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Weekly Report

Paying the cradle's bill: the long term economic consequences of economic crises

Argentina hit world news headlines in 2002 due to the largest debt-default in history and a sudden economic collapse reminiscent of economic statistics 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 on. Using the case of Argentina, we examine the long-term consequences of adverse economic conditions for those born during the crisis. We focus on birth weight - a key indicator of health at birth - and the effects that this has on the income of the cohort born during the crisis, to illustrate how a "cradle bill" may emerge in these situations. We find that in just about 6 months, the birth weight of newborns in a middle-high income country like Argentina deteriorated in a magnitude that is comparable to 1/6th the difference in birth weight between American and Pakistani babies. These results are also stunning because such disruption in health status occurred in a country with a similar ratio of physicians per person than Germany or Norway. We estimate the average loss of future individual earnings due to the reduction in average birth weight is about 500 US-Dollars in present value. This is a conservative estimate because it does not include other potential losses not reflected in lifetime earnings, for example life-time health care costs or a reduction in life expectancy. This "bill" will not be paid equally, since poor mothers are most affected in terms of birth weight, which may exacerbate income inequalities in the long run. The policy implications of these findings are not solely relevant for developing countries, but also for developed countries in terms of setting priorities in aid strategies to countries under economic distress.

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It is well known that economic crises exert enormous costs on citizens. In one way or another, individuals are affected by a myriad of dreaded events, from bank runs, foreclosures, unemployment and bankruptcies. Argentina is a clear example of recurrent economic crises that make news headlines worldwide. Yet the headlines are usually oblivious to the potential long-term consequences this economic downturns for individuals and entire countries. Very often, economic crises in developing countries (such as Argentina) require tight control of government expenditures in health or education to counteract declining fiscal revenues and the burden on the public budget resulting from potential bail-outs. In combination with high unemployment and high inflation - eroding the capacity of poor families to buy foodstuff—this results in deteriorating living conditions of those born during such a crisis.

JEL Classification:
I12, J13

Keywords:
birthweight, economic crises, health production, long term impact

Table

Living conditions in comparison

	Births attended by skilled health personnel (%)*	Government expenditure in health (per person) in 2006, dollars**	Income per capita, 2008	Life Expectancy (years), 2006	Newborns weighing <=2500g (low birthweight)*
Germany	100	2 548	35 442	80	7
Argentina	99	758	14 413	75	7
Brazil	97	367	10 326	72	10
India	47	21	2 762	63	30

1 Latest information available, years may vary.

2 Purchasing power parity dollars.

Source: World Health Organization and International Monetary Fund.

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Citizens from countries with low income and deficient healthcare systems experience shorter lives and a high percentage of their newborns are of low birthweight.

There is substantial evidence in the specialized literature that indicates that circumstances in the first years of life (e.g. proper nutrition, proper health care) have a powerful impact decades later because they affect long run economic achievement of those born in the dire times¹. Undernutrition and exposure to other adverse conditions early in life are thought to affect physical development and cognitive abilities such as the ability to hold and process information. Deficiencies at this critical stage cannot be completely compensated later. It has been shown empirically that being born in a recession can subtract a few years from a person's life expectancy, although these findings are based on a cohort of Dutch born before 1912, who lived 40 years, on average.²

Health conditions become economic problems

Different studies have elucidated a chain of causation that goes through different stages from the "cradle" to infancy (higher risk of mortality), to school (lower chance of completing educational milestones, disadvantages in cognitive abilities), and finally influencing labor market performance (lower income).³ Evidence coming from different

1 The influence of early life conditions exceeds the realm of economic outcomes. See for example Carlos Bozzoli & Angus Deaton & Climent Quintana-Domeque, 2009. "Adult Height and Childhood Disease", *Demography*, vol. 46(4), pages 647-669.

2 Gerard J. van den Berg & Maarten Lindeboom & France Portrait, 2006. "Economic Conditions Early in Life and Individual Mortality," *American Economic Review*, vol. 96(1), pages 290-302.

