

## Notes on Multidimensional Poverty

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### Learning Objectives

After reading the *Notes on Multidimensional Poverty*, you should be able to

1. Justify the relevance of measuring multidimensional poverty
2. Describe the “dashboard” approach to presenting poverty, using the Millennium Development Goals as an illustration
3. Explain how the Human Development Index summarizes countrywide “attainments”
4. Identify the steps required to calculate the Alkire-Foster Multidimensional Poverty Index (MPI)
5. Explain and illustrate the UNDP implementation of the MPI
6. Show why conclusions based on monetary measures of poverty may differ from those based on multidimensional measures
7. Explain the importance of examining the joint distribution of poverty dimensions
8. Show how to use Venn diagrams to illustrate the dimensions of poverty

### Introduction

In chapters 1-4 of the *Handbook on Poverty and Inequality* we looked at poverty in the traditional fashion, focusing on expenditure or income per capita as our measure of welfare. However, it is widely recognized that poverty is multidimensional, and the purpose of these notes is to explain what that means, and to address the problem of how to measure poverty in a multidimensional sense.

As we have already seen, poverty is defined as a pronounced deprivation in well-being. Up to now we have used a monetary approach to the measurement of poverty, where the emphasis was on the individual’s command over commodities. Then, based on one’s income, an individual makes choices, and exercises those choices by spending that income. This does, as a practical matter, exclude some nonmarket items that may be important, such as education, or other public services.

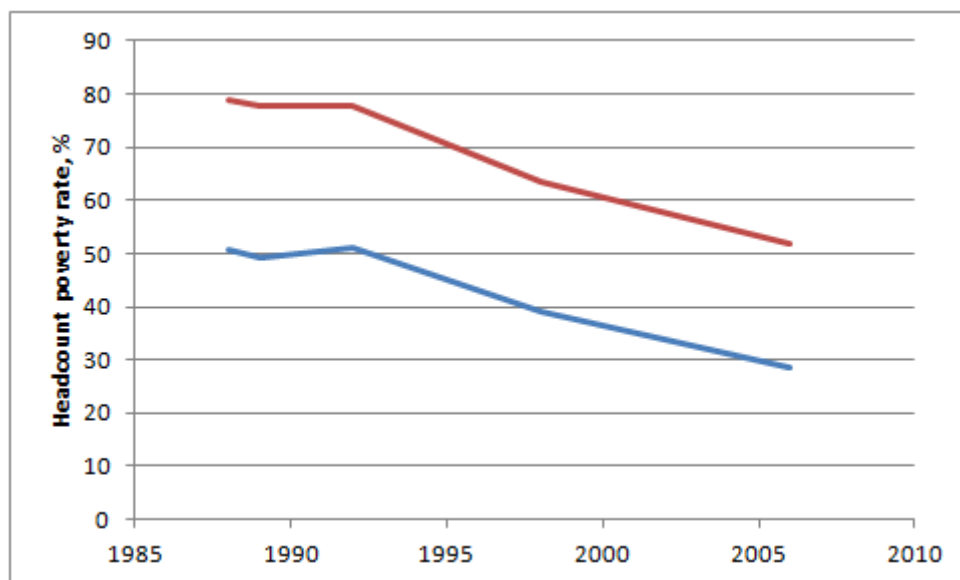
An alternative way of looking at poverty is to take the dimensions of poverty one at a time, so a person might be food poor, or house poor, or health poor. Presumably we want to make sure that people are not poor in any of these individual dimensions. It is a more paternalistic approach, because if somebody has enough income to feed themselves, and chooses not to, who are we to say that they are indeed poor?

The third, and broadest, approach goes back to Amartya Sen's notion of capabilities – the idea that poverty is the lack of a capability to function in society. What makes it difficult to function might include poor health, limited education, low self-confidence, insufficient income, and a lack of personal liberties. Here once again we see there are many dimensions to being poor, and it is in this spirit that we want to try to measure multidimensional poverty.

It is easy enough to recognize the desirability to take into account the multiple dimensions of poverty, but far more difficult to know how to present this information. In the next section we start by outlining the dashboard approach, which displays multiple indexes – that is, it shows the measures of different dimensions of poverty – and allows the viewer to decide what is important. After that we will introduce the multidimensional poverty index, which seeks to combine several measures into a single index. Neither of these approaches is perfect, so we will explore some compromises, especially Venn diagrams in the last section.

## **The Dashboard Approach**

The first approach to measuring multidimensional poverty, favored by Ravallion, is simply to set out information on the different dimensions. The reader can then interpret the numbers. We illustrate this approach using the case of Ghana, and we will show how Ghana has performed on the various Millennium Development Goals. If we were just looking at monetary poverty, we would focus on the monetary-based headcount rate, and on information such as that shown in Figure 1, which shows the poverty rates for two different poverty lines – US\$1.25 a day, and a US\$2 line; by any standard, poverty has fallen steadily and substantially in Ghana since the early 1990s.

