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Aggregate Economic Shocks, Child Schooling and Child Health

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Abstract

Do aggregate economic shocks, such as those caused by macroeconomic crises or droughts, reduce child human capital? The answer to this question has important implications for public policy. If shocks reduce investments in children, they may transmit poverty from one generation to the next. This paper uses a simple framework to analyze the effects of aggregate economic shocks on child schooling and health. It shows that the expected effects are ambiguous, because of a tension between income and substitution effects. The paper then reviews the recent empirical literature on the subject. In richer countries, like the United States, child health and education outcomes are counter-cyclical: they improve during recessions. In poorer countries, mostly in Africa and low-income Asia, the outcomes are pro-cyclical: infant mortality rises, and school enrollment and nutrition fall during recessions. In the middle-income countries of Latin America, the picture is more nuanced: health outcomes are generally pro-cyclical, and education outcomes counter-cyclical. Each of these findings is consistent with the simple conceptual framework. The paper discusses possible implications for expenditure allocation.

This paper—a product of the Poverty and Human Development and Public Services Teams , Development Research Group—is part of a larger effort in the department to to understand the determinants of outcomes in child education, health, and nutrition. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors can be contacted at fferreira@worldbank.org and nschady@worldbank.org.

Aggregate Economic Shocks, Child Schooling and Child Health

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1. Introduction

Investments in children's health and education have long-term consequences. In both the United States and the United Kingdom, low levels of cognitive development in childhood, measured by a child's performance on tests administered as early as 22 months of age, have been shown to be important predictors of adult wages (see Currie and Thomas, 1999, and Case and Paxson, 2006). In developing countries, long-term panels suggest that adverse experiences in early childhood result in worse outcomes in adulthood. A well-known study in Jamaica shows that children who were stunted (had height-for-age two standard deviations or more below that of a reference population) in early childhood were significantly more likely to have deficits in cognition and school achievement in adolescence, and had poorer emotional and behavioral outcomes (Walker et al., 2005, 2007). In Guatemala, children exposed to a nutritional intervention have better reading comprehension and perform better on tests of cognitive development in adulthood, and earn higher wages (Maluccio et al., 2008; Hoddinott et al., 2008; see also Martorell, 1999). Almost universally, dropping out of school earlier is associated with lower labor earnings in adulthood.

The persistence of the effects of early-life investments in nutrition, health and education has rightly attracted considerable academic and policy interest in their determinants. In this paper, we review the recent empirical evidence on one particular set of factors that affect investments in the human capital of children, namely aggregate economic shocks. Following the literature, we focus primarily on the effects of the macroeconomic cycle, understood as the sequence of aggregate economic expansions ('booms') and contractions ('recessions' or 'crises'). In some cases, the shocks were caused by policy errors, or by exogenous variations in the price of a key export product. In other settings, the contraction resulted from natural phenomena, such as droughts. The common feature of the macroeconomic events we review was a substantial temporary reduction in overall production and income levels.[2,3]

[2] This paper does not address the impact of idiosyncratic shocks, such as death, illness, or employment loss of the main breadwinner, on the accumulation of human capital of children, for two reasons. First, there is a large separate literature on this subject. Second, the economics of idiosyncratic shocks is substantively different in some important respects. As we discuss in detail below, the effect of *aggregate* shocks on child schooling and health is a function of income and substitution effects. The substitution effect results from reductions in the opportunity cost of time of children and adults during recessions; this is absent in the case of idiosyncratic shocks. As a result, even within the same country and time period, aggregate and idiosyncratic shocks can have quite different effects on the accumulation of human capital. For example, focusing on Brazil in the 1990s, Duryea and Arends-Kuenning (2003) find that aggregate economic shocks generally result in increases in school enrollment of children, while Duryea,

There is now a large literature on the effects of such aggregate shocks on both schooling and health outcomes for children, in countries that span the development spectrum: from Zimbabwe to the United States. Although early work on this topic often betrayed a general presumption that economic crises would have a negative impact on education and health outcomes, the actual empirical findings reveal no such simple regularity.[4] Some recessions have led to reductions in school enrollment, as in Costa Rica between 1981 and 1982, while others have led to substantial increases, as in the United States during the Great Depression. There is similar variation for child health outcomes: negative covariate shocks in Zimbabwe, associated with the 1982-84 drought, led to persistent losses in height-for-age for affected children, while infant and adult mortality are both pro-cyclical in the United States.

We review the literature on the effects of aggregate shocks on child education and health in light of a simple conceptual framework which relates the disparate nature of these outcomes to the basic economic mechanisms at work. On the basis of a simple model of educational choice and of a stylized "production function" for health outcomes, we argue that the effect of crises on both schooling and child health is theoretically ambiguous. In the case of schooling, the basic tension is one between the substitution and the income effects of the recession: declines in average wages tend to lower the child wage rate and thus the opportunity cost of schooling (leading to a "pro-schooling" substitution effect), while declines in overall income levels raise the marginal utility of whatever the child can contribute to the family's budget today (an "anti-schooling" income effect). Our framework suggests four factors that should help determine which of the two effects dominate: the initial household income level; whether or not it is credit-

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Lam, and Levison (2007) find that idiosyncratic shocks such as unemployment of the household head generally result in lower school enrollment.

[3] The economic consequences of "slow-onset" natural shocks, such as prolonged droughts, have much in common with those of recessions, and we discuss some examples here. On the other hand, "sudden-onset" natural disasters, such as earthquakes, severe floods or hurricanes, are arguably different in a number of respects. They may cause sudden and widespread loss of life, and destroy large amounts of existing physical and human capital. On the other hand, their effects on relative prices and income flows may or may not be as long-lasting. These are different phenomena, and we do not consider them in this paper. Recent examples of the analysis of sudden-onset shocks include Poertner (2008) on the effects of hurricane shocks on educational attainment in Guatemala, and del Ninno and Lundberg (2005) on the effects of the 1998 floods in Bangladesh on nutritional status.

[4] An example of the presumption that recessions would hurt human capital accumulation rates can be found in the influential volume edited by Lustig (1995). Although she provides a careful and balanced review of the declines in infant mortality and illiteracy rates, as well as of the increases in completed years of schooling, during the recessions of the 1980s in Latin America, she nevertheless concludes that "smaller earnings may have led households to postpone their entry into primary school…and young adults to join the workforce instead of continuing their education" (p.13). The 2000/2001 World Development Report similarly states that "most social indicators either deteriorate or improve at a slower pace during a macroeconomic crisis" (p. 164).

constrained; the magnitude of the income shock; and whether there are any contemporaneous changes in the quality of the education services provided.

Health outcomes are better conceived in terms of a simple "production function" where outcomes are determined by private expenditures on health-promoting goods, private allocation of time to health-promoting activities, and public expenditures on health care. Recessions have an ambiguous effect because they tend to lower private and public expenditures on health, but they increase the time allocated to child care by family members.

We discuss the conceptual framework in more detail in Section 2, and then review the empirical literature in Section 3. We organize our review of the evidence in terms of the predictions of our model, and find that the framework is helpful in understanding the diversity of experience across countries and periods. Section 4 concludes, and considers implications for the policy debate.

2. A conceptual framework

I. Schooling outcomes

Our conceptual framework for schooling outcomes draws on a simple model of educational choice (Ferreira, 2008), in which agents live for two periods, and derive utility from private consumption in each period. [5] In the first period, they must decide how to divide their time between schooling and work (child labor). If they work, they are paid an unskilled wage. [6] The wage they are paid in the second period depends on how much human capital they chose to acquire in period 1. The level of human capital is a function of how much they studied, but also of the (exogenously given) quality of the school they attended. Human capital, or the schooling process that builds it, does not generate utility directly. Schooling is an investment, useful only as a means to increase earnings in the future.

The key trade-off, therefore, is between child work that increases first-period consumption, and schooling that increases second-period consumption. The optimal schooling choice always depends on the following three factors: (i) the child wage rate in period 1 (w); the

[5] The basic idea of investment in human capital as a time-allocation decision in an inter-temporal utility maximization problem goes back to Becker (1965) and Ben-Porath (1967). It has been extended in Becker (1991), and applied to a discussion of the efficiency of child labor by Baland and Robinson (2000). Ferreira (2008) builds on these models.

[6] Although child labor is modeled as earning a wage, the same argument applies if children work in self-employment, family businesses or domestic chores, provided they produce goods or services to which a monetary value can be attached.

expected returns to schooling in period 2 (π); and the quality of the schools (q). It also depends on whether or not the family has access to a functioning credit market, which would allow it to separate the investment decision from the inter-temporal consumption decision. If credit markets work, school choice will also depend on the interest rate; on the other hand, if they do not, the choice is influenced by initial income or consumption levels in the household.[7]

Either way, the basic insight can be illustrated by Figure 1, where the optimal schooling choice is plotted against the child wage rate. With the wage on the horizontal axis and the quantity of schooling demanded on the vertical axis, this relationship is simply the demand for schooling, derived from the first-order conditions of the household's maximization problem. In Ferreira (2008), the investment in schooling variable on the vertical axis is interpreted as the share of the child's time spent in school (or studying), as opposed to working. Since the only determinant of the schooling choice which is plotted on the diagram is the wage rate, the other determinants can be thought of as "shifters". When credit markets are missing, for instance, there would be three basic shifters: expected returns to schooling in period 2 (π); school quality (q); and initial consumption levels (c_1).

Imagine that before an aggregate shock (a recession, say), a particular household is at a point such as *A*, investing S_0 in education (with the implication that the child spends a share $1 - S_0$ of her time working).[8] When a recession hits the economy, the shock affects at least two parameters in this decision problem: the contemporaneous unskilled wage rate (which falls from w_0 to w_1), and other sources of household income that determine period 1 consumption (c_1).

The effect on schooling depends, first of all, on whether the household has access to a functioning credit market. If it does, the recession does not translate into an effect on the schooling choice. The household would simply borrow to smooth out the income shock.[9] But

[7] As well as on the expected value of other income sources in period 2, and on the discount rate. We do not focus on those variables in this paper.