3 See for example Sandra E Black & Paul J Devereux & Kjell G Salvanes, 2007.

"From the Cradle to the Labor Market? The Effect of Birth Weight on Adult Outcomes," *The Quarterly Journal of Economics*, MIT Press, vol. 122(1), pages 409-439 and references cited therein. The literature on the consequences of birthweight is extensive, but mostly focuses on OECD countries: see for example Janet Currie & Rosemary Hyson, "Is

countries strongly suggests that birth weight - an important indicator of initial health status - affects long term measures of socioeconomic success, even in developed countries such as the U.S. or Norway. A difference of about 500 grams in birth weight (which is a normal variation in developed and developing countries) translates into about 2-3% higher earnings in adulthood.⁴ This effect of birth conditions on adult outcomes is not only seen in those with low birth weight, but within "normal" levels (i.e. from 2.5 to about 3.5 kg), so that it becomes relevant for a large proportion of the population.

Do cry for me, Argentina

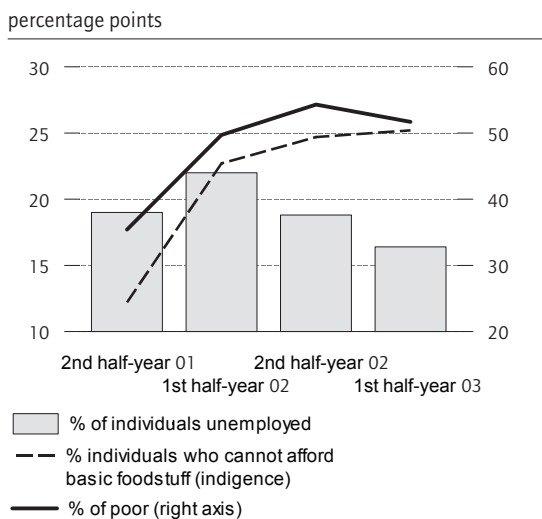
Living conditions in Argentina are better than in poor countries, but worse than those prevailing in most high income nations (Table). The country is an interesting case to study because its economy was shaken by a traumatic financial crisis at the turn of the century. Output declined about 11% only in 2002, while it had been decreasing another 7% between 1999 and 2001 (as a reference, Germany has experienced a contraction in its GDP of about 5% in 2009, its worst downturn year in the post-war period). At the peak of the crisis, one out of four Argentineans could not even afford buying basic foodstuff (what is technically called being "indigent") and almost 2 out of 3 were poor (Figure

the Impact of Health Shocks Cushioned by Socioeconomic Status? The Case of Low Birthweight," *American Economic Review*, vol 89(2), pages 245-250. For a broader perspective between health status in early life, its determinants and consequences, please refer to Janet Currie, 2009. "Healthy, Wealthy, and Wise: Socioeconomic Status, Poor Health in Childhood, and Human Capital Development," *Journal of Economic Literature*, vol. 47(1), pages 87-122.

4 Of course it would be simplistic to explain complex dynamics in the life cycle by only resorting to birth weight. There are other determinants (e.g. parental investments in the child and nutrition, just to name two factors) but the point is that, keeping other factors constant, "initial conditions" matter.

Figure 1

Dire times: indigence, poverty and unemployment in Argentina



1 For statistical purposes, „indigent“ are individuals who cannot afford a basic foodstuff basket.

Source: Own calculations based on information published by the National Statistical Institute of Argentina. **DIW Berlin 2010**

The economic crisis of 2002 sharply increased the rates of poverty and indigence to record levels.

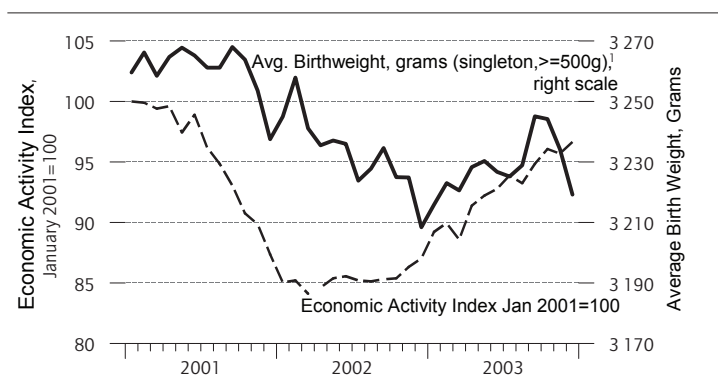
1). Yet, most news about the Argentinean crisis of 2002 related to immediate consequences: a historical default in public debt (creating large losses in bondholders), double digit inflation rates and a massive devaluation of its currency (about 75% of its value was lost in less than half a year).