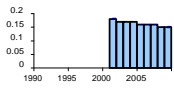
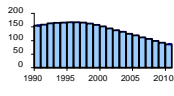
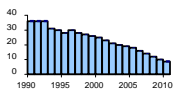
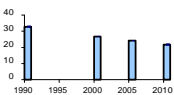
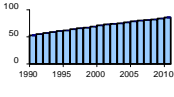
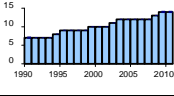
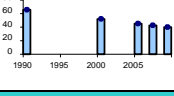
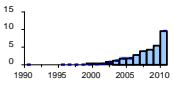


**Figure 1. Headcount poverty rates for Ghana, based on poverty lines of US\$1.25 (blue line) and US\$2.00 (brown line) per day.**

*Source: PovcalNet*

Table 1 shows Ghana’s progress toward achieving the millennium development goals. The first panel shows the evolution of the poverty rate, and tells the same story as Figure 1: poverty in Ghana has come down quite substantially, and the country is well on its way toward halving the poverty rate between about 1990 and 2015. The rest of the table shows Ghana’s progress toward achieving other goals. For instance, under goal three we see that Ghana has essentially achieved gender parity in primary school enrollment.

| <b>MDG Country Progress Snapshot: Ghana</b>              |   |                   |             |                    |             |                                   |              |   |             | Last update: Dec. 2012 |
|--|---|-------------------|-------------|--------------------|-------------|-----------------------------------|--------------|---|-------------|------------------------|
| <b>Goals and Targets</b>                                 | <b>Indicators</b>   | <b>First Year</b> |             | <b>Latest Year</b> |             | <b>Country Progress</b>           |              | <b>Region Latest Data: Sub-Saharan Africa</b> |             |                        |
|  |   | <b>Value</b>      | <b>Year</b> | <b>Value</b>       | <b>Year</b> | <b>Level<sup>2/</sup></b>         | <b>Chart</b> | <b>Value</b>                                  | <b>Year</b> |                        |
| <b>Goal 1: Eradicate Extreme Poverty and Hunger</b>      |   |                   |             |                    |             |                                   |              |   |             |                        |
| Reduce extreme poverty by half                           | Proportion of population living below \$1.25 (PPP) per day (%)  | 51.1              | 1992        | 28.6               | 2006        | very high poverty                 |              | 47.5  | 2008        |                        |
| Reduce hunger by half                                    | Proportion of population below minimum level of dietary energy consumption (%)  | 40.5              | 1991        | <5                 | 2011        | very low hunger                   |              | 27.0  | 2008        |                        |
| <b>Goal 2: Achieve Universal Primary Education</b>       |   |                   |             |                    |             |                                   |              |   |             |                        |
| Universal primary schooling                              | Net enrolment ratio in primary education (enrollees per 100 children)   | 61.5              | 1999        | 84.2               | 2011        | moderate enrollment               |              | 76.2  | 2010        |                        |
| <b>Goal 3: Promote Gender Equality and Empower Women</b> |   |                   |             |                    |             |                                   |              |   |             |                        |
| Equal girls' enrolment in primary school                 | Ratio of girls to boys in primary education   | 0.86              | 1991        | 1.00               | 2011        | parity                            |              | 0.93  | 2010        |                        |
| Women's share of paid employment                         | Share of women in wage employment in the non-agricultural sector (%)  | ..                | ..          | 31.7               | 2000        | medium share                      |              | 32.5  | 2010        |                        |
| Women's equal representation in national parliaments     | Proportion of seats held by women in national parliament (single or lower house only - %)                                 | 9.0               | 1998        | 8.3                | 2012        | very low representation           |              | 20.0  | 2012        |                        |
| <b>Goal 4: Reduce child mortality</b>                    |   |                   |             |                    |             |                                   |              |   |             |                        |
| Reduce mortality of under-five-year-old by two thirds    | Under-five mortality rate (deaths of children per 1,000 births)   | 120.9             | 1990        | 77.6               | 2011        | moderate mortality                |              | 121   |             |                        |
| <b>Goal 5: Improve maternal health</b>                   |   |                   |             |                    |             |                                   |              |   |             |                        |
| Reduce maternal mortality by three quarters              | Maternal mortality ratio (maternal deaths per 100,000 live births)  | 580               | 1990        | 350                | 2010        | high mortality                    |              | 500   | 2010        |                        |
| Access to universal reproductive health                  | Contraceptive prevalence rate (percentage of women aged 15-49, married or in union, using contraception)                  | 17.2              | 1992        | 23.5               | 2008        | low access to reproductive health |              | 24.6  | 2010        |                        |
|  | Unmet need for family planning (percentage of women aged 15-49, married or in union, with unmet need for family planning) | 36.9              | 1993        | 35.7               | 2008        |                                   |              | 25.4  | 2010        |                        |