[8] For simplicity, we assume an interior solution in this discussion. Of course, if returns to education are sufficiently high relative to the marginal utility of period 1 consumption, a corner solution may obtain, where children fully specialize in schooling. Whether a recession has any impact on schooling then depends on whether the downward shift of the demand for schooling is large enough to shift to an interior optimal. See also Baland and Robinson (2000).

[9] This is a particular manifestation of the general result that perfect credit markets make investment decisions independent from household wealth. Formally, in the Ferreira (2008) model, with perfect credit markets the marginal rate of intertemporal substitution, $[\beta u'(c_2)/u'(c_1)]$ is replaced in the first-order condition by a function of the interest rate, $1/(1+r)$, which is invariant in c_1. If, instead, schooling were partly seen as consumption, entering the utility function directly, then there would be an income effect arising from the impact of the recession on the full intertemporal budget constraint (as opposed to the effect on contemporaneous income).

there is a substitution effect: the child wage rate has fallen, reducing the opportunity cost of studying. This effect corresponds to a movement along the original demand curve, from point A to point B. The implication is that, with functioning credit markets and when schooling is seen as an investment rather than a consumption good, we should expect schooling to behave counter-cyclically: enrollment should rise in recessions, and fall during expansions.

There are, however, two caveats to this prediction. First, if the recession were somehow to lower expected future returns to schooling, this would shift the demand curve downwards, leading to an offsetting effect on the quantity demanded. This would be the case, for instance, if a recession led to larger (proportional) declines in income for more skilled workers, and if a component of this shift were expected to be permanent. Second, a similar effect would obtain if the recession reduced the contemporaneous quality of schooling, say through reduced public expenditures on materials or teacher salaries.

In most developing countries, however, access to credit markets is by no means universal. If credit markets are missing, or function very badly, then first-period consumption is a shifter of the demand for schooling. As c_1 falls, so does the optimal schooling choice at every wage rate, because the marginal utility of period 1 consumption rises relative to that of period 2 consumption (which is what schooling buys). This shifts the schooling demand curve downwards, to a curve such as D_1 or D_2. There are now two effects from the recession: an income effect, corresponding to segments AC or AE, and the same substitution effect, corresponding to arcs CD or EF.[10]

An immediate implication is that, when credit markets are missing or imperfect, the effect of a recession on the quantity of schooling demanded, usually measured in terms of school enrollment or completed years of schooling, is theoretically ambiguous. If the income effect is small relative to the substitution effect (as in curve D_1), then the end-point is a place such as D, where schooling remains above the initial level S_0. This result is qualitatively equivalent to the "functioning credit market scenario", since the substitution effect arising from the lower child wage dominates. Schooling outcomes then tend to be counter-cyclical. If, on the other hand, the income effect is large relative to the substitution effect (as in curve D_2) then the household could

[10] Naturally, the caveats raised above for the perfect credit market case also apply here: Any reduction in expected future returns to schooling or in contemporaneous school quality will reinforce the income effect.

end up at a point such as F, where schooling is below the initial level. This scenario corresponds to a pro-cyclical pattern of schooling investment.

In addition to drawing attention to the theoretical ambiguity of the effect of aggregate shocks, this simple framework provides us with some basic testable predictions of what factors are likely to determine the relative importance of the income and substitution effects. We highlight four such factors.

First, if access to credit is limited, the initial level of income matters. At higher initial levels of consumption, its marginal utility is lower, and the same proportional reduction in income from a recession will shift the demand curve downwards by less. This would lead us to expect richer countries, like the United States or the richer Latin American countries, to be more likely to have a counter-cyclical demand for schooling than very poor countries, such as those in much of Sub-Saharan Africa and parts of Asia.

Second, as we have already seen, the degree of development of credit markets matters. In particular, we should expect smaller income effects, and smaller downward shifts of the demand curve in countries where access to consumer credit is more widespread and is better able to reach middle-income and poor households than in those where credit markets are undeveloped or inaccessible.

Third, for a given initial level of income, the magnitude and expected duration of the crisis matter. A deeper crisis, with a greater fall in GDP or in average wages, shifts the demand curve down by more, for a given initial consumption level, and for every child wage rate. Deeper and longer crises are thus more likely to lead to pro-cyclical schooling outcomes.

Finally, controlling for other characteristics of the recession, large reductions in public spending on education add a “quality effect” that reinforces the income effect, and thus result in a larger reduction in the demand for schooling at every given wage rate. This would lead us to expect that recessions where public expenditures on education are more protected would be more likely to have a counter-cyclical schooling pattern. In the next section, we review the evidence on aggregate shocks and schooling outcomes in light of these “theoretical predictions”, and find that theory and evidence are actually quite consistent.

II. Health and nutrition outcomes

The analogy between health outcomes and education outcomes, which are often discussed alongside one another, is not perfect. Naturally, it is possible to think of investments in health just as meaningfully as one can describe investments in education. But some aspects of the underlying economics are sufficiently different that the conceptual framework requires adaptation. In particular, the opportunity cost of health investments in terms of forgone child income is likely to be much less important than for schooling. Going to a preventive health check-up once in a while takes time, but nowhere near as much as going to school every day. Remaining healthy and well-fed is likely to increase a child's contemporaneous labor productivity, whereas spending four to seven hours a day in school might reduce it. Finally, whereas a child's time is an essential input into the education production function, the parents' time is an important input into the production function for child health. This is because activities such as antenatal check-ups for pregnant women or preventive health care visits for children, breastfeeding, cooking healthy meals, or collecting clean water all take time to carry out.

We therefore adopt a different conceptual framework to consider the effects of aggregate shocks on child health outcomes. We postulate a production function for child health which has three main arguments, namely: private expenditures on health-promoting goods (x); private allocation of time to health-promoting activities (t); and public expenditures on health care (g). There may be other arguments in this function, but these three all contribute with positive, but decreasing, marginal productivity to health outcomes. Because of the decreasing marginal productivity of each factor, the production function plots as a concave function of any one of the three inputs. Figure 2 plots it against private expenditures on health-promoting goods, and thus leaves time allocation (t) and public expenditures (g) as shifters.

This simple set-up also sheds some light on the nature of the mechanisms through which an aggregate economic shock affects health outcomes like infant mortality or child height-for-age. First of all, if a recession has no effect on how adults allocate their time towards health-improving activities, or on the levels of public provision of health services, then the primary channel of impact will be through the consumption of health-promoting goods. At their most basic, these consist of nutritious foodstuffs, but may also include protective clothing and apparel, such as shoes or mosquito nets, medicines, and hygiene products.

The composite health-promoting good x is part of overall household consumption c. Unless x is inferior (in the sense that its consumption level decreases with total consumption c), then a recession that lowers family incomes will also lower consumption of these goods, say from x_0 to x_1. By moving from point A to point C in Figure 2, child health outcomes in the family are reduced, and child health is expected to be pro-cyclical. If *public* health expenditures also fall during the recession, this would shift the curve from $h_0\ (x, t, g)$ to $h_2\ (x, t, g)$—in addition to the negative effect on health from declining private expenditures (A to C), there is a further deterioration caused by declining expenditures from the public sector (C to D). This second kind of recession leads to even more pro-cyclical health outcomes.

It may be, however, that decreases in the consumption of health-promoting goods and (possible) reductions in public health expenditures are offset by other effects. Health-*reducing* goods such as smoking and drinking may also be normal, in which case consumption of them might decrease during recessions. Recessions also increase the time available to adult household members for health-promoting behaviors. If reductions in employment or hours worked free up time that can be used in better child care, the production function shifts upwards. If this increase is large enough to offset any effect from falling g, then the curve could move from $h_0\ (x, t, g)$ to a position such as $h_1\ (x, t, g)$, where child health outcomes are actually higher than before the crisis (comparing points A and B). Below we discuss the evidence on these changes, primarily based on data for the United States.

Finally, there may be changes in the composition of women giving birth. Dehejia and Lleras Muney (2004) provide a useful discussion of this, drawing on Becker (1965), Ben-Porath (1973), Ward and Butz (1980) and Heckman and Walker (1990). Dehejia and Lleras Muney (2004) argue that decreases in women's wages, caused by an aggregate shock, have income and substitution effects on fertility. Children are time-intensive, so the substitution effect would result in women having more children during a crisis. On the other hand, the income effect reduces the demand for children. The relative importance of the income and substitution effects is likely to vary across households, with the income effect being more important for women who are credit constrained. The aggregate effect of a crisis on the composition of women is therefore ambiguous, and is an empirical matter. A number of papers using data from developing countries, including Paxson and Schady (2005), Baird, Friedman, and Schady (2007), and

Bhalotra (2008) analyze changes in the composition of women giving birth during macroeconomic expansions and contractions, and we discuss these results below.

As in the case of education, then, this simple framework suggests that the effect of aggregate shocks on child health outcomes is theoretically ambiguous. Also, it suggests a few testable predictions for the direction of change. We highlight three.[11]

First, the initial level of income matters because of the diminishing marginal productivity of consumption of health-promoting goods. Put differently, the marginal impact of a dollar of consumption on child health should be larger in a very poor country (or for very poor people in any country), where it is used to buy more nutritious food, than in richer countries (or for richer households), where it is used on less essential commodities. If that is the case, then the same proportional reduction in income levels will have a larger negative impact on health in poorer countries (where the slope in Figure 2 is steeper) than in richer countries.

Second, and also analogous to the case of education, recessions which are accompanied by large decreases in public health spending are likely to lead to even worse outcomes than a recession of similar magnitude but where productive health expenditures are protected.

Third, if child health outcomes are observed to behave counter-cyclically then this is likely to be due to a reallocation of adult time to child health-promoting activities. This effect is more likely to dominate over the private consumption effect in a richer country, where the marginal utility of private consumption is lower, and the opportunity cost of time higher. Graphically, this implies that a given upward shift in the $h\,(x, t, g)$ function will prevail over the effect of moving leftwards along the curve at higher income levels, when the function is flatter. A similar shift might also arise from reductions in the consumption of health-reducing goods, or from an "improvement" in the composition of the pool of mothers during downturns, but the evidence on these effects, both in the US and internationally, is more mixed (as we will see below).

