THE IMPACT OF THE ECONOMIC CRISIS ON THE WELL-BEING OF FAMILIES IN BRAZIL*

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Resumen: Se analiza el impacto de la crisis económica en Brasil entre los años 1987 y 1991 sobre el bienestar de las familias. Los resultados de interés se refieren a educación, salud y pobreza y se concluye que una crisis económica: *i*) reduce la probabilidad de que los niños en edad escolar atiendan la escuela; *ii*) aumenta la probabilidad de que un niño muera antes de los seis meses de edad comparado con otras cohortes y *iii*) aumenta la incidencia de la pobreza en general sobre toda la población y tiene un impacto negativo fuerte entre los niños más jóvenes. En suma, los resultados sugieren que una crisis económica puede tener efectos nocivos sobre el bienestar de las familias.

Abstract: This study examines the impact of the economic crisis occurred in Brazil in the years 1987 to 1991 on the well-being of families. The outcomes of interest are measures of education, health and poverty. Our main findings are that and economic crisis: *i*) reduces the probability that children of an age to begin school will actually do so, and increases that they will be delayed in school later on compared to other cohorts; *ii*) crisis increases the probability that a child will die before six months of age compared to other cohorts; and *iii*) increases the incidence of poverty in general for the overall population and has a strong negative impact among young children. Taken together, the results suggest that, given the absence of solid safety nets at that time, the economic crisis had deleterious effects on the well-being of families.

Clasificación JEL/JEL Classification: O10, I20, I10

Palabras clave/keywords: crisis económica, bienestar de las familias, educación, salud, pobreza, economic crisis, Brazil, family well-being, education, health, and poverty.

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1. Introduction

This study examines the impact of economic crises on the well-being outcomes of families. The outcomes of interest are education, health and poverty. The particular event of "economic crisis" in this study is the long period of recession and stagnation that the Brazilian economy experienced between 1987 and 1991. Therefore, we are interested in learning how well-being is affected by an aggregate negative economic shock on the economy, which is observationally characterized as a sudden sharp decline of the GDP per capita.

An economic crisis can affect the well-being of families through many different channels. Ferreira and Schady (2009) rightly argue that the effects of aggregate economic shocks on child schooling and health are theoretically ambiguous depending on the magnitudes of the income and the substitution effects. It can affect directly the capacity of families to generate income both in the labor market through unemployment or underemployment or even in the goods market when the families cannot sell their goods and services. This income effect leads to less investment on child education and health, particularly when the families are credit constrained. On the other hand, the economic crisis can reduce child wage rates and thus decrease the opportunity cost of schooling. If families are not credit constrained and schooling is an investment good, families can increase their investment in child education and health. Additionally, the effects of aggregate economic shocks can also operate through the decline of supply or quality of public services such as education and health services, among others, that are important for the well-being of families.

After reviewing the economic literature for developed and developing countries, Ferreira and Schady (2009), conclude that the effects of an economic crisis depend on the income level of a country. For richer countries, the education and health outcomes improve during periods of negative economic shocks, suggesting that the substitution effect prevails. For poorer countries, these outcomes are cyclical, that is, they deteriorate during economic recessions, suggesting that the income effect dominates. For middle income countries, however, health outcomes are pro-cyclical but education outcomes are counter-cyclical.

This study examines the effects of an aggregate economic shock on education, health and poverty outcomes for a middle income country. More precisely, it presents a set of estimations of the impact of the economic crisis that occurred in Brazil from 1987 to 1991 on the education, health, and poverty outcomes of Brazilian families. The main findings are: *i*) an economic crisis reduces the probability that children of an age to begin school will actually do so, and increases the probability that they will be delayed in school later on compared to other cohorts; *ii*) an economic crisis increases the probability that a child will die before six months of age compared to other cohorts; and *iii*) an economic crisis increases the incidence of poverty in general for the overall population and has a strong negative impact among young children. Taken all together, the results suggest that the Brazilian economic crisis of 1987-1991 had deleterious effects on the well-being of families.

This study is divided into more five sections. Section 2 presents the crisis event considered for Brazil. Sections 3 to 5 present the methodology, data and results for the education, health and poverty outcomes, respectively. The analysis for each outcome is presented separately so the reader can concentrate on one section without losing any important information regarding the topic of interest. Section 6 concludes.

2. Defining the Crisis Episode

The Getulio Vargas Foundation, FGV, has a formal definition of economic recession periods for Brazil. A recession is defined as a sharp simultaneous decline of the economic activity in many sector of the economy. Formally, a recession period is defined as a negative growth of the GDP for at least two consecutive quarters. The measure of the GDP used is the market price deseasonalized quarterly GDP.

Table 1 presents the dates of the business cycles in Brazil from 1981 to 2008. Figure 1 depicts the chronology of Brazil's business cycles. The shadowed areas are the recession periods.

Brazil experienced several recession periods between 1983 and 2008. However, the magnitude and length varied markedly. In general, the recessions in the 1990's were less severe and shorter compared to the ones in 1980's.

We will concentrate on the period from 1987 to 1991. This will be our crisis period of interest in this study. There are at least three reasons for this period choice. First, this is a long crisis in the middle of two relative long periods of growth. These changes are interesting since we can compare the outcomes during the crisis with the outcomes during the growth periods. Second, for that period we do have enough data and information to use household surveys for the years before, during and after the crisis. Third, this is a crisis period that occurred simultaneously in other countries, particularly to

Latin America, which resembles in this aspect the current global crisis. Exploring the effects of this crisis may shed some light on what can happen to the well-being of families in similar crises.

Table 1
Quarterly Cronology of the Brazilian Business Cycles Duration and Amplitude Recessions

Period	*Duration in quarters*	*Accumulated growth %*	*Average quarterly growth %*
From the first quarter of 1981 to the first quarter of 1983	9	-8.5	-1.0
From the third quarter of 1987 to the fourth quarter of 1988	6	-4.2	-0.7
From the third quarter of 1989 to the first quarter of 1992	11	-0.9	-0.1
From the second quarter of 1995 to the third quarter of 1995	2	-2.8	-1.4
From the first quarter of 1998 to the first quarter of 1999	5	-1.6	-0.3
From the second quarter of 2001 to the fourth quarter of 2001	3	-1.0	-0.3
From the first quarter of 2003 to the second quarter of 2003	2	-1.7	-0.8
From the fourth quarter of 2008 on	-	-3.6	-

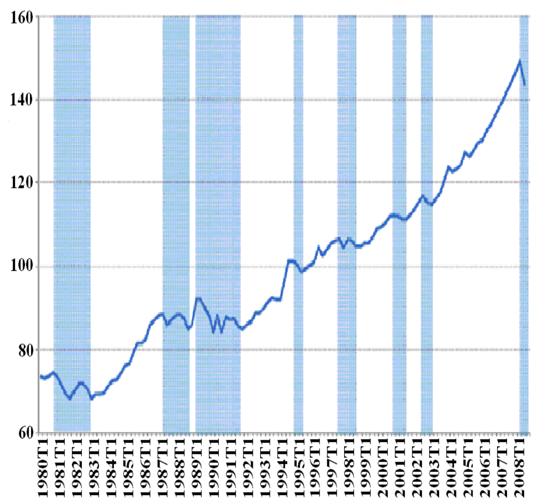
3. Effects on Education

This section presents the analysis of the impact of the economic crisis on educational outcomes. An economic crisis can affect educational outcomes in many different ways.

From the demand side it can, in principle, affect one's educational attainment positively or negatively, particularly if education is an investment good. On the one hand, a negative shock reduces the prevailing wage in the labor market. If the wage rate is an important component of the opportunity cost of attending school, it triggers a substitution effect toward an increase of the demand for schooling. On the other hand, it decreases overall wages and family income. The negative income effect can reduce the demand for education if education is a normal good. These two effects can be sizable if families are credit constrained.

Figure 1

GDP Quarterly Variation Index, Brazil



From a supply side perspective, an economic crisis affects the tax revenues of the public providers and so it can reduce the public investment in public education, affecting its supply quantitative and qualitatively. Thus, the final overall impact of an economic crisis on educational outcomes is an empirical matter that depends on the context and time that it happens. The crucial assumption here is that an economic crisis can shift structurally the optimal trajectory of human capital accumulation of those directed affected by the crisis.

