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Comment on Chapters 1 and 2

John Hoddinott

The chapters by Emma Dean, Frank Schilbach, and Heather Schofield and by Elizabeth Frankenberg and Duncan Thomas are thoughtful, well-written studies by researchers with deep knowledge of their subject matter. But beyond that, a first impression would suggest that they are chapters with radically different objectives and analyses. The Dean, Schilbach, and Schofield chapter provides economists with a solid understanding of the interplay between aspects of cognitive function and economic behavior, including its implications for poverty. By contrast, Frankenberg and Thomas provide a careful empirical analysis of the impact of two shocks, the 1998 Indonesian financial crisis and the 2004 Indian Ocean tsunami, on children's human capital. Nor is it immediately clear what links these chapters make with the broader themes of this book. Once past their respective introductions, the phrase "poverty traps" occurs only three times in the Dean, Schilbach, and Schofield chapter and not at all in Frankenberg and Thomas.

But these first impressions are misleading. Both chapters are deeply relevant to current research agenda on poverty traps and they complement each other in at least three ways. In this comment, I provide a brief summary of these chapters before outlining these complementarities.

Summary

Frankenberg and Thomas use two high-quality data sets from Indonesia to examine the impact of early life shocks on health and human capital out-

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comes. Using multiple rounds of the Indonesian Family Life Survey (IFLS), they show that the severe 1998 financial crisis had no effect on child anthropometric status as measured by height ten years after the crisis had passed. Nor were there impacts on grade attainment. Using multiple rounds of the STAR (Study of the Tsunami Aftermath and Recovery) surveys, Frankenberg and Thomas find that in utero exposure to the tsunami during the second trimester has a large initial adverse effect on height-for-age *z*-scores, but that this diminishes over time. Based on these findings, Frankenberg and Thomas note that public and private responses to shocks can be effective in blunting their malign consequences. Short-term shocks do not necessarily translate into long-term adverse consequences. History is not destiny.

There are, however, some caveats to their findings. In their introductory remarks, Frankenberg and Thomas comment that looking at aggregate effects may mask impacts that differ across income or other distributions. This is an important and correct point, but one that does not receive as much attention as one might like. They document recovery from the tsunami but offer relatively little in the way of explanation about why this occurs. And a case could be made for making their conclusions more nuanced. Over the time frames and outcomes they consider, there are no measurable impacts of these shocks on children's health and human capital outcomes. But this does not mean that there are *no* effects; it may be that more time must pass before these begin to manifest themselves. This was true of the Dutch Famine discussed in their introduction and is an issue I return to below.

Dean, Schilbach, and Schofield provide a terrific introduction to the literature on the measurement and interpretation of cognitive function; appendix table 2A.1 provides a useful summary of these. They provide a state-of-the-art assessment of how poverty in its various manifestations can affect cognitive function; the discussion of the effect of the physical environment (noise, heat, air pollution) being especially noteworthy. They note that poor cognitive function can contribute to poverty through the adverse consequences of lowered attention, poorer inhibitory control, memory, and poorer higher-order executive function. As they provide more than fifteen pages of references—a testament to the thoroughness of their research—it is a little churlish to ask for more discussion of certain points. But with that caveat, there are three areas where further discussion would be helpful:

- While they provide an excellent summary of various measures of cognitive function, there is much less discussion of the magnitudes of these measures. Does poverty in its various guises have linear or nonlinear effects on these? Does cognitive function have linear impacts on the outcomes considered or are there threshold effects? How much of a change in any of these can be considered a "big" effect?
- How feasible is it to take these out of the lab and into the field? Would it be helpful to do so, for example, in order to obtain population-level

assessments of these aspects of cognitive function? If this is not feasible, does this limit our ability to assess the interplay between poverty (and possibly poverty traps) and cognitive function?

- The discussion of the determinants of cognitive function seems to focus heavily on contemporaneous causes. To what extent are these a function of early life experiences? Are they transmitted intergenerationally? Once individuals reach adulthood, how malleable are these and what do the answers to these questions imply for poverty and poverty traps?

