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

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February 28, 2011.

Abstract

We investigate how birth weight in Argentina responds to monthly economic fluctuations around the economic collapse of December 2001, and document its procyclicality with respect to the month of birth during 2001–2003. Our data reveal that this procyclicality is driven by children born to low-educated mothers. We exploit the fact that the impacts of maternal nutrition and stress on birth weight vary according to the stages of gestation. We find evidence that the birth weights of children to low-educated mothers are sensitive to macroeconomic fluctuations during both the first and third trimester of pregnancy, while those of high-educated mothers only react to the first trimester of pregnancy. Our results are consistent with low-educated women facing credit constraints and suffering from both nutritional deprivation and maternal stress, while high-educated women are only affected by stress.

Keywords: Argentina, birth weight, trimester of pregnancy, economic crisis, macroeconomic shocks.
JEL Codes: I12, E32.

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*We thank Mariano Bosch, Claudio Campanale, Matteo Cervellati, Jocelyn Finlay, Jed Friedman, Marco Gonzalez-Navarro, Carmen Herrero, Lawrence Katz, Vadym Lepetyuk, Sonia Oreffice, one anonymous reviewer, participants at the 7th Health Economics World Congress – IHEA (Beijing, July 2009), the FBBVA-IVIE Workshop "Health and Macroeconomics" (Madrid, December 2009), the 25th European Economic Association Meetings (Glasgow, August 2010), and the 5th Annual Research Conference on Population, Reproductive Health, and Economic Development (Marseille, January 2011) for helpful comments and suggestions. We thank the CIF of Universidad Torcuato Di Tella, and especially Guido Sandleris, Ernesto Schargrodsky, and Julieta Serna for providing us access to disaggregate consumer confidence indicators. The usual disclaimers apply. Quintana-Domeque acknowledges financial support from the Spanish Ministry of Science and Innovation (ECO 2008-05721/ECON). Corresponding author: Climent Quintana-Domeque, Departament de Fonaments de l'Anàlisi Econòmica, Universitat d'Alacant, Campus de Sant Vicent, Alacant 03690, Spain. E-mail: climent@ua.es

1 Introduction

The analysis of how infant health responds to economic crises, or more generally macroeconomic shocks, has recently attracted considerable attention. 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. However, evidence coming from developed countries show that infant mortality actually decreases during recessions (e.g., Deheija and Lleras-Muney, 2004). Results from developing country-level studies are more mixed (Cutler et al., 2002; Paxson and Schady, 2005; Bhalotra, 2010).

As recently emphasized by Miller and Urdinola (2010), the variety of conclusions on the impact of macroeconomic shocks on children's health can be explained by the use of diverse methodologies or different *behavioral* responses to distinct macroeconomic shocks. Households may be able to smooth consumption or at least buffer expenditures on goods that protect health, as long as they are not credit constrained, which may explain why the mortality of children born to less educated women is more sensitive to economic shocks (Baird, Friedman and Schady, 2010). At the same time, the opportunity cost of time allocated to the production of children's health may decrease with economic contractions. Indeed, Miller and Urdinola (2010) show that when Colombia's coffee trade suddenly booms, mortality rates among children increase in coffee-producing counties. These authors find evidence that when coffee prices go up, parents work more and spend less time in producing children's health.

While previous work has emphasized the role of credit constraints and time allocations in the relationship between economic fluctuations and children's health, it has remained silent on the interaction between behavioral responses and *biological* constraints. This is somewhat surprising in light of the empirical evidence suggesting the existence of critical periods (during gestation) for children's health (in particular birth outcomes), and calls for a more complete understanding of how macroeconomic shocks affect maternal, and subsequently, fetal health, *during gestation*. When households experience a (negative) income shock at a critical period for children's health, they may react accordingly by substituting consumption of nutritious food from a non-critical period to the critical one, as long as they are not credit constrained. If the shock happens instead during a non-critical period, households may not need to update their allocation of resources.

The goal of this paper is not only to study the impact of the economic crises on children's health, but to investigate the importance of biological constraints in shaping behavioral responses. To that end, we focus on *birth weight*, which is mainly a function of the length of the gestation (GL) and the intrauterine growth (IUG) of the fetus (Kramer, 1987). While IUG depends on maternal nutrition, maternal stress appears to be the most important determinant of GL. During bad times, food security is threatened, and individuals suffer from psychosocial stress. In addition, deep recessions can lead to dramatic losses of resources, to the extent that credit constrained people may be forced to reduce their food expenditures below poverty levels. Hence, there are (at least) two plausible channels whereby exposure to a macroeconomic shock could affect birthweight: Nutritional deficits, and maternal (psychosocial) stress, with their impact varying according to the stages of gestation. Indeed, there is ample evidence that birth weight is generally most responsive to nutritional changes affecting the *third trimester* of pregnancy (evidence ranging from the Dutch Famine –e.g., Stein and Lumey, 2000– to the Food Stamp Program in the US– Almond, Hoynes and Schanzenbach, 2010), while maternal stress appears to impact birth weight when it occurs during the *first trimester* of pregnancy (Camacho, 2008).

We investigate the effects of the Argentine macroeconomic episode of 2001–2002 on birth weight, and the channels through which these effects emerge. Argentina was shaken by a traumatic financial crisis at the turn of the century; its output declined by about 11% in 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 the 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 administrative data on approximately 1.9 million live births that occurred over a three-year period, from 2001 through 2003.

We first link the state of the economy with birth weights on a monthly basis from January 2001 through December 2003, and find that average birth weight is procyclical with respect to the state of the economy in the month of birth.[3] Stratifying the sample by mother's education, we document that average birth weight is procyclical only for low-educated mothers, suggesting that the poor are disproportionately affected during economic crises, perhaps because they face important credit constraints. Since the literature on the determinants of birth weight suggests that the effects of economic shocks vary according to the stages of gestation, we create a measure of the economic activity in each of the three quarters that a pregnancy usually takes. We show that *only* the economic activity in the first and third trimester of pregnancy matter.

We then seek to understand the channels behind the reduction in birth weight. After stratifying the sample by mother's education, our data reveal that economic activity during both the first and the third trimester of pregnancy matter for low-educated mothers, while for

[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 online 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]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. We calculate the deviation of the economic activity index with respect to a Hodrick-Prescott type long run trend (both in log units). The index has a monthly frequency and extends from 1993 until 2008. By *procyclicality* we refer to the positive correlation between the deviation of the economic activity index with respect to the trend and birth weight.

high-educated mothers *only* the economic activity during the first trimester is relevant. This is consistent with nutritional deficiencies affecting low-educated mothers, who are more likely to be credit constrained, while stress associated to the economic downturns affects both low- and high-educated mothers. Additionally, we show that extreme-poverty rates in the third trimester of pregnancy affect birth weight only for low-educated mothers, reinforcing the role of nutritional deprivation in explaining the birth weight loss of their children.

To account for selection into pregnancy based on unobservables, we make use of an event study within the period under analysis: the economic collapse of December 2001-January 2002. In light of the evolution of the economic activity, the uncertainty predicted by private-sector financial analysts, and the degree of consumer confidence, the collapse could not be anticipated by mothers who decided to become pregnant before August 2001. Within this group, some of them gave birth to babies who were exposed in utero to the collapse, while the rest gave birth to babies who were *not* exposed in utero to the collapse. Using month-by-month average-birth-weight comparisons between 2001 and 2002, we obtain reduced form estimates. The largest gap, nearly 30 grams, is found in April, which coincides with the nadir of economic activity and the peak of social unrest. Stratifying the sample by mother's education, we find much smaller effects for high-educated mothers. Moreover, we provide an explanation for the variation by month of birth and mother's educational level, consistent with the role of the nutrition and stress channels depending on mother's education and timing of exposure to the shock. Our reduced-form estimates confirm our previous results.

Is 30-gram a sizeable loss in birth weight? Although birth weight is the most important determinant of perinatal, neonatal and postneonatal outcomes (McCormick, 1985; Pollack and Divon, 1992), there is very limited evidence on its response to economic crises, as documented by the very recent survey by Friedman and Sturdy (2011).[4] The effect that we uncover for the Argentine sudden-economic collapse is more than three times higher the 8.7-gram reduction

[4] Lower-birth-weight babies have worse outcomes in terms of one-year mortality rates (Van den Berg, Lindeboom, and Portrait, 2006).

due to stressful events estimated by Camacho (2008), and more than half of the 57-gram difference explained by the intensity in mother's smoking behavior (20 cigarettes/day vs. > 1 pack/day), see Abel (1980). Perhaps more important in evaluating the estimated magnitude is that children with low birth weight who survive into adulthood 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). For this reason, 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 (heart disease, diabetes, and obesity in adulthood), all of which contribute to a reduction in life expectancy.

