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ABSTRACT

Children of Crisis: The Effects of Economic Shocks on Newborns*

In this paper, we explore the deep economic crisis experienced by the Turkish economy in 2001 and 2008 as quasi-experiments to causally identify the association between economically challenging conditions in-utero and child's birth weight. First, we utilize the temporal and spatial variations of the economic crisis. Second, we estimate mother fixed effects models by exploring the variation in the birth weight of siblings by their in-utero exposure to economic downturn. Using the Turkish Demographic Health Surveys (DHS), we find that a higher regional GDP contributes significantly to better birth outcomes among crisis-time children; adverse health effects are mainly observed in children born to mothers with low socio-economic status, suggesting that the main driver of the estimated effects of economic crises in Turkey is credit constraints. Our mother fixed effects models reveal that selective fertility, abortion, and unobserved heterogeneity across mothers are important omitted variables in the interpretation of regional regressions. The estimated effects of economic downturns cease to be statistically and economically significant once we control more accurately and directly for a family's firsthand experience with economic recessions. Thus, our results demonstrate that regional-level regressions estimating potential infant health costs of economic recessions potentially overestimate the true effects, and more direct measures of unobserved heterogeneity should also be considered in these analyses.

JEL Classification: 12, J13

Keywords: infant health, childhood environment, economic crisis

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1. **Introduction**

In the 21st century, globalization has connected countries all around the world, making them more vulnerable to economic shocks and recessions originating not only in their own domain but also elsewhere in the world. As a result, many countries have been going through economic hardships more frequently and these recessions also last longer. The neoclassical growth model predicts that the effects of recessions on output will be temporary and countries will return to their steady state in the long run. However, the micro-level effects of recessions on individuals' outcomes, such as children's birth outcomes, can be profound. These outcomes can last a lifetime exacerbating income inequalities in the long run as low-income families who frequently face credit constraints are more vulnerable to economic downturns and are more likely to defer prenatal care under financial hardship. Moreover, deep recessions and economic instabilities can inflict psychosocial stress to both relatively disadvantageous and better off mothers alike and can engender adverse birth outcomes, even though the latter group might have financial resources to smoothen their consumption. Mothers and children in emerging and developing countries are especially at greater risk in times of economic crises since they are more susceptible to these drastic shocks and have weaker institutions and welfare structure to provide safety nets.

Birth weight is of special social and economic concern as it has long lasting effects on an individuals' health, education and employment outcomes. Low birth weight babies (babies with birth weight of less than 2500 grams) are found to have greater one-year mortality risk than heavier babies (Morris et al., 1998; Almond et al., 2005). The survivors are more likely to have impaired motor and neurological development and chronic illnesses (Strauss and Dietz, 1998; Adair, 1989; De Boo and Harding, 2006). Low birth weight babies are also more likely to have lower IQs, lower educational attainment, and worse labor market outcomes (Currie and Hyson, 1998; Case et al., 2004; Behrman and Rosenzweig, 2004; Black, Devereux and Salvanes, 2007), contributing to long-term inequality in socioeconomic indicators. There is also a well-documented positive relationship between birth weight and adult height which further intensifies the effects of early health endowments on future outcomes (Case and Paxson, 2008; Persico, Postlewaite and Silverman, 2004). Therefore, causal evidence aiding our understanding of the determinants of birth weight is of extreme importance for economic and public policy in developing and developed countries alike.

In this paper, we quantify the causal effects of economic downturns on children's birth outcomes in Turkey. As a fragile emerging market, Turkey had major economic crises in 1994, 2001, and 2008.[1] First, a weak banking sector and severe public deficits in the early 2000s led to a prolonged fragile economic structure in Turkey and made the economy vulnerable to sudden capital outflows and an associated devaluation of domestic currency. Increased political instability further exacerbated the instability in this fragile economy, engendering a massive panic in the markets on February 2001 when the current government lost the vote of confidence. As a result, the interest rate reached 3000%. The economy was hit by sudden and sharp capital outflows. Moreover, switching from the managed to the free floating exchange rate regime as a result of the sudden capital outflows led to an unprecedented depreciation. The devastating results of the crisis are evident from macroeconomic indicators: GDP shrank by 5.7%, the unemployment rate reached 12%, and real wages decreased by 70% as compared to 1997. Another major economic crisis that Turkey experienced was the 2008 global crisis, which led to a 4.8% drop in GDP, an unemployment rate of 14%, and a significant decline in real wages and purchasing power.

These severe economic crises significantly deteriorated the pre-natal environment for children born during these times and were not driven by individual or household behavior; thereby providing a novel quasi-experimental set up to identify the causal association between challenging conditions in conception and infant birth outcomes. We causally identify the health effects of the economic downturn on infants following two difference-in-differences strategies. We first utilize the temporal and spatial variations of the economic crisis measured by the regional GDP. More specifically, we compare the birth outcomes of children in the heavily affected regions and relatively less affected regions who are exposed to economic downturn during gestational period to those of children who were not exposed to these shocks in either region. We further investigate whether the estimated regional effects of the economic crises vary by the level of spatial aggregation. In addition, we explore potential heterogeneity through the mother's education, household wealth, and differential prenatal care in an effort to disentangle the impact of potential mechanisms such as credit constraint, psychological stress and prenatal care on regional analysis. More importantly, we find evidence suggesting that behavioral changes lead to selective fertility, abortion and neonatal

[1]Since we are unable to match individual level information with regional level GDP information for earlier DHS surveys, we only focus on the severe economic crises of 2001 and 2008 in our analysis.

mortality at times of crises at the regional level analysis. Therefore, in contrast to previous studies, we estimate mother fixed effects models, which explore the birth outcomes of the siblings who were in-utero during the economic crisis and whose gestational period falls in the non-crisis years. Thus, we can effectively account for the selection in the composition of the newborns and unobserved heterogeneity in general in these models by controlling for possible time-invariant behavioral and physiological characteristics of the mothers and very likely fathers. Further, we compare the spatial models with mother fixed effects to enhance our understanding of the potential regional and household level effects of the financial crisis on infant health.

Our paper is closely related to several strands of literature. The first of these strands studies the effect of economic and financial shocks on children's birth outcomes. Facing a negative income shock, households might be forced to cut down on health expenditures and may not be able to smoothen the consumption of nutritious food and micronutrients, both of which lead to adverse pregnancy and birth outcomes. For instance, Aran (2013) finds that food expenditures were the main adjustment mechanism for Turkish households, particularly for low-income households, against the income shocks faced during the 2008 financial crisis. In addition to negatively affecting birth outcomes through adverse food consumption, economic shocks might also lead to low birth weight by increasing mothers' cortisol and stress levels (Aizer et al 2016). Bozzoli and Quintana-Domeque (2014) examines the consequences of the Argentine economic crisis in 2001 on newborns and shows that birth weight is procyclical with respect to the first and third trimesters of pregnancy. Olafsson (2016) examines the collapse of the Icelandic economy in 2008 and finds that first-trimester exposure to crisis resulted in a significant reduction in birth weight among the affected cohorts of newborns. Wehby et al. (2017) provides similar evidence by examining the effects of business cycles in Argentina and demonstrates that higher unemployment reduces fetal growth rate particularly among highly educated parents and increases maternal poverty-related infectious diseases.

