

The Health of Children and Mothers during Financial Crises and Economic Shocks:
Perspectives from the Caribbean

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April 2017

Abstract: The effects of economic crises on the health of children and mothers in the developing world is a topic of significant policy importance. In this paper, I investigate the impacts of the 2003-2004 Dominican Republic Banking Crisis on health outcomes of children and mothers. From 2002 to 2005, the percentage of Dominicans living in poverty increased from 33% to just over 50%. Due to a collapse in purchasing power resulting from surging inflation, large segments of the population could not afford food and medicine. Unemployment peaked at 19.7% in 2004, and public health spending fell sharply. I use a modified difference-in-differences estimation strategy to investigate the effects of the banking crisis on maternal health indicators and infant mortality. I find evidence of declines in utilization of health services: during the Dominican Republic's economic crisis, mothers were 4.3% less likely to be assisted by a medical professional during birth, and 3.6% more likely to give birth at home instead of at a formal medical facility. I also find evidence of increased risks of death in infancy during the main period of the crisis, and higher risk for children born to highly educated mothers, though these results are not likely to be economically significant.

1 Introduction

The analysis of how the health of mothers and children responds to economic crises in developing economies has attracted considerable attention, in part due to policy considerations and aid efforts from the international community. In 2003-2004, the Dominican Republic underwent an economic shock resulting from an internal banking crisis. This crisis began a sharp rise in inflation and significant currency devaluation. It also led to a substantial short-term deterioration in living standards for many Dominicans: the rapid loss of purchasing power and basic public services, such as healthcare, education, and electricity were very hard felt. These effects were accompanied by a significant spike in poverty levels across the country.

The banking crisis was caused by the collapse of Banco Intercontinental (commonly known as BanInter), then the Dominican Republic's second largest privately-held commercial bank. BanInter's president, Ramon Baez Figueroa, took over the company from his father and grew it into an expansive conglomerate. Through an aggressive series of acquisitions in the 1990's and 2000-2002, BanInter came to control interests in numerous companies which touched on almost every part of Dominican life. It owned the country's largest media group, its leading newspaper, four television stations, and over seventy radio stations. BanInter's rapid growth raised doubts over the legitimacy and sustainability of the bank's operations. Doubt was also cast over the source of Baez's incredible wealth. In 2002, he bought a US \$14.6 million yacht, an addition to his existing fleet of four private planes, six helicopters, and four smaller yachts. Baez's monthly expenses were estimated at roughly \$1 million¹.

Rumors of fraud began circulating in 2002. Concerned customers began to withdraw their deposits. The Central Bank of the Dominican Republic (BCRD) promptly intervened and temporarily propped up the bank by providing emergency lines of credit. The situation persisted, and the Dominican government pushed for a permanent private-sector solution. A deal was reached in March 2003, where Banco del Progreso (then the country's 6th largest bank) would acquire BanInter and assume all liabilities. However, Banco del Progreso abruptly withdrew from the deal, after discovering evidence of extensive undisclosed problems. Instead, in April 2003, the Dominican government took control of BanInter. They began external evaluations of company books, in correspondence with the International Monetary Fund and Inter-American Development Bank. Investigators found evidence pointing to staggering levels of corruption and fraud. BanInter executives were accused of bank fraud and money laundering amounting to more than US \$2.23 billion. Industry regulators and PricewaterhouseCoopers (BanInter's auditor) pointed to the bank's software program, which allowed deposits to be diverted for use by Baez and his associates, while not appearing on official company books¹.

Considering the size of the Dominican Republic's economy, the scale of fraud was staggering. Financial contagion from the collapse of BanInter spread to two other medium-sized banks - Bancredito and Banco Mercantil - which also were tied up in fraudulent schemes. The BCRD acted to guarantee all unbacked BanInter, Bancredito, and Banco Mercantil deposits, regardless of currency denomination and geographic holding. Equal to roughly two-thirds of the national budget and 15% of GDP, the US \$2.23 billion bailout immediately decapitalized the BCRD and led to a significant fiscal shortfall. It led to a 30% annual rise in inflation and doubling of government debt to 57% of GDP. The government was forced to devalue the peso by over 100% (by printing roughly US \$2.6 billion dollars in new securities), and interest rates surged to 21.1%².

From a social standpoint, the consequences of the crisis were immediate. Dominicans experienced a large drop in real wages. Dominican household budgets were strained, causing poverty and indigence rates to rise.

Over 2 years, the share of Dominicans living under the national poverty line increased from 32.7% in 2003 to 50.0% (just before 2005). Large segments of the population could not afford basic foodstuffs and medicine because of rapidly rising levels of inflation. Unemployment reached 19.7% in 2004. Towards the end of the year, economic sentiment had largely improved and the peso had recovered to pre-crisis levels (in real terms). This helped to reduce inflationary pressure and interest rates on central-bank notes. The bloated electricity sector also saw costs narrow. Despite this, poverty remained high and the effects of the crisis remained severe¹.

2 Literature Review

A strong inverse relationship between macroeconomic conditions and health outcomes has been found to exist³. In the United States, evidence suggests that the more severe recessions in the 1980's to 2000's had a protective effect on total mortality. This effect was around twice as large as the effect predicted by the higher unemployment rates during such periods alone⁴. Similarly, in a study of 114 U.S. cities, infant mortality rates declined during the period from 1929 to 1940 (during the Great Depression). Greater declines were associated with increased relief spending, resulting from the New Deal (massive spending programs through public works programs). However, the reduction in non-infant mortality was not as pronounced. Yet, increased relief spending is believed to have led to a reduction in suicides, deaths from communicable diseases, and possibly homicides⁵.

Though such results may possibly be surprising, the literature offers a few explanations. During economic upturns, non-market 'leisure' time decreases. The cost of exercise (a time-intensive activity) increases during such periods: lower unemployment is associated with reduced physical activity and worsened diets⁶. Furthermore, during periods of expansion, work hours may be lengthened. For workers in labor-intensive industries that require physical exertion and exposure to hazardous conditions (mining, construction, trucking), lengthened work hours may result in negative health effects⁷.

However, the relationship in developing and middle-income countries appears to be mixed. During the 1998 Asian financial crisis, infant mortality increased by about 1.4% in Indonesia. Urban infants conceived at the height of the crisis bore 1.7% higher neonatal mortality risk (17 per 1000 births) than those conceived during non-crisis periods, while rural infants bore a 2.2% (22 per 1000 births) higher risk. However, the neonatal mortality risks were statistically more significant for urban infants⁸. Furthermore, expenditures on healthcare decreased (both in absolute and as a percentage of overall spending) as the Indonesian Rupiah devaluated, while self-reported morbidity rose sharply across the country. Healthcare utilization fell by 25%⁹. However, the Indonesian government began policy efforts to shield the poor from the effects of the crisis. In particular, efforts were made to maintain essential health services such as midwifery programs, contributing to improved access for poorer demographics¹⁰.

