may be redundant. This concern is addressed in the next section.

Cramer's V shows reasonable correlations among most indicators. Of most interest are the cases where deprivations are negatively correlated. There is a negative correlation between being deprived in housing costs and being deprived in overcrowding. This

makes intuitive sense, as overcrowding can be avoided by paying more for housing and paying more than half of household income on housing can be avoided by accepting overcrowding. Nonetheless, both remain housing-related deprivations. Internet access and overcrowding are also negatively correlated, perhaps reflecting that geographic areas with overcrowding problems are more likely to have readily available internet access (or even simply that households with a lot of people can split the bill for the internet more ways). Health insurance and disability are also negatively correlated. Individuals with disabilities are more likely to qualify for health insurance (on average they are older and thus more likely to qualify for Medicare). Finally, there is a slight negative correlation between overcrowding and linguistic isolation. This may be a reflection of the geographic circumstances and preferences of the communities that are most likely to be linguistically isolated.

The correlations may also be of interest for questions that focus specifically on one or more indicators. In this sense, the correlations serve as a reference that may be useful to future analysis, but do not affect the currently proposed index construction.

Table 4.2 Cramer's V for 2016

	Income	Employ-ment	Housing Cost	Health Insurance	Disability	Overcrowding	No HS Degree	Internet
Income								
Employment	0.24							
Housing Cost	0.51	0.16						
Health Ins.	0.1	0.06	0.07					
Disability	0.05	0.21	0.02	- 0.04				
Overcrowding	0.02	0.36	- 0.06	0.1	0.16			
No HS Degree	0.18	0.11	0.11	0.09	0.05	0.1		
Internet	0.13	0.17	0.09	0.06	0.1	- 0.05	0.13	
Lng. Isolation	0.09	0.02	0.09	0.1	0	- 0.01	0.15	0.1

4.3.2 Redundancy Index

Using the same notation as Cramer's V, the redundancy index can be written as

$$R^o = \frac{\mathbb{P}_{11}^{jj'}}{\min(\mathbb{P}_{+1}^{j'}, \mathbb{P}_{1+}^{j})}, 0 \leq R^o \leq 1$$

The redundancy index looks at the percentage of the population who are deprived in both indicators, divided by the percentage who are deprived in the less common deprivation. If everyone who is deprived in indicator 1 is also deprived in indicator 2 then the index will take on a value of 1. In that case, indicator 2 provides no new

information about poverty. In this case, the indicators are taken from a survey that is already being collected. The redundancy index is still a helpful measure of how indicators relate to each other, but its primary use would be if designing a survey and wanting to keep costs lower by reducing the number of questions. The highest value in the redundancy index is between income and housing costs, and shows that 63% of the population that is deprived in housing costs (the more common deprivation of the two) is also deprived in income. There is no hard and fast rule for how redundant is too redundant, but it seems safe to say that at 63% there is a substantial contribution of new information to the index from finding out if people who are housing cost deprived are also income deprived.

Table 4.3 Redundancy Index for 2016

	Income	Employment	Housing Cost	Health Insurance	Disability	Overcrowding	No HS Degree	Internet
Income								
Employment	0.37							
Housing Cost	0.63	0.31						
Health Ins.	0.26	0.19	0.24					
Disability	0.21	0.41	0.18	0.04				
Overcrowding	0.17	0.62	0.05	0.19	0.23			
No HS Degree	0.38	0.31	0.3	0.32	0.28	0.36		
Internet	0.29	0.3	0.25	0.17	0.22	0.04	0.37	
Lng. Isolation	0.31	0.16	0.32	0.21	0.07	0.05	0.51	0.27

4.3.3 P-values from Chi Square Test

Finally, a Chi Square test can also be applied to the table to see if the relationships are likely to have occurred by chance. Table 4.8 reports p-values from a Chi Square test. Notably, only linguistic isolation and disability status are uncorrelated. Both however, correlate with all other indicators.

Table 4.4 Chi Square Test for 2016

	Income	Employment	Housing Cost	Health Insurance	Disability	Overcrowding	No HS Degree	Internet
Income								
Employment	<.001							
Housing Cost	<.001	<.001						
Health Ins.	<.001	<.001	<.001					
Disability	<.001	<.001	<.001	<.001				
Overcrowding	<.001	<.001	<.001	<.001	<.001			
No HS Degree	<.001	<.001	<.001	<.001	<.001	<.001		
Internet	<.001	<.001	<.001	<.001	<.001	<.001	<.001	
Lng. Isolation	<.001	<.001	<.001	<.001	0.85	<.001	<.001	<.001

4.4 Sensitivity Analysis

Several of the decisions made in producing a multidimensional poverty index are fundamentally normative. Two of the most prominent are the choice of the poverty threshold and the choice of which indicators to include. While these are argued for in

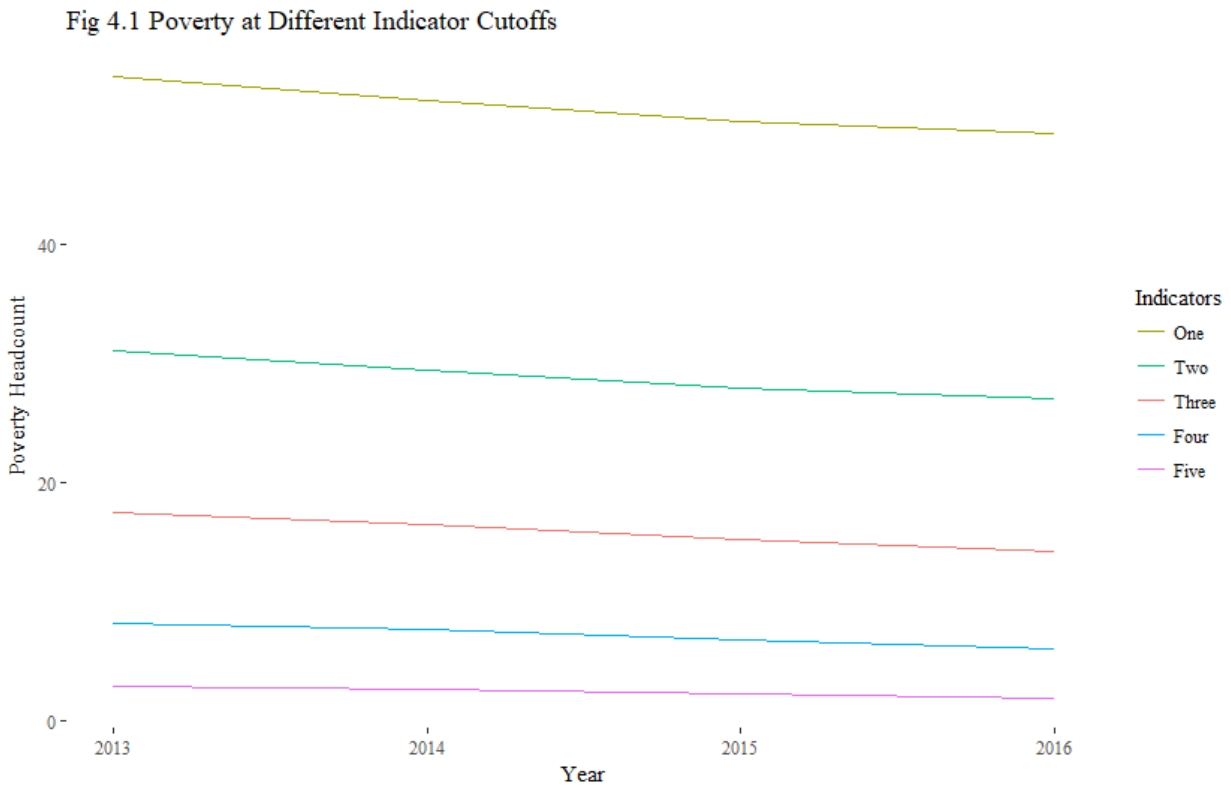
Chapter 3, it is nonetheless helpful to examine what happens if these choices are changed. The goal is to see how sensitive a particular conclusion is to the choices made in index construction. The precise nature of the sensitivity analysis may vary depending on the question. In this case, I analyze if trends over time are consistent.

First, I vary the threshold from being poor in one or more indicators (49 percent of the population in 2016) to being poor in five or more indicators (2 percent of the population in 2016). As shown in Table 4.9 and Figure 4.9, the poverty rate is uniformly slowly declining over the 2013-2016 period regardless of the choice of poverty threshold.