The second strand of literature explores the association between intra-uterine exposure to armed conflicts and birth outcomes. Mansour and Rees (2012) demonstrates that an additional al-Aqsa Intifada related fatality 6–9 months before birth is associated with a 2.6% increase in the odds of having a low birth weight child. Similarly, Quintana-Domeque and Rodenas Serrano (2017) studies the effect of in-utero exposure to terrorism in Spain on

birth outcomes during the period 1980-2003 and finds that a mother's exposure to terrorism during pregnancy, as measured by the number of bomb casualties in the mother's province of residence in the first trimester of pregnancy, has detrimental effects on birth outcomes. Camacho (2008) provides further evidence by assessing mine explosions in Colombia and finds that landmine explosions caused a decrease of 8.7 grams in birth weight.

This paper makes several contributions to these literatures. First, we add to the previous studies by documenting the existence of selective fertility, abortion and neonatal mortality during the economic collapse at the regional level analysis and consequently, by estimating the mother fixed models which allows us to more directly account for a family's first-hand experience with the economic crisis and control for crisis-time selective fertility and unobserved heterogeneity in general. To the best of our knowledge, this paper is the first to examine the effects of financial crises on birth weight and other birth outcomes including low birth weight, premature birth, gestational length, and birth spacing in Turkey as well as in the Middle East region, which seems to be prone to frequent economic and political turmoil. As children and youth are one of the most vulnerable sections of this demographically young region, an important indicator of adulthood socioeconomic success, birth weight, calls for the attention of researchers and policy makers. Moreover, we quantify whether the estimated infant health effects are sensitive to the level of spatial aggregation, which could aid in the design of public policies. In addition, we formally quantify the potential channels underlying the regional-level analysis such as credit constraints, maternal stress and prenatal care. Such analysis is imperative to ascertain the segments of the population that suffered the most from adverse prenatal conditions and to tailor social welfare policies to aid the needs of these groups. Finally, we investigate multiple economic crises in our analysis, thereby assessing whether the potential effects of recessions on infant health vary by intensity and duration of the crisis.

Using the 2003, 2008, and 2013 Turkish DHS, we demonstrate that birth outcomes have significantly deteriorated in crisis-afflicted regions during an economic collapse and these adverse health effects were mainly observed in children born to mothers with low socioeconomic status, suggesting that the main driver of the estimated effects of economic crises in Turkey is credit constraints. We also find that these detrimental infant health effects arise from the third and second trimester exposure to financial hardship and these estimated trimester effects are also double in magnitude for mothers with less favorable socioeconomic

indicators. Consistent with birth weight results, our analysis also demonstrates that mothers residing in regions significantly hit by economic recessions are more likely to have premature babies and shorter gestational length, both of which elevate the prevalence of low birth weight newborns.

Our regional level analysis further reveals selective fertility, abortion and neo-natal mortality during an economic collapse with more educated and wealthier households deterring childbearing, thus suggesting that a regional level analysis potentially overestimates the true infant health effects of financial crises. Our mother fixed effects models further support the concern that selective fertility and more generally, unobserved heterogeneity across mothers are important omitted variables in the interpretation of a regional level analysis. The estimated effects of economic downturns cease to be statistically and economically significant once we more accurately and directly control for selective fertility and a family's firsthand experience with economic recessions in mother fixed effects models. Thus, our results suggest that regional-level regressions estimating potential infant health costs of the economic recessions should consider directly accounting for selective fertility and unobserved heterogeneity for credible causal identification.

The remainder of the paper is organized as follows. Section 2 gives a brief background of the Turkish economy and deep economic crises during 2000s. Section 3 describes the data used in our analysis and presents descriptive statistics. Section 4 lays out the estimation framework. Section 5 presents the main results, discusses the implications of our findings, performs some robustness checks and presents the source of heterogeneity, and potential mechanisms explaining our results. Section 6 concludes the paper.

2. **Background of the Turkish Economy and Economic Crises**

In this section, we provide a brief summary of the Turkish economy and the drastic economic downturns that the Turkish economy has gone through in the 2000s. At the end of the 1990s, the Turkish government was forced to institute a disinflation program under the supervision and technical support of the IMF to alleviate the persistent high inflation, high real interest rates and increasing budget deficit. This IMF-supported program relied on exchange rate-based disinflation and aimed at normalizing public sector balances. However, a weak banking sector along with large public deficits in the early 2000s led to a prolonged fragile economic structure and made the Turkish economy vulnerable to

sudden capital outflows and the associated devaluation of the domestic currency. Increased political instability further exacerbated worsened conditions, engendering a massive panic in the markets in February 2001 when the current government lost the vote of confidence. Due to this financial and political turmoil, Turkey was hit by a deep liquidity crisis and consequently led to the demise of the disinflation program. The extent and impact of the 2001 financial crisis on the economic well-being of households and of the Turkish economy overall was substantial. As a consequence, Turkish households became significantly poorer in a relatively short amount of time due to sudden and sharp capital outflows. Further, switching from the managed to the free floating exchange rate regime as a result of the sudden capital outflows resulted in an unprecedented depreciation of the domestic currency and the interest rate reached 3000%.

The aforementioned devastating results of the crisis are evident from Figure 1 which displays the quarterly economic growth of Turkey between 2001 and 2014. In Figure 2, we further demonstrate the monthly industry production index as an additional measure of economic activity. The statistics presented in these figures are highly correlated, suggesting that the crisis in the financial sector was transmitted to the industry and to the other sectors of the economy as well. Figure 1 shows that following the first quarter, GDP growth was negative throughout 2001 with an annual growth rate of -5.7%. As the crisis conditions spread to the real economy, massive layoffs occurred in the labor market. The unemployment rate reached 12% and the real wages decreased by 70% as compared to 1997. Moreover, the consumption of durable goods fell by 30.4%; semi-durable and nondurable consumption expenditures decreased by 9%.

In an effort to quickly recover from this deep financial crisis and restore the losses in household income and purchasing power, both of which significantly deteriorated during this economic downturn, the Turkish government announced a new economic stabilization program in May 2001 in collaboration with the IMF. This program aimed at radically restructuring the institutions governing the economy, including granting independence to the Turkish Central Bank. Institutional reforms within the scope of the recovery program improved the regulatory capacity and the fiscal stability of Turkey. The fall in inflation rate, along with the attainment of fiscal discipline and political stability, facilitated a relatively stronger and stable economy from 2002 onwards, particularly until 2008.

However, despite the stronger, improved financial sector, the Turkish economy was hit by the global financial crisis. From the last quarter of 2008 through the year 2009, economic growth was consistently negative. In the same period, GDP fell by 4.8%, the unemployment rate increased to 14% and as a result, real wages plummeted. Although the recovery from the 2008 global crisis was relatively fast, a relatively low quality growth followed in subsequent years due to the weakening of institutions and increasing discretion-based economic policies (Acemoglu and Ucer, 2016). In our empirical analysis below, we explore the cyclical variation in GDP presented in Figure 1 and in the industrial production index displayed in Figure 2 engendered by the 2001 and 2008 economic crises to determine the time periods that Turkey was hit by a major economic crisis and investigate whether being in-utero during these severe economic downturns significantly affected children's birth weight and other birth outcomes.

3. **Data**

We conduct our empirical analysis using the 2003, 2008 and 2013 waves of the Turkish DHS, which contain detailed information on socio-demographic characteristics of women, men and children. Importantly, the DHS reports women's complete birth histories, including each child's date of birth, gender, birth weight, and prenatal care, enabling us to explore the causal association between economic conditions and birth outcomes. Birth histories enable us to identify siblings and compare the birth outcomes of children born to same mother during different economic conditions.

