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ABSTRACT

The Weight of the Crisis: Evidence from Newborns in Argentina*

Argentina hit headlines around the world in 2002 on account of the largest debt default in history and a sudden economic collapse that generated statistics reminiscent of those from the Great Depression. In this article we focus on other consequences of the crisis that are not so obvious but that may linger for decades. Combining macroeconomic indicators with the Argentine national registry of live births (approximately 1.9 million from 2001 through 2003), we show that the crisis led to an average birth-weight loss of 30 grams. Our estimate is robust to different identification strategies. This deterioration in birth weight occurred in only about six months, and represents one-sixth of the difference in average birth weight between American and Pakistani babies. We also find that the crisis affected particularly the weight of babies born of mothers of low socioeconomic status. In an attempt to estimate the long-term economic costs of the crisis, we simulate the average loss of future individual earnings due to the reduction in average birth weight: about $500 per live birth.

JEL Classification: I1, J1

Keywords: Argentina, birth weight, economic crisis

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1 Introduction

Economic crises may affect children's health, and in particular their birth weight. During recessions households may be prompted to reduce spending on items vital to children's health, including nutritious food and medical care for mothers and infants. Moreover, economic downturns are likely to worsen prenatal stress, increasing the risk of adverse birth outcomes, and may also cause public-health services to deteriorate.

We investigate the impact of the Argentine crisis that began in August 2001 on birth weight. Argentina was shaken by a traumatic financial crisis at the turn of the century; its output declined not only by about 11% in 2002 but by an additional 7% between 1999 and 2002. At the peak of the crisis, one out of four Argentines could not even afford to buy basic foodstuffs,[1] and nearly two out of three were categorized as poor.[2]

The occurrence of this Argentine macroeconomic episode, combined with the existence of a national registry of live births, offers the possibility of studying the effect of such a crisis on the weight of the newborns by means of data on approximately 1.9 million live births that occurred over a three-year period, from 2001 through 2003. We find that in only about six months the weight of newborns in this middle-high-income country deteriorated by a magnitude comparable to one-sixth of the difference between the average weights of American and Pakistani newborns.

We choose birth weight as our outcome of interest for two reasons.[3] First, birth weight

[1] Technically, these were individuals who lived in households whose total income was below a basic-foodstuffs basket (canasta básica alimentaria) that covers the minimal nutritional requirements for an individual of a certain sex and age. For instance, in September 2001 the cost of the basic-foodstuffs basket was estimated to be \$61.02 per month per adult equivalent (the exchange rate used for the conversion was the 1 to 1 parity to the U.S. dollar). Further information can be found in an on-line report prepared by Argentina's National Institute of Statistics and Censuses (INDEC), available at http://www.indec.mecon.ar/nuevaweb/cuadros/74/pobreza2.pdf. Related statistics, derived from the periodical National Household Survey (Encuesta Nacional de Hogares), can be obtained at the INDEC website, http://www.indec.mecon.ar

[2] That is, living in households under the poverty line. For reference, the poverty line in September 2001 was estimated to be at \$150.11 per month per adult equivalent.

[3] Margerison (2010) offers a detailed account of possible pathways linking economic recessions and birth outcomes.

is a reliable predictor of survival (Mc Cormick, 1985): infants who weigh less than 2,500 grams (low-birth-weight infants) are 20 times more likely to die than are heavier babies (UNICEF/WHO, 2004). In fact, birth-weight-specific neonatal mortality follows a reverse J-pattern, with minimal risk of mortality at about 3,500 grams (Wilcox, 2001). Lower-birth-weight babies have worse outcomes in terms of one-year mortality rates (Van den Berg, Lindeboom, and Portrait, 2006) and are significantly shorter through childhood (Case and Paxson, 2010).[4] Economic costs due to low birth weight are also substantial. For example, Almond, Chay, and Lee (2005) show that increasing the birth weight from 2,000 to 2,500 grams reduces inpatient hospital bills by about $10,000.

Second, recent longitudinal studies have shown that lower-birth-weight babies have worse outcomes in terms of educational attainment, employment, and earnings (Behrman and Rosenzweig, 2004; Case, Fertig, and Paxson, 2005; Black, Devereux, and Salvanes, 2007; Oreopoulos, Stabile, Walld, and Roos, 2008; Royer, 2009). Moreover, researchers have also found that the educational level attained by cohorts affected by health insults in utero is on average lower than that of adjacent birth cohorts who did not suffer the same health insult. Almond (2006) documents the fact that children born to women infected with influenza during the 1918 pandemic received on average five months less education than did children born before or conceived after this event. If economic crises affect the weight of newborns, economic recessions could result in poverty traps that affect not only present welfare levels but future ones as well.

Previous research on the effects of economic crises on children's health provides mixed results. Paxson and Schady (2005) find that in Peru infant mortality increased by 2.5 percentage points during the macroeconomic crisis of the late 1980s. The authors attribute this increase to a collapse in public and private health expenditures. In contrast, Rucci (2004) finds no change in Argentina's infant-mortality rate during the crisis of the late 1990s, and

[4]Using data from the NLSY Child and Young Adult Survey, Case, and Paxson (2010) find that children who were heavier and taller at birth are significantly taller through childhood and that taller children are less likely to be reported to be afflicted with an emotional or neurological limiting condition.

credits this stability to the fact that public health expenditures were maintained at their previous levels throughout the crisis years.

In this context, one of the main contributions of our work is the combination of a two-million-observation sample with an actual "event" study to show that an economic collapse can lead to large losses in birth weight in a short period of time, complementing recent work on coffee-price fluctuations and child-survival rates in Colombia (Miller and Urdinola, 2010) and on the role of poor conditions in the fetal period (Bhalotra, 2010).

Our work is related to a large economic-research agenda on the effects of in utero insults to birth weight, mainly nutritional deficiencies (Ceesay et al., 1997) and psychosocial stressors (Hobel and Culhane, 2003), at different trimesters of pregnancy.[5] Economic crises can lead to a loss of resources (worsened nutrition in utero) and psychosocial stress (Margerison, 2010). Evidence coming from extreme cases of nutritional deprivation, such as the Dutch "Hunger Winter" (Stein et al., 2004), of 1944-1945, during which food rations were reduced to below 1,000 Kcal per person for seven months, indicates that the birth weight of those exposed to famine in the third trimester dropped by about 300 grams. In a recent study based on four million childbirth events in Colombia, Camacho (2008) finds that the intensity of random land-mine explosions during a woman's first trimester of pregnancy has a significant negative impact on her child's birth weight. We show that birth-weight deficits in Argentina are correlated with economic conditions in both the first and the third trimesters of pregnancy during 2001-2003.

We also find that socioeconomic status (proxied by mother's education) could mitigate the effects of economic crisis, consistent with existing evidence linking maternal education and birth-weight outcomes (e.g., Starsfield, 1991; Currie and Moretti, 2003; Currie, 2009). The

[5] Although the biological pathways linking psychosocial stressors and birth outcomes have not been completely elucidated, a neuropeptide (corticotrophin-releasing hormone, or CRH) involved in stress response and affecting the initiation of labor is thought to be a central factor. The role of CRH confirms the finding that job status (in particular, jobs that demand physical exertion, and thus create physiological stress) are known to have an adverse effect on birth outcomes. Aizer, Stroud and Buka (2009) find that in utero exposure to elevated levels of the stress hormone cortisol negatively affects the cognition, health, and educational attainment of offspring.

average weight loss for newborns whose mothers' educational level is low is approximately 33 grams, while it is 19 grams for babies born of highly educated mothers.

Our main results are surprisingly robust to the addition of province-specific time trends, suggesting that the drop in average birth weight was not driven by a reduction in either the quality or the quantity of public resources allocated to children's health across different provinces over time. Additionally, if we link birth-weight statistics with regional time-varying household-survey data, we document strong links between average birth weight and indicators of deprivation, in particular regional extreme-poverty (indigence) rates.

In a back-of-the-envelope calculation, we estimate that the reduction in birth weight that occurred during the economic collapse reduced the income prospects of the crisis cohort by about $500 per childbirth. This is a lower-bound estimate that does not take into account other long-term costs stemming from the crisis, such as the increased health burden in adult life.[6]

The paper is organized as follows. In Section 2 we present a description of the data. In Section 3 we report the estimates of the effect of the Argentine crisis on average birth weight. In Section 4 we provide an estimate of the loss in future earnings of the newborns affected by the crisis. In Section 5 we present some robustness checks. In Section 6 we conclude.

[6] Adverse conditions at time of birth have been linked to heart disease, diabetes, and obesity in adulthood, all of which contribute to a reduction in life expectancy.

2 The data

The main source of data for this study is the Argentine national registry of live births, Informe Estadístico del Nacido Vivo (IENV). The main strength of this dataset is its universal coverage of all live births occurring in the country. The IENV contains information on birth weight and weeks of gestation, but not on other child health indicators (such as AGPAR score or head circumference). Regarding mother characteristics, there is information on her age, parity history, marital status, and educational attainment, but not on risky behaviors such as smoking or drinking. By definition, the IENV only contains information on live births, mortality cannot be examined. This micro-level dataset contains information on 1.9 million births occurring 2001 through 2003 in Argentina.[7] Following previous work on the determinants of birth weight, we focus on mothers aged 15-49, we exclude multiple births and those newborns whose weight was under 500 grams. Our sample size is 1,829,104 observations and birth weight is available for 99% of births.

The core of our empirical analysis contains two well-differentiated parts. We first use month-by-month average-birth-weight comparisons between 2001 and 2002 to assess the effect of the crisis. In the second part, we link the state of the economy with average birth weight on a monthly basis from January 2001 through December 2003. The state of the economy is captured by means of an index of economic activity which replicates the fluctuations in the gross domestic product (GDP), but at monthly frequencies.