Table 4.5 Poverty headcount over time by threshold

	2013	**2014**	**2015**	**2016**
One	54	52	50	49
Two	31	29	28	27
Three	17	16	15	14
Four	8	8	7	6
Five	3	3	2	2

Figure 4.1 Poverty at Different Indicator Cutoffs



Although the inclusion of each indicator is justified in chapter 3, it can also be determined if the conclusions of the analysis rest on the inclusion of any particular indicator. (The ability to determine the percent contribution each indicator makes to the overall poverty index can also suggest which indicators are driving the overall index value). In table 4.10, I leave out one indicator at a time and show a consistent downward trend in poverty headcount from 2013 to 2016. The absolute level of the index varies – leaving out common deprivations like low income or lacking a high school degree reduces the poverty rate relative to leaving out indicators experienced by a smaller percent of the population, like disability or overcrowded housing conditions.

This makes sense and is matched by the percent contribution to the overall index presented in Chapter 3.

Table 4.6 Indicators left out one at a time

	2013	**2014**	**2015**	**2016**
Income	13	12	11	9
Employment	14	13	12	11
Housing Cost	13	12	11	10
Health Insurance	14	14	13	12
Disability	16	15	14	13
Overcrowding	16	15	14	13
No HS Degree	13	12	11	10
Internet	14	13	12	12
Lng. Isolation	16	15	14	13

The multidimensional poverty index is a broad enough tool that it can answer questions well beyond trends over time. The nature of a sensitivity analysis though is to depend on the question being asked. The conclusion that there is a downward trend in poverty over the past four years is robust to different thresholds and specifications. Similar sensitivity analyses could be performed for other applications of the index.

4.5 Conclusion

The final decision about the inclusion/exclusion of indicators and choice of weighting schemes is a normative decision, as well as being influenced by what is useful to policymakers. However, normative decisions can and should be influenced by empirical research.

Cramer's V and the redundancy index suggest that the indicators are related to each other without expressing redundant information. Multiple correspondence analysis suggests the nine indicators that make up the multidimensional poverty index can usefully be grouped into three dimensions.

- Economic
    - Income
    - Employment
    - Housing Costs
- Health
    - Health Insurance
    - Disability
    - Overcrowding
- Education
    - High School Degree
    - Internet Access
    - Linguistic Isolation

The three dimensions are equally weighted, with equal weights on each indicator. The sensitivity analysis suggests that using a different threshold or dropping an indicator would not change the way the index moves over time.

Whether or not the index is valid depends ultimately upon the judgment of the relevant community. Along with the rest of the dissertation, this chapter presents an argument for using this specification of a multidimensional poverty index in the United States. The

evaluation of that argument is up the community of poverty researchers and policymakers.

Chapter 5: The Multidimensional Poverty Index Applied

When introducing the multidimensional poverty index in chapter three, a breakdown of poverty by gender showed that the index's decomposability property could be a useful tool for policy analysis. This chapter focuses on how the index can be used to reveal information about poverty in ways that could lead to policy decisions. Each section could be a standalone paper based off of the multidimensional poverty index. This chapter demonstrates both the value of constructing an index as well as the potential for a fruitful research agenda. The goal is not to do a complete analysis of each in each section, but rather to show the versatility of the poverty index.

Section one examines the differences in multidimensional poverty across states. Section two looks specifically at Kentucky and how the index can be used by an individual state. Section three considers the differences between rural and urban poverty. Section four explores differences by race and ethnicity. Section five looks at gender and section six examines age differences.

5.1 Multidimensional Poverty across States

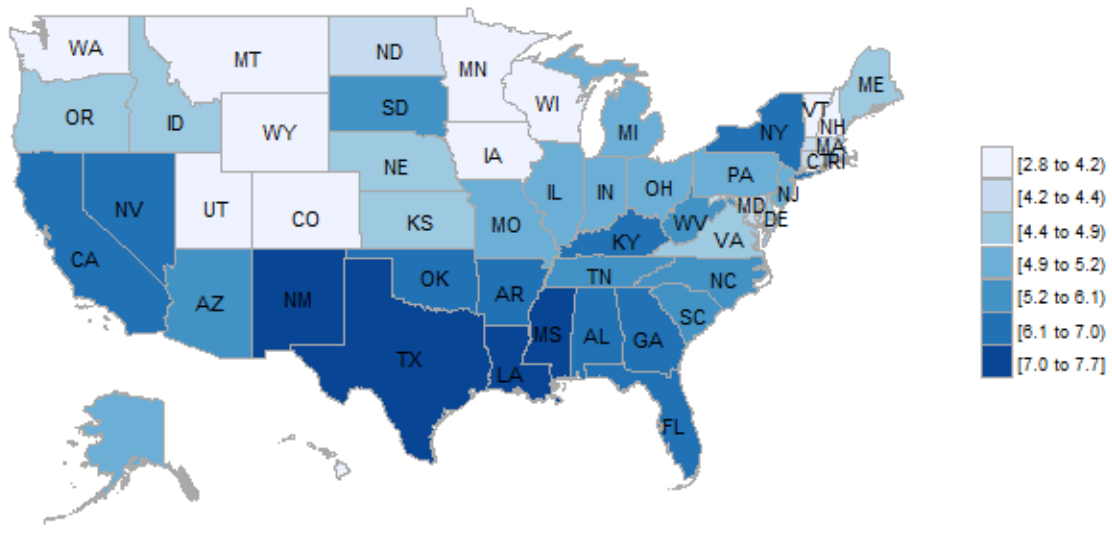
The multidimensional poverty index is subgroup decomposable, which allows for consistent comparisons across states. This section starts with a broad overview of the MPI at the state level, before looking at how individual states could use the index to inform policy. In comparing data across states, I look primarily at the adjusted headcount measure, an indicator that starts with the familiar headcount (percent of the population in poverty) and then accounts for the depth of poverty. The most intuitive

way to think about the adjusted headcount is as the percent of deprivations experienced by the poor out of all possible deprivations. So an adjusted headcount of 100 would mean not only that everyone in the society was poor, but also that everyone experienced all 9 deprivations. For this reason, the scale for adjusted headcount numbers is substantially lower than headcount numbers. Deprivations that are experienced by the nonpoor are not counted in the adjusted headcount measure.

In 2016, Mississippi had the highest adjusted headcount, at 7.7 percent, while New Hampshire had the lowest at 2.8 percent. Figure 5.1 shows the rates across the United States.