In contrast, for the same economic crisis, public healthcare service utilization rose by 22% in Thailand despite the 50% devaluation of the Thai Baht. This was due to expansion of health insurance coverage during the crisis. It is thus possible for governments to implement programs that can help households buffer the effects of an economic crisis. In particular, some low-income countries have managed to develop effective social programs and in certain cases, protect them in times of an economic crisis⁹. Moreover, during Argentina's 2001-2002 debt crisis, a decrease in public healthcare expenditure of 0.5% of GDP was associated with a 1.4% increase in cases of low birthweight in children¹¹. Though these results are not sufficient to establish a causal link between public expenditures and health outcomes, it does lend plausibility to public expenditure as a mechanism linking economic shocks and health outcomes (such as

utilization of health services). This will become important when evaluating the mechanisms through which maternal health may be affected in the time of an economic crisis.

Paxson and Schady evaluated Peru’s 1988-1992 economic collapse. The collapse was brought about by an unsustainable heterodox stabilization program, which involved reduced foreign debt payments, wage increases, and job creation efforts. They found that the infant mortality rate increased by 2.5% in response to the economic crisis. Infant mortality was at its highest in 1990, when real wages had fallen by over 30%, healthcare utilization had declined significantly, and Peruvian public health expenditures had fallen to their lowest level in decades. Furthermore, the share of households purchasing medicines fell by over half from 1986 to 1991¹². Additional research has also evaluated how health outcomes in Mexico evolved over a period of economic difficulty. The Mexican economic crises of 1982-84 and 1995-6 translated into an estimated increase in mortality rates of 6-9% and 5-7%, respectively. Mortality rates for vulnerable groups (children and the elderly) increase absolutely and relatively during periods of economic crises to less vulnerable groups. Economic crises affected mortality in Mexico by reducing incomes and most likely by placing a greater burden on the medical sector¹³.

3 Data

3.1: USAID Demographic and Health Surveys

I use data from USAID’s 2002 and 2007 cross-sectional Dominican Republic Demographic and Health Surveys (DHS). These surveys sampled 23,384 women ages 15-49 in 2002, and 27,195 women in 2007. I also use USAID’s 2000, 2005-2006, and 2012 cross-sectional Haiti DHS. In Haiti, 10,159 women were surveyed in 2000, 10,757 in 2005-06, and 14,287 women in 2012. DHS surveys are nationally representative, and provide detailed information on individual characteristics, fertility, child health, and maternal health.

Table 1 presents summary information about the surveys used in this paper. Though the survey years used for Haiti are not identical to the Dominican Republic, the survey phases were. Furthermore, it was possible to construct reshaped datasets for the same time periods through dataset pooling. This was done as though not all items were not coded identically across survey phases, the items used for our main estimations were. However, discrepancies arise in calculations of asset-based wealth. Coded answers to questions on the material of floor (such as natural, wood, ceramic), main water source (such as piped into house, well, rainwater, lakes, rivers, and bottled water), and toilet system (flush toilet, latrines, no toilet) are not identical across survey phases. However, the general format is retained, allowing for sorting respondents into low, average, and high quality categories for the quality of their house's floor material, water access, and toilet facility.

TABLE 1. *Demographic and Health Surveys, Summary Information*

		Phase	Fieldwork	Size	Implementing Organization
DR	2007	V	03/07 - 08/07	27,195	Center for Demographic Studies
	2002	IV	07/02 - 12/02	23,384	Center for Demographic Studies
Haiti	2012	VI	01/12 - 06/12	14,287	Institut Haïten de l’Enfance
	2005-06	V	10/05 - 06/06	10,757	Institut Haïten de l’Enfance
	2000	IV	02/00 - 07/00	10,159	Institut Haïten de l’Enfance

All respondents were asked a series of questions on their reproductive history, family vital statistics, and sociodemographic background. Sociodemographic characteristics such as place of residence (urban or rural), housing sanitation and quality, and level of education were available for use.

I reorganized the datasets to show child-level observations, while preserving maternal characteristics. Information was available for up to 20 children for each mother. However, because maternal histories are only recorded for children born in the five years prior to the survey, I excluded all children who were born before 60 months prior to the survey. To prevent data censoring, incomplete information and data-heaping, I excluded all children born within 12 months of the survey. These datasets were used for the empirical section of this paper, for detailed study into the effects on maternal health is only possible for children born within 60 months of each survey. It is important to note several bias considerations at this stage. Each DHS is nationally representative of women aged 15-49 at the time of the survey, but is not representative of all child births and deaths in preceding years. Respondents who were 15-49 at the time of the 2007 DHS survey were 10-45 in 2002, and any histories reported for that year would have occurred when they were in the 10-45 age range. This could bias measures of the infant mortality rate in either direction. Specifically, the direction of the bias depends the specific infant mortality levels of the excluded population.

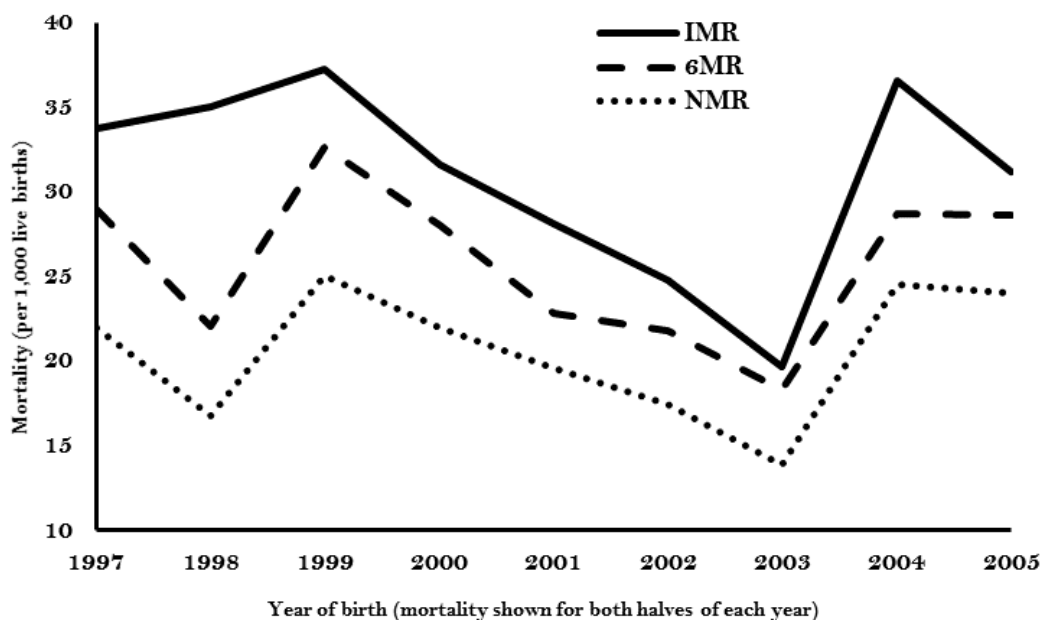
3.2: Child Mortality in the Dominican Republic