There are many studies on the effects of economic recessions on child schooling outcomes. Particularly for Latin American countries, Binder (1999) and McKenzie (2003) examine the effects of the 1982-1983 and 1995-1996 crisis in Mexico, respectively, on education outcomes. Both studies find that under negative economic shocks the schooling outcomes improve in Mexico. Schady (2004) analyses the impact of late 1980's crisis in Peru on child's educational outcome. He finds that school attainment during the recession improved. Duryea and Arends-Kuenings (2003) estimate the impact of 1981-1983 economic crisis in urban Brazil. They find no significant change on school enrollment due to the crisis. Funkhouser (1999) finds that the 1981 to 1983 recession in Costa Rica had no permanent impact on child educational attainment. Maluccio (2005) for Nicaragua and Kruger (2007) for Brazil, both examining the varioation in coffee prices on school enrollment in coffee growing areas find that prices are negatively related to school enrollment. All these studies together suggest that for Latin American countries the substitution effect seems to dominate the income effect.

This study will investigate the impact of economic shocks on education outcomes during the more prolonged recession period in Brazil, 1987 to 1991. The sharp declines of economic activities considered in these other studies were relatively more temporary changes whereas the one considered in this study is lengthier. Perhaps this difference can have a more deleterious effect on the education outcomes.

3.1. *Methodology, Dataset and Sample Selection*

In this section we present the strategies that are used to identify the impacts of economic crises on the education outcomes. A key identification assumption is that the economic crisis affects differently individuals of a particular age group during the crisis period. Although there are other age groups in the crisis period, we will assume that they are not directly affected by the crisis. Additionally, in the absence of a crisis, we assume that, for a given age, the time evolution of educational outcomes for different cohorts is the same.

In order to formalize this idea, let c_j be a birth cohort j, a_j be the j age group such that $Y_i(c_j, a_j; t)$ is the school attendance (or school delay) indicator variable of individual i of cohort c, age group a at year t.

Consider the case of two cohorts, two age groups and three years. Let $j = 0, 1$ and $t = 0, 1,$ and 2. Year $t = 0$ is the period before the crisis, $t = 1$ is the crisis year, and $t = 2$ is the year after the crisis. Cohort c_0 is observed in years $t = 0$ and 1, with ages a_0 and a_1, respectively. Cohort c_1 is observed in years $t = 1$ and 2, with ages a_0 and a_1, respectively. Note that the cohort c_0 in year $t = 0$ ($t = 1$) have the same age of c_1 in year $t = 1 (t = 2)$.

In order to illustrate the identification strategy, the table 2 presents the hypothetical observable outcomes of this environment.

Table 2
Hypothetical Observable Outcomes

Pre crisis	*Crisis*	*Post crisis*
$t = 0$	$t = 1$	$t = 2$
$Y(c_0, a_0)$	$Y(c_1, a_0)$	
	$Y(c_0, a_1)$	$Y(c_1, a_1)$

Suppose the economic crisis affects individuals of age group a_0 only. In this case, the cohort c_1 is the cohort affected by the crisis. The identifying assumption is that, if there were no crisis, the time evolution of educational outcomes for cohort c_1 between periods $t = 1$ and $t = 2$ would be the same as for cohort c_0 during the periods $t = 0$ and $t = 1$.

The observed change in the cohort c_0 between $t = 0$ and $t = 1$ having a_0 as the reference age group is given by $Y(c_0, a_0) - Y(c_0, a_1)$. Analogously, the observed change in the cohort c_1 between $t = 1$ and $t = 2$ is given by $Y(c_1, a_0) - Y(c_1, a_1)$. Assuming additively linear models, these first differences eliminate cohort fixed effects. Moreover, assuming that the effect on the outcome of changing ages from a_0 to a_1 between $t = 0$ and $t = 1$ is equal to the effect of changing ages from a_0 to a_1 between $t = 1$ and $t = 2$, the difference in difference $[Y(c_1, a_0) - Y(c_1, a_1)] - [Y(c_0, a_0) - Y(c_0, a_1)]$ eliminates the (changing) age effects. This difference in difference estimator is the estimator of the crisis effect on cohort c_1. Note that this estimator is constructed in such a way as to obtain the following counterfactual: the educational outcome level for age group a_0 of cohort $c_1 (Y^*(c_1, a_0))$ if there had been no crisis. Given the identification assumptions, we have that

$$Y^*(c_1, a_0) = Y(c_1, a_1) - [Y(c_0, a_1) - Y(c_0, a_0)] \tag{1}$$

and therefore the crisis effect, α_3, is:

$$\alpha_3 = Y(c_1, a_0) - Y^*(c_1, a_0) \tag{2}$$

This difference in difference estimator can be computed using individual observations with at least two cohorts, two age groups and three different periods. The equation in this case is:

$$Y_{icat} = \alpha_0 + \alpha_1 C_i + \alpha_2 A_i + \alpha_3 C_i^* A_i + \theta' X_{it} + \varepsilon_{it} \tag{3}$$

where C_i is the indicator variable, assuming a value equal to one for the cohort c_1, and A_i is the indicator variable of the group age a_0. X_{it} is the vector of additional controls and ε_{it} is idiosyncratic error term. This equation implies that (dropping the vector X for simplicity):

$$\begin{aligned} E[Y|c_1, a_0; t = 1] &= \alpha_0 + \alpha_1 + \alpha_2 + \alpha_3 \\ E[Y|c_1, a_1; t = 2] &= \alpha_0 + \alpha_1 \\ E[Y|c_0, a_1; t = 1] &= \alpha_0 + \alpha_2 \\ E[Y|c_0, a_0; t = 0] &= \alpha_0 \end{aligned} \tag{4}$$

The difference in difference estimator is given by

$$\{E[Y|c_1, a_0; t = 1] - E[Y|c_1, a_1; t = 2]\} \tag{5}$$

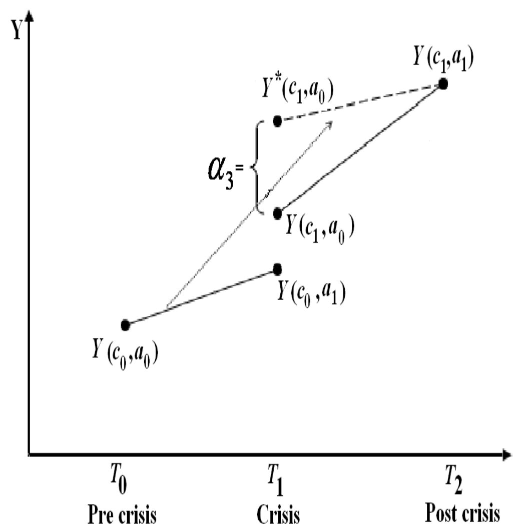
$$-\{E[Y|c_0, a_0; t = 0] - E[Y|c_0, a_1; t = 0]\} = \alpha_3$$

Figure 2 illustrates this contra-factual procedure.

The educational outcome trend of cohort c_0 between $t = 0$ and $t = 1$ is $[Y(c_0, a_1) - Y(c_0, a_0)]$. The assumption is that this would be the trend of cohort c_1 between $t = 1$ and $t = 2$ if there were no crisis. Since cohort c_1 is affected by the crisis when they are age a_0 (and not affected when they are age a_1), one can obtain a counterfactual outcome level for individuals of that cohort when they are age a_0. Note that at age a_0, cohort c_1, by construction, is in the middle of the crisis period.

One final caveat is worth mentioning. If the identification assumptions are not correct, they can lead to biases in different directions. On one hand, the age group a_1 might be affected directly by the crisis in $t = 1$. In this case the outcome $Y(c_0, a_1)$ under no crisis effect would be greater than the one observed. This would lead to an overestimation of α_3. On the other hand, the age group a_1 might be affected by the crisis in the after-crisis period $t = 2$. In this case the outcome $Y(c_1, a_1)$ under no crisis effect would be greater than the one observed. This would lead to an underestimation of α_3. The net bias could be positive or negative depending on the relative magnitudes of each of the biases or they could conceivably even cancel each other out.

Figure 2



3.1.1. Data Set and Sample Selection

The data set used is the Brazilian household survey PNAD for the years 1983 to 1996 (except 1991 since there is no PNAD that year). The PNAD's are yearly household surveys representative of the Brazilian population. They collect household socio-demographic and labor market information. Of particular importance to this study is that they provide information on the scholing attendance, grade, age, and gender of Brazilian children.