These predictions suggest that health outcomes should generally be pro-cyclical in most developing countries, especially the poorest ones—with infant mortality and child malnutrition

[11] There are possible feedback loops between the education and health effects of a recession, which we do not consider here. For instance, a recession that encourages children to reduce the hours they work in a hazardous occupation, and enables them to benefit from school meals instead, might lead to health improvements. Conversely, a recession that worsens nutrition might reduce a child's ability to benefit from schooling. Whether or not such feedback loops are important is an empirical matter, on which further analysis is required. In terms of our framework, introducing these effects would simply either dampen or accentuate the power of some of our shifters.

increasing during economic downturns. Conversely, in richer countries, where the opportunity cost of adult time is high, health outcomes may be counter-cyclical, with infant mortality rising during expansions. As we show below, this is consistent with the bulk of the empirical evidence.

3. Empirical evidence

I. Child schooling

There are a number of papers that consider the impact of aggregate economic shocks on schooling outcomes in the developing world. Many of these focus on Latin America, including Binder (1999) and McKenzie (2003) on macroeconomic crises in Mexico; Schady (2004) on the economic crisis of the late 1980s in Peru; Duryea and Arends-Kuenning (2003) on economic fluctuations in Brazil; Funkhouser (1999) on a recession in Costa Rica in 1981-83; and Maluccio (2005) on the effects of a reduction in coffee prices on schooling outcomes in coffee-growing areas in Nicaragua. Outside Latin America, Thomas et al. (2004) consider the impact of the 1998 crisis in Indonesia; Jensen (2000) analyzes the effect of the 1986-87 drought in Cote d'Ivoire; and World Bank (2007) focuses on the impact of deviations from long-term rainfall in Malawi.

Before reviewing the evidence from developing countries, it is instructive to briefly discuss studies that focus on the United States. A number of papers consider high school enrollment and graduation rates in the United States during the Great Depression. Goldin (2001) shows that, between 1928 and 1938, high school graduation rates increased from approximately 30 to 50 percent (see also Black and Sokoloff, 2006). Further, as she points out, "between 1928 and 1938, Delaware, New Jersey, New York, and Pennsylvania, all hard hit by the unemployment of the Great Depression, experienced increases in their graduation rates that were among the greatest (of any state) on a percentage point basis" (p. S79) This counter-cyclical pattern in investments in education appears more recently, too: various authors have shown that college enrollment rates in the United States increase during economic downturns, and fall when the economy picks up. For example, Betts and McFarland (1995) show that a 1 percent increase in the unemployment rate of all adults is associated with a 4 percent increase in full-time attendance at community colleges, while Kane (1994) shows that the enrollment of both blacks and whites in college is negatively associated with average weekly earnings in manufacturing.

Turning to Latin America, Binder (1999) analyzes the relationship between changes in per capita GDP and school retention rates (school enrollment at the close of the school year,

divided by school enrollment at the beginning of the year), and continuation rates (the number of students beginning a given school level divided by those who graduated in the previous school year from the earlier school level) in Mexico. Over the period she analyzes, 1977 to 1994, Mexico saw two sharp macroeconomic contractions: in 1982-83, when per capita GDP fell by 9 percent, and in 1986, when per capita GDP fell by 6 percent. Binder shows that school retention and continuation rates in Mexico over the period were generally counter-cyclical, with sharp positive spikes in outcomes corresponding to the periods when the economy was contracting.[12]

McKenzie (2003) studies the effect of the Mexican Peso crisis of 1995-96 on a variety of outcomes, including school enrollment rates. The Peso crisis was a sharp setback to aggregate living standards: GDP per capita fell by 8 percent, and real wages contracted by 21.7 percent. McKenzie uses the *Encuesta Nacional de Ingreso-Gasto de los Hogares* (ENIGH) household surveys for 1992, 1994, 1996 and 1998 to estimate the effects of the crisis on schooling. He uses a differences-in-differences approach to test for changes in school enrollment leading up to and after the crisis. McKenzie shows that school enrollment grew by more between 1994 and 1996 (the crisis period) than either between 1992 and 1994 (before the crisis) or between 1996 and 1998 (after the crisis). Put differently, after accounting for underlying trends, enrollment rates were significantly higher in the crisis year, 1996, than they were in either the pre-crisis or post-crisis years. Table 1, reproduced from his paper, shows that the increase in the growth rate of enrollment between 1994 and 1996 (relative to changes over the 1992-94 period) is particularly apparent among boys aged 15-20. The same group also saw significant declines in enrollment between 1996 and 1998 (relative to changes between 1994 and 1996). Similar, if somewhat less clear, patterns are also apparent for girls in this age group.

The economic crisis in Peru in the late 1980s was particularly deep. As a result of macroeconomic mismanagement in 1985-87, GDP per capita fell by 10.5 percent in 1988, 13.4

[12] Binder also conducts an econometric analysis in which school retention and continuation rates in year t are regressed on log GDP levels in the same year, percentage changes in GDP in the calendar year in which a school year was begun, percentage changes in GDP in the year in which a school year was finished, and a time trend. She interprets the coefficient on log GDP, which tends to be positive and significant in most specifications, as the "income" effect, and the coefficient on GDP changes, which tends to be negative and significant in most specifications, as the "price" effect. It should be clear that these definitions of "income" and "price" effect do not correspond to the notions of income and substitution effect which are more commonly used in the literature, and which we adopted in Section 2. In any case, there is no clear pattern whereby the coefficient on log GDP is larger or smaller than the coefficient on GDP changes in Binder's regressions.

percent in 1989, and 6.9 percent in 1990, for a cumulative drop of approximately 30 percent.[13] Inflation skyrocketed during the crisis, reaching almost 7,500 percent in 1990. Wages and household consumption collapsed. While there are no comparable data for the country as a whole, per capita consumption in Lima, as measured by household surveys, fell by approximately 50 percent between 1985 and 1990 (Glewwe and Hall, 1994). The collapse in real wages was even more dramatic—estimates for Lima suggest that real wages fell by 80 percent between 1987 and 1990 (Saavedra, 1998; Saavedra and Maruyama, 1998).

Schady (2004) uses comparable, nationally-representative Living Standard Measurement Study (LSMS) household surveys for 1985/86, 1991 and 1997 to analyze the impact of this recession on schooling outcomes. Schady first shows that the probability of being enrolled in school was similar before, during, and after the crisis—if anything, enrollment rates in 1997 are lower than during the crisis year of 1991; the magnitude of the difference is small, approximately 1 to 2 percentage points, although it is statistically significant. More striking are the differences in the probability that children work, which is much lower during the crisis than before or after. For older school-aged children, ages 12-17, this probability is between 16 and 22 percentage points lower in 1991 than in 1985/86 or 1997.

Schady (2004) also analyzes the impact of the crisis on the number of years of schooling attained. Table 2, reproduced from his paper, shows that children who were school-aged during the entire crisis period have completed, on average, about 0.25 *more* years of schooling at any given age than those who were not school-aged during the crisis (upper panel). Schooling is completed in whole years, rather than fractions, so a more intuitive description of this result is that every fourth child who was fully exposed to the crisis has completed one more year of schooling than a comparable child who was not exposed. A disaggregation of these results to account for differences by the number of years of exposure to the crisis suggests that the positive effects of the crisis on school attainment levels are only apparent for children with "high" levels of exposure—that is, children who were school-aged for at least three of the five crisis years (lower panel). Schady suggests that the increase in school attainment during the recession may have partly been a result of the decrease in child labor, which freed up time that children could expend in more "effort" at school.

[13] Per capita GDP was essentially flat in 1991 and 1992, before beginning a recovery in 1993. Nevertheless, the crisis was so severe that it was not until 2005 that per capita GDP in Peru reached the pre-crisis, 1987 level—despite generally positive growth rates from 1993 onwards.

Duryea and Arends-Kuenning (2003) study the effects of macroeconomic crises on schooling outcomes in urban Brazil. The period covered by their analysis includes two aggregate economic contractions—between 1981 and 1983, when GDP per capita fell by 13 percent, following adoption by the government of an austerity plan agreed upon with the International Monetary Fund; and between 1990 and 1992, when GDP per capita fell by 8 percent, following a freeze in wages and prices to control inflation. Duryea and Arends-Kuenning first show that there is no evidence in the aggregate data that school enrollment rates changed appreciably for either boys or girls. They then exploit variation across states in the timing and depth of the economic shocks. Specifically, they construct state-level measures of aggregate labor market conditions by calculating the mean wage of low-skilled men, which they define as the average wage of men with less than four years of schooling living in a given state. Duryea and Arends-Kuenning show that an increase in unskilled wages is associated with increases in the probability that a child is employed, and decreases in the probability that she is in school. This effect is somewhat more muted during crisis years, but the sign of the regression coefficient is the same—in crisis and non-crisis years, higher state-level wages for low-skilled workers are associated with a lower probability that a child will attend school.

Funkhouser (1999) studies the effects of a sharp decline in living standards in Costa Rica, also between 1981 and 1983. This recession, which followed the adoption of a fiscal austerity package, resulted in a contraction of GDP of 14 percent between 1981 and 1982, and a fall in real wages of approximately 50 percent between 1981 and 1983. Funkhouser shows that, unlike the pattern found in Mexico, Brazil, and Peru, there was a drop in school enrollment rates of approximately 6 percent between 1981 and 1982, with larger changes in rural areas, and an increase in the fraction of children working during the same period. However, when he compares the educational attainment of children who were exposed to the crisis and those who were not, at ages 18, 19, 20-22, and 23-25, there are no differences in attainment between the two groups. It thus appears that the drop in school enrollment rates was only temporary, and children who were exposed to the crisis made up schooling deficits later on.[14]

[14] The lack of a crisis effect on school *attainment*, in spite of the decline in school *enrollment*, is somewhat puzzling. A number of authors (for example, de Janvry et al. 2006) have suggested that, once children have dropped out of school, they are unlikely to re-enroll for a variety of reasons: they have fallen behind their group of class peers and friends, and the opportunity cost of their time will have increased as they age. It is possible that the aggregate results for Costa Rica mask some underlying heterogeneity, with some children exposed to the crisis dropping out of school

In Nicaragua, Maluccio (2005) investigates the effects of a sudden reduction in the price of coffee between 2000 and 2002. The data he uses were collected for an analysis of the impact of the Nicaraguan pilot conditional cash transfer (CCT) program, known as the *Red de Protección Social*. These data are not nationally representative—rather, they cover households in select rural areas. Maluccio first uses household survey data to show that, between 2000 and 2002, per capita consumption for households in the control group—those that were randomly assigned not to receive transfers from the *Red*—fell by an average of 10 percent. The reduction in consumption in coffee-growing areas was larger, approximately 27 percent. Concurrent with these reductions in consumption levels, school enrollment of children aged 7-12 increased, and increased particularly in coffee-growing areas. For example, among boys, school enrollment increased by 15 percentage points, which suggests that the opportunity cost of going to school fell sharply.