Argentina has an almost complete coverage of details surrounding every single birth event. We have studied 1.9 million births occurring between 2001 and 2003, excluding multiple births and births whose weight was under 500g, using administrative data provided by the Statistical Department of Argentina’s Ministry of Health.⁵ Figure 2 shows an index of economic activity and the mean birthweight of babies born in different months between 2001 and 03. The crisis “peaked” in March 2002 (economic activity had declined by about 16% in a year by that time) and birthweight was at its minimum in December of that year. The “delay” results from the fact that birth weight is the *cumulative* effect of different inputs (e.g. nutrition, quality and quantity of medical checkups, maternal stress, etc) during

⁵ Results of the study co-authored with Climent Quintana-Domeque, PhD. Presented at the 7th Annual Conference of the International Health Association, held in Beijing, China, in July 2009, and at the Workshop on “Health and Macroeconomics”, FBBVA-IVIE, December 2009. The latest draft version can be retrieved from <http://merlin.fae.ua.es/climent/research.html>.

Figure 2

Economic activity and birthweight



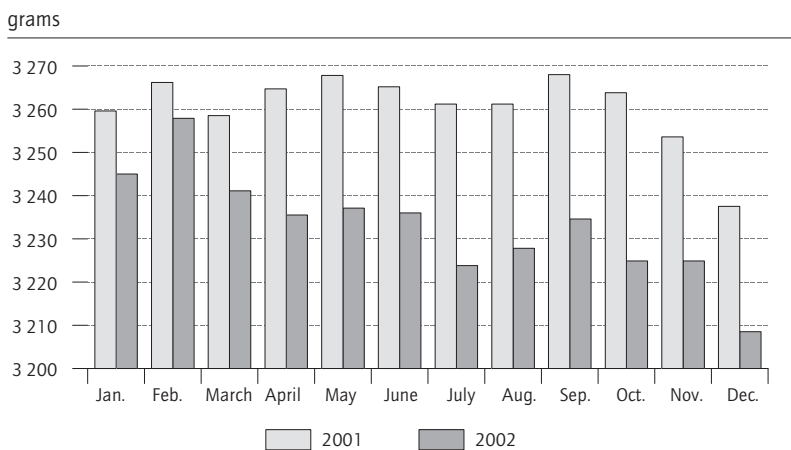
1 Average birthweight (in grams), singletons weighting at least 500 grams.

Source: Own calculations based on the Demographic Database of Live Births, provided by the Argentine Ministry of Health. **DIW Berlin 2010**

Birthweight hit its trough months after the peak of the economic crisis.

Figure 3

Average birthweight in 2001-02, by month of birth



Sources: Own calculations based on the Demographic Database of Live Births, provided by the Argentine Ministry of Health. **DIW Berlin 2010**

Despite monthly fluctuations, the birthweight of children born in the crisis (2002) was below preexisting levels (same month in 2001).

the 9 months that a pregnancy usually takes, not just those prevailing at the time of birth.

Because birth weight usually fluctuates with seasons, we have compared the birth weight of babies born in a given month of 2002 to that of the same month in 2001. The difference was always negative in 2002,

Box

Measuring the impact of the economic collapse on birthweight and calculating the "cradle's bill"

The methodology to assess the impact of economic conditions on birth weight outcomes makes use of two sources of data. First, we use a large dataset including all births occurring in Argentina between 2001 and 2003. Second, we use an index of economic activity which replicates the fluctuations in the gross-domestic product (GDP), but at monthly frequencies, to have a more accurate monitor of the dynamics of the crisis.

To assess the state of the economy we calculate the deviation of the economic activity indicator with respect to its long run trend. This deviation is usually referred to as "cyclical" component, in that it isolates business cycle fluctuations. We use a Hodrick-Prescott filter, which is the standard approach to identify business cycle fluctuations. Our findings are not sensitive to the method used, as assessed by applying other filtering methods. In our case, the economy plunges into a deep recession fast enough, so that by mid 2002 economic activity is more than 10% below its long run trend.