The paper is organized as follows. In Section 2 we present a description of the data. In Section 3 we report our estimates of the effect of economic fluctuations by month of birth (or trimester of pregnancy) on birth weight. In Section 4 we investigate the channels explaining our main results. In Section 5 we present an event study to address potential endogeneity concerns of our previous estimates. In Section 6 we assess the magnitude of the Argentine birth weight loss. Section 7 concludes.

2 Data

2.1 Informe Estadístico del Nacido Vivo

The main source of data for this study is the Argentine national registry of live births, Informe Estadístico del Nacido Vivo (IENV), from the Dirección de Estadísticas e Información en Salud (DEIS). 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 approximately 1.9 million births occurring 2001 through 2003 in Argentina. 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.

On account of a change in the structure of the birth-weight-report form, data prior to the year 2001 are not directly comparable. Moreover, our repeated attempts in obtaining pre-2001 and post-2003 data from the DEIS have not been fructiferous. Our analysis therefore focuses on short-term fluctuations from 2001 through 2003. In practice, however, this is not a concern. Previous studies (e.g., Grandi and Dipierri, 2008) show that the decline in average birth weight experienced between 2001 and 2002 was not a reflection of a secular trend but an acute phenomenon.[5]

2.2 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 relatively small rate of low birth weights (LBW, live-birth babies weighing less than 2,500 grams; UNICEF/WHO, 2004). Table 1 shows summary statistics regarding the period 2001-2003. 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 LBW ($<$ 2,500 g) singletons is between 6.5 and 7%, slightly above comparable U.S. statistics.

[5] The sudden decline in birth weight that occurred in 2002 alone amounts to 30 grams (Table 1).

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. 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.[6] Different indicators of public expenditures on child health show a reduction of such expenditures, consistent with the findings of Cavagnero and Bilger (2010). 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. Nevertheless, returns to schooling, in particular completion of secondary (high school) education and college education, are large. Hence, completion of high school represents a good proxy for income opportunities (Savanti and Patrinos, 2005).

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 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 can be explained if birth weight is the cumulative effect of different inputs during the nine months that a pregnancy usually takes or by the existence of critical development periods (even if no cumulative exposure exists). The adverse influence of the crisis declines over time on account of the economic recovery that ensued.

[6] 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.

3 The effect of economic fluctuations on birth weight

3.1 Birth weight and economic activity in the month of birth

We link the state of the economy with children birth weights on a monthly basis from January 2001 through December 2003. As mentioned before, to assess the state of the economy (i.e., economic activity), 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).[7] 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 regressions of the form

$$BW_{i,r,m,t} = \beta C_{m,t} + I_m + \kappa_r + \tau_t + X_i \Gamma + \varepsilon_{i,r,m,t} \quad (1)$$

where $BW_{i,r,m,t}$ is the birth weight of child i born in province r in month m in year t, $C_{m,t}$ is the cyclical component of the economic-activity indicator during the month of birth m in year t, and $\varepsilon_{i,r,m,t}$ is a random error term. The regression contains two types of control variables, and it is estimated by OLS using clustered standard errors at the month-by-year level (36 clusters).

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 τ_t (either year-fixed effects or a linear time trend) to account for secular trends

[7] The detrending procedure uses the monthly economic activity index from 1993 through 2008. 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.

in birth weight.[8] We also consider month-specific province fixed effects, province-specific linear trends and month-specific linear trends.

The 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.[9]

Table 2 displays a series of regressions of birth weight on economic activity at birth and other variables. The estimates indicate that birth weight is positively associated with economic activity at birth. In other words, birth weight is a procyclical variable. A deviation of 0.1 log units (about 11%) from the long-term trend in the month of birth would explain a reduction in birth weight of about 8-12 grams, depending on the specification. Looking at the rest of the coefficients in 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 on average 24 grams heavier than those whose mothers are not, which is consistent with previous studies linking maternal education and birth-weight outcomes (e.g., Starsfield, 1991; Currie and Moretti, 2003; Currie, 2009). Finally, column (7) indicates that our results are robust to the addition of province-specific linear time trends, month-of-birth-specific linear time trends, and province-specific month of birth-fixed effects.

We now inquire about the possibility that macroeconomic shocks have heterogeneous effects on (mothers and their) children. In particular, high-SES mothers may be able to smooth consumption of critical inputs during pregnancy, while low-SES mothers may not because of credit constraints. Although we do not have information on either occupation or family in-

[8] 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.

[9] 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; the mother's education; parity and birth order; and behavioral factors (such as smoking and drinking).

come, returns to schooling, in particular completion of secondary (high school) education and college education, are large. Indeed, in Argentina, completion of high school (and above) represents a good proxy for income opportunities (Savanti and Patrinos, 2005).[10] Table 3 presents evidence on the differential impact of the crisis on the weight of newborns according to their mothers' educational level (high-school and above versus less than high-school). The table shows that in every specification the economic activity at birth is strongly correlated with the birth weight of children born to mothers whose educational level is low, while the impact on children born to high educated mothers is weak and not statistically different than zero. Not only mothers of low socioeconomic status had on average lighter babies than did the others (Table 2), but less-educated mothers were hit harder by the crisis (Table 3). 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). The results from this table suggest that the previous procyclicality of birth weight was driven by babies born to low educated mothers. Again, columns (3) and (6) highlight the robustness of our results.

Finally, we compute average birth weight by month- and year-of-birth for the full sample, and by mother's education, and estimate the relationship of average birth weight and economic activity in the month of birth, conditional *only* on month of birth fixed effects and a linear time trend. The results reported in Table 4 are consistent with our micro-regressions. Panel A shows that in the full sample average birth weight is procyclical, but the data reveal that procyclicality comes from children born to low-educated mothers. In Panel B, simultaneous estimation of the regressions of birth weight means by mother's education, together with the cross-equation test of coefficients, indicate that the coefficients on the economic activity in the month of birth are statistically different between low-educated and high-educated samples.

[10] We have also stratified the sample by sex of the child, without finding significant differences on the sensitivity of birth weight to economic cycle by gender of the child (results available upon request). Recently, Baird, Friedman and Schady (2010) find that female infant mortality is more sensitive than male infant mortality to negative income shocks. This could reflect within-household discrimination: boys are better protected from negative health shocks than girls. Our results do not contradict their findings, since birth weight is less likely to be affected by discriminatory behavior, given the lack of information on the sex of the child during (at least part of the) pregnancy.

3.2 Birth weight and economic activity by trimester of pregnancy

Since the literature on the determinants of birth weight suggests that the effects of economic shocks vary according to the stages of gestation, for each birth we now create a measure of the economic activity in each of the three quarters that a pregnancy usually takes. For the first quarter of pregnancy, we take the average of the monthly cyclical component in those three initial months, $C_{1,t}$, and we do a similar procedure for the second and third quarters of pregnancy, $C_{2,t}$ and $C_{3,t}$.

We estimate models of the form

$$BW_{i,r,m,t} = \sum_{T=1}^{3} \beta_T C_{T,t} + I_m + \kappa_r + \tau_t + X_i\Gamma + \varepsilon_{i,r,m,t} \quad (2)$$

where β_T reflects the sensitivity of birth weight to economic conditions during trimester T of pregnancy.

Table 5 shows that only economic conditions during the first and third quarters significantly affect birth weight. The table also reports the sum of the quarterly-estimates. 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 (consistent with the 27.4 gram-reduction shown in Table 1). According to these results, our previous estimates were severely downward biased. Moreover, Table 5 highlights the existence of critical stages of gestation (i.e., the first and third trimesters of pregnancy).[11] These findings hold even when controlling for mother and pregnancy controls.