Complementarities

There are two straightforward complementarities in the Frankenberg and Thomas and Dean, Schilbach, and Schofield chapters. First, both provide immensely helpful overviews of the literatures that they nest their work within. They emphasize that identification of effects is challenging. They stress that making progress on these difficult topics requires economists to "raise their game," including long-term data collection efforts such as the Indonesia Family Life Surveys and by engaging more substantively with other disciplines. Second, much of the literature on asset poverty traps sees assets in terms of financial resources, machinery and equipment, and land and livestock (Carter and Barrett 2006). As both chapters make clear, research on poverty traps can be enriched through expanding the set of assets to include health and cognitive function.

The third complementarity, and arguably the most important, is more subtle. Various dimensions of undernutrition in early life have neurological consequences that lead to cognitive impairments. Prado and Dewey (2014) provide a recent review of this literature, updating an older review by Levitsky and Strupp (1995). This earlier work showed that the prefrontal cortex may be especially vulnerable to undernutrition as well as reduced myelination of axon fibers, thus reducing the speed at which signals are transmitted (Levitsky and Strupp 1995); that undernourished children score poorly on tests of attention, fluency, and working memory is consistent with this (Kar, Rao, and Chandramouli 2008). Undernutrition adversely affects the hippocampus by reducing dendrite density (Blatt et al. 1994; Mazer et al. 1997; Ranade et al. 2008) and by damaging the chemical processes associated with spatial navigation, memory formation (Huang et al. 2003), and memory consolidation (Valadares and de Sousa Almeida 2005). Chronic undernutrition damages the occipital lobe and the motor cortex (Benítez-Bribiesca, De la Rosa-Alvarez, and Mansilla-Olivares 1999), producing dentrites with fewer spines and greater numbers of abnormalities, thus leading to delays in the evolution of locomotor skills (Barros et al. 2006) with adverse consequences for learning. Levitsky and Strupp (1995) note that early life undernutrition decreases the number of neurons in the locus coeruleus, which plays a role in signaling the need to inhibit the production of cortisol. Thus, early life malnutrition diminishes the ability to exhibit down regulation and handle stressful situations.

Do these malign effects have persistent effects on attention, inhibitory control, memory, and higher-order cognitive function—the four areas identified by Dean, Schilbach, and Schofield? Galler et al. (2005), using case control cohort data, report that children who suffered from kwashiorkor in their first year of life had, relative to well-nourished peers, poorer socialization skills at ages five to eleven years, a greater propensity for aggressive behavior at ages nine to fifteen, and a greater likelihood of attentional deficits (60 percent versus 15 percent for controls) at age eighteen. Particularly relevant, given the findings of Frankenberg and Thomas of no discernable effects on anthropometry in their Indonesian studies, is the fact that the malnourished children in the Galler et al. study were treated for kwashiorkor and recovered, exhibiting neither chronic nor acute undernutrition subsequently. Galler et al. (2012) find that these attentional deficits persist into mid-adulthood (ages thirty-seven to forty-three), and Galler et al. (2013) find that, as adults, these malnourished children were more likely to exhibit anxiety, lowered sociability, less intellectual curiosity, a more egocentric rather than altruistic orientation, and a lowered sense of efficacy. Hoddinott et al. (2013) find that children who were chronically undernourished at age two years scored lower on tests of vocabulary, reading, and fluid intelligence. That said—and as discussed in a different way by Frankenberg and Thomas—Prado and Dewey (2014) emphasize that the timing of nutrient deficiency, the form and degree of the deficiency, and the potential for environmental factors (such as compensating public or parental investments) all play a role in attenuating or accentuating the effect of shocks on cognitive function.

These biomedical literatures—which receive too little attention from economists—suggest a deep complementarity between the chapters by Frankenberg and Thomas and Dean, Schilbach, and Schofield. Frankenberg and Thomas provide a guide to the literature on the impact of shocks in early life and a cautionary case study in over interpreting the short-run impact of these. The biomedical literature tells us, however, that depending on environmental responses, these short-run shocks can have adverse consequences for cognitive function, some of which may not become apparent until adulthood. Dean, Schilbach, and Schofield give economists the tools to assess many of these as well as an understanding of how they link to lowered living standards in adulthood. Together, they suggest that early life shocks that result in undernutrition, whether temporary or permanent, can contribute to poverty traps in adulthood through their effect on reduced cognitive function. But our evidence base on the magnitude and extent of such contributions is limited; this represents an important area for future research.

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