Since birthweight could be affected by economic conditions throughout pregnancy, using the economic cycle at birth may not be accurate. Thus, for each birth, we create a measure of the economic cycle (called "Cycle") in the three quarters that a pregnancy usually takes. For the first quarter of pregnancy, we take the average of the variable "Cycle" in those three initial months, and we do a similar procedure for the second and third quarter of pregnancy.

Our outcomes of interest are birthweight (in grams) or an indicator for a low-birth weight delivery (<2500g). We also use other measures of pregnancy outcomes, to assess the robustness of our findings. To give an example of our methodology, for the case of birthweight, the simplest model we estimate is a least-squares model of the form

$$\text{Birthweight}_i = \sum_{j=1,3} \beta_j \text{Cycle}_j + \Gamma X_i + v_i$$

where β reflects the sensitivity of birth weight to economic conditions during each quarter ($j=1,2,3$) of pregnancy,

and X includes characteristics of the mother (educational level, number of previous pregnancies, age, job market status, health insurance, partnership status) as well as province indicators to capture regional differences not accounted for by mothers' characteristics (this accounts for variations in health infrastructure and other factors fixed in time but that vary across provinces). We find that economic conditions during the first and third quarter significantly affect birth weight. Using estimates for β and cyclical indicators, we can construct the effect of economic conditions on cohorts born in different months, expressed in grams lost due to business cycle fluctuations.

Once the effects on birth weight are found, we simulate life-time earnings of these children under different assumptions regarding the period of their life that they work (age at which they start working and age at which they retire, in Argentina this would represent a working period between ages 22 and 68, approximately) and income growth patterns (how fast are wages increasing from one year to another). We calibrate our model with information from Argentina, in particular, current information about income in current purchasing power parity Dollars, as is standard in the specialized literature of cross-country comparisons. Since it is not possible to know how fast personal income will grow, we run a sensitivity analysis using growth rates between 1 and 5% per year, which is in line with long-term forecasts for a middle-high income country such as Argentina.

For each birth, we simulate earnings under two scenarios: given the recorded birthweight, and given the birthweight that would have prevailed had the economy not been in crisis. We are interested in the "gap" (income lost) between these two projections, and discount it to present value at different discount rates (from 1 to 5%). Thus, for instance, a Dollar earned 20 years from now is only worth 0.35 current Dollars when discounted at a 5% annual compounded rate. The estimate of 500 Dollars is an average over simulations with different parameters (expected income growth, intertemporal rate of discount).

i.e., babies born in a given month in 2002 were, on average, lighter than those born in the same month of 2001 (Figure 3). In addition, statistical procedures reveal that not only mothers of low socioeconomic status (defined as mothers who had not completed

high school) had lighter babies, but that they also experienced a more pronounced downturn during the crisis than mothers with better socioeconomic standing (Box). To put it another way, babies born in poor families have a disadvantage even in normal

times: they are born with lower birthweight. This gap is not constant, but becomes even wider in bad times: it almost doubles in recessions.

The crisis explains a loss of about 30 grams in birth weight, which is about 15% of the gap in birthweight between babies born in the US and those born in Pakistan (a country with notoriously low birthweights)⁶. It is important to keep in mind that this loss in birthweight only happened in a short time period (about 6-7 months) and that this is a population average: the impact of the recession was even more pronounced in mothers of low socioeconomic status. These results are also stunning because such disruption in health status occurred in a country with a similar ratio of physicians per person than Germany or Norway⁷. The effect of the crisis on reduced birthweight is thought to be mediated by two channels: the negative effects on nutrition in-utero (which particularly affected poor mothers) and psychosocial stressors (which could have affected babies born to mothers of widely different SES levels: after all, the middle class was badly affected by the freezing of bank accounts and by rising unemployment)⁸.

How big is the cradle's bill?