In sum, in five countries in Latin America for which careful analysis has been done, there is little evidence that school enrollment systematically declined during aggregate economic contractions. Enrollment rose markedly during recessions in Mexico and Nicaragua, and marginally in Peru and Brazil. Only in Costa Rica did school enrollment behave procyclically. Nor does it appear that school attainment suffered: in Peru, children who were exposed to the crisis of the late 1980s had completed more years of schooling for their age than comparable children who were not exposed, while even in Costa Rica school attainment appears to have been unaffected by the economic contraction earlier in the decade, despite the decline in enrollment at that time.

Much less is known about the effects of aggregate income shocks on the *quality* of education and about how, if at all, any possible changes in quality affected the labor market performance of cohorts who received their education during crisis years. In Peru, public recurrent expenditures on education dropped sharply between 1987 and 1990, by approximately 50 percent (Schady, 2004). Recurrent expenditures are largely made up of teacher salaries, which were severely eroded by the hyperinflation of the late 1980s. The quality of instruction may have deteriorated during the crisis—for example, if there was a higher incidence of teacher absenteeism (although outside options for teachers would also have diminished in the economic

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and completing fewer years of schooling, and others completing more, as appears to have been the case in Peru (Schady, 2004).

downturn), or if teachers were less motivated. Understanding the impact of crises on the quality of education, as opposed to enrollment levels, is an important priority for future research.[15]

We now turn to evidence of the effects of shocks on schooling outcomes in countries outside Latin America, including Indonesia, Cote d'Ivoire and Malawi. The economic crisis of 1998 in Indonesia was a sudden reversal of fortune for a country that had enjoyed high growth rates for decades. In 1998 GDP per capita contracted by 14 percent, and by a further 1 percent in 1999. Since then growth has resumed, although at rates generally lower than those enjoyed by the country in the decade or so before the crisis.

Thomas et al. (2004) analyze the impact of the crisis on schooling outcomes. Table 3, based on their results, shows that there was a decrease in enrollment during the crisis, although the estimated changes are very small.[16] For no age group between 7 and 17 did school enrollment fall by more than 1 percent. Even among households in the lowest quartile of the distribution of per capita expenditures, changes in enrollment rates never exceed 2 percent; for most ages, changes were substantially smaller than this.

A different picture emerges from Jensen's (2000) analysis of the effects of drought on school enrollment in Cote d'Ivoire. Jensen uses panel data for 1986-87 to compare children in villages that were affected by drought and others that were not.[17] Jensen shows that, between 1986 and 1987, school enrollment of boys grew by 5 percentage points in villages that were not affected by droughts, while the school enrollment of girls grew by 10 percentage points; in

[15] One way to address this question would be to compare the performance of students on standardized tests in different years, but (to our knowledge) no such data are available from a developing country spanning the years before, during, and after a major economic recession. Another approach would be to see whether the wage premium paid to adults for each additional year of schooling is lower for those who received their education during the crisis years. We attempted to do this with the *Encuesta Nacional de Hogares* (ENAHO) surveys for Peru. Specifically, using surveys for 2002 and 2007, we traced out the earnings profiles of adults with no schooling, primary school, and secondary school by calendar year of birth. These graphs have the expected shape—the earnings profiles for workers with more schooling lie above those for workers with less schooling, and the difference between the earnings schedules increases with age. If school quality dropped appreciably during the crisis, we might expect to see a "dent" in the earnings profile of workers with primary school education, relative to those with no education, for cohorts that received their education during the crisis years. Children of primary school age, age 6-11 during the 1988-92 crisis, would have been 16 to 25 years of age in 2002, and 21 to 30 years of age in 2007. We see no clear evidence of any crisis patterns, although the estimates tend to be quite noisy, in spite of the reasonably large number of observations in these surveys (56,371 observations in 2002, and 65,549 in 2007). We thank Luis Barrantes for making these data available to us.

[16] Thomas et al. (2004) report percentage changes in school *non*-enrollment rates. These appear to suggest quantitatively large, negative effects of the crisis. However, because enrollment rates before the crisis were high, a small increase in non-enrollment translates into a large percentage change. When reported as changes in enrollment, the effects appear quite small.

[17] He defines villages as having suffered from a drought if rainfall was more than one standard deviation below the historical mean.

contrast, in villages that were affected by droughts, the school enrollment of boys fell by 14 percentage points, while that of girls fell by 11 percentage points. The implied negative difference-in-difference effects of the drought on school enrollment are quite large, on the order of 20 percentage points.[18] Similar negative effects of weather shocks on child schooling are reported elsewhere in Africa. In Malawi in 1994-95, a rainfall shock of 10 percent below the long-run average was associated with an increase of 23 percent in the fraction of students who missed two or more consecutive weeks of instruction in the last 12 months, with the largest effects concentrated among children in the poorest households (World Bank, 2007).

How does the evidence just reviewed compare with the testable predictions of the framework in Section 2? All else being equal, the theory would lead us to expect investments in schooling to behave counter-cyclically in richer countries, and in those with better developed credit systems, but pro-cyclically in poorer countries, and in those where access to credit is severely limited. In addition, deeper, more prolonged crises are more likely to have negative effects on schooling than shorter ones. To summarize the pattern of effects across countries, Table 4 reports per capita GDP levels at the time of the crisis, in PPP 2005 US dollars, the magnitude of the shock, and the effect it had on school enrollment.[19] (No comparable data are available on the development of the financial sector in these countries, although it is likely to be highly correlated with per capita income levels.)

The table shows that Mexico and Brazil had the highest income levels at the time their economies went into recession: consistent with the framework in Section 2, schooling outcomes in these countries were counter-cyclical—they behaved in a fashion similar to those in the United States. In terms of Figure 1, this is best represented as a movement from point A to points B or D: insofar as there was an income effect of the recession on schooling, it was dominated by the substitution effect. On the other hand, Malawi and Cote d'Ivoire were the poorest countries in the table. Here, the income effect appears to have dominated the substitution effect, with school enrollment behaving in a pro-cyclical manner. In terms of Figure 1, this involves a movement

[18] Although the results in Jensen (2000) are suggestive, the large, positive change in school enrollment rates in a single year in villages that were unaffected by the drought could be a source of concern. Moreover, because data are available for only two periods, Jensen cannot test whether the two groups of villages had different trends in outcomes, including enrollment, prior to the period he analyzes.

[19] Note that the studies for Nicaragua (Maluccio, 2005) and Cote d'Ivoire (Jensen, 2000) refer to rural areas, where incomes are likely to be much lower than in urban areas, so the GDP values in the table for these two countries give a somewhat misleading picture of the welfare of households affected by the crises described in these papers.

from point A to point F. [20] Peru and Indonesia lie somewhere in the middle—the effects of their economic crises on school enrollment were generally small, and in the expected directions.

Costa Rica and Nicaragua are somewhat harder to explain. In Costa Rica, there was a reduction in school enrollment in spite of the fact that per capita income levels at the time of the crises were reasonably high (similar to Peru), although enrollment appears to have recovered quickly. Nicaragua saw an increase in school enrollment during the period of the coffee crisis in spite of the fact that it is a poor country, more closely comparable in its GDP levels to Cote d'Ivoire than to the other countries in the table. This may be explained, however, by the fact that the magnitude of the negative shock in Nicaragua was smaller than in Costa Rica or Peru, leading to a smaller negative income effect.

II. Child health and nutrition

We next turn to the effects of aggregate economic shocks on child health and nutrition. As with the evidence on schooling, there are a reasonable number of studies from developing countries to draw on. A handful of these refer to Latin America, including Paxson and Schady (2005) on Peru, Cutler et al. (2002) on Mexico, Maluccio (2005) on Nicaragua, and Miller and Urdinola (2007) on Colombia. Other country-specific studies that consider the impact of aggregate economic shocks on health outcomes include Stillman and Thomas (2004) on Russia; Frankenberg et al. (1999) Rukumnuaykit (2003) and Strauss et al. (2004) on Indonesia; and Bhalotra (2008) on India. We also discuss findings from a recent study that uses Demographic and Health Surveys (DHS) to analyze the effect of positive and negative aggregate income shocks on infant mortality for 59 developing countries (Baird, Friedman, and Schady, 2007). Finally, we review the evidence of the effects of droughts on child nutritional status in Africa, including Hoddinott and Kinsey (2001), and Alderman, Hoddinott and Kinsey (2006) on Zimbabwe; Yamano, Alderman, and Christiaensen (2005) on Ethiopia; Alderman, Hoogeveen, and Rossi (2008) on Tanzania; and Jensen (2000) on Cote d'Ivoire.

[20] The cycle of production in agricultural areas may have reinforced the negative income effect in Malawi and Cote d'Ivoire. Rainfall shocks often coincide with the harvest season, and result in reductions in household income and consumption. This is the income effect of the shock on child schooling. By the time of the planting season, however, the demand for child labor once again increases, so there is no (pro-schooling) substitution effect. Indeed, if the shock to income is severe enough, the demand for child labor during the planting season may be higher as a result of the drought, as families try to eke out more output from the farm (even if the marginal product of additional child labor is low). We thank Harold Alderman for this point.

As with schooling, it is useful to begin by briefly reviewing the literature on the United States. A series of papers by Ruhm (2000, 2003, 2005, 2007) and Ruhm and Black (2002) argue that adult health status tends to improve during recessions in the United States. In part, this appears to be a result of increases in the fraction of adults who regularly exercise during recessions, and decreases in the corresponding fractions who smoke, drink excessively, and eat unhealthy foods.[21] Turning to child health, Chay and Greenstone (2003), and Dehejia and Lleras-Muney (2004) both document counter-cyclical patterns in infant mortality, with more babies dying during economic expansions.

