

To reduce poverty, let's measure it properly

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Economic development is ideally about the improvement in the wellbeing of all members of a society. Yet one can make a compelling argument that the poor deserve special attention. It is said that a society should be judged by how it treats its weak and downtrodden. The term “pro-poor growth” in development circles is intended to draw attention to the plight of the poor. So also are terms like “inclusive growth”, “broad-based growth”, and “shared growth”.

In 1999, the World Bank and the IMF introduced the Poverty Reduction Strategy Papers (PRSPs) as a framework to enhance domestic accountability for poverty reduction programs. These papers are updated every three years and describe a country's macroeconomic and social policies over a three year or longer horizon to reduce poverty.

A core component of the effectiveness of a poverty reduction strategy or program is the measurement of poverty. Without the measurement of poverty, it is very difficult, if not impossible, to determine whether poverty has risen or fallen. A cynic might ask that if people are poor why should they be told that they are poor? This confuses individual poverty with aggregate (national) poverty. The fact that different and uncoordinated individuals know their own state of poverty tells us almost nothing about aggregate poverty. Poverty measurement is about aggregating individual information about poverty into a national index that can be used to track the evolution of poverty and to devise policies for dealing with such human deprivation.

Member countries of the World Bank collect data on poverty through the Living Standards Survey. For example, in Ghana, the first Living Standards Survey (GLSS) was conducted in 1987; the second in 1988; the third in 1991/92; and the fourth in 1998/99. The fifth survey and most recent was conducted in 2005/2006. Overall poverty was estimated at 52% in 1992, 39.5% in 1998, and is currently estimated at 28%. This is sometimes touted as evidence that Ghana is on track to achieve the UN “millennium development goal” for poverty reduction. For example, based on these figures, the IMF in its country report No. 09/238 issued in July 2009 claimed that “[T]he recently completed Ghana Living Standards Survey (GLSS-5) confirms that Ghana is on track to halving the poverty rate before the target date.”

In spite of such claims about reductions in poverty, there are people who contend that poverty may have actually increased in Ghana. Statistical truths may well be in the eyes of the beholder. This raises the issue of whether the reductions in poverty reported by the World Bank, the IMF, and statistical agencies of developing countries are real or spurious.

The purpose of this article is to draw the attention of the general public to some of the reasons why claims about reductions in poverty must be subjected to more scrutiny especially when such claims are based on very simple measures of poverty. I shall discuss what, in my view, are the important problems in the measurement of poverty. There are other issues such as the duration of poverty, absolute versus relative poverty, inequality within households, access to public goods, estimation techniques, and the vulnerability of the poor that will not be discussed.

As is well known and was emphasized in the September 2009 report of the “Commission on the Measurement of Economic Performance and Social Progress”, chaired by Nobel laureate Joe Stiglitz, per capita GDP growth is an imperfect and potentially misleading measure of wellbeing. The focus of this article is on a related but different issue. This difference is evident in the following question: “Even if growth in per capita GDP has reduced poverty, how can we determine that this is indeed the case?” Investigating this issue requires the proper measurement of poverty.

To determine the level of poverty in a country, World Bank, government statistical agencies, and the development community employ a commonly-used measure of poverty known as the **head count ratio**, **HCR**. For example, the aforementioned poverty figures for Ghana were based on the HCR. The **HCR** is simply the proportion of individuals (or households) below the poverty line (e.g., \$2 a day). A fall in the HCR implies a fall in poverty according to this measure. The HCR measures the **incidence** of poverty but not the **intensity** (or depth) of poverty. That is, it only focuses on the number of individuals (or individuals) below the poverty line but not how far or how close they are to the line. When more individuals get closer to the line but do not cross it, the **HCR** does not capture this effect, so there is no change in the incidence of poverty. For a given poverty-alleviation budget, the **HCR** leads to the undesirable conclusion that we should ignore those farther away from the poverty line and focus on those closer to the line because it is cheaper or easier to help the latter group to cross the poverty line. And the HCR implies that taking income away from the poor does not increase poverty. These major shortcomings of the **HCR** were pointed out by Nobel Laureate Amartya Sen more than thirty years ago. They imply that the depth of poverty may actually be worsening while the development community hails a poverty reduction program as a success. This disturbing possibility reflects Amartya Sen’s remark in 1979 that the “... headcount measure ... has commanded implicit support that is quite astonishing.” However, the **HCR** is very popular because, relative to other measures of poverty, it is easier for the average person to understand it (e.g., 30% of Ghanaians are poor). Perhaps, the HCR is also popular because it makes it easier for politicians and bureaucrats to claim credit for a successful poverty reduction program when indeed such credit is not due.

