The Impacts of Hurricane Mitch on Child Health: Evidence from Nicaragua

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1. Introduction

Individuals in both developing and developed countries are subject to transitory shocks, whether they are manmade or natural disasters. When such events reduce consumption, as in cases where households are unable to fully insure against them, they lead to welfare losses (Skoufias, 2003; Dercon, 2005). Child malnutrition is a case in point of such welfare loss, and there is ample evidence that disasters had significant nutritional impacts on children (Behrman, Alderman, and Hoddinott, 2004). However, implication of such losses, from a policy standpoint, depends partly on whether they result in long-term consequences. Studies have shown that malnutrition in early childhood can lead to lower human capital, in both health and education, which causes losses in lifetime earnings and welfare (Alderman, Hoddinott, and Kinsey, 2003).

Such disaster took place in Nicaragua in November 1998 with Hurricane Mitch, causing economic damage of more than US$1 billion, represented by a loss of 50 percent of the total annual bean crop, 20 percent of the maize crop, and 30 percent of the rice crop (WFP, 2000).[1] The purpose of this paper, therefore, is to estimate the impacts of Hurricane Mitch on child health measured in height-for-age z-scores.

[1] In nearby Honduras, studies indicate that children 5 years and below of the resettled families were still confronting a nutritional crisis in July and August of 1999, some 9 months after the hurricane struck (Barrios et al., 2000).

Especially, we focus on children who were younger than 2.5 years old at the time of Hurricane Mitch because the previous studies show that children under two to three years old are especially vulnerable to shocks that older children (Behrman, Alderman, and Hoddinott, 2004). We use two Living Standard Measurement Surveys of the World Bank conducted in 1998 and 2001, before and after Hurricane Mitch in November 1998. We divide the children under 5 into two groups, younger and older than 2.5 years old, in the two surveys, and estimate determinants of HAZ score and stunting in the pooled cross section models. In the pooled cross section models, we identify the impacts of the Hurricane Mitch by using the interaction term between the age and year dummies.

2. Literature Review

Previous studies show that children are especially vulnerable to shocks in their first two to three years of life, and there are several potential reasons for this observation (Martorell, 1999; Behrman, Alderman, and Hoddinott, 2004). First, the growth rate is the highest in infancy, thus adverse factors have a greater potential for causing retardation at this time. Second, younger children have higher nutritional requirements per kg of their body weight and are also more susceptible to infections. Third, they are also less able to make their needs known and are more vulnerable to the effects of poor care practices. Hoddinott and Kinsey (2001), for instance, have found that children aged 12 to 24 months have lost 1.5-2cm of growth in the aftermath of droughts in Zimbabwe in 1994 and 1995, although they did not find a similar negative loss among older children. Yamano, Alderman, and Christiaensen (2005) also find a negative shock on child growth in height only among children aged 6 to 24 months, not older children.

3. Data and Method

The data for this analysis come from two rounds of questionnaires compiled by the World Bank's Living Standard Measurement Surveys.[2] We transfer the height to height-for-age z-scores (HAZ) by using EpiNut software for all children aged 6 to 60 months to improve the data interpretation.[3] Computed z-scores were evaluated for biological plausibility using criteria established by the World Health Organization.[4] The final samples are 2,701 children in 1998 and 2,454 children in 2001.

By pooling the two LSMS surveys, which cover both the pre and post Hurricane Mitch periods, we can estimate the pooled cross-section model. First, we

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2 The 2001 survey covers the 1998 sample households as base samples. Thus, in principle, it is possible to match the same children covered in the both surveys, but it turned out to be difficult because of missing reliable individual ids. Thus, in this paper, we estimate the pooled cross section model, in stead of the individual fixed effects model.

3 We exclude children aged below 6 months since the height measurements of babies younger than 6 months may contain large errors.