2.1 Descriptive statistics

Argentina is an upper-middle-income country (World Bank, 2009), ranking as "high" in UNDP's Human Development Index (UNDP, 2009). In line with this ranking is its rel-

[7] On account of a change in the structure of the birth-weight-report form, data prior to the year 2001 are not directly comparable. Our analysis therefore focuses on short-term fluctuations from 2001 through 2003. In practice, however, this does not appear to be a concern. Previous studies (e.g., Grandi and Dipierri, 2008) show that the decline experienced during the crisis was not a reflection of a secular trend but an acute phenomenon, occurring in a matter of a few months.

atively small rate of low birth weights (live-birth babies weighing less than 2,500 grams; UNICEF/WHO, 2004).Table 1 shows summary statistics regarding the period 2001-2003.[8] Birth weight fluctuated between 3,263 and 3,231 grams, resulting in an average that is 100 grams below the U.S. standard (Martin et al., 2005). Consistent with this, the proportion of low-birth-weight ($< 2{,}500$ g) singletons is between 6.5 and 7%, slightly above comparable U.S. statistics. Infant Mortality Rate (IMR) increased only slightly during the economic crisis, but resulted in a four-year period of stagnation after a period of two decades in which IMR were halved. The second panel in the table shows selected economic indicators. Economic activity declined by about 10% in 2002, resulting in an economy that was 10.6% below its long-term trend in the year of the collapse. Unemployment rates reached 20% of the active population and more than half of the population was poor, as a result of a combination of increased unemployment and a steep drop in real wages due to inflation pressures caused, in turn, by a sharp depreciation of the national currency.[9] Different indicators of public expenditures on child health show a reduction of such expenditures, consistent with the findings of Cavagnero and Bilger (2010).[10] The last panel shows that the characteristics of the mothers remained stable throughout the period: the mothers' average age when they gave birth was 27 years, 36% of them were primiparous, 35-40% had completed high school, and 85% had a partner (involving marriage or cohabitation). We use completion of high school as a proxy for high socioeconomic status because income information is not included in the demographic-surveillance data.[11]

Figure 1 shows the evolution of the index of economic activity (which replicates GDP fluctuations at monthly frequencies) and the average birth weight of babies born from January 2001 through December 2003. There is a delay between the evolution of the economic crisis

[8] Although the IENV has an extensive set of proxy measures for underlying risks of poor birth outcomes, information to determine the health-insurance status of the mother and the employment status of the mother and particularly of her partner is not perfectly reported. See Section 6.

[9] By June 2002, the value of the peso relative to the US dollar was reduced to a quarter of what it had been in December 2001.

[10] These authors find that in terms of utilization of heath services, unemployment and job instability reduced private- health-plan coverage, putting an additional strain on the already underfinanced public-health system.

[11] Returns to schooling, in particular completion of secondary (high school) education and college education, are large and thus represent a good proxy for their income opportunities (Savanti and Patrinos, 2005).

and the changes in average birth weight: although the crisis peaked in March 2002 (economic activity had declined in a year by about 16% by that time) birth weight was at its nadir in December 2002. This is what we expect, since birth weight is the cumulative effect of different inputs (e.g., nutrition, quality and quantity of medical checkups, maternal stress, etc.) during the nine months that a pregnancy usually takes, and not just those prevailing at time of birth.

3 The effect of the Argentine economic crisis on average birth weight

3.1 Month-by-month estimates

In order to identify the effect of the Argentine crisis on the weight of the newborns, we need to take into account that fertility decisions are likely to be affected by economic conditions, a fact already acknowledged in the theoretical work of Becker (1991) and proven empirically both by Dehejia and Lleras-Muney (2004), by means of US data, and, more recently, by Neugart and Ohlsson (2009) in a quasi experiment that exploits the German parental-benefit reform of 2007.

As long as fertility decisions are sensitive to macroeconomic conditions, sensible methods of estimating the effect of the crisis involve accounting for the full set of characteristics of the mother (related to both macroeconomic conditions and birth weight) or using a quasi experiment to estimate the impact of the crisis as the mean difference in birth weight between those babies who were exposed to the crisis without their mothers' anticipating it and those babies who were not. Otherwise, the estimated effect of the crisis can be confounded by the compositional change in the pool of childbearing women.[12]

There is a plethora of studies documenting the roles of different mother-and-pregnancy characteristics relative to birth weight. In a frequently cited meta-analysis assessment, Kramer (1987) cited 43 potential determinants of low birth weight ($<$ 2,500 g). The most important factors are considered to be: the age of the mother (with mothers under 20 and over 35 running a relatively high risk of delivering a child of low birth weight); the mother's education, which proves to be correlated with lower rates of low birth weight (Starfield et al., 1991); parity and birth order (Puffer and Serrano, 1975); behavioral factors such as smoking and drinking,

[12] However, it must be noted that even when the full set of characteristics is available, compositional changes can create problems if there are interactions and other sources of non-linearities.

which have a negative impact on birth weight (Brooke et al., 1989; Cornelius et al., 1995).

We have chosen to use a mixed approach, not only accounting for characteristics of the mother and her child but also comparing month-by-month average weights of babies born in 2001 and 2002 whose mothers did not anticipate the crisis around the time when they conceived.

In order to implement the quasi-experimental design, it is crucial that one find a cohort of newborns who were conceived during a period when the extent of the crisis was not yet anticipated. This assumption is plausible in light of two pieces of evidence. The first one found in Figure 2, from Kannan and Köhler-Geib (2009), shows the degree of uncertainty around the period of the Argentine crisis, measured by the dispersion of GDP forecasts based on surveys performed by private-sector analysts: the degree of uncertainty jumped in August 2001. As long as anticipation can be proxied by lack of uncertainty, this figure suggests that until August 2001 the crisis was unanticipated.

The second piece of evidence supporting this assumption comes from the evolution of the Consumer Confidence Index for Argentina, as depicted in Figure 3, which indicates a similar pattern in terms of expectations, with consumer-confidence levels dropping sharply after August 2001. Perhaps more interesting (although not reported here) is the fact that this drop is of the same magnitude whether the consumers in question are of low or of high socioeconomic status.[13] The point is that the magnitude of the crisis was unexpected, even though mildly pessimistic expectations may have prevailed throughout the period.

Since this paper is concerned with the impact of the crisis on live births, abortion data must be considered. Unfortunately, not only are such data scant but the entire issue is complicated by the fact that in Argentina abortion is illegal. A recent study by Mario and Pantelides (2009) estimates the number of annual abortions by means of various indirect methods, adequate for

[13]Since 1998 the Consumer Confidence Index has been updated monthly by the Universidad Torcuato Di Tella. The index is based on a monthly survey of consumer expectations similar to surveys used in OECD countries. We thank the Center for Research in Finance (CIF) of Universidad Torcuato Di Tella, and especially Guido Sandleris, Ernesto Schargrodsky, and Julieta Serna, for providing us with the access that we needed in order to disaggregate consumer-confidence indicators.

describing general trends but not for projecting the evolution of abortion cases from year to year. Very crude and indirect indicators of abortion prevalence are the number of maternal deaths due to pregnancy terminating in abortion and the number of fetal deaths. These indicators have many shortcomings, and no discernible trend can be established by means of data from the Official Statistical Yearbooks (Ministerio de Salud 2000-2007, Estadísticas Vitales). Although we cannot study directly the evolution of abortion during the period under analysis, we can proceed indirectly by looking at the fluctuations in the number of live births. Figure 4 shows that this number fluctuates erratically, whereas average birth weight fluctuates systematically, relative to the economic cycle.

Our comparison group comprises babies who were both conceived and born before August 2001, while our treatment group comprises babies who were conceived before August 2001 but born after August 2001 (Fig. 5). For example, a baby conceived in July 2001, after a normal, nine-month, gestation period, be delivered in April 2002.

In order to account for seasonality patterns in birth weight, we compare the monthly average birth weights for January through April 2001 with those for the same four-month period in 2002. Means of birth weight by month are estimated as the coefficients of the following model:

$$BW_{i,r,m,t} = \sum_{m=1}^{12} \delta_m I_m + \sum_{m=1}^{12} \theta_m Y_t I_m + \kappa_r + X_i \Gamma + \varepsilon_{i,r,m,t} \quad (1)$$

where $BW_{i,r,m,t}$ is the birth weight of child i born in province r in month m in year t, $I_m = 1$ if the month of birth is m, $Y_t = 1$ if the year of birth is 2002, $\kappa_r = 1$ if the province of birth is r, X_i is a vector of mother-pregnancy characteristics (mother's age, number of pregnancies, mother's education, and mother's partner status), and $\varepsilon_{i,r,m,t}$ is a random error term. δ_m is average birth weight in month m, while θ_m is the difference in average birth weight in month m between 2001 and 2002. Equation (1) is estimated by OLS using clustered standard errors at the month-by-year level (24 clusters).

Table 2 displays the monthly mean birth weight in 2001 and 2002 and its difference. The first panel uses as controls province and child-gender dummy variables. In all four month-pair comparisons, birth weight in 2002 is lower than in 2001. The largest gap, nearly 30 grams, is found in April, while the smallest one, about 7 grams, is found in February. Interestingly, the 30-gram gap coincides (or nearly so) with the nadir of economic activity and the peak of social unrest. Similar estimates are reported in panel II (which adds mother's age and pregnancy categories as controls) and panel III (which controls for the mother's education and partner status as well).

These findings suggest that the crisis had a negative effect on birth weight, which was about 30 grams for babies born in the month of April 2002. Babies born earlier in the crisis were less affected than those born in February and March, probably because the effects of the crisis operate in utero in a cumulative manner: children born in April 2002 were exposed to nine months of the crisis, while those born in February and March 2002 were exposed to seven and eight months of the crisis, respectively.

Table 3 disaggregates results by the sex of the newborn. Although all comparisons point toward a reduction in birth weight, boys are slightly more affected than girls. These findings are consistent with some evidence that boys are particularly vulnerable to food supply shortages in utero (Eriksson, Kajantie, Osmond, Thomburg, and Barker, 2010).

In Table 4 we inquire about the differential effect of the crisis on average birth weight depending on the mother's socioeconomic status, proxied for whether the mother completed completed high school. Regardless of the set of controls used, the decline in birth weight is particularly prevalent in boys and girls born to low-socioeconomic status mothers. If anything, a higher socioeconomic status appears to cushion newborns during an economic crisis.