| MDG Country Progress Snapshot: <b>Ghana</b>   |  | Last update: Dec. 2012                     |            |      |             |      |                                  |   |  |      |  |
|---|--|--|------------|------|-------------|------|----------------------------------|---|--|------|--|
| Goals and Targets   | Indicators   |  | First Year |      | Latest Year |      | Country Progress                 |   | Region Latest Data: Sub-Saharan Africa |      |  |
|   |  |  | Value      | Year | Value       | Year | Level <sup>1/</sup>              | Chart   | Value                                  | Year |  |
| <b>Goal 6: Combat HIV/AIDS, malaria and other diseases</b>  |  |  |            |      |             |      |                                  |   |  |      |  |
| Halt and begin to reverse the spread of HIV/AIDS  | HIV incidence rate (number of new HIV infections per year per 100 people aged 15-49) |  | 0.18       | 2001 | 0.15        | 2009 | intermediate incidence           |    | 4.80                                   | 2010 |  |
| Halt and reverse spread of tuberculosis   | Incidence rate and death rate associated with tuberculosis                           | Number of new cases per 100,000 population | 155        | 1990 | 86          | 2010 | low mortality                    |    | 276                                    | 2010 |  |
|   |  | Number of deaths per 100,000 population    | 36.0       | 1990 | 8.7         | 2010 |                                  |    | 30                                     | 2010 |  |
| <b>Goal 7: Ensure environmental sustainability</b>  |  |  |            |      |             |      |                                  |   |  |      |  |
| Reverse loss of forests   | Proportion of land area covered by forest (%)  |  | 32.7       | 1990 | 21.7        | 2010 | medium forest cover              |    | 28.1                                   | 2010 |  |
| Halve proportion without improved drinking water  | Proportion of population using an improved drinking water source (%)                 |  | 53.0       | 1990 | 86.0        | 2010 | moderate coverage                |    | 61.0                                   | 2010 |  |
| Halve proportion without sanitation   | Proportion of population using an improved sanitation facility (%)                   |  | 7.0        | 1990 | 14.0        | 2010 | very low coverage                |  | 30.0                                   | 2010 |  |
| Improve the lives of slum-dwellers  | Proportion of urban population living in slums (%)                                   |  | 65.5       | 1990 | 40.1        | 2009 | high proportion of slum-dwellers |  | 61.7                                   | 2012 |  |
| <b>Goal 8: Develop a global partnership for development</b>   |  |  |            |      |             |      |                                  |   |  |      |  |
| Internet users  | Internet users per 100 inhabitants   |  | 0.0        | 1990 | 14.1        | 2011 | moderate usage                   |  | 12.6                                   | 2011 |  |
| <p><b>The MDG Country Progress Snapshot</b> provides an overview of the progress achieved at country level since 1990 towards the Millennium Development Goals. The snapshot is intended mainly to provide the international community easy access to the information and are not meant to replace in any way the country profiles produced at the national level in several countries. They are also meant to reflect the contribution of country-level progress to the global and regional trends on progress towards the MDGs.</p> <p>The data used in the snapshot are from the MDG global database (<a href="http://mdgs.un.org/unsd/mdg/Data.aspx">http://mdgs.un.org/unsd/mdg/Data.aspx</a>). The metadata and responsible agencies can be found on <a href="http://mdgs.un.org/unsd/mdg/Metadata.aspx">http://mdgs.un.org/unsd/mdg/Metadata.aspx</a>. Sources of discrepancies between global and national figures are due to, among others, different methodology and definitions or different choice of data sources. At the global level, the monitoring of the progress aims to ensure better comparability of data among countries. Country can contact the responsible agencies for resolving data discrepancies.</p> <p><b>Note:</b> 1) The country progress level indicates the present degree of compliance with the target based on the latest available data. The technical note on the progress level can be found at <a href="http://mdgs.un.org/unsd/mdg/Resources/Static/Products/Progress2012/technicalnote.pdf">http://mdgs.un.org/unsd/mdg/Resources/Static/Products/Progress2012/technicalnote.pdf</a></p> |  |  |            |      |             |      |                                  |   |  |      |  |

The data under Goal 4 refer to the under- five mortality rate: It fell from 121 in 1990 to 78 in 2011, which is still high by world standards, but modest by the standards of Sub-Saharan Africa. We might also note that the maternal mortality rate, although it has also fallen substantially, is still relatively high.

On the second page of Table 1 we see, for instance, that HIV prevalence has fallen somewhat, and that the area covered by forest has also fallen. There have also been significant increases in the proportion of the population that is using improved drinking water, and sanitation.

The key point here is that most of the dimensions set out in this dashboard affect the poor more than anyone else. Moreover, one can see that there are many different potential dimensions of poverty, and quite a good way to present the data is in a table like this, where one can get a decent sense of what is going on. What this does not do, however, is provide a way of ranking countries, of saying “this country is poorer than that country”. Yet such a ranking would be useful, especially if we are trying to channel resource to the neediest places on earth.

## The Human Development Index

One widely-reported approach to measuring poverty, or at least the poverty of nations, is the human development index (HDI) that the UNDP has been publishing since 1990. The UNDP wanted a measure of well-being that was a bit different, or in the words of Mahbub-ul-Haq, “more people-centered” than the traditional per capita GDP. One reason that the HDI has received a good deal of attention is precisely because it tries to be multidimensional, combining information on health and education with data on income.

The current version of the human development index constructs a single index out of three components: an index of life expectancy, an index of educational attainment, and an index that tracks per capita income. These are calculated as shown in Table 2.

| <b>Table 2. Component indexes of the Human Development Index, 2013</b>                                     |  |
|--|--|
| Life Expectancy index  | $(\text{Life expectancy at birth in years} - 20) / (83.6 - 20)$  |
| Education index  | $\frac{1}{0.971} \sqrt{\frac{\text{Mean yrs schooling}}{13.3} \cdot \frac{\text{Expected yrs schooling}}{18.0}}$ |
| Income index   | $\ln(\text{GNI per capita} / 100) / \ln(87478 / 100)$  |
| <i>Source:</i> <a href="http://hdr.undp.org/en/statistics/hdi/">http://hdr.undp.org/en/statistics/hdi/</a> |  |

The HDI is the geometric mean of these three indexes. In Table 3 we illustrate the computations involved for the case of Egypt. According to the UNDP, life expectancy at birth in Egypt is 73 ½ years, adults have on average 6.4 years of schooling, but children expect to attain 12.1 years of schooling; in

addition Gross National Income stands at just over 5,400 U.S. dollars per person per year. We plug the numbers into the formulas, as shown on the previous slide, and arrive at an overall index for Egypt of 0.662.

| <b>Table 3. Computing the Human Development Index for Egypt, 2012</b> |   |
|---|---|
| Basic parameters  |   |
| –   | Life expectancy at birth: 73.5 years                            |
| –   | Mean years schooling of adults: 6.4 years                       |
| –   | Expected years of schooling of children: 12.1 years             |
| –   | GNI/capita, PPP, 2005 international \$: 5,401                   |
| Computation of indexes  |   |
| –   | Health index: 0.841 [= (73.5 – 20)/(83.6 – 20)]                 |
| –   | Education index: 0.586 [= (1/.971)*((6.4/13.3)(12.1/18.0))^1.5] |
| –   | Income index: 0.589 [= ln(5401/100)/ln(87478/100)]              |
| Computation of HDI  |   |
| –   | HDI overall: 0.662 [= (0.841 * 0.586 * 0.589)^(1/3)]            |