For a population that is constant over time, a more accurate measure is the **poverty gap ratio** (**PGR**) which takes both the **incidence** and **intensity** of poverty into account. The **PGR** does not require more data than the **HCR**. Suppose the **PGR** = 0.3. This means that, on average, the poor have an income deficit of 30% relative to the poverty line. And if the poverty line is \$730 a year (i.e., \$2 a day), then this means that the annual cost of eliminating poverty per poor person is $0.3(\$730) = \219 .

If the HCR falls because the incidence of poverty has fallen, the PGR may not fall if the average income of those in poverty also falls. Therefore, if growth reduces the number of individuals below the poverty line, the PGR will not necessarily register this as a fall in poverty if those who are still remain below the line have a lower average income than before. For example, the PGR will not necessarily fall if it is the “least poor of the poor” who were lifted out of poverty as a result of pro-poor growth while the incomes of the “poorest of the poor” fell. A fall in the HCR will *necessarily* lead to a fall in the PGR if and only if the average income of those still in poverty remained constant or increased. However, like the HCR, the PGR is not sensitive to the distribution of income amongst the poor. The poorest of the poor has the same weight as the least poor.

Notwithstanding the superiority of the PGR over the HCR, both poverty measures and several others have some major shortcomings. In particular, they do not measure poverty properly when the population is changing. This is because all these measures look at poverty **relative** to the overall population and ignore the **absolute number** of people in poverty. This is a serious drawback of these measures.

To illustrate the preceding point, imagine two **identical** societies A and B. Each society has a 100 individuals with 20 individuals below the poverty line. According to HCR, the level of poverty in each society is $20/100 = 20\%$. Now suppose that these societies are merged into one big society. There will now be 200 individuals with 40 individuals below the poverty line. According to HCR, the level of poverty in the bigger society is still 20% (i.e., $40/200$). Using the PGR will also lead to the conclusion that there is no change in the level of poverty although the **absolute number** of individuals in poverty has increased from 20 to 40 in the bigger society. Using this example, we may have no qualms about the conclusion that there is no change in the level of poverty. Perhaps, this stems from the fact that merging the two societies may not be seen as a failure of policy. Yet framed differently, we may change our opinion of this thought experiment. Note that merging the two societies is equivalent to increasing the population of one of the societies. Suppose then that as result of a 2% annual growth in population, the number of people below the poverty line increases by 2% annually in a country. Then according to the HCR, the level of poverty is unchanged. Yet the **absolute number** of individuals or people in poverty has increased. Our sense of decency does not allow us to believe that the level of poverty is unchanged when indeed the number of people in poverty has risen. Even more disturbing is the observation that if the number of people in poverty were to increase by 1% annually while the population increased by 2%, the level of poverty will fall by approximately 1% annually according to HCR. This disturbing conclusion can also not be ruled out if the PGR is used.

The second example of population growth may be seen as a failure of policy because of the inability to reduce the number of people in poverty at a faster rate relative to population growth. An increasing number of poor people has serious implications in the real world. According to Ravi Kanbur, a professor of economics at Cornell University (USA) and a former chief economist at the World Bank:

“... in Ghana between 1987 and 1991 the incidence of poverty came down by one percentage point per year, while the absolute number of the poor increased because total population was growing by around two percentage points a year. The World Bank and the IMF trumpeted the first measure as measure of the success of their recommended “structural adjustment” policies, while those in civil society who criticized these policies did so partly because they looked around them and they could see more poor people in the streets. ... in South Asia the number of poor people increased by more than 180 million people, while the incidence of poverty fell by 2.7 percentage points. ... These contrasts raise questions about the recent UN “millennium target” for income poverty reduction – which has been specified in terms of the incidence of poverty rather than in terms of the absolute numbers of the poor.”