3.2 Economic cycle and average birth weight

3.2.1 Economic cycle at birth and average birth weight

To assess the state of the economy, we calculate the deviation of the economic-activity indicator with respect to its long-term trend (expressed in log units). This deviation is usually referred to as the cyclical component, in that it isolates business-cycle fluctuations. We use a Hodrick-Prescott filter, which is a standard decomposition method of identifying fluctuations at business-cycle frequencies (i.e., booms and recessions).[14] In the case under consideration, the economy plunges into a recession so quickly that by mid-2002 economic activity is more than 10% below its long-term trend.

We estimate models of the form

$$BW_{i,r,m,t} = \beta C_m + I_m + \kappa_r + Y_t + X_i\Gamma + \varepsilon_{i,r,m,t} \tag{2}$$

$$BW_{i,r,m,t} = \beta C_m + I_m + \kappa_r + \gamma t + X_i\Gamma + \varepsilon_{i,r,m,t} \tag{3}$$

where C_m is the cyclical component of the economic-activity indicator during the month of birth m. Both models (2) and (3) contain two types of control variables. The first set of controls includes: month of birth-fixed effects I_m, to account for seasonality patterns in birth weight; province of birth-fixed effects κ_r, to capture regional differences in the health-care infrastructure and other factors that are fixed in time but vary across provinces; and time effects (either year-fixed effects Y_t in (2), or a linear time trend t in (3)) to account for secular trends in birth weight. However, given our small time window (2001-2003), using a time trend, comes at a risk: the overestimation of the secular decline in birth weight.[15] The

[14] Since we are using monthly data, we choose a smoothing parameter of 129,600 (Ravn and Uhlig, 2002). Our findings are not sensitive to the method used, as our use of other filtering methods attests.

[15] Grandi and Dipierri (2008) use data from 1992 through 2002 and find a secular decline of about 2 grams per year in the birth weight of Argentine babies. The decline in birth weight that occurred in 2002 alone amounts to 30 grams (Table 1). Moreover, the secular trend in the 2001-2003 sample may absorb business-

second set of controls, X_i, includes: mother's-age categories, parity categories, an indicator of whether the mother has completed high school, an indicator of whether the mother is living with his partner (married or cohabiting), and the interaction of these last two variables. Unfortunately, information on mothers' smoking and drinking habits/patterns is not included in the birth-registry.

Table 5 displays a series of regressions of birth weight on economic cycle at birth and other variables for the full sample of boys and girls. The estimates indicate that average birth weight is positively associated with the cycle at birth. In other words, average birth weight is a procyclical variable. It should be noted, however, that if in utero conditions affect birth outcomes in a cumulative manner (that is, if they operate, to a greater or lesser degree, throughout the entire gestation period), one would expect business-cycle lags, too, to have an influence on birth weight.

Looking at the rest of the coefficients on the table we can see that at birth girls are on average 103 grams lighter than boys: a finding similar to one reported in Kramer (1987). Newborns of highly educated mothers are heavier than those whose mothers are not, a finding that resonates with others linking maternal education and birth-weight outcomes (e.g., Starsfield, 1991; Currie and Moretti, 2003; Currie, 2009).

In Table 6 we report estimates from the last two specifications of Table 5 for boys and girls separately. The estimated impact of the business cycle is slightly more important for boys than for girls: a finding consistent with the estimates presented in Table 3, above.

Table 7 presents evidence on the differential impact of the crisis on the weight of newborns according to their mothers' educational level. The table shows that in every specification the business cycle at birth is strongly correlated with the birth weight of children born to mothers whose educational level is low, and that the impact on children born to highly educated mothers at least doubles the effect on the others. In fact, a specification using a linear

cycle fluctuations and could theoretically reduce the estimates of the impact of business-cycle fluctuations (i.e. the collapse) on birth weight for this particular sample period.

time trend indicates that the effect of the business cycle during the month of birth for this subsample of children is insignificant.[16]

Mothers of low socioeconomic status had on average lighter babies than did the others (Tables 5 and 6). Moreover, less-educated mothers were hit harder by the crisis (Table 7). In other words, babies born into poor families have a disadvantage in normal times (without recessions) which becomes even wider in bad times (with recessions).

What would be the observed evolution of average birth weight had the economy not entered in the recession? Figure 6 shows the evolution of actual average birth weight, what the average birth weight would have been – according to the model in column (6) of Table 5 – had the economy not entered in the recession, and the difference between them.[17] This simulation (hypothetical situation) is achieved by replacing the actual monthly cyclical component from August 2001 to the end of our time window with randomly chosen realizations of the cyclical components from January 2001 through July 2001. The negative effect of the crisis in terms of birth-weight peaks during the third quarter of 2002, six months after the business cycle trough (see Fig. 1) and its adverse influence declines over time on account of the economic recovery that ensued.

3.2.2 Economic cycle during the trimesters of pregnancy and average birth weight

Since birth weight is affected by economic conditions throughout pregnancy, attempting to capture the impact of the economic crisis by using only the economic cycle at birth may not be accurate. Thus, for each birth we create a measure of the economic cycle in each of the three quarters that a pregnancy usually takes. For the first quarter of pregnancy, we take

[16] If in addition we break down the sample by gender of the child, reestimation of column (3) separately for boys and girls gives us cycle coefficients of 147.96*** (27.51), and 136.62*** (32.37), respectively. Reestimating column (6), we obtain coefficients of 28.57 (31.48) and 21.27 (23.59) for boys and girls, respectively. Similar qualitative results are obtained if instead of using a linear time trend we control for year-fixed effects. More specifically, the significant estimates, which are obtained for those childbirths involving mothers with a low educational level, are 120.53** (49.53) and 100.04** (42.76) for boys and girls, respectively.

[17] Note that the period during which the comparison takes place now begins with August 2001.

the average of the monthly cyclical component in those three initial months, C_1, and we do a similar procedure for the second and third quarters of pregnancy, C_2 and C_3.

We start by estimating models in which we include the cyclical component for only one of the trimesters

$$BW_{i,r,m,t} = \beta_T C_T + I_m + \kappa_r + Time + X_i\Gamma + \varepsilon_{i,r,m,t} \tag{4}$$

where β_T reflects the sensitivity of birth weight to economic conditions during trimester T of pregnancy, and $Time$ is either a set of year-fixed effects, Y_t, or a linear time trend, t. Table 8 shows that different indicators of the business cycle during pregnancy have effects of the same order of magnitude on birth weight. This is not surprising given the high autocorrelation displayed by business-cycle deviations and the fact that indicators are introduced separately.[18] The impact of quarterly indicators (cycle in a given trimester of pregnancy) shown in Table 8 is much greater than the effect of the business cycle during the month of birth. Although speculative, this result is expected if monthly time series are noisier than quarterly averages, or if the effect of adverse economic conditions is cumulative throughout the pregnancy period.

The next step is to include the cycles in each trimester simultaneously, in a single equation:

$$BW_{i,r,m,t} = \sum_{T=1}^{3} \beta_T C_T + I_m + \kappa_r + Time + X_i\Gamma + \varepsilon_{i,r,m,t} \tag{5}$$

Table 9 shows that economic conditions during the first and third quarters significantly affect birth weight. The cumulative impact of the three trimesters is comparable to the estimates shown in Table 8. Using these estimates, a deviation of 0.1 log units (about 11%) from the long-term trend (similar to that observed in 2002, as shown in Table 1) would explain a reduction in birth weight of about 25-30 grams. Using the results in Table 9, we can predict the average birth weight lost on account of business-cycle fluctuations in different months.

[18] The correlation between the cyclical components is: 0.8866 between the third and second trimesters of pregnancy; 0.6437 between the third and the first; and 0.9000 between the second and the first.

For example, using estimates in model (5) of Table 9 as a reference, we predict average birth weight under the actual scenario and under a counterfactual (no crisis) situation that assumes macroeconomic conditions in those observed in August 2001 and other regressors fixed at their observed levels. The difference between the predicted and the counterfactual outcomes is averaged by monthly cohorts (by month of birth) and shown in Figure 7, along with the monthly business-cycle indicator.

Table 10 shows how the results in columns (5) and (6) of Table 9 change when the sample is broken down by gender: the effect on boys is somewhat greater than it is on girls. When the sample is split according to the mother's educational level, we find that the sensitivity of birth weight to economic conditions is substantially larger for children of mothers whose educational level is low (Table 11). This subset is sensitive to economic conditions in the first and last trimesters of pregnancy, while children of mothers of high socioeconomic status are sensitive to early-pregnancy economic conditions. Thus, depending on the subsample studied, results are consistent with the famine literature (highlighting nutritional-deprivation factors) or with the quasi-experimental results of Camacho (2008) from Colombia (emphasizing psychosocial-stress factors). Using the estimate from the sum of the cyclical coefficients, a deviation of 0.1 log units (about 11%) from the long-term trend (similar to that observed in 2002, as shown in Table 1) would explain a reduction in birth weight of about 31-35 grams for babies born of mothers with a low educational level and 17-20 grams for babies born of mothers with a high level.

4 The long-lasting effect of the Argentine economic crisis: a simulation exercise

For those whose births were affected by the crisis, what is its long-term impact? We offer a tentative answer to this question by simulating lifetime earnings of these individuals under different assumptions regarding their working life (the age at which they start working and the age at which they retire) and income-growth patterns (the rate at which incomes increases from one year to the next). We calibrate our model with Argentine data on income in current purchasing-power-parity (PPP) dollars, as is standard in the specialized literature of cross-country comparisons.