[11] 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. Hence, although there is no clear biological reason to expect an effect of economic activity in the second trimester of pregnancy on birth weight, it is important to keep in mind that the not-statistically different than zero correlation between birth weight and the state of the economy in the second trimester of pregnancy can be driven by the collinearity of the second trimester with respect to the first and the third trimesters. Section 4 will provide biological reasons of why we should expect effects of the first and third trimesters of pregnancy on birth weight.

4 Exploring the channels: nutrition or stress?

Why did the crisis reduce average birth weight? In order to offer an answer to this question, we first need to review the main determinants of birth weight. In a nutshell, and following Kramer (1987), birth weight can be thought of as being a function of the gestation length (GL) and intrauterine growth (IUG). Maternal *nutrition* and cigarette smoking are the two most important and potentially modifiable determinants of IUG. While GL is more important in determining birth weight, it is also more difficult to manipulate its determinants, such as maternal *stress*.[12]

Economic crises may compromise food security and increase psychosocial stress. Moreover, dramatic reductions in resources can force credit constrained people to reduce their food expenditures below poverty levels. Hence, there are (at least) two plausible channels whereby exposure to a macroeconomic shock could affect birthweight: Nutritional deficits, and maternal (psychosocial) stress. More importantly: The impact of these determinants on birth weight varies according to the stages of gestation. In this section we investigate the plausibility of each of these channels by exploring the sensitivity of birth weight (and gestation length) to the economic activity in each trimester of pregnancy by mother's SES.

4.1 The nutrition channel

The role of nutrition in affecting fetal growth (or IUG) is clear.[13] If the nutritional channel is at work, a macroeconomic shock should be expected to have stronger effects on the birth weight of newborns to low-SES mothers. Why? While high-SES mothers may be able to smooth the consumption of nutritious food during pregnancy, low-SES mothers are more likely to face credit constraints. Actually, Table 3 is entirely consistent with this mechanism. However, high-SES mothers may be able to smooth not just the consumption of nutritious food, but of

[12] Malnutrition may cause stress in the fetus which is an important factor regarding preterm birth.

[13] The adequacy of fetal nutrition is dependent upon many factors and regulating mechanisms. These include nutrient intake of the mother; nutrient uptake of the nutrients and fetal regulation of the nutrients.

other critical inputs.[14]

In order to further investigate the nutrition channel, we note that a woman's nutritional need varies according to the stages of gestation. In general, birth weight is found to be most responsive to nutritional changes affecting the *third trimester* of pregnancy (Rush et al., 1990). For example, evidence coming from the end of the Second World War shows that the cohort exposed to the Dutch Famine in the *third trimester* had lower average birth weight than cohorts exposed earlier in pregnancy (Kliegman, Rottman and Behrman, 1990; Painter et al., 2005; Smith, 1947; Stein and Lumey, 2000).[15] More recently, Almond, Hoynes, and Schanzenbach (2010) show that in the U.S. pregnancies exposed to the Food Stamp Program *three months prior to birth* yielded deliveries with increased birth weight.[16] In summary, if the nutritional channel explains (part of) the loss in birth weight during the Argentine crisis, we should find that the birth weights of children born to low-SES mothers are more affected than those of high-SES mothers by the economic activity in the *third trimester* of pregnancy.

This sort of heterogeneity is analyzed in Table 6. We split the sample according to the mother's educational level, and find that the sensitivity of birth weight to economic conditions in the *third trimester* of pregnancy is *only* present for babies born to low-educated mothers, which is consistent with nutritional shocks affecting low-SES women, but not their high-SES counterparts. Using the estimates from columns (4) and (8), a deviation of 0.1 log units (about 11%) from the long-term trend in the *third trimester* of pregnancy would explain a reduction in average birth weight of about 13 grams for low-educated mothers, and of 0.5 grams (not statistically different than zero) for high-educated mothers.

In addition, using data from the Encuesta Permanente de Hogares (EPH), we estimate

[14]Our findings are robust to any compositional changes operating through observable health inputs, since similar results are obtained after considering 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).

[15]During the Dutch "Hunger Winter" of 1944–1945 food rations were reduced to below 1,000 Kcal per person for seven months: the birth weight of those exposed to famine in the *third trimester* dropped by about 300 grams.

[16]The Food Stamp Program is the most expensive of the U.S. food and nutrition programs. Although the program is means tested, there is no additional targeting to specific populations or family types.

the same models as in Table 7 but replacing the economic activity in the third trimester of pregnancy with the *indigence rate* (moving average) at this trimester.[17] The indigence (or extreme-poverty) 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*.[18] As expected, the estimates in Table 7 show that indigence rate in the third trimester of pregnancy matters *only* for low educated mothers.

All in all, these findings support the existence of nutritional deficits as a mediating channel in our context. While low-educated mothers, which are more likely to be credit constrained, cannot buffer expenditures on nutritious foods, high-educated mothers do not face credit constraints and do not suffer from nutritional deprivation. Hence, the economic activity in the third trimester of pregnancy impacts average birth weights of children born to low-SES mothers, but not of those of high-SES mothers. Still, it remains to be explained why birth weight is sensitive to economic conditions in the *first trimester* of pregnancy for both low- and high-SES mothers. We turn now to the stress channel to shed some light on this issue.

4.2 The stress channel

Stressful events are linked to pregnancy outcomes. In particular, maternal psychosocial stress is negatively associated to length of gestation (LG). Although the exact mechanism of onset of preterm labor is not known, there is growing evidence of an interaction or interplay of

[17] The EPH is a household survey of urban areas. It provides us with information on indigence rates in 29 such urban conglomerates, which represent urban populations in 22 provinces and the Federal District (Ciudad de Buenos Aires). Only the urban population of one province (Rio Negro) was not included systematically from the start (but instead from October 2002 on). 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 Figure 1).

[18] The poverty line is based on the indigence line plus additional expenditures on basic nonfood items (e.g., transportation, housing, and clothing).

neuro-endocrine and immunological processes (Wadhwa et al., 2001). Stress experienced by the individual plays a role in altering both processes.[19] Perhaps more interesting is the very recent evidence showing that birth weight is most responsive to stressful events affecting the *first trimester* of pregnancy (Camacho, 2008). Camacho has found that in Colombia the intensity of random land-mine explosions during a woman's *first trimester* of pregnancy has a negative significant impact on her child's birth weight.

Whether a macroeconomic shock is expected to be more stressful for low-SES than high-SES mothers is hard to know ex ante. On the one hand, high-SES mothers may have more coping mechanisms than low-SES mothers. For example, high-SES mothers have better access to counselling services, which is widespread in Argentina, a country with an exceedingly high ratio of psychologists per 100,000 (WHO, 2005). Moreover, comparing unemployment rates between May 2002 and May 2001, the increase in unemployment was much higher for low-SES individuals (INDEC).[20] On the other hand, in Argentina, high-SES families were particularly exposed to the freezing deposits in banks (whose value diminished in real terms due to a large devaluation). They also may suffer from higher initial costs of adaptation to a crisis situation. As highlighted by Friedman and Sturdy (2011), the emerging evidence suggests that negative (or positive) life shocks are linked to worse (or improved) psychosocial health among adults in developing countries (Das and Das, 2006; Stillman, McKenzie, and Gibson, 2009), which indicates that transitions into poverty and the conditions associated with transition are linked to an increased likelihood of poor mental health (rather than povery per se). The estimates in Table 6 and 7 reveal that economic activity in the *first trimester* of pregnancy is associated with birth weight for both low- and high-SES mothers.

We investigate further the feasibility of the stress channel by noting that forced starvation

[19]The biological pathways linking psychosocial stressors and birth outcomes have not been completely elucidated. However, a neuropeptide (corticotrophin-releasing hormone, or CRH) involved in stress response and affecting the initiation of labor is thought to be a central factor. 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.

[20]See Homer, James and Siegel (1990) for the relationship between work-related psychosocial stress and risk of preterm and low birthweight delivery.

during the Dutch Famine led to a reduction in the birth weight *without* an effect on preterm births (Smith, 1947). This piece of evidence suggests that while nutrition deprivation leads to a birth weight loss, it does not affect length of gestation. On the other hand, there is substantial evidence linking maternal psychosocial stress to length of gestation (e.g, Hobel et al., 2008). Unfortunately, although several studies have found a link between economic events and psychosocial stress (Catalano and Dooley, 1977; Pearlin et al., 1981; Rook et al., 1991), studies examining the effects of *economic contraction* on length of gestation are notably absent from the literature (Margerison, 2010), perhaps due to measurement error concerns in reported weeks of gestation. In Table 8 we assess this relation by looking at the economic activity in the trimester of pregnancy and gestation length, by mother's educational level.

