

## **Child Health and Economic Crisis in Peru**

Christina Paxson  
Princeton University

Norbert Schady  
World Bank

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### **Abstract**

The effect of macroeconomic crises on child health is a topic of great policy importance. We use data from the Demographic and Health Surveys (DHS) to analyze the impact of a profound crisis in Peru on infant mortality. We show that there was an increase in the infant mortality rate of about 2.5 percentage points for children born during the crisis, implying that about 17,000 more children died than would have in the absence of the crisis. Accounting for the precise source of the increase in infant mortality is difficult, but it appears that the collapse in public and private expenditures on health played an important role.

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## **I. Introduction**

Over the last two decades, a large number of countries, including Indonesia, Mexico, Argentina, Russia, and Peru, experienced economic crises that led to sharp reductions in incomes and living standards. A growing literature has examined whether these crises had adverse effects on health outcomes. To the extent that crises do lead to declines in health outcomes, it is important to identify the specific mechanisms that are responsible, with an eye toward developing policies that can ameliorate adverse health effects in the future.

We consider how economic shocks affect health by examining the effect of one crisis—that experienced by Peru in the late 1980s—on infant mortality. The Peruvian case is noteworthy because the crisis was unusually sharp: per capita GDP declined by 30 percent and real wages in the capital city of Lima fell by more than 80 percent. The sheer depth of the economic collapse makes Peru a useful place in which to study the health effects of economic crises. In addition, Peru has good information on infant mortality from a set of household surveys—the Demographic and Health Surveys (DHS)—which have been collected at regular intervals since 1986. Using the DHS surveys, we are able to construct a long time series on the evolution of infant mortality, spanning the period before, during, and after the economic crisis. We can therefore analyze whether changes in infant mortality are departures from pre-existing trends, and whether there is a return to these trends after the crisis—an important advantage over papers that focus on more recent crises.

Before discussing the details of the Peruvian case, it is useful to consider why economic crises might affect infant mortality. One possibility is that households are unable to buffer consumption from sharp income declines, producing reductions in the nutritional status of pregnant women and infants that can contribute to infant death (see, for example, Martorell and Ho 1984). Another possibility is that income declines reduce household expenditure on health care—in particular, prenatal care and care surrounding the births of children. Finally, economic crises may also affect health through reductions in

public sector spending on health care, which may increase the price or reduce the quality of health care that is available.

It is also possible that economic crises have no effect on infant mortality. Households may be able to smooth consumption, or at least buffer expenditures on goods that protect health; governments may implement programs that mitigate the effects of crises on health. Furthermore, families may avoid infant deaths by delaying fertility until the crisis has passed. Deferred fertility may lead to more widely-spaced births and to fewer births to very young women, which lowers mortality (Palloni and Hill 1997).<sup>1</sup> Finally, it is possible that recessions produce changes in behavior that are beneficial to health: During downturns, women may do more exercise, eat healthier diets, and smoke less, all of which could reduce infant mortality (see Ruhm 2000 on the United States). Whether economic crises adversely affect health is therefore an empirical question.

The existing literature suggests that the relationship between infant mortality and economic fluctuations varies a great deal across countries. Recent evidence from the US indicates that infant mortality declines during recessions, due to changes in maternal behaviors as well as shifts in the composition of women giving birth (Dehejia and Lleras-Muney 2004). Similarly, recessions in the US have been shown to produce declines in air pollution, reducing infant deaths (Chay and Greenstone 2003). Results from poorer countries with sharper economic fluctuations have yielded mixed results. The collapse in income in many countries of the former Soviet Union in the 1990s was associated with dramatic increases in adult mortality, particularly from alcoholism and suicide, but no obvious change in child health (Shkolnikov et al. 1998; Brainerd 1998 and 2002; Cutler and Brainerd 2004). The 1998 Indonesian financial crisis appears to have led to an increase in infant mortality of about 1.4 percentage points (Rukumnuaykit 2003). In Latin America, the financial crisis of the late 1990s in Argentina did not affect the infant mortality rate (Rucci 2004), whereas there is evidence that the economic crises in

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<sup>1</sup> There is considerable evidence that couples defer conception during economic crises (for example, Ben-Porath 1973 on Israel; Ashton et al. 1984 and Coale 1984 on China during the “Great Leap Forward”; Stein et al. 1975 on the impact of the Dutch famine of 1944-45).

Mexico in the 1980s and 1990s increased mortality for the very young and the elderly (Cutler et al. 2002).<sup>2</sup> Our results for Peru are most consistent with those from Indonesia and Mexico, in that we find that the economic crisis had a large effect on infant mortality.

The paper is structured as follows: Section II describes the economic crisis in Peru, and discusses key features of our data. Section III presents evidence on infant mortality. We show that there was an increase in the infant mortality rate of 2.5 percentage points for children born during the crisis, implying that about 17,000 more children died than would have in the absence of the crisis. In Section IV, we consider a variety of hypotheses—including changes in food consumption patterns, changes in the use of health care services, and changes in the composition of women giving birth—to explain our findings. Section V concludes.

## **II. Setting and data**

### *A. The Peruvian Context*

Figure 1 shows the evolution of GDP per capita, real wages (in Lima only) and inflation over the 1980s and 1990s.<sup>3</sup> Each of these indicators provides clear evidence of a macroeconomic collapse in 1988. The reasons for this crisis—a “heterodox” stabilization program involving reduced foreign debt payments, wage increases and job creation programs that quickly proved unsustainable—and the impact that the crisis had on poverty and education outcomes have been documented elsewhere (Glewwe and Hall 1994; Schady 2004). What Figure 1 makes obvious is the *depth* of the crisis. Real GDP per capita

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<sup>2</sup> Similarly mixed results can be found in studies that examine the effects of crises on children’s anthropometric outcomes. In Africa, Jensen (2000) shows that rainfall shocks in Cote d’Ivoire led to fewer sick children being taken for medical consultation, and increased the fraction of children with low weight for height by 3-4 percent; Yamano, Alderman and Christiaensen (2003) find that children between the ages of 6 and 24 months in Ethiopia experience about 1 cm less growth over a six-month period in communities with crop damage by drought; Hoddinott and Kinsey (2001) find that exposure to drought resulted in a loss of stature of 1.5-2 cm in Zimbabwe. In South Asia, the 1988 and 1998 floods in Bangladesh resulted in lower-than-expected growth among exposed children (Foster 1995; del Ninno and Lundberg 2002). In East Asia, the Indonesian financial crisis had little discernible effect on weight-for-height and on height-for-age (Frankenberg, Thomas and Beegle 1999; Cameron 2002; Waters, Saadah and Pradhan 2003; Strauss et al. 2002). An earlier draft of this paper contained results that suggest the Peruvian crisis adversely affected the growth of children exposed to the crisis (see World Bank Policy Research Working Paper 3260, April 2004.)

<sup>3</sup> Data on per capita GDP and inflation, as measured by changes in the consumer price index, are taken from World Bank data bases. Data on real wage income are taken from labor force surveys conducted in Lima, as published in Saavedra and Pasco Font (2001). Labor force surveys were conducted in Lima on a yearly basis from 1986 onwards, except for 1989 and 1996. We thank Jaime Saavedra for making these data available to us.

contracted by almost 30 percent between the pre-crisis year of 1987 and 1990, and did not begin to recover until 1993. The collapse in wages in Lima was even more dramatic, with a fall in real wages of more than 80 percent between 1987 and 1990, and a gradual recovery thereafter. Data from multi-purpose income and consumption surveys conducted in Lima in 1985 and 1990 (not shown) suggest that per capita consumption in 1990 were less than half its 1985 level, although there appears to have been a recovery in consumption thereafter.<sup>4</sup> Inflation skyrocketed during the crisis—rising from an annual rate of 86 percent in 1987 to almost 7,500 percent in 1990, before falling to 410 percent in 1991 and 74 percent in 1992.

By any measure, the extent of the economic collapse in Peru in the late 1980s is staggering. Indeed, in large measure as a consequence of this crisis, per capita GDP and real wages in 2000 were still well below their 1987 levels, in spite of respectable growth rates during most of the 1990s. Consider, as points of comparison, crises in the 1990s in Mexico, Argentina, Indonesia, and Russia. In Mexico, the 1995 crisis resulted in a 6.3 percent reduction in per capita GDP, and a reduction in per capita consumption of 19 percent (McKenzie 2004); in Argentina, the 1998-2002 crisis involved an 18 percent reduction in per capita GDP over the period, and a 32.4 percent reduction in wages in 2002 (McKenzie and Schargrotsky 2004); in Indonesia, per capita GDP fell by 12 percent in 1997, and per capita consumption in 1999 was 23 percent below its 1996 value (World Bank 2004). Only the collapse of the Russian economy presents a crisis of similar magnitude: Between 1992 and 1998 per capita GDP fell by 29 percent, and monthly income contracted by 43 percent (Mroz, Henderson and Popkin 2001).<sup>5</sup>

Two additional points about Figure 1 are noteworthy. First, while the beginning of the crisis is clear—1988—the end is not: The data on wages and inflation suggest a recovery beginning in 1991, whereas the data on per capita GDP suggest that the recovery only began in earnest in 1993. As we will

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<sup>4</sup> These figures are based on Glewwe and Hall (1994). Schady (2004) reports a fall in per capita income in of 24 percent between 1985/86 and 1991 in urban areas, excluding the urban jungle.

<sup>5</sup> All changes in per capita GDP are calculated from World Bank data bases.

show, our results are consistent with a shorter crisis—one that had an effect on child health between 1988 and 1990. Second, the GDP data show that there was an economic crisis earlier in the 1980s, involving a 14 percent contraction in per capita GDP in 1983. We return to both of these points in our discussion below.