Our previous results suggest that the average birth-weight loss associated with the crisis was about 30 grams. Since we are interested in the impact of a reduction in birth weight on lifetime earnings, we compare the earnings path of an individual born during the recession (with the 30-gram birth-weight loss) with the counterfactual income path for an individual not born in the recession (without the 30-gram birth-weight loss). For the no-recession path of income, we assume that individuals earn a level of income equal to the expected (national) GDP per capita for each year they are in the labor force. Expected future income is based on a baseline GDP per capita for 2009 and an annual-income-growth rate that varies from 1% to 5% per year. To calculate the income loss we use results from Black, Devereux, and Salvanes (2007) to approximate $\Delta\ln(\text{Income})/\Delta\ln(\text{Birthweight})$, as shown in the footnote of Table 12, which presents our estimates.[19] We find that the average loss of future earnings due to the reduction in average birth weight is about $500 per baby born, although the magnitude (but not the sign) of the costs is sensitive to key model assumptions (namely, expected income growth and intertemporal discount rate). However, it is very likely that these costs exceed

[19] The impact of birth weight on lifetime income has been estimated using within-twin variation (Behrman and Rosenzweig, 2004; Black, Devereux, and Salvanes, 2007). One should keep in mind that although these estimates control for unobservable factors capturing the in utero environment, they are based on a selected sample (twins).

those of measures designed to prevent birth-weight loss. For example, eliminating poverty among pregnant mothers (by raising their income to the poverty line) would cost only $100 per mother to do so for the entire nine-month period of pregnancy, which can be considered an overestimate of the cost of preventing the drop of birth weight from occurring.

What can be done to prevent such costs? Since birth outcomes are affected by different factors, there is no simple recipe to avoid these problems. But there is ample evidence that targeted interventions work, even amid poverty, where they are most needed (Ramakrishnan, 2004). Depending on specific circumstances, these interventions would include a combination of strategies: nutritional supplementation, provision of adequate prenatal care, and promotion of maternal behavioral changes associated with better health outcomes.[20]

One must keep in mind that the $500 estimate does not take into account other long-term costs stemming from the crisis, such as increased health burdens in adult life; : adverse conditions at time of birth have been linked to heart disease, diabetes, and obesity in adulthood, all of which contribute to a reduction in life expectancy.

[20]See Almond, Hoynes and Schanzenbach (2010) for a recent study on the impact of food stamps on birth outcomes in the US.

5 Robustness checks

5.1 Additional controls

We have yet to consider the influence of the type of health coverage (public or private), the location in which the birth took place (public or private hospital/clinic, home, or street), and who aided in the delivery of the baby (doctor or someone else).

For 1,785,384 observations we have information on whether a doctor or someone else aided in the delivery of the baby. In 2001, 72% of childbirths were attended by a doctor. The percentages were very similar in 2002 and 2003: 71% and 72%, respectively.

Regarding the health coverage of mothers who gave birth during the period under analysis, we have information on only 88% of childbirths. Twenty-five percent of them had public health-care coverage, 2.8% had coverage with the private sector, 0.3% had both, and 38% had none. Because our dataset is incomplete, we have a large percentage of unknowns (38%) and a few miscodings (736 births).

Finally, our dataset also contains information on the location where the birth took place. However, it is far from perfect. We observe the following location categories for the entire period: public hospital/clinic (35.75%), private hospital/clinic (22.5%), home or street (0.75%), miscoded (29.15%), and unknown (11.85%).

In Table 13 we report specifications similar to Table 9 (columns 5 and 6), but including the controls mentioned above. The sensitivity of birth weight to business cycle is not substantially altered with respect to those shown in Table 9. This indicates that our findings are robust to any compositional changes operating through observable health inputs.

5.2 Alternative indicators of economic activity: indigence and poverty

Our analysis of economic activity and birth weight relied on the (HP-detrended) cyclical component of economic activity at the national level and in monthly frequency. However, it is

possible that there was regional variation in the magnitude of the crisis and/or that it presented lag/lead shifts with respect to the national indicator. Unfortunately, no monthly (or even quarterly) indicator of economic activity is available at the provincial level. Nevertheless, the household survey of urban areas (Encuesta Permanente de Hogares)[21] provided us with information on poverty and indigence rates in 29 such urban conglomerates, which represent urban populations in 22 provinces and the Federal District (Ciudad de Buenos Aires). Information on poverty indicators is available for May and October for each year since 2001. Data after May 2003 are not comparable on account of a change in the methodology. Because the data are collected twice a year in particular months, we have extrapolated missing observations linearly to generate monthly observations. This procedure is not fail-safe, but it benefits from the fact that the periods in which the data were collected were near turning points in the business cycle (see Fig. 1).

We calculate poverty rates at the district level in the third, second, and first trimesters of pregnancy, respectively. Poverty rates are calculated on the basis of international standards by the official National Institute of Statistics and Censuses of Argentina. The poverty line varies according to household composition and the month/year in which the survey is carried out, but, for example, \$149 per month per adult equivalent in December 2001, or about \$5 per day, using the prevailing exchange rate at that time (not PPP).

Similarly, the indigence indicators represent the indigence rate (or extreme-poverty rate) at different trimesters of pregnancy. The indigence rate is calculated by means of an "indigence line": for example, in December 2001 this indicator was \$60 per month per adult equivalent, or about \$2 per day. The indigence line is the sum required to buy a basic-foodstuffs basket (Canasta Básica Alimentaria) that meets minimum nutritional requirements, while the poverty line is based on the indigence line plus additional expenditures on basic nonfood items (e.g., transportation, housing, and clothing).

[21] Only the urban population of one province (Rio Negro) was not included systematically from the start (but instead from October 2002 on).

Table 14 displays regressions of birth weight on poverty and indigence rates. The first column shows a specification with moving averages of the indigence rates. Coefficients are jointly, but not individually, significant. Similar results are obtained for three regressors involving moving averages of poverty rates. We therefore proceed by eliminating one of the regressors in each specification. Column (3) shows that indigence rates at the district level in the three last months of pregnancy significantly decrease birth weight. The same result is found in column (4) for poverty in the last three months of pregnancy, although poverty rates in the first three months exhibit a positive (but insignificant) sign. However, the sum of both coefficients is negative, and significantly so (p-value=0.045). Column (5) combines poverty and indigence (both in the last term of pregnancy) as predictors of birth weight, with indigence (extreme poverty) proving to be significant, with the expected sign.

These results show that poverty and indigence may have a deprivation effect on birth weight. These five models have very different predictive capabilities. Figure 8 displays the change in birth weight using August 2001 as baseline and using the temporal variation in regressors specified in each column of Table 14, together with their estimated coefficients. For purposes of comparison we present the actual variation in birth weight and the prediction based in the model with the national business-cycle indicator displayed in Table 9 column (5). The models that combine time and regional variation are less powerful in predicting fluctuations in birth weight, with the model in column (5) being the one with the best predictive power. This result can be interpreted in a number of ways. First, the fact that poverty and indigence indicators are monthly extrapolations based on actual indicators calculated every six months may weaken their predictive ability. Second, poverty and indigence indicators may explain variation when it comes to mothers with a low educational level, whereas other indicators may be more useful predictors when it comes to mothers with a high educational level. Finally, the models shown in Table 14 use information from June 2001 through May 2003. The methodology of household survey changes after May 2003, no disaggregated data

by urban areas are available for the period prior to October 2000. The temporal dimension of the sample, lacking as it does the early period of 2001 (before the crisis hit) and the 2003 recovery period, is thus reduced.

These estimates suggest that the results from the national monthly business-cycle indicator may be – at least in part – capturing a deprivation effect that is mediated by indigence and poverty, which are good predictors of the fluctuations in birth weight during the crisis.

5.3 Additional checks: transformations of the dependent variable and province-specific-time/month effects

We will now highlight two of the additional checks we have performed in order to assess the validity of our estimates. First, when we replace birth weight with its logarithm and when we use fetal growth, defined as birth weight over weeks of gestation, we obtain similar qualitative results. Second, the addition of province-specific linear time trends, province-specific month of birth-fixed effects, and even interactions between month of birth and a linear time trend leads to estimates that are of the same order of magnitude as that of those reported in the previous specifications.[22]

[22] All of these estimates are available from the authors upon request.

6 Conclusions

Economic crises are episodic phenomena that raise concerns about unemployment, poverty, and bailouts, terms all too familiar to the public at large. In this article we focus on less obvious – but perhaps equally important – costs stemming from an economic crisis: a birth-weight loss. This burden is likely to have long-lasting effects, since birth weight influences lifetime earnings, as has been shown in the literature.

We find that the crisis explained a loss of about 30 grams in average birth weight. It is important to keep in mind that this loss occurred in a short period of time (about six to seven months) and that this is a population average: the impact of the recession was even more pronounced among mothers of low socioeconomic status.

In an attempt to estimate the long-term economic costs of the crisis, we simulate the average loss of future individual earnings due to the reduction in average birth weight: about $500 per live birth. This is a conservative estimate because it does not include other potential losses that are not reflected in lifetime earnings, such as lifetime health-care costs and a reduction in life expectancy. The price paid will be higher for some than for others, since low birth weight is associated with poor mothers, a discrepancy that may exacerbate income inequalities in the long run.

Another reason that our results are striking is that such a disruption in health status occurred in a middle-to-high-income country with a physician-to-patient ratio similar to those of Germany and Norway. Perhaps our most important conclusion is that the adverse effects of economic crises on children health may not be restricted to times or to places distinguished by extreme poverty.