Using vital statistics information reconstructed from the 2007 DHS, I constructed birth and death histories for each child to evaluate general mortality trends in the Dominican Republic. This involved creating an indicator for mortality rates at 12 months or younger (infancy), 6 months or younger, and 1 month (neonatal) or younger. These definitions were chosen instead of the standard definitions due to the tendency of age heaping. When computing infant mortality rates, information on children born within 18 months of the survey was discarded. Similarly, information on children born within 12 months of the survey was discarded when computing 6-month mortality rates, and information on children born within 7 months of the survey were discarded when calculating neonatal mortality rates. Moreover, DHS surveys are retrospective - respondents were asked to recall information on dates of births and deaths. Therefore, non-classical measurement error in the form of wrong/inaccurate recall may introduce bias into our study. Therefore, to calculate general infant mortality rates, we excluded all children born before 12 years of the 2007 DHS in order to reduce recall bias. Mortality trends were then calculated using sample weights provided by the survey.

Figure 1 displays the evolution of mortality rates in the Dominican Republic from 1997 to 2005. Prior to the crisis, we observe a general decline in all three classes of mortality rates, consistent with country secular trends. However, we see a noticeable uptick in 2014 from 2013 (the interim line is the transition between two data points), after the peak of the economic crisis. It would be important to determine how this spike relates to the financial crisis.

At this stage, we must also consider the unreliability and possibility of under-reporting in the Dominican Republic's vital statistics. Our sample does not include children born to very young or very old mothers, by necessity. Moreover, women who died before the survey would also be necessarily excluded from reporting vital statistics. Thus, it is possible that DHS and public estimates are downwards-biased. The evidence presented here suggests that infant mortality increased during the economic crisis in the Dominican Republic, a result which may be indicative of worsened health conditions for children. My estimates computed for the DHS are slightly different from the World Bank's; my estimates show a spike in infant mortality around 2004, while the World Bank displays a smooth downtrend for the same time period.

FIGURE 1. *Child Mortality Rates by Age Group, Dominican Republic, 1997-2005*



3.3: Descriptive Statistics

Finally, to approximate the crisis onset and end, I consider data collected from the BCRD and World Bank's World Development Indicators, in addition to the DHS. Descriptive statistics are provided below. Table 2 shows the evolution of the index of economic activity and health indicators (aside from child mortality rates) in the Dominican Republic from 2000 to 2005.

The Dominican Republic is a middle-income developing country. Its economy is primarily driven by manufacturing, agriculture, mining, trade, and a mix of services (tourism, telecommunications, and finance). Economic growth has been possible despite persistent problems with the energy sector: blackouts are frequent and prices are high.

TABLE 2. *Demographic and Health Surveys, Summary Information*

Outcomes	2000	2001	2002	2003	2004	2005
Home Births (%)	2.80	2.21	2.27	2.51	2.83	2.43
Birth Assisted by Professional (%)	78.3	79.0	78.8	77.3	78.4	76.9
Urban Population (%)	59.9	63.4	63.8	64.6	65.9	67.4
Poverty Rate (%)	32.0	32.8	32.7	41.5	50.0	47.9
CPI (% Annual Change)	7.7	8.9	5.2	27.5	51.5	4.2
GNI per Capita (\$US, 2010)	3,718.2	3,723.6	3,883.5	3,717.2	3,630.0	4,043.1

Prior to the 2003 economic crisis, the country was in a stage of growth and declining inflation. Problems began to surface in 2003 when BanInter was bailed out by the BCRD, setting off the economic crisis. A considerable spike in inflation and poverty rates can be seen in the table, consistent with the scale of the crisis. The rise in inflation is especially concerning for mothers, as they tend to be especially vulnerable from

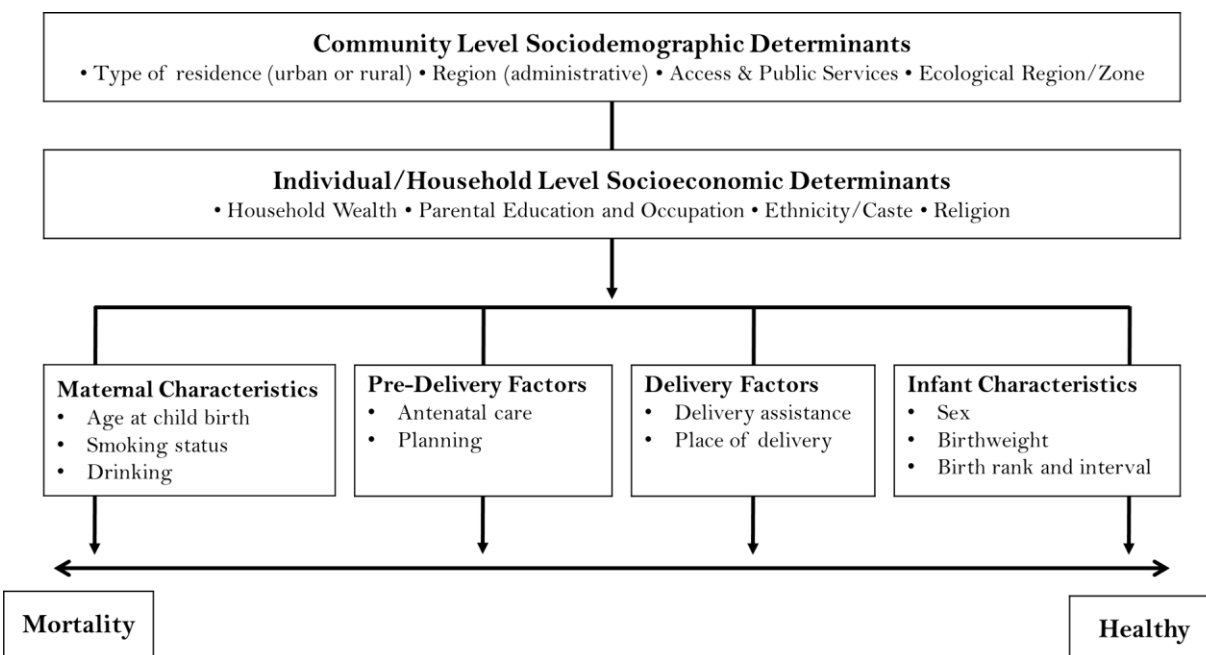
increases in consumer prices. In particular, as mothers tend to spend more of their income on food than men, surging food prices tends to affect their total expenditures more dramatically. If food is less available due to a collapse in purchasing power, the health of children could suffer as a result. These outcomes include increases in childhood wasting and nutritional deficiencies¹⁴.