In contrast to extant work, we have been granted access to special calendar data in DHS, which provide detailed information on the actual length of the pregnancy, enabling us to determine the exact gestational duration for each birth. Pregnancy duration is essential for our estimation framework in order to precisely identify the children who are in-utero during economic downturns and to measure the causal impacts of the crisis on birth outcomes. In addition to gestational duration, DHS calendar data also provide information on miscarriages, stillbirths, and abortions, which are helpful in understanding the heterogeneity in regional regressions. Since we explore both the spatial and temporal variations in the exposure to economic downturns during pregnancy, it is also imperative to correctly assign children to their birth region. In this pursuit, we utilize migration histories in DHS and carefully match the residence at the time of each birth.

We quantify the spatial variations in economic downturns by exploring provincial level economic activity. We explore regional differences in output levels by utilizing regional GDP data, which has recently been released by TURKSTAT. Since the DHS is representative at the NUTS 1 level, the unit of spatial area is NUTS 1 in our analysis, which corresponds to 12 regions in Turkey.[2] Guided by the economic indicators shown in Figure 1 and Figure 2, we define the crisis period as follows. The 2001 crisis covers the period between February 2001 and December 2001, while the 2008 crisis spans the period between October 2008 and September 2009. We further test the robustness of our results by using alternative definitions of crises taken from Cosar and Sahinoz (2018) and Aruoba and Sarikaya (2013). In addition, we further test the robustness of our regional analysis by exploring a finer level of spatial aggregation, i.e. NUTS 2 (which corresponds to 26 regions), and NUTS 3 (which includes 81 provinces).

In our analysis, we focus on the birth outcomes of children who are not multiple births and who were in-utero at least 7 months, since multiple births and prematurely born children are more likely to have low birth weight regardless of the economic condition.[3] We also exclusively focus on children who were born in Turkey since we have limited or no information on the birthplaces of children born outside of Turkey. Table 1 reports the summary statistics of the main variables of interest for the sample analyzed and the regional GDP per capita. On average, children weighed 3189 grams at birth in our sample; 15 percent of these babies reported having a low birth weight, which is defined as having a birth weight of 2500 grams or less, while 11 percent of these babies had high birth weight (4000 grams or higher). The average years of schooling for mothers is 6.6 years, and 8.2 years for fathers. The mother's average age at the time of the interview is approximately 29 years of age, while their age at first birth is 22 years of age. The number of children ever born to the mothers in our sample is 2.4 children, and more than half of these children were born within the last five years. Finally, the average regional GDP per capita is 14,011 Turkish lira.

[2]Since regional GDP data starts from 2004, we cannot include the 2001 economic crisis in the regional analysis, we only include the 2001 crisis in the fixed effect analysis.
[3]However, we note that our results remain similar when we include these omitted groups to our sample.

4. **Estimation Framework**

In this section, we describe our strategy to identify the causal health effects of crises on infants. We follow two difference-in-differences strategies. First, similar to previous studies quantifying the infant health effects of recessions, we utilize the temporal and spatial variations of the economic crisis measured by the regional GDP. More specifically, we compare the birth outcomes of children who are exposed to economic downturn during gestational period to those of children who were not exposed to these shocks in heavily affected regions and relatively less affected regions. Exploring the regional and time variations in the intensity of economic crisis across regions and birth cohorts allows us to credibly isolate the true health effect of the crisis from general regional differences in infant health endowments. However, we note that our regional difference-in-differences analysis would potentially yield conservative estimates of the health effects of the crisis since we explore regional variation in economic activity in this specification and our estimated coefficients would demonstrate the health effects as compared to the mean. The nationwide effects of these economic crises are thus likely to be significantly more pronounced.

In particular, the proposed estimate of the average treatment effect is given by β in the following equation:

$$BirthWeight_{imrt} = \alpha + \beta Crisis_{imt} XGDP_{rt} + \theta GDP_{rt} + \delta_r + \phi_t + \omega X_{imt} + \epsilon_{irmt} \tag{4.1}$$

where $BirthWeight_{imrt}$ is the birth weight in grams of child i of mother m in region r born in year t. $Crisis_{imt}$ is a dummy variable indicating whether a child is in-utero during the economic crisis . GDP_{rt} is the regional GDP spanning the period 2004-2013. δ_r denotes birth region fixed effects, controlling for the fact that regions may be systematically different from each other. ϕ_t is the child's year of birth fixed effects, controlling for likely secular changes in birth outcomes over time. X_{imt} includes a vector of controls for a mother's age at birth dummies, mother's and father's educational attainment dummies, gender and birth order of child, mother's marital status, household wealth index, and urban/rural residence. ϵ_{irmt} is a random, idiosyncratic error term. The standard errors are also clustered by birth region and birth year to account for correlations in outcomes between children residing in the same region over time.

We have carried out additional robustness checks of the baseline results to test whether our results are sensitive to different specifications and potential confounders. In contrast with previous studies, the calendar data in the DHS pertains to the entire fertility history of the women in the sample, allowing us to directly quantify whether the drastic economic downturn elevated the incidence of abortion, miscarriages and stillbirths, thereby contributing to the unobserved heterogeneity in birth outcomes. In addition, as postulated by the Trivers-Willard hypothesis and shown by Valente (2015), women might have borne more daughters than sons in times of hardship, potentially changing the parental neonatal investment. Thus, we also investigate whether the gender ratio at birth has changed during the economic crises in meaningful ways.[4]

As an additional validity check, we investigate whether there was a fertility response to the crisis by estimating equation (1) using the total number of births by month and by region as an outcome of interest. Finally, we assess whether there was selective fertility during crises by mother's and father's education attainment and household wealth, which has not been quantified in the previous studies that have explored regional variation in economic downturn. We find evidence to suggest that more educated and affluent parents indeed postpone childbearing during economic hardship; therefore, the true effects of the economic crisis on infant health might be overestimated due to this selection.

This potential selection led us to explore mother fixed effects specifications in an attempt to more directly account for unobserved heterogeneity and a family's exposure to crisis. More specifically, in our second specification, we re-estimate equation (1) including mother fixed effects. In this difference-in-differences type setting, we utilize the variation in birth weights of the siblings who were in-utero during the economic crisis and whose gestational period falls in the non-crisis years. The mother fixed effects analysis enables us to account for possible time-invariant behavioral and physiological characteristics of the mothers by exploiting the variation between siblings that have at least one, and generally two common parents. More precisely, we estimate the following mother fixed effects regression:

[4]Similar to Bozzoli and Quintana-Domeque (2014), we further apply an additional falsification test for our results by estimating whether the postnatal economic activity within 9 months after birth is related to the child's birth weight. This falsification test would help us to assess whether our results are driven solely by pre-crisis region-cohort trends.

$$BirthWeight_{imt} = \alpha + \beta Crisis_{imt} + \delta_m + \phi_t + \theta GDP_{rt} + \lambda_r + \omega X_{imt} + \epsilon_{irmt} \quad (4.2)$$

where $BirthWeight_{imrt}$ is the birth weight of child i of mother m born in year t. $Crisis_{imt}$ is a dummy variable indicating whether a child is in-utero during the economic crisis. δ_m is the mother fixed effects controlling for the possible time-invariant behavioral and physiological characteristics of the mothers. Hence, δ_m also absorbs mother's educational attainment and household wealth. X_{imt} now controls for time-variant characteristics such as dummies for mother's age at birth, birth region, and birth year fixed effects.