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Fig. 1: Economic Activity Index and Average Birth Weight
January 2001 – October 2003

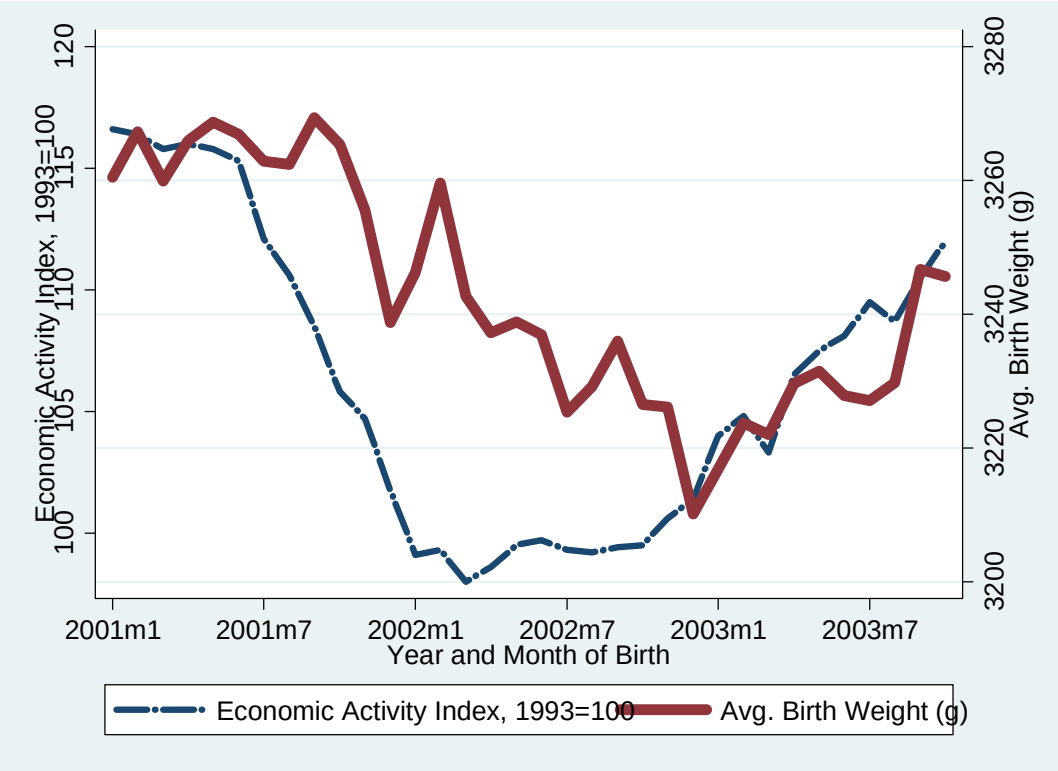
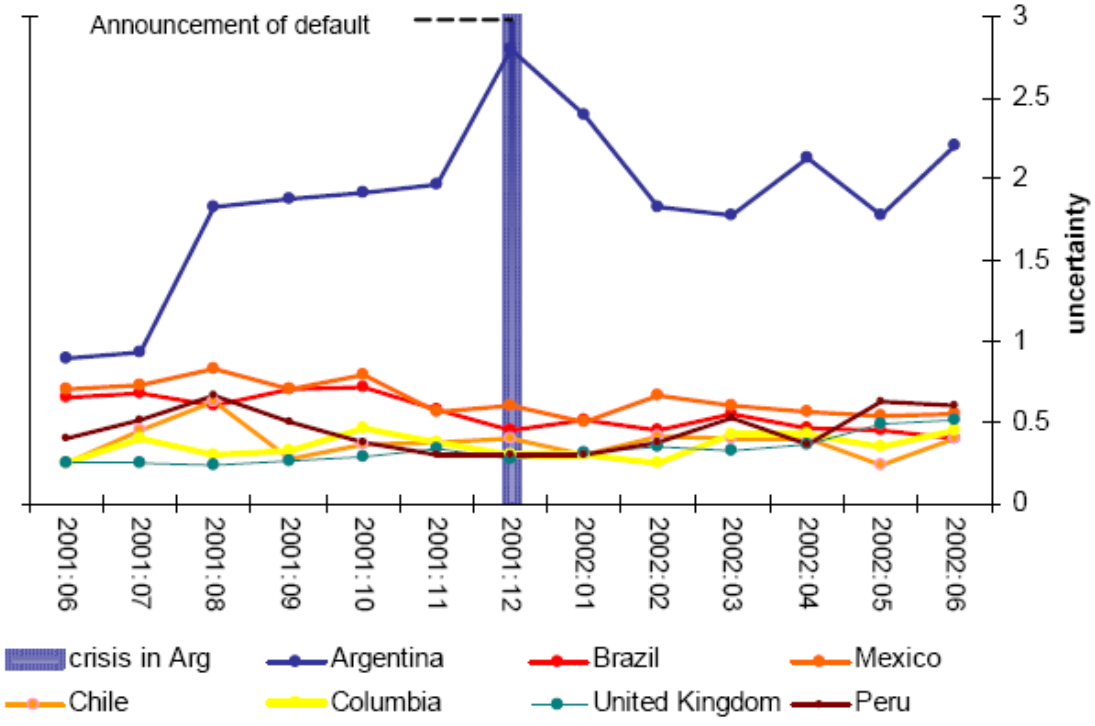


Fig. 2: Evolution of Uncertainty



Source: Figure 2 in Kannan and Köhler-Geib (2009).

Fig. 3: Evolution of Consumer Confidence

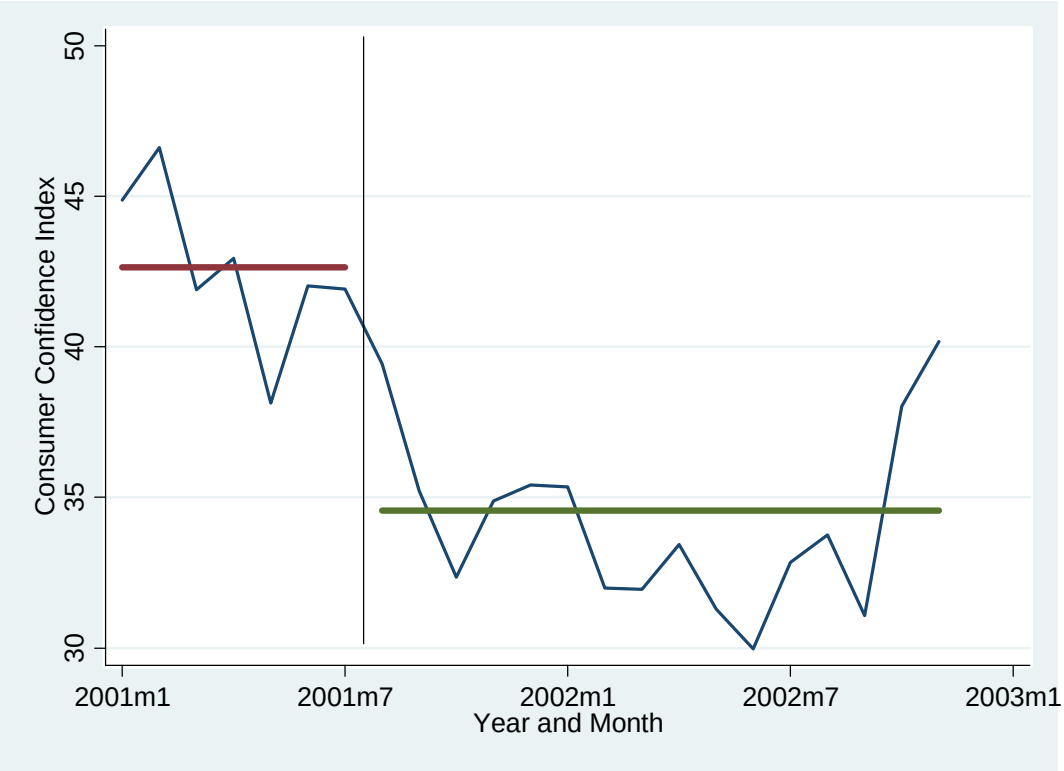


Fig. 4: Evolution of Live Births

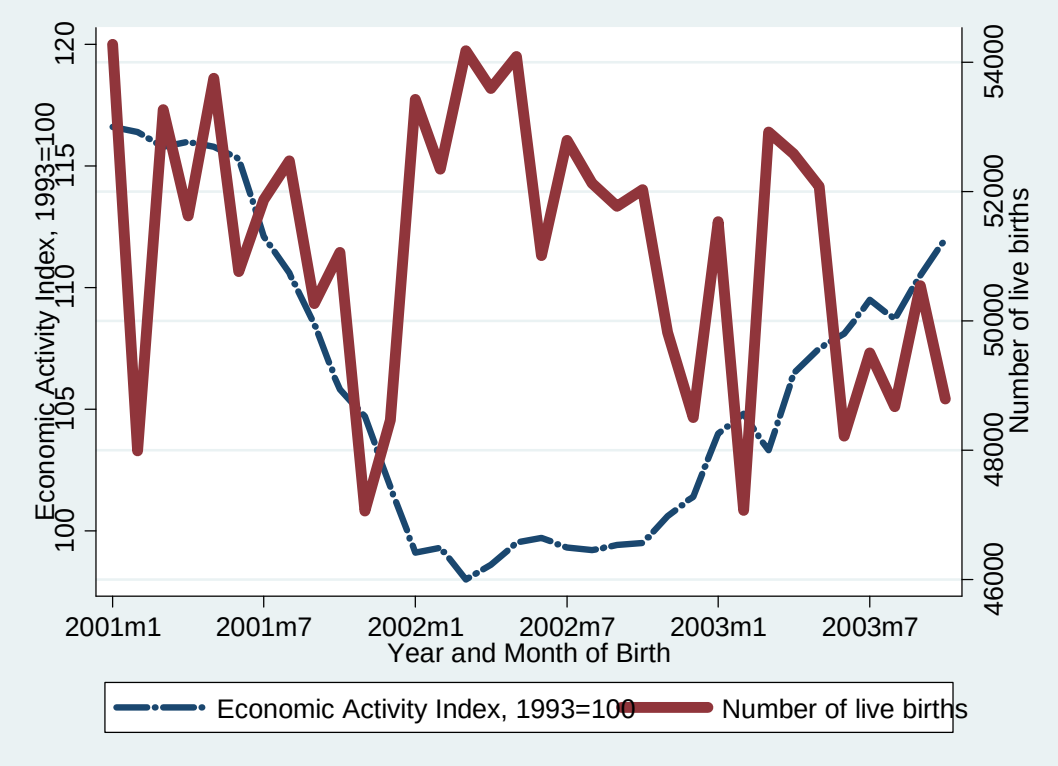


Fig. 5: Comparison and Treatment

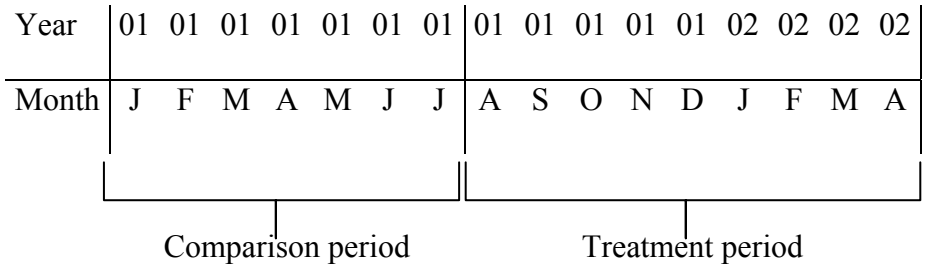


Fig. 6: Loss in Average Birth Weight due to the Crisis
August 2001 – October 2003

Note: Avg. Birth Weight (g), Hyp.: predicted average birth weight (in grams) using model in column (6) of Table 5 replacing cycles from August 2001 to October 2003 with cycles from January 2001 to July 2001 // Avg. Birth Weight (g): actual average BW, in grams, shown in right scale // Difference in BW (g): difference between them.