### *B. The Peru Demographic and Health Surveys*

Our major data source is Peru’s Demographic and Health Surveys (DHS) conducted in 1986, 1991/92, 1996 and 2000.<sup>6</sup> These surveys sampled women aged 15-49, with sample sizes of 4,999 women, 15,882 women, 28,951 women, and 27,843 women, respectively. The surveys are nationally representative, subject to the caveat that in 1986 and 1991/92 some areas were not surveyed due to high levels of terrorist activity. In 1986, three departments—Ayacucho, Apurímac and Huancavelica—representing 6% of the population were excluded. In 1991/92, special precautions were taken in high-terrorism “emergency areas”, including escorts of enumerators by the army or police. However, despite these efforts, 66 districts (a smaller administrative unit than a department) representing approximately 5% of the population were excluded due to security concerns. As discussed below, terrorism abated by the mid-1990s and did not pose a problem for the 1996 and 2000 surveys.

All four surveys included a set of questions on the date of birth, current vital status, and the date of death (if deceased) of all children ever born to the respondent. More extensive information was collected on children born to the respondents within the five years prior to the survey. The 1991/92, 1996 and 2000 DHS data contain information on circumstances surrounding the births of children aged 59 months or less and, for children who are living, their heights and weights. All surveys also collect

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<sup>6</sup> General information on the DHS surveys can be found at <http://www.measuredhs.com/>. Details of the sample framework for the four Peru DHS can be found at the following websites: For the 1986 survey, see <http://www.measuredhs.com/pubs/pdf/FR31/00FrontMatter.pdf>; for the 1992 survey, see <http://www.measuredhs.com/pubs/pdf/FR33/11AppendiceA.pdf>; for the 1996 survey, see <http://www.measuredhs.com/pubs/pdf/FR87/11ApendiceA.pdf>; for the 2000 survey, see <http://www.measuredhs.com/pubs/pdf/FR120/13AppendixA.pdf>.

information on a range of household socio-demographic characteristics, including urban status, maternal education, housing characteristics and ownership of durable goods.

In addition to the DHS, we use administrative data on health expenditures and the number of terrorist incidents, and household survey data on consumption patterns from the 1985/86 and 1991 Peru Living Standards Measurement Surveys (LSMS). These are discussed in more detail below.

### **III. Infant Mortality in Peru During the Crisis**

We begin by examining how infant mortality evolved over the 1980s and 1990s. We use the retrospective birth and death histories from each DHS survey to construct mortality rates, by date of birth, in the first and second half of each calendar year. Our main measure of mortality is an indicator for whether a child died at age 12 months or less, which we term “infant mortality”.<sup>7</sup> We also show results for mortality rates for children aged 1 month or less, which we term “neonatal mortality”, and 6 months or less.<sup>8</sup> Mortality rates were constructed using the sample weights provided in the survey.

Although each DHS is representative of women aged 15 to 49 at the time of the survey, it is not representative of all births (and child deaths) at earlier years. For example, the mothers who were aged 15 to 49 at the time of the 2000 DHS were aged 5 to 39 in 1990, and any births and deaths they report for that year occurred within this (younger) age range. In theory, this feature of the data could bias our measures of the infant mortality rate in either direction—the direction of bias depends on whether the children of the older mothers who were excluded have higher or lower infant mortality rates on average than the younger age group that is included. Because mortality rates may be highest for the very

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<sup>7</sup> The DHS data display age heaping in mortality, so that more children are reported to have died at exactly 12 months than at 11 or 13 months. There is generally heaping at 6 month intervals (6 months, 12 months, 18 months, etc.) We measure infant mortality as mortality at 12 months or less rather than less than 12 months (as is conventional) since many of the children who are reported to have died at 12 months may in fact have died earlier.

<sup>8</sup> To avoid problems with censored data, information on children born within 23 months of the survey was discarded when computing mortality rates for children aged 12 months or less. In theory we should only have to discard children born at least 12 months before survey, since we do not know if these children survive past 12 months. However, given the age heaping of deaths we discussed, we adopt a more conservative approach. Similarly, records for children born within 5 months of the survey were discarded when computing 1-month mortality rates, as were those for children born within 11 months of the survey computing 6-month mortality rates. We obtain very similar results when we use a less conservative approach to censoring. Mortality in the first month of life approximates neonatal mortality, defined as the death rate in the first 28 days of life.

youngest mothers, we discard births that occurred when the mother was less than 15 years of age. An additional source of bias is error in recalling the dates of more distant births and deaths. To reduce problems of recall error, we exclude births that occurred more than 12 years prior to the survey date. Our results are not, however, sensitive to these choices of maternal age-ranges and recall periods.<sup>9</sup> Finally, it should be noted that maternal mortality will bias our estimates of infant mortality. There is no information in the sample on births to mothers who died prior to the survey, since these women are not alive to be sampled. If their children were themselves at higher risk of death, our infant mortality estimates are too low.<sup>10</sup>

We first show infant mortality rates calculated from each DHS separately, so that we can compare mortality rates computed for the same date of birth but using different rounds of the DHS. The results, shown in Figure 2, have two important features. First, the patterns of infant mortality rates by date of birth are similar across surveys. Thus, there do not appear to be systematic biases in the rates we calculate using up to 12 years of retrospective information on births. Second, there is a sharp increase in the infant mortality rate around 1990. This increase, which appears in data from the 1991/92, 1996 and 2000 surveys, begins with children born in the second half of 1989, and peaks for children born in the first half of 1990. This increase in the infant mortality rate—from approximately 50 per 1000 births to 75 per 1000 births—is large. The Peruvian population was 21,988,912 in 1990, with a crude birth rate of 31.73 per thousand,<sup>11</sup> implying that approximately 697,708 children were born in the country in 1990. The rise in the mortality rate observed during the crisis implies there were 17,184 “excess” infant deaths among children born in 1990. The fact that the mortality spike appears in all three surveys that cover this time period indicates that it is not the result of sampling error.

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<sup>9</sup> We have re-estimated the results shown below restricting the samples to births to mothers between the ages of 15 and 39, and have also estimated models with no restrictions on the length of the recall periods. These are available upon request.

<sup>10</sup> Children who are maternal orphans appear in the household rosters of DHS surveys. However, the retrospective information on births, infant deaths, and the use of maternal health care services does not include information on these children.

<sup>11</sup> U.S. Census Bureau’s on-line International Data Base, found at <http://www.census.gov/ipc/www/idbacc.html>.

Because the different DHS surveys yield similar infant mortality rates for children born at different dates, we average mortality rates across surveys.<sup>12</sup> Figure 3 shows results for the neonatal mortality rate, mortality in the first six months of life, and the infant mortality rate. A comparison of this figure with Figure 1 highlights the fact that the spike in mortality among children born in 1990 coincides with the worst portion of the economic crisis, when per capita GDP was falling to its lowest levels and real wages had not yet recovered. A similar spike is observed in 1983, when Peru experienced a smaller economic crisis. But the spike in infant mortality in 1983 appears in data from the 1986 DHS but not from the 1991/92 DHS (Figure 2). Because the 1986 survey was quite small and the estimates of mortality based on these data are noisy, this spike provides much less clear evidence of a possible increase in mortality in 1982-83. Mortality and per capita GDP are clearly inversely related over this time period: A regression of the logarithm of the infant mortality rate on the logarithm of per capita GDP, including a time trend, implies that the elasticity of infant mortality with respect to per capita GDP is  $-0.973$  ( $t=2.92$ ).

Figure 3 also indicates that the increase in mortality in 1990 was not confined to infants in specific age ranges. Children born in the second half of 1989 through 1990 were more likely to die in the first month of life. They were also more likely to die in the first 6 and 12 months of life. This is not a mechanical result of there having been a higher mortality rate in the first month of life: For example, of children born in the first half of 1990 who survived at least one month, 20 per 1000 died between ages one and six months, in contrast to conditional death rates of 8 per 1000 for those born in the first half of 1988. Similarly, the mortality rate of those between six and twelve months (conditional on survival to six months) rose from 14 per 1000 to 25 per 1000 between these two periods.<sup>13</sup> We also examined whether the increase in mortality appears in urban and rural areas, and in the coast, highlands, and jungle

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<sup>12</sup> The DHS surveys have different sample sizes and we do not want to give more weight to larger samples. The rates in Figure 3 reflect unweighted averages of the infant mortality rates from the relevant surveys, with sample weights used to construct mortality rates for each survey.

<sup>13</sup> We tested for increases in the mortality of children older than one year of age during the crisis, and found no clear patterns.

regions.<sup>14</sup> The increase in infant mortality appears in all areas except the jungle, for which the estimates are very noisy due to small sample sizes. As we discuss below, this is important as it allows us to rule out explanations for the increase in mortality which would only affect some parts of the country.

Finally, we examined vital statistics data on the registered number of deaths, by age group, in the 1980s and 1990s.<sup>15</sup> These statistics show no increase in the number of reported deaths in 1989-91. However, there is reason to believe that the vital statistics data for Peru are not reliable. The Pan American Health Organization estimates that less than half of all deaths are recorded in Peru, and the number of recorded deaths is lowest in the poorest departments—for example, in Ayacucho, Amazonas, Loreto and Huancavelica less than a quarter of deaths are reported, compared to more than three-quarters in the three wealthiest departments of Ica, Lima, and Tacna (PAHO 1998). This conclusion is consistent with our comparison of the vital statistics and the DHS. We computed the number of infant deaths from the 1992 DHS, using the appropriate survey expansions factors, and compared these with the vital statistics data. Our estimates indicate that the vital statistics covered 63% of infant deaths in 1988, 65% in 1989, 50% in 1990 and 47% in 1991.<sup>16</sup> Coverage appears to have worsened during the crisis, possibly due to budget cuts in the Ministry of Health, which is responsible for collection and verification of the data, and because of lower use of health facilities—both of which we document below. We return to these discrepancies between the DHS and vital statistics data in our concluding section.

#### **IV. Sources of Declines in Child Health**

The evidence presented in the last section indicates that infant mortality increased during the economic crisis in Peru. We now examine the possible ways in which the crisis may have affected health

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<sup>14</sup> The region codes provided in the DHS data files are not comparable across all surveys, so we can do this using only the 1996 and 2000 surveys.