The Table shows that length of gestation is a procyclical variable with respect to the *first trimester* of pregnancy: it increases with the economic activity in early pregnancy. Given the findings in Camacho (2008) linking stressful events in the *first trimester* of pregnancy with lower birth weight, and the existing link between maternal psychosocial stress and length of gestation (e.g., Hobel et al., 2008), our estimates on the relationship between economic activity in the first trimester and lenght of gestation supports the existence of a maternal stress channel in explaining (part of the) lower birth weights during the Argentine crisis.

Unexpectedly, we find that the length of gestation is a countercyclical variable with respect to the *third trimester* of pregnancy: it decreases with the economic activity in late pregnancy. The fact that the variable is not procyclical with respect to the third trimester of pregnancy together with its procyclicality with respect to the first trimester matches the stress channel interpretation. However, its counter-cyclicality with respect to the third trimester is somewhat puzzling. One possiblility is that good economic conditions in the last trimester of pregnancy may be associated with better prenatal attention and planned early child deliveries. Indeed, given the higher countercyclicality for high-SES mothers than for low-SES mothers, this could be a possibility.

We also estimate the relationship of average birth weight and economic activity in each trimester, conditional *only* on month of birth fixed effects and a linear time trend. The results reported in Table 9 are consistent with our micro-regressions. Panel A shows that only the first and third trimesters of pregnancy affect average birth weight. However, once we run separate regressions for mean birth weight depending on mother's education, we find that while both the first and third trimesters are relevant in explaining low-educated average birth weight, only the first trimester matters for high-educated average birth weight. In Panel B, we estimate simultaneously the regressions of birth weight means by mother's education, and our cross-equation tests of coefficients reject their equality on the third trimester of pregnancy, consistent with nutrition constraints affecting low-educated women. However, our tests concerning the first and second trimesters of pregnancy do not reject, suggesting that maternal stress affects similarly low- and high-educated women.

Finally, using the estimate of the sum of the cyclical coefficients from Table 9, we can see that 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 31-34 grams for babies born of mothers with a low educational level and 17-22 grams for babies born of mothers with a high level. This suggests that not only children born to low educated mothers are thinner at birth than those born to high educated mothers, but that this birth-weight gap is exacerbated when there are negative macroeconomic shocks.

5 An event study to capture the weight of the crisis

Our previously estimated positive association between birth weight and aggregate economic circumstances can be explained by (at least) two different reasons.[21] First, it is possible that

[21] Fertility decisions are likely to be affected by economic conditions, and heterogenous mothers are likely to react differently to the crisis. This fact is already acknowledged in the theoretical work of Becker (1991) and has 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.

a child born to a woman of given characteristics is more likely to suffer from low birth weight if economic circumstances are unfavorable. Indeed, we have already shown that birth weight appears to be procyclical with respect to the month of birth for low educated mothers but not for high educated ones. Second, it is possible that the composition of pregnant women (and women giving birth) changes with economic circumstances. In our previous analysis we adjusted for compositional changes including several observable pregnancy-and-mother characteristics.[22] However, this does not rule out the possibility that pregnant women in periods of crises have different unobservable characteristics than pregnant women in "normal" periods.[23]

In this section we use month-by-month variation in the timing of the crisis to exploit the fact that the "magnitude" of the Argentine crisis could not be anticipated for a group of mothers. Within this group some of them gave birth to babies who were exposed to the December 2001-January 2002 collapse in utero, while the rest gave birth to babies who were *not* exposed to the collapse in utero. This comparison allows us to have an alternative estimate of the *weight* of the crisis.

5.1 Identification strategy

Our first step in our identification strategy relies on finding a cohort of newborns who were conceived during a period when the extent of the crisis could not be anticipated. After the

[22]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.

[23]What about abortion? 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 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 total fertility rate (TFR, births per woman). If we look at the TFR in Argentina over the period 1995–2008, we see evidence of a negative secular trend, but no significantly different change from 2001 to 2002 in comparison to other years (Ministerio de Salud 2000-2007, Estadísticas Vitales).

crisis of 1999, the Argentine economy entered into a Plateau or growth slowdown in 2000 and until mid–2001. Figures 2, 3 and 4 indicate that the *extent* of the crisis, with the *collapse* of December 2001–January 2002, could not be anticipated before August 2001.

We start by presenting Figure 2, which displays the evolution of economic activity in Argentina during the period 1995–2008. This Figure shows two local minimums, corresponding to the financial crisis of 1995 and the slump after the devaluation of Brazil in 1998, and a global minimum: January 2002. It is difficult to believe that the collapse of the year 2002 could be anticipated given the historical evolution of economic activity since January 1995. Indeed, from mid–2000 to mid–2001 the year-over-year growth rates in monthly GDP were close to 0.

Figure 3, from Kannan and Köhler-Geib (2009), shows the behavior of the degree of "uncertainty", as measured by the dispersion of GDP forecasts based on surveys of private-sector analysts from June 2001 through June 2002. The individual lines show the measure of uncertainty regarding fundamentals for a select group of countries. For our purposes, however, the important point to note is that, at least before August 2001, the (default) crisis of December 2001 could not be anticipated, if anything, because the degree of uncertainty was around 1 in June and July of 2001, and then it jumped (actually doubled) in August 2001, reaching its maximum of around 3, with the announcement of default. As long as anticipation can be proxied by lack of uncertainty, this figure indicates that (at least) until August 2001 the extent of the crisis could not be anticipated.

The evolution of the Consumer Confidence Index (CCI) for Argentina, as depicted in Figure 4, tells us basically the same story. It 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.[24]

[24]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

Finally, and to summarize the relevant information contained in Figures 2, 3 and 4, we note that Cárdenas and Henao (2010) compute an index (LACER) combining real, financial and confidence variables, using principal component analysis, which shows the same sort of jump by mid–2001.[25]

All in all, these different observations indicate that the extent of the crisis could not be anticipated before August 2001, even though mildly pessimistic expectations may have prevailed throughout the period. Our comparison group comprises then 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. For example, a baby conceived in July 2001, after a normal, nine-month, gestation period, will be delivered in April 2002.

5.2 Estimation and results

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:

$$BW_{i,r,m,t} = \sum_{m=1}^{12} \delta_m I_m + \sum_{m=1}^{12} \theta_m Y_t I_m + \kappa_r + X_i \Gamma + \varepsilon_{i,r,m,t} \tag{3}$$

where $I_m = 1$ 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 partnership 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 (3) is estimated by OLS

Guido Sandleris, Ernesto Schargrodsky, and Julieta Serna, for providing us with the access that we needed in order to disaggregate consumer-confidence indicators.

[25] On a more descriptive account on December 19, 2001, food riots erupted in several Argentine cities. Within hours, the riots escalated into a broad protest against the government and social unrest unfolded into a full institutional debacle. Two administrations collapsed in less than two weeks, the country defaulted on the service of its debt, and political instability returned to the country after eighteen years of democratic rule. See Pérez-Liñan (2002).

using clustered standard errors at the month-by-year level (24 clusters).

Importantly, the interpreation of θ_m depends on m. If $m < 5$ (i.e., babies born from January through April), θ_m captures the effect of the extent of the crisis (collapse) on average birth weight for babies born in month m, as long as there are no month-of-birth-specific time trends in average birth weight (or positive jumps or drops between year by month).[26] However, if $m \geq 5$ (i.e., babies born from April through December), the effect of the extent of the crisis (collapse) is potentially confounded with the effect of selection into pregnancy of mothers who already knew (or anticipated) the extent of the crisis (collapse). Hence, estimates corresponding to $m \geq 5$ are not reported (but available upon request). Again, the Argentine economy was in a plateau (i.e., 0% y-o-y growth rate) since mid–2000 to mid–2001. This was hardly a growing economy (or even an economy with a decent growth rate), but based on this record, and on the evidence shown before, families who decided to have children before August 2001 could not anticipate the extent of the crisis that suddenly occurred.

Table 10 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 partnership status as well). It is worth noting that the addition of province-specific month of birth-fixed effects does not affect our estimates (results not reported).