Fig. 7: Average birth weight loss due to business cycle fluctuations in different months, August 2001 – October 2003

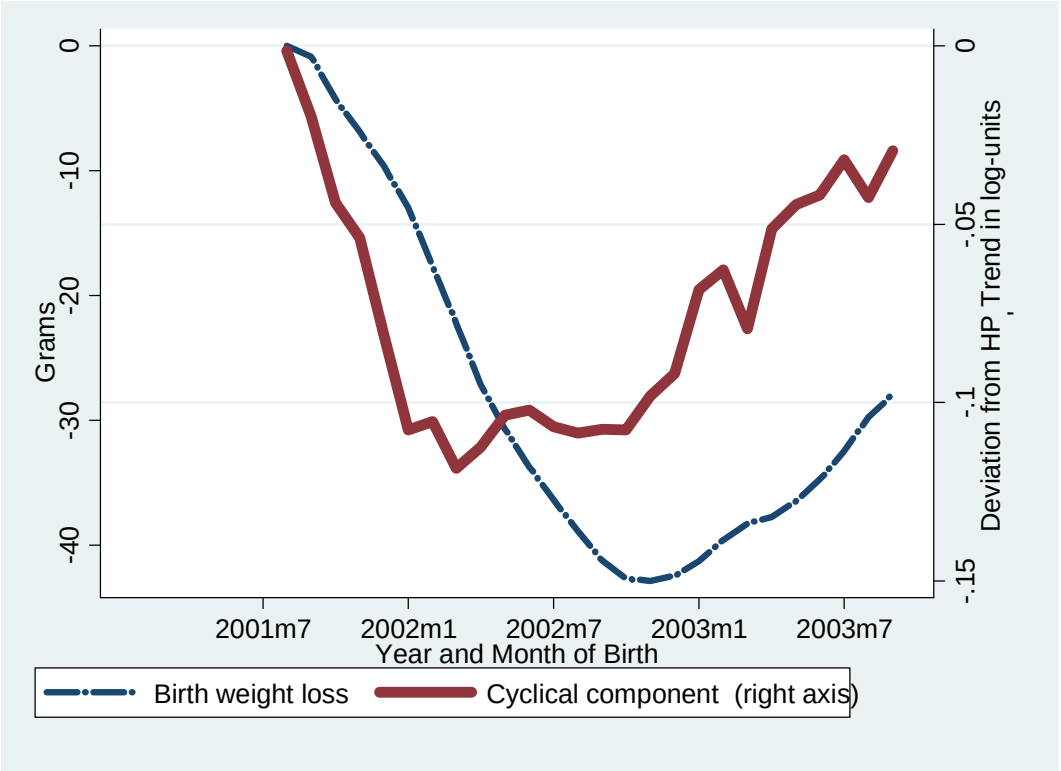


Fig. 8: Comparisons of economic activity, poverty and indigence models

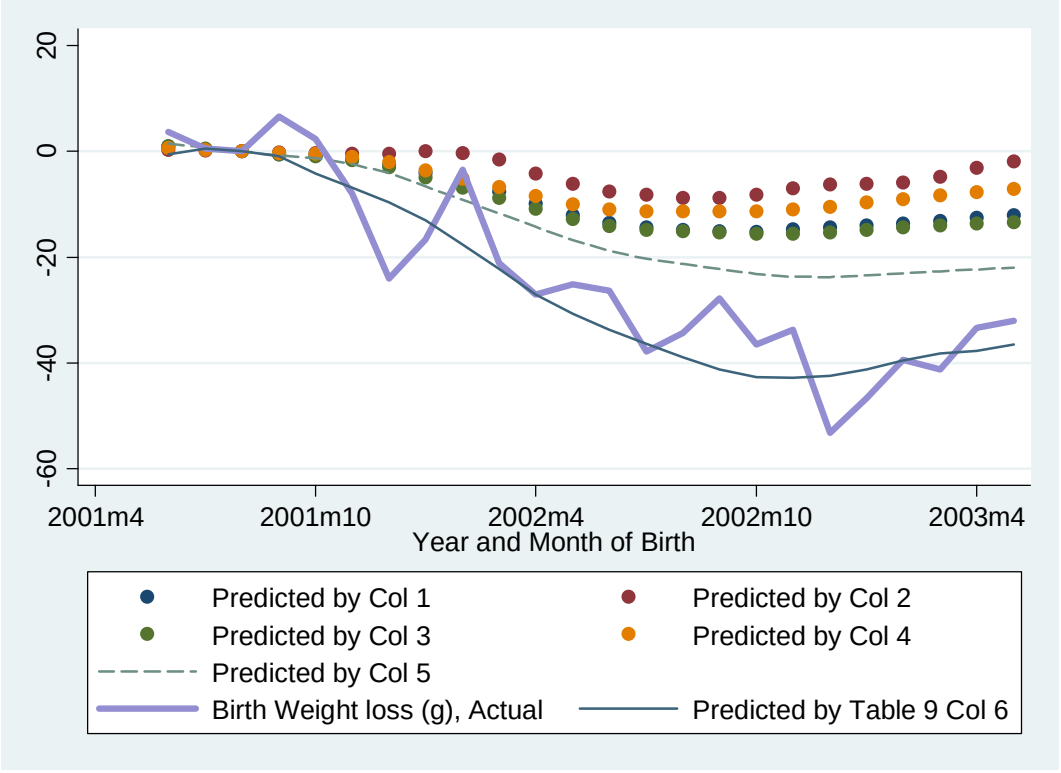


Table 1: Descriptive Statistics, means and (standard deviations)

	2001	2002	2003
Birth Outcomes			
Birth Weight (g)	3263.33	3235.93	3231.30
	(543.64)	(538.36)	(541.07)
Low Birth Weight	0.065	0.069	0.070
	(0.246)	(0.253)	(0.256)
Female	0.488	0.486	0.487
	(0.500)	(0.500)	(0.500)
Infant Mortality Rate[a]	16.3	16.8	16.5
Economic Indicators			
Economic Activity Index[b] (1993 = 100)	95.73	85.30	92.84
Economic Cycle[c]	0.0046	−0.1059	−0.0433
Unemployment[d]	17.4%	19.7%	15.6%
Poverty[e]	37.1%	55.3%	54.7%
Public Expenditure in Children Health (2006 PPP $)[f]			
National Budget per child[g]	24.39	30.72	31.14
National Budget on Mother-Infant Program per child	4.17	5.63	8.11
National and Provincial Budget per child[g]	268.61	192.68	189.34
Characteristics of the mother			
Age (years)	26.62	26.59	26.94
	(6.44)	(6.44)	(6.40)
First pregnancy	0.361	0.353	0.361
	(0.480)	(0.478)	(0.480)
High School	0.356	0.370	0.395
	(0.479)	(0.483)	(0.489)
Partner (married or cohabiting)	0.853	0.834	0.848
	(0.354)	(0.372)	(0.359)

Note: Number of observations to calculate live birth characteristics (birth weight, low birth weight, female, age of the mother, first pregnancy, mother has high-school or above, and mother has a partner) are 595,980 in 2001, 581,188 in 2002, and 548,257 in 2003. The number of observations in 2003 is "artificially" smaller than in 2001 and 2002, since childbirths occurring in the last three months of the year are statistically reported with a lag, and our dataset does not capture the updates occurring after 2003.

[a] Source: Argentine Ministry of Health, Yearbook. // [b] Indicador Sintetico de la Actividad Economica. Source: Instituto Nacional de Estadisticas y Censos (INDEC) // [c] Cyclical component of log Economic Activity Index (in log units) // [d] National Average of Unemployment Rate for May/October (2001 and 2002), and May (2003). Source: Instituto Nacional de Estadisticas y Censos (INDEC) // [e] Proportion of Individuals under the Official Poverty Line. National Average for /October (2001 and 2002), and May (2003). Source: Instituto Nacional de Estadisticas y Censos (INDEC) // [f] Source: DAGPyPS/Unicef (2007) "Gasto Publico Social dirigido a la Niñez en la Argentina 1995-2007" Available online: http://www.gastopubliconinez.gov.ar/inversion_n_04.php. Nominal values are converted to 2006 pesos using a mixed CPI-WPI price index and then converting to PPP dollars at the parity of 2006. // [g] Includes mother-infant programs, prevention programs, vaccination, school health, medication, outpatient/inpatient services, organ transplantation, sexual/reproductive health, AIDS/HIV and other STDs and other services and goods provided by central and provincial government and targeted to individuals ages 0-17.