We explore a very specific impact of the economic crisis on educational outcomes. We are interested in the impact of the crisis on school attendance and school delay. If schooling is an investment good and families, particularly poor ones, are credit constrained, an economic crisis can alter the human capital accumulation trajectory of their children. We can verify this by exploring the change in the probability of school attendance and the probability of being delayed in school among those children exposed to the crisis in comparison with those not affected by the crisis. Our hypothesis is that children that are seven years old during the crisis period are affected differently by the crisis compared with those children that are seven years old in previous periods (up to a trend) and that are older than seven during the crisis period. This is so because seven is the mandatory age for school entry in Brazil. An economic crisis can affect the decision of families to let their children start school at the appropriate age.

The sample consists of all children aged seven to twelve born between 1983 and 1991. The crisis period ranges from 1987 to 1991. Thus, all children that turned seven between 1983 and 1986 are the pre-crisis/crisis cohorts. All children that turned seven between 1987 and 1991 are the crisis/post-crisis cohorts. The structure of the sample is best illustrated by table 3.

Table 3

Cohort Regression Structure

1983 to 1986				*1987 to 1991*					*1992 to 1996*				
Children's age													
7	7	7	7	7	7	7	7	7					
	8	8	8	8	8	8	8	8	8				
		9	9	9	9	9	9	9	9	9			
			10	10	10	10	10	10	10	10	10		
				11	11	11	11	11	11	11	11	11	
					12	12	12	12	12	12	12	12	12
t = 0				*t = 1*					*t = 2*				
Pre crisis				*Crisis*					*Post crisis*				

We will run several alternative specifications of equation (3). The main specification is the following: C_i is the indicator variable for the cohorts that are seven years old in 1987 to 1991, and A_i is the indicator variable of the individuals aged seven years old (zero otherwise). The alternative specifications will include additional indicator variables for the age groups. The controls for all regressions are the child's gender indicator variable, the child's birth order variable, the household head's years of schooling, age, and gender, and indicator variables for states and urban regions. All the regressions are linear probability models where the dependent variables are the indicator variables for school attendance and school delay. A child is considered to be attending school if he or she answers positively if he or she is currently attending school. A child is considered delayed in school if he or she is older than the ideal age for the grade in which he or she is currently enrolled. If he or she is out of school, the delay variable is constructed comparing the actual educational attainment with the ideal educational attainment for the current age of the child.

It is worthwhile discussing further the interpretation of the main specification. The expected values for each age and cohort are:

$$E[Y|c_1, a = 7, t = 1] = \alpha_0 + \alpha_1 + \alpha_2 + \alpha_3 \tag{6}$$

$$E[Y|c_1, a > 7, t = 2] = \alpha_0 + \alpha_1$$

$$E[Y|c_0, a = 7, t = 0] = \alpha_0 + \alpha_2$$

$$E[Y|c_0, a > 7, t = 1] = \alpha_0$$

The difference in difference estimator is:

$$\begin{aligned} &\{E[Y|c_1, a = 7, t = 1] - E[Y|c_1, a > 7, t = 2]\} \\ -&\{E[Y|c_0, a = 7, t = 0] - E[Y|c_0, a > 7, t = 1]\} = \alpha_3 \end{aligned} \tag{7}$$

Or alternatively:

$$\begin{aligned} &\{E[Y|c_1, a = 7, t = 1] - E[Y|c_0, a = 7, t = 0]\} \\ -&\{E[Y|c_1, a > 7, t = 2] - E[Y|c_0, a > 7, t = 1]\} = \alpha_3 \end{aligned} \tag{8}$$

The additional specifications include more age group indicator variables and their interaction with the cohort indicator variable. For instance, specification II is:

$$Y_{icat} = \alpha_0 + \alpha_1 C_i + \alpha_2 A_i^7 + \alpha_3 A_i^{7,8} + \alpha_4 C_i^* A_i^7 \\ + \alpha_5 C_i^* A_i^{7,8} + \theta' X_{it} + \varepsilon_{it} \tag{9}$$

where C_i is the indicator variable for the cohort c_1, $A_i^{7,8}$ is the indicator variable for seven or eight year-old children, and A_i^7 is the indicator variable for seven year-old children. This equation implies that (dropping the vector X for simplicity):

$$E[Y|c_1, a = 8, t = 1, 2] = \alpha_0 + \alpha_1 + \alpha_3 + \alpha_5 \tag{10}$$

$$E[Y|c_0, a = 8, t = 0, 1] = \alpha_0 + \alpha_3$$

$$E[Y|c_1, a > 8, t = 1, 2] = \alpha_0 + \alpha_1$$

$$E[Y|c_0, a > 8, t = 0, 1] = \alpha_0$$

The difference in difference estimator is:

$$\{E[Y|c_1, a = 8, t = 1, 2] - E[Y|c_0, a = 8, t = 0, 1]\} \\ -\{E[Y|c_1, a > 8, t = 1, 2] - E[Y|c_0, a > 8, t = 1, 2]\} = \alpha_5 \tag{11}$$

The interpretation of this estimator is the following. The impact of the crisis is the difference in the outcome of eight year old children who were seven years old during the crisis compared to the outcomes of the eight year old children who were seven years old before the crisis, controlling for the cohort and (changing) age effects.

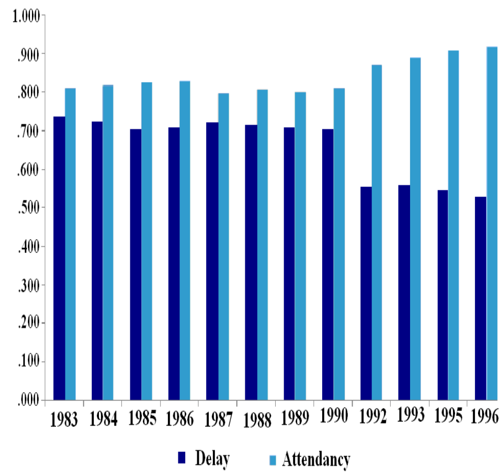
3.2. *Results*

The figures for the school attendance rate and school delay rate for all children aged seven to fourteen years old are presented in figure 3. Note that during the crisis years, 1987 to 1991, there is a decrease in the proportion of children attending school and a slight increase in the proportion of children delayed in school.

It is interesting to note that there is an increase in school attendance and a sharp decrease of school delay after 1990. It seems that the crisis period of 1987 to 1991 slowed both trends. This is what we will verify after controlling for demographics and cohort and age effects.

Figure 3

Proportion for School Attendance and School Delay by Year Seven to Fourteen Year Old Children - Brazil



The results for the overall sample are shown in the table 4. The cohort indicator variable is a dummy variable equal one if the individual is seven years old during the years 1987 to 1991, and zero otherwise. Age seven dummy is an indicator variable equal to one if the individuals is seven years old and zero otherwise. Similarly, we construct a dummy for age less than or equal to eight years old. We then construct other age group indicator variables that refer to the age group equal or below age nine, and repeat the exercise for age ten.

We are interested in the interaction term which gives us the difference-in-difference estimator controlled by cohort and age effects. Specification I in the second column shows that children who are seven years old during the crisis period have a 12.7 percentage point lower probability of attending school compared to the seven year old children before the crisis. Note that this difference is over and above the age and cohort effects.

Table 4

Probability of School Attendance - Linear Regression Model

Variable	I	II	III	IV	V
Cohort dummy	-.018	-.011	-.011	-.011	-.001
	.00	.00	.00	.00	.75
Age seven dummy	-.126	-.099	-.099	-.099	-.099
	.00	.00	.00	.00	.00
Cohort*age seven	-.127	-.115	-.116	-.115	-.115
	.00	.00	.00	.00	.00
Age <= eight dummy		-.039	-.030	-.030	-.030
		.00	.00	.00	.00
Cohort*(age <= eight)		-.018	-.019	-.019	-.019
		.00	.00	.00	.00
Age <= nine dummy			-.012	-.024	-.024
			.00	.00	.00
Cohort*(age <= nine)			.001	-.001	-.001
			.81	.80	.80
Age <= ten dummy				.019	.008
				.00	.00
Cohort*(age <= ten)				.001	.006
				.65	.09
Age <= eleven dummy					.025
					.00
Cohort*(age <= eleven)					-.015
					.00
Head of household's	.021	.020	.020	.020	.020
schooling	.00	.00	.00	.00	.00
Head of household's	.000	.000	.000	.000	.000
age	.59	.04	.02	.04	.07
Head of household's	.022	.027	.027	.027	.026
gender	.00	.00	.00	.00	.00
Male	-.022	-.022	-.022	-.022	-.022
	.00	.00	.00	.00	.00
Birth order	.000	.000	.000	.000	.000
	.75	.04	.05	.06	.08

Table 4

(continued)

Variable	I	II	III	IV	V
Urban area	.101	.101	.101	.101	.101
	.00	.00	.00	.00	.00
Constant	.601	.615	.618	.611	.597
	.00	.00	.00	.00	.00
N	343066	343066	343066	343066	343066

Note: 1) *P*-values are shown below the coefficients; 2) Additional controls are state indicator variables.