The validity of the difference-in-differences analysis relies on the parallel trend assumption, which assumes that regions with varying exposure to the economic crisis would exhibit parallel trends in child's birth outcomes had the economic crisis not occurred. Similarly, in mother fixed effects specification, the parallel trend assumption suggests that there are no systematic trends in birth outcomes across siblings except the one engendered by the differential exposure to economic crisis. We attempt to assess the plausibility of this parallel trend assumption in the next section by performing a falsification test/control experiment where we repeat the analysis by focusing exclusively on the infants born in non-crisis years. In this falsification test, we randomly assign the year that crisis had occurred and test whether this placebo difference-in-differences estimate is statistically and economically significant. We have performed these control experiments for both of our specifications described above. It is comforting that there is no evidence to suggest differential trends at times outside of crisis years, lending confidence that our findings indeed demonstrate the health costs of the economic crisis rather than the pre-existing trends in birth outcomes across regions or siblings.

5. **Estimation Results**

5.1. **Regional Economic Indicators**

In this section, we discuss our estimation results. We first start with regional regressions and then turn to the analysis with mother fixed effects in the next section. Results with regional fixed effects where the outcome of interest is the child's birth weight in grams are presented in Table 2. Column (1) demonstrates the analysis with our entire sample. We allow for heterogeneous effects in columns (2)–(5) by the mother's education and household

wealth, respectively. Column (2) presents the results for the children born to mothers with secondary school education or less, while we exclusively focus on children whose mothers have more than secondary school education in column (3). Similarly, in column (4), we illustrate the results for children of households that are classified as poorest or poorer, and middle based on the wealth index in our data. On the other hand, column (5) only includes the children of households that are categorized as richer or richest. All regressions control for a battery of the child's, the mother's and the father's characteristics such as the child's gender and birth order, the mother's age at birth dummies, the father's educational attainment dummies, the mother's marital status, household wealth dummies, and urban/rural residence in addition to the yearly regional GDP per capita, region of birth, and birth year fixed effects.

To put our findings into perspective, we first describe the association between our control variables and a child's birth weight in Table 2. We find that a child's gender is an important determinant of birth weight, with girls weighing 131 grams less on average at birth. Similarly, the birth order of a child does seem to matter for the birth weight, as our results show that higher birth order children are heavier. This positive effect of birth order on the birth weight is significantly more pronounced for children born to mothers with higher SES. We also see in Table 2 that a mother's educational attainment almost monotonically increases the infant's birth weight, with mothers with the highest educational attainment having babies 134 grams heavier than the mothers with the lowest educational attainment. The same pattern emerges when we divide the sample with respect to the mother's household wealth. Consistent with the economic theory, household income also significantly contributes to an infant's birth outcomes. We find that households that are categorized as rich and richest have babies who are 185 grams and 147 grams heavier at birth than the poorest households, respectively. Moreover, Table 2 reveals that the mother's marital status is also important for a child's birth outcomes, especially for high-educated and more prosperous mothers, as shown in columns (3) and (5). On the other hand, we find that the type of residence and the father's educational attainment have limited to no effects on determining an infant's birth weight after controlling for the mother's and the child's characteristics.

Table 2 further demonstrates that birth weight is procyclical with respect to GDP. As importantly, we find that children born during the crisis have significantly lower birth weight if they were born in regions more heavily hit by the 2008 global financial crisis. More

specifically, the first row of Table 2 shows children born in that crisis-time in the most prosperous regions are approximately 100 grams heavier than the same cohorts of children in the poorest region.[5] Alternatively, our results indicate that crisis-time newborns in the poorest regions are 50 grams lighter than children of the same age born in a region with average GDP per capita. This effect is economically and statistically significant suggesting that in-utero exposure to economic downturn decreases birth weight as much as maternal smoking during pregnancy. On average, our estimated coefficient on economic crisis is more than double the magnitude presented in Bozzoli and Quintana-Domeque (2014) for Argentina and larger than the estimates presented for Iceland in Olafsson (2016). This difference can be explained by the institutional differences across countries in the quality of healthcare provision and welfare structures allowing for consumption smoothing and safety nets in times of hardship.

The potential mechanisms through which economic and social shocks affect birth weight are multifold. First, medical literature shows that psychological stress during pregnancy which could be related to economic hardship in our setting is strongly associated with low birth weight (Beydoun and Saftlas, 2008; Paarlberg et al., 1995; Mulder et al., 2002; Wadhwa et al., 1993). Second, malnutrition, especially during the critical months of the gestational period leads to poor birth outcomes (Stephenson and Symonds, 2002; Lumey, 1998; Almond and Mazumder, 2011). When households experience a negative income shock, they might be forced to decrease the consumption of nutritious food, which increases the probability of having a low birth weight child. Third, limited access to prenatal care, especially in the third trimester of pregnancy is shown to be associated with lower birth weight and other severe complications (Grossman and Joyce, 1990; Reichman and Teitler, 2003; Rous et al, 2004; Jewell and Triunfo, 2006; Wehby et al 2009).

Table 2 demonstrates that our results are mainly driven by mothers with low SES since the estimated difference-in-differences estimate for less educated mothers is almost double the magnitude of the entire sample, suggesting that the credit-constraint/limited resources channel is more pronounced among less educated and poor women in Turkey. On the other hand, the results in columns (3) and (5) of Table 2 indicate that the birth outcomes of children born to more affluent mothers are virtually immune to economic crisis. The point

[5]We interpret the difference-in-differences estimate by taking the difference in 2008 GDP per capita in the richest and the poorest regions and multiplying this difference with the estimated coefficient in the first row.

estimates for these mothers are statistically insignificant and smaller in magnitude. Therefore, we infer that psychosocial stress is not a significant mediator for the estimated birth weight results. Further, we more directly assess whether there were quantifiable behavioral changes among pregnant women in the prenatal care utilization during the economic collapse in Appendix Table 1, by focusing on the probability of seeing a doctor during pregnancy as an outcome of interest. We indeed find a discernable difference in the demand for and access to prenatal care for infants who were in-utero during the 2008 global economic crisis in more heavily stricken regions, especially among less educated mothers. Therefore, our results allude to differential prenatal care as another important mechanism explaining the estimated regional infant health effects.

In addition to the overall infant health effects of the economic crisis, we also separately estimate the effects by the trimester of pregnancy that was affected by the financial crisis in order to more accurately identify the point during the pregnancy when mothers and newborns become more susceptible to adverse shocks. Following the medical literature, we categorize the duration of the pregnancy into three trimesters. We utilize the special calendar data in DHS for the trimester analysis, since it provides detailed information on the actual length of pregnancy and allows us to precisely identify the trimester(s) that the mother was affected by the financial crisis. Results with trimester dummies are presented in Table 3. We find that adverse health effects of deep recessions are more pronounced for babies exposed during the third trimester, while there is limited effect from first trimester exposure. This finding is consistent with the medical literature which suggests that babies gain most of their birth weight during the last trimester. The results on gestational length that we discuss next also demonstrate that gestational length is shorter in regions that are more severely affected by the financial crisis, thereby providing supporting evidence to the results shown in Table 3. Moreover, similar to the birth weight results discussed in Table 2, we continue to find that mothers with lower socioeconomic background are mainly driving these results. The point estimates on the third trimester exposure are also higher for these groups suggesting that adverse infant health costs of the financial collapse are disproportionately borne by these mothers and their children.