In Table 4 we present a sampling of values of the HDI for 2012. Egypt’s score is close to the world average. The three countries with the highest rankings are Norway, Australia, and the United States, while at the bottom we find the Democratic Republic of Congo, and Niger.

| <b>Table 4. Selected values of the Human Development Index for 2012</b> |              |             |  |      |             |      |
|---|--------------|-------------|--|------|-------------|------|
| Rank  |              | 2012        |  | Rank |             | 2012 |
| 1   | Norway       | .955        |  | 112  | Egypt       | .662 |
| 2   | Australia    | .938        |  | 113  | Moldova     | .660 |
| 3   | USA          | .937        |  | 114  | Philippines | .654 |
| 54  | Kuwait       | .790        |  | 153  | Nigeria     | .471 |
| 55  | Russia       | .788        |  | 186  | DR Congo    | .304 |
| 56  | Romania      | .786        |  | 186  | Niger       | .304 |
|   | <b>World</b> | <b>.694</b> |  |      |             |      |

However, there are some serious practical problems with the Human Development Index. One is that the weights applied to the components are arbitrary, and it is not clear why, for instance, a unit increase in the education index should have the same weight as a unit increase in the income index. A second problem is that the details of how the index is constructed vary slightly from year to year, which means that it is not appropriate to track a country's HDI over time, since that would be comparing apples with oranges. Moreover, there is a very high correlation between the index and the log of GNI per capita, so

one might wonder how much additional information is gained by using this index rather than a more conventional measure of per capita income. There are also omissions; for instance the index does not measure personal security, or the sustainability of the economic arrangements in a given country.

### **Multidimensional Poverty Index: Construction**

The Human Development Index measures multidimensional poverty at the level of a country, but we are often interested in measuring poverty in a multidimensional way at the level of the individual household. Here we set out the methodology for constructing a multidimensional poverty index, using the approach pioneered by Alkire and Foster.

There are six steps.

1. First we have to select the dimensions of deprivation that we believe are important, such as the level of schooling, health outcomes, or access to electricity.
2. The second step is that for each of these dimensions we have to establish a poverty line; for instance, if you have less than five years of schooling, we might consider you to be “schooling poor.”
3. Third, we need to decide what weights to put it on each dimension. For instance, we might put an equal weight on each of the dimensions that interest us.
4. In step four we count the number of deprivations for each person. For example, a household might be schooling poor and health poor, but might have access to electricity; in that case we would say the household has two deprivations.
5. This is not yet enough to determine whether you are poor; for that we have to decide how many deprivations you must have for us to consider you to be poor. For example, you might not have electricity, but not be deprived in any other dimension, in which case we may not want to consider you as being poor overall.
6. Finally, we construct our measure of multidimensional poverty, which is the product of two parts, H, which is the headcount measure, and A, the average proportion of deprivations per poor person. For example, suppose 40% of the population is poor using the headcount measure; and that among the poor, they are below the poverty line for 80% of the dimensions under consideration. Then the value of the multidimensional poverty index would be 0.32.



To help us understand how the index is constructed, Table 5 shows an example that comes from Alkire and Foster (2011). Imagine we have a society with four individuals (labeled 1 through 4), and there are four dimensions of poverty, labeled here as A through D. These might include years of schooling, or a measure of health, and so on. The *achievement matrix* shows the value of each of these dimensions for each individual. At the bottom we can see the poverty line that applies to each dimension. So, for example, three of the individuals are below the poverty line on dimension B; and the relevant cells are shaded in grey.

In the *deprivation matrix*, we put one if the individual is deprived on that dimension, and zero otherwise. We quickly see that individual two has two deprivations, and individual three has four deprivations. Our cutoff for being poor is being deprived on at least two dimensions, so by this measure, individuals two and three are poor, but individual four is not, even though he is deprived on one dimension. Thus the headcount poverty measure is 50%.

On the right hand side we have the so-called *censored deprivation matrix*, which allows us to calculate the average number of deprivations per poor person. In our example the average proportion of deprivations is 0.75; that means that for poor people, they are poor on average on three of the four dimensions. So the multidimensional poverty index is 50% times 0.75, which gives 0.375.

**Table 5. Computing the Multidimensional Poverty Index**

| Achievement matrix |           |           |          |          | Deprivation matrix |                                  |   |   |   | Censored deprivation matrix |                          |           |   |   |   |   |
|--------------------|-----------|-----------|----------|----------|--------------------|----------------------------------|---|---|---|-----------------------------|--------------------------|-----------|---|---|---|---|
|                    | Dimension |           |          |          |                    | Dimension                        |   |   |   | #                           |                          | Dimension |   |   |   | # |
| Individual         | A         | B         | C        | D        | Individual         | A                                | B | C | D |                             | Individual               | A         | B | C | D |   |
| 1                  | 13.1      | 14        | 4        | 1        | 1                  | 0                                | 0 | 0 | 0 | 0                           | 1                        | 0         | 0 | 0 | 0 | 0 |
| 2                  | 15.2      | 7         | 5        | 0        | 2                  | 0                                | 1 | 0 | 1 | 2                           | 2                        | 0         | 1 | 0 | 1 | 2 |
| 3                  | 12.5      | 10        | 1        | 0        | 3                  | 1                                | 1 | 1 | 1 | 4                           | 3                        | 1         | 1 | 1 | 1 | 4 |
| 4                  | 20        | 11        | 3        | 1        | 4                  | 0                                | 1 | 0 | 0 | 1                           | 4                        | 0         | 0 | 0 | 0 | 0 |
| Cutoff             | <b>13</b> | <b>12</b> | <b>3</b> | <b>1</b> |                    | H = 2/4 = 0.5 = 50%              |   |   |   |                             | A = avg(2/4, 4/4) = 0.75 |           |   |   |   |   |
|                    |           |           |          |          |                    | <b>MPI = 50% * 0.75 = 0.375.</b> |   |   |   |                             |                          |           |   |   |   |   |

Note: Poverty here is defined as having at least two deprivations.