4 Empirical Strategy

4.1: Conceptual Framework

We next consider a framework to identify main transmission mechanisms of the economic crisis to the health outcomes of children and mothers. I utilize the following conceptual framework (Figure 2), an adoption of the Mosley-Chen¹⁵ framework.

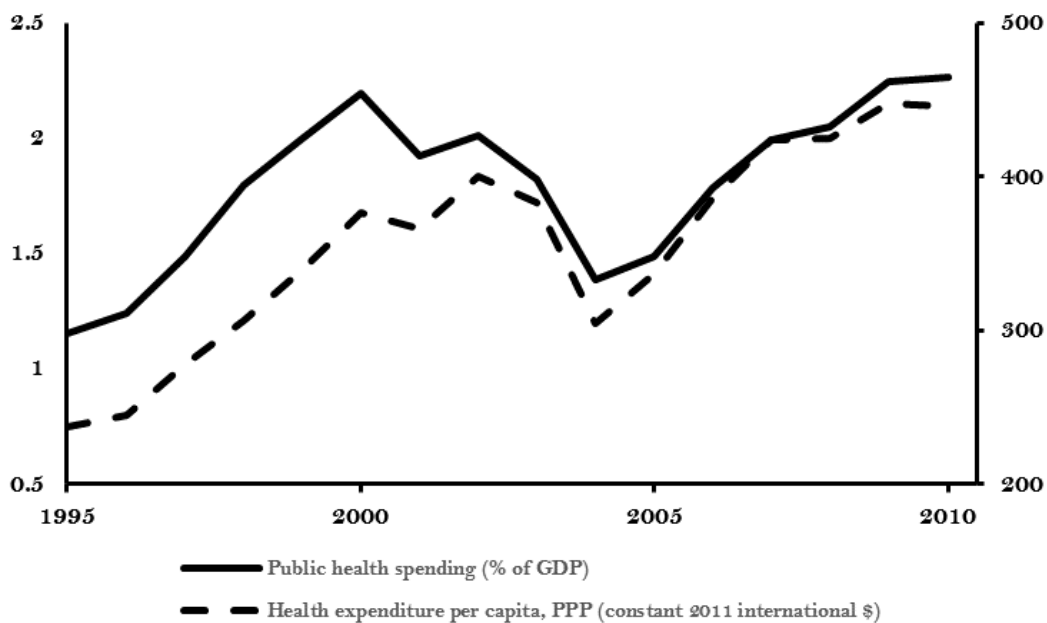
FIGURE 2. *Conceptual Framework of Determinants Influencing Child Health Outcomes*



The key structural determinants of child health may be organized into a framework for the purpose of empirical study. Child health outcomes are affected by a broad and complex range of direct causes, from diseases to congenital defects to accidents. Due to data limitations and control restrictions, it is impractical to account for every possible cause. Therefore, central to the application of this conceptual framework is the identification of a class of proximate determinants that directly influence the *risk* of infant morbidity and mortality. These address the social, behavioral, and health risk factors which may affect childhood health outcomes. Listed key contributors are arranged into a scale of possible risk factors (‘proximate determinants’), each of which either makes a death in infancy more likely or less likely depending on their specific value. Our framework displays the dynamics of how these determinants interact with one another. In particular, the risk of dying in infancy should be thought of as a broad multi-factor chronic ‘disease’ process, rather than merely a single-factor phenomenon. It is also possible to identify areas from where to study changes in maternal health, which may in turn affect the health of children according to our framework. Using this framework, I note three pathways through which economic crises may negatively impact health outcomes among children and mothers.

First, a deep economic crisis may lead to a decline in public expenditures on healthcare and social services. Policy responses to a crisis may necessitate a reduction in healthcare expenditures as part of the national budget^{16, 17}. This tends to affect vulnerable groups the hardest, as they tend to be dependent on publicly-funded healthcare services. In the case of substantial currency devaluation, the price of healthcare inputs may rise. Rising unemployment may result in a widespread loss of social security coverage, and thus visits to medical providers may decline. As shown in Figure 3, public health spending in the Dominican Republic declined during the time of the crisis. It would be interesting to investigate whether this decline affected utilization of health services (such as medical professional assistance during birth, hospital facilities for place of delivery) among mothers.

FIGURE 3. *Public Health Spending, Dominican Republic 1995-2010. Source: World Bank.*



Clearly, a second pathway is through the reduction of purchasing power. Average household incomes tend to decline in an economic crisis, and households must adjust in response. Moreover, real prices for food and health services may increase due to rapid inflation, brought about by currency devaluation or capital flight. Households can smooth consumption to maintain a basic level of access to healthcare services, especially in the case of a short-term shock¹⁸. However, those living in countries lacking sophisticated credit markets or financial institutions may find it difficult to borrow emergency funds on such short-notice. If households are not able to borrow, consumption will decline in correspondence with declines in purchasing power. They may reduce their out-of-pocket spending on healthcare services, as well as on necessities such as food and sanitation. Inadequate dietary intake and inadequate access to food may lead to malnutrition. Vulnerable groups, such as children and the elderly, are of greatest risk to these shocks in consumption. Though this question is indeed interesting, micro-data on household incomes throughout the banking crisis is unfortunately unavailable. Instead, I adopt a broad approach and investigate whether being born in a year of the economic crisis has an effect on infant mortality.

Secondly, economic crises may affect different demographic groups differently. There exists evidence of disparate effects of economic crises across demographic groups¹⁹. For example, depending on their level of educational attainment, individuals may be better or worse equipped to buffer the effects of an economic

crisis. Those with higher educational attainment during the time of an economic crisis may have more knowledge on shielding themselves from the negative effects. Alternatively, as they may be more likely to hold assets in bank accounts and rely on city businesses for food and supplies, they may suffer when those businesses struggle. In contrast, those less educated may be less knowledgeable on how to adjust their lifestyles in response. Furthermore, mothers who are highly educated in a developing country may be selected in such a way that substantially reduces their likelihood of their medical situation worsening during a crisis. These mothers may tend to come from wealthier, more stable families than the less-educated. It would be interesting to study what direction these effects take.