Of course, the incidence of poverty and the absolute number of the poor could both fall. According to Ravi Kanbur, this was the case in East Asia, excluding China, where the number of poor people fell by 16% and the incidence of poverty fell by 30%. Another perverse property of measures of poverty, including the HCR and PGR, is the fact that the death of a poor person, **because of poverty**, reduces poverty. Indeed, the poor have a higher rate of mortality and lower life expectancy than the rich. A policy, natural disaster, or epidemic that disproportionately kills the poor will be recorded as a fall in poverty according to commonly-used measures of poverty. Nothing can be more repugnant. This is somewhat similar to the practice of not considering discouraged workers, who have stopped looking for a job, as unemployed. In the context of poverty, this issue raises a very daunting intellectual and moral problem. If we cannot say that poverty in 2009 has fallen because some of the poor died in 2008, then how far in the past should we go? Should deaths due to poverty fifty years ago pose a moral dilemma for the measurement of poverty today? In a recent paper, Ravi Kanbur and Diganta Mukherjee tried to provide an answer to this nagging question. Not surprisingly, their approach involves a *value judgement* on how long the poor would have lived.

We must bear in mind that being non-poor is not the same as being well-off or being able to afford a sufficiently high standard of living. Marginally crossing a poverty line of \$2 a day is encouraging but such people are very vulnerable to falling back into poverty. Crossing the poverty line cannot and should not be the end of the goal of improving the lives and wellbeing of everyone especially those at lower end of the income distribution. The poor must not only cross the line but must also go sufficiently beyond it. In many countries, this calls for raising the poverty line and thus setting a higher goal.

Let me state that the purpose of this article is not to cast aspersions on the integrity of the development community. Indeed, it should be obvious to the reader that some of the problems in the measurement of poverty do not lend themselves to easy solutions. There are also theoretical results that show that there exists no poverty index that satisfies certain desirable conditions including the reasonable condition that the index should rise when a poor person is added to the population.

Accordingly, several other indicators must be used in conjunction with poverty measures in order to properly assess the economic wellbeing of the citizens of a country. The

Human Development Index attempts to do this, although it does not exclusively focus on the poor. Also, the living standards surveys, for example the GLSS-5 for Ghana, are very thorough and comprehensive. They cover areas such as education, health, employment, savings, and housing. The point of this article is not to argue that such thorough exercises are not undertaken but instead to point out the drawbacks of relying solely on poverty measures to make some of the aforementioned claims by the IMF, the World Bank, and national statistical agencies. If we have to choose between the PGR and the HCR, we should opt for the PGR. Like all statistical measures, we must note that the devil of poverty measures is in the details.

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References

John Broome, "The Welfare Economics of Population." *Oxford Economic Papers*, 1996.

Angus Deaton, "Measuring Poverty in a Growing World (or Measuring Growth in a Poor World)", *The Review of Economics and Statistics*, 2005.

Ravi Kanbur and Diganta Mukherjee, "Premature Mortality and Poverty Measurement", *Bulletin of Economic Research*, 2007.

Satya Chakravarty, Ravi Kanbur and Diganta Mukherjee, "Population Growth and Poverty Measurement", *Social Choice and Welfare*, 2006.

Ravi Kanbur and Lyn Squire, "The Evolution of Thinking About Poverty: Exploring the Interactions", in G. Meier and J. Stiglitz (eds.), *Frontiers of Development Economics: The Future in Perspective*, Oxford University Press, 2001.

Amitabh Kundu and Tony Smith, "An Impossibility Theorem on Poverty Indices", *International Economic Review*, 1983.

Sanjay Reddy and Camelia Minoiu, "Has World Poverty Really Fallen?", *The Review of Income and Wealth*, 2007.

Amartya Sen, "Issues in the Measurement of Poverty", *Scandinavian Journal of Economics*, 1979.

Savithri Subramanian, "Counting the Poor: an Elementary Difficulty in the Measurement of Poverty." *Economics and Philosophy*, 2002.

