In-Utero Rainfall Variability and Birth Weight in the Rural Philippines

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The World Bank Group


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BACKGROUND: “Climate change threatens all countries, with developing countries the most vulnerable. Estimates are that they would bear some 75 to 80 percent of the costs of damages caused by the changing climate.” World Development Report, 2010

THE ECONOMIC ISSUE

• Extreme weather events hamper access to food and healthcare, while also spreading diseases like diarrhea and creating poor sanitary environments. Hence, such events can affect fetal growth, resulting in persistent and latent effects.
• The nine months in-utero can determine several key health outcomes in a person’s life and thus shape the individual’s life path.
• For instance, a large rain shock while an individual is in-utero may lead to a low birth weight, which in turn increases infant mortality rates and infant illness while decreasing learning and lifetime productivity.
• Alderman and Behrman (2006) estimate that reducing the incidence of low birth weight generates approximately $510 of economic productivity.

MOTIVATION

1. 60% of the Philippine population lives in coastal areas, which are prone to typhoons.
2. The IPCC noted that the Philippines is among the top 10 countries worldwide at risk for both climate change and disasters.
3. Forecasts on climate change predict an increase in average annual precipitations for the Philippines, coupled with an increase in variability within the year, with wetter wet seasons and dryer dry seasons.
4. The nine months in-utero can determine several key health outcomes in a person’s life and thus shape the individual’s life path.
5. The IPCC noted that the Philippines is among the top 10 countries worldwide at risk for both climate change and disasters.

CONTRIBUTIONS OF THIS PAPER

1. This is one of few analyses of the impact of birth weight in a middle-income context like the Philippines, and is unique in its focus on routine weather variability, rather than on a natural disaster.
2. We use mother fixed effects to control for the impact of the mother’s health endowment on birth weight, which several previous papers have struggled to accomplish, given observational household data.
3. This paper is the first to examine distributional variation in the relationship between rainfall and birth weight using the Unconditional Quantile Regression estimator.

RESEARCH QUESTION

What is the impact of increased variability in in-utero rainfall on birth weight in the rural Philippines?

EMPIRICAL ANALYSIS

1. We match historical data from every rainfall station in the Philippines to births recorded in the 2003 and 2008 Philippine National Demographic and Health Surveys.
2. Using municipality and mother fixed-effects, we estimate the impact of variability in rainfall in the nine months before a child’s birth, as measured by standard deviations from monthly historical patterns, on the child’s birth weight.
3. Then, we use the barangay (community) censuses of 2000 and 2007 to estimate the relationship between having a hospital in the barangay and the impact of rainfall shocks on birth weight.
4. Finally, recognizing the heterogeneous impact of rainfall on birth weights, we also use Unconditional Quantile Regressions (Firpo et al., 2009) to study the varying effects of weather shocks on birth weight.

RESULTS

1. Without controlling for barangay or mother fixed effects, large positive shocks in rainfall appear to increase birth weight.
2. However, after we control for barangay or mother fixed effects, we find no significant relationship between rainfall and birth weight.
3. Although insignificant, the coefficient estimate on rainfall in the mother-fixed effect specification is negative, suggesting that large positive shocks may in fact reduce birth weight.
4. Unconditional quantile regressions tell us that while large positive shocks are uniformly bad for birth weight, such deviations have the greatest marginal effect on children at the lowest end of the distribution.
5. Thus, our results highlight the complicated relationship between rainfall variability and birth weight, particularly at observed levels of weather variability.

CAVEATS AND IMPLICATIONS

• These findings are comforting from a climate-change perspective, since they suggest that marginal increases in the variability of the level of rainfall are not likely to affect the initial health endowments of newborn children.
• The findings, however, underlie the particular vulnerability of the poor to extreme weather events, and emphasize the importance of policy interventions protecting these households.
• However, two major caveats are in order here:
  • First, although the years covered in our study are representative of the types of shocks experienced by households in the Philippines, it is quite likely that the number of births sampled by the DHS in the exact areas where the typhoons hit may be too small to influence the estimates obtained for rural areas at the national level.
  • Second, our analysis is concerned with changes in the variability in the level of rainfall over the nine months of pregnancy. It is quite possible that it is the timing, rather than the level of the rainfall, during the nine months of pregnancy that may have an impact of child birth weight.

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Table 1: Distribution of Rainfall Shocks in Rural Areas and Births in DHS, 2003 and 2008

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