Clearly, there are negative conceptual impacts of economic crises on the health of mothers and children. This runs counter to results in wealthy countries, but the results in developing nations remain mixed. Given the particularly drastic shocks to the Dominican economy and surging consumer prices, I hypothesize that the differential effects of the crisis on child and maternal health will be negative for those residing in the Dominican Republic when compared to those in Haiti, our control, at a minimum.

4.2: Methodology

It would be interesting to study how economic crises affects maternal health through a decline in public health service spending. If shocks in spending pose a larger risk to vulnerable population members, we may perhaps see declines in healthcare service utilization. One possible decline might be in the availability of medical professionals to assist during birth. If public health facilities are strained or individuals unable to afford attention, we may observe a decline in births assisted by a medical professional. Furthermore, we may also see a differential rise in the likelihood of home births. Given pre-crisis, during-crisis, and post-crisis time period data, this question may be examined with a modified difference-in-differences estimation strategy. The Dominican Republic represents our treatment group, while Haiti represents our control group. Haiti presents itself as a particularly useful control group, due to it not having an internal banking crisis and given potentially unobserved medical outbreaks on the island of Hispaniola. The basic specification is modeled using the regression equation listed below:

$$Y_{ibt} = \alpha + \beta_1 DR_{ib} + \beta_2 Crisis_t + \beta_3 (DR_{ib} \times Crisis_t) + \gamma X + \varepsilon_{ibt} \quad (1)$$

where Y_{ibt} denotes the health outcomes for a child i born to mother b in time period t . DR_{ib} takes on a value of 1 if the child is in the Dominican Republic and 0 if the child is in Haiti. $Crisis_t$ is an indicator for whether the child was born in the time of the economic crisis. This time period is defined to start in May 2003, when the Dominican government assumed control of BanInter, and to end in August 2004, when interest rates and the peso returned to pre-crisis levels. Model (1) measures the effects of the crisis by conducting a modified difference-in-differences estimation using our 2000-2006 data from the banking crisis. Specifically, β_3 measures the differential effect of the economic crisis on our specified health outcomes: whether or not the expected mean change in health outcomes from before to after was different between the Dominican Republic and Haiti.

A vector of covariates, X , is also included in the formulation. In particular, we include an indicator for whether the child i born to mother b was the mother's first birth. This is done as mothers may choose different levels of health care for the first birth, in comparison to succeeding births. We also include an indicator on whether the mother has attained higher education, as a mother's level of education may predict her capacity to adjust in the time of an economic crisis. The mother's age at birth was also computed for each child-level observation, and then segregated into three groups: youngest (20 years or younger), middle-

aged (20 to 35 years or younger), and older (36 years and older). Information on whether the mother lived in a rural area at the time of the survey was included, as those living in urban areas may more easily access health care facilities than those residing in rural areas. To approximate each mother's wealth, asset-based wealth index scores based on the International Wealth Index (IWI), popularized by Jeroen Smits²⁰, were computed. The purpose of this is to approximate the longer-term socioeconomic position of respondents. Information on durable goods ownership, quality of housing and sanitation, as well as access to utilities, were used to approximate material wealth based on asset weights specified in the IWI. Such practices are used widely in development studies to analyze variation in wealth across developing countries, where wealth and income measurement can be unreliable.

These maternal characteristics are assumed not to change over time. This could conceivably bias our results as characteristics such as education and place of residence could change within a period of 10 years. However, I discarded births for mothers at extreme ages. Thus, we may have reason to believe mobility is not so dramatic for these mothers aged 20-45 who have largely passed the age of higher education in the Dominican Republic. This still presents a problem, and it is not clear which direction in which our results may be biased.

We also investigate differences in child births assisted by a professional using a modified difference-in-difference-in-differences estimation strategy. Our second specification is:

$$\begin{aligned}
 Y_{ibt} = & \alpha + \beta_1 DR_{ib} + \beta_2 Crisis_t + \beta_3 HigherEd_{ib} + \beta_4 (DR_{ib} \times Crisis_t) \\
 & + \beta_5 (DR_{ib} \times HigherEd_{ib}) + \beta_6 (Crisis_t \times HigherEd_{ib}) \\
 & + \beta_7 (DR_{ib} \times Crisis_t \times HigherEd_{ib}) + \gamma X + \varepsilon_{ibt}
 \end{aligned} \tag{2}$$

This method can potentially account for the unobserved trends in health outcomes across the Dominican Republic and Haiti, and the changes in health outcomes of mothers who have completed higher education and mothers who have not in the Dominican Republic. We choose higher education as it is plausible women who have completed higher education in Haiti may see differential effects from women who have completed higher education in the Dominican Republic. Changes in the health of mothers who are highly educated might be due to systematic differences across countries (for instance, due to unobserved health trends), rather than the effects of the crisis. In this sense, our second specification is a more robust approach than the first. Naturally, our coefficient of interest is now β_7 . This starts with the time change in averages for the highly educated in the Dominican Republic, nets out the change in means for highly educated in Haiti, and then the change in means for the non-highly educated in the Dominican Republic. As in the first specification, we include a vector of covariates.

These specifications are first run for two primary outcomes of interest. It would be interesting to study how births assisted by medical professionals and the place of delivery evolved over the period of the crisis. We also study infant mortality trends. We define infant mortality to be whether a child i born to mother b in year t died in the first year of life (here defined to be less than or equal to 12 months). We define ‘medical practitioner’ to be a qualified doctor, nurse, or midwife. If we see a difference in the likelihood of medical practitioners assisting mothers with or home births in the Dominican Republic, then such a decline in public health service utilization may be evidence of how an economic crisis can affect maternal health in an developing middle-income country. We define to be born at home, to be born at home (outside a formal medical facility).

4.3: Parallel Trends Assumption

Key to the difference-in-differences estimation strategy is the assumption that the selected treatment and control groups would have followed similar trends in the absence of the studied ‘treatment’ (in this case, the banking crisis). Violation of this assumption would bias our estimates of the causal effect. To test this assumption, I compare pre-crisis trends in annual means of births assisted by medical professionals and infant mortality. Though this assumption is difficult to accurately verify without rich intervention data, figures were calculated from each country's respective DHS as no richer micro-level data source was readily available. Intervals are scaled appropriately, in order to make comparisons between country trends. Figure 4 displays the percentage of professionally-assisted births that took place at home across both countries in the time period before the crisis. As this figure shows displays, the Dominican Republic and Haiti have strikingly different levels of birth assistance. Crucially, however, the pre-crisis trends are quite similar. It therefore seems plausible to assume that parallel trends hold for the two countries.