Table 2: Differences in average birth weight (g) between 2002 and 2001

	2001	2002	Difference
I. Controls: province and child gender dummy variables			
January	3413.77	3400.82	−12.95***
			(0.043)
February	3420.82	3413.38	−7.44***
			(0.052)
March	3414.10	3395.93	−18.17***
			(0.048)
April	3420.59	3390.87	−29.72***
			(0.055)
N	1,238,320		
II. Controls: I + age and pregnancy categories			
January	3370.96	3357.33	−13.63***
			(0.050)
February	3377.89	3370.49	−7.40***
			(0.049)
March	3370.93	3353.52	−17.41***
			(0.056)
April	3378.31	3349.06	−29.25***
			(0.055)
N	1,223,823		
III. Controls: II + mother's education and partner dummy variables			
January	3324.22	3311.45	−12.77***
			(0.188)
February	3330.97	3324.15	−6.82***
			(0.179)
March	3323.78	3308.43	−15.35***
			(0.179)
April	3331.33	3304.10	−27.22***
			(0.183)
N	1,153,457		

Note: OLS regressions of birth weight on month of birth indicators, their interactions with 2002, and controls. Robust standard errors clustered at the "month-year" of birth level are reported in parentheses.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1
I: excluded province (jurisdiction) is "Tierra del Fuego"
II: excluded age category is "45-49" and excluded pregnancy category is "4 or more"
III: mother's education dummy variable is 1 if high-school or above, 0 otherwise; partner dummy variable is 1 if living with a partner, 0 otherwise.

Table 3: Differences in average birth weight (g) between 2002 and 2001 by gender

	Boys			Girls		
	2001	**2002**	**difference**	**2001**	**2002**	**Difference**
I. Controls: province and child gender dummy variables						
January	3414.16	3399.34	−14.82***	3310.37	3299.32	−11.05***
			(0.051)			(0.067)
February	3424.59	3413.92	−10.67***	3313.87	3309.84	−4.03***
			(0.078)			(0.067)
March	3417.40	3395.60	−21.80***	3307.65	3293.32	−14.33***
			(0.068)			(0.060)
April	3420.80	3390.20	−30.60***	3317.40	3288.59	−28.81***
			(0.077)			(0.073)
N	635,151			603,169		
II. Controls: I + age and pregnancy categories						
January	3364.26	3348.85	−15.41***	3275.20	3263.49	−11.71***
			(0.062)			(0.063)
February	3375.05	3364.83	−10.22***	3278.15	3273.69	−4.46***
			(0.074)			(0.063)
March	3367.79	3347.18	−20.61***	3271.51	3257.47	−14.04***
			(0.067)			(0.077)
April	3372.12	3342.53	−29.59***	3282.06	3253.20	−28.86***
			(0.072)			(0.081)
N	627,661			596,162		
III. Controls: II + mother's education and partner dummy variables						
January	3317.01	3304.15	−12.86***	3228.64	3216.15	−12.61***
			(0.220)			(0.193)
February	3327.10	3317.88	−9.22***	3231.94	3227.64	−4.31***
			(0.226)			(0.168)
March	3320.76	3302.77	−17.99***	3223.86	3211.35	−12.58***
			(0.207)			(0.186)
April	3324.56	3298.24	−26.31***	3235.29	3207.26	−28.12***
			(0.205)			(0.211)
N	591,593			561,864		

Note: See Table 2.

Table 4: Differences in average birth weight (g) between 2002 and 2001 by gender broken down by mother's education

I. Controls: province dummy variables

	Boys		Girls	
	Low	High	Low	High
January	−23.06***	−2.72***	−19.61***	2.15***
	(0.058)	(0.073)	(0.093)	(0.082)
February	−13.57***	−4.55***	−7.81***	−1.76 ***
	(0.105)	(0.132)	(0.071)	(0.134)
March	−31.08***	−4.09***	−20.57***	−6.61***
	(0.122)	(0.089)	(0.071)	(0.079)
April	−33.21***	−23.68***	−34.59***	−18.62***
	(0.120)	(0.093)	(0.082)	(0.117)
N	392,993	225,007	374,852	212,226

II. Controls: I + age and pregnancy categories + partner dummy variables

	Boys		Girls	
	Low	High	Low	High
January	−20.37***	0.796***	−19.16***	−0.445
	(0.262)	(0.244)	(0.253)	(0.279)
February	−13.67***	−1.94***	−5.61***	−2.66***
	(0.266)	(0.262)	(0.212)	(0.241)
March	−28.28***	−0.142	−16.50***	−5.99***
	(0.273)	(0.256)	(0.230)	(0.238)
April	−29.88***	−20.70***	−35.84***	−15.14***
	(0.264)	(0.235)	(0.282)	(0.251)
N	377,109	214,484	359,804	202,060

Note: See Table 2.

Table 5: Regressions of Birth Weight on Economic Cycle in the Month of Birth

	(1)	(2)	(3)	(4)	(5)	(6)
Cycle in the Month of Birth	81.43**	115.66***	73.67*	111.18***	68.57*	99.35***
	(36.41)	(25.86)	(38.06)	(26.57)	(38.52)	(25.85)
Female	−102.92***	−102.92***	−103.08***	−103.08***	−103.44***	−103.44***
	(0.757)	(0.757)	(0.791)	(0.791)	(0.826)	(0.826)
Time and region controls						
Month of birth fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Province of birth fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects?	Yes	No	Yes	No	Yes	No
Linear time trend	--	−1.14***	--	−1.22***	--	−1.24***
		(0.109)		(0.113)		(0.111)
Mother's and pregnancy controls						
Mother's age categories?	No	No	Yes	Yes	Yes	Yes
Parity categories?	No	No	Yes	Yes	Yes	Yes
Mother's High School	--	--	--	--	24.02***	24.01***
					(3.44)	(3.45)
Mother's Partner Status	--	--	--	--	58.43***	58.44***
					(1.72)	(1.72)
Mother's High School × Mother's Partner Status	No	No	No	No	−17.18***	−17.18***
					(3.36)	(3.36)
N	1,803,585		1,782,311		1,689,913	

Note: All regressions include a constant term. Robust standard errors clustered at the "month-year" of birth level are reported in parentheses. Month of birth fixed effects: 11 dummy variables; Province of birth fixed effects: 24 dummy variables; Year of birth fixed effects: 2 year dummy variables; Linear time trend = 1…, 36; Mother's age categories: 6 dummy variables (15-19, 20-24, 25-29, 30-34, 35-39, 40-44); Parity categories: 3 dummy variables (1st pregnancy, 2nd pregnancy, 3rd pregnancy); Mother's High School: 1 if mother has high-school or above, 0 otherwise; Mother's Partner Status: 1 if mother is living with a partner, 0 otherwise.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 6: Regressions of Birth Weight on Economic Cycle in the Month of Birth by Gender

	Boys		Girls	
	(1)	(2)	(3)	(4)
Cycle in the Month of Birth	83.93*	103.57***	52.73	94.89***
	(44.60)	(26.10)	(35.99)	(27.60)
Time and region controls				
Month fixed effects?	Yes	Yes	Yes	Yes
Province fixed effects?	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	No	Yes	No
Linear Time Trend	--	−1.24***	--	−1.24***
		(0.119)		(0.117)
Mother's and pregnancy controls				
Mother's age categories?	Yes	Yes	Yes	Yes
Parity categories?	Yes	Yes	Yes	Yes
Mother's High School	26.65***	26.65***	21.20***	21.18***
	(4.68)	(4.68)	(3.71)	(3.72)
Mother's Partner Status	58.65***	58.66***	58.28***	58.28***
	(2.38)	(2.38)	(2.37)	(2.37)
Mother's High School × Mother's Partner Status	−13.70***	−13.70***	−20.86***	−20.86 ***
	(4.53)	(4.54)	(3.86)	(3.86)
N	866,812		823,101	

Note: See Table 5.

Table 7: Regressions of Birth Weight on Economic Cycle in the Month of Birth broken down by mother's education

	Mother's Education < High School			Mother's Education >= HS		
	(1)	(2)	(3)	(4)	(5)	(6)
Cycle in the Month of Birth	250.69***	246.22***	142.45***	122.09***	112.32***	24.92
	(31.15)	(33.64)	(28.34)	(30.58)	(30.81)	(24.81)
Female	−98.53***	−98.96***	−98.99***	−110.58***	−110.98***	−110.94***
	(1.06)	(1.13)	(1.13)	(1.39)	(1.43)	(1.42)
Time and region controls						
Month fixed effects?	No	Yes	Yes	No	Yes	Yes
Province fixed effects?	No	Yes	Yes	No	Yes	Yes
Linear Time Trend	--	--	−1.29***	--	--	−1.15***
			(0.124)			(0.112)
Mother's and pregnancy controls						
Mother's age categories?	No	Yes	Yes	No	Yes	Yes
Parity categories?	No	Yes	Yes	No	Yes	Yes
Mother living with a partner	--	56.22***	55.99***	--	46.60***	46.53***
		(1.78)	(1.78)		(2.68)	(2.70)
N	1,099,356	1,059,925	1,059,925	653,899	629,988	629,988

Note: See Table 5.

Table 8: Regressions of Birth Weight on Economic Cycles during Trimesters of Pregnancy

	(1)	(2)	(3)	(4)	(5)	(6)
Cycle 3rd Trimester of Pregnancy	203.28***	133.76***	--	--	--	--
	(41.11)	(21.20)				
Cycle 2nd Trimester of Pregnancy	--	--	245.39***	202.12***	--	--
			(19.09)	(14.50)		
Cycle 1st Trimester of Pregnancy	--	--	--	--	182.27***	204.36***
					(19.36)	(21.48)
Female	−103.45***	−103.44***	−103.45***	−103.45***	−103.46***	−103.45***
	(0.825)	(0.825)	(0.825)	(0.825)	(0.826)	(0.825)
Time and region controls						
Month fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	No	Yes	No	Yes	No
Linear Time Trend	--	−0.988**	--	−0.491***	--	−0.362**
		(0.111)		(0.098)		(0.153)
Mother's and pregnancy controls						
Mother's age categories?	Yes	Yes	Yes	Yes	Yes	Yes
Parity categories?	Yes	Yes	Yes	Yes	Yes	Yes
Mother's High School	24.03***	24.04***	24.11***	24.10***	24.12***	24.09***
	(3.44)	(3.44)	(3.44)	(3.44)	(3.44)	(3.44)
Mother's Partner Status	58.36***	58.36***	58.35***	58.33***	58.41***	58.52***
	(1.72)	(1.72)	(1.72)	(1.72)	(1.72)	(1.72)
Mother's High School × Mother's Partner Status	−17.19***	−17.19***	−17.26***	−17.24***	−17.26***	−17.28***
	(3.36)	(3.36)	(3.36)	(3.36)	(3.36)	(3.36)
N	1,689,913		1,689,913		1,689,913	

Note: See Table 5.