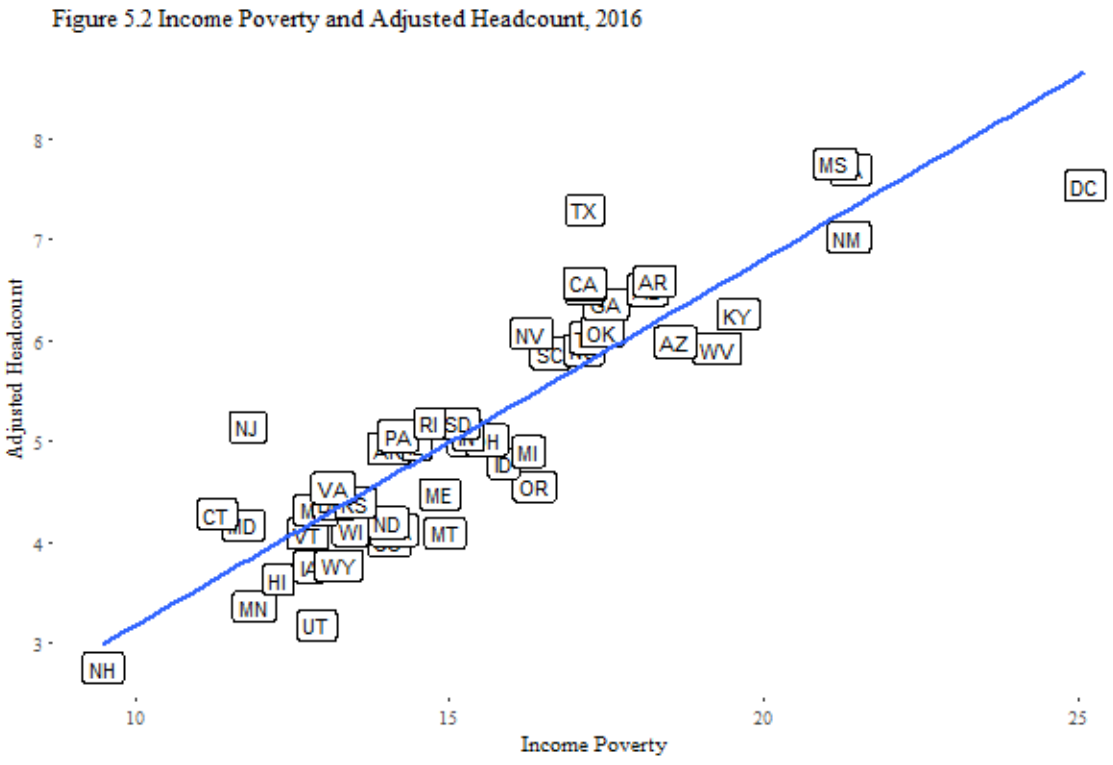
Figure 5.1 Adjusted Headcount, 2016

Figure 5.1 Adjusted Headcount, 2016



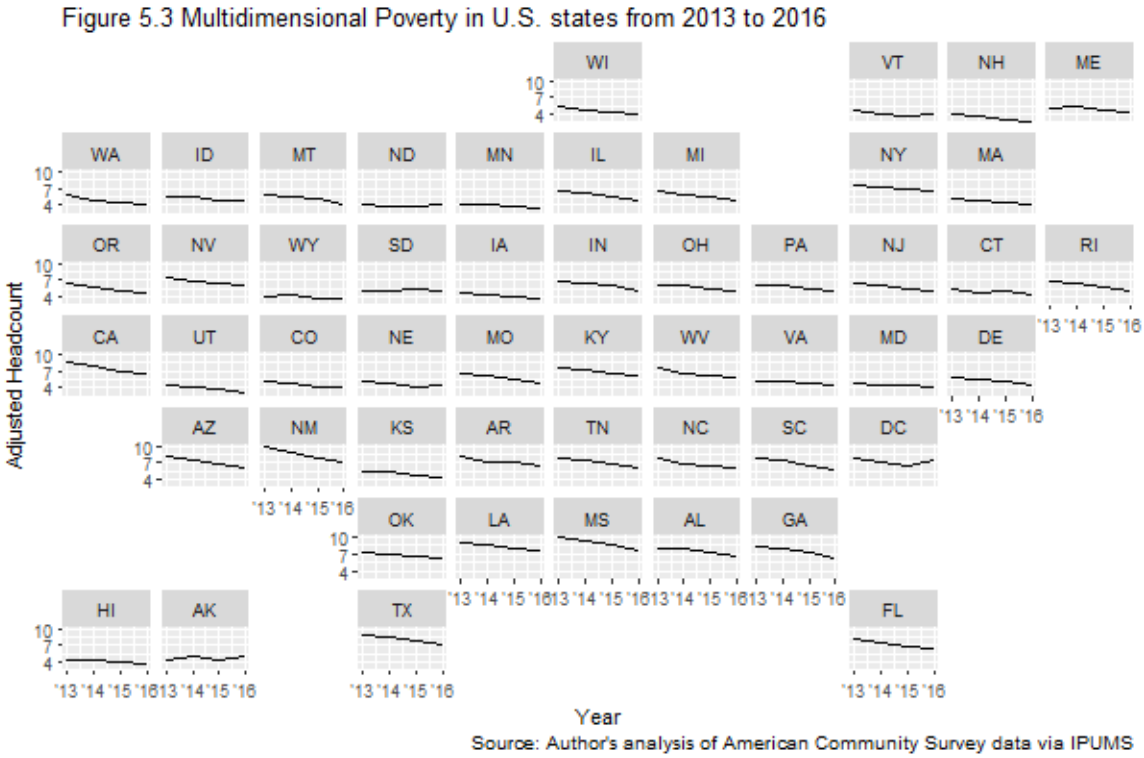
At the state level, the adjusted headcount is fairly strongly correlated with income poverty (0.82). Of course, within states the individuals identified as MPI poor and income poor are not the same, even though aggregate levels by state are correlated. Even with the fairly strong correlation, there are still some notable differences. For example, in 2016, New Jersey had an 11.8 percent poverty rate, essentially indistinguishable from Minnesota's 11.9 percent. However, New Jersey's 5.1 percent adjusted headcount is much higher than Minnesota's 3.4 percent. Figure 5.2 plots each state's income poverty rate against their adjusted headcount. Texas also stands out as having a much higher adjusted headcount than would be predicted based on Texas's level of income poverty.

Figure 5.2 Income Poverty and Adjusted Headcount



In addition to considering the poverty rate across states, the index is also comparable over time. The American Community Survey first started asking questions about home internet access in 2013, so the data currently only goes back four years. Figure 5.3 shows trends in multidimensional poverty over time for each U.S. state. The states are arranged geographically rather than alphabetically in order to visually be able to see geographic patterns.

Figure 5.3 Multidimensional Poverty in U.S. states from 2013 to 2016

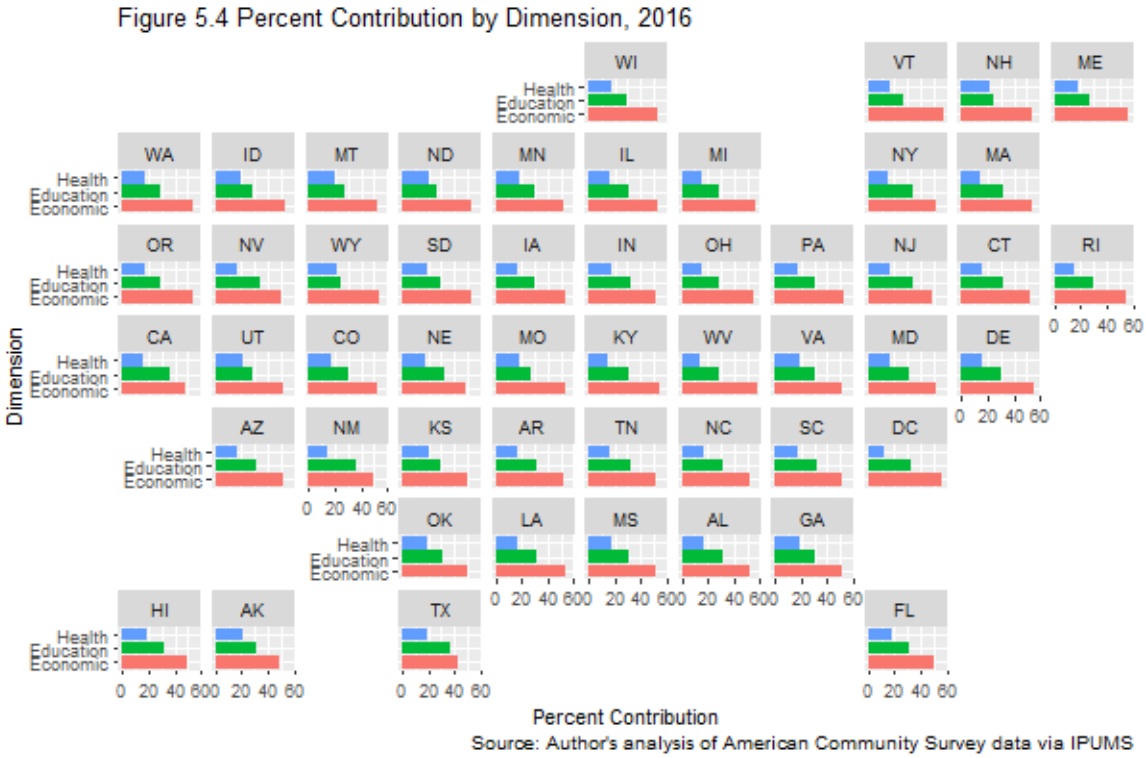


Due, perhaps, to ongoing recovery from the recession during the 2013-2016 time period, most states saw a decline in the poverty rate reflected by adjusted headcount.

States that started with lower poverty levels were less likely to experience declines (The correlation between high start values in 2013 and percent change from 2016 is -0.30, p = 0.035).

The proposed poverty index can also be broken down by both region and dimension. Rather than show all 9 indicators in a single map, the indicators are grouped into the dimensions of Health, Education, and Economic well-being. The percent contribution for each dimension is simply the sum of the percent contribution of each of its indicators. Figure 5.4 shows the percent contribution of each dimension in each state in 2016. Percent contribution is constrained to add to 100 percent, which facilitates comparisons across states that have different levels of poverty.

Figure 5.4 Percent Contribution by Dimension, 2016



The percent contribution itself can also be tracked over time. Figure 5.5 shows the percent contribution of the health insurance indicator over time. State's that expanded Medicaid between 2013 and 2016 are shown with a dashed line.