The specifications II to V (columns 3 to 5) include more age group indicator variables and their interactions with the cohort indicator variable. For instance, the results of specification II show that the eight year old children who were affected by the crisis when they were seven have a 1.8 percentage-point lower probability to attend school compared to the eight year old children in the previous cohort, after controlling for age and cohort effects. The potential channels through which the effects work can be two: first, a direct effect during the crisis years when they were eight years old, and second, a path dependent effect since they were seven years old during the crisis years. Note that interaction terms regarding the older children in the specifications III and IV are not statistically significant different from zero. Altogether, the results suggest that the main impact occurs among those who were seven years old during the crisis years.

The same regressions are estimated for male and female children, separately. The results are presented in the next two tables.

Table 5

Probability of School Attendance - Linear Regression Model

Male Children

Variable	I	II	III	IV	V
Cohort dummy	-.020	-.012	-.012	-.012	-.003
	.00	.00	.00	.00	.49
Age seven dummy	-.130	-.103	-.103	-.103	-.103
	.00	.00	.00	.00	.00

Table 5

(*continued*)

Variable	I	II	III	IV	V
Cohort*age seven	-.126 .00	-.112 .00	-.112 .00	-.112 .00	-.112 .00
Age <= eight dummy		-.038 .00	-.028 .00	-.028 .00	-.028 .00
Cohort*(age <= eight)		-.022 .00	-.024 .00	-.023 .00	-.023 .00
Age <= nine dummy			-.014 .00	-.026 .00	-.026 .00
Cohort*(age <= nine)			.002 .69	.001 .90	.001 .90
Age <= ten dummy				.018 .00	.009 .01
Cohort*(age <= ten)				.001 .89	.005 .31
Age <= eleven dummy					.021 .00
Cohort*(age <= eleven)					-.014 .02
Head of household's schooling	.023 .00	.022 .00	.022 .00	.022 .00	.022 .00
Head of household's age	.000 .00	.000 .00	.000 .00	.000 .00	.000 .00
Head of household's gender	.027 .00	.032 .00	.033 .00	.032 .00	.032 .00
Birth order	.000 .81	.000 .06	.000 .07	.000 .08	.000 .09
Urban area	.100 .00	.101 .00	.101 .00	.101 .00	.101 .00
Constant	.476 .00	.489 .00	.493 .00	.486 .00	.472 .00
N	173708	173708	173708	173708	173708

Note: 1) *P*-values are shown below the coefficients; 2) Additional controls are state indicator variables.

Table 6

Probability of School Attendance - Linear Regression Model
Female Children

Variable	I	II	III	IV	V
Cohort dummy	-.016	-.011	-.010	-.010	.001
	.00	.00	.00	.00	.79
Age seven dummy	-.123	-.096	-.096	-.095	-.095
	.00	.00	.00	.00	.00
Cohort*age seven	-.128	-.119	-.120	-.119	-.119
	.00	.00	.00	.00	.00
Age <= eight dummy		-.040	-.033	-.032	-.032
		.00	.00	.00	.00
Cohort*(age <= eight)		-.014	-.014	-.014	-.014
		.00	.01	.01	.01
Age <= nine dummy			-.010	-.022	-.022
			.00	.00	.00
Cohort*(age <= nine)			-.001	-.003	-.003
			.85	.58	.58
Age <= ten dummy				.019	.007
				.00	.04
Cohort*(age <= ten)				.002	.007
				.67	.18
Age <= eleven dummy					.029
					.00
Cohort*(age <= eleven)					-.016
					.00
Head of household's	.019	.019	.019	.019	.019
schooling	.00	.00	.00	.00	.00
Head of household's	.000	.000	.000	.000	.000
age	.02	.22	.30	.20	.16
Head of household's	.016	.021	.022	.021	.020
gender	.00	.00	.00	.00	.00
Birth order	.000	.000	.000	.000	.000
	.43	.32	.35	.38	.46
Urban area	.101	.101	.101	.101	.101
	.00	.00	.00	.00	.00

Table 6

(*continued*)

Variable	I	II	III	IV	V
Constant	.702	.716	.719	.712	.697
	.00	.00	.00	.00	.00
N	169358	169358	169358	169358	169358

Note: 1) *P*-values are shown below the coefficients; 2) Additional controls are state indicator variables.

Finally, table 7 presents the results for the school delay indicator variable. The specifications are the same as the ones used for the school attendance outcomes. The regressions are estimated for the overall sample as well as for male and female children, separately. The interpretation of the coefficients is the same as the ones above. The interaction term for specification I compares the cohort of children that are seven years old during the crisis relative to those who were seven before the crisis. In this case, the results should be qualitatively the same as the school attendance ones since age seven is the school entry age in Brazil. A delayed child would be a child not in school yet. However, the interpretations for the other specifications are more subtle. As children get older, they are more likely to be delayed in school. The crisis can have a cumulative effect along the years among the children who were affected by the crisis earlier. We can expect that older children in the cohort who were affected by the crisis earlier would be more delayed in school than older children not affected earlier by the crisis. In this case we are interested, for instance in the specification II, in the following crisis effect:

$$\{E[Y|c_1, a > 8, t = 1, 2] - E[Y|c_0, a > 8, t = 0, 1]\} \tag{12}$$

$$-\{E[Y|c_1, a = 8, t = 1, 2] - E[Y|c_0, a = 8, t = 0, 1]\} = -\alpha_5$$

In other words, the crisis effect in the delay is obtained as the delay in older children affected by the crisis when younger compared to older children not affected by the crisis when younger, controlling age and cohort effects. The underlying assumption is that the crisis affects the seven year olds directly and older children indirectly through the effect on them when they were seven years old.

Table 8 presents the results for the overall sample. Results for specification I show that seven year old children affected by the crisis are more likely to be delayed than seven years old children not affected by the crisis, controlling for age and cohort effects.

Specification II shows that controlling for age and cohort effects, children over eight who were affected by crisis at age seven are 4.4 percentage points more likely to be delayed in school compared to children older than eight years old not affected by the crisis when they were seven years old. Note that similar results are obtained for the interaction terms in all the specifications.

Table 7

Probability of School Delay - Linear Regression Model

Variable	I	II	III	IV	V
Cohort dummy	-.028	-.010	-.016	-.029	.025
	.00	.00	.00	.00	.00
Age seven dummy	-.460	-.375	-.375	-.376	-.376
	.00	.00	.00	.00	.00
Cohort*age seven	.184	.212	.208	.207	.207
	.00	.00	.00	.00	.00
Age <= eight dummy		-.122	-.064	-.064	-.064
		.00	.00	.00	.00
Cohort*(age <= eight)		-.044	-.015	-.017	-.016
		.00	.00	.00	.00
Age <= nine dummy			-.083	-.050	-.050
			.00	.00	.00
Cohort*(age <= nine)			-.051	-.024	-.024
			.00	.00	.00
Age <= ten dummy				-.053	-.030
				.00	.00
Cohort*(age <= ten)				-.038	-.024
				.00	.00
Age <= eleven dummy					-.054
					.00

Table 7

(*continued*)

Variable	I	II	III	IV	V
Cohort*(age <= eleven)					-.011
					.04
Head of household's schooling	-.046	-.048	-.048	-.048	-.048
	.00	.00	.00	.00	.00
Head of household's age	-.001	-.001	-.001	-.001	-.001
	.00	.00	.00	.00	.00
Head of household's gender	-.066	-.052	-.045	-.042	-.041
	.00	.00	.00	.00	.00
Male	.05	.05	.05	.05	.05
	.00	.00	.00	.00	.00
Birth order	.005	.004	.004	.004	.004
	.00	.00	.00	.00	.00
Urban area	-.066	-.065	-.065	-.065	-.065
	.00	.00	.00	.00	.00
Constant	1.071	1.112	1.141	1.164	1.196
	.00	.00	.00	.00	.00
N	343066	343066	343066	343066	343066

Note: 1) *P*-values are shown below the coefficients; 2) Additional controls are state indicator variables.