Our data also allows us to investigate the causal effects of the deep recessions on other birth outcomes. We explore having a low birth weight baby (column 1), having a gestation length of less than 7 months (column 2), the duration of gestation (column 3), and birth

spacing (column 4) in Table 4 as additional birth outcomes. Not surprisingly, we find that newborns of less educated mothers in heavily stricken areas are more likely to have shorter gestation and are born prematurely compared to the same cohorts in less affected regions, both of which elevate the prevalence of low birth weight and also likely contribute to the results on birth weight discussed in Table 2. More specifically, we find in Table 4 that the likelihood of a premature birth decreases by almost half in more prosperous regions compared to poorer regions during crisis, which leads to a 12 percent reduction in the prevalence of low birth weight relative to the mean.[6] However, we find no evidence to suggest a change in birth spacing at the times of the crisis. Thus, taken together, our results demonstrate that challenging intra-uterine conditions have detrimental effects on a battery of birth outcomes, and these adverse effects are more often borne by mothers and children from disadvantageous backgrounds. These households likely face greater economic insecurity and credit constraints, and have limited access to prenatal care during economic collapse, leaving them and their offspring more vulnerable in the presence of weak institutions and limited welfare support to facilitate consumption smoothing and to provide safety nets.

5.2. **Validity Tests for Regional Estimations**

We have carried out several robustness checks of the baseline results to test whether our results are sensitive to different spatial aggregation, alternative specifications and potential confounders and whether the parallel trend assumption is satisfied. First, as mentioned in the estimation framework section, the parallel trend assumption in our setting would suggest that regions with varying economic strength measured by GDP per capita had similar trends in children's birth outcomes before they were hit by the 2008 economic crisis. We formally test whether indeed the parallel trend assumption is satisfied for regional analysis by conducting the following falsification test via randomly assigning the timing of the crisis 20 months before 2008 and treating as if it lasted for 12 months during this period. Results from this falsification test are shown in Table 5. The point estimates from this falsification exercise are statistically insignificant and small in magnitude suggesting that our regional estimates are unlikely to be driven by pre-existing region-cohort trends.

[6]For the interpretation of the difference-in-differences coefficients, we multiply the point estimates in this table with the average GDP per capita in 2008, which was 14000 TL.

Second, we investigate whether our results are sensitive to the level of spatial aggregation in economic activity as shown by Lindo (2015). In this pursuit, we explore the spatial variation at the NUT2 level, which corresponds to 26 regions in Turkey, in Panel A of Appendix Table 2. Similarly, we utilize spatial variation at the NUTS3 level, which covers 81 provinces in Turkey, in Panel B of Appendix Table 2. Similar to the baseline specification, we continue to find that adverse economic conditions at birth engendered by the massive economic downturn significantly deteriorate the birth weight of the children born in households with less education and wealth. Moreover, our difference-in-differences estimates remain virtually unchanged in magnitude and statistical significance both in NUTS2 and NUTS3 specifications, suggesting that our main regional results are not sensitive to the different levels of spatial aggregation.

In addition, according to the Trivers-Willard hypothesis, parental condition at conception could influence the sex ratio of offspring, more favorable being associated with the conception of males. Accordingly, Valente (2015) shows that the in-utero exposure to civil conflict, for instance, can generate a skewed sex ratio in favor of girls. Since girls generally have lower birth weights compared to boys as shown in Table 2, the regional analysis might overestimate the true health effect of the crisis if more girls were born in heavily affected areas during economic downturn. Thus, in Table 6, we investigate whether the gender ratio at birth has changed differentially during or right after the economic crisis in a significant way. As an outcome of interest, we utilize the number of boys born by month by year by region in this analysis.[7] The coefficients for the 2001 and 2008 economic crises are statistically insignificant suggesting that there are no discernable systematic changes in sex ratio during deep recessions experienced in Turkey.

Further, economic crises and resulting credit constraints and psychosocial stress might prompt fertility responses such as postponing childbearing until after the economy has recovered. Such potential fertility responses might also be more common among more educated and more affluent parents since contraception usage is significantly more prevalent among this group. On the other hand, the composition of newborns might have changed during severe economic hardships through increased incidences of abortions, miscarriages, or stillbirths. In an attempt to tackle potential selection in fertility as well as the change

[7]In addition to region and year fixed effects, we also control for regional averages for mother's and father's education, wealth, GDP per capita at child's birth region and urban/rural residence in these estimations.

in the composition of the babies born during the drastic economic downturn, in the first two columns of Table 7, we first formally test whether the fertility behavior of mothers has changed in a significant manner during or right after the economic downturn by exploring the number of births by month by year by region as an outcome of interest. We indeed find evidence to suggest that fertility rates were lower in the more prosperous regions during economic crises; it is therefore possible that there were fertility responses to the deep recession as shown in Table 7.

In the remainder of Table 7, we further investigate the possibility of selective fertility by estimating the number of children born by region by year by month by mother's and father's educational attainment and household wealth. Previous studies exploring spatial variation in economic downturns to causally estimate infant health effects provide limited analysis on selective fertility and the possible change in the composition of the babies born -through abortion and prenatal mortality - and often argue that the unobserved heterogeneity driven by these potential behavioral changes yields only minor consequences for their findings, if any. However, our results presented in Table 7 suggest that selective fertility, and more generally, changes in the composition of the newborns are indeed present during economic crises and should be considered in the estimation of infant health costs of economic recessions as a potential source of unobserved heterogeneity. More specifically, the outcome of interest in columns (3) and (4) of Table 7 is the number of children born by month by region by mother's education, where higher maternal education is categorized by a higher value. Similarly, columns (5) and (6) present the number of children born by month by region by partner's education, while the last two columns of Table 7 show the results for the number of children born by month by region by household wealth. Household wealth is also defined with a higher value representing more wealth. In Table 7, we find evidence to suggest that more educated and affluent parents indeed postpone childbearing during economic hardship and these effects are consistent across different socioeconomic indicators.

We further investigate whether there was an evident change in the incidences of abortions, miscarriages and stillbirths during crises. Abortion, and to an extent, miscarriage, could potentially be alternative birth control practices in efforts to defer crisis-time conception. Since we were granted access to the unique calendar data in DHS on the complete conception history, we can identify the incidences of abortions, miscarriages and stillbirths in our data. Using this information, we generate indicators for abortion (in Panel A of Table 8) and

miscarriage and stillbirths (in Panel B of Table 8). We demonstrate that the likelihood of the pregnancy being terminated by an abortion or a miscarriage has indeed increased in the most affected regions, especially among more affluent parents during the severe economic downturn in 2008, thereby suggesting that there were other behavioral responses in addition to fertility responses contributing to the unobserved heterogeneity. Taken together, our analyses presented in Table 7 and Table 8 demonstrate that the true effects of the economic crisis on infant health might be overestimated in the regional analysis due to selective fertility and abortion of babies during crises. This potential selection in crisis-time fertility and change in the composition of the newborns led us to explore mother fixed effects specification in the next section in order to more directly account for unobserved heterogeneity and a family's first-hand exposure to crisis.

5.3. **Mother Fixed Effects Models**

Given the evidence presented in Table 7 and Table 8 on unobserved heterogeneity and fertility responses at the times of the economic downturns, we now estimate models with mother fixed effects. This specification allows us to unmask the potential unobserved heterogeneity as well as to more directly assess the effect of crisis after controlling for possible time-invariant behavioral and physiological characteristics of the mothers and households in general. As we describe in the estimation framework section, mother fixed effects models compare the birth outcomes of the siblings who were in-utero during deep recessions, and those whose gestational period falls in non-recession years.