Figure 5.5 Percent Contribution of Health Insurance to MPI in U.S. States from 2013 to 2016

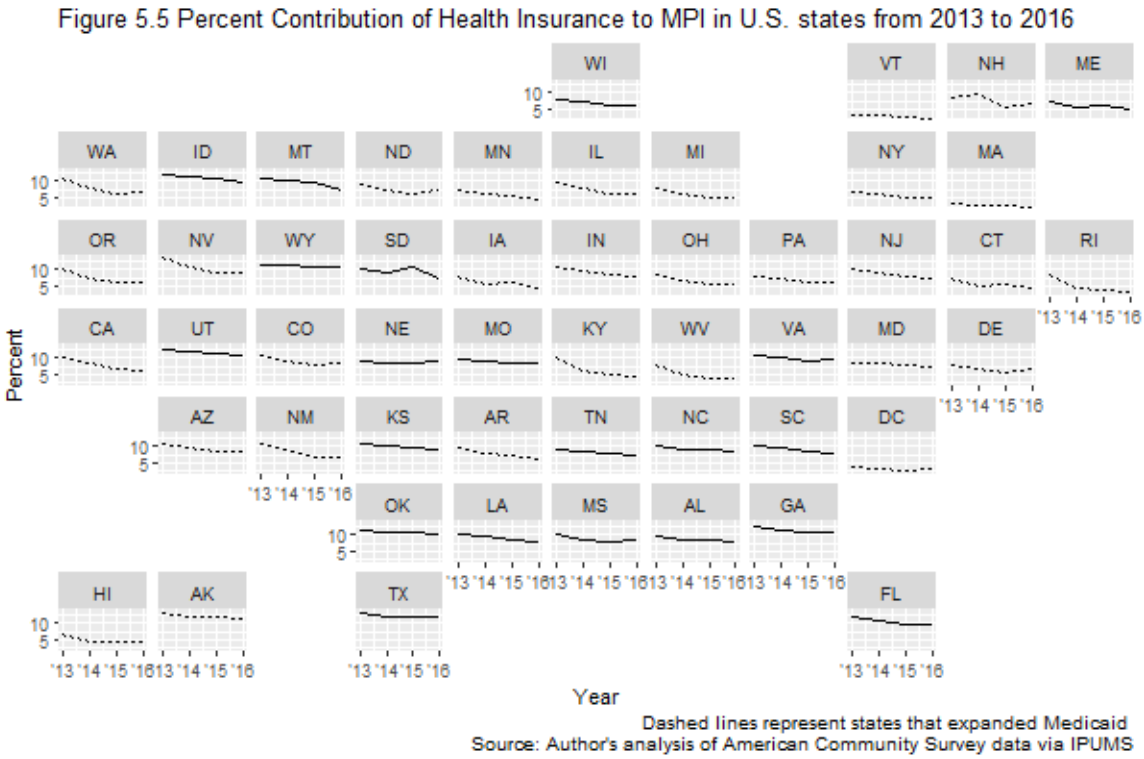
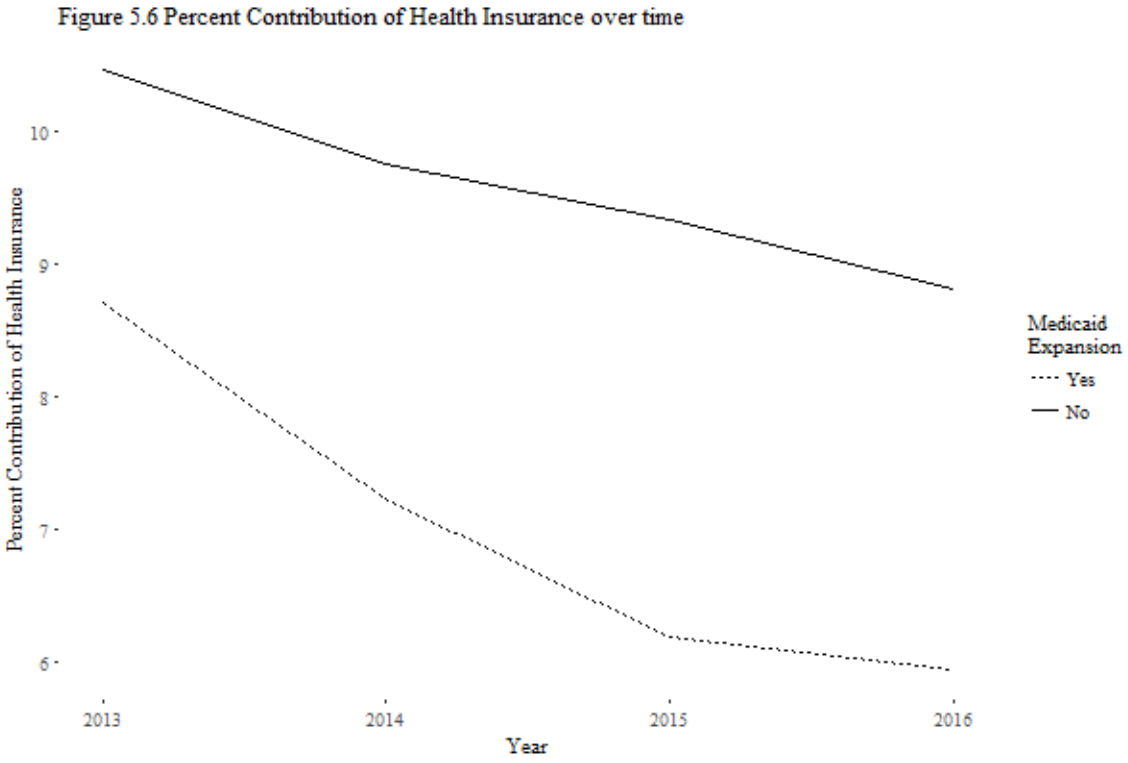


Figure 5.6 aggregates the data across states and looks at the percent contribution to adjusted headcount of the health insurance indicator specifically. States that chose to expand Medicaid are, of course, different than those that did not, most notably by starting with a higher percentage of people who are both uninsured and multidimensionally poor.

It appears that Medicaid expansion states likely reduced the contribution of health insurance to MPI poverty more quickly through 2015. However, a differences-in-differences estimate is not significant (p = 0.08). Of course, failing to reject the null hypothesis of no difference does not mean accepting the null hypothesis. The conclusion here is simply that we do not have enough data to tell based on conventional levels of significance testing.

Figure 5.6 Percent Contribution of Health Insurance over time



5.2 Kentucky

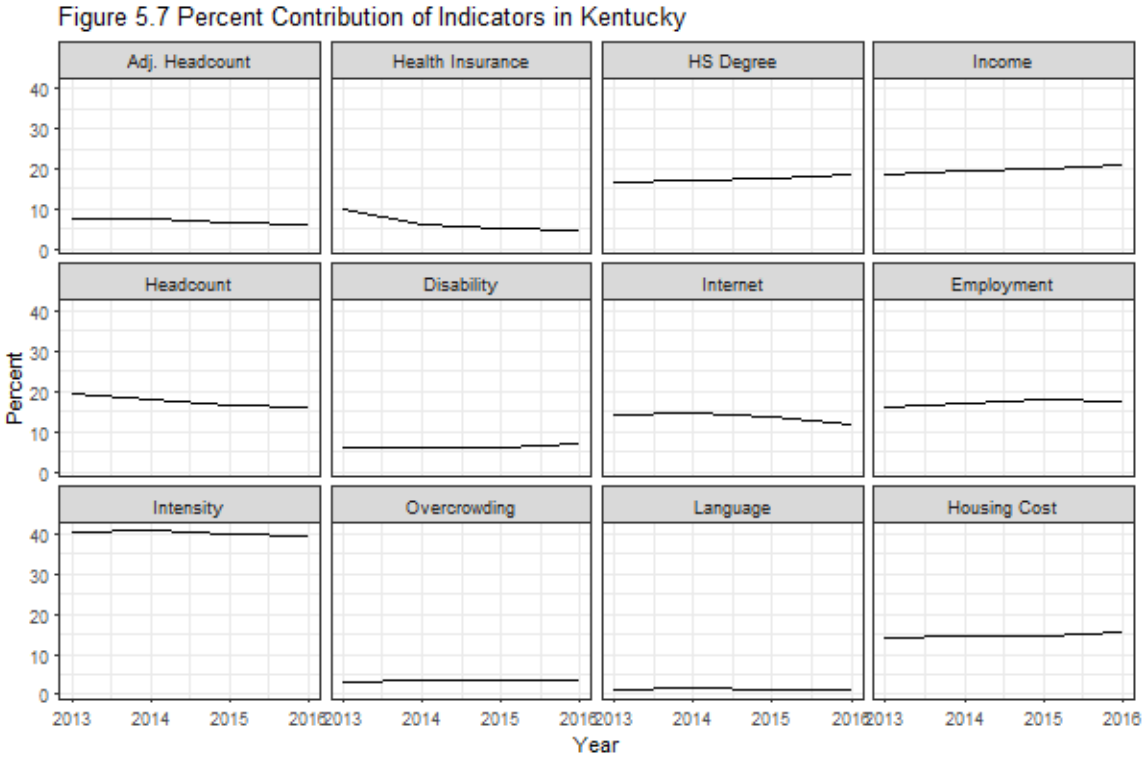
A more detailed analysis is possible by narrowing the exploration to a single state. This section explores multidimensional poverty in Kentucky. Kentucky's adjusted headcount

fell from 7.7% to 6.3% between 2013 and 2016. Figure 5.7 shows the degree to which each indicator has contributed to the overall poverty rate over time.