Similarly, I plot mean home deliveries per year from each country's respective DHS used in my regression estimations. As Figure 5 shows, though again there exists a striking difference in mean levels of home deliveries between the Dominican Republic and Haiti, parallel trends are very roughly similar given the trajectory of pre-crisis growth levels. We may expect some convergence. However, each yearly statistic is computed from a range of 500-2,000 observations. Thus, we should be conservative in regard to the displayed trend lines and proceed with caution.

It is important to note an event which could have influenced health outcomes on the island of Hispaniola during the period of the Dominican Republic's economic crisis. Tropical Storm Jeanne brushed the Haitian north coast and hit part of the Dominican Republic. While monetary damages were large in the Dominican Republic (\$270 million in 2004 USD), fortunately, only 18 died. The impact on Haiti was much more severe, with 3,006 fatalities. This is a large effect on Haiti, and presents a possible concern for the assumption of parallel trends. The effects of this storm are unclear, and introduce bias into our study. However, it may not be a strictly serious problem for the purposes of the parallel trends assumption. The population affected was relatively small, and it was a natural event.

FIGURE 4. Trends in Births Assisted by a Medical Professional, 1997-2002

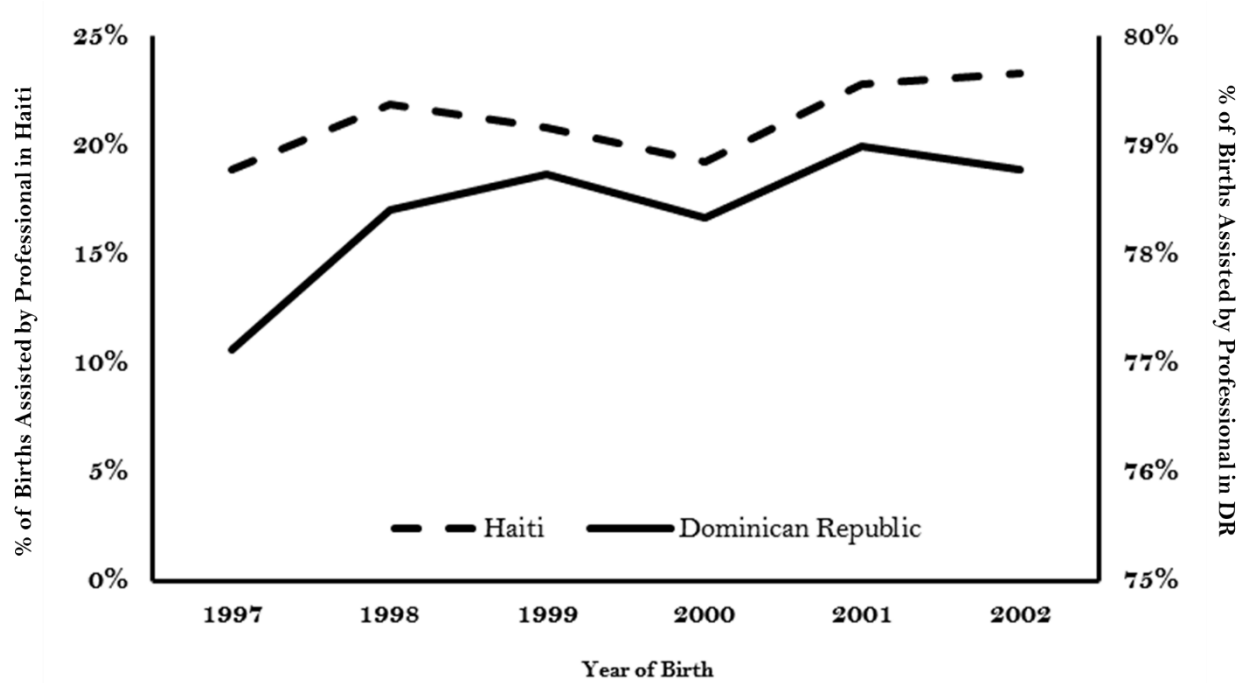
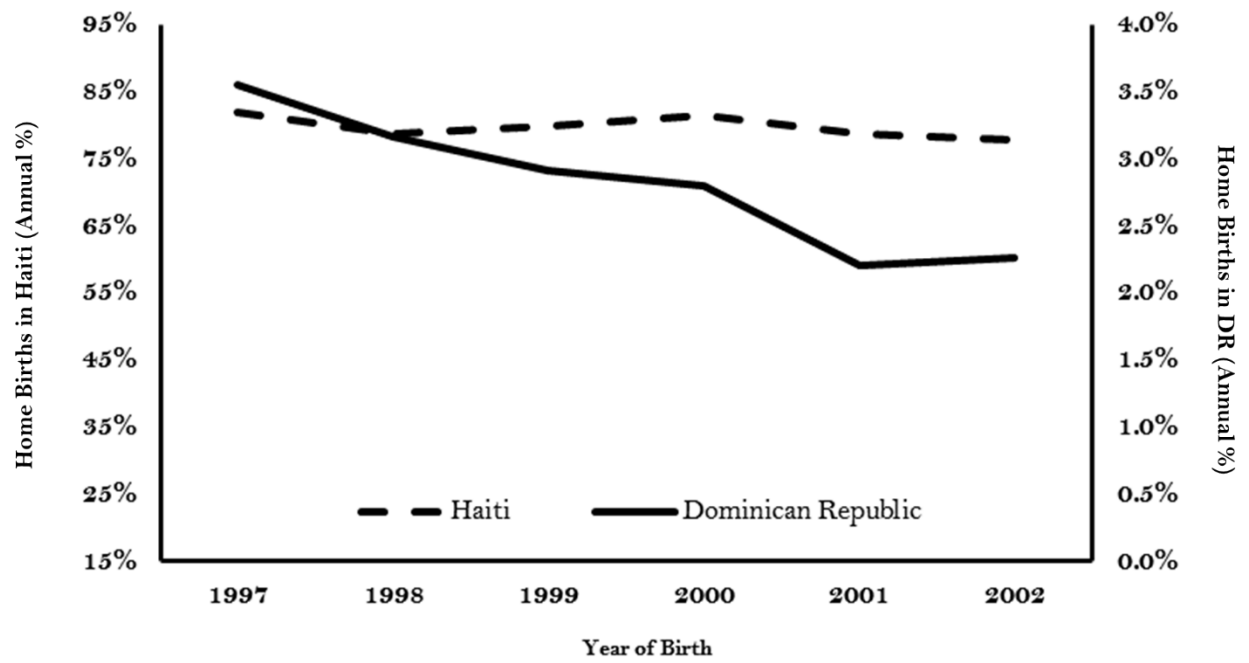