Source: Alkire and Foster (2011).

The UNDP has tried to implement the Alkire and Foster method using real data, and in a way that mirrors the construction of the human development index. So it groups their measures of deprivation into three dimensions, namely education, health, and the standard of living, measured using ten indicators, as shown in Table 6. For education, for example, UNDP looks at the years of schooling that

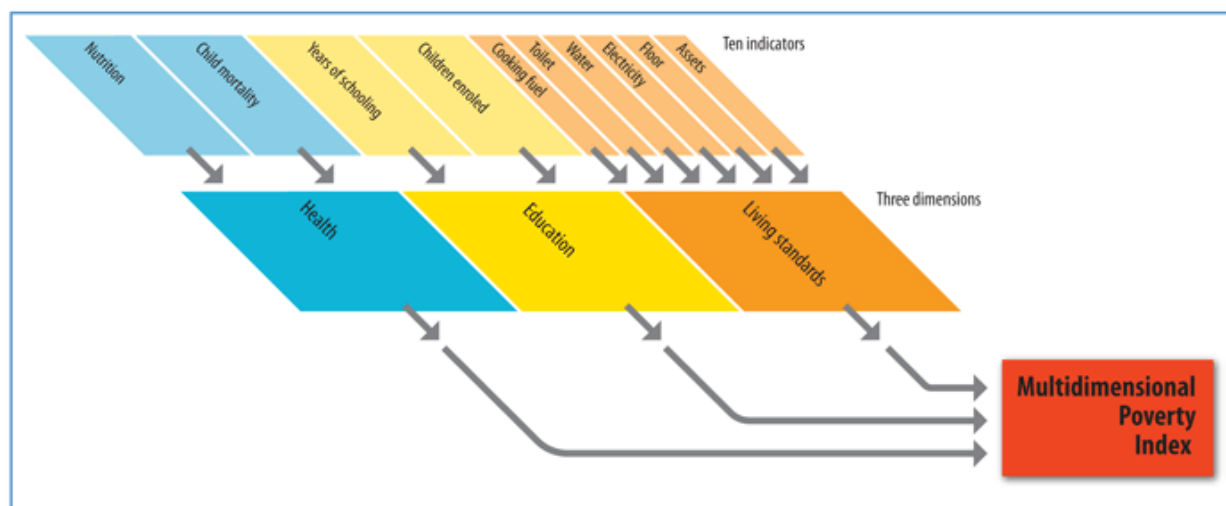
one has had, and also at school attendance. A household is schooling deprived if no one has had at least five years of schooling. Under health, if a child died, or a household member is malnourished, the household would be considered health poor. Under the standard of living, you would be considered deprived if you lack electricity, do not have improved sanitation, and so on. Notice too that in order to ensure that education, health, and the standard of living each have the same weight, the constituent indicators have different weights. Thus school attendance has a weight of one sixth in the overall index, but having a dirt floor has a weight of one in 18. In the UNDP implementation, you are considered to be poor if you are deprived in at least a third of the indicators, after applying the weights of course.

| <b>Table 6. Dimensions and indicators of poverty used in the UNDP implementation of the Multidimensional Poverty Index</b> |   |
|--|---|
| Dimension 1: Education   |   |
| Indicators   | Years of schooling. Deprived if no one has 5 or more (1/6)                      |
|  | School attendance. Deprived if not at school to class 8 (1/6)                   |
| Dimension 2: Health  |   |
| Indicators   | Child mortality. Deprived if any child died (1/6)                               |
|  | Nutrition. Deprived if any household member malnourished (1/6)                  |
| Dimension 3: Standard of Living  |   |
| Indicators   | No electricity (1/18)   |
|  | No improved sanitation (1/18)   |
|  | No access to safe drinking water (1/18)   |
|  | Dirt floor (1/18)   |
|  | Cooks with wood/charcoal (1/18)   |
|  | Has no more than one consumer durable such as a radio, phone, bike, etc. (1/18) |

Figure 2 displays a graphic that summarizes the components of the UNDP MPI. It shows the three main dimensions of poverty, and within them the 10 indicators used in their calculation. A more detailed discussion about the construction of its multidimensional poverty index may be found on the UNDP web site at <http://hdr.undp.org/en/statistics/mpi/>.

## Components of the Multidimensional Poverty Index

MPI—three dimensions and 10 indicators



Note: The size of the boxes reflects the relative weights of the indicators.

Source: Alkire and Santos 2010.

In Table 7 we simply present a modest selection of results from the UNDP's multidimensional poverty index. Take the case of Bangladesh, for instance. The data refer to 2007, and the value of the index is 0.292. By this standard, Bangladesh is poorer than Bhutan, but better off than Burkina Faso. The rest of the table has some further details. We note that 57.8% of the population of Bangladesh is considered to be poor by this measure, and that represents about 83 million people.