Figure 5.7 shows 12 key trends over time for analyzing multidimensional poverty. The chart can be read one column at a time. The first column is overall multidimensional poverty. The adjusted headcount is the percent of deprivations experienced by the poor out of all possible deprivations. The headcount is the percent of the population who are multidimensionally poor, and the intensity is the arithmetic mean of the percent of deprivations experienced by the poor. In Kentucky, the adjusted headcount has fallen. Looking at the headcount and intensity reveals that the adjusted headcount has fallen because there are fewer people who are poor (fall in headcount) while the intensity of poverty has remained approximately the same (little change in intensity). Headcount remaining the same while intensity fell would also reduce adjusted headcount and reflect a real-world situation where there were just as many people who are poor, but the depth of their poverty had been (on average) reduced.

The other three columns show the percent contribution of each indicator. Although most indicators do not change much over the four years shown (health insurance is an exception), the graph still reveals the relative percent contributions and can catch the cases that do change over time. Column 1 shows the indicators associated with the health dimension, while columns 2 and 3 show the education dimension and the economic dimension.

Figure 5.7 Percent Contribution of Indicators in Kentucky



Lack of health insurance contributes significantly less to Kentucky's multidimensional poverty than it did four years ago. This may seem to follow from Kentucky's uninsured rate going down, but it is worth pointing out that the percent contribution of each indicator is a function of the overlap between that indicator and multidimensional poverty. The dramatic decline in health insurance's percent contribution to the index suggests that many of the newly insured were multidimensionally poor.

Kentucky's overall adjusted headcount decreased between 2013 and 2016. However, the percent contribution of each indicator is constrained to sum to 100 percent. This means that indicators like income that have seen an increase in their percent contribution are now a bigger contributor to multidimensional poverty, but are not

necessarily worse in absolute terms. The primary advantage of this sort of constraint is that it allows for a comparison of the composition of multidimensional poverty across areas that have different overall multidimensional poverty levels.

Kentucky ranks 40th out of 51 states (D.C. is included in the data) in adjusted headcount. The percent contribution of each indicator over time was shown in figure 5.7, but adding in the state rank allows an easy comparison of Kentucky to the rest of the nation on each indicator. Kentucky is very split on the indicators, and in all indicators is either in the top 10 or the bottom 10. Relative to other states, housing costs, health insurance, overcrowding, and linguistic isolation contribute less to the index. However, Kentucky sees the largest contribution of any state by lack of high school degree, and also ranks low in income, employment, disability, and internet access.

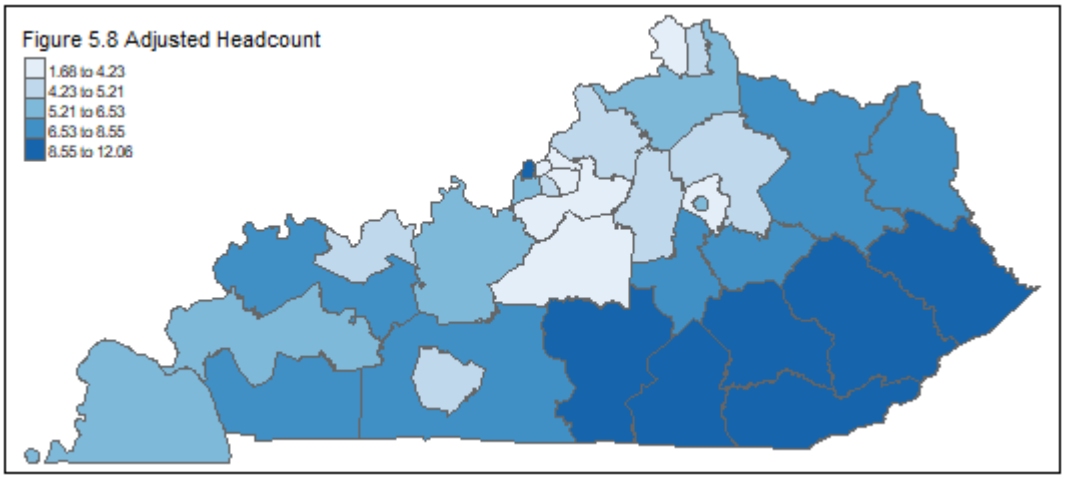
Table 5.1 Percent Contribution of Each Indicator in Kentucky, 2016

Indicator	Value (%)	State Rank
Adjusted Headcount	6.3	40
Income	21.1	48
Employment	17.4	43
Housing Costs	15.4	9
Health Insurance	4.5	8
Disability	6.8	41
Overcrowding	3.5	8
High School Degree	18.3	51
Internet Access	11.6	41
Linguistic Isolation	1.3	6

Data is available down to the level of Public Use Microdata Areas (PUMAs), which are areas of at least 100,000 people. Looking at the PUMA level displays substantial

variation across Kentucky. To those familiar with Kentucky, seeing the deepest levels of multidimensional poverty in Easter Kentucky and in West Louisville will be unsurprising.

Figure 5.8 Adjusted Headcount



The composition of poverty may also change across PUMAs. The following two maps show the percent contributions of internet access and of housing costs. As expected, internet access is a larger contributor to MPI in rural areas, while housing costs are a larger contributor in urban areas, particularly in Louisville. The differences between urban and rural areas through the U.S. are explored in the next section.

Figure 5.9 Internet Access Percent Contribution

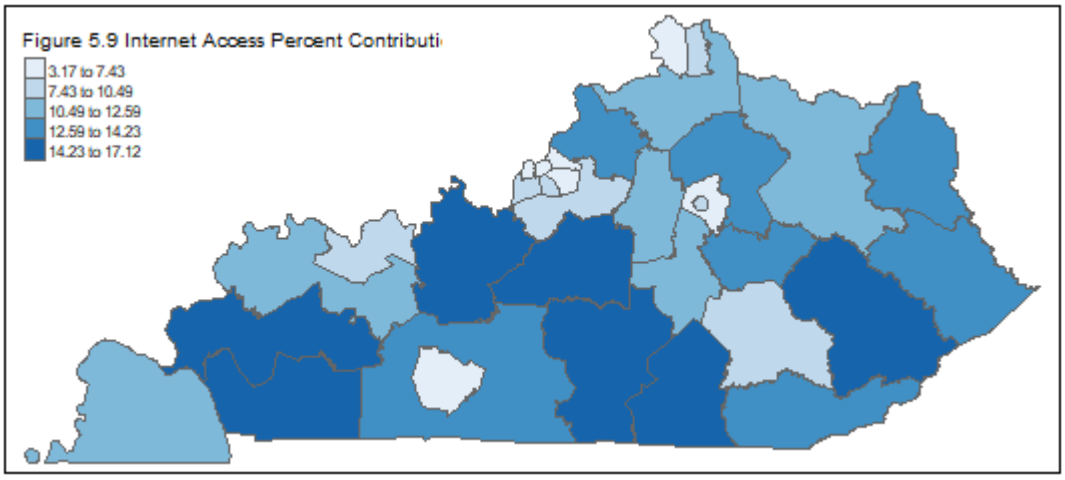
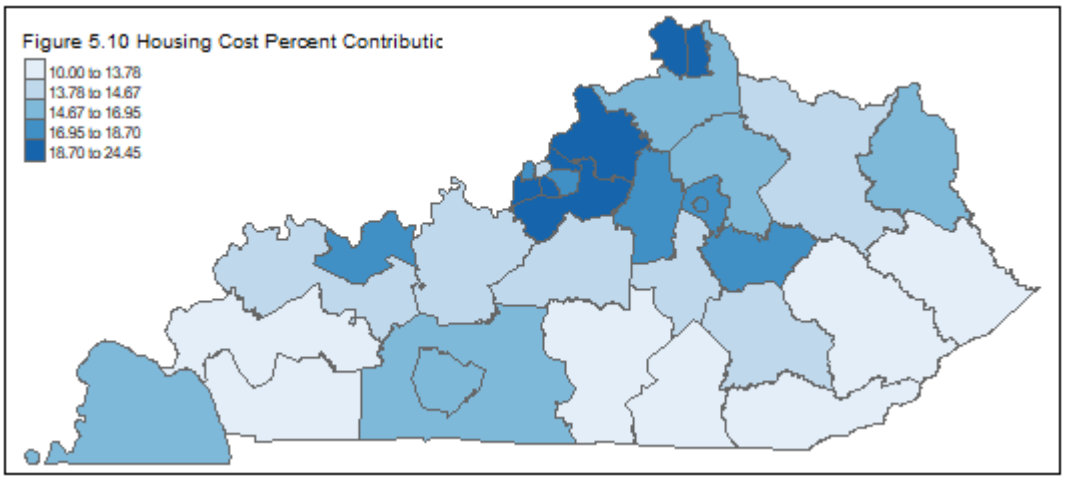