4 HAZ scores under and above 8 standard deviations were excluded.

stratify the children into two groups by their age: children younger and older than 30 months. Because young children are considered vulnerable to economic shocks, children in the younger age group in 1998 might have suffered from negative economic shocks created by Hurricane Mitch in November 1998. Such negative shocks could have left a permanent reduction in their height and could be measurable in the 2001 survey when they are in the older age group. In figure 1, for instance, we present the smoothed average HAZ score for each age in moths, separately for 1998 and 2001. The two lines suggest that the average z-score of children who were younger than 30 months is low in 2001 when they become older than 30 months. In Table 1, we present average HAZ scores and percentages of stunting of the two age groups across years.

To identify the HAZ score of the Mitch cohort in 2001 in the pooled cross-section model, we include an interaction term between the age dummy for the older group and the 2001 year dummy:

$$HAZ_{it} = \beta_M \, Old_{it} + \beta_Y \, Y2001_t + \delta \, (Old_{it} \times Y2001_t) + \phi X_{it} + e_{it} \qquad (1)$$

The dependent variable is the HAZ_{it} score for child i at time t; Old_{it} is a dummy variable for children aged 30 to 60 months; *Y2000* is a dummy variable for year 2001; and X_{it} is a set of child and household characteristics. Thus, the estimated coefficient, δ, of the interaction term identifies the difference in the HAZ score between the young and old age groups across years, and it is called the difference-in-differences estimator.

In addition to the HAZ model, we also estimate the stunting model by using the specification in (1) but by using Probit model because the dependent variable is a dummy variable for stunting, which is defined as the HAZ score being below -2. Thus, the stunting model can be specified as:

$$Porb(HAZ_{it} < -2) = \beta_M \ Old_{it} + \beta_Y \ Y2001_t + \delta (Old_{it} \times Y2001_t) + \phi X_{it} + e_{it} \quad (2)$$

To control for child characteristics, X_{it}, we include a gender dummy for boys, and age and its squared term. To control for household characteristics, X_{it}, we include the per capita expenditure in natural log, numbers of male and female adults in the household, and education dummies for the most educated male and female adults. We take the information of the most educated male and female adults in the household, as opposed to the education of the parents, to capture the potential intra-household externalities from education. We classify the education variable into three categories: zero to completion of primary school (Level 1), completion of middle school (Level 2), and above (Level 3).

4. Estimation Results

The results in Table 2 indicate that the HAZ score of the older age cohort in 1998 is 0.4 points higher than the younger age cohort in 1998. However in general the HAZ score is 0.3 points lower in 2001 than in 1998, and especially the old age cohort, the Mitch cohort, has 0.35 score lower than expected in 2001. We interpret the results as that the Hurricane Mitch has contributed to the low HAZ score among the Mitch cohort, although there could be other factors that have contributed to it. Turning to the probability of stunting, we find a consistent result: the probability of stunting is about 6.6 percent higher than expected among the Mitch cohort, after controlling for the age and year effects as long as other observed characteristics included in the model.

5. Conclusion

Using two nationally representative surveys conducted during in 1998 and 2001, we find that children who experienced Hurricane Mitch when they were younger than 2.5 years old have 0.35 points lower HAZ-scores and have 6.6 percent higher probability of stunting than expected in 2001, more than two years after experiencing the Hurricane Mitch. The result is consistent with earlier studies which indicate that children aged 2 to 3 years old are vulnerable to economic shocks. The results indicate the importance of safety nets programs to mitigate negative impacts on child health in their early childhood because negative shocks on them could remain permanently and result in poor human capital and economic capacity in their adulthood.