Table 11 shows that the decline in birth weight is particularly prevalent in children born to low-socioeconomic status mothers. While the reduction in average birth weight for children of low-educated mothers ranges from 11 to 34 grams, the one corresponding to high-educated

[26] Given that in the previous section we obtained very similar results accounting or not for month-of-birth-specific time trends, we think that the "no month-of-birth specific time trends" is a reasonable assumption.

mothers is between 0 and 21. If anything, a higher socioeconomic status appears to cushion newborns during an economic crisis. Regardless of the set of controls used (mother's age and pregnancy categories, and province-specific month of birth-fixed effects), the estimates are very similar (results not reported).

Finally, note that these reduced-form estimates highlight the robustness of our previous results. Table 12 indicates that the month-by-month reductions in average birth weight between 2001 and 2002 by mother's education matched with the magnitude of the correspondent change in the cyclical component (log units) with respect to the previous year during the relevant trimester are the expected ones in terms of nutrition and stress channels. For example, changes in the economic activity of –0.03 and –0.15 in the first and third trimesters, respectively, are linked to reductions in average birth weight between March 2001 and March 2002 of 25 grams and 5 grams for low- and high-educated mothers, respectively. Similar observations can be made regarding January and April. These results reinforce our previous findings: for low-educated mothers both the nutrition and the stress channels are at work, while only the stress channel operates in the case of high-educated mothers.

6 Is 30-gram a sizeable birth weight loss?

We have shown that the Argentine crisis explains an average birth weight loss of 30 grams. In this section we try to understand whether this is a sizeable magnitude. To that end, we first compare our magnitude with those associated to other risk factors, such as prenatal stress and mother's smoking behavior. We then investigate the effects of the crisis on low-birthweight ($<$ 2,500 grams, LBW), since LBW babies are much more vulnerable and at much higher risk of detrimental later outcomes. Finally, we simulate the expected long-lasting effects in life-time income due to the 30-gram loss in birth weight by means of a calibration exercise.

6.1 Comparison with other risk factors

To put things in perspective, we compare the 30-gram loss with reductions due to stressful events and mothers' smoking behavior. We choose these two risk factors because in the former we can rely on recent quasi-experimental evidence (Camacho, 2008), while the latter is a well studied and important modifiable risk factor for low birth weight (Kramer, 1987). Quasi-experimental evidence from Colombia shows that, on average, a baby experiencing stress in utero due to landmine explosions in the municipality of residence suffers a decrease of 8.7 grams (Camacho, 2008). Hence, the documented birth weight loss for the Argentine quick-economic collapse is more than three times higher the reduction due to stressful events. Observational studies (e.g., Abel, 1980) show a 57-gram difference in mean birth weight of babies by mothers smoking behavior (11-20 cigarettes/day vs. > 1 pack/day). Thus, the effect attributed to the Argentine crisis is more than half of the difference explained by the intensity in mother's smoking behavior.

6.2 Elasticities and LBW prevalence

It is important to acknowledge that even an increase in birth weight of 40 grams could have a significant impact on the population in terms of neonatal mortality and morbidity (Luke, 1994). Hence, avoiding the 30-gram loss due to the crisis could have had relevant population effects. To investigate such a possibility, we explore the effect of the crisis on the proportion of LBW babies. Although this cutoff is arbitrary –researchers still debate the utility of LBW as an independent outcome (Wilcox, 2001)–, there is relative consensus that LBW babies are much more vulnerable and at much higher risk of detrimental outcomes later in life.

Table 13 displays regressions of log(BW) and LBW on the economic activity during the first and third trimesters of pregnancy, stratified by mother's education. The first column shows that the elasticities of BW with respect to the economic activity in the first and third trimesters of pregnancy are around 6% and 5%, respectively, for low-educated women. For high-educated women, the third column shows that the statistically significant elasticity is found only with respect to the economic activity during the first trimester of pregnancy, and its magnitude is virtually the same as for low-educated women, around 5%. Regarding the probability of LBW, similar qualitative results emerge in the second and fourth columns, although the effects seem rather small: a deviation of 0.1 log units (about 11%) from the long-term trend in both the first and third trimesters of pregnancy would explain a reduction in the probability of LBW of about 0.6% for babies born of mothers with low educational level and of about 0.4% for babies born of mothers with a high level. These are sizeable effects given the low prevalence of low-birth weight in Argentina (7% in 2003).

6.3 Long-lasting effects: a lower bound estimate

Recently, Royer (2009) emphasizes that returns to increases in birth weight may be reaped from "normal-weight" births. Indeed, this author finds that the positive effect of birth weight on education is largest for births exceeding 2,500 grams, a range where outcomes are often assumed to be unaffected by birth weight. Hence, the concentration on low birth weight may be misplaced. In this subsection we ask: For those whose births weights were affected by the crisis, what is its long-term impact? Alhough it is too early to have any longer-term follow-up outcomes (e.g., educational attainment or earnings for the affected cohorts vs. those in utero just before), 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.

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 birthweight 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 twin estimates of the returns to birth weight from Black, Devereux, and Salvanes (2007) to approximate $\Delta\ln(\text{Income})/\Delta\ln(\text{Birthweight})$, as shown in the footnote of Table 14, which presents our estimates. Of course, in doing that, a note of caution is warranted. Although it is true that the twin estimates control for unobservable factors capturing the in utero environment (Behrman and Rosenzweig, 2004), they are based on a selected sample: the average birth weight and the proportion of LBW is much lower for twins.

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 of the costs is sensitive to key model assumptions (namely, expected income growth and intertemporal discount rate). However, one must keep in mind that the $500 estimate is likely to be a lower bound, since we are not taking into account other long-term costs stemming from the crisis (heart disease, diabetes, and obesity in adulthood), all of which contribute to a reduction in life expectancy.

Even if $500 per baby born was a lower bound, it is very likely that these costs exceed 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. Assessing the nutritional status of all pregnant women and providing nutritious food to mothers identified to have limited resources (ensuring a balanced intake of protein/energy to meet the demands of pregnancy) may help to mitigate the negative impact of economic shocks on birth weight.

Indeed, Almond, Hoynes, and Schanzenbach (2010) show that in the U.S. pregnancies exposed to the Food Stamp Program three months prior to birth yielded deliveries with increased birth weight.[27] Alleviating the impact of adverse psychosocial circumstances on birth outcomes is likely to be much more complex. However, proper identification of women experiencing chronic stress during the prenatal period and provision of psychosocial support may be justified.[28]

7 Conclusions

The occurrence of the Argentine macroeconomic collapse in 2001–2002, combined with the existence of administrative data on approximately 1.9 million live births that occurred over a three-year period, from 2001 through 2003, has allowed us to investigate the cyclicality of birth weight. We have shown that birth weight is procyclical with respect to the month of birth. In addition, our data reveal that this procyclic behavior is driven by children born to low-educated mothers.

To better understand the channels by which economic fluctuations affect birth weight, and investigate the importance of biological constraints in shaping behavioral responses, we exploit the fact that the impacts of maternal nutritional and stress on birth weight vary according to the stages of gestation. Indeed, there is ample evidence that birth weight is generally most responsive to nutritional changes affecting the third trimester of pregnancy (evidence ranging from the Dutch Famine –e.g., Stein and Lumey, 2000– to the Food Stamp Program in the US– Almond, Hoynes and Schanzenbach, 2010), while maternal stress appears to impact birth weight when it is located in the first trimester of pregnancy (Camacho, 2008).

We uncover that the macroeconomic activity during both the first and the third trimester of pregnancy matter for low-educated mothers, while for high-educated mothers only economic

[27] The Food Stamp Program is the most expensive of the U.S. food and nutrition programs. Although the program is means tested, there is no additional targeting to specific populations or family types. See also Ceesay et al. (1997) and Ramakrishnan (2004) on the effectiveness of nutritional programs.

[28] Methods to alleviate the adverse impact of stressful events include, among others: provision of easy and reliable access to health care, provision of social support, among others.

conditions during the first trimester are relevant. This is consistent with nutritional deficiencies affecting low-educated mothers, who are more likely to be credit constrained, while stress associated to the negative economic fluctuations affects both low- and high-educated mothers. Additionally, we show that extreme-poverty rates in the third trimester of pregnancy affect birth weight only for low-educated mothers, reinforcing the role of nutritional deprivation in explaining the birth weight loss of their children.