Technical Appendix

Let z be the poverty line; y_i be the income of individual i ; q be the number of poor people; and n be the size of the population. Then the head count ratio, HCR, is

$$\text{HCR} = \frac{q}{n}. \quad (1)$$

The Poverty Gap ratio, PGR, is

$$\text{PGR} = \frac{1}{n} \sum_{i=1}^q \left[\frac{z - y_i}{z} \right]. \quad (2)$$

The expression, $z - y_i$, measures how far the i -th individual is from the poverty line. We can rewrite (2) as

$$\text{PGR} = \frac{1}{n} \sum_{i=1}^q \left[\frac{z - y_i}{z} \right] = \frac{1}{n} \sum_{i=1}^q 1 - \frac{1}{n} \sum_{i=1}^q \frac{y_i}{z} \quad (3)$$

Multiplying the second term on the RHS of (3) by $\frac{q}{n} \frac{n}{q}$ gives

$$\text{PGR} = \frac{1}{n} \sum_{i=1}^q 1 - \frac{q}{n} \frac{n}{q} \frac{1}{n} \sum_{i=1}^q \frac{y_i}{z} \quad (4)$$

Then (4) gives

$$\text{PGR} = \frac{q}{n} - \frac{q}{n} \frac{1}{q} \sum_{i=1}^q \frac{y_i}{z} = \text{HCR} - \text{HCR} \frac{\bar{y}}{z}, \quad (5)$$

where $\bar{y} = \frac{1}{q} \sum_{i=1}^q y_i$ is the average income of the poor (i.e., those below the poverty line).

It then follows that

$$\text{PGR} = \text{HCR} \times \frac{z - \bar{y}}{z} \quad (6)$$

It is obvious from (6) that whether HCR and PGR move in the same direction depends on the direction of \bar{y} (i.e., the average income of the poor). As claimed in the text, if HCR falls and \bar{y} also falls, then PGR may rise.

Since the PGR only considers the average income of the poor, it does not take the distribution of income into account. A transfer from the poorest of the poor to the least poor has no effect on PGR. This is also true of the HCR.

The poverty gap ratio in equation (2) is a special case of a more general measure of poverty developed in 1984 by James Foster, Joel Greer, and Erik Thorbecke (FGT) based on a set of axioms.¹ This is the generalized poverty gap ratio, GPGR:

$$\text{GPGR} = \frac{1}{n} \sum_{i=1}^q \left(\frac{z - y_i}{z} \right)^\alpha, \quad (7)$$

where $\alpha \geq 0$ is a parameter that captures the aversion of society to the depth of poverty. The higher is α , the more averse is society to the depth of poverty. When $\alpha = 0$, society has no aversion to the depth of poverty. It can easily be shown that in that case GPGR boils down to HCR. That is, $\text{GPGR} = \text{HCR}$ if $\alpha = 0$. When $\alpha = 1$, then $\text{GPGR} = \text{PGR}$.

When $\alpha = 2$, we may write equation (7) as

$$\text{GPGR} = \frac{1}{n} \sum_{i=1}^q \left(\frac{z - y_i}{z} \right) \left(\frac{z - y_i}{z} \right). \quad (8)$$

In this case, the income shortfall of the i -th individual from the poverty line, $z - y_i$, is weighted by $z - y_i$. This means that the poorer a person is, the higher is the weight assigned to his/her depth of poverty. The expression in (8) is therefore sensitive to the income distribution amongst the poor.

A desirable property of the GPGR measure is that it is additively decomposable. That is, if one knows the GPGR measure for subgroups of the poor (e.g., urban poor and rural poor; poor males and poor females), one can obtain the overall GPGR by a weighted summation of the GPGR measures of the various subgroups. This helps to determine the relative contribution of each subgroup to overall poverty.

¹ The axiomatic approach to the measurement of poverty was pioneered by Amartya Sen in 1976. Some of the axioms are: (1) **focus axiom**: a poverty measure should be independent of the income distribution of the non-poor; (2) **monotonicity axiom**: a decrease in a poor person's income should increase the overall poverty level and vice versa; (3) **transfer axiom**: a transfer from a poorer member among the poor to a relatively less poor member should increase poverty and vice versa; (4a) **replication invariance axiom**: replicating the income distribution of the population should not change the poverty index; or (4b) **Population growth axiom**: the addition of a poor person should increase the poverty index, and (5) **decomposability axiom**: the poverty index should increase when poverty in a subgroup increases, and vice versa.

Amartya Sen, who began the axiomatic study of the measurement of poverty in 1976, derived the following poverty index:

$$P_{\text{SEN}} = \text{HCR} \times G_p + (1 - G_p) \times \text{PGR} , \quad (9)$$

where G_p is the Gini coefficient (i.e., a measure of inequality) of the income distribution of the poor. Sen's index is a weighted average of the HCR and PGR, with the Gini coefficient being the weight. Unlike the FGT measure, Sen's measure is not additively decomposable.