**Table 7: Selected data on the Multidimensional Poverty Index**

|   | Multidimensional Poverty Index | Population in multidimensional poverty* |                    |               |                              |                                      | Contribution of deprivation to overall poverty (%) |           | Population below income poverty line (%) |                  |                  |                       |
|---|--------------------------------|---|--------------------|---------------|------------------------------|--------------------------------------|--|-----------|--|------------------|------------------|-----------------------|
|   |                                | Year <sup>b</sup>                       | Value <sup>a</sup> | Headcount (%) | Intensity of deprivation (%) | Population vulnerable to poverty (%) | Population in severe poverty (%)                   | Education | Health                                   | Living standards | PPP \$1.25 a day | National poverty line |
| <b>ESTIMATES BASED ON SURVEYS FOR 2007–2011</b> |                                |   |                    |               |                              |                                      |  |           |  |                  |                  |                       |
| Albania   | 2008/2009 (D)                  | 0.005                                   | 1.4                | 45            | 37.7                         | 7.4                                  | 0.1  | 32.0      | 44.9                                     | 23.0             | 0.6              | 12.4                  |
| Armenia   | 2010 (D)                       | 0.001                                   | 0.3                | 6             | 35.2                         | 3.0                                  | 0.0  | 25.8      | 64.8                                     | 9.4              | 1.3              | 35.8                  |
| Bangladesh                                      | 2007 (D)                       | 0.292                                   | 57.8               | 83,207        | 50.4                         | 21.2                                 | 26.2   | 18.7      | 34.5                                     | 46.8             | 43.3             | 31.5                  |
| Bhutan  | 2010 (M)                       | 0.119                                   | 27.2               | 198           | 43.9                         | 17.2                                 | 8.5  | 40.4      | 21.2                                     | 38.4             | 10.2             | 23.2                  |
| Bolivia, Plurinational State of                 | 2008 (D)                       | 0.089                                   | 20.5               | 1,972         | 43.7                         | 18.7                                 | 5.8  | 19.8      | 27.5                                     | 52.6             | 15.6             | 60.1                  |
| Burkina Faso                                    | 2010 (D)                       | 0.535                                   | 84.0               | 13,834        | 63.7                         | 7.1                                  | 65.7   | 36.2      | 27.9                                     | 35.9             | 44.6             |                       |
| Cambodia  | 2010 (D)                       | 0.212                                   | 45.9               | 6,415         | 46.1                         | 21.4                                 | 17.0   | 22.1      | 32.7                                     | 45.1             | 22.8             | 30.1                  |
| Colombia  | 2010 (D)                       | 0.022                                   | 5.4                | 2,500         | 40.9                         | 6.4                                  | 1.1  | 31.8      | 33.5                                     | 34.7             | 8.2              | 37.2                  |
| Congo   | 2009 (D)                       | 0.208                                   | 40.6               | 1,600         | 51.2                         | 17.7                                 | 22.9   | 10.4      | 45.6                                     | 44.0             | 54.1             | 50.1                  |
| Congo, Democratic Republic of the               | 2010 (M)                       | 0.392                                   | 74.0               | 48,815        | 53.0                         | 15.1                                 | 45.9   | 18.0      | 25.1                                     | 56.9             | 87.7             | 71.3                  |
| Dominican Republic                              | 2007 (D)                       | 0.018                                   | 4.6                | 439           | 39.4                         | 8.6                                  | 0.7  | 39.1      | 22.6                                     | 38.2             | 2.2              | 34.4                  |
| Egypt   | 2008 (D)                       | 0.024                                   | 6.0                | 4,699         | 40.7                         | 7.2                                  | 1.0  | 48.1      | 37.3                                     | 14.5             | 1.7              | 22.0                  |
| Ethiopia  | 2011 (D)                       | 0.564                                   | 87.3               | 72,415        | 64.6                         | 6.8                                  | 71.1   | 25.9      | 27.6                                     | 46.5             | 39.0             | 38.9                  |
| Ghana   | 2008 (D)                       | 0.144                                   | 31.2               | 7,258         | 46.2                         | 21.6                                 | 11.4   | 32.1      | 19.5                                     | 48.4             | 28.6             | 28.5                  |
| Guyana  | 2009 (D)                       | 0.030                                   | 7.7                | 58            | 39.2                         | 12.3                                 | 1.0  | 17.4      | 50.4                                     | 32.2             | ..               | ..                    |

Source: UNDP, Human Development Report 2013.

The intensity of deprivation, for which we use the symbol  $A$ , shows that poor people in Bangladesh typically are poor on about half of the dimensions of poverty. Further to the right we see the extent to which education health and living standards contribute to the measure of poverty. On the far right we see some more-conventional measures of poverty, including the so-called dollar-a-day standard. By this measure, 43% of the population of Bangladesh is poor, and indeed this is more than in Bhutan, and less than in Burkina Faso. The UNDP says that it's multidimensional poverty index supplements, but does not displace, more-conventional monetary measures of poverty.