To address endogeneity concerns, we perform an event study analysis. In light of the historical evolution of the economic activity in Argentina, the uncertainty predicted by private-sector financial analysts, and the degree of consumer confidence, the extent of the crisis could not be anticipated before August 2001, even though mildly pessimistic expectations may have prevailed throughout the period. Our comparison group comprises then 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. Our results are confirmed. The average birth weight loss due to the Argentine crisis is around 30 grams, which is more than three times higher the 8.7-gram reduction due to stressful events estimated by Camacho (2008), and more than half of the 57-gram difference explained by the intensity in mother's smoking behavior (Abel, 1980).

Our results are striking because the reduction in average birth weight occurred in a middle-to-high-income country with a physician-to-patient ratio similar to those of Germany and Norway, affecting both low- and high-educated mothers. Alhough it is too early to have any longer-term follow-up outcomes (e.g., educational attainment or earnings for the affected cohorts vs. those in utero just before), 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. Moreover, the price paid will be higher for some than for others, since birth weight of children born to low-educated mothers is more sensitive to economic shocks. This discrepancy may exacerbate income inequalities in the long run.

There are certain limitations of the present study that must be acknowledged. Probably, the most important one is the absence of information on direct measures of maternal nutrition and stress, which should be taken into account in the design of future data collection schemes. However, our findings represent an advance in understanding the impact of economic crises, and more generally macroeconomic activity, on children's health, after accounting for the interactions between biological channels, timing of (economic) insults, and household behavioral responses.

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FIGURES

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

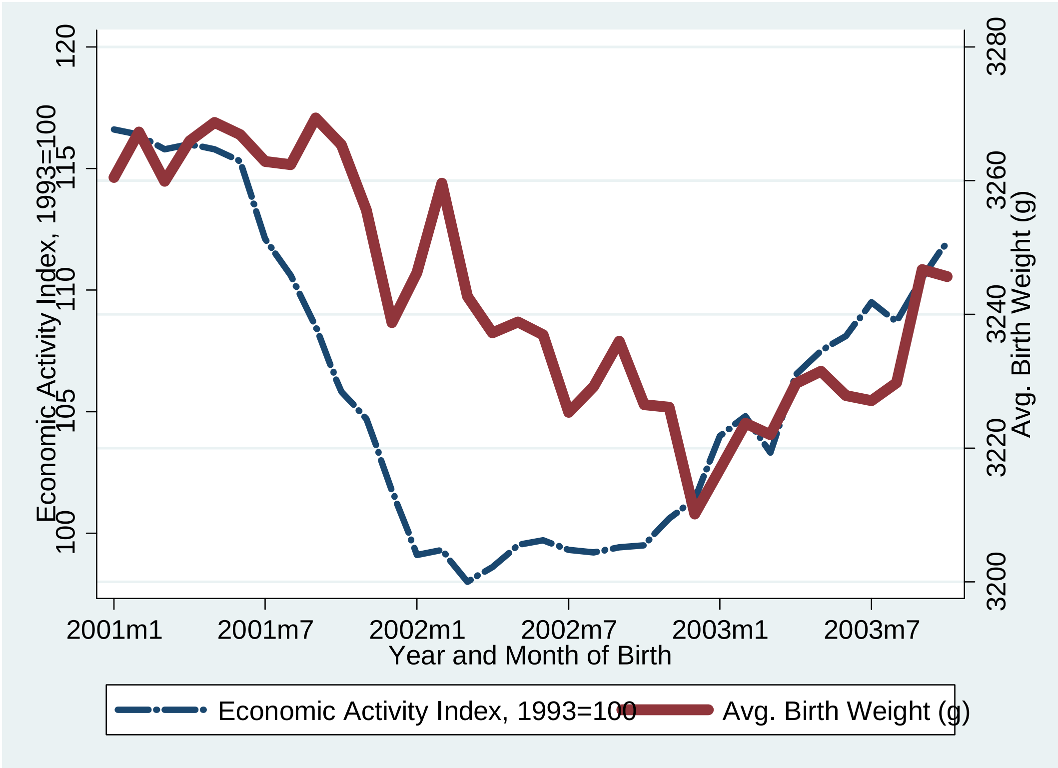
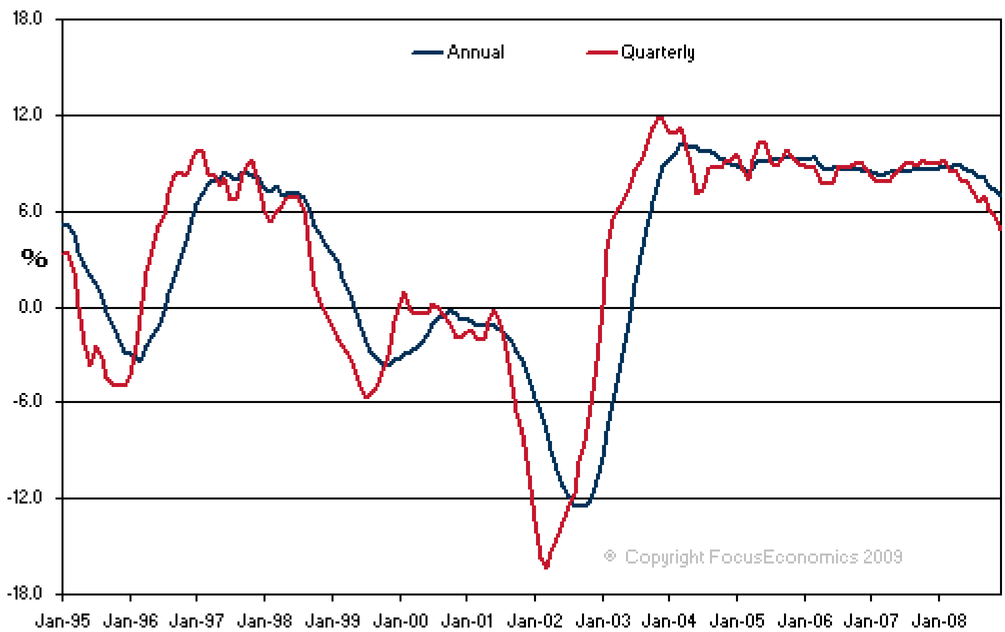
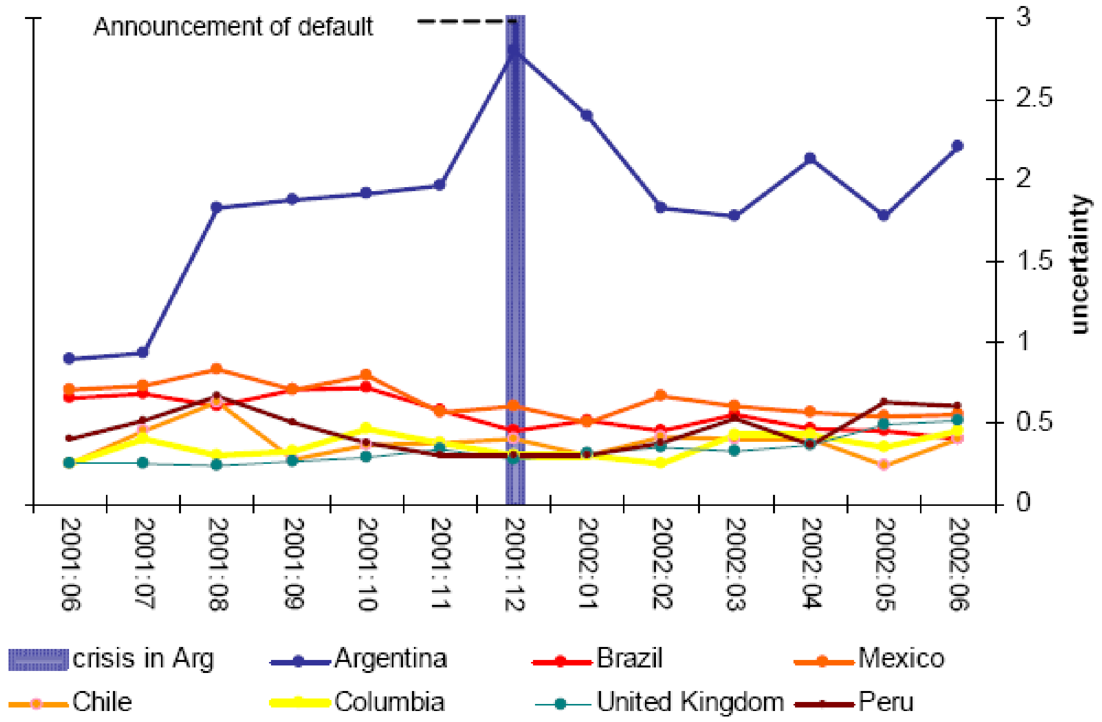