Furthermore, one can compare the differences in delay among two specific age groups. For instance, the coefficient of the interaction variable cohort*(age<= eleven) in the specification V gives us the difference in school delay among eleven year olds compared to twelve year olds over and above age and cohort effects. Alternatively, it gives us the difference in school delay among twelve year olds compared to eleven year olds over and above age and cohort effects. In this case, they (the twelve year olds) are 1.1 percentage points more likely to be delayed (compared to eleven year olds), although the increase is not statistically different from zero.

The tables 8 and 9 present the results for male and female children, separately.

In summary, taking together the school attendance and school delay results, they suggest that the crisis affected most strongly children that were seven years old during the crisis period. Not only they were less likely to attend school during the crisis but also they were more likely to be delayed in school as they got older (compared to previous cohorts). Additionally, the results are qualitatively the same for male and female children.

Table 8

Probability of School Delay - Linear Regression Model

Boys

Variable	I	II	III	IV	V
Cohort dummy	-.029	-.011	.017	.032	.029
	.00	.00	.00	.00	.00
Age seven dummy	-.476	-.389	-.389	-.389	-.389
	.00	.00	.00	.00	.00
Cohort*age seven	.186	.215	.212	.211	.211
	.00	.00	.00	.00	.00
Age <= eight dummy		-.127	-.070	-.071	-.071
		.00	.00	.00	.00
Cohort*(age <= eight)		-.047	-.015	-.016	-.016
		.00	.04	.03	.03
Age <= nine dummy			-.081	-.051	-.051
			.00	.00	.00
Cohort*(age <= nine)			-.056	-.025	-.025
			.00	.00	.00
Age <= ten dummy				-.048	-.025
				.00	.00
Cohort*(age <= ten)				-.043	-.028
				.00	.00
Age <= eleven dummy					-.053
					.00
Cohort*(age <= eleven)					-.012
					.09
Head of household's	-.044	-.046	-.046	-.046	-.046
schooling	.00	.00	.00	.00	.00
Head of household's	-.001	-.001	-.001	-.001	-.001
age	.00	.00	.00	.00	.00
Head of household's	-.063	-.048	-.041	-.039	-.038
gender	.00	.00	.00	.00	.00

Table 8

(*continued*)

Variable	I	II	III	IV	V
Birth order	.005	.003	.004	.003	.003
	.00	.00	.00	.00	.00
Urban area	-.056	-.055	-.055	-.055	-.055
	.00	.00	.00	.00	.00
Constant	1.162	1.204	1.235	1.259	1.293
	.00	.00	.00	.00	.00
N	173708	173708	173708	173708	173708

Note: 1) *P*-values are shown below the coefficients; 2) Additional controls are state indicator variables.

Table 9

Probability of School Delay - Linear Regression Model
Girls

Variable	I	II	III	IV	V
Cohort dummy	-.026	-.010	.014	.026	.021
	.00	.00	.00	.00	.00
Age seven dummy	-.443	-.362	-.362	-.362	-.363
	.00	.00	.00	.00	.00
Cohort*age seven	.181	.207	.204	.203	.203
	.00	.00	.00	.00	.00
Age <= eight dummy		-.117	-.057	-.058	-.058
		.00	.00	.00	.00
Cohort*(age <= eight)		-.041	-.015	-.016	-.016
		.00	.04	.02	.03
Age <= nine dummy			-.085	-.049	-.049
			.00	.00	.00
Cohort*(age <= nine)			-.047	-.023	-.023
			.00	.00	.00
Age <= ten dummy				-.058	-.035
				.00	.00
Cohort*(age <= ten)				-.033	-.020
				.00	.01

Table 9

(*continued*)

Variable	I	II	III	IV	V
Age <= eleven dummy					-.055
					.00
Cohort*(age <= eleven)					-.009
					.24
Head of household's schooling	-.048	-.049	-.050	-.050	-.050
	.00	.00	.00	.00	.00
Head of household's age	.000	-.001	-.001	-.001	-.001
	.00	.00	.00	.00	.00
Head of household's gender	-.070	-.056	-.049	-.046	-.045
	.00	.00	.00	.00	.00
Birth order	.006	.004	.004	.004	.004
	.00	.00	.00	.00	.00
Urban area	-.077	-.076	-.076	-.076	-.076
	.00	.00	.00	.00	.00
Constant	1.037	1.077	1.104	1.126	1.156
	.00	.00	.00	.00	.00
N	169358	169358	169358	169358	169358

Note: 1) *P*-values are shown below the coefficients; 2) Additional controls are state indicator variables.

4. Effects on Health

In this section we present some evidence of negative impacts resulting from the long recession that the Brazilian economy passed through between 1987and 1991 on infant health. Our focus is on the aggregate impact of economic crisis on health of the children of the most disadvantaged households and our measure of interest is infant mortality. Because our focus is on aggregate impacts, we do not separate out the possible channels through which an economic downturn could affect infant mortality, which could include the reduction in the supply of public goods such as hospital capacity, as well as decreases in per capita household income. There are many studies on the effect of aggregate economic shocks on child health outcomes in Latin American countries, including Cutler *et al.* (2020) on Mexico, Maluccio (2005) on Nicaragua, Paxson and Schady (2005) on Peru, and Miller and Urdinola (2007) on Colombia. In general their results suggest that child health outcomes, particularly child mortality, improve during periods of economic growth, and worsen during economic recessions and crisis.

We describe below the methodology used in this section to measure the effects of the 1987-91 crisis on infant mortality. We then present and briefly describe the data set used in this empirical exercise, the Brazilian waves of the Demographic and Health Survey, DHS. Finally, we present and discuss our main results.

4.1. *Methodology*

One obvious yet key point about infant mortality is that if we try to use methods based on panel data by observing the same individual over time, our panel will be, by construction unbalanced. This does not preclude using a difference in differences approach, but the unit of observation has to be changed, for example, to the family or to the child's mother.

Because of the specifics of the infant mortality variable when we use individuals as units of observations, in this section we discuss a different methodological approach from the one that has been used throughout this chapter. Our approach here could be defined as a simple difference. However, by modeling an underlying time trend, we can identify the impact on infant mortality during the crisis period. In fact, if the goal of the analysis is to separate the effects of the crisis episode from the observable characteristics of the individuals and the long-run trend in the infant mortality, we can use the following specification to estimate these effects.

$$Y_{imt}^{j} = \beta_0 + X_{imt}'\beta_1 + W_{mt}'\beta_2 + \delta D_t + g(t;\theta) + c_m + \varepsilon_{imt} \qquad (13)$$

where Y_{imt}^{j} is a dummy variable that equals 1 if child i born at time t from mother m died after j months of birth; X_{imt} and W_{mt} are vectors of observable characteristics; D_t is a dummy that equals 1 if child i was born during the crisis episode; g is a known function of time up to a parameter vector θ; c_m are unobservable mother's characteristics that are invariant over time; ε_{imt} is an idiosyncratic unobserved component that is assumed to be mean independent from the regressors; and β's, δ and θ are unknown parameter vectors.

Our parameter of interest is δ as it gives a measure of the impact of a crisis on the probability of child i's death, controlling for observed characteristics of the child and his mother, unobserved mother's characteristics and the long run trend. Note that in the fixed effects model that controls for c_m, the identification is achieved by comparing the probability of death between siblings born inside and outside the times of crises.

4.2. *Data*

To understand the impact of crises on infant mortality, we use data from the *Demographic and Health Surveys* (DHS). The survey was conducted in Brazil in the years 1986, 1991 and 1996, but in 1991 the data was collected only from the Northeast region. We thus decided focus on the 1986 and 1996 information, which is nationally representative. The original sample size is 5 892 women for the DHS-86 and 12 612 for the DHS-96. This corresponds to a total of 12 356 children from DHS-86 and 25 513 from DHS-96, summing up to our initial sample size of 37 869.