<sup>15</sup> We thank Pedro Francke for making these data available to us.

<sup>16</sup> The DHS surveys are likely to yield estimates of the number of infants deaths that are too low. The reason is that deaths of infants born to mothers who themselves die before the survey, and to mothers who fall out of the DHS age range at the time of the survey, are not recorded. If so, then the extent of undercoverage by the vital statistics is even higher.

outcomes. While there are many factors that affect infant mortality—for example, maternal education and knowledge about basic health practices and nutrition, water supply, the nutritional content of food intake, access to and quality of health services for children and their mothers—we believe that there are two major channels through which the crisis could have worked. First, the crisis could have caused public health services to deteriorate, and second, it could have led to reductions in household expenditures on inputs to child health, including nutritious foods or purchased medical care for mothers and infants. In what follows, we present evidence on the importance of each of these factors. We also examine whether the increase in mortality was driven by a change in the composition of women giving birth. Finally, we assess whether the increase in infant mortality could have been due to other factors—such as a cholera outbreak or increases in terrorist activity—that happened to coincide with the crisis but were not directly caused by it.

A. *Declines in health care utilization*

We begin by graphing the evolution of public health spending in Peru between 1970 and 2000 in Figure 4. This figure shows that public sector spending on health fell by 58 percent between 1985 and 1990, and declined from 4.3 percent to 3.0 percent of the budget during this period.<sup>17</sup> One consequence of deep budget cuts in health (combined with high inflation) was a reduction in real wages for health sector workers, which led to labor unrest. Ministry of Health workers went on strike from March to July of 1991, forcing closures of public hospitals and clinics, and then went on strike again in early 1992 (Associated Press, July 20, 1991 and February 11, 1992).

Public health expenditures fell sharply during the economic crisis, and it seems likely that this would lead to reductions in the utilization of health services. The 1991/92 and 1996 DHS surveys

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<sup>17</sup> Public health expenditures include all expenditures made by the Ministry of Health, both by the centrally administered programs and programs executed locally. We would like to thank Pedro Francke for providing us with these data. The series does not include expenditures by local governments on health, although these are negligible in Peru, or expenditures made by the health insurance system which covers formal sector workers. No comparable data on the evolution of private health expenditures over time are available. The GDP per capita data are taken from World Bank data bases, and are in constant 1995 US dollars.

include questions on the place in which all children born within 59 months of the survey were delivered, and the number of antenatal health visits the mother had while pregnant. We use this information to examine whether there were increases in home births and declines in antenatal care during the crisis period. Specifically, for each of the two DHS surveys, we estimate models of the following form:

$$(1) \quad Y_{ibr} = \beta_0 + X_i \beta_1 + Z_{ibr} \beta_2 + \sum_{\tau=t_0}^{\tau_T} \alpha_\tau I(t = \tau) + \varepsilon_{ibr}$$

where  $Y_{ibr}$  is an outcome (number of antenatal visits or an indicator for home delivery) for child  $b$  born to mother  $i$  in year  $t$ . The term  $X_i$  is a set of maternal characteristics that are assumed not to change over time. These include maternal education (whether her highest level of education was primary school, secondary school, or post-secondary school, with no school being the omitted category); indicators for maternal age (ages 20 to 29, 30 to 39 and 40 to 49, with age 15 to 19 being the omitted category); and an indicator for whether she lived in an urban area at the time of the survey (we do not know the location of the mother at the date of birth). Because mothers may choose different levels of health care for first births, we include an indicator  $Z_{ibr}$  for first births. The parameters of interest are the terms  $\alpha_\tau$ , which capture differences in the outcome across years, controlling for maternal and child characteristics. We estimate (1) using linear regression models, including either mother-specific random effects or mother-specific fixed effects. In the fixed-effects models, the time-invariant, mother-specific variables are necessarily excluded.<sup>18</sup>

Table 1 provides descriptive statistics on health care and birth outcomes. The table shows that the average number of antenatal visits in both surveys is roughly 3.5, while slightly more than half the

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<sup>18</sup> For the dichotomous outcomes, we also estimated conditional logit models and found similar results. In theory, the two surveys could have been pooled and (1) estimated using the combined sample. We did not do so, for two reasons. First, when mother fixed effects are included, it is not possible to identify changes in the outcomes that occurred across the survey years, since mothers in the 1996 survey were not asked about the outcome measures for births occurring before 1992. For these results, pooling the data would yield identical results to those presented below. Second, the question on the place the child was delivered was coded somewhat differently between the two surveys, and the responses to this question may not be completely comparable. In 1996, a new category of “birth in the midwife’s home” was added. It is not clear if these births would have been coded as “home births” or as “other” in 1991/92. In addition, the coding of types of births at public and private facilities other than the home changed between 1991/92 and 1996, so that it is not possible to construct consistent series on other places of birth. For this reason, it makes sense to not pool the surveys for the random effects specifications.

births take place at home in both survey years. Table 2 reports results from estimations of equation (1). Specifically, we report values of  $\alpha$  for 1988 to 1991 when using the 1991/1992 data (1987 is the omitted category), and values of  $\alpha$  for 1993 to 1996 when using the 1996 data (1992 is the omitted category).<sup>19</sup> The left-hand side of the table shows that the number of antenatal visits fell steadily from 1987 through 1991, and increased steadily from 1992 to 1996. For example, focusing on the random effects results, women who gave birth in 1991, many of whom would have been pregnant in 1990, had 0.28 fewer antenatal visits than those in 1987, while women who gave birth in 1992, many of whom would have been pregnant in 1991, had 0.38 fewer visits than those in 1996. Note that this sort of see-saw pattern is not consistent with any obvious form of recall bias, for example if women remember fewer antenatal visits for pregnancies that occurred further in the past. The right-hand side of the table shows that the fraction of home births was highest in 1990 (using the 1991/92 survey) and 1992 (using the 1996 survey).

The results in Table 2 suggest that there were important declines in health care utilization during the years in which the crisis was most profound. These declines could have occurred either because of declines in public expenditures on health, as shown in Figure 4, or because declines in household incomes made it more difficult for households to make co-payments at health facilities.<sup>20</sup> We cannot distinguish between these two possibilities with the data that are available.

#### *B. Declines in household consumption of food items*

Since the crisis entailed large reductions in household income and consumption, it is possible that households were unable to protect expenditures on items of importance in determining child health.

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<sup>19</sup> The 1991/92 DHS was completed by March 1 1992, and there were only reported 55 births that occurred in 1992. We exclude them from this analysis.

<sup>20</sup> In Peru, health services are delivered at Ministry of Health facilities, hospitals and clinics run by the public health insurance system that covers formal sector employees, and private health providers. The coverage of private health insurance is minimal, so users of private facilities generally pay the full cost of the service. In health facilities run by the Ministry of Health, labor costs are heavily subsidized, but drugs and medical inputs are financed from user fees, and are charged to the user at full cost plus a mark up. Co-payments also apply to users of facilities run by the public health insurance system (World Bank 1999).

This issue cannot be examined using the DHS, both because information on births is retrospective and because expenditure information is not collected. Instead, we use the 1985/86 and 1991 Peru LSMS to analyze patterns of consumption prior to and during the crisis.

The 1985/86 LSMS was a nationwide, multipurpose household. By contrast, the 1991 LSMS covered Lima and the urban areas of the coast and the highlands (but not the jungle), and the rural areas of the highlands (but not the coast or the jungle). There are serious concerns with the quality of data from the rural highlands in the 1991 LSMS, as detailed in Schady (2004).<sup>21</sup> Moreover, the 1985/86 and 1991 LSMS were not conducted in the same months of the year, and seasonal differences in consumption patterns are likely to be important in rural areas, where a large part of food consumption comes from own-food production. Our analysis is therefore limited to comparisons of the urban areas of Lima, the coast, and the highlands. We do not use the 1994 and 1997 LSMS because, unfortunately, there were important changes in the way in which these later surveys collected information on the consumption of food and non-food items, which makes comparisons between 1991 and 1994 or 1997 problematic.<sup>22</sup>

The 1985/86 and 1991 LSMS surveys asked respondents whether they purchased a particular item and, in the case of food items and semi-durables and services, the amount spent on each item. No questions were asked about quantities, and the extremely high rate of inflation during the crisis makes it

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<sup>21</sup> For example, in the rural highlands, mean income per capita appears to be higher in the 1991 LSMS than in the 1997 LSMS, and the mean education of adults approximately doubles between 1985/86 and 1991, and stays constant thereafter. It appears that the 1991 LSMS visited households in the rural highlands who, on average, had higher socio-economic status than those visited in the earlier or later surveys—perhaps, because of security concerns in remote areas of the rural highlands. No comparable anomalies are found in the urban samples.

<sup>22</sup> There are numerous differences. The 1985/86, 1991, and 1994 LSMS, but not the 1997 LSMS, first separated households into those who owned a business or farm, and those who did not. The former households were then asked about “purchase, or self-provision from business, store or farm”, while the latter were only asked about “purchase” of a given item. In 1997, this separation no longer took place—all households were asked about “purchase or self-provision”. Moreover, the categories of food items in the 1997 do not correspond exactly to those in the earlier surveys. The 1985/86 and 1991 LSMS, but *not* the 1994 and 1997 LSMS, ask households who own a particular durable good about the date in which it was purchased. We use these data to construct measures of durable goods purchases in the last three years, but cannot construct comparable measures using the later surveys. Use of the 1994 survey is further complicated by the fact that it is not clear whether one should treat 1994 as a “crisis” or “non-crisis” year—the GDP and labor force survey data suggest that by 1994 the recovery was in full swing, whereas the consumption and income aggregates that have been calculated from the LSMS by the Peruvian think-tank GRADE, and which have been used for much of the poverty analysis in Peru, suggest there was no improvement in household incomes between 1991 and 1994.

impossible to accurately deflate expenditures to real terms. We therefore focus on whether specific goods were purchased by the household. We calculate the fraction of households in the survey who report that they consumed a given food item in the last two weeks, purchased a given “semi-durable” or service in the last three months, and purchased a given durable in the last three years. In the case of food items, households are coded as having consumed a particular item if they report they purchased it, or they report they “provided themselves with this item from their own store, business, or plot”. Results of these calculations are presented in Table 3. All means are weighted by the appropriate expansion factors in the surveys.