Chay and Greenstone (2003) show that pollution falls during recessions. Using variation over time and across counties in pollution levels, they show that lower pollution levels, in turn, results in fewer infant deaths. Dehejia and Lleras Muney (2004) use state-level data to show a decrease in the incidence of low and very low birth weight babies and in infant mortality during recessions. Part of the explanation for these patterns is that there are changes in the composition of women giving birth, with significant reductions in the fraction of black mothers who are high-school dropouts during recessions. This is consistent with high-school dropouts being more credit-constrained than more educated women, and therefore preferring to have children during economic expansions, when incomes are higher, despite a higher opportunity cost.

When they consider changes in behaviors that might explain the differences in infant mortality rates, Dehejia and Lleras-Muney (2004) find that (both black and white) mothers have more prenatal care visits during recessions. The incidence of smoking and drinking during pregnancy declines for black mothers, but increases for white mothers, during recessions. The authors conclude that child health improvements during recessions in the United States are driven both by changes in the compositions of the pool of mothers and by behavioral "improvements" for blacks, and by the dominance of a higher prenatal care effect over a "deteriorating" pool of mothers and higher drinking and smoking, in the case of white mothers.

In contrast with the literature from the United States, the evidence on developing countries—including middle-income countries, such as those in Latin America—suggests that child mortality is counter-cyclical, decreasing in booms and increasing in crises. Paxson and

[21] More recent research suggests that improvements in health status during recessions do not affect all population groups, and are not apparent for all health outcomes. For example, Charles and DeCicca (2008) show that mental health deteriorates and obesity increases during recessions, especially for those whose (pre-recession) employment status is most marginal.

Schady (2005) analyze the effects of the crisis of the late 1980s in Peru on infant mortality using DHS data. They show that the crisis coincided with a large spike in infant mortality—from 50 to 75 per 1,000 children born. Using these estimates they calculate that the crisis resulted in approximately 18,000 "excess" deaths—deaths that would not have taken place without the economic crisis.[22]

Paxson and Schady (2005) make two other points. First, they show that the increase in mortality was not a result of possible changes in the composition of women giving birth.[23] Second, they show that the crisis came hand in hand with a dramatic collapse in public expenditures on health, which fell from approximately 80 Peruvian soles per capita in 1988 to 30 soles in 1990. Using the DHS data, Paxson and Schady also show declines in health service utilization by households during the crisis years, including a higher fraction of home births and fewer antenatal check-ups. They conclude that the health sector collapse may be part of the explanation for the spike in infant mortality. We return to this point below.

Cutler et al. (2002) use vital registration data to analyze the effects of economic contractions on mortality in Mexico between 1980 and 1998.[24] They focus on three crisis periods, corresponding to 1982-84, 1985-89, and 1994-96. To quantify the impact of these crises on the mortality of vulnerable groups, in particular children (age 0-4) and the elderly (age 60+), Cutler et al. assume that the mortality of prime-age males, age 30-44, was unaffected by the crises. They then compare changes in mortality among children and the elderly before and during the crisis with the corresponding changes in mortality among prime-age males. Based on this difference-in-differences estimation strategy, Cutler et al. conclude that the three crisis periods resulted in increases in child mortality of 9.2 percent (1982-84 crisis), 10.3 percent (1985-89)

[22] In the Working Paper version of their paper, Paxson and Schady (2004) also provide evidence of a deterioration in height-for-age for young children during the crisis.

[23] Paxson and Schady (2005) use Oaxaca-style decompositions to show that changes in the composition of women giving birth along various observable characteristics, such as education and place of residence, are small, and that holding constant these characteristics has little effect on their estimates of infant mortality during the crisis.

[24] The use of vital registration data is a source of concern. In most developing countries, including Mexico, under-reporting of deaths is common. Moreover, if, as seems plausible, the coverage of the vital registration system itself changes with aggregate economic conditions, the estimates may be systematically biased. For example, if fewer deaths are reported or accurately recorded during bad economic times, the associations reported by Cutler et al. (2002) would be downward biased.

and 6.9 percent (1994-96). Using a similar approach, they also report increases in the mortality of the elderly, ranging from 2 to 8 percent.[25]

Two papers look at the impact of sudden changes in the price of coffee on child health and mortality in coffee-growing areas. The first of these, by Maluccio (2005), discusses the impact of the sharp reduction in the price of coffee between 2000-02 on child nutritional status in coffee-growing areas in Nicaragua. Maluccio shows that the coffee price shock, and the attendant reduction in living standards, came hand in hand with a decline in the height-for-age z-score of children aged 6 to 48 months of 0.15 points, although the coefficient is only borderline significant.[26]

The results for Mexico and Nicaragua, like those for Peru, suggest a dominance of the (health-reducing) public and private expenditure effects of a recession over the (health-promoting) "time-for-care" and "lower externalities" effects in Latin America. This is not the case in the analysis by Miller and Urdinola (2007) of the impact of three sudden changes in the price of coffee on infant mortality in coffee-growing areas in Colombia.[27] Miller and Urdinola use population census data to analyze changes in the size of birth cohorts between the year immediately before a coffee price shock and the year of the shock itself. Implicitly, this assumes that the price shocks did not have an effect on the mortality of older children. The analysis also exploits differences between coffee-growing municipalities and other municipalities. The estimation strategy is therefore difference-in-differences (across municipalities and over time). Based on this, Miller and Urdinola conclude that infant mortality is pro-cyclical—increasing when there are positive price shocks (and therefore higher incomes in coffee-growing areas), and decreasing when shocks are negative. This pattern of results is similar to that found in the United

[25] Additional evidence for the 1994-96 crisis in Mexico reveals that private household expenditures on health care fell more than proportionately at the time (McKenzie, 2006). This may be one of the mechanisms behind the pro-cyclical behavior of health indicators in Mexico, and is direct evidence in support of a movement along the "health production function" in Figure 2, from a point such as A to one such as C. Interestingly, over the same period private expenditure on education actually rose as a share of total consumption, which is also consistent with a prevalence of the (pro-schooling) substitution effect discussed above.

[26] As with the analysis of changes in school enrollment patterns, these numbers refer to children in the control group, who were ineligible for transfers from the *Red de Protección Social*.

[27] These three price shocks correspond to a frost which devastated the coffee crop in Brazil in 1975, and resulted in an increase in coffee prices in Colombia of more than 50 percent; a severe drought in Brazil in 1985, which also led to increases in the price of coffee in Colombia of more than 50 percent; and the collapse of the International Coffee Agreement among producer countries in 1990, which resulted in a decrease in coffee prices in Colombia by approximately one-third.

States—see the discussion of Dehejia and Lleras Muney (2004) above. However, the magnitude of the coefficients reported by Miller and Urdinola is very large, perhaps implausibly so.[28]

We turn next to evidence from developing countries outside Latin America. Stillman and Thomas (2004) analyze the impact of an economic contraction in Russia in 1998 on household expenditures on food, food intake, and measures of nutritional status—including Body Mass Index (BMI) for adults, and height-for-age and weight-for-height for children. The 1998 crisis analyzed by Stillman and Thomas was particularly deep, involving a 30 percent contraction in GDP in the last two quarters of 1998, and an 18 percent decrease in per capita expenditures; however, the recovery was also quick—by 2000, income levels were back to their pre-crisis levels.

Stillman and Thomas (2004) use a rich data set that includes measures of expenditures as well as nutrient intake, as reported by households for 24-hour recall periods. They show that total *expenditures* on food dropped sharply during the crisis. When they consider the impact of the crisis on the *quantities* of various foodstuffs consumed, however, the results are more nuanced. For starches, meats, and dairy products, the crisis did not result in a decrease in the quantity consumed—rather, it seems, households switched from more expensive to less expensive sources of calories within these food categories. Only in the case of consumption of fruits and vegetables is there clear evidence of a sharp decrease during the crisis, and of a rebound thereafter. Despite this resilience in total caloric intake, however, there is some evidence of a deterioration in the nutritional status for children—estimates of the effect of the transitory shock to income on the weight-for-height z-score suggest a decline of about 0.11 points. On the other hand, there is no evidence of a deterioration in height-for-age, a more long-run measure of child nutritional status.

A variety of authors have studied the impact of the 1998 crisis in Indonesia on child health and nutrition, with mixed results. Strauss et al. (2004) show that there is no evidence that weight-for-height, height-for-age, or blood hemoglobin levels were negatively affected by the

[28] The infant mortality rate in Colombia in 1980 was approximately 37 per thousand children born (World Bank, 2008). In the main table of results in Miller and Urdinola (Table 2), the authors report the effects of the three price-change events they study, at the median coffee-growing intensity and for a 500 peso price change. These imply a change in cohort size of between 0.40 and 2.89 percent or, equivalently, between 4 and 29 fewer (more) cohort members per 1000 people born. This, in and of itself, is very large—for the larger estimate, it represents substantially more than half of infant mortality in Colombia in 1980. However, both the Brazilian frost and the Brazilian drought resulted in price increases of about 1,250 pesos. Taking the parameter estimates in Table 2 in their paper at face value, and focusing on the Brazilian drought, this would mean decreases in infant mortality of between 40 per thousand and 70 per thousand for the median county in Colombia.

crisis—see also Frankenberg et al. (1999). Of the child health outcomes they study, only mother-reported child health status appears to have worsened significantly. On the other hand, there is some evidence that infant mortality spiked up sharply, from about 30 per 1,000 in 1996 to 48 per 1,000 in 1998 (Rukumnuaykit, 2003; see also Simms and Rowson, 2003, who argue that infant mortality increased between 1996 and 1999 in 22 of Indonesia's 26 provinces).[29]

An important issue with regard to the Indonesian crisis is that expenditures on health appear to have been protected from sharp cuts. This point is made in the upper panel of Figure 3, which shows that although Government health expenditures contracted during the crisis, by about 20 percent, much of this shortfall was made up by donor assistance to the health sector, which increased sharply. This pattern of expenditures may help explain why, with the possible exception of infant mortality, child health outcomes do not appear to have suffered much. The lower panel of the figure shows that, by contrast, public health expenditures in Peru fell by more than half, and there is no evidence that these shortfalls were made up from other sources, including donor assistance.

