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Measuring Social Welfare With and Without Poverty Lines

By Martin Ravallion*

It is increasingly common to use poverty measures in making distributional comparisons across countries, over time for a given country, and in assessing public policies. A poverty measure attaches zero weight to levels of living above some "poverty line"; it is thus an exclusive measure (EM) of social welfare; an example is the proportion of the population below the poverty line. Alternatively one might prefer an inclusive measure (IM), giving positive weight to the entire distribution; the overall mean is an example.

At one level, the choice is fundamentally an ethical issue. IM's have their origins in utilitarianism, which (though various specializations exist) starts from the proposition that social welfare should be judged by some aggregation of all levels of individual "well-being." The ethical appeal of this proposition has been a point of great debate in moral philosophy. For example, John Rawls (1972) has argued against the utilitarian view that a loss to the poorest strata can be compensated for by a gain to another. An aversion to inequality can be readily built into IM's—so that poorer people are given higher weights—though that alone does not assure that IM's will adequately reflect concerns about poverty.²

However, at another level, it is not clear how much weight these normative arguments carry to empirical practice. There are two distinct issues:

(i) Is the theoretical argument persuasive in guiding practice?
(ii) Does the theoretical distinction matter to the empirical results?

This paper tries to throw some light on both questions. I will first argue that an explicit recognition of the problems of doing empirical work influences the way welfare-theoretic arguments are translated into practice; some of the key theoretical distinctions can get quickly blurred by the realities of data. Secondly, I will test how much difference the choice makes empirically. Here I will focus on the problem of making distributional comparisons across developing countries. This will illustrate that the theoretical distinction can sometimes be of very little practical consequence.

I. Translating Theory into Practice

By a "social-welfare measure" I mean a single-valued nondecreasing function defined on the values taken by some measured indicator of levels of living in a population; thus I confine attention to measures found in applied work, rather than the more abstract formulations found in welfare economic theory. The measure may or may not

²For example, it is possible to find that a wide range of IM's with inequality aversion prefer distribution A to B (even with second-order stochastic dominance) and yet the percentages deemed poor according to some (but not all) possible poverty lines are higher in A than B.

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Assessments of overall progress in economic development have increasingly relied on poverty measures (examples include World Bank [1990] and Lyn Squire [1993]). A number of recent papers have also examined impacts on poverty measures of targeted transfers and pricing policy reforms (Ravi Kanbur, 1987; Timothy Besley and Kanbur, 1993; Ravallion, 1994a). For a survey of the recent literature see Michael Lipton and Ravallion (1994).
have curvature properties that penalize inequality in the indicator distribution, and it may or may not be inclusive.\(^3\) Most economists would be happier to have the social-welfare function predetermined by some higher authority; but that is rare. Instead the tendency has been to try to find a general basis for choice, about which dissent will hopefully be minimal. Thus it is sometimes claimed that an IM should be preferred because it embodies concern for both the poor and nonpoor (Nicholas Stern, 1987; Angus Deaton, 1993). Indeed, the strictly increasing Bergson-Samuelson social-welfare functions postulated in theoretical work are often intended to represent everything that matters directly to social preferences. If this were also true of IM's in practice then one would have to agree on their appeal. But it is plainly not true; the empirical IM is unlikely to be a sufficient statistic for a number of reasons: aside from disagreements over the properties of its functional form, one may question whether it is defined on the right indicator of human well-being, or one may want certain nonhuman (animal or environmental) concerns to be valued directly.

Two factors lie at the heart of most concerns about empirical measures of social welfare: measurement errors in the distribution of the welfare indicator and uncertainty about key parameters of the measure used in aggregating over that distribution. Both have implications for how theoretical arguments about social-welfare measurements translate into practice.