Figure 5.10 Housing Cost Percent Contribution



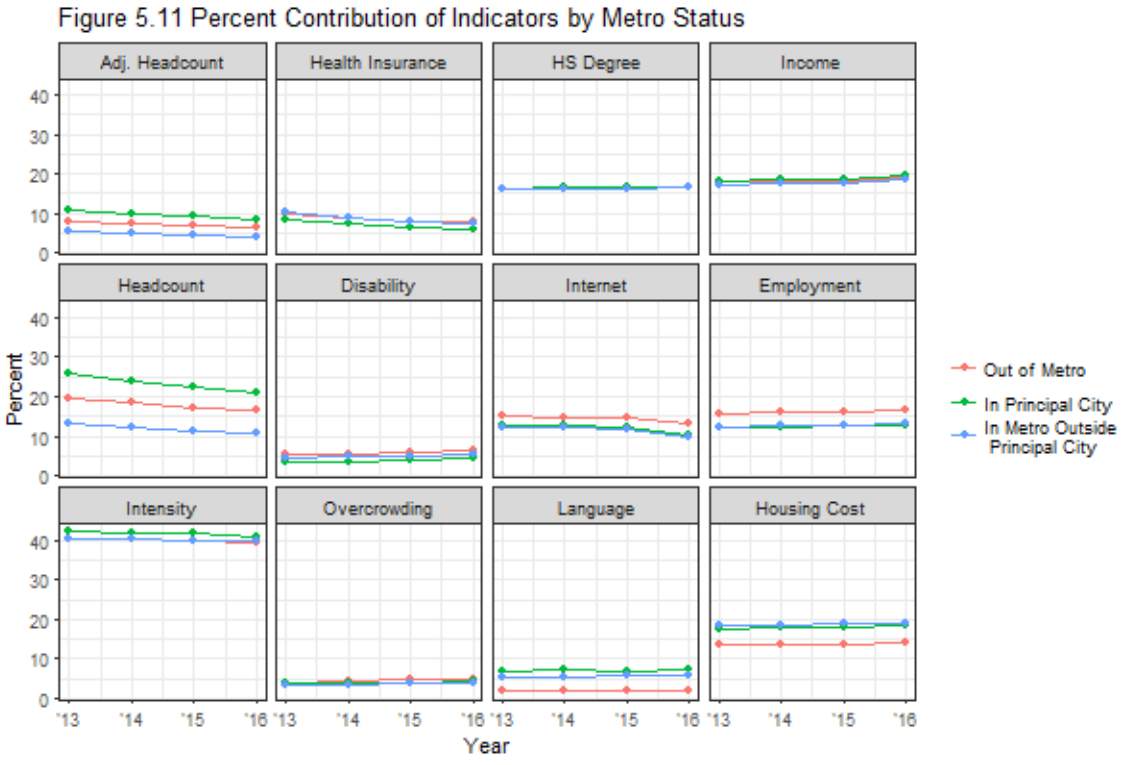
5.3 Metro and non-metro areas

Geographic subgroups are one way to break to examine differing levels of poverty across the United States. As seen in the case of Kentucky, though, there may also be salient differences between urban and rural populations. The data contains categories for living in cities, living in metro areas but in the principal city, and living outside of

metro areas. For this analysis, individuals for whom their geographic location was uncertain were not included.

The results are largely in line with reasonable expectations. Multidimensional poverty is highest in urban areas and lowest in suburban areas. Housing costs and linguistic isolation contribute less to multidimensional poverty in rural areas, while lack of internet access and employment contribute more. Although this is expected, using the multidimensional poverty index allows these indicators to be quantified and tracked over time.

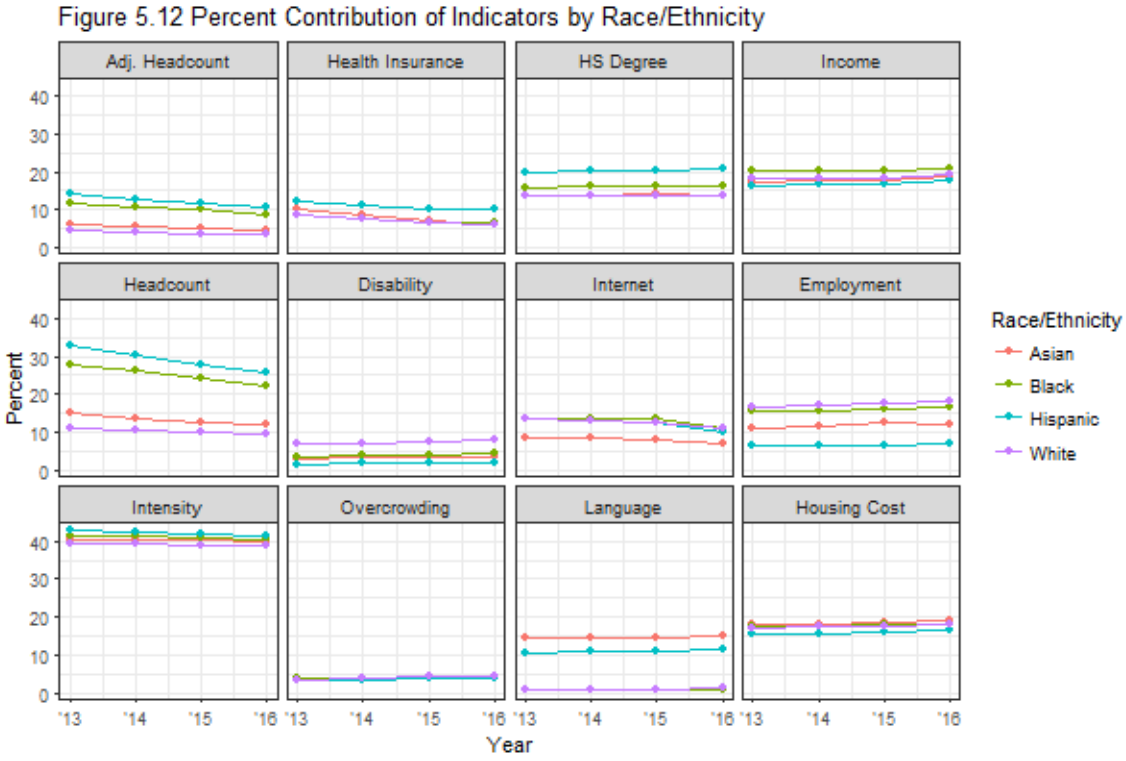
Figure 5.11 Percent Contribution of Indicators by Metro Status



5.4 Race and Ethnicity

The American Community Survey asks relatively detailed questions about race and ethnicity. For the sake of this exploratory analysis that is designed to demonstrate the possible uses of the MPI and not to be a full analysis of poverty by race, I restrict the scope of the analysis to the four largest racial/ethnic groups currently in the United States, White, Black, Hispanic, and Asian.