Table 3 suggests that, by and large, there were *not* important changes in consumption patterns of food items during the crisis.<sup>23</sup> While there are statistically significant differences between 1985/86 and 1991, there are no clear patterns—consumption of some items goes up (bread, potatoes, yams, yucca, poultry, eggs, oil, margarine, legumes, fresh vegetables), and consumption of others goes down (maize, cookies, cake, “other” meat products, fish, seafood, milk, dairy products, and frozen, dried or canned vegetables and fruits). There is no clear substitution out of “expensive” sources of protein—for example, meat, poultry, fish and seafood. Moreover, the magnitude of the changes is generally quite small—only in the case of dairy products other than milk does the fraction of households who report having consumed it appear to fall by a large amount (from 0.72 to 0.39). By comparison, consumption of *all* semi-durables and services falls, and some of the changes are large. The fraction of households who report purchases of child and adult clothing or footwear is 8 percentage points lower in 1991 than in 1985/86 in every category, and the fraction of households who purchased medications drops by almost half.<sup>24</sup> Finally, the last rows in the table show a mixed picture with regards to purchase of durable

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<sup>23</sup> We calculated similar means when the sample is limited to households with children under the age of five, or children under the age of one. The results are very similar, although they are noisier because of the smaller sample sizes.

<sup>24</sup> Declines over the period in the fraction of households who report having spent money on health care are even larger, although we do not include these numbers in the table because this question was not phrased in the same way in the two surveys. In both cases—medications, health care—household expenditures would be a function, at least in part, of the underlying health status of health

goods—in some cases, households were more likely to purchase these in crisis than in non-crisis years (radios, electronics, including televisions and stereos), in others, less (cars, motorbikes, and machines such as sewing or weaving machines, floor-waxing machines, and washing machines). Note that purchase of durable goods may be a reasonable way for households to protect their income during hyper-inflation, so these findings may not be surprising.

The results in Table 3 do not tell us how *much* households consumed of each of these items, and whether households substituted into cheaper or less nutritious alternatives within a given category (for example, from high-quality to low-quality red meat).<sup>25</sup> Table 3 suggests, however, that households in Peru were able to protect consumption of food items reasonably well during the crisis—a finding that is consistent with results from crises in Mexico (McKenzie 2004) and Russia (Stillman and Thomas 2004; also Brainerd and Cutler 2004). In sum, the evidence is consistent with an effect of the crisis on child health through its effect on health care utilization and, possibly, through declines in purchases of some non-food items, such as medications.

### C. *Maternal Selection and Infant Health*

Another explanation for the decline in child health during the crisis is that it reflects changes in the composition of women giving birth. Infant mortality rates vary by socio-demographic group, with lower rates observed among women with more education and those living in urban areas, and higher rates observed for very young mothers. In theory, the spike in mortality in 1990 could be due to a relative increase in the numbers of “high risk” women versus “low risk” women giving birth during the economic crisis.<sup>26</sup>

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members. There is no reason to believe that health status would have improved over the crisis, and questions about illness and their treatment are not exactly comparable in the 1985/86 and 1991 LSMS.

<sup>25</sup> Also, households may make more, lower-volume purchases during a crisis, both because they are searching for the best bargains, and because they are inclined to spend available income quickly—before hyper-inflation erodes the value of the cash they hold (see McKenzie and Schargrodsy 2004 on Argentina).

<sup>26</sup> Note, however, that recent evidence for the United States suggests that it is high-risk rather than low-risk women who “select” out of child-bearing during recessions (Dehejia and Lleras-Muney 2004).

To examine this hypothesis, we present Oaxaca-type decompositions of the changes in infant mortality across years. We first estimate linear regressions of the following form for each year of birth:

$$(2) \quad M_{it} = \alpha_t + X_{it}\beta_t + \varepsilon_{it}$$

where  $M_{it}$  is an indicator for whether a child born in year  $t$  to mother  $i$  died in the first year of life, and  $X_{it}$  is a set of maternal characteristics, including indicators for maternal education, maternal age, and an indicator for whether she lived in an urban area at the time of the survey—all coded in the same way as in the estimations of (1) above.<sup>27</sup> Equation (2) is estimated for each year of birth, from 1978 to 1999.

The parameter estimates are used to decompose changes in the mortality rate between years as follows:

$$(3) \quad \Delta \bar{M}_t = [(\hat{\alpha}_t - \hat{\alpha}_{t-1}) + \bar{X}_{t-1}(\hat{\beta}_t - \hat{\beta}_{t-1})] + [(\bar{X}_t - \bar{X}_{t-1})\hat{\beta}_t],$$

where  $\Delta \bar{M}_t$  is the change in the mortality rate between children born in years  $t$  and  $t-1$ , and  $\bar{X}_t$  represent (appropriately weighted) means of the maternal characteristics in year  $t$ . The first term in square braces measures changes in the mortality rate between years, holding the average characteristics of mothers fixed at last year's values. The second term in square braces measures the change in the mortality rate attributed to changes in the average characteristics of women giving birth. We label the first of these terms “time effects” and the second “selection effects.” The hypothesis that changes in the composition of women giving birth accounts for patterns of mortality over time implies that a large part of the changes in mortality will be due to selection effects.

Estimates of (2), not shown, yield unsurprising results. Infant mortality is systematically higher for women with less education, especially in the 1980s and early 1990s;<sup>28</sup> for women in the youngest (ages 15-19) and oldest (40-49) age categories, although differences in infant mortality across maternal age groups are smaller and less precisely estimated than those across education groups; and for women

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<sup>27</sup> We use ordinary least squares estimates rather than probit estimates since the OLS estimates produce exact linear decompositions. However, probit models yield very similar results.

<sup>28</sup> The differences in infant mortality across education groups narrowed substantially over the time period under study so that, by the end of the 1990s, education differences in mortality had largely disappeared. However, there are still large differences in infant mortality by education group during the crisis period.

in rural areas. These differences in infant mortality by education, age and rural status make it possible for shifts in the composition of women giving birth to have sizeable effects on the overall infant mortality rate. But the results also show that infant mortality increased during the crisis for *all* groups—prima facie evidence that the increase in infant mortality during the crisis was not due solely to compositional changes.

The results of the decomposition exercise are shown in Figure 5. The figure graphs year-to-year *changes* in infant mortality, along with the “time effects” and “selection effects” from equation (3). We see some evidence of a shift toward “high risk” mothers in 1990, and toward “low risk” mothers in 1991, but the time effects account for the bulk of the observed changes in mortality, both in the crisis years and across the entire time period. These results indicate that the selection of “high risk” women in or out of pregnancy cannot account for year-to-year changes in infant mortality we observe.

#### *D. Cholera and other diseases*

An alternative explanation for the deterioration in child health is that adverse circumstances happened to coincide with the economic crisis. An example is cholera, which broke out along the coast north of Lima in January, 1991. Coastal areas of Peru were affected first, but the disease spread rapidly throughout the country and, by the summer, to neighboring countries (Colwell 1996).<sup>29</sup> The number of recorded cases of cholera in Peru was 322,562 in 1991 (approximately 1.5 percent of the population) and 210,836 in 1992, after which time the disease abated. There were 2,909 deaths reported in 1991 and 727 in 1992 (PAHO 2003).<sup>30</sup> There are no reliable estimates of the distribution of deaths across age groups.

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<sup>29</sup> The precise source of the cholera epidemic is unknown. It has been attributed to contaminated water dumped from a freighter, and to changes in water temperatures that accompanied El Niño weather patterns (Colwell 1996). Whatever the cause, it is likely that the cholera epidemic reinforced the economic crisis by reducing earnings from tourism and seafood exports. In addition, the spread of the disease may have been exacerbated by the economic crisis. As shown in Figure 4, the start of the cholera epidemic came in a year of very low public sector health expenditures. In addition, the four-month strike of Ministry of Health workers started in the third month of the cholera epidemic. Despite the lack of resources for public health, the recorded mortality rate from cholera was under 1 percent, and for this reason Peru has been credited with managing the epidemic well.

<sup>30</sup> These estimates may be unreliable. Measurement of the number of cases of and deaths from cholera is difficult, especially in children, because the primary symptom of cholera—diarrhea—is associated with a number of diseases that are common in childhood.

The cholera epidemic could, in theory, have caused large increases in infant mortality, but we present three pieces of evidence that suggest that it was not responsible for the spike in infant mortality we observe. First, the magnitude of the cholera epidemic was simply not large enough for this to be the case. We estimate that there were more than 17,000 “excess” infant deaths among children born in 1990. This number is an order of magnitude higher than the total number of cholera deaths (2,909) reported for individuals of *all* ages in Peru in 1991. Even with gross underreporting of cholera deaths, it is not credible that cholera was responsible for the bulk of the increase in infant mortality.

Additional evidence that cholera is not the main reason for the increase in infant mortality is related to the timing and age distribution of the mortality spike. The World Health Organization notes that in endemic areas cholera is mainly a disease of young children, although “breastfeeding infants are rarely affected” (WHO 2000). Breastfeeding offers protection by reducing the child’s exposure to infected water and food. In addition, some evidence indicates that antibodies in breast milk are protective against cholera (Glass et al. 1983; Hanson et al. 2003). Yet, the results shown in Figure 3 indicate that children born in 1990 had high rates of mortality in the first month and the first six months of life, even through breastfeeding is likely to have protected many of these children.<sup>31</sup> More importantly, the upward spike in infant mortality is apparent among children born in the first half of 1990, who died before the cholera epidemic began.