Health outcomes appear to have deteriorated during economic contractions in most other developing countries. In a study using DHS data for India, Bhalotra (2008) analyzes the effects of aggregate income shocks on infant mortality. Methodologically, the approach is similar to that followed by Paxson and Schady (2005) in their analysis for Peru. However, Bhalotra arguably has better data and a more credible identification strategy because she exploits differences across states in GDP growth rates, and in the magnitude and timing of deviations from GDP trends, rather than simply using national averages. Bhalotra concludes that there is no clear pattern of effects in urban areas. In rural areas, however, infant mortality appears to be counter-cyclical—like in Peru, Mexico, and Indonesia. The magnitude of her estimates implies that a negative income shock of median size in the data is associated with an increase in mortality of approximately 2 per 1,000, which is equivalent to approximately two-thirds of the annual linear decline in rural mortality in India over the period she studies. Bhalotra also argues that high-risk women were more likely to select out of fertility during aggregate downturns in India, and she controls for this by using mother fixed effects.

[29] Even with regard to infant mortality, there is no conclusive agreement. World Bank (2000) concludes that "infant mortality rates seemed to have continued a downward trend (during the crisis)" (cited in Simms and Rowson, p. 1385).

Pongou, Salomon, and Ezzati (2006) focus on the effects of the macroeconomic decline in Cameroon between 1991 and 1998. They show that this decline was associated with an increase in weight-for-age malnutrition, which increased by 9 percentage points for boys, and 3 percentage points for girls. Increases in malnutrition were larger among children of mothers with no education than those with primary schooling, and larger for mothers with primary schooling than those with secondary schooling; they were also larger in rural areas than in urban areas, and among households with few assets.

Finally, Baird, Friedman, and Schady (2007) use data from DHS covering 59 developing countries and approximately 1.7 million births. On the basis of these data they construct country-specific infant mortality series, and merge these with data on per capita GDP. After flexibly removing country-specific trends in the infant mortality and GDP series, they show that income shocks have large negative effects on infant mortality: a one percent decrease in per capita GDP is associated with an increase in infant mortality of between 0.31 and 0.79 percent.

Baird, Friedman, and Schady (2007) present various extensions to this basic finding. First, they include mother fixed effects in their regressions and show that changes in infant mortality are not accounted for by the changing composition of women giving birth—the estimates that include fixed effects are very close in magnitude to those that do not. Second, they merge their data with data on weather shocks (droughts, floods) and conflicts, and show that the association between changes in per capita GDP and changes in infant mortality is unaffected by the inclusion of these additional controls. This is important as weather shocks and conflict could have independent effects on mortality, above and beyond their effects on aggregate incomes. Finally, Baird, Friedman, and Schady argue that there are important asymmetries in the relationship between GDP shocks and infant mortality. Figure 4, reproduced from their paper, presents the results of nonparametric regressions of the infant mortality rate on the logarithm of per capita GDP, separately for boys and girls, after country-specific cubic trends have been removed from both time series. The units on the vertical axis thus correspond to the number of infant deaths per 1,000 children born, while those on the horizontal axis correspond (approximately) to percentage changes in per capita GDP. The picture shows that positive income shocks tend to imply quantitatively small improvements in infant mortality, even when these shocks are large; moreover, these improvements in income affect the likelihood of survival

for boys and girls in a similar way. On the other hand, negative income shocks have much larger effects on infant mortality, especially for girls, and especially for the largest, negative shocks.

In other parts of the world, such as Africa, aggregate economic fluctuations are often caused by weather shocks, and we discuss the findings from a substantial body of research that has studied the effect of droughts on child nutrition in Africa.[30] We begin by discussing two papers on Zimbabwe (Hoddinott and Kinsey, 2001; Alderman, Hoddinott, and Kinsey, 2006). Using five rounds of panel data, Hoddinott and Kinsey show that children who were 12-24 months during a drought in 1995-96 grew by approximately 1 cm. less than other children in this age range in non-drought years. When they control for a variety of child and household characteristics, the coefficient on drought exposure among young children increases, implying a deceleration in growth of approximately 1.7 cm. Hoddinott and Kinsey also show that children in older age groups do not appear to experience a similar growth slowdown, consistent with the nutritional literature which suggests that children are particularly vulnerable to nutritional insults between weaning and the second birthday (Shrimpton et al., 2001; Martorell, 1999).

Alderman, Hoddinott, and Kinsey (2006) focus on the effects of a two-year drought in 1982-84, and on the civil war in Zimbabwe prior to 1980. They first show that children who were exposed to the drought had lower growth trajectories than other children—consistent with the results in Hoddinott and Kinsey (2001). Similar results also hold for "exposure" to the civil war, which resulted in significantly lower height-for-age. Alderman, Hoddinott, and Kinsey then show that children who were shorter as a result of exposure to the drought or civil war do not make up these growth deficits later on: they become shorter adolescents. Further, they start school later, and attain fewer years of schooling.

Negative effects of droughts on child nutritional status are also reported elsewhere in Africa. Jensen (2000) shows that drought exposure is associated with an increase of 3.5 percentage points in the fraction of children with weight-for-age more than 2 standard deviations below the international norm (from a base of approximately 5 percent). Yamano, Alderman, and Christiaensen (2005) estimate that a 10 percentage point increase in the proportion of plots that

[30] The analogy between the effects of weather shocks and macroeconomic contractions on child health and nutrition is not perfect. Weather shocks may be particularly damaging for nutrition outcomes if, in addition to their income effect (and in a context of poorly integrated markets), they directly affect food availability, or increase the relative price of food. Furthermore, weather shocks may change the disease environment—for example, a drought may reduce breeding grounds for mosquitoes carrying vector-borne diseases, such as malaria. These effects of the weather shock can themselves have consequences for child health, separate from the income effect.

are damaged by drought is associated with a decline in child growth rate of approximately 0.12 cm. over a six month period in Ethiopia. Finally, Alderman, Hoogeveen, and Rossi (2008) use a panel extending for more than 10 years in the Kegara region of Tanzania to show that children who experienced weather shocks in early childhood were more likely to have low height-for-age, start school late, and have completed fewer years of schooling in adolescence. They use various simulations to show that this, in turn, translates into substantial reductions in earnings in adulthood.

Although much of the literature on the effects of droughts on investments in early childhood has focused on Africa, we close with a discussion of a recent paper by Maccini and Yang (2008) that uses data from Indonesia. Maccini and Yang match health, education and labor market outcomes for adults in a recent round of the Indonesian Family Life Survey (IFLS) with locality-specific rainfall for their birth year. Their results suggest substantial effects of rainfall in the first year of life on adult outcomes for women, but not for men. Women who were born in localities with higher rainfall have better self-reported health status, are taller, and have completed more years of schooling; these women had also accumulated more assets in adulthood. The coefficients for comparable regressions for men are never significant, suggesting that, in Indonesia, investments in boys are better protected from income fluctuations than investments in girls. These gender differences are reminiscent of the asymmetric effect of recessions on infant mortality reported by Baird, Friedman and Schady (2007).[31]

To summarize, the picture on the effects of economic shocks on child health seems empirically clearer than that for schooling outcomes. In rich countries (effectively, in our sample of studies, for the United States), health status is counter-cyclical (i.e. mortality and morbidity fall during recessions). In terms of the conceptual framework, this is consistent with a move from point A to point B in Figure 2. Increases in adult time spent on health-promoting activities and, in the case of blacks, a reduction in the consumption of alcohol and cigarettes more than make up for reductions in the private consumption of health-increasing goods.

In developing countries, on the other hand, child health is pro-cyclical (i.e. infant mortality and malnutrition increase during recessions). In terms of Figure 2, this is consistent with a move from point A to point C during downturns or, in countries like Peru, where there

[31] One limitation of the analysis by Maccini and Yang is that they do not separate results for positive and negative rainfall shocks. It is possible that gender interacts in important ways with the direction of the rainfall shock—see the discussion of Baird, Friedman and Schady (2007) above.

were also sharp reductions in public health expenditures at the time of the crisis, to point D. The only exception to this pattern, among the studies we have surveyed, are the results in Miller and Urdinola (2007) on pro-cyclical infant mortality in Colombia.

4. Conclusions and policy implications

The simple framework in Section 2 suggests that the effect of aggregate economic shocks on child health and education outcomes is theoretically ambiguous—and therefore, that we should expect it to vary across countries and episodes. But the framework also suggests some elements of *how* we should expect it to vary.

Richer countries, and those with deeper and better-functioning credit markets, are more likely to see improvements in both health and education during downturns. School enrollment increases because the income effect of a crisis is weaker for initially richer countries, and for households with greater access to credit markets, leading to a dominance of the "pro-schooling" substitution effect. Health improves because the marginal product of public and private expenditures in health is lower in rich countries and households, relative to the health contribution of additional parenting time (and, in some cases, lower consumption of goods with negative externalities).

In the poorest countries, we would expect to see exactly the opposite pattern: education and health outcomes should be pro-cyclical, with things getting worse in recessions. Middle-income countries should fall somewhere in between, and the resolution of the (different) trade-offs in health and education are an empirical matter. The review of the literature in section 3 is highly supportive of the predictions for rich and poor countries—largely the United States at one extreme, and Africa and a few low-income Asian countries at the other. It is also quite informative of the empirical outcomes for middle-income countries, largely in Latin America. Table 5 provides a schematic summary of these findings.

As Table 5 illustrates, recessions, droughts and other economic downturns tend to have negative effects on both health and education outcomes for children in poor countries. This was apparent for school enrollment and child health in a variety of African countries. To some extent, the picture that emerges for Indonesia during the 1998 crisis is similar, although the magnitude of the negative effects is much smaller—perhaps because Indonesia was wealthier than the African countries that were analyzed, or perhaps because public expenditures on education and

health were better protected in Indonesia. At the other end of the spectrum, economic downturns appear to be robustly associated with improvements in child health and education outcomes in the United States.

Between those two extremes in the income scale, there lies a middle-income range populated (not exclusively) by a number of Latin American countries. In this intermediate range, results are different for health and for education. In practice, with the exception of the results for Colombia, health outcomes in Latin America appear to be pro-cyclical—worsening during recessions. This was also the case in Russia in 1998, at least with regard to child weight-for-height. In contrast, with the exception of the results for Costa Rica, education outcomes appear to be counter-cyclical in middle-income countries—improving during recessions.