The DHS collects information about the whole birth history of the female respondent. She is asked about the dates of birth and death of all children, so we can construct not only the infant mortality rates but also use the information about demographic and socioeconomic characteristics of the respondent to separate the crisis effect from others determinants of infant mortality.

The DHS-86 has a slightly different population of reference from the one of DHS-96. The DHS-96 sample consists of women with ages between 15 and 49 years, while the 1986 DHS sample consists of woman with ages between 15 and 44 years. In this study, as we are interested in the information on children, this change of population did not seem likely to have an important effect on the consistency of our estimates. Furthermore, women between 45 and 49, 1996 belonged to the universe of DHS-86. However, to avoid inconsistency and lack of precision in the definition of the population of interest, we chose to focus on children born of mothers under 40 at the time of the birth.

Another problem associated with the data is that the sample is only representative for women, not necessarily for their children. This means that we have a clustered-random sample of children that had mothers in the age interval and, most importantly, are alive. Because of that, we chose to drop from our sample all children that were born 16 years before the interview. This filter ended up not being important to the specifics of our analysis because we also needed to deal with the fact that Brazil went through a recession around 1982. Thus, in order to avoid having a control sample that could have been affected by a recession we dropped all children born before 1983. From our initial sample of 37 869, after dropping those born before 1983, we kept 17 073. From those, we dropped all children whose mothers were above 40 when they were born. We ended up with 16 861.

Finally, to avoid censoring to the right, we dropped all children born within the year of the interview, that is, we excluded children from respondent mothers of DHS-86 that were born in 1986 and children from respondent mothers of DHS-96 that were born in 1996. Our final sample size was 16 160.

4.3. *Results*

Our final sample of 16 160 children is summarized in table 10. We see that mortality rate within the first year is of 6%, 5% in the first six months and 3% in the first month. About 34% were born in a recession year and the mother's average age at birth was 26 years. The sample contained a high level of mothers with a low level of education, as at least 58% of mothers did not complete high school. Finally, 65% of the respondent mothers were married at the time of the interview.

Table 10

Descriptive Statistics of Children

Variable	*Mean*	*Std. Dev.*	*No. of observations*
Proportion of children who died within first year	0.06	(0.24)	16 160
Proportion of children who died within first 6 months	0.05	(0.22)	16 160
Proportion of children who died within first month	0.03	(0.17)	16 160
Born in a crisis year[a]	0.34	(0.47)	16 160
Year of birth (1900 subtracted)	88.18	(3.83)	16 160

Table 10

(*continued*)

Variable	*Mean*	*Std. Dev.*	*No. of observations*
Birth order	2.91	(2.26)	16 160
Mother's age	25.58	(5.83)	16 160
Mother's education			
No education	0.11	(0.32)	16 153
Primary	0.47	(0.50)	16 153
Secondary	0.38	(0.49)	16 153
Higher	0.04	(0.20)	16 153
Mother's marital status			
Never married	0.03	(0.18)	16 160
Married	0.65	(0.48)	16 160
Living together	0.21	(0.41)	16 160
Widowed	0.01	(0.12)	16 160
Divorced	0.01	(0.10)	16 160
Not living together	0.08	(0.27)	16 160
Male	0.51	(0.50)	16 160
Region			
Rio de Janeiro	0.05	(0.21)	14 079
São Paulo	0.09	(0.29)	14 079
South	0.11	(0.31)	14 079
East Central	0.11	(0.31)	14 079
Northeast	0.43	(0.50)	14 079
North	0.11	(0.31)	14 079
West Central	0.11	(0.31)	14 079
Dummy: Rural areas	0.27	(0.44)	16 160
DHS[b]	1.87	(0.33)	16 160

Source: DHS-86 and DHS-96. Notes: [a] Crisis is defined by the period between years 1987-1991, [b] DHS = 1 if the data comes from DHS-86 and 2 if the data comes from DHS-96.

We also present some crude evidence of the relevant factors explaining observed heterogeneity in mortality. Table 11 shows that infant mortality is basically a rural northeastern problem and is slightly more prevalent among boys. This table sheds some light on the importance of controlling for observed individual and family background when trying to infer the impact of recessions on infant mortality.

Table 11

Descriptive Statistics of Mortality Rates

Mortality rate	*12 months*	*06 months*	*01 month*
Unconditional	.061	.049	.030
Conditional on gender			
Female	.058	.046	.030
Male	.064	.051	.030
Conditional on region			
Rio de Janeiro	.037	.031	.023
São Paulo	.042	.034	.022
South	.024	.023	.019
East Central	.041	.035	.028
Northeast	.086	.066	.037
North	.047	.035	.020
West Central	.043	.037	.026
Conditional on place of residence			
Urban	.052	.042	.028
Rural	.087	.067	.037
Conditional on education			
No education	.122	.096	.051
Primary	.070	.055	.032
Secondary	.037	.030	.022
Higher	.016	.016	.014

Table 11

(*continued*)

Mortality rate	*12 months*	*06 months*	*01 month*
Conditional on marital status			
Never married	.049	.045	.033
Married	.052	.042	.026
Living together	.086	.067	.039
Widowed	.113	.082	.048
Divorced	.051	.045	.038
Not living together	.066	.056	.036
Conditional on surveys			
DHS-86	.074	.062	.035
DHS-96	.059	.047	.029
Number of observations	16 160	16 160	16 160

Source: DHS-86 and DHS-96.

Infant mortality by year is shown in figures 4 to 6. Solid lines in these figures show that despite the peak in the late 80's and early 90's (our crisis episode), infant mortality seems to be following a long run declining trend. Thus, in an assessment of the economic crisis impact on mortality it is important to take into account not only that there are observed factors that explain mortality, as revealed by table 11, but also that mortality itself seems to be declining over the observed period.

Our main results are summarized by tables 12 and 13. In table 12 we show that the overall impact of being born in a recession period on the probability of dying within the first twelve months is not significant, regardless of the type of controls used.

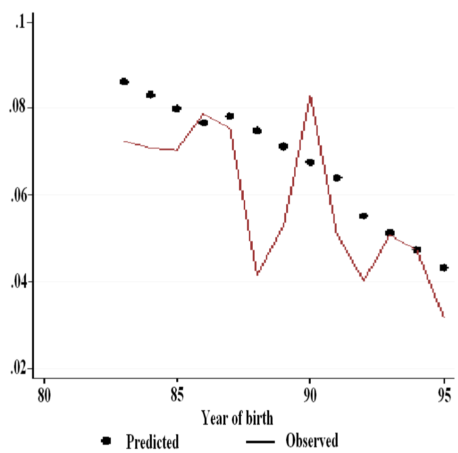
In table 13, column II, we can see that controlling for children's characteristics (month of birth, birth orderand gender) and mother's characteristics (marital status, age and education), the overall impact of being born in a recession period is to increase the probability of dying during the first six months after birth by 0.9 percentage points.

Given that the mortality rate for the first six months is 5%, it corresponds to an increase in 18% in the mortality rate in the first six months. Note that for all other specifications, although we obtain similar point estimates, the results are not statistically significant.