Finally, the pattern of other diseases over the period in Peru cannot account for the increase in mortality. The Pan-American Health Organization (1998) reports steady increases in malaria cases between 1989 and 1996; malaria in Peru only affects some areas of the jungle and the coast. The distribution of mortality and the timing of the increase therefore do not coincide with the spike in mortality. The last measles epidemic in Peru occurred in 1992, and resulted in 263 reported deaths. Again, neither the timing of the outbreak nor the magnitude of the epidemic is a plausible explanation

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<sup>31</sup> The median duration of breastfeeding among children between 1 and 5 years of age in the 1996 DHS was 15 months, and only 10% of children were breastfed 5 months or less. Similar patterns are found in the 1991/92 survey.

for the increase in infant mortality in 1990. A dengue epidemic which took place in 1990 coincides with the increase in mortality, but the total number of reported dengue *cases* in that year (9,623) is significantly smaller than the “excess” number of infant *deaths* we estimate. Moreover, like malaria, dengue only affects the jungle and some coastal areas in Peru, whereas the increase in mortality during the crisis was nationwide.

#### *E. Terrorism*

Terrorism could plausibly explain some of the increase in child mortality if it hampered the ability of the government to deliver health services in affected areas, or if it happened to bias our estimates of infant mortality due to lack of coverage of some areas.<sup>32</sup> The Peruvian Ministry of the Interior has compiled data for the 1989-1995 period on the number of terrorist incidents broken down by department and by year (INEI 1996). These data show that there was an increase in the number of terrorist incidents that roughly coincided with the economic crisis: The total number of reported terrorist incidents increased between 1987 and 1989 (from 2,489 to 3,149), stayed roughly at the same level between 1989 and 1992, and dropped sharply thereafter (from 2,995 in 1992 to 1,232 in 1995).

Terrorism was highly concentrated in some areas of Peru—predominantly in departments in the central and southern highlands, as well as in Lima. To analyze the effects of terrorism, we used the 1996 and 2000 DHS surveys, which provide consistent geographic identifiers and had national coverage. We classified departments as having either “high” or “low” rates of terrorism, where “high” terrorism is defined as more than 0.1 incidents per 1,000 population in every year between 1989 and 1995, or more than 0.2 incidents per 1,000 population in any year. This classification yields roughly equal numbers of respondents in “high” and “low” terrorism departments.<sup>33</sup> We then estimate the infant mortality series separately for the two groups. The results, which are presented in Figure 6, suggest that the increase in

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<sup>32</sup> We thank an anonymous referee for pointing this out to us.

<sup>33</sup> High terrorism departments are Ancash, Apurímac, Ayacucho, Huancavelica, Huánuco, Junín, Lima, Pasco, San Martín and Ucayali; low terrorism departments are Amazonas, Arequipa, Cajamarca, Cusco, Ica, La Libertad, Lambayeque, Loreto, Madre de Dios, Moquegua, Piura, Puno, Tacna and Tumbes.

infant mortality during the economic crisis occurred in high- and low-terrorism departments—if anything, the increase was *larger* in the departments with low terrorism. We cannot rule out an indirect effect of terrorism on infant mortality—for example, if expenditures on the military diverted funds that would otherwise have gone to health care—but the results in Figure 6 show that disruptions in access to health care or changes in the composition of the samples caused by terrorism cannot account for the changes in infant mortality we observe.

## V. Conclusion

The extent to which macroeconomic crises affect child health is an important policy question. In this paper, we show that the infant mortality rate increased by 2.5 percentage points during a deep economic crisis in Peru in the late 1980s. As a result, there were more than 17,000 excess deaths. The data we have do not allow for a complete parsing out of the causes of the increase in infant mortality—particularly, because of limited information on the economic circumstances of households over the crisis period. However, we document a collapse in public expenditures on health during the crisis period, and we find evidence that women’s use of health care during pregnancy and child birth declined. Households appear to have protected expenditures on food, but not on other, possibly important determinants of child health status, such as medications. As a whole, the evidence supports the hypothesis that the collapse in public and private expenditures on health contributed to the observed increases in infant mortality. There is no evidence that the increase was due to changes in the composition of women giving birth, to outbreaks of infectious disease, or to terrorism.

In comparison to the changes in mortality during crisis periods documented in other countries, the change in infant mortality in Peru is large. In Indonesia, the 1998 financial crisis was associated with an increase in infant mortality of about 1.4 percentage points (Rukumnuaykit 2003); in Mexico, macroeconomic crises in the 1980s and 1990s were associated with increases in child mortality relative to trends (Cutler et al. 2002); in Argentina, the financial collapse of the late 1990s did not result in

increases in infant mortality (Rucci 2004); the collapse of the former Soviet Union, finally, led to increases in adult mortality, but no changes in infant mortality rates (Shkolnikov et al. 1998; Brainerd 1998 and 2002; Cutler and Brainerd 2004).

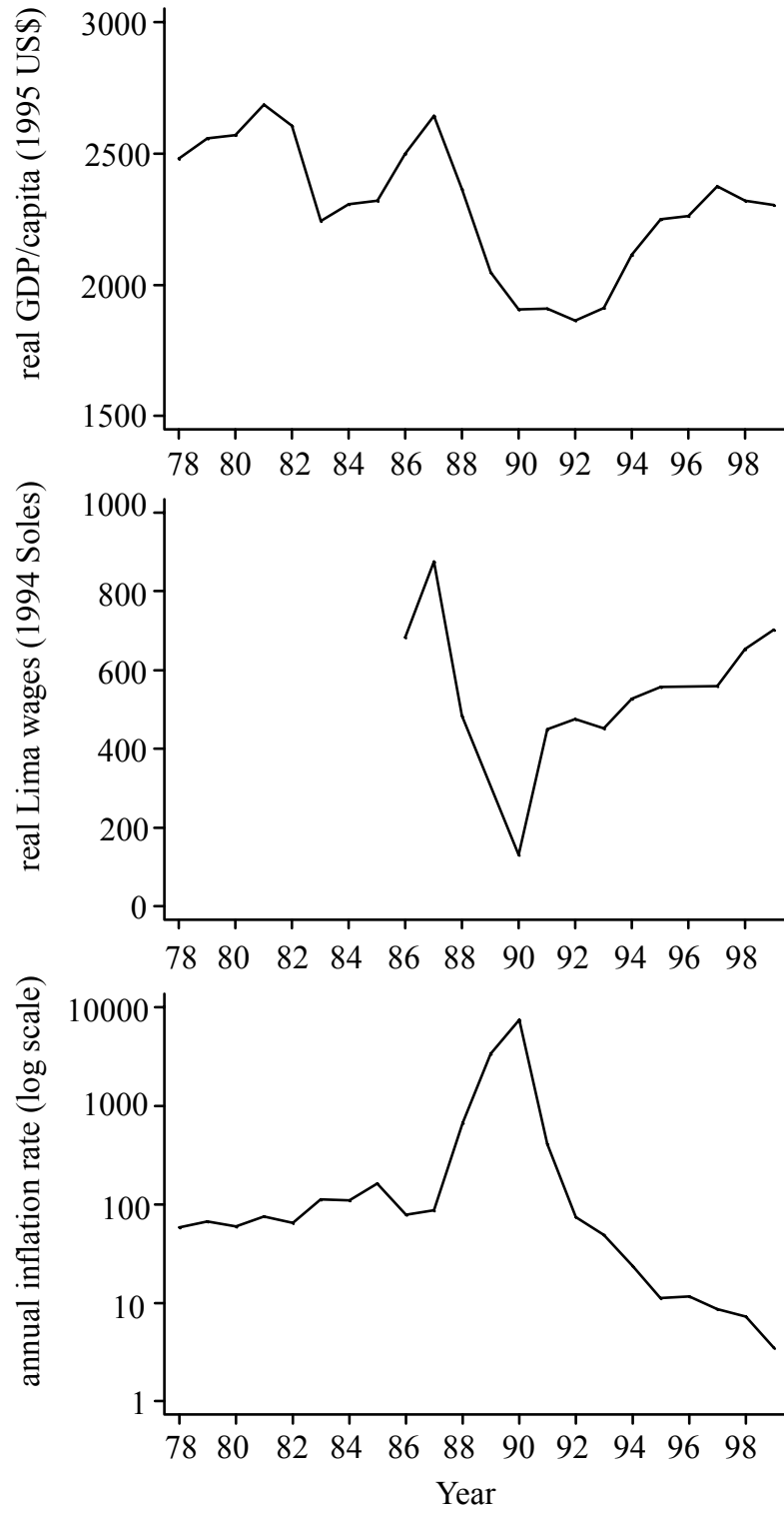
There are several possible explanations for the cross-country differences in the effects of crises on infant mortality. One is that the data on vital statistics, which are used for the analysis of infant mortality trends in Mexico, Argentina and the former Soviet Union, are too inaccurate to pick up changes in infant mortality. The fact that we observe increases in mortality in Peru with the DHS data but not with the vital statistics data lends some credence to this hypothesis—although the quality of the vital statistics data in richer countries like Russia is likely to be far superior to that in Peru. Other explanations for these differences across countries could be the depth of the crisis—particularly severe in the case of Peru—or the extent to which health care expenditures changed—in Argentina, for example, health expenditures do not appear to have fallen during the crisis (Rucci 2004). Future research on the reliability of different sources of mortality data, and on the importance of changes in household income and consumption relative to changes in public expenditures on health and other services would be important for the design of policies to protect child health during macroeconomic crises.