Despite the pervasiveness of measurement error in survey data, its implications for social-welfare measurement are only starting to be understood.\(^4\) The theoretical distinction between the two types of measures can become impossible to implement once one recognizes the existence of potentially large measurement error in the living-standards indicator. Measurement error may entail that poverty comparisons have to be made over a very wide range of the empirical distribution; indeed, depending on the error structure, one may end up with an inclusive measure of poverty. For example, suppose one wants to base distributional comparisons on the well-being of the poorest person (or subgroup), but acknowledges that this and other levels of living are measured with error. Let \(x_i\) denote the true welfare of the \(i\)th person, \(i = 1, \ldots, n\), of which the lowest value is \(x_1\), say. The observed welfare indicator is \(y_i = x_i + \nu_i\) where \(\nu_i\) is measurement error. The expected value of the welfare of the worst-off person is then \(\Sigma y_i \phi(y_i)\) where \(\phi(y_i)\) is the probability that \(y_i = x_1\) (equal to the probability that \(\nu_i = y_1 - y_i\)). Suppose that \(\phi(y_i)\) is the highest for the person who appears to be worst off and decreases in a convex way up to some point, above which there is zero probability of being the poorest person. The expected welfare of the worst-off person will then look like many standard poverty measures if there are observed levels of living which are too high for there to be any chance of being the poorest person. For example, suppose that measurement errors yield a beta distribution:

\[
\phi(y_i) = \begin{cases} 
  k (1 - y_i / z)^\alpha > 0 & \text{for } y_i < z \\
  0 & \text{otherwise}
\end{cases}
\]

for suitable positive constants \(k\) and \(z\), and for \(\alpha > 1\). Then the expected value of the lowest level of welfare will be a Foster-Greer-Thorbecke (James Foster et al., 1984) poverty measure where \(z\) is interpretable as a “poverty line.” If \(z\) happens to be above \(\max(y_i)\) then the expected welfare of the worst-off person will yield an inclusive empirical measure, with inequality aversion. Recognizing the existence of measurement error clearly blurs the theoretical distinctions.

Uncertainty about aggregation is another problem. While in practice one does not know as much about individual well-being

\(^3\)I ignore a thorny issue: the choice of an indicator of individual well-being. For discussions see Amartya Sen (1985), Sudhir Anand and Ravallion (1993), Deaton (1993), and Ravallion (1994a).

\(^4\)On aspects not considered here see Frank Cowell and Maria-Pia Victoria-Feser (1993) and Ravallion (1993b).
as often postulated in theory, one does sometimes have information about the preferences of decision-makers. When a government is committed to the idea of bringing all its citizens up to some standard of living, it is saying something potentially informative for distributional analysis. However, drawing out that information can be difficult. People often have strong feelings about what constitutes “poverty” in specific societies, but those views differ. Among individuals, survey evidence (mainly European) suggests that most people hold quite well-defined but heterogeneous subjective perceptions of what “poverty” means (Arie Kapteyn et al., 1988). One also observes variation across countries in the real value of their commonly used poverty lines, though this variation narrows a good deal when one focuses solely on low-income countries (Ravallion et al., 1991).

Thus one must recognize that there is a degree of uncertainty in setting a poverty line. The resulting measures may be sensitive to the choice; in poor countries the poverty line is typically found in a dense part of the distribution. Though there is more agreement on what constitutes “poverty” in poor countries, their poverty measures tend to be more sensitive to the remaining disagreement. Empirical identification of key parameters of social-welfare measures is often problematic, though the choice of an inequality-aversion parameter is no less problematic than the choice of a poverty line. Clearly one should be aware of these uncertainties in applications; for this reason it is advisable (though still uncommon) in applied work to ask “what is the maximum admissible poverty line?” rather than “what is the poverty line?” and to apply modified stochastic dominance criteria to the distributional comparisons (Anthony R. Atkinson, 1987; Foster and Anthony F. Shorrocks, 1988; Stephen Howes, 1993). Again, poverty comparisons in practice start to look like IM’s.

Other uncertainties about the desirable properties of an empirical social-welfare measure can further blur the distinction. For example, there are long-standing issues concerning the curvature properties of EM’s (on the appeal of convex poverty measures, see Sen [1976a]). Another, less well understood, issue concerns their properties in the neighborhood of the poverty line. Some measures (such as the head-count and Sen indexes) show a discontinuity at the poverty line, while others do not (such as the H. W. Watts [1968] index, and certain measures in the Foster-Greer-Thorbecke [1984] class). There is also an issue of whether a poverty measure should have a discontinuity in its slope at the poverty line; some have a zero (left and right) derivative with respect to the living standards indicator at the poverty line, such as the squared poverty-gap index \( P_2 \) (defined below) while others do not (such as the Watts and Sen indexes). Smooth convex measures such as \( P_2 \) only attach a small difference in weight to someone slightly below the poverty line versus above it, a smoothness they share with most IM’s.