Figure 4

Mortality Rate by Year - 12 Months

Panel A



Panel B

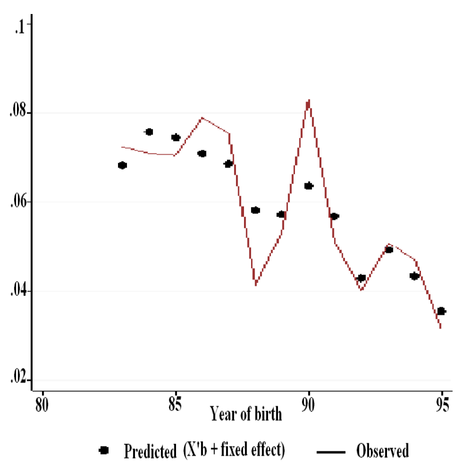


Figure 4
(*continued*)
Panel C

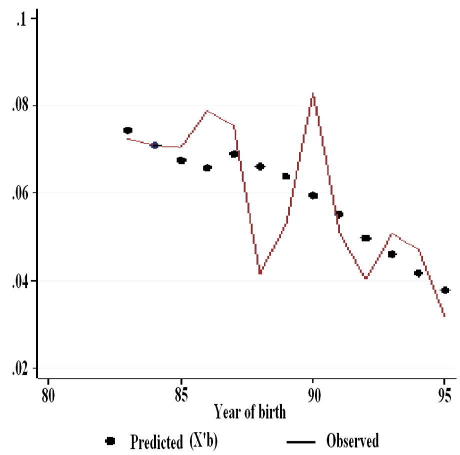


Figure 5
Mortality Rate by Year - 06 Months
Panel A

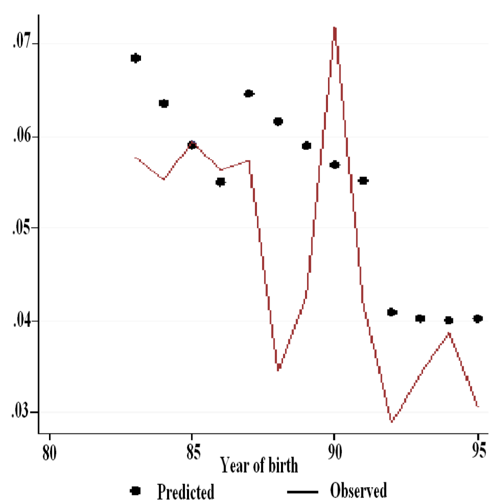
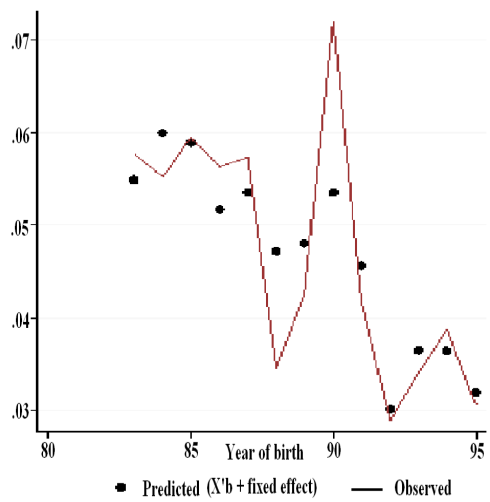


Figure 5
(*continued*)

Panel B



Panel C

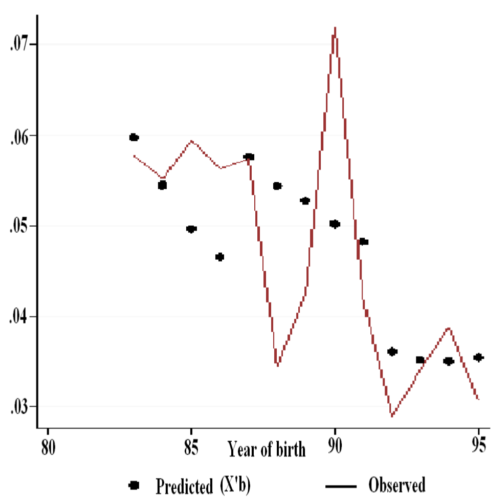
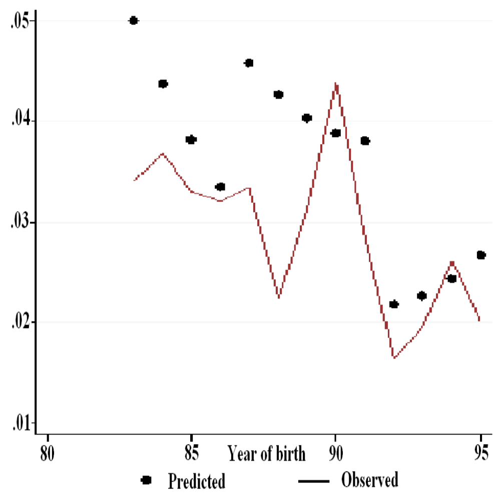


Figure 6

Mortality Rate by Year - 01 Month

Panel A



Panel B

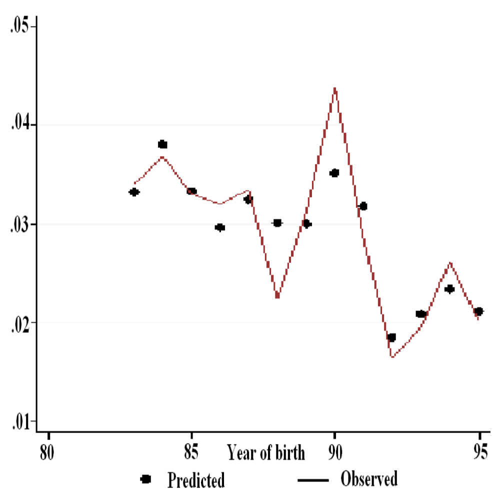


Figure 6
(*continued*)
Panel C

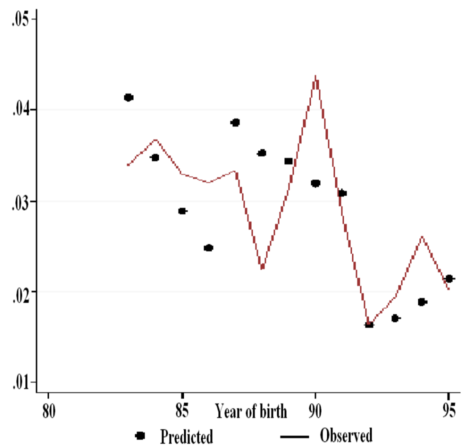


Table 12
Crisis Impact on Infant Mortality Rates -up to 12 Months

Regressors	I	II	III
Born in a crisis year[a]	.001	.002	.005
	(.005)	(.005)	(.010)
Time[b]	.020	.020	.004
	(.046)	(.048)	(.076)
Squared time trend	-.000	-.000	-.000
	(.000)	(.000)	(.000)
Controls			
Region	yes	yes	yes
Month of birth	yes	yes	yes
Birth order	yes	yes	yes
Gender	yes	yes	yes

Table 12
(continued)

Regressors	I	II	III
Mother's characteristics			
Observable[c]	no	yes	yes
Fixed effects	no	no	yes
Number of observations	14 079	14 075	16 160
R^2	.019	.028	.006

Notes: Standard errors in parenthesis clustered at the regional level for the models I and II, and were robust for the model III. [a] Defined by the period between the years 1987-1991, [b] Variable equal the year of birth of child and [c] Marital status, age, education and a dummy that equals 1 if the mother lives in a rural area. Source: DHS-86 and DHS-96.

Table 13
Crisis Impact on Infant Mortality Rates -up to 06 Months

Regressors	I	II	III
Born in a crisis year[a]	.008	.009*	.013
	(.005)	(.006)	(.009)
Time[b]	-.031	-.030	-.044
	(.045)	(.046)	(.069)
Squared time trend	.000	.000	.000
	(.000)	(.000)	(.000)
Controls			
Region	yes	yes	yes
Month of birth	yes	yes	yes
Birth order	yes	yes	yes
Gender	yes	yes	yes
Mother's characteristics			
Observable[c]	no	yes	yes

Table 13

(*continued*)

Regressors	I	II	III
Fixed effects	no	no	yes
Number of observations	14 079	14 075	16 160
R^2	.013	.021	.004

Notes: *p<0.1. Standard errors in parenthesis clustered at the regional level for the models I and II, and were robust for the model III. [a] Defined by the period between the years 1987-1991, [b] Variable equal the year of birth of child and [c] Marital status, age, education and a dummy that equals 1 if the mother lives in a rural area. Source: DHS-86 and DHS-96.

In table 14 all columns provide statistically significant numbers. The most dramatic result is obtained after controlling for observed and unobserved mother's characteristics. These results can be seen in column III and they correspond to results from a regression using fixed effects estimator. The overall impact of being born in a recession period is to increase the probability of dying in the first month in 1.6 percentage points. Given that the mortality rate in the first six months is 6%, it corresponds to an increase of 27% in the mortality rate in the first month.