## **Bibliography**

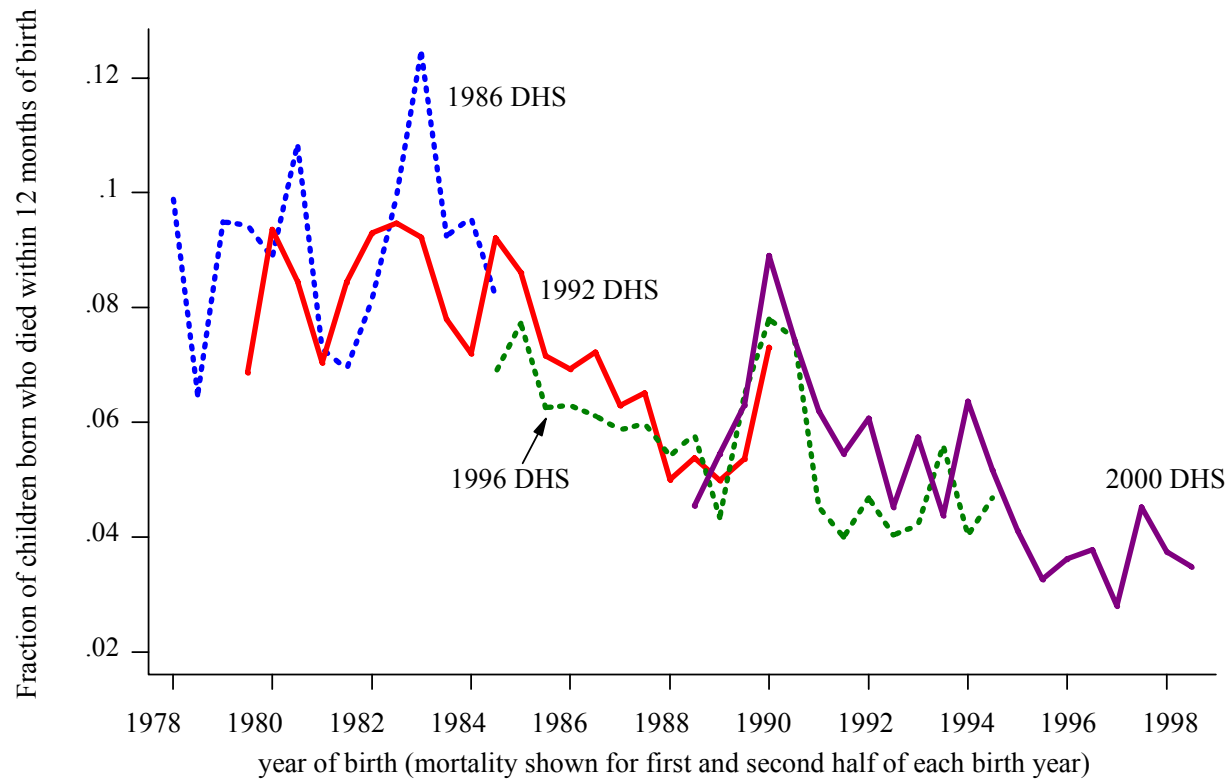
- Ashton, Basil, et al. 1984. "Famine in China, 1958-61", *Population and Development Review* 10(4): 613-46.
- Associated Press, July 21, 1991, "Peru State Health Workers Suspend Strike After Four Months," (Alex Emery).
- Associated Press, February 11, 1992, "Peru: Health Workers Go On Strike as Cholera Continues to Spread."
- Ben-Porath, Yoram. 1973. "Short-Term Fluctuations in Fertility and Economic Activity in Israel", *Demography* 10(2): 185-204.
- Brainerd, Elizabeth. 1998. "Market Reform and Mortality in Transition Economies", *World Development* 26(11): 2013-2027.
- , 2001. "Economic Reform and Mortality in the Former Soviet Union: A Study of the Suicide Epidemic in the 1990s", *European Economic Review* 45(4-6): 1007-1019.
- , and David M. Cutler. 2004. "Autopsy of an Empire: Understanding Mortality in Russia and the Former Soviet Union", National Bureau of Economic Research Working Paper 10868.
- Cameron, Lisa. 2002. "The Impact of the Indonesian Financial Crisis on Children: Data from 100 Villages Survey", World Bank Policy Research Working Paper 2799.
- Chay, Kenneth Y., and Michael Greenstone. 2003. "The Impact of Air Pollution on Infant Mortality: Evidence from Geographic Variation in Pollution Shocks Induced by a Recession", *Quarterly Journal of Economics* 118(3): 1121-67.
- Coale, Ansley J. 1984. *Rapid Population Change in China, 1952-1982*, Committee on Population and Demography, 27, Washington, DC: National Academy Press.
- Colwell, Rita. 1996. "Global Climate and Infectious Disease: The Cholera Paradigm", *Science* 274 (5295), December 20: 2025-2031.
- Cutler, David M., Felicia Knaul, Rafael Lonzano, Oscar Méndez and Beatriz Zurita. 2002. "Financial Crisis, Health Outcomes and Ageing: Mexico in the 1980s and 1990s", *Journal of Public Economics* 84(2): 279-303.
- Dehejia, Rajeev and Adriana Lleras-Muney. 2004. "Booms, Busts, and Babies' Health", *Quarterly Journal of Economics* 119(3): 1091-1130.
- Del Ninno, Carlo and Mattias Lundberg. 2002. "Treading Water: Long-Term Impact of the 1998 Flood on Nutrition in Bangladesh", unpublished manuscript, The World Bank.
- Glewwe, Paul, and Gillette Hall. 1994. "Poverty, Inequality and Living Standards During Unorthodox Adjustment: The Case of Peru, 1985-1990", *Economic Development and Cultural Change* 42(4): 689-717.
- Foster, Andrew D. 1995. "Prices, Credit Markets and Child Growth in Low-Income Rural Areas", *Economic Journal* 105(430): 551-570.
- Frankenberg, Elizabeth, Duncan Thomas and Kathleen Beegle. 1999. "The Real Costs of Indonesia's Economic Crisis: Preliminary Findings from the Indonesia Family Life Surveys", RAND Labor and Population Working Paper Series 99-04.

- Glass, R.I., A. M. Svennerholm, B. J. Stoll, M. R. Khan, K. M. Hossain, M. I. Huq, and J. Holmgren. 1983. "Protection Against Cholera in Breast-fed Children by Antibodies in Breast Milk", *New England Journal of Medicine* 308: 1389-1392.
- Hanson, Lars, Marina Korotkova, Samuel Lundin, Liljana Haversen, Sven-Arne Silfverdal, Inger Mattsby-Baltzer, Birgitta Strandvik and Esbjorn Telemo. 2003. "The Transfer of Immunity from Mother to Child", *Annals of the New York Academy of Sciences* 987: 199-206.
- Hoddinott, John, and Bill Kinsey. 2001. "Child Growth in the Time of Drought." *Oxford Bulletin of Economics and Statistics* 63(4): 409-36.
- Instituto Nacional de Estadística e Informática (INEI). 1996. *Perú: Estadísticas de la Criminalidad, 1994-96*, Lima, Peru: INEI.
- Jensen, Robert. 2000. "Agricultural Volatility and Investments in Children", *American Economic Review* 90(2): 399-404.
- Martorell, Reynaldo and Teresa J. Ho. 1984. "Malnutrition, Morbidity and Mortality", *Population and Development Review* 10 (Supplement): 49-68.
- McKenzie, David J. 2004. "The Consumer Response to the Mexican Peso Crisis", unpublished manuscript, Department of Economics, Stanford University.
- , and Ernesto Schargrotsky. 2004. "Buying Less, But Shopping More: Changes in Consumption Patterns During a Crisis", unpublished manuscript, Department of Economics, Stanford University.
- Mroz, Thomas, Laura Henderson, and Barry Popkin. 2001. "Monitoring Economic Conditions in the Russian Federation: The Russia Longitudinal Monitoring Survey 1992-2000", unpublished manuscript, Carolina Population Center, University of North Carolina at Chapel Hill, North Carolina.
- Palloni, Alberto and Kenneth Hill. 1992. *The Effects of Economic Changes on Mortality by Age and Cause: Latin America, 1950-90*, University of Wisconsin—Madison: Center for Demography and Ecology.
- Pan American Health Organization. 1998. *Health in the Americas*, 1998 Edition, Volume II, Peru Country Profile, available at <http://165.158.1.110/english/sha/prflper.html#asis>.
- . 2003. "Cholera: Number of Cases and Deaths in the Americas (1991-2001, by country and year)", <http://www.paho.org/english/hcp/hct/eer/cholera-1991-2001.htm>, update dated March 3, 2003.
- Rucci, Graciana. 2004. "The Role of Macroeconomic Crisis on Births and Infant Health: The Argentine Case", unpublished manuscript, Department of Economics, UCLA.
- Ruhm, Christopher. 2000. "Are Recessions Good for Your Health?", *Quarterly Journal of Economics* 115(2): 617-650.
- Rukumnuaykit, Pungpond. 2003. "Crises and Child Health Outcomes: The Impacts of Economic and Drought/Smoke Crises on Infant Mortality and Birthweight in Indonesia", unpublished manuscript, Department of Economics, Michigan State University.
- Saavedra, Jaime and Alberto Pascó Font. 2001. *Reformas Estructurales y Bienestar: Una mirada al Perú de los noventa*, Lima, Peru: Grupo de Análisis para el Desarrollo.