Results with mother fixed effects are presented in Table 9. Since we focus exclusively on siblings in our analysis, we can estimate the mother fixed effects models separately as well as jointly for the 2001 and 2008 economic crises. Using mother fixed effects controls, we find that the adverse effects of in-utero exposure to economic hardship are no longer present. The point estimates for 2001 and 2008 economic crises separately and jointly cease to be economically and statistically significant after more directly and accurately controlling for the mother's exposure, selective crisis-time fertility and unobserved heterogeneity in general. We also note that the estimates for the 2008 global economic crisis are negative, however, they are not statistically significant at the conventional level. In addition, since the exact timing of the 2001 economic crisis is known, we focus exclusively on women who were already pregnant by the time the Turkish economy was disabled by the massive economic crisis in

February 2001. Mother fixed effects results with this sample are presented in Appendix Table 3. Our results virtually remain statistically and quantitatively similar to the baseline mother fixed effects analysis, as summarized in Table 9.

In order to more precisely quantify the effects of regional economic hardship on children's birth outcomes and compare the spatial models with the mother fixed effects models, we exclusively focus on the sample utilized in mother fixed effects and estimate the regional effects for this sample. Our results with this sample remain virtually the same as the entire sample. Taken together, the comparison of the regional and mother fixed effects models suggests that selective fertility and unobserved heterogeneity across mothers, and more directly assessing the potential impacts of the economic crisis on mothers and households, are imperative in understanding the true infant health costs of economic downturns. Our analyses demonstrate that the previous studies quantifying the health costs of in-utero exposure to deep economic recessions using regional variation in economic activity potentially overestimate the true effects of the crisis without accounting for selective fertility, change in the composition of newborns, and more generally, unobserved heterogeneity across mothers.

6. **Conclusion**

In this paper, we analyze the causal effects of in-utero exposure to economic crisis on infant health. We exploit the deep economic crises experienced in the Turkish economy in 2001 and 2008 as quasi-experiments to causally identify the association between economically challenging conditions in-utero and children's birth outcomes. We first utilize the temporal and spatial variations of the economic crisis measured by regional GDP. Second, we estimate mother fixed effects models by exploring the variation in the birth weight of siblings whose gestational period was within the period of the crisis, to those who were unaffected. Using several waves of the Turkish DHS, we find that a higher regional GDP contributes significantly to better birth outcomes among crisis-time children after accounting for a wide range of controls for the child's and parental characteristics, region and birth year fixed effects. We also find that the birth outcomes of the children born to mothers with low SES are significantly more sensitive to economic wellbeing, while children of more affluent mothers perform equally well in the crisis years, suggesting that the main driver of the estimated effects of economic crisis in Turkey is credit constraints low SES women facing during the financially challenging times. It is sensible to presume that the disadvantages set

up in childhood and youth persist in the future, making these individuals less productive members of society. Thus, given the well-established evidence on the causal effects of birth weight on long-term professional and social success, our study aids us in understanding the origins of potential future income inequalities in emerging economies and would help policy makers devise policies to promote the well-being of the vulnerable segments of the population.

On the other hand, our mother fixed effects models reveal the existence of selective fertility, increasing incidences of abortion and miscarriages during crises, thereby suggesting that unobserved heterogeneity across mothers should be taken into account in the interpretation of the regional analysis of economic recessions. The estimated effects of economic downturns cease to be statistically and economically significant once we more accurately and directly control for a family's firsthand experience with economic recessions. Thus, our results suggest that regional level regressions estimating the potential infant health costs of the economic recessions potentially overestimate the true effects and more direct measures of unobserved heterogeneity should also be considered in these analyses.

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FIGURE 1. Quarterly Growth Rates of Turkey: 2001-2014 (Source: TURKSTAT)

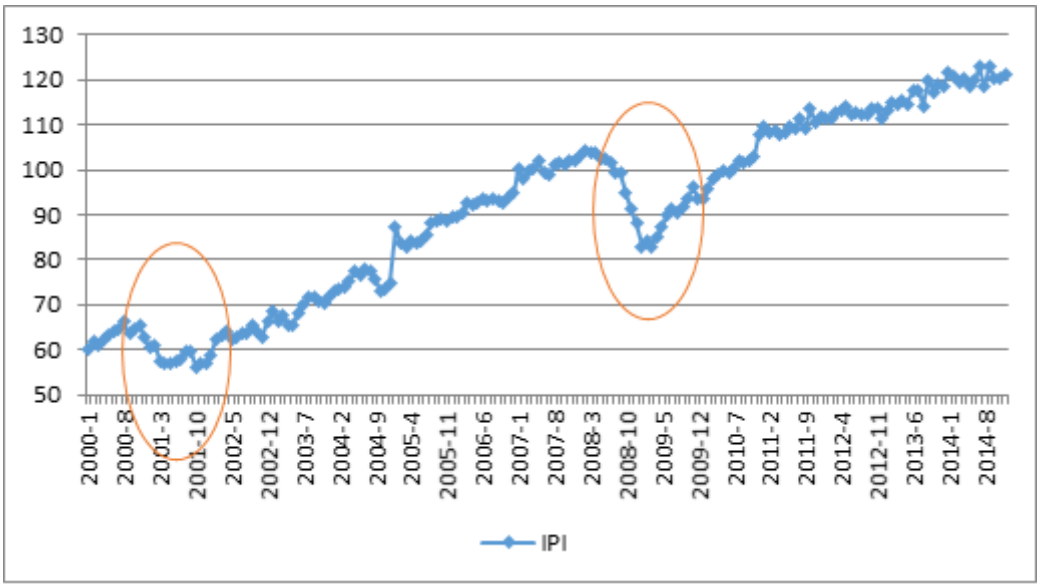

FIGURE 2. Industry Production Index (IPI): 2001-2014 (Source: TURKSTAT)

TABLE 1. Descriptive Statistics

	N	Mean	Standard Deviation	Min	Max
Child Birthweight (grams)	8,906	3220	687	600	7000
Low Birthweight (2500 gr or less)	8,906	0.115	0.319	0	1
High Birthweight (4000 gr or more)	8,906	0.115	0.319	0	1
Mother's Years of Schooling	7,480	6.600	3.984	0	21
Partner's Years of Schooling	7,438	8.245	3.827	0	21
Mother's Age at Interview	7,480	28.963	5.796	15	48
Number of Children Ever born	7,480	2.372	1.595	1	14
Number of Births in Last 5 Years	7,480	1.241	0.489	1	5
Number of Births Last Year	7,480	0.269	0.446	0	2
Age at First Birth	7,480	22.3	4.158	12	44
GDP Per Capita (TL)	132	14011	7.616	3.850	43645

