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Comment

Amitabh Chandra and Heidi Williams

The World Bank estimated that in 2001, 1.1 billion individuals lived under a dollar a day, and over 2.7 billion (approximately half of the world's population) lived on less than two dollars a day. The prevalence of extreme poverty as measured by the fraction of the world's population who live under a dollar a day has been falling, but the toll, as measured by population counts, has been steadily increasing (Bourguignon and Morrisson 2002). Sala-i-Martin (2006) documents that the decline in prevalence is driven largely by improvements in South Asia and East Asia; the past two decades have not seen improvements in Sub-Saharan Africa, the Middle East, Latin America, or Eastern Europe. These sobering facts provoke several sets of immediate and interrelated questions. What causes extreme poverty? What are the effects of living in such poverty? And what policies, microeconomic and macroeconomic, successfully lift people out of these conditions?

In this insightful chapter, Banerjee and Duflo document new facts that illuminate our understanding of the second question. Their analysis uses data from a number of low-income countries (including two new data sets collected by the authors and their colleagues) to study the association between poverty and what is arguably the single most important determinant of welfare: health (in particular, adult mortality). We say most important because even marginal improvement in health, when monetized into dollars using quality-adjusted life years (QALYs) and a societal measure of the willingness to pay for life, will generally dominate improvements in incomes and other measures of well-being. The new facts that emerge from their chapter build on the authors' own previous work (Banerjee and Duflo 2007)

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in providing insights into the lives of the poor in low-income countries, and also suggest several ways forward for learning about the causes and effects of poverty in low-income countries.

Methods for Measuring Adult Mortality

One reason that so little is known about the correlation between poverty and adult mortality in low-income countries is that many such countries lack a comprehensive death registration system. Registration of deaths is often incomplete, and even when coverage is adequate the data on age is often inaccurate (Hill, Choi, and Timaeus 2005). We tend to have comparatively better data on child mortality in low-income countries, but changes in child mortality measures may correlate poorly with changes in old-age survival. In part due to this lack of high quality data, several broad methods have been developed by demographers to estimate old-age mortality (Hill, Choi, and Timaeus 2005):

1. *Death distribution methods.* If the relationship between deaths and recorded deaths can be estimated, data on recorded deaths can be adjusted and unbiased death rates can be calculated. Demographers have developed methods for such estimation that necessarily rely on simplifying assumptions, but can be designed to account for factors such as migration.
2. *Sample registration systems.* As an example, India's sample registration system has historically been a dual record system consisting of a continuous enumeration of births and deaths by a resident enumerator, and an independent survey every six months. Data from India's system are thought to be of relatively high quality, although attempts to initiate similar systems in other countries are thought to have been less successful.
3. *Census or survey questions concerning household deaths over some reference period.* Although commonly used, this method has a number of potential weaknesses—the method of data collection implies that some deaths will be omitted (such as deaths in single-person households), and deaths in households that dissolve after the death (perhaps due to the death itself) may also be missed.
4. *Indirect methods based on the survival of close relatives.* A variety of methods fall into this category—including methods asking mothers about their children, children about their parents (the so-called "orphanhood" method), widows about their first spouse, and everyone about their siblings.
5. *Intercensal survival methods.* Given data from two censuses, survivorship ratios can be compared to model life table values in order to estimate post-childhood mortality. Concerns with this method often arise due to changes in census coverage and age misreporting.

Each of these methods has strengths and weaknesses. For example, the second method is (at least in some countries, such as India) highly dependent

on the quality of local informants—such as barbers, priests, school teachers, and nurses—who inform the first round of enumeration, and is also quite expensive to implement. Moreover, many of these methods do not permit an examination of the relationship between poverty and mortality.

In their chapter, Banerjee and Duflo use a variant of the fourth method—the "orphanhood" method—which has a rich history in the demographic literature, but to the best of our knowledge had not previously been combined with information on household poverty. It is instructive to briefly review the intellectual antecedents of Banerjee and Duflo's contribution. William Brass developed the first formal methods for converting indicators of mortality based on survival of close relatives into standard life table measures. Brass and Hill (1973) and Hill and Trussell (1977) proposed methods for estimating life table survivorship ratios from proportions of respondents in five-year age groups whose mother or father were alive. Rather than attempting to collect ages of the dead relatives, demographers instead estimated these ages based on the ages of respondents (which presumably are reported more accurately than would be the ages of the dead relatives).

Blacker (1977) notes several practical advantages of this orphanhood method: the questions "Is your father alive?" and "Is your mother alive?" are simple, involve no dating or reference period, and can be answered by a straightforward "yes" or "no." Despite these advantages, several potential drawbacks of this method were noted from the outset. For example, if surveyed individuals use the words "mother" and "father" to denote individuals other than their biological parents then bias could result—in part because the process of adoption by foster parents or other relatives may take place precisely due to the adult mortality the researcher is attempting to measure. Carefully worded survey questionnaires attempt to circumvent such issues, although many demographers argue that an "adoption effect" may still be potentially problematic if many children are unaware that the adults who reared them are not their biological parents. A second potential problem is sample selection, in the sense that the mortality experience of nonparents, or of parents whose children have all died, is not represented. Biases could thus arise if parents' survival probabilities are systematically related to their number of living children. Timaeus (1991) argues this effect appears to be small empirically. In terms of reliability, demographer's views on the value of the orphanhood method as a way of estimating adult mortality have varied over time (Timaeus 1991). Blacker (1977) compared some of the early results of the orphanhood method with those from other sources and concluded that the orphanhood method was a cheap and simple way of obtaining a rough index of adult mortality.