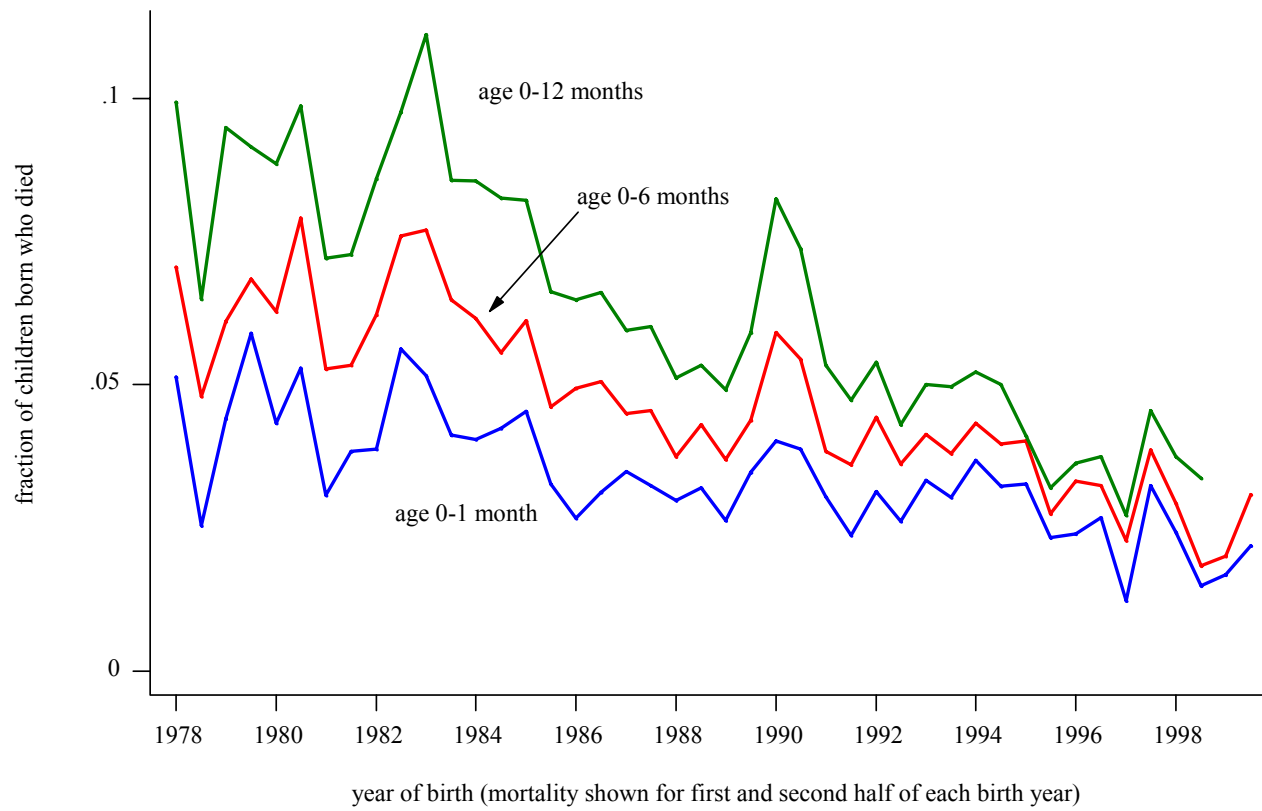
- Schady, Norbert R. 2004. "Do Macroeconomic Crises Always Slow Human Capital Accumulation?" *World Bank Economic Review* 18(2): 131-54.
- Shkolnikov, Vladimir, Giovanni Cornia, David Leon and France Mesle. 1998. "Causes of the Russian Mortality Crisis: Evidence and Interpretations", *World Development* 26(11): 1995-2011.
- Stein, Zena, Mervyn Susser, Gerhard Saenger and Francis Marolla. 1975. *Famine and Human Development: The Dutch Hunger Winter of 1944-45*, New York: Oxford University Press.
- Stillman, Steven, and Duncan Thomas. 2004. "The Effect of Economic Crises on Nutritional Status: Evidence from Russia", Institute for the Study of Labor (IZA) Discussion Paper No. 1092.
- Strauss, John, Kathleen Beegle, Agus Dwiyanto, Yulia Herawati, Daan Pattinasarany, Elan Satriawan, Bondan Sikoki, Sukamdi, and Firman Witoelar. 2002. "Indonesian Living Standards Three Years After the Crisis: Evidence from the Indonesia Family Life Survey", unpublished manuscript.
- Waters, Hugh, Fadia Saadah, and Menno Pradhan. 2003. "The Impact of the 1997-98 East Asian Economic Crisis on Health and Health Care in Indonesia", *Health Policy and Planning* 18(2): 172-181.
- World Bank. 1999. *Improving Health Care for the Poor*, Washington, D.C.: World Bank.
- . 2004. "East Asia Update: Regional Overview: Scaling Up Poverty Reduction—Lessons and Challenges from China, Indonesia, Korea and Malaysia", unpublished manuscript, Washington, DC.
- World Health Organization. 2000. Fact Sheet N107 [www.who.int/inf-fs/en/fact107.html](http://www.who.int/inf-fs/en/fact107.html).
- Yamano, Takashi, Harold Alderman, and Luc Christiaensen. 2003. "Child Growth, Shocks, and Food Aid in Rural Ethiopia," World Bank Policy Research Working Paper 3128.



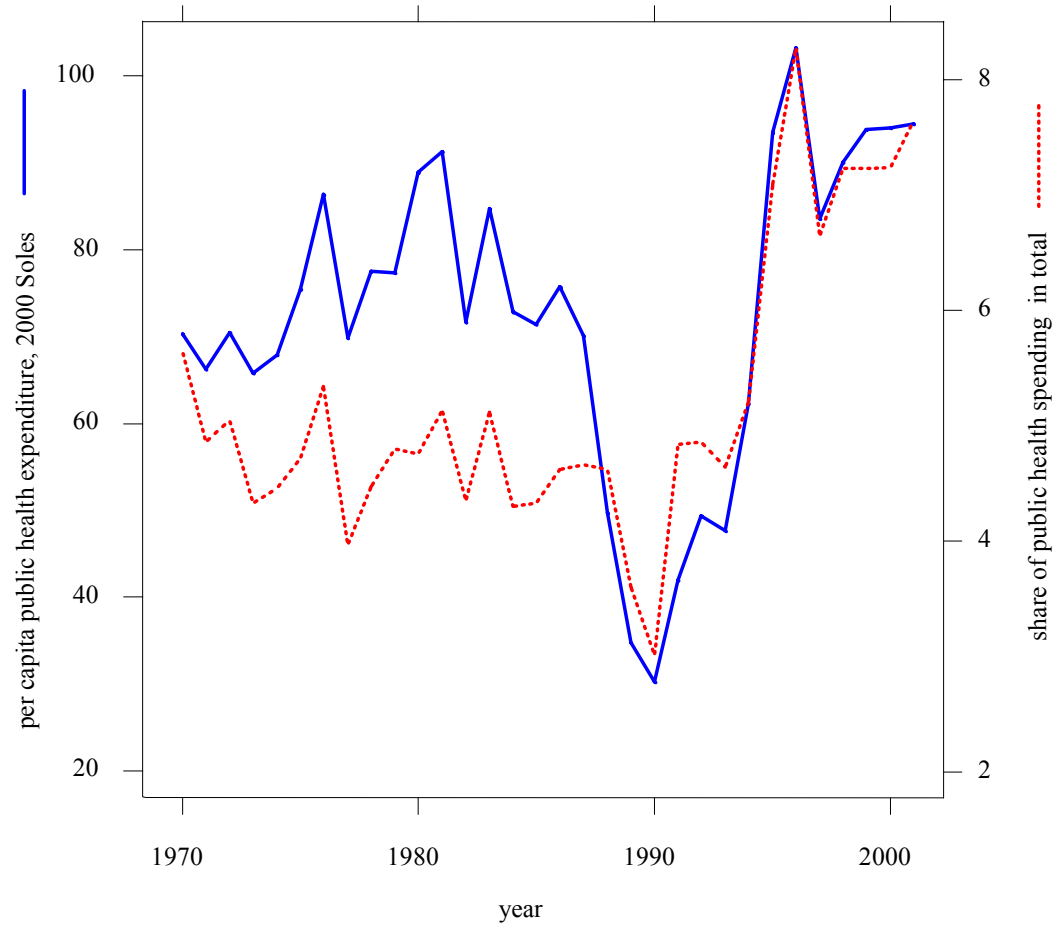
**Figure 1: Per capita GDP, wages and inflation**



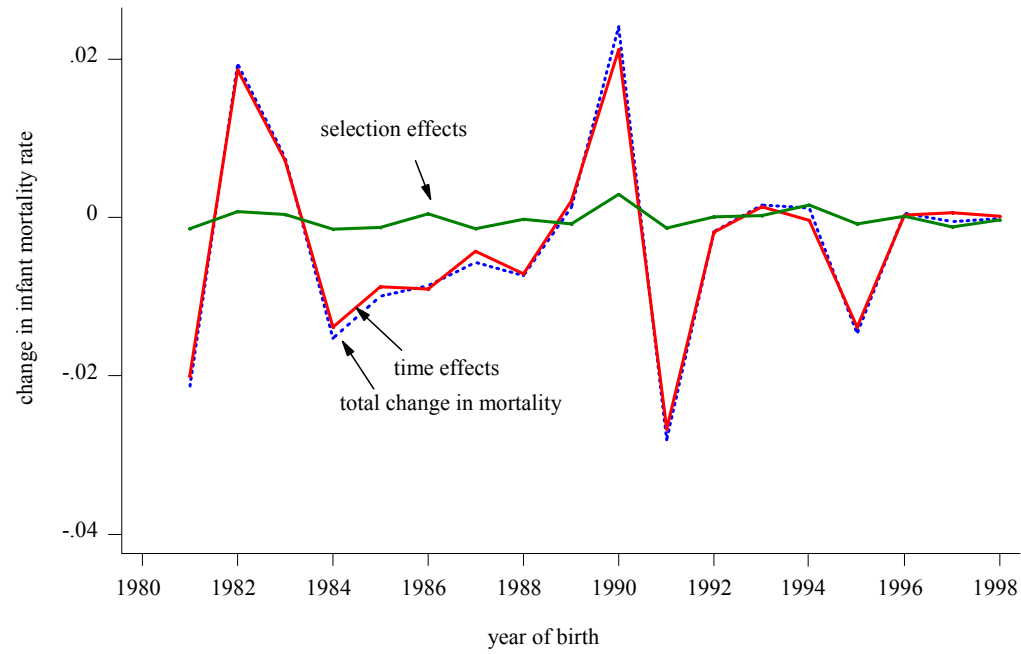
**Figure 2: Infant mortality, by survey year**