TABLE 2. Effect of Financial Crisis on Birthweight: Regional Regressions

	(1)	(2)	(3)	(4)	(5)
	All Children	Low Educated Mothers	High Educated Mothers	Poorer Households	Richer Households
	Dependent Variable: Birthweight (grams)				
2008 Crisis * GDP	0.004**	0.005**	0.002	0.006***	0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)
Birth Order	20.681***	14.525**	59.712**	12.624*	45.188**
	(7.203)	(6.291)	(25.900)	(7.206)	(21.340)
Mother- Primary Educ.	57.122			79.493**	-56.284
	(37.393)			(32.281)	(113.124)
Mother- Secondary Educ.	69.001			92.027	-4.671
	(59.139)			(58.247)	(117.330)
Mother- Higher Educ.	133.928***			172.454***	50.561
	(45.162)			(59.892)	(121.774)
Father- Primary Educ.	21.373	49.989	4.958	18.069	293.329**
	(57.200)	(58.419)	(191.648)	(69.360)	(119.665)
Father- Secondary Educ.	39.990	78.507	69.528	80.282	227.887
	(72.540)	(80.511)	(190.787)	(85.637)	(144.084)
Father- Higher Educ.	13.202	16.047	110.836	40.041	224.626
	(71.869)	(70.224)	(185.162)	(81.977)	(138.072)
Poorer	128.087***	130.657***	44.870		
	(36.623)	(39.933)	(53.602)		
Middle	171.985***	180.589***	67.102		
	(55.918)	(52.237)	(68.505)		
Richer	184.461***	189.817***	116.206**		
	(37.616)	(34.136)	(46.881)		
Richest	146.816***	149.833***	65.570		
	(31.997)	(45.310)	(60.123)		
Rural	-5.044	-13.458	72.095	-68.194**	96.998
	(32.842)	(31.342)	(51.499)	(27.890)	(76.614)
Girl	-131.222***	-133.591***	-137.053***	-100.253***	-181.528
	(17.009)	(26.696)	(15.301)	(35.049)	(180.000)
Formerly Married	140.154**	38.749	403.650***	13.997	354.997***
	(59.369)	(155.319)	(80.249)	(141.659)	(94.149)
Observations	5,973	4,576	1,397	4,174	1,799
R^2	0.053	0.051	0.103	0.041	0.116

Notes: In all regressions dependent variable is the child's weight in grams at birth. Column 1 includes all children, Column 2 includes the children of mothers with secondary school education or less, Column 3 includes the children of mothers with more than secondary school education, Column 4 includes the children of households that are classified as poorest, poorer and middle, Column 5 includes the children of households that are classified as richer or richest. All regressions include controls for birth order, dummies of mother age at birth, mother's education, father's education, urban/rural residence, marital status, wealth and child's region of birth fixed effects, and birth year fixed effects. Standard errors that are clustered by region of birth and birth year level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE 3. Effect of Financial Crisis on Birthweight by Trimester

	(1)	(2)	(3)	(4)	(5)
	All Children	Low Educated Mothers	High Educated Mothers	Poorer Households	Richer Households
	Dependent Variable: Birthweight (grams)				
Exposed in 1st Trimester*GDP	-0.006**	0.000	-0.013***	0.011***	-0.004
	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)
Exposed in 3rd Trimester**GDP	0.014***	0.018***	0.007	0.017	0.009**
	(0.001)	(0.003)	(0.004)	(0.017)	(0.004)
Exposed in 2nd and 3rd Trimesters*GDP	0.009	0.010	0.007	0.007	0.012
	(0.009)	(0.010)	(0.004)	(0.005)	(0.009)
Exposed in 1st and 2nd Trimesters*GDP	0.011***	0.008***	0.030	0.005	0.019***
	(0.003)	(0.003)	(0.030)	(0.004)	(0.006)
Exposed in All 3 Trimesters*GDP	0.011***	0.014***	-0.006	0.008***	0.006***
	(0.002)	(0.003)	(0.006)	(0.003)	(0.002)
Observations	5,973	4,576	1,397	4,174	1,799
R^2	0.055	0.053	0.111	0.041	0.122

Notes: In all regressions dependent variable is the child's birth weight in grams. Column 1 includes all children, column 2 includes the children of mothers with secondary school education or less, column 3 includes the children of mothers with more than secondary school education, column 4 includes the children of households that are classified as poorest, poorer and middle, column 5 includes the children of households that are classified as richer or richest. All regressions include controls for birth order, dummies of mother age at birth, mother's education, father's education, urban/rural residence, marital status, wealth and child's region of birth fixed effects, and birth year fixed effects. Standard errors that are clustered by region of birth and birth year level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE 4. Effect of Financial Crisis on Birth Outcomes

	Low Birthweight	Premature Births	Pregnancy Duration	Spacing
2008 Crisis * GDP	-0.017*	-0.010***	0.089***	-2.445
	(0.009)	(0.001)	(0.022)	(2.242)
Observations	4,662	4,662	4,662	975
R^2	0.058	0.030	0.030	0.266

Notes: Low birthweight babies are born weighting less than 2,500 grams. Spacing is the number of months between subsequent births. Premature birth is one that occurs before the start of the 37th week of the pregnancy. All regressions include controls for birth order, dummies for mother age at birth, mother's education, father's education, urban/rural residence, marital status, wealth and region of birth fixed effects, birth year fixed effects and regional GDP per capita. Standard errors that are clustered by region of birth and birth year level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

TABLE 5. Falsification Test: Fake Crisis

	(1)	(2)	(3)	(4)	(5)
	All Children	Low Educated Mothers	High Educated Mothers	Poorer Households	Richer Households
	Dependent Variable: Birthweight (grams)				
Fake Crisis * GDP Per Capita	-0.000	-0.003	0.003	-0.004	0.003
	(0.002)	(0.003)	(0.008)	(0.004)	(0.005)
Observations	5,973	4,576	1,397	4,176	1,797
R^2	0.052	0.050	0.103	0.040	0.116

Notes: 20 months before the 2008 crisis is taken as the crisis period. In all regressions, the dependent variable is the child's birth weight in grams. Column 1 includes all children, column 2 includes the children of mothers with secondary school education or less, column 3 includes the children of mothers with more than secondary school education, column 4 includes the children of households that are classified as poorest, poorer and middle, column 5 includes the children of households that are classified as richer or richest. All regressions include controls for birth order, dummies for at mother's age at birth, mother's education, father's education, urban/rural residence, marital status, wealth and child's region of birth and birth year fixed effects. Standard errors that are clustered by region of birth and birth year level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE 6. Effect of Financial Crisis on Gender

	(1)	(2)
Dependent Variable: Number of Boys (Year x Month x Region)		
2008 Crisis * GDP	-0.003	-0.004
	(0.013)	(0.013)
Observations	1,213	1,212
R^2	0.236	0.240

Notes: Dependent variable is the number of boys by year by month by region. The first column controls for year and region of birth fixed effects; column 2 also adds controls for regional averages for mother's education, father's education, wealth, GDP per capita at child's birth place and urban/rural residence. Standard errors that are clustered at the year by region of birth are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE 7. Effect of Financial Crisis on Fertility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total Births		Births by Mother's Education		Births by Father's Education		Births by Household Wealth	
2008 Crisis * GDP	-0.039**	-0.036**	-0.009**	-0.009**	-0.012***	-0.012***	-0.005	-0.003
	(0.017)	(0.017)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
Observations	1,370	1,369	3,605	3,594	3,567	3,567	3,682	3,672
R^2	0.359	0.364	0.058	0.069	0.069	0.070	0.098	0.124

Notes: In columns (1) and 2, the dependent variable is the number of births by region by year by month, in columns (3) and (4), the dependent variable is the number of births by region by year by month by education of mothers, in columns (5) and (6), the dependent variable is the number of births by region by year by month by education of fathers, in columns (7) and (8), the dependent variable is the number of births by region by year by month by household wealth. Regressions in columns 1, 3, 5, and 7 control for birth year and region of birth fixed effects; regressions in columns 2, 4, 6 and 8 add controls for regional averages for mother's education, father's education, wealth, GDP per capita at child's birth place and urban/rural residence. Standard errors that are clustered at the year and region of birth are in parentheses *** p<0.01, ** p<0.05, * p<0.1.