### Multidimensional Poverty Index: Applications and Limitations

Although it is generally true that poverty as measured conventionally is closely correlated with measures of multidimensional poverty, this is not always the case. We can illustrate this using an example from Vietnam. The data come from a survey that was undertaken in the two major cities in Vietnam, that is Ho Chi Minh City and Hanoi, in 2009. If we measure poverty using income per capita, we see in Table 8 that the poverty rate in Ho Chi Minh City is less than half the rate seen in Hanoi. Surprisingly enough, migrants in the two cities have a lower poverty rate than official residents; although their wage rates are lower, migrants work longer hours, and have fewer dependents, than local residents.

| <b>Table 8: Monetary and Multidimensional Poverty, Hanoi and Ho Chi Minh City, 2009</b>   |                  |          |
|---|------------------|----------|
|   | Ho Chi Minh City | Hanoi    |
|   | %                |          |
| Headcount poverty rate based on income/capita   | 2.1              | 4.6      |
| Headcount poverty rate based on multidimensional poverty (H)  | 28               | 15       |
| Adjusted poverty headcount rate (MPI = $H \times A$ )   | 12               | 6        |
|   | City residents   | Migrants |
|   | %                |          |
| Headcount poverty rate based on income/capita   | 3.0              | 2.6      |
| Adjusted poverty headcount rate (MPI = $H \times A$ )   | 3                | 14       |
| Note: The 8 dimensions used (with equal weights) were income per capita; education; health; access to social security; housing quality; housing services; social inclusion; and physical safety |                  |          |
| Source: UNDP and Statistical Offices: <i>Urban Poverty Assessment</i> , 2010.   |                  |          |

Alternatively, we could develop a multidimensional measure of poverty, and this was done using the eight dimensions listed in Table 8. The poor are defined as those who fall below the poverty threshold on at least three of these dimensions. By this standard, the headcount poverty rate in Ho Chi Minh City

is twice the level of that in Hanoi, and so is the multidimensional poverty index. Even more striking, by this measure migrants are far poorer than residents. That is because although migrants have more income, by every other dimension they are poorer than residents. In short, this example shows the potential value of measuring multidimensional poverty in addition to the standard measures of poverty.

The use of a multidimensional poverty index has been gaining some traction, and is now the norm in Mexico and in Colombia. There are, however, major challenges involved in summarizing so much data in a single index. The first problem is that of data; ideally we need quite extensive data from household surveys that ask people about their degree of deprivation along the different dimensions. The UNDP does the best it can, but in practice is forced to use data from surveys, such as the demographic and health surveys, that do not routinely collect much information on incomes. That is unfortunate, because as a result the indexes do not include income.

The second important challenge is: What weights do we use? For example, how do we trade off deprivation in access to clean water against deprivation in access to schooling? In a monetary measure of poverty, prices are used to weight different components of spending, and this has the logic of the market behind it (Ravallion 2011). There is no equivalent when we are trying to trade off the components of poverty in non-market dimensions.

We also have the usual problems of what series to include in our analysis, what poverty thresholds to apply, and what overall poverty cutoff to use. Interestingly, Atkinson and Lugo argued that a multidimensional approach to measuring poverty risks diluting the message, because if indicators go in different directions, it may be difficult to determine what is happening to poverty, and anyway access to income may be the most fundamental component of all.

## The Middle Ground

We first looked at the dashboard approach, which gave us information on such things as life expectancy, or access to electricity, and we might call these measures the marginal distributions. Certainly this provides a lot of information, which we then have to make sense of. At the other extreme we have the multidimensional poverty index, where aggregating everything is problematic; what weights do we use? And are the data good enough?

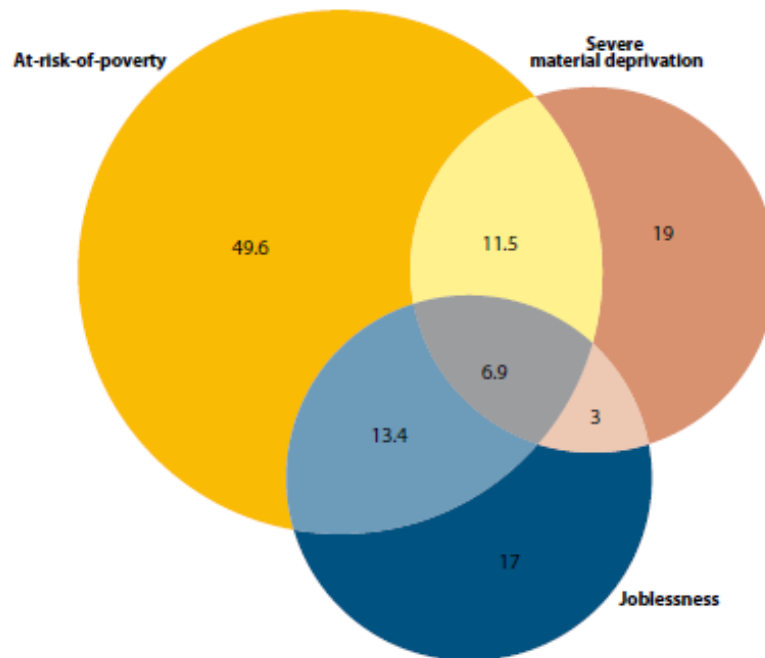
The middle ground would have us look more carefully at the joint distribution of the dimensions of poverty. This is most easily explained by looking at the example shown in Table 9. Let's compare country A with country B, and ask a very simple question: Which country is poorer? Look first at country A; 30% of the population is thin, as measured by a low body mass index, and 25% has a low life expectancy. Compare this with country B, where only 25% are thin and 23% have a low life expectancy. If we focus on these numbers in the margins, as would be done by the dashboard approach, country A is unambiguously poorer than country B. But the joint distribution of these attributes, that is the numbers in the boxes, tells a different story. In country B, 15% of the population has both a low body mass index *and* low life expectancy, compared to just 10% in country A. So one could certainly make the case that country B is poorer than country A because it has more people who are deprived along multiple dimensions. Indeed much of the interest in exploring multidimensional poverty arises from the fact that there may be different correlations between the dimensions of poverty between one country and another.