New Facts About Poverty and Adult Mortality

It is worth noting from the outset that any empirical study of the relationship between poverty and adult mortality in low-income countries would

expect to be plagued by issues of measurement error. Measurement error in how daily per capita consumption or expenditures are constructed, or in the per capita equivalence scales used to differentiate children and adults, should bias the authors against finding support for a poverty-mortality gradient. With this caveat in mind, the author's empirical findings are even more striking.

Based on three panel data sets from Indonesia, Vietnam, and Udaipur (India), we learn that, across all age groups of adults, the extremely poor (those who live at less than one dollar per day) experience substantially higher adult mortality than those less poor who survive at a higher level of consumption (between six and ten dollars per day). Moreover, in all three countries the differential death rate between the extremely poor and the non-poor is largest in magnitude for the oldest of the poor. As noted by the authors, this empirical regularity in the data is especially striking since if the poor are more likely than the non-poor to die at any given age, the surviving old-age poor could have been expected to have been selected for having relatively good health. In terms of more general health measures, older poorer persons are weaker in Udaipur, but this pattern does not appear to hold in the Indonesian data.

As the authors are careful to note, these relationships may or may not reflect a causal association between poverty and health, though they, like us, are tempted to interpret their results as providing at least suggestive evidence of a causal association running in the direction from poverty to health. A principal threat to this causal interpretation of their results is the possibility that adverse health shocks in the past made people sick, destroyed health capital, and compromised their ability to acquire new human capital.

Using Adult Mortality Data to Learn About Health and Well-Being

Banerjee and Duflo's chapter motivates several lines of future research—both through further investigating the particular stylized facts their chapter generates, and through applying the measure of adult mortality they utilize to other areas of economic research.

As long as one believes that at least some portion of this observed correlation is explained by the direction flowing from poverty to health, the results motivate research into the channels that might give rise to this relationship. What is it about extreme poverty that makes it so lethal? Is it behaviors, poor nutrition, an inability to access appropriate medical care, or neighborhood characteristics such as environmental pollution that kill? Is it poverty per se that kills, or is extreme poverty a marker for extremely low rank in the socioeconomic distribution? In other words, would we expect exogenous increases in income to actually improve health? Work by David Cutler, Angus Deaton, and James Smith, among others, has argued that the causal effect of income per se on health may not be as strong as is often argued

(see, e.g., Cutler, Deaton, and Lleras-Muney 2006; Smith 1999). Case and Deaton (2008) note that even for countries that have yet to transcend the "epidemiological transition," changes in income are not particularly predictive of improvements in health. One could read these arguments as suggesting that direct cash-transfer programs may not improve health or reduce mortality for those in extreme poverty. But this conclusion would likely be premature: while it is possible that the direct effect of income on health is small even at low levels of income, it is still not known if the relationship is flat at *extremely* low levels of expenditures such as living under a dollar a day—and it is this portion of the distribution that is the focus of Banerjee and Duflo's analysis. Moreover, while the perceived link between income or expenditures and mortality may be weak at the population level, this relationship may exhibit considerable heterogeneity by age, as the elderly may potentially be better able to utilize resources that are made available to them.

Fortunately for researchers interested in these questions, a number of data sets exist that include the types of orphanhood measures utilized by Banerjee and Duflo. If combined with other sources of variation in incomes, we may start to learn more about the precise mechanisms by which extreme poverty kills. The collection of orphanhood measures began in low-income countries in the mid-1960s (see Timaeus [1991] for a discussion), and these types of questions have since been included in several standard surveys including World Fertility Surveys, the World Bank's Living Standards Measurement Study (LSMS) surveys (as utilized by Banerjee and Duflo in their chapter), and in many Demographic and Health (DHS) surveys. The availability of these measures over a relatively long time period offers the potential for these measures to be utilized to construct retrospective studies, potentially in combination with useful natural experiments. For example, studies analogous to Adriana Lleras-Muney's work (2005) using compulsory education laws to study the effect of education on mortality in the United States could be extended to analyze the relationship between education and mortality in low-income countries—perhaps in combination with some natural experiments such as the Indonesian school expansion program analyzed by Duflo (2001). Studies analogous to Stephen Snyder and William Evans' work (2006) using the U.S. social security "notch" to study the effect of income on mortality in the United States could be extended to analyze the relationship between income and mortality in low-income countries—again, potentially in combination with natural experiments such as the South African pension program analyzed by Duflo (2000) and others, or the Indian social banking experiment analyzed by Burgess and Pande (2005). Issues of statistical power may plague researchers' abilities to utilize these adult mortality measures in otherwise interesting contexts, but the potential for interesting studies seems promising.

Beyond utilizing existing surveys to analyze natural experiments retrospectively, these measures could also be utilized in combination with prospective randomized experiments that vary various dimensions of resources available to the extremely poor. Banerjee and Duflo have been tireless pioneers in this area, and through their efforts we have become very optimistic about the ability of experiments to disentangle the relative importance of different causal channels. For both natural and randomized experiments, the resulting estimates may of course be context dependent—what appears to affect mortality among the elderly poor in rural Udaipur may not have the same effects in a Sao Paulo slum—but these measures as well as direct mortality measures (which presumably could be collected in the context of a prospective randomized experiment) could nonetheless begin to paint a picture of the causes and effects of this poverty-adult mortality gradient in low-income countries. Such evidence would ideally shed light on interventions, which could reduce the incidence of avoidable adult deaths in low-income countries.

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