FIGURE 5. Trends in Place of Delivery, 1997-2002



5 Results and Discussion

5.1: Primary Model Estimates

TABLE 3. Impact of the Financial Crisis on Birth Outcomes

Outcomes	Skilled (1)	Skilled (2)	Home Birth (3)	Home Birth (4)
DR	0.4456 (0.1021)**	0.4576 (0.0931)**	-0.6391 (0.0895)**	-0.6504 (0.0814)**
Crisis	0.0455 (0.0075)**	0.0433 (0.0065)**	-0.0360 (0.007)**	-0.0346 (0.0059)**
Higher Education	-0.0554 (0.0194)**	0.4983 (0.1703)**	0.0131 (0.018)**	-0.4907 (0.1538)**
DR × Crisis	-0.0428 (0.0088)**	-0.0353 (0.0087)**	0.0359 (0.008)**	0.0334 (0.0077)**
DR × Higher Education		-0.5729 (0.1081)**		0.5259 (0.0972)**
Crisis × Higher Education		0.0063 (0.0030)*		-0.0191 (0.0019)**
DR × Crisis × Higher Education		-0.0381 (0.0053)**		0.0155 (0.0036)**
Controls?	Yes	Yes	Yes	Yes
Observations	33,691	33,691	33,599	33,599
R-squared	33.2%	33.6%	25.9%	25.7%

NOTE. ‘Skilled’ refers to the dichotomous indicator for whether a medical professional assisted the child’s birth. ‘Home Birth’ is the dichotomous indicator for whether the child was born at home. The main entries represent OLS estimates, and two-tailed levels of statistical significance are represented by *(5%) and **(1%). Standard errors are listed in parentheses and are clustered at the country level.

Table 3 presents the results from the initial difference-in-differences regressions. Model 1 suggests that mothers in the Dominican Republic giving birth at the time of the economic crisis were 4.3% less likely to have a medical professional attending when they were giving birth. Our second estimation (Model 2) shows that highly-educated mothers giving birth at the time of the economic crisis were 3.8% less likely to have a medical professional assisting at the time of birth. Both results are highly significant, and the differences can be interpreted to be the risk difference due to the crisis. Our results suggest that in this respect, there were significant declines in the use of health services during the years in which the crisis was most profound. These declines could have occurred either because of a collapse in public health spending, or because declines in household incomes made it more difficult for households to afford the services of trained healthcare professionals. It could also be because the Dominican Republic’s health service system could not adequately respond to the increased strain imposed by the crisis. Due to data limitations, is impossible to distinguish between these three possibilities. Though generally we must be careful; it is possible that mothers giving birth without professional assistance is not necessarily a sign of worsened health outcomes. This depends on the background of the mother: it is possible highly-educated mothers are better equipped to plan and ensure medical safety. Conversely, for poorly-educated mothers, or mothers without a strong ‘safety’ net, child births without professional assistance could be especially concerning. If mothers are not available to identify possible risk factors or not able to handle complications during birth, maternal health (and child health) could be severely affected²¹.

At the time of the crisis, the Dominican Republic’s health sector had several structural problems. Problems included low coverage, low vertical synergy across the workforce, inefficient institutions, and unequal distribution of health services. Doctors work both in the public and private sectors; compensation is low in

the public sector, and hence doctors are incentivized to shirk their public duties in order to focus on their private practices, where they are better compensated. A recent study found that in developing countries, private-sector providers may be a worthwhile alternative to public providers in healthcare matters²². Once qualifications and competency are controlled for (a public provider who is qualified, and works in both private and public settings), private settings see far better diagnostic and treatment outcomes: The rate of correct treatment is 42% higher, the rate of providing a clinically non-indicated palliative treatment is 20% percent lower. It would be interesting to investigate in detail how the network of hospitals in the Dominican Republic responded to the crisis; however, data is severely limited and thus this question cannot be answered for now.

We also consider the use of public health facilities in context of the place of delivery. Models (3) and (4) present our results for both difference formulations, but with the place of birth as the outcome variable. This dichotomous indicator takes on a value of 1 if the child's birth occurred at home, and 0 otherwise. Within context of the DHS, all other valid responses are medical facilities. Mothers giving birth in the Dominican Republic during the time of the crisis were 3.6% more at risk of giving birth at home. Among highly educated Dominican mothers, this effect is slightly smaller, at 1.6%. Both results are significant and the risk difference presents more evidence towards a general decline in health service utilization. It is not clear what composition of these home births are planned. However, out-of-hospital births generally pose increased health risks to the mother and child, even in the case of planned home births²³. This is a possible mechanism by which the crisis could affect child health, in addition to maternal health. Though it is not possible to directly attribute these declines directly to declines in public health spending, the coinciding of the two trends lends support to our initial hypothesis. In summary, we see important declines in professional assistance during birth, as well as increases in home births (away from medical facilities).

5.2: Trends in Child Health

We now turn to a broad investigation of child health, focusing on infant mortality. Results for the same formulations, but with infant mortality as the modeled outcome, are represented in Table 4. Dominican children born in the time of the economic crisis were 0.082% more likely to die in infancy than our control group. This is a significant result and one that indicates the crisis did have a differential impact on the risk of death in infancy for Dominican children. It is possible that increased risk factors for mothers could have spilled over into the health of children. Moreover, it is possible that the economic crisis had a lagged effect on infant mortality. Unfortunately, due to data limitations, it is not possible to distinguish the effects of the crisis on children exposed fully to the crisis, versus those in-utero. However, this is a very small effect and not economically important, despite its statistical significance. Surprisingly, for children born to highly educated women in the time of the crisis, we see a large effect: these children were 3.4% more likely to die in their infancy. This is plausible evidence of disparate effects of the banking crisis across demographic groups, which is consistent with previous study results¹⁹. However, our results here run counter to expectation. Conceptually, highly educated women should be able to shield their children from economic crises - the effects shouldn't be so pronounced. A possible explanation would be that highly educated mothers may be used to a certain standard of living. The crisis had a significant effect on consumer prices and many households saw their wealth disappear during the bailout. It is conceivable that the relative drop in living standards is responsible for driving this effect. Moreover, though less educated mothers may be more acutely prone to changes in consumer prices, they may be more adept at dealing with harsh economic conditions.

TABLE 4. Impact of the Financial Crisis on Infant Mortality

Outcomes	Infant Mortality (5)	Infant Mortality (6)
DR	-0.0308 (0.0008)**	-0.0313 (0.0004)**
Crisis	-0.0051 (0.0001)**	-0.0045 (0.0001)**
Higher Education	-0.0119 (0.0016)**	-0.0206 (0.0019)**
DR × Crisis	0.0008 (0.0002)**	0.0006 (0.0001)**
DR × Higher Education		0.0104 (0.0008)**
Crisis × Higher Education		-0.0364 (0.0009)**
DR × Crisis × Higher Education		0.0345 (0.0003)**
Controls?	Yes	Yes
Observations	51,901	51,901
R-squared	8.7%	8.9%

NOTE. ‘Infant Mortality’ refers to the dichotomous indicator for whether the child died within twelve months of birth. ‘The main entries represent OLS estimates, and two-tailed levels of statistical significance are represented by *(5%) and **(1%). Standard errors are listed in parentheses and are clustered at the country level.