Figure 5.12 Percent Contribution of Indicators by Race/Ethnicity



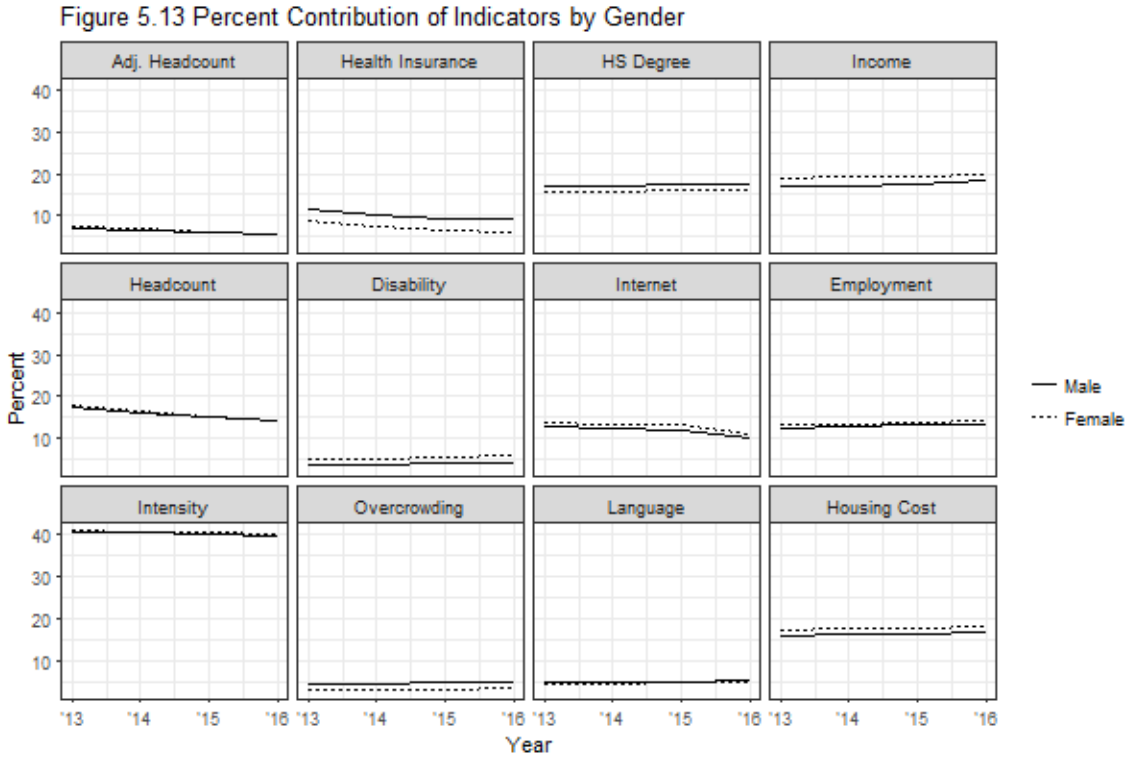
Multidimensional poverty is highest among Hispanics, closely followed by Blacks. This matches the literature review finding of Alkire and Foster that multidimensional poverty rates are higher among Hispanics (Alkire and Foster 2011). Hispanic multidimensional poverty is composed of higher contributions from education, health

insurance, and linguistic isolation. Hispanic multidimensional poverty has much lower levels of contribution from lack of employment. Asian multidimensional poverty appears to be characterized by lower contributions from lack of internet access and higher contributions from linguistic isolation. White multidimensional poverty is at a lower overall adjusted headcount than Black poverty, but seems to be relatively similarly composed across the indicators. The exception is Whites having higher percent contributions to the index from disability.

5.5 Gender

Gender differences in multidimensional poverty were briefly discussed in chapter 3, using data from 2016. This analysis extends that over time. Both genders have similar levels of multidimensional poverty including similar headcount, intensity, and adjusted headcount. The differences are in the composition of poverty. Males have higher contributions to multidimensional poverty from education, health insurance, and overcrowded housing. Males have lower contributions from disability, housing costs, and income.

Figure 5.13 Percent Contribution of Indicators by Gender



5.6 Age

Multidimensional poverty differs substantially by age. Unsurprisingly, children and adults over 65 have higher poverty rates than adults aged 18 to 64. The gap is driven almost entirely by headcount, as intensity is the same across all three groups.

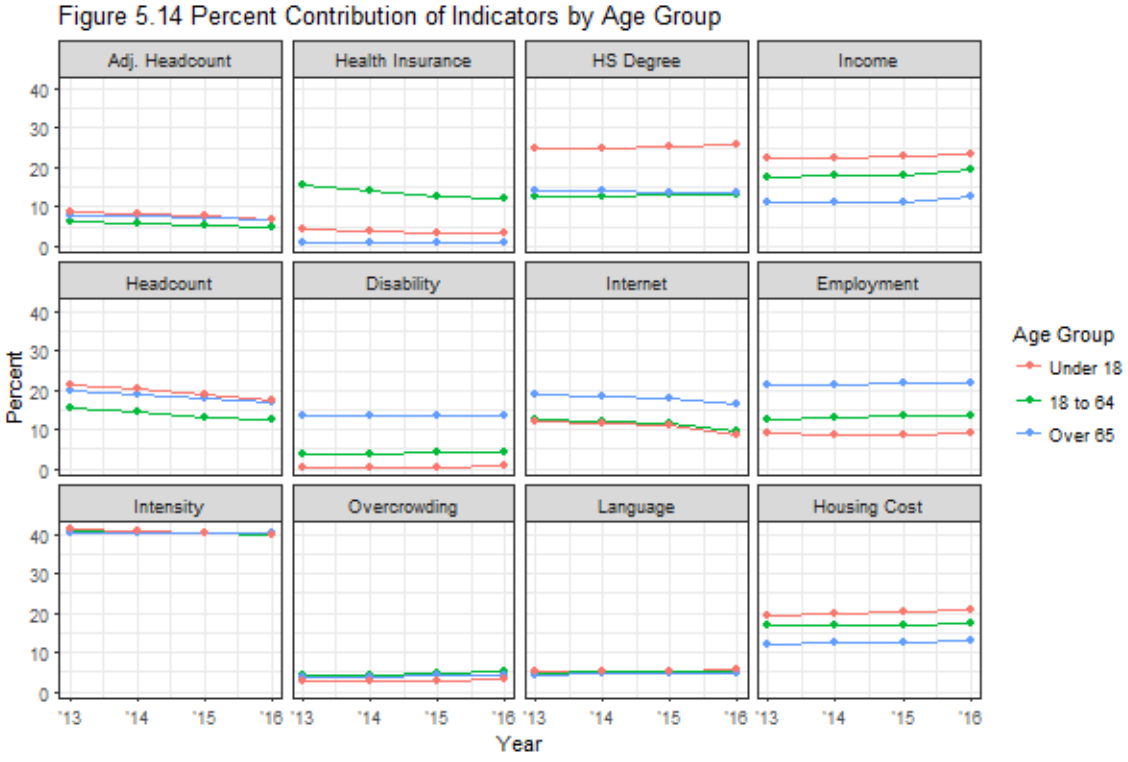
The percent contribution from disability increases with age. The under 18 group has the largest contribution from not having a high school degree. For children the high school degree indicator is living in a household in which no one has a high school degree. The over 65 group sees the biggest contribution from employment. At first, this might seem to be due to retirement, but individuals with retirement income or investment income that lifts them out of poverty are not coded as employment deprived. Thus, the

indicator suggests that there are a substantial number of people over 65 who do not have sufficient income and do not have a job.

The health insurance dimension shows a fairly clear impact of public policy choices. There is a substantially lower contribution from health insurance for the segments of the population that the government actively seeks to insure. The over 65 group is eligible for Medicare, while the under 18 group is eligible for CHIP.

Housing costs and income affect youth the most followed by adults, and then those over 65. The percent contribution of internet access is higher among those over 65, while linguistic isolation and overcrowding affect all age groups roughly equally.

Figure 5.14 Percent Contribution of Indicators by Age Group



5.7 Subgroup Analysis with Regression Controls

If certain characteristics were correlated (e.g. race/ethnicity and state of residence) it is possible that the subgroup analysis above would see differences that were the result of the grouping characteristics being correlated with other factors. An ordinary least squares regression with robust standard errors allows for an exploration of the effects of individual characteristics while controlling for other observed characteristics. The full sample is over 12 million observations, so I use a random sample of 10%. Controls for year and state are included but not reported in the table (the coefficients confirm that poverty decreases from 2013 to 2016. Difference among states in poverty are shown in Figure 5.1).

I regress the same set of individual characteristics against three dependent variables, number of deprivations experienced, MPI poverty status and income poverty status.[23] Results are shown in table 5.1 None of the results change the conclusions of the analysis presented earlier in this chapter. There is no difference between men and women in overall MPI poverty (however the composition of poverty is different, as shown in section 5.5). Notably, the effect of being Hispanic is larger than the effect of being Black on being MPI poor, while this is not true of income poverty. Age and age squared are both included in the regression as the relationship between age and poverty is not

[23] MPI and income poverty status are both binary dependent variables, which are often treated with logits or probit regressions. However, there is no reason a linear model will not work, and linear models are easier to interpret. (The concern expressed is that a linear model could predict a value not between 0 and 1 – but the point of this regression analysis is to look at the effect sizes of individual characteristics. Running a logit and taking marginal effects is one option and would yield the same results. When a more complicated modeling option and a simpler modeling option provide the same conclusions, I opt for the simpler and more understandable choice.)

linear, as higher levels of poverty are observed at both the younger and older ends of the age spectrum. The regression serves as a useful check that the differences observed in the descriptive statistics reflect differences related to those characteristics (e.g. the observed differences in race are related to race and not a reflection of different races being more likely to live in different states and different states having different poverty levels).