Does this analysis have any implications for policy? It is hard to extrapolate the lessons from this (or any other) literature review to any particular country that may be exposed to aggregate shocks in the future, without a careful effort to understand the specific circumstances of the country in question. Nevertheless, to the extent that this paper reveals the empirical regularities summarized above, four general implications are worth highlighting.

First, education and child health outcomes do not respond to shocks in the same way everywhere. If an international institution sought to allocate a certain budget so as to minimize the decline in enrollment (or the increase in infant mortality) *across a number of countries* of very disparate income levels, then it might consider an allocation that is biased towards the poorest countries, and those that have the least developed credit markets. The evidence suggests that human capital investments in these countries suffer most from aggregate shocks.

Second, in a developing country that suffers from a negative income shock, our analysis provides yet another reason (if one were needed) why a government *allocating resources to different population groups* might consider targeting these to the poor. These households are more likely to be credit-constrained, and the disutility of reductions in consumption is likely to be larger. They are, therefore, most likely to engage in "destructive" behaviors (from the point of view of investments in child human capital), such as taking children out of school or curtailing expenditures on health-promoting inputs.

Third, in a middle-income country that suffers a negative aggregate shock, if a government or agency sought to allocate a given budget *between the education and health sectors* so as to protect the human capital of children, a presumption might be justified to favor

health rather than education. The evidence suggests that in middle-income countries like those in Latin America recessions harm child education much less often than they harm child health.

Finally, the model on which the conceptual framework in Section 2 is based suggests that one way in which the effect of crises on outcomes can be mitigated (across all countries) is a protection of public expenditures in the supply of health and education services. Such expenditures make services more attractive by preserving quality. That simple model and the review of the evidence in this paper are not sufficient to yield general policy recommendations on the composition of that expenditure, with one possible exception. That exception is the nature of public expenditure on education in middle-income (say, Latin American) countries, during moderate downturns.

The evidence suggests that, in these circumstances, the substitution effect of falling child wages tends to outweigh the income effects of the recession, leading to increased demand for schooling. In this light, reductions in the quality of education services would appear to represent a greater threat to enrollment, attainment and achievement than falling demand. The implication is that countries should carefully consider whether expenditures that protect the supply side of the educational system, such as by preserving the real salaries of teachers and continuing to invest in schools, are not more important than expenditures aimed at further buttressing demand, such as conditional cash transfers (CCTs). Cash transfers might, of course, need to be increased for a variety of reasons during a recession. And it may be that an existing CCT scheme provides the most cost-effective means for a social protection system to respond rapidly to a crisis. But those, rather than a misperceived need to support the demand for schooling during downturns, should be the grounds on which a CCT is preferred over alternative expenditures.

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Figure 1: Aggregate shocks and the demand for schooling

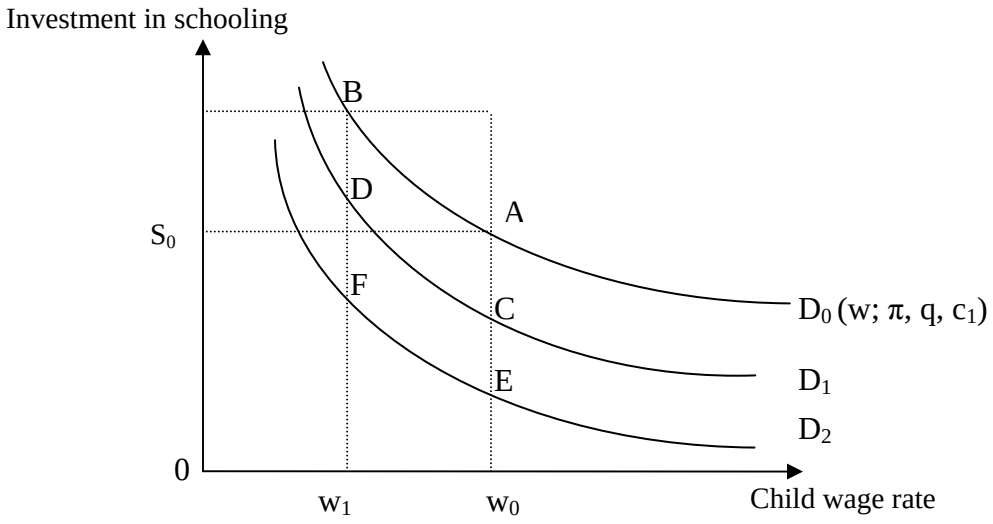
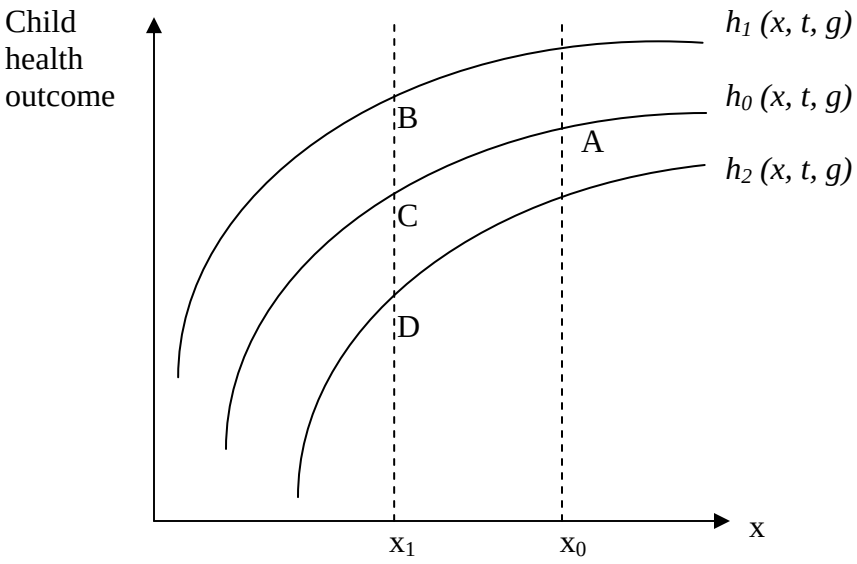


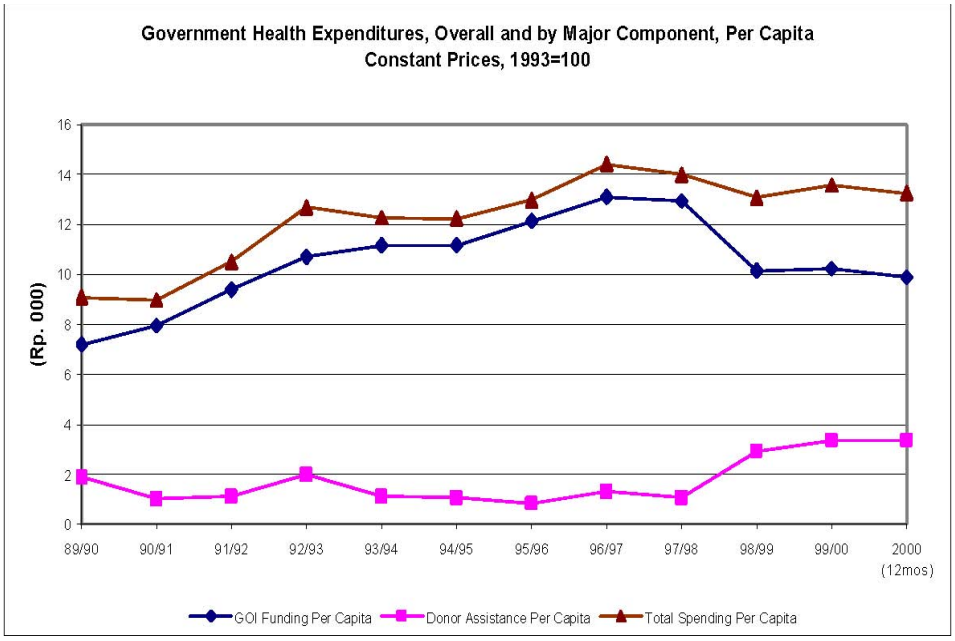
Figure 2: Aggregate shocks and the child health outcomes



Private expenditures on health-promoting goods

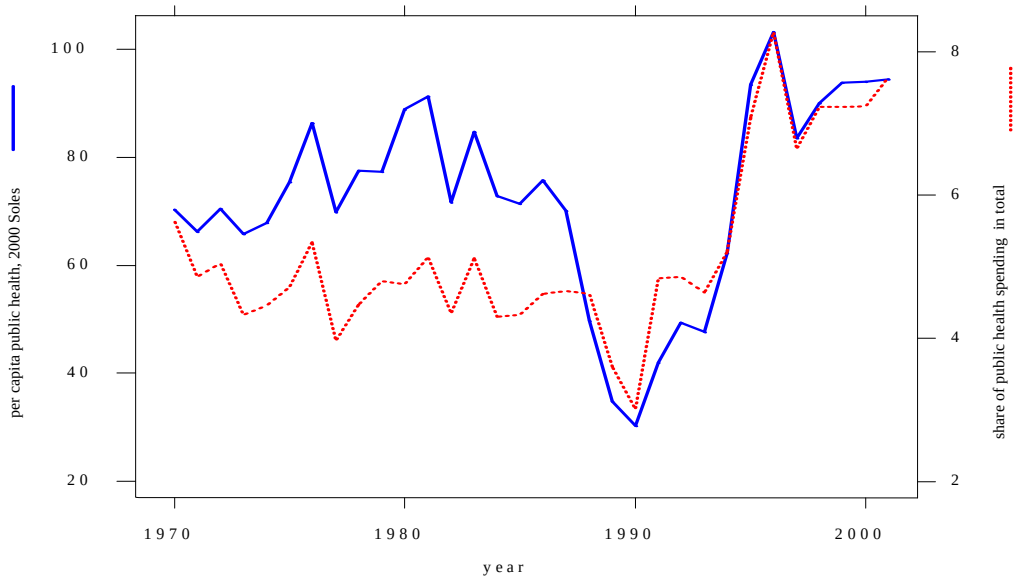
Figure 3: Public Expenditures on Health during the crisis, Indonesia and Peru