TABLE 8. Effect of Financial Crisis on Abortion and Miscarriages/Stillbirths

	Panel A: Dependent Variable: Dummy Variable for Abortion				
	(1)	(2)	(3)	(4)	(5)
	All Children	Low Educated Mothers	High Educated Mothers	Poorer Households	Richer Households
2008 Crisis * GDP	-0.091***	-0.078***	-0.129***	-0.072***	-0.117***
	(0.006)	(0.009)	(0.017)	(0.006)	(0.013)
Observations	6,702	5,135	1,567	4,640	2,062
R^2	0.137	0.135	0.194	0.122	0.185
	Panel B: Dependent Variable: Dummy Variable for Miscarriages and Stillbirths				
2008 Crisis * GDP	-0.138***	-0.100	-0.199***	-0.158***	-0.105*
	(0.052)	(0.061)	(0.060)	(0.058)	(0.055)
Observations	7,419	5,707	1,712	5,213	2,206
R^2	0.048	0.047	0.118	0.048	0.085

Notes: In Panel A, the dependent variable is a dummy variable indicating whether the pregnancy was terminated or completed to full term, in Panel B, the dependent variable is a dummy variable indicating whether the pregnancy was a miscarriage/stillbirth or completed to full term. Column 1 includes all children, column 2 includes the children of mothers with secondary school education or less, column 3 includes the children of mothers with more than secondary school education, column 4 includes the children of households that are classified as poorest, poorer and middle, column 5 includes the children of households that are classified as richer or richest. All regressions include controls for birth order, dummies of mother age at birth, mother's education, father's education, urban/rural residence, marital status, wealth, child's region of birth and birth year fixed effects. Standard errors that are clustered by region of birth and birth year level are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

TABLE 9. Effect of Financial Crisis on Birthweight: Mother Fixed Effects Models

	Dependent Variable: Birthweight (grams)				
	Panel A: 2001 Crisis				
	(1)	(2)	(3)	(4)	(5)
	All Children	Low Educated Mothers	High Educated Mothers	Poorer Households	Richer Households
2001 Crisis	0.006	0.004	0.013	0.006	0.007
	(0.013)	(0.012)	(0.049)	(0.013)	(0.021)
Observations	7,601	5,900	1,701	4,880	2,721
R^2	0.917	0.918	0.940	0.914	0.940
	Panel B: 2008 Crisis				
2008 Crisis	-0.012	-0.011	-0.006	-0.014	0.007
	(0.019)	(0.019)	(0.040)	(0.019)	(0.039)
Observations	5,992	4,593	1,398	4,194	1,797
R^2	0.895	0.894	0.920	0.891	0.925
	Panel C: 2001 and 2008 Crisis				
2001 and 2008 Crisis	0.001	-0.000	0.009	0.001	0.006
	(0.010)	(0.009)	(0.034)	(0.010)	(0.017)
Observations	8,685	6,707	1,978	5,628	3,057
R^2	0.900	0.899	0.924	0.895	0.925

Notes: In all regressions, the dependent variable is the child's birth weight in grams. Pregnancies lasted less than 7 months are excluded from the regressions. In all panels, column 1 includes all children, column 2 includes the children of mothers with secondary school education or less, column 3 includes the children of mothers with more than secondary school education, column 4 includes the children of households that are classified as poorest, poorer and middle, column 5 includes the children of households that are classified as richer or richest. All regressions include controls for birth order, dummies for mother age at birth, mother fixed effects and child's birth year fixed effects. Panel B controls for regional GDP per capita at child's birth place. Standard errors that are clustered by region and year level are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

TABLE A1. Effect of Financial Crisis on Prenatal Care

	(1)	(2)	(3)	(4)	(5)
	All Children	Low Educated Mothers	High Educated Mothers	Poorer Households	Richer Households
	Dependent Variable: Had Prenatal Doctor Care				
2008 Crisis * GDP Per Capita	0.010**	0.019**	-0.002	0.014	0.011
	(0.005)	(0.009)	(0.011)	(0.012)	(0.007)
Observations	4,952	3,719	1,233	3,344	1,608
R^2	0.076	0.082	0.076	0.077	0.076

Notes: In all regressions, the dependent variable is an indicator for mother's prenatal care utilization during pregnancy. Column 1 includes all children, Column 2 includes the children of mothers with secondary school education or less, Column 3 includes the children of mothers with more than secondary school education, Column 4 includes the children of households that are classified as poorest, poorer and middle, Column 5 includes the children of households that are classified as richer or richest. All regressions include controls for birth order, dummies for mother age at birth, mother's education, father's education, urban/rural residence, marital status, wealth child's region of birth fixed effects, and birth year fixed effects. Standard errors that are clustered by region of birth and birth year level are in parentheses. p<0.01, ** p<0.05, * p<0.1.

TABLE A2. Effect of Financial Crisis on Birth Weight: NUTS2 and NUTS3

	(1)	(2)	(3)	(4)	(5)
	All Children	Low Educated Mothers	High Educated Mothers	Poorer Households	Richer Households
Panel A: NUTS 2 Level Regressions (26 Regions)					
2008 Crisis * GDP	0.003	0.006*	-0.001	0.008**	-0.005
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	3,396	2,549	847	2,343	1,053
R^2	0.064	0.071	0.135	0.067	0.138
Panel B: NUTS 3 Level Regressions (81 Provinces)					
2008 Crisis * GDP	0.004	0.006*	-0.000	0.008**	-0.004
	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
Observations	3,396	2,549	847	2,343	1,053
R^2	0.084	0.094	0.181	0.095	0.182

Notes: In all regressions, the dependent variable is the child's weight in grams. Column 1 includes all children, column 2 only includes the children of mothers with secondary school education or less, column 3 includes the children of mothers with more than secondary school education, column 4 only includes the children of households that are classified as poorest, poorer and middle, column 5 includes the children of households that are classified as richer or richest. All regressions include controls for birth order, dummies for mother age at birth, mother fixed effects, birth year and region of birth fixed effects. Standard errors that are clustered by region of birth and birth year level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

TABLE A3. Validity Test: Mother FE Models

	(1)	(2)	(3)	(4)	(5)
	All Children	Low Educated Mothers	High Educated Mothers	Poorer Households	Richer Households
	Dependent Variable: Had Prenatal Doctor Care				
2001 Crisis	0.010	0.007	0.016	-0.006	0.024
	(0.018)	(0.019)	(0.058)	(0.020)	(0.035)
Observations	7,148	5,553	1,595	4,653	2,495
R^2	0.926	0.927	0.944	0.922	0.952

Notes: In all regressions, the dependent variable is the child's weight in grams. Column 1 includes all children, column 2 only includes the children of mothers with secondary school education or less, column 3 includes the children of mothers with more than secondary school education, column 4 only includes the children of households that are classified as poorest, poorer and middle, column 5 includes the children of households that are classified as richer or richest. All regressions include controls for birth order, dummies for mother age at birth, mother fixed effects, birth year and region of birth fixed effects. Standard errors that are clustered by region of birth and year level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.