To calculate the long-term cost of deteriorated birth conditions in terms of lifetime earnings, we simulated the life cycle of children born in Argentina's recession (2002-03) and compared it with a hypothetical cohort of children born without the effect of the recession. All other characteristics (e.g. mother's education) were kept constant in this comparison. This will result in conservative estimates because earnings are just one dimension in which low birthweight creates a burden. For example, reduced birthweight is associated with increased health care costs or with a reduced lifetime span. Since life trajectories are uncertain at this time, we calculated a range of scenarios, each specifying how long these people would work, what their income would be, how fast their income would grow over time, etc. This sensitivity analysis gives us a potential cost in terms of foregone labor income in

adulthood due to lower birthweight. Finally, we also used the latest estimates of the impact of birthweight on adult wages.⁹

The income gap between "recession" and "non-recession babies" will materialize only in the future: those born in 2002 will enter the job market approximately in the decade that starts in year 2020, and so the *future* gap has to be "discounted" to present monetary values. We find that a plausible estimate of the loss of future earnings due to the reduction in average birth weight is about 500 US-Dollars per baby born, in present value. As a comparison, eliminating poverty of pregnant mothers (by supplementing their income up to the basic needs poverty line¹⁰) would have cost only 100 US-Dollars for the full 9 months of pregnancy, which can be considered a reasonable estimate of the additional resources needed to prevent the drop in birth weight.

Since birth outcomes are affected by different factors, there is no simple recipe to avoid the problems shown here. But there is ample evidence that targeted interventions work, even in poor settings, where they are most needed. Depending on specific circumstances, these interventions would include a combination of strategies: nutritional supplementation, provision of adequate prenatal care and promoting maternal behavioral changes associated with health outcomes.

The 500 US-Dollar estimate does not take into account other long-term costs stemming from the crisis. For example, there is evidence that the collapse affected those going to school, disrupting their human capital formation. And our cost estimate does not account for the increased health burden in adult life: adverse conditions at time of birth have also been linked to heart disease, diabetes and obesity in adulthood, all of which factors in a reduced life expectancy.

Conclusion

The long-term burden of economic crises is borne by the generations born during the economic collapse. This occurs because life conditions at birth have a strong impact on job and schooling prospects in adult life. This link between birth conditions and

⁶ The reduction in birthweight in such a short period of time cannot be the result of a preexisting secular trend. Additional information on long-run trends can be found in the current draft of the article at <http://merlin.fae.ua.es/climent/research.html>. Similarly, the authors find no evidence these effects are due to compositional changes in the pool of pregnant mothers.

⁷ Source: World Health Statistics 2009, World Health Organization (WHO).

⁸ The article on which this report is based discusses extensively why these mechanisms may have a crucial role in the Argentine case. A current draft is electronically available at <http://merlin.fae.ua.es/climent/research.html>.

⁹ Sandra E Black & Paul J Devereux & Kjell G Salvanes, 2007. "From the Cradle to the Labor Market? The Effect of Birth Weight on Adult Outcomes," *The Quarterly Journal of Economics*, MIT Press, vol. 122(1), pages 409-439, 02

¹⁰ Using the national poverty line for basic needs as calculated by the National Statistics Institute of Argentina, the Instituto Nacional de Estadísticas y Censos (INDEC). More information (in Spanish) can be found on: <http://www.indec.mecon.gov.ar/>

indicators of success in adult life does not come from a “black box”, but is grounded in multidisciplinary research in social and medical sciences. As a case study, we estimate the impact of the deep economic crisis in Argentina in the years 2002 and 2003 on birth outcomes (in our case summarized in the weight of newborns) and estimate the future costs of the crisis-generation in terms of foregone income. We find a strong negative effect of the crisis on birth weight which is particularly pronounced in poor mothers. It is particularly striking that in just about 6 months, birthweight of newborns in Argentina deteriorated in a magnitude that is comparable to 1/6th the difference in birthweight between USA and Pakistan babies. The average loss of future individual earnings due to the reduction in average birth weight is about 500 US-Dollars in present value. This figure is a conservative estimate and marks the absolute lower bound of total costs. It does not include other potential losses like life-time health care costs or a reduction in life expectancy. The burden of low birth weight is not borne equally: mothers of low socioeconomic status experienced the most prominent drop in the birth weight of their newborns.

The fact that this was occurring in a medium income country with moderate human development indicators suggests that these effects may not only be restricted to periods of starvation or to very low income countries. Economic crises in developing countries should not only raise concerns about short term disruptions but also about not being able to shield the next generations from the long-run costs. Even from the perspective of a high income country such as Germany, aid packages sent to countries in dire situations should put even more attention to supporting strategies to ease the burden of crises on future generations.

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