Thus the realities of empirical practice—errors in measuring welfare and uncertainties about aggregation—tend to blur the theoretical differences between these measures. It is also of interest to enquire into how much difference the choice really makes empirically.

II. How Much Do the Two Measures Diverge in Practice?

In the limit, as the poverty line approaches the highest level of living, certain EM’s will automatically rank distributions identically to certain IM’s; for example, it can be readily shown that when everyone is deemed poor the IM proposed by Sen (1976b) is a simple linear transformation of Sen’s (1976a) poverty index. More typically (even in very extreme cases),
poor countries), poverty lines exclude the majority of the population. Do poverty measures then rank very differently to IM's?

The present results are based on household-level survey data for 40 developing countries over the last 10 years; details on the data and countries can be found in Shaohua Chen et al. (1993). Only salient features are described here. All of the primary data sets used are nationally representative household surveys and the welfare indicator is expenditure or income per person. In all cases, calculations have been from the primary data source (detailed tabulations or household-level data), rather than from existing estimates. Purchasing-power-parity exchange rates for consumption have been used in all currency conversions (Robert Summers and Alan Heston, 1991). The poverty line is $1 per day at 1985 purchasing-power parity (World Bank, 1990; Ravallion et al., 1991); 33 percent of the total population of the 40 countries consume less than this amount (the unweighted mean is 27 percent). In most of these experiments I also tested a poverty line below this figure (around India's, at about $21 per month), and above ($40 per month); the results look very similar, and nothing much about the comparisons drawn here seems to depend critically on that choice, at least within this range of possible poverty lines.

For the inclusive measure, I use Atkinson's (1970) constant-elasticity-of-substitution (CES) form; for a distribution of measured levels of living, \( y_i \) \((i = 1, \ldots, n)\), the value of social welfare is then given by

\[
SW_e = \sum_{i=1}^{n} y_i^{1-\varepsilon} / n
\]

where \( \varepsilon \) is the elasticity of marginal social welfare, a nonnegative parameter indicating the extent of inequality aversion. My exclusive measure is the Foster-Greer-Thorbecke (1984) class of poverty measures,

\[
P_\alpha = \sum_{i=1}^{q} (1 - y_i / z)^\alpha / n
\]

where \( \alpha \) is a nonnegative parameter, \( z \) is

the poverty line, and the distribution is now ordered such that \( y_i \leq z \) if and only if \( i \leq q \). For \( \alpha = 0 \) one obtains the head-count index giving the proportion of the population deemed poor. The "poverty-gap index" has \( \alpha = 1 \), while a convex measure reflecting differences in equality among the poor is obtained by setting \( \alpha > 1 \); an example is the "squared poverty-gap index," \( P_2 \).

Figure 1 gives the Spearman rank correlation coefficient between three poverty measures (the \( P_\alpha \) measures for \( \alpha = 0,1,2 \)) and the Atkinson-type IM's for various inequality-aversion parameters across 40 countries. Frequent differences in rankings by the two methods emerge when one uses either an IM with low inequality-aversion (such as the mean, at one extreme) or a low-dimensional poverty measure (such as the head-count index). However, correlations exceed 0.97 for the poverty-gap indexes as long as the inequality-aversion parameter is set at 2 or higher. Evidently there is a high degree of "comovement" across countries in the fortunes of different strata; in countries where the poor are worse off, other strata tend also to be relatively worse off.

### III. Conclusions

Conceptually there is a marked difference between inclusive and exclusive measures of social welfare, and both are defensible approaches to resolving otherwise ambiguous
distributional comparisons. However, the theoretical difference becomes blurred in application once measurement errors and uncertainties about key parameters are recognized. The conceptual distinction can be very difficult to implement convincingly. In poverty comparisons with typically available data sets there is a strong case for using a (potentially wide) range of “poverty lines,” making poverty measures more inclusive in practice.

Even using a single poverty line, however it is an empirical question as to how much the two types of measures will diverge in practice. Using new data for 40 developing countries, I find that there is enough co-movement in the distributions for it to be true that inclusive measures with only quite modest inequality-aversion yield very similar rankings to poverty measures, even though on average two-thirds of the population is given zero weight by the latter.

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