Figure 2: Economic Activity, 1995-2008



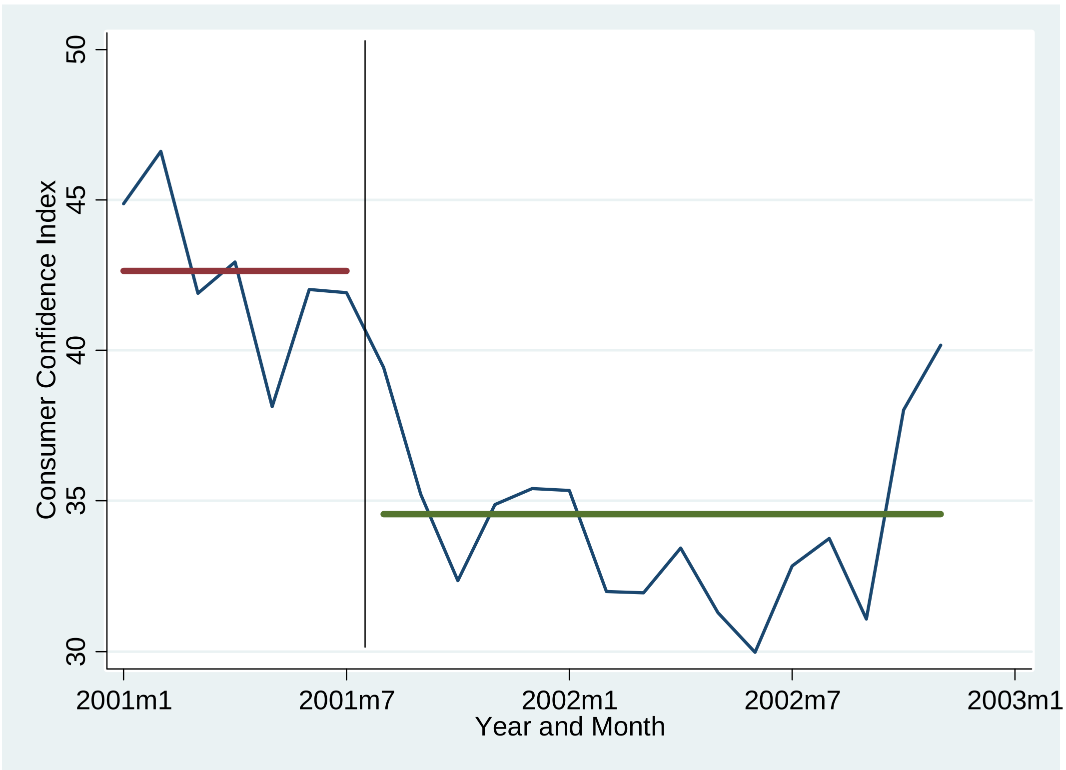
Note: Quarterly (year-over-year growth in monthly GDP, Estimador Mensual de Actividad Económica); Annual (variation of moving annual average).
Source: http://www.latin-focus.com/latinfocus/countries/argentina/arggdp.htm

Figure 3: Evolution of Uncertainty



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

Figure 4: Evolution of Consumer Confidence Index



TABLES

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 (< 2,500 g)	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
Poverty[d]	37.1%	55.3%	54.7%
Public Expenditure in Children Health (2006 PPP $)[e]			
National Budget per child[f]	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[f]	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] 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) // [e] 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. // [f] 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: Regressions of birth weight on economic cycle in the month of birth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cycle month of birth	81.43**	115.66***	73.67*	111.18***	68.57*	99.35***	90.67***
	(36.41)	(25.86)	(38.06)	(26.57)	(38.52)	(25.85)	(29.08)
Female	−102.92***	−102.92***	−103.08***	−103.08***	−103.44***	−103.44***	−103.44***
	(0.757)	(0.757)	(0.791)	(0.791)	(0.826)	(0.826)	(0.829)
Month FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE?	Yes	No	Yes	No	Yes	No	No
Time trend (linear)?	No	Yes	No	Yes	No	Yes	Yes
Time trend x province?	No	No	No	No	No	No	Yes
Time trend x month?	No	No	No	No	No	No	Yes
Month x province FE?	No	No	No	No	No	No	Yes
Mother's age categories?	No	No	Yes	Yes	Yes	Yes	Yes
Parity categories?	No	No	Yes	Yes	Yes	Yes	Yes
Mother's High School	--	--	--	--	24.02***	24.01***	24.02***
					(3.44)	(3.45)	(3.45)
Mother's Partnership Status	--	--	--	--	58.43***	58.44***	58.56***
					(1.72)	(1.72)	(1.71)
Mother's High School × Mother's Partnership Status	--	--	--	--	−17.18***	−17.18***	−17.24***
					(3.36)	(3.36)	(3.37)
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 Partnership Status: 1 if mother is living with a partner, 0 otherwise.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 3: Regressions of birth weight on economic cycle in the month of birth by mother's education

	Low-Educated Mothers			High-Educated Mothers		
	(1)	(2)	(3)	(4)	(5)	(6)
Cycle month of birth	110.35**	142.45***	133.06***	1.27	24.92	15.57
	(43.46)	(28.34)	(30.92)	(37.39)	(24.81)	(28.13)
Time/region controls						
Month FE?	Yes	Yes	Yes	Yes	Yes	Yes
Province FE?	Yes	Yes	Yes	Yes	Yes	Yes
Year FE?	Yes	No	No	Yes	No	No
Time trend (linear)?	No	Yes	Yes	No	Yes	Yes
Time trend × province?	No	No	Yes	No	No	Yes
Time trend × month?	No	No	Yes	No	No	Yes
Month × province FE?	No	No	Yes	No	No	Yes
N		1,059,925			629,988	

Note: All regressions include a constant term, sex of the child, mother's age categories, parity categories, and mother's partnership status. 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; Time trend (linear) = 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); High-Educated Mothers (mother's education is high-school or above), Low-Educated Mothers (mother's education is below high-school).

*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 4: Regressions of average birth weight on economic cycles in the month of birth

	Panel A: OLS regressions					
	Full sample		Low-Educated		High-Educated	
	(1)	(2)	(3)	(4)	(5)	(6)
Cycle in the month of birth	201.63***	114.47***	241.16***	152.27***	123.32***	40.33
	(36.55)	(32.31)	(38.30)	(34.31)	(37.25)	(31.94)
Month fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Linear time trend?	No	Yes	No	Yes	No	Yes

	Panel B: SUR regressions	
	Low-Educated	High-Educated
Cycle in the month of birth	160.84***	41.33*
	(24.32)	(22.89)
Month fixed effects?	Yes	Yes
Linear trend?	Yes	Yes
	Test of equality of coefficients	
	$\chi^2(1) = 60.14$	
	p-value = 0.0000	
N	36	

Note: Regressions are weighted by the number of observations that gave rise to the average. Robust standard errors.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 5: 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: 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 Partnership 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: Mechanisms I. Regressions of birth weight on economic cycle by trimester and mother's education

	Low-Educated Mothers				High-Educated Mothers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cycle 3	182.51***	143.48***	145.20***	134.15***	6.93	−24.35	11.45	5.34
	(45.73)	(48.48)	(12.76)	(12.74)	(41.64)	(36.64)	(13.42)	(13.65)
Cycle 2	25.84	3.00	--	--	86.48	63.00	--	--
	(68.76)	(72.62)			(60.38)	(59.06)		
Cycle 1	141.12***	159.95***	161.78***	158.13***	110.03**	128.64***	166.57***	165.35***
	(39.94)	(42.98)	(19.16)	(17.03)	(43.95)	(41.58)	(20.96)	(18.95)
Sum	349.47***	306.43***	306.98***	292.28***	203.43***	167.29***	178.02***	170.70***
	(31.57)	(20.89)	(16.05)	(10.66)	(30.84)	(27.95)	(25.58)	(24.52)
Month?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year?	Yes	No	No	No	Yes	No	No	No
Time?	No	Yes	Yes	Yes	No	Yes	Yes	Yes
TxP	No	No	No	Yes	No	No	No	Yes
TxM	No	No	No	Yes	No	No	No	Yes
MxP	No	No	No	Yes	No	No	No	Yes
N	1,059,925				629,988			