Table 5.2 Regression Analysis

	Number of Deprivations	*MPI Poor*	*Income Poor*
Female	-0.003	0.000	0.025
	(0.003)	(0.001)	(0.001)
Asian	-0.227***	-0.54***	-0.043***
	(0.039)	(0.011)	(0.011)
Black	0.181***	0.048***	0.068***
	(0.039)	(0.011)	(0.011)
Hispanic	0.487***	0.100***	0.049***
	(0.039)	(0.011)	(0.011)
White	-0.493***	-0.100***	-0.063***
	(0.038)	(0.011)	(0.011)
Not In Metro	0.075***	0.016***	0.013***
	(0.007)	(0.002)	(0.002)
Principal City	0.071***	0.019***	0.028***
	(0.007)	(0.002)	(0.001)
Out of Principal City	-0.0315***	-0.061***	-0.056***
	(0.005)	(0.001)	(0.001)
Age	-0.031***	-0.006***	-0.004***
	(0.000)	(0.000)	(0.000)
Age Squared	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)

***p <0.001

5.8 Policy Implications from Measurement

This chapter has focused on demonstrating how the multidimensional poverty index can be broken down into its component parts and analyzed across population subgroups.

However, the primary argument for using the multidimensional poverty index instead of income poverty is that the adjusted headcount is a more accurate measure of human deprivation. Thus, the multidimensional poverty index can be used for any policy purpose for which the income poverty line was used. This includes determining federal aid to states and evaluating anti-poverty programs. Determining eligibility standards for may pose a data collection problem, as the data is survey-based and verifying its accuracy for each individual would be significantly more difficult than verifying household income. For example, a household with internet access could easily claim not to have it if it would push them over the poverty threshold and make them eligible for benefits.

The ability to breakdown the index by indicator also allows for better anti-poverty program design and targeted interventions. Knowing that Kentucky's multidimensional poverty index has the highest percent contribution from educational attainment (lacking a high school degree) has a clear implication that Kentucky ought to focus on improving its educational system in order to reduce deprivation along the education dimension.

Across the four race/ethnicity categories presented in this chapter, Hispanics have the highest percent contribution from educational attainment and the lowest percent contribution from employment. Education is often seen primarily as a means to employment, but this index imposes the normative assumption that education matters regardless of whether or not the individual is employed. This suggests that perhaps there is a role for education programs that are targeted at those who are already employed but looking to increase their educational level – e.g. a nonvocational

education program that is about education as an end in itself, not merely means to a job.

All policy suggestions from this dissertation should be treated as preliminary. The point is to show that the index is flexible enough that it can be used to draw a variety of conclusions depending on what the data shows and that different groups of policymakers can use the index in different ways depending on the question they are trying to answer. A full answer to any of these policy questions would require significantly more background research and context on the questions beyond what the index can offer by itself.

5.8 Conclusion

The above analysis demonstrates four important points. First, the poverty index behaves in a reasonable way that matches our intuitive notions about poverty and deprivation. Second, the index is a useful tool that allows us to track changes over time and across groups. Although the index matches our intuitive expectations about, for example, the differences in the composition of rural and urban poverty, the index represents a substantial improvement on intuition by allowing us to quantify and track these differences over time. Third, the multidimensional poverty index allows for both a top-level analysis for policymakers and a deeper level of analysis for policy analysts. This dual focus means a robust index can be used both for analysis and for communication. Fourth, the index produces a fruitful research agenda for scholars interested in poverty. Any of these sections could be expanded to a deep dive on poverty.

Conclusion

Although this dissertation moves the field of multidimensional poverty analysis in the United States forward, there are at least three areas in which to consider improvements: 1) the index itself, 2) analysis using the index, and 3) policy implementation.

The index itself is limited by the data that are currently available, since the data are collected for other uses. The addition of indicators of hunger and security would improve the index's ability to more accurately represent deprivation. Each indicator is equally weighted, which may not be a reflection of how they are actually experienced. Surveying the multidimensionally poor population would produce data that could serve as the basis for weighting the indicators. The index could also be extended over time. The indicator for internet access only became available in 2013, but for research projects requiring additional years of data, an eight indicator index could be constructed reaching back to 2005 (Ruggles et al. 2015). Finally, the MPI proposed here is one of a few currently available for the United States. Collaborating with other multidimensional poverty scholars could move the field toward producing a single proposed index.

The focus of the dissertation was on producing the index itself, with Chapter five serving to highlight possible uses in analysis. Those analyses could be extended. For example, working with an expert on state politics and policy could produce a much more thorough analysis of differences across states.

Analysis should also be extended to examine the causes and consequences of multidimensional poverty. For example, a state-level analysis could compare the impact of a robust welfare state, strong economic growth, and low taxes on levels of multidimensional poverty. The multidimensional poverty index is designed as a means to measure reductions in human deprivation, and knowing which policies most effectively bring that about is an important research topic. At the state level data from the MPI can be combined with data on budgets, policies, and macroeconomic performance.

Multidimensional poverty may also prove to be a predictor of important outcomes in a variety of circumstances. Multidimensional poverty in children could predict future educational or labor market outcomes. The predictive properties of the index should be checked against individual indicators. For example, once we know a child is deprived in the education indicator does knowing that the child has other overlapping deprivations improve the ability to predict outcomes? Multidimensional poverty may also be related to outcomes like all-cause mortality or subjective well-being. The relationship between all-cause mortality and multidimensional poverty could be examined at the state level, while the data needed for other research questions is not yet available (e.g. future child outcomes based on growing up in multidimensional poverty is not available because there is no historic measure of multidimensional poverty to be linked to adult outcomes).

Finally, the index is designed to be used by policymakers, which means a continuing feedback loop between researchers, government, and nonprofit is necessary. This loop

can be used both to improve communication as well as to push to improve data collection so that further research can proceed with fewer decisions about the index being determined by data constraints.

Multidimensional Poverty Indices are new to developed countries, but over time their use may expand. Mexico was the first country to officially adopt a multidimensional poverty index. President Enrique Peña Nieta spoke about how its adoption had changed Mexico (Multidimensional Peer Poverty Network 2018):

> This represented a profound change in how poverty is conceived and measured and at the same time it created a real state policy to fight against poverty. Poverty was no longer defined as a condition related exclusively to insufficient income and started to be seen as a multidimensional phenomenon, incorporating social rights, such as food, access to health and social security services, education, as well as basic services and quality of housing.
>
> …
>
> Mexico became the first country in the world to officially measure multidimensional poverty. It is encouraging for us that now, the United Nations and various countries have taken that route to measure and reduce poverty. Based on the methodology and the experience gained, Mexico designed comprehensive strategies, with coordinated efforts of different agencies and levels of government.
>
> The most recent example is the National Inclusion Strategy, which has four essential elements. One. A shared vision, with goals and instruments aligned, between federal agencies and states and between state and municipal governments. Two. Better social intervention performance, now better targeted based on more reliable information. Three. The active participation of public, private, and social sectors. And four. A periodic measurement of the impact of social policy.
>
> The National Inclusion Strategy has already proved its usefulness. Since its implementation, the percentage of the population in poverty has declined and it is at its lowest level since we have data. From 2014 to

> 2016, two million people left extreme poverty behind. This is the largest decrease in absolute and relative terms that has been recorded.
>
> The end of extreme poverty, in less than a decade, is now feasible if we continue at this rate. Social deprivations are at their lowest level in our history, and they continue to decline. For example, in just two years 3,400,000 more Mexicans have a healthy, varied, and sufficient diet. 2,700,000 more Mexicans have access to health services. 1,900,000 more people have essential basic services, such as water, electricity and drainage. And 1,700,000 more Mexicans joined the population that has social security.
>
> The methodology for measuring multidimensional poverty that Mexico developed, either by itself or tailored to each country's priorities, can be a very useful tool to guide each nation's efforts towards the Sustainable Development Goals. As for us, we will redouble our efforts for the National Inclusion Strategy and we will work committedly for the Agenda 2030.

Redefining the way a nation thinks of poverty and plans to eliminate it, of course, is not a modest goal. It was done in Mexico. On a smaller scale, the process is starting in Louisville, KY (see Introduction). This dissertation provides the solid analysis and index construction that is necessary to move the discussion on poverty forward.

Chapter 1 looked at the ways in which information is used in policy and showed the need for an informative measure of ill-being that can be used to judge between two different possible states of the world. Chapter 2 reviewed the literature on poverty measurement and the way in which poverty measurement has always been conceived of as a process of gradually improving and refining our ability to accurately measure human deprivation. Chapter 3 proposed the multidimensional poverty index. Chapter 4 examine the components of the index statistically and showed that conclusions using the index can be shown to be robust to variation in the choices made in using indicators

and selecting poverty cutoffs. Chapter 5 demonstrated how to use the index in assessing poverty and understanding how each indicator contributes to overall poverty.

A robust multidimensional poverty index in the United States could be an invaluable guide for measuring and then reducing poverty. Until now, all available indices for the U.S. were restricted to adults, excluding the most vulnerable age groups. The index proposed in this dissertation is currently the most comprehensive proposal for a U.S. multidimensional poverty index.

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