Indonesia



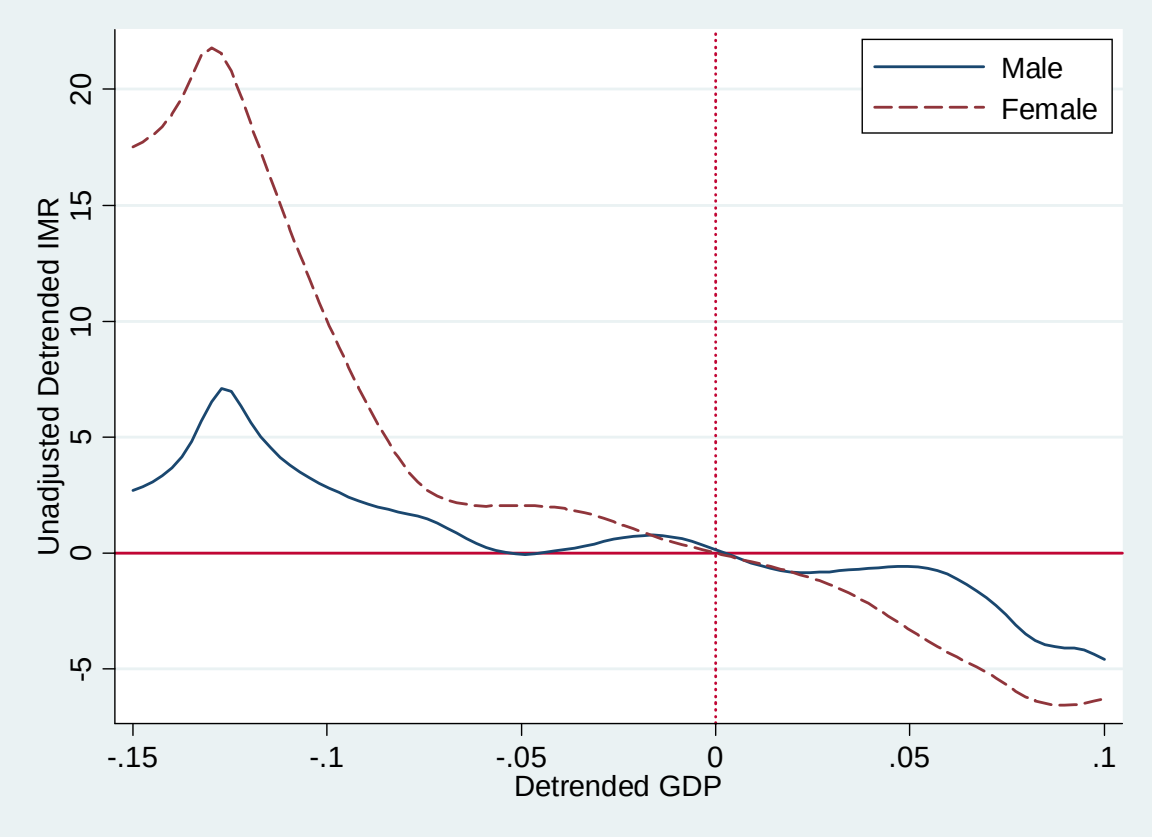
Source: Lieberman, Juwono and Marzoeki (2001)

Peru



Source: Paxson and Schady (2005)

Figure 4: Income Shocks and Infant Mortality in the Developing World



Source: Baird, Friedman and Schady (2007)
Note: These are locally-weighted least-squares regressions of the Infant Mortality Rate, per 1,000 live births, on the logarithm of per capita GDP. Country-specific cubic trends have been removed from both series.

Table 1: The impact of the 1995 Mexican Peso crisis on school attendance

Age	Boys				Difference-in-difference p-value	
	1992	1994	1996	1998	(T96-T94)-(T94-T92)	(T98-T96)-(T96-T94)
5-6	0.73	0.80	0.86	0.85	0.817	0.006***
7-8	0.94	0.96	0.97	0.97	0.154	0.502
9-10	0.97	0.96	0.97	0.98	0.412	0.963
11-12	0.92	0.94	0.94	0.96	0.151	0.319
13-14	0.79	0.79	0.82	0.83	0.238	0.507
15-16	0.52	0.52	0.58	0.58	0.064*	0.048**
17-18	0.33	0.31	0.36	0.35	0.012**	0.038**
19-20	0.22	0.22	0.28	0.25	0.039**	0.010**
21-22	0.18	0.19	0.19	0.19	0.849	0.661
23-24	0.13	0.11	0.10	0.11	0.589	0.317
25-26	0.05	0.07	0.07	0.06	0.246	0.614
	Girls					
5-6	0.72	0.82	0.87	0.84	0.061*	0.001***
7-8	0.95	0.96	0.98	0.97	0.912	0.026**
9-10	0.96	0.97	0.97	0.97	0.178	0.734
11-12	0.90	0.91	0.92	0.93	0.483	0.493
13-14	0.72	0.73	0.76	0.78	0.640	0.829
15-16	0.48	0.49	0.54	0.51	0.452	0.033**
17-18	0.33	0.31	0.34	0.32	0.041**	0.046**
19-20	0.19	0.21	0.23	0.20	0.915	0.113
21-22	0.14	0.15	0.16	0.15	0.992	0.570
23-24	0.07	0.09	0.09	0.08	0.202	0.789
25-26	0.03	0.06	0.05	0.05	0.031**	0.842

Source: McKenzie (2003)

Note: The difference-in-difference p-values correspond to tests of equality of the growth in school attendance between (T2-T1)-(T1-T0), for different years. * significant at the 10% level; ** at the 5% level; *** at the 1% level.

Table 2: The impact of the Peruvian crisis of 1988-92 on the number of years of school attained

	No controls	Including controls
Years of crisis Exposure	0.050**	0.043**
Crisis Exposure=1	0.008	0.035
Crisis Exposure=2	-0.011	0.089
Crisis Exposure=3	0.204**	0.173*
Crisis Exposure=4	0.184**	0.234**
Crisis Exposure=5	0.224**	0.199*

Source: Schady (2004)

Note: The upper panel reports results from regressions in which the number of years of crisis exposures enters linearly. The lower panel includes five dummies corresponding to the number of years of crisis exposure, with the omitted category being children who were not school-aged during the crisis years, 1988-92. Controls include variables for child gender, parental education, household size, the number of children in a household in six age categories, and municipality fixed effects. The sample for the specifications with controls is limited to municipalities that were visited in the 1985/86, 1991, and 1997 rounds of the LSMS. * significant at the 10% level; ** at the 5% level; *** at the 1% level.

Table 3: The impact of the 1998 Indonesian crisis on school enrollment

Age		**Boys**			**Girls**	
	1997	**1998**	**Change**	**1997**	**1998**	**Change**
7	86	86.8	0.8	88.4	87.6	-0.8
8	94.5	93.8	-0.7	94.9	94.5	-0.4
9	96.2	95.8	-0.4	96.7	96	-0.7
10	96.5	95.6	-0.9	96.7	96.2	-0.5
11	96.2	95.7	-0.5	96.8	96.4	-0.4
12	92.8	91.8	-1	92.6	92.6	0
13	86.4	85.2	-1.2	85.8	84.7	-1.1
14	78.8	78.5	-0.3	77	77.7	0.7
15	68.6	68.2	-0.4	67.6	69.2	1.6
16	60.6	61	0.4	58.9	60.4	1.5
17	49.2	52.5	3.3	48.8	50.7	1.9
18	39.6	40.5	0.9	35.5	36.1	0.6
19	26.4	27.7	1.3	21	22.3	1.3
	Richest quartile			**Poorest Quartile**		
	1997	**1998**	**Change**	**1997**	**1998**	**Change**
7	81.7	78.9	2.8	56.5	54.6	-1.9
8-9	98.8	99.2	-0.4	92.1	90.6	-1.5
10-11	98.9	99.2	-0.3	94.2	92.8	-1.4
12-13	96.5	96.2	0.3	83.5	82.2	-1.3
14-15	89.2	88.7	0.5	58.4	59.6	1.2
16-17	77.0	78.6	-1.6	33.5	33.9	0.4
18-19	50.7	54.1	-3.4	15.1	15.4	0.3

Source: Thomas et al. (2004)

Table 4: The impact of various macroeconomic crises on school enrollment

Country	Year of crisis	GDP in last year before crisis	Size of shock (cumulative contraction in per capita GDP)	Size of shock (other outcomes)	Change in enrollment (sign)
Brazil	1981-83	7,630	13.3%		+
	1990-92	7,691	8.4%		
Mexico	1982-83	10,037	9.0%	• 21.7% contraction in real wages	+
	1986	9,313	5.7%		
	1995	9,809	7.9%		
Peru	1988-92	6,223	29.8%	• 50% contraction in per capita consumption (Lima) • 80% contraction in real wages (Lima) • 7,500% inflation	+
Costa Rica	1980-82	6,158	14.3%	• 50% contraction in real wages	-
Nicaragua	2000-02	2,357		• 27% contraction in per capita consumption (coffee-growing areas)	+
Indonesia	1998	3,087	14.3%		-
Cote d'Ivoire	1986-87	2,147			-
Malawi	1994-95	653			-

Source: World Bank (2008)
Note: GDP levels are GDP per capita, PPP (constant 2005 international US $).

Table 5: The expected effect of a negative aggregate economic shock on child health and education outcomes

	Education outcomes	Health and nutrition outcomes
Rich countries	Positive impact • United States	Positive impact • United States
Middle-income countries	Ambiguous impact Examples of positive impact • Mexico • Brazil • Peru • Nicaragua Examples of negative impact • Costa Rica	Ambiguous impact Examples of positive impact • Colombia Examples of negative impact • Peru • Mexico • Russia
Poor countries	Negative impact • Indonesia • Cote d'Ivoire • Malawi • *(Nicaragua)*	Negative impact • Nicaragua • India • Cote d'Ivoire • Zimbabwe • Ethiopia • Tanzania • Cameroon

Note: Parentheses indicate the reverse effect, for countries that deviate from the theoretical predictions.