Note: All regressions include a constant term, sex of the child, mother's age categories, parity categories, and mother's partnership status. 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; Time trend (linear) = 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); High-Educated Mothers (mother's education is high-school or above), Low-Educated Mothers (mother's education is below high-school).
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 7: Mechanisms II. Regressions of birth weight on economic cycle and extreme poverty by trimester and mother's education

	Low-Educated Mothers		High-Educated Mothers	
	(1)	(2)	log(BW)	LBW
Extreme Poverty 3rd Trimester	−0.945***	−1.47***	−0.422	−0.307
	(0.301)	(0.279)	(0.355)	(0.304)
Cycle 1st Trimester	92.16***	73.28***	144.03***	147.82***
	(25.00)	(22.77)	(22.93)	(22.79)
Year FE?	Yes	No	Yes	No
Linear (time) trend?	No	Yes	No	Yes
N	895,948		503,844	

Note: All regressions include a constant term, sex of the child, mother's age categories, parity categories, a mother's partnership status indicator, month of birth fixed effects, and province of birth fixed effects. Robust standard errors clustered at the month-by-year of birth level are reported in parentheses.
Period: January 2001/May 2003
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 8: Mechanisms III. Regressions of weeks of gestation on economic cycle by trimester and mother's education

	Low-Educated Mothers				High-Educated Mothers			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cycle 3	−0.019	−0.562**	−0.812***	−0.947***	−0.563**	−1.26***	−1.28***	−1.45***
	(0.190)	(0.251)	(0.063)	(0.059)	(0.221)	(0.312)	(0.094)	(0.100)
Cycle 2	−0.119	−0.438	--	--	−0.492	−0.029	--	--
	(0.241)	(0.367)			(0.314)	(0.437)		
Cycle 1	0.457***	0.719***	0.451***	0.495***	0.218	0.631**	0.614***	0.627***
	(0.164)	(0.240)	(0.121)	(0.086)	(0.192)	(0.265)	(0.185)	(0.159)
Month?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year?	Yes	No	No	No	Yes	No	No	No
Time?	No	Yes	Yes	Yes	No	Yes	Yes	Yes
TxP	No	No	No	Yes	No	No	No	Yes
TxM	No	No	No	Yes	No	No	No	Yes
MxP	No	No	No	Yes	No	No	No	Yes
N	1,019,998				615,357			

Note: All regressions include a constant term, sex of the child, mother's age categories, parity categories, and mother's partnership status. 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; Time trend (linear) = 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); High-Educated Mothers (mother's education is high-school or above), Low-Educated Mothers (mother's education is below high-school).
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 9: Mechanisms IV. Regressions of average birth weight on economic cycles during trimesters of pregnancy

	Panel A: OLS regressions					
	Full sample		Low-Educated		High-Educated	
	(1)	(2)	(3)	(4)	(5)	(6)
Cycle 3rd Trimester of Pregnancy	117.33**	89.16*	180.14***	155.23**	29.23	−16.20
	(43.95)	(47.01)	(55.83)	(60.66)	(51.01)	(51.27)
Cycle 2nd Trimester of Pregnancy	−0.253	44.25	−34.79	4.06	7.14	80.68
	(65.45)	(69.11)	(81.72)	(89.47)	(89.90)	(81.15)
Cycle1st Trimester of Pregnancy	172.39***	125.02***	188.57***	147.79**	187.46***	107.13*
	(32.13)	(41.97)	(40.02)	(52.96)	(50.67)	(55.03)
Month fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Linear time trend?	No	Yes	No	Yes	No	Yes

	Panel B: SUR regressions	
	Low-Educated	High-Educated
Cycle 3rd Trimester of Pregnancy	152.82***	−18.95
	(41.36)	(54.07)
Cycle 2nd Trimester of Pregnancy	5.62	84.105
	(70.27)	(91.87)
Cycle1st Trimester of Pregnancy	145.89***	103.71*
	(44.96)	(58.78)
Month fixed effects?	Yes	Yes
Linear time trend?	Yes	Yes
	Test of equality of coefficients on	
Cycle 3rd	$\chi^2(1) = 60.14$ p-value=0.0060	
Cycle 2nd	$\chi^2(1) = 0.55$ p-value=0.4599	
Cycle 1st	$\chi^2(1) = 0.39$ p-value=0.5348	
N	36	

Note: Regressions are weighted by the number of observations that gave rise to the average. Robust standard errors.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 10: 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 11: Differences in average birth weight (g) between 2002 and 2001 by mother's education

	Low-Educated Mothers			High-Educated Mothers		
	2001	**2002**	**difference**	**2001**	**2002**	**Difference**
January	3404.75	3383.34	−21.31***	3421.79	3421.395	−0.395***
			(0.059)			(0.049)
February	3407.31	3396.58	−10.73***	3437.32	3434.135	−3.185***
			(0.074)			(0.091)
March	3405.03	3379.09	−25.94***	3422.86	3417.48	−5.38***
			(0.075)			(0.048)
April	3405.82	3371.94	−33.88***	3437.86	3416.70	−21.16***
			(0.085)			(0.060)
N	767,845			437,233		

Note: OLS regressions of birth weight on month of birth indicators, their interactions with 2002, and controls: province (excluded jurisdiction is "Tierra del Fuego") and gender child dummy variables.
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

Table 12: Understanding our reduced form quasi-experimental estimates

	Difference in *cyclical component* (log units) with respect to the previous year																
	2000 and 2001								2001 and 2002								
Month	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR					
Difference in cyclical component (log units)	0,02	0,01	-0,02	-0,03	-0,05	-0,07	-0,08	-0,15	-0,15	-0,15	-0,16	-0,15		Difference in *Average BW* between 2001 and 2002			
January 2002 Trimester-Correspondence	I	I	I	II	II	II	III	III	III				Date of Birth	Low Educated Mothers	Why?	High Educated Mothers	Why?
Trimester-Cycle		**0,00**			**-0,05**			**-0,13**					JAN 2002	**-21,31**	N	**-0,395**	Nothing
February 2002 Trimester-Correspondence		I	I	I	II	II	II	III	III	III							
Trimester-Cycle			**-0,01**			**-0,07**			**-0,15**				FEB 2002	**-10,73**	S & N	**-3,185**	S
March 2002 Trimester-Correspondence			I	I	I	II	II	II	III	III	III						
Trimester-Cycle				**-0,03**			**-0,10**			**-0,15**			MAR 2002	**-25,94**	S & N	**-5,38**	S
April 2002 Trimester-Correspondence				I	I	I	II	II	II	III	III	III					
Trimester-Cycle					**-0,05**			**-0,13**			**-0,15**		APR 2002	**-33,88**	S & N	**-21,16**	S

Note: This table presents month-by-month reductions in average birth weight between 2001 and 2002 by mother's education matched with the magnitude of the correspondent change in the cyclical component (log units) with respect to the previous year during the relevant trimester.

I = First Trimester, II = Second Trimester, III = Third Trimester
S = Stress, N = Nutrition

Table 13: Regressions of log(BW) and LBW (< 2,500 g) by mother's education

	Low-Educated Mothers		High-Educated Mothers	
	log(BW)	LBW	log(BW)	LBW
Cycle 3rd Trimester	0.059***	−0.031***	0.017	0.009
	(0.009)	(0.010)	(0.010)	(0.010)
Cycle 1st Trimester	0.048***	−0.027***	0.053***	−0.042***
	(0.006)	(0.005)	(0.008)	(0.008)
N	1,059,925		629,988	

Note: All regressions include a constant term, sex of the child, mother's age categories, parity categories, a mother's partnership status indicator, month of birth fixed effects, province of birth fixed effects, and a linear time trend. Robust standard errors clustered at the month-by-year of birth level are reported in parentheses.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 14: 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 $\sum_{t=2024}^{2065}(1-\delta)^{t-2009}Y_t(1-gap)$