**Table 9. Exploring the Joint Distribution of Dimensions of Poverty**

|       | Country A       |    |       |       | Country B       |    |       |
|-------|-----------------|----|-------|-------|-----------------|----|-------|
|       | Life expectancy |    |       |       | Life expectancy |    |       |
| BMI   | Low             | OK | Total | BMI   | Low             | OK | Total |
| Low   | 10              | 20 | 30    | Low   | 15              | 10 | 25    |
| OK    | 15              | 55 | 70    | OK    | 8               | 67 | 75    |
| Total | 25              | 75 |       | Total | 23              | 77 |       |

Figure 3 provides one way of presenting the information that captures the idea that there are joint distributions of the dimensions of poverty. This is a Venn diagram, and covers the 27 countries of the European Union in 2008. Three dimensions of poverty are being considered here. The first dimension is labeled as “at-risk-of-poverty”, and refers to those whose disposable income is below 60% of the national median. The second dimension is called “severe material deprivation”, and refers to households that have difficulty paying the rent or utility bills, or heating their home, and so on. And the third dimension is “joblessness”; a household is included in this category if none of its working-age members has a job. Altogether 120 million people are covered by this diagram, out of a total population in the EU of almost 500 million. It is interesting that 6.9 million people are deprived on all three of the dimensions shown here. It is just as important to note that 17 million people are jobless, and yet are not considered to be either at risk of poverty or to face severe material deprivation.

**Figure 3. Multiple Indicators for EU-27 in millions of persons, Survey Year 2008.**



<sup>5</sup> Persons “at risk of poverty” are defined as those who have an equivalized disposable income below 60 % of the national median equivalized disposable income, after social transfers. Material deprivation covers indicators relating either to economic strain or to the ownership of durables. Severely materially deprived persons cannot afford at least four of the following: to pay rent or utility bills; to keep their home adequately warm; to pay unexpected expenses; to eat meat, fish or a protein equivalent every second day; a week holiday away from home; a car; a washing machine; a color TV; or a telephone. Finally, a ‘jobless household’ is one where none of the members aged 18-59 are working or where members aged 18-59 have very limited work attachment.

Table 10 presents a case where we face a puzzle, and where our multidimensional approach helps us understand things better. Between 2001 and 2007, real GDP in Tanzania rose by more than 50%. Expressed in per capita terms, GDP rose by about 30%, which is impressive by any standard. According to the national accounts, household consumption per capita rose by over a quarter over this same period. Yet information from household budget surveys shows almost no increase in consumption over this period, and indicates a very modest reduction in the headcount poverty rate. There seems to be a contradiction between the two stories presented here. So what is going on?

| Table 10. The Poverty Reduction Puzzle         |        |        |          |
|--|--------|--------|----------|
| [Tanzania mainland, 2001 prices]               | 2001   | 2007   | % change |
| Real GDP, bn Tshs                              | 8,515  | 12,875 | 51.2     |
| GDP/capita/month, Tshs                         | 18,965 | 25,795 | 29.9     |
| Household final consumption/cap/mth, Tshs      | 15,924 | 20,078 | 26.1     |
| Household consumption (from HBS)/cap/mth, Tshs | 8,897  | 9,109  | 2.4      |
| Headcount poverty rate (national definition)   | 35.7   | 33.4   |          |



Although Table 11 may not completely solve the puzzle, it does at least help. It seems that between 2001 and 2007, quite a lot of other improvements took place in Tanzania. For instance, the proportion of households with no children at school dropped sharply. The proportion of households deprived of assets also fell, from two-thirds to less than a half. On the other hand, the proportion of households without access to clean water actually rose slightly. It seems that this particular type of infrastructural investment did not keep up with the growth of the population. The bottom part of this table breaks down these marginal numbers into the joint distribution. The proportion of the population that has no deprivations at all doubled from 10 to 20% of the population. In most of the other cells, with the exception of those deprived of clean water, there were substantial improvements. In short, what partly happened in Tanzania during this period was that economic growth was channeled into more schooling, and the acquisition of assets.

Table 11. Deprivations in schooling, access to protected water and durable assets

| <b>Proportion of the individuals living in households ...</b>                   | <b>2001</b> | <b>2007</b> |
|---|-------------|-------------|
| <b>School deprived: at least one child 5-16 years old not in school</b>         | 55.2        | 34.5        |
| <b>assets deprived: no car and fewer than one 'small asset'</b>                 | 66.6        | 47.4        |
| <b>water deprived: no access to piped or protected source of drinking water</b> | 45.8        | 50.7        |
| <b>Distributions of individuals</b>   |             |             |
| Not deprived in school, water or assets   | 10.3        | 20.1        |
| Only school deprived  | 8.9         | 7.5         |
| Only water deprived   | 4.7         | 14.4        |
| Only assets deprived  | 17.3        | 15.1        |
| School and water deprived   | 9.5         | 10.7        |
| Water and assets deprived   | 12.5        | 15.9        |
| School and assets deprived  | 17.6        | 6.6         |
| School, water and assets deprived   | 19.1        | 9.8         |

Source: own calculations based on HBS 2001 and 2007.

Note: small assets include television, radio, telephone (including mobile phones), refrigerator, bicycle and motorcycle.

Source: Atkinson and Lugo, 2010. *Growth, Poverty, and Distribution in Tanzania*. IGC.

## Conclusion

Multidimensional poverty, and its measurement, is a relatively complex subject, and remains an area of active research. A good place to get a flavor of these debates is in the June 2011 issue of the *Journal of Economic Inequality*; Martin Ravallion favors the dashboard approach, and is skeptical of the multidimensional poverty index methodology, which was developed by, and is defended by, Alkire and Foster. Ferreira and Lugo try to find the middle ground, and they make the case that devices such as Venn diagrams can be useful. The UNDP web site is the place to look for information both on the human development index, and their implementation of the multidimensional poverty index.

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