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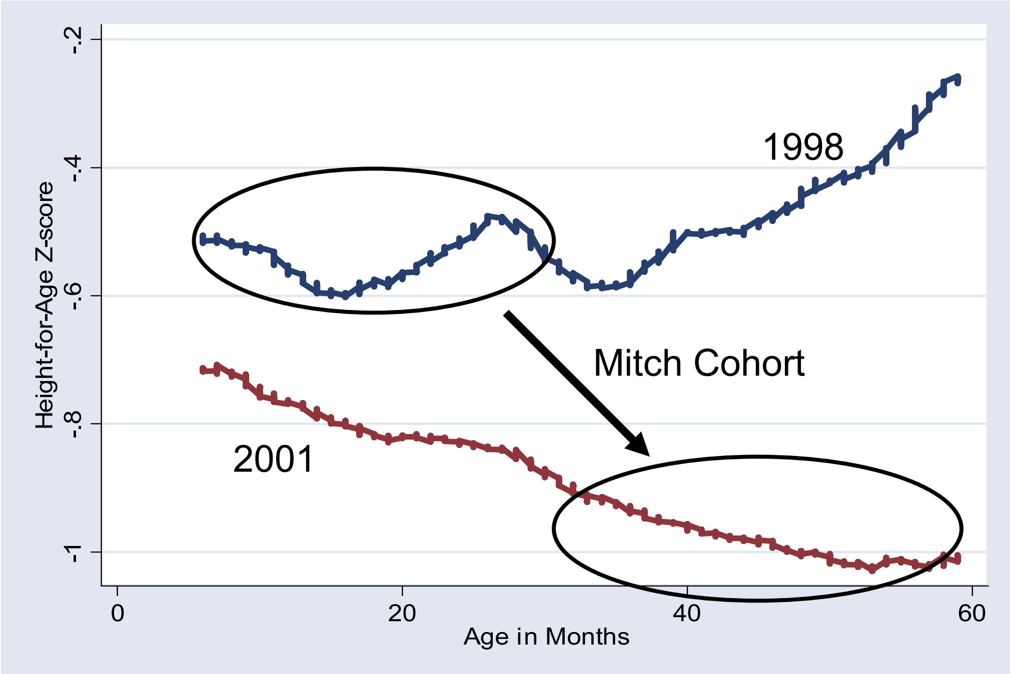

Figure 1. Height-for-Age Z-score in Nicaragua in 1998 and 2001

Table 1. HAZ-score and Stunting by Hurricane Mitch Status

	1998 (A)	2001 (B)	Difference 2001-1998 (C)
HAZ Score			
Age: 6 to 29 months	-0.513	-0.722	-0.209
	(1.594)	(1.292)	[3.38] **
Age: 30 to 60 months	-0.420	-1.017	-0.597
	(1.520)	(1.223)	[11.6] **
Stunting			
Age: 6 to 29 months	0.150	0.128	-0.022
	(0.357)	(.335)	[1.45]
Age: 30 to 60 months	0.142	0.391	0.249
	(0.349)	(0.013)	[3.39] **

Note: ** (*) indicates the 1 (5) percent level significance.

Table 2. Impacts of Hurricane Mitch on Height-for-Age and Stunting in Nicaragua (Pooled Cross Section Model)

	HAZ (OLS)	Stunting (Probit)
	(A)	(B)
Hurricane Mitch		
Aged 30 months or older (=1)	0.404	-0.060
	(4.81)**	(2.82)**
Year 2001 (=1)	-0.312	-0.002
	(5.55)**	(0.13)
DID Estimator: δ (=1)	-0.352	0.066
	(4.76)**	(3.24)**
Child Characteristics		
Boys (=1)	-0.157	0.045
	(4.27)**	(4.88)**
Age in months	-0.062	0.009
	(9.28)**	(4.93)**
Age squared	0.001	-0.000
	(9.09)**	(4.71)**
Household Characteristics		
ln (Consumption Expenditure)	0.522	-0.109
	(15.93)**	(12.28)**
Number of male adults	0.013	-0.002
	(0.54)	(0.40)
Number of female adults	-0.022	0.006
	(0.86)	(0.89)
Male education (level=2)	-0.070	0.004
	(1.46)	(0.38)
Male education (level=3)	0.021	0.001
	(0.34)	(0.05)
Female education (level=2)	0.062	-0.013
	(1.27)	(1.11)
Female education (level=3)	0.339	-0.054
	(5.32)**	(3.49)**
16 Department Dummies		
Constant	-4.227	5,101
	(14.45)**	
Observations	5,101	2,194
R-squared	0.18	0.15

Note: * (**) 10 (1) percent significance level. Coefficients in Column B are marginal probability changes.