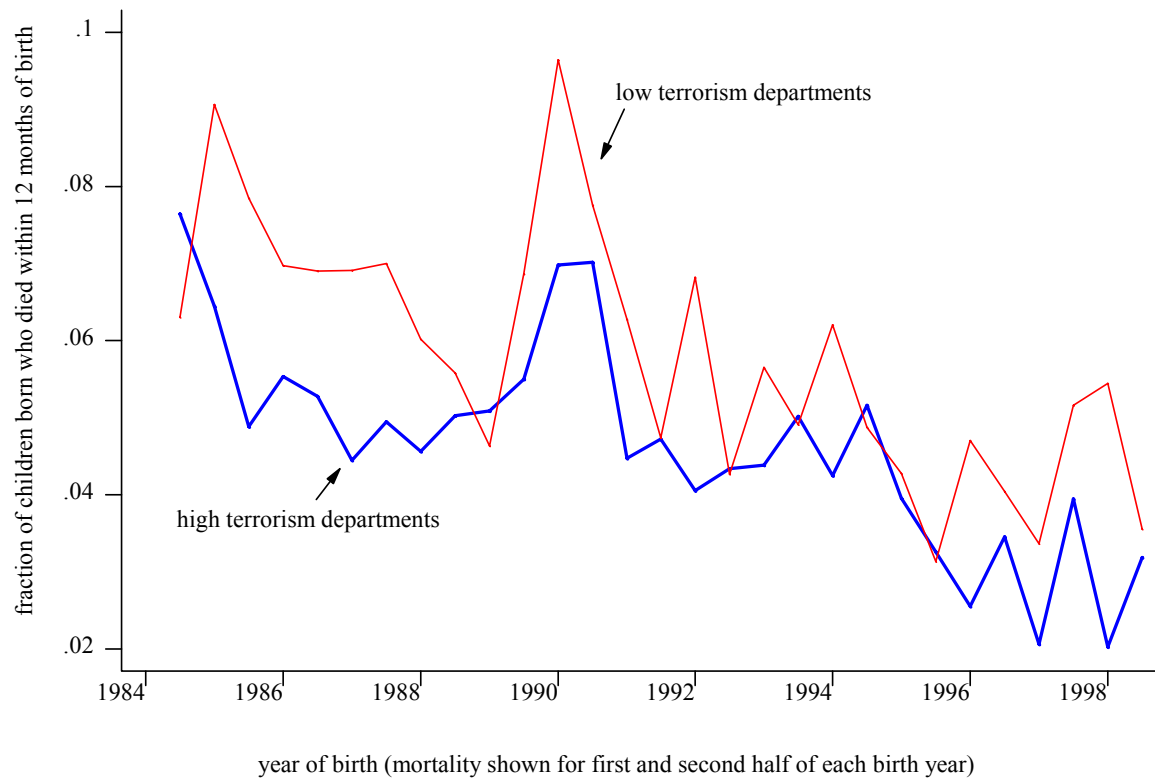
**Figure 3: Mortality rates averaged across survey years, by age group**



**Figure 4: Public health spending**



**Figure 5: Decomposition of change in infant mortality into time and selection effects**



**Figure 6: Infant mortality for "high" and "low" terrorism departments. 1996 and 2000 DHS**

**Table 1: Descriptive Statistics for Health Care and Birth Outcomes**

|   | 1991/92 DHS    | 1996 DHS       |
|---|----------------|----------------|
| Average number of antenatal visits (standard deviation)                 | 3.81<br>(4.07) | 3.48<br>(3.63) |
| Fraction of births at home  | 0.534          | 0.549          |
| Fraction of births that are first births                                | 0.242          | 0.253          |
| Observations:   |                |                |
| Number of births in 5 years preceding the survey                        | 9,027          | 16,669         |
| Number of mothers   | 6,193          | 12,014         |
| Number of mothers with 2 or more births in 5 years preceding the survey | 2,392          | 4,093          |
| Number of mothers with 2 or more births who:                            |                |                |
| Had change in number of antenatal visits                                | 1,254          | 2,100          |
| Had change in “birth at home”   | 307            | 480            |

**Note:** Means are calculated with the expansion factors in the survey.

**Table 2: Health Care and Birth Outcomes**

| Estimation method                                     | # Antenatal Visits |                   | Home Birth        |                   |
|---|--------------------|-------------------|-------------------|-------------------|
|   | RE                 | FE                | RE                | FE                |
| 1991/92 DHS (birth year=1987 is the omitted category) |                    |                   |                   |                   |
| Birth year=1988                                       | -0.014<br>(0.084)  | -0.033<br>(0.102) | -0.007<br>(0.011) | 0.007<br>(0.013)  |
| Birth year=1989                                       | -0.017<br>(0.020)  | 0.032<br>(0.095)  | 0.001<br>(0.010)  | 0.016<br>(0.013)  |
| Birth year=1990                                       | -0.151<br>(0.086)  | -0.064<br>(0.106) | 0.031<br>(0.011)  | 0.042<br>(0.014)  |
| Birth year=1991                                       | -0.277<br>(0.086)  | -0.208<br>(0.107) | 0.014<br>(0.011)  | 0.037<br>(0.014)  |
| First birth   | 0.630<br>(0.076)   | 0.711<br>(0.100)  | -0.074<br>(0.010) | -0.035<br>(0.013) |
| Test: Year effects jointly 0 (p-value)                | 0.001              | 0.149             | 0.004             | 0.006             |
| 1996 DHS (birth year=1992 is the omitted category)    |                    |                   |                   |                   |
| Birth year=1993                                       | 0.064<br>(0.057)   | 0.035<br>(0.074)  | -0.017<br>(0.008) | -0.015<br>(0.010) |
| Birth year=1994                                       | 0.121<br>(0.054)   | 0.104<br>(0.066)  | -0.027<br>(0.007) | -0.029<br>(0.009) |
| Birth year=1995                                       | 0.264<br>(0.056)   | 0.256<br>(0.073)  | -0.041<br>(0.007) | -0.336<br>(0.010) |
| Birth year=1996                                       | 0.382<br>(0.062)   | 0.410<br>(0.080)  | -0.047<br>(0.008) | -0.039<br>(0.011) |
| First birth   | 0.523<br>(0.054)   | 0.517<br>(0.076)  | -0.092<br>(0.007) | -0.066<br>(0.010) |
| Test: Year effects jointly 0 (p-value)                | 0.000              | 0.000             | 0.000             | 0.000             |

**Notes:** Standard errors in parentheses. Linear probability models are used throughout. The columns marked “RE” include mother-level random effects, and the columns marked “FE” include mother-level fixed effects. The RE models also include controls for the mother’s level of schooling (primary, secondary, or postsecondary, with “no school” omitted); mother’s age at the time of the survey (age categories 20-29, 30-39 and 40-49, with 15-19 omitted); and urban status.

**Table 3: Changes in consumption, urban areas**

|  | 1985  | 1991  | t-statistic |
|--|-------|-------|-------------|
| <b>Foods</b>   |       |       |             |
| <u>Grains &amp; starches</u>                               |       |       |             |
| Rice   | 0.90  | 0.91  | 0.72        |
| Maize  | 0.47  | 0.43  | 1.99        |
| Flour  | 0.49  | 0.35  | 6.30        |
| Barley, oats   | 0.17  | 0.16  | 1.08        |
| Quinoa   | 0.30  | 0.33  | 1.39        |
| Bread  | 0.97  | 0.98  | 2.11        |
| Cookies, cake  | 0.53  | 0.47  | 2.69        |
| Noodles  | 0.89  | 0.89  | 0.02        |
| Potato, yams, yucca  | 0.90  | 0.96  | 4.86        |
| <u>Animal products</u>                                     |       |       |             |
| Red meat   | 0.77  | 0.79  | 1.15        |
| Other meat products  | 0.28  | 0.17  | 5.69        |
| Poultry  | 0.73  | 0.81  | 3.15        |
| Eggs   | 0.79  | 0.91  | 7.45        |
| Fish, seafood  | 0.77  | 0.69  | 3.53        |
| <u>Dairy, fats and oils</u>                                |       |       |             |
| Milk   | 0.81  | 0.75  | 2.62        |
| Yogurt, butter, cheese                                     | 0.72  | 0.39  | 15.30       |
| Oil, margarine   | 0.90  | 0.93  | 2.05        |
| <u>Vegetables</u>  |       |       |             |
| Legumes (chickpeas, lentils, beans)                        | 0.70  | 0.77  | 3.35        |
| Fresh vegetables   | 0.92  | 0.95  | 2.42        |
| Fresh fruit  | 0.89  | 0.90  | 0.36        |
| Frozen, dried, or canned vegetables & fruits               | 0.13  | 0.07  | 5.27        |
| <b>“Semi-durables” and services</b>                        |       |       |             |
| Adult clothing   | 0.61  | 0.54  | 3.45        |
| Child clothing   | 0.44  | 0.36  | 4.53        |
| Adult footwear   | 0.68  | 0.56  | 5.26        |
| Child footwear   | 0.42  | 0.32  | 5.55        |
| Home furnishings (furniture, curtains, sheets, silverware) | 0.37  | 0.27  | 4.88        |
| Entertainment (toys, cinema, records, sports events)       | 0.51  | 0.30  | 9.91        |
| Personal care (haircut and beautician services)            | 0.75  | 0.74  | 0.59        |
| Medications  | 0.81  | 0.43  | 14.25       |
| <b>Durables</b>  |       |       |             |
| Radio  | 0.11  | 0.23  | 9.10        |
| Electronics (TV, stereo)                                   | 0.22  | 0.26  | 3.13        |
| Car, motorbike   | 0.04  | 0.02  | 3.51        |
| Bicycle  | 0.06  | 0.08  | 1.52        |
| Sewing, weaving, waxing, washing machine                   | 0.07  | 0.05  | 3.28        |
| Fridge, oven, blender                                      | 0.20  | 0.18  | 1.53        |
| Number of observations                                     | 2,614 | 1,715 |             |

**Notes:** Means are calculated with the expansion factors in the survey; the t-statistic is based on a test of the equality of coefficients in the two years.