Table 14

Crisis Impact on Infant Mortality Rates -up to 1 Month

Regressors	I	II	III
Born in a crisis year[a]	.008***	.009***	.016**
	(.003)	(.003)	(.007)
Time[b]	-.037	-.036	-.072
	(.031)	(.031)	(.053)
Squared time trend	.000	.000	.000
	(.000)	(.000)	(.000)

Table 14
(*continued*)

Regressors	I	II	III
Controls			
Region	yes	yes	yes
Month of birth	yes	yes	yes
Birth order	yes	yes	yes
Gender	yes	yes	yes
Mother's characteristics			
Observable[c]	no	yes	yes
Fixed effects	no	no	yes
Number of observations	14 079	14 075	16 160
R^2	.006	.009	.006

Notes: ***$p<0.01$ and **$p<0.05$. Standard errors in parenthesis clustered at the regional level for the models I and II, and were robust for the model III. [a] Defined by the period between the years 1987-1991, [b] Variable equal the year of birth of child and [c] Marital status, age, education and a dummy that equals 1 if the mother lives in a rural area. Source: DHS-86 and DHS-96.

We can also use figures 4 to 6 to perform a visual inspection of the importance of changes in observed and unobserved components over time in explaining infant mortality. All dotted points in the three panels use model specification from columns III presented in table 3, figure 3 and table 4 to construct several predicted values for infant mortality.

Panel A in figure 4 shows that there is a very small break in the trend after fixing the covariates[1] and normalizing the mother's unobserved component to be zero. That is in line with non-significant effects found in table 11.

Panel C sets only unobserved fixed effects to zero, but allows covariates to assume their actual values in the sample. The difference between Panel C and Panel A accounts therefore for a composition effect arising from observed covariates. In this case, covariates seem

[1] We fix covariates for the child as: male, mother's age at birth 25, child born in January and second child of respondent mother (birth order = 2).

to play a role in shifting the predicted values above and below, but do not change the shape of predicted values across years. That role is played by unobserved components and this is reflected by the difference between Panel C and Panel B. We see that after allowing unobserved factors to be heterogeneous over time, we obtain predicted values that are closer to actual ones.

The same pattern is found in figures 5 and 6. In figure 6 we obtain more dramatic visual results, which reinforce the analytical results provided by table 14.

5. Poverty

In this section we are interested in the impact of the economic crisis on the incidence of poverty in Brazil. We expect that the occurrence of a crisis can have a strong impact on the incidence of poverty for many reasons, from the rise of unemployment affecting the labor income of the families directly to the reduction to the complete halt of basic public services that are important for the well-being of families directly or instrumental to their ability to generate income. It has been carefully documented by Ferreira, Leite and Ravallion (forthcoming) that economic growth was an important factor in reducing poverty in Brazil between 1985 and 2004. Instead of examining a longer period of time, this section focuses on the impact of the crisis of 1987 to 1991 on poverty.

We will use the measure of poverty head count that considers the poverty line to vary across regions in Brazil. The poverty lines used are from Rocha (2001). Figure 7 presents the overall figures for GDP per capita and poverty incidence from 1985 to 1996 for Brazil.

Figure 7 shows that the overall poverty rate in Brazil hovers around 25% from 1987 to 1996. The decline in 1986 is due to the *Cruzado Plan*, a heterodox stabilization plan that froze all prices for a year which increased in the short-run the real income of Brazilian families.

The objective of this section is to obtain a measure of the relation between changes in per capita GDP and changes in overall poverty in Brazil.

5.1. *Methodology*

We are interested in measuring the effects of changes in per capita GDP on poverty incidence in Brazil. Our approach explores per capita

GDP variation across states within Brazil from 1985 to 1996, the period that encompasses the crisis period we are interested in. The regression to be estimated is:

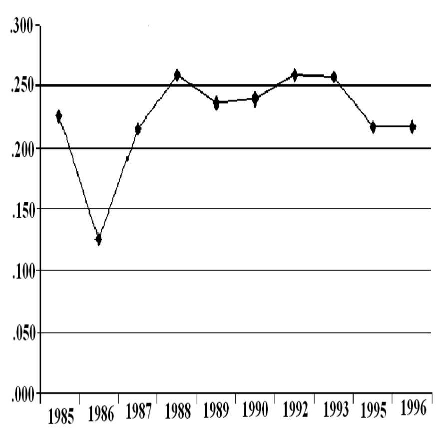
$$Y_{ijt} = \beta_0 + \beta_1 GDP_{jt} + \theta' X_{ijt} + \eta_j + \phi_t + \varepsilon_{ijt} \tag{14}$$

where Y_{ijt} is the indicator variable if individual i in region j and year t is poor. X is a vector of control variables, η_j is the state fixed effect, ϕ_t is the year fixed effect, and ε_{ijt} is the error term. The parameter of interest is β_1, which captures the effect of GDP on Y. The above specification explores variations in GDP across regions and over time. The main advantage of this approach is on the interpretation side. The parameter β_1 gives the impact of one log-unit change in GDP on child poverty, so one has an important direct measure of how GDP impacts well-being and how large are the long lasting effects of its changes.

The identification in this case comes from the variation among the rates of growth across the different regions. However, if one believes that the impact of a negative aggregate shock should be the same for all regions in a specific point in time, one can drop the year fixed effect ϕ_t from the specification of equation (14). We will use three specifications in our exercises: first without state or fixed effects, second with state fixed effects only, and third with state and year fixed effects together

Figure 7

Poverty Head Count Ratio - Brazil



5.2. *Dataset and Results*

The data set used comes from Brazilian household surveys (PNAD-IBGE) from 1985 to 1996. All observation with valid information is used in the regressions. A individual is considered poor if his or her per capita family income is below the poverty line for his or her region. The figures for state per capita GDP comes from IPEADATA.

We use PNAD's statistics for 25 states over 10 years.[2] Thus, there are 250 observations of state-year GDP. The estimations rely on this variation. Table 15 presents the results for all three specification using two samples; overall sample and all children under seven.

Table 15
Regressions of Poverty Head Count Ratio

	Overall sample			*Children under seven*		
Variable	Ia	IIa	IIIa	Ib	IIb	IIIb
Log of per	-.151	-.113	-.113	-.218	-.161	-.127
capita GDP	.00	.00	.00	.00	.00	.00
Age	-.002	-.002	-.002	.004	-.001	-.006
	.00	.00	.00	.00	.02	.00
Years of	-.027	-.025	-.025	-.100	-.083	-.094
schooling	.00	.00	.00	.00	.00	.00
Male	-.01	-.01	-.01	.00	.00	.00
	.00	.00	.00	.14	.23	.25
Constant	.642	.573	.619	.660	.554	.520
	.00	.00	.00	.00	.00	.00
State fixed effect	no	yes	yes	no	yes	yes
Year fixed effect	no	no	yes	no	no	yes
Observations	2952041	2952041	2952041	220076	220076	220076

Note: P-values are shown below the coefficients.

[2] There are no PNAD's in 1991 and 1993.

We are interested in the results of the first row of table 15. The coefficients measure the percentage point change in poverty due to a one percentage change in per capita GDP. For instance, column IIIa shows that a one percent decrease in per capita GDP increases poverty by 0.113 percentage points.

The results suggest a negative impact of an economic downturn on poverty incidence. Comparing the results for the two samples, they also suggest that this negative impact may be stronger among young children.

6. Conclusions

In this study we have examined the effects of an aggregate economic shock on the education, health and poverty outcomes for a middle income country. More precisely, we present a set of estimations of the impact of the economic crisis that occurred in Brazil from 1987 to 1991 on the education, health, and poverty outcomes of Brazilian families.

Our main findings suggest that an economic crisis may have the following impacts: *i*) it reduces the probability that children of an age to begin school will actually do so, and increases the probability of them being in school later on compared to other cohorts; *ii*) it increases the probability of a child to die before six months of age compared to other cohorts; and *iii*) it increases the incidence of poverty in general for the overall population and has a strong negative impact on young children. Taken all together, the results suggest that the 1987-1991 economic crisis may have had deleterious effects on the well-being of families.

There is one important reason to believe that the effects of the Brazilian crisis event in 1987-1991 are paradigmatic of other middle income countries. It corresponded to a long period of stagnation, and therefore, its effects are more difficult to be counteracted by individuals themselves particularly in a period when the social safety nets were not highly developed. The effects of current crisis can be, however, mitigated by the existence of safety nets for the poorest. Anecdotal evidence of the impact of the recent global economic crisis on well-being outcomes of the poor countries indicates that countries like Brazil are currently better equipped to deal with economic crises than 20 years ago.

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