Given these results, it would be useful to investigate whether or not the composition of women giving birth changed during the crisis. Economic crises may also influence household fertility preferences and decisions. Households (particularly the more-educated or experienced) may adjust the timing of fertility until after the crisis has passed. Deferred fertility may lead to fewer births during the time of a crisis, which may in turn lead to lower infant mortality rates²⁴. More generally, a deep economic crisis may lead to a change in maternal selection; that is, the composition of high-risk or low-risk mothers giving birth may change. We now consider whether or not changes in maternal selection - the composition of women giving birth during the crisis - contributed to changes in child health during the height of the economic crisis. Conceptually, the 2004 spike in infant mortality could be explained by a relative increase in the number of higher-risk women giving birth during the crisis. Next, we adopt and adapt a strategy employed by Paxson and Schady¹².

Using linear regressions, I estimate for the Dominican Republic for each year in 2000-2006:

$$Y_{it} = \alpha_t + \gamma_t X_{it} + \varepsilon_{it} \quad (3)$$

Y_{it} is the dichotomous indicator for whether a child i born in year t died in the first twelve months of life. X_{it} is a vector of covariates. It contains information on the respondent's highest educational attainment (no education omitted), age at birth of child (oldest group omitted), wealth level (middle third omitted), and place of residence at the time of survey. After running these regressions and obtaining parameter estimates, we use Oaxaca-type decompositions to study changes in mortality rates across years:

$$\Delta \bar{Y}_{it} = [(\hat{\alpha}_t - \hat{\alpha}_{t-1}) + \bar{X}_{t-1}(\hat{\gamma}_t - \hat{\gamma}_{t-1})] + [(\bar{X}_t - \bar{X}_{t-1})\hat{\gamma}_t] \quad (4)$$

ΔY_{it} is the change in the mortality rate between children born in years t and $t - 1$. $\Delta \bar{X}_t$ represents approximately weighted averages of maternal characteristics in year t . Our decomposition can be classified

into two effects: time effects and maternal selection effects. The first term in brackets measures time effects. Specifically, it measures changes in mortality rates between years, holding constant average maternal characteristics at the previous year's values. Maternal selection effects are given by the second term in brackets: this term measures the change in mortality rates due to variations in average maternal characteristics. If changes in the composition of women giving birth can explain variations in mortality over time, then a large part of these estimates should be due to selection effects.

FIGURE 6. *Oaxaca Decompositions of Changes in Infant Mortality*

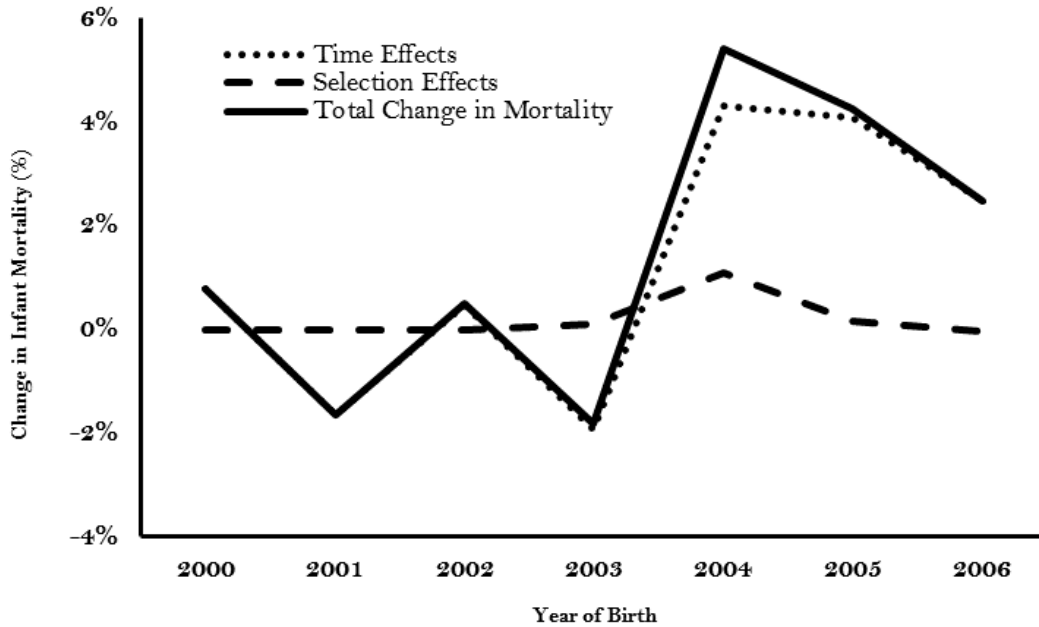


Figure 4 plots annual changes in infant mortality, decomposed into maternal selection effects and time effects. Though the changes in selection effects are small, we can see a slight uptick towards higher-risk women in 2004. However, this effect is very small. Time trends dominate the maternal selection effects. Despite our previous results, we cannot infer that the rise in mortality was due to a shift towards women with negatively selected characteristics (higher risk) giving birth during the crisis.

6 Conclusion

The impacts of economic crises on the health outcomes of children and mothers is an important policy question. Our results suggest that healthcare utilization declined in the Dominican Republic during the crisis. Mothers were 4.3% less likely to be assisted by a professional during birth, and 3.6% more likely to give birth at home instead of a medical facility. These outcomes may have led mothers and their children to become more at risk from health complications. The evidence on the effects of the crisis on infant mortality point to an increase, though due to data limitations, it is not possible to fully tease out the specific causes of infant mortality during the economic crisis. Our results do support our hypothesis that the decline in healthcare spending was associated with a decline in healthcare utilization and possibly child health.

Though the Dominican Republic has largely recovered amid successful structural reforms, the fact that a decline in maternal health may be partially due to a decline in healthcare spending suggests possible areas of

reform and contingency planning. Countries may look to budget in anticipation of economic shocks, in order to maintain an adequate level of social expenditure. Moreover, structural reforms towards reinforcing health care governance and incentivizing private practice providers may encourage improved health outcomes at the community level. Governments and international aid agencies should develop policies which help mothers buffer the effects of economic crises, in order to shield them and the health of their children.

Future research should focus on changes in household-level consumption in the time of an economic crisis. In addition, it would be useful to understand the incentives and responses of private practice providers during an economic crisis in developing countries.

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