Table 9: Regressions of Birth Weight on Economic Cycles during Trimesters of Pregnancy

	(1)	(2)	(3)	(4)	(5)	(6)
Cycle 3rd Trimester of Pregnancy	128.70***	91.43**	119.74***	85.84**	113.28***	79.31**
	(32.90)	(36.01)	(33.15)	(35.91)	(33.87)	(36.18)
Cycle 2nd Trimester of Pregnancy	65.64	43.47	62.36	42.12	51.47	29.46
	(53.82)	(53.86)	(54.41)	(54.38)	(54.04)	(55.55)
Cycle 1st Trimester of Pregnancy	107.93***	126.26***	119.58***	136.28***	126.23***	144.10***
	(33.39)	(33.27)	(33.73)	(33.46)	(33.80)	(34.25)
Sum of Coefficients on Cycle	302.27***	261.16***	301.69***	264.24***	290.99***	252.87***
	(22.98)	(17.67)	(23.63)	(17.59)	(23.32)	(17.61)
Female	−102.93***	−102.93***	−103.10***	−103.10***	−103.46***	−103.46***
	(0.756)	(0.756)	(0.789)	(0.789)	(0.825)	(0.826)
Time and region controls						
Month fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	No	Yes	No	Yes	No
Linear Time Trend	--	−0.183**	--	−0.224**	--	−0.263***
		(0.090)		(0.091)		(0.093)
Mother's and pregnancy controls						
Mother's age categories?	No	No	Yes	Yes	Yes	Yes
Parity categories?	No	No	Yes	Yes	Yes	Yes
Mother's High School	--	--	--	--	24.11***	24.12***
					(3.44)	(3.44)
Mother's Partner Status	--	--	--	--	58.34***	58.34***
					(1.72)	(1.72)
Mother's High School × Mother's Partner Status	No	No	No	No	−17.26***	−17.26***
					(3.36)	(3.36)
N	1,803,585		1,782,311		1,689,913	

Note: See Table 5.

Table 10: Regressions of Birth Weight on Economic Cycles during Trimesters of Pregnancy by Gender

	Boys		Girls	
	(1)	(2)	(3)	(4)
Cycle 3rd Trimester of Pregnancy	144.97***	99.28***	79.67	57.63
	(28.52)	(34.18)	(58.26)	(58.02)
Cycle 2nd Trimester of Pregnancy	28.50	−1.08	76.97	62.66
	(41.89)	(50.28)	(103.46)	(101.79)
Cycle 1st Trimester of Pregnancy	148.65***	172.59***	101.82	113.47*
	(30.67)	(33.38)	(67.16)	(66.08)
Sum of Coefficients on Cycle	322.12***	270.80***	258.46***	233.75***
	(23.69)	(19.71)	(33.05)	(26.76)
Time and region controls				
Month fixed effects?	Yes	Yes	Yes	Yes
Province fixed effects?	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	No	Yes	No
Linear Time Trend	--	−0.197**	--	−0.332**
		(0.099)		(0.140)
Mother's and pregnancy controls				
Mother's age categories?	Yes	Yes	Yes	Yes
Parity categories?	Yes	Yes	Yes	Yes
Mother's High School	26.73***	26.74***	21.31***	21.31***
	(4.67)	(4.67)	(3.71)	(3.71)
Mother's Partner Status	58.57***	58.56***	58.19***	58.20***
	(2.38)	(2.38)	(2.38)	(2.38)
Mother's High School × Mother's Partner Status	−13.76***	−13.76***	−20.97***	−20.97***
	(4.53)	(4.52)	(3.86)	(3.86)
N	866,812		823,101	

Note: See Table 5.

Table 11: Regressions of Birth Weight on Economic Cycles during Trimesters of Pregnancy by Mother's Education

	Mother's Education < High School		Mother's Education ≥ High School	
	(1)	(2)	(3)	(4)
Cycle 3rd Trimester of Pregnancy	182.51***	143.48***	6.93	−24.35
	(45.73)	(48.48)	(41.64)	(36.64)
Cycle 2nd Trimester of Pregnancy	25.84	3.00	86.48	63.00
	(68.76)	(72.62)	(60.38)	(59.05)
Cycle 1st Trimester of Pregnancy	141.12***	159.95***	110.02**	128.64***
	39.94	(42.98)	(43.96)	(41.58)
Sum of Coefficients on Cycle	349.47***	306.43***	203.43***	167.29***
	31.57	(20.89)	(30.84)	(27.95)
Female	−99.01***	−99.01***	−110.97***	−110.97***
	(1.13)	(1.13)	(1.42)	(1.42)
Time and region controls				
Month fixed effects?	Yes	Yes	Yes	Yes
Province fixed effects?	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	No	Yes	No
Linear Time Trend	--	−0.222*	--	−0.305**
		(0.112)		(0.142)
Mother's and pregnancy controls				
Mother's age categories?	Yes	Yes	Yes	Yes
Parity categories?	Yes	Yes	Yes	Yes
Mother's Partner Status	55.88***	55.89***	46.41***	46.40***
	(1.79)	(1.78)	(2.70)	(2.70)
N	1,059,925		629,988	

Note: See Table 5.

Table 12: A simple calculation of the Future Income Loss due to Lower Birth Weight, in PPP International Dollars of 2009.

		Annual Income Growth		
		1%	3%	5%
Annual Discount Factor	2%	452	925	1981
	5%	175	328	643
	8%	78	136	245

Note: Calculation assumes $\Delta\ln(\text{Wage})/\Delta\ln(\text{BW}) = 0.09$ (lower bound from Black, Devereux and Salvanes, 2007), $\Delta\ln(\text{BW}) = -0.0091$ (mean birth weight in singletons 2002-03 vs. 2001), annual income in 2009 = $ 14,559 (GDP per capita, PPP, 2009). Individuals earn income between age 22 and 65 (for an individual born in 2002 this represents the period 2024-2067). The discounted income loss is calculated as the difference between income with and without birth weight loss, where the gap is calculated using the estimates from Black, Devereux and Salvanes (2007) and above, and the birth weight gap mentioned above ($gap = 0.11*0.0091 \cong 0.001$). Income at year t is $Y_t = 14559(1+g)^{(t-2009)}$, the income loss in year t in dollars is $Y_t(1 - gap)$ and the present value using discount δ is $\sum_{t=2024}^{2065} (1-\delta)^{t-2009} Y_t(1-gap)$

Table 13: Robustness checks with additional controls

	(1)	(2)	(3)	(4)	(5)	(6)
Cycle 3rd Trimester of Pregnancy	111.19***	79.22*	142.72***	107.72**	110.53***	84.64**
	(36.95)	(40.78)	(40.68)	(43.82)	(37.42)	(40.29)
Cycle 2nd Trimester of Pregnancy	65.57	44.82	22.62	6.65	72.30	55.28
	(62.53)	(63.17)	(66.96)	(67.05)	(62.78)	(62.70)
Cycle 1st Trimester of Pregnancy	109.16***	126.02***	131.40***	147.60***	105.51***	119.21***
	(37.72)	(38.14)	(40.09)	(39.51)	(38.21)	(38.32)
Sum of Coefficients on Cycle	285.93***	250.06***	296.73***	261.97***	288.34***	259.13***
	(25.28)	(18.99)	(26.46)	(20.28)	(25.33)	(19.54)
Time and region controls						
Month fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	No	Yes	No	Yes	No
Linear Time Trend	--	−0.217**	--	−0.214***	--	−0.128
		(0.102)		(0.107)		(0.103)
Mother's and pregnancy controls						
Mother's age categories?	Yes	Yes	Yes	Yes	Yes	Yes
Parity categories?	Yes	Yes	Yes	Yes	Yes	Yes
Mother's Education Status	Yes	Yes	Yes	Yes	Yes	Yes
Mother's Partner Status	Yes	Yes	Yes	Yes	Yes	Yes
Mother's High School × Mother's Partner Status	Yes	Yes	Yes	Yes	Yes	Yes
New controls						
Doctor aiding the delivery of the baby indicator?	Yes	Yes	No	No	No	No
Mother's health insurance coverage indicators?	No	No	Yes	Yes	No	No
Place of birth (public hospital, private hospital, home, street) indicators?	No	No	No	No	Yes	Yes
N	1,737,331		1,541,482		1,754,872	

Note: See Table 5.

Table 14: Regressions of Birth Weight on Indigence and Poverty Rates

	(1)	(2)	(3)	(4)	(5)
Indigence 3rd Trimester	−0.961	--	−1.316***	--	−0.898**
	(0.892)		(0.381)		(0.403)
Indigence 2nd Trimester	−0.629	--	--	--	--
	(1.515)				
Indigence 1st Trimester	0.615	--	0.283	--	--
	(1.017)		(0.337)		
Poverty 3rd Trimester	--	0.158	--	−0.862**	−0.528
		(0.833)		(0.392)	(0.438)
Poverty 2nd Trimester	--	−1.645	--	--	--
		(1.285)			
Poverty 1st Trimester	--	1.265	--	0.356	--
		(0.791)		(0.238)	
Joint Sign. F-test	6.10***	2.16	8.95***	2.43	14.72***
p-value F-test	0.003	0.120	0.001	0.111	0.000
N	1,125,353	1,125,353	1,125,353	1,125,353	1,125,353
Period Covered	Jun01/ May03	Jun01/ May03	Jun01/ May03	Jun01/ May03	Jun01/ May03

Note: Robust standard errors clustered at the "month-year" level. Controls: all used in column (5) in Table 5 (except business cycle indicators).
*** p-value < 0.01, ** p-value < 0.05,* p-value < 0.1.