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# Impacts of Typhoons on Children's Human Capital Investments in Filipino Households

Key Words: *typhoons, Philippines, breastfeeding, human capital investments*

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Abstract: Typhoons are a unique type of natural disaster affecting both developing and developed countries, causing both short and long-term destruction. Typhoons are random both in intensity and frequency, making them difficult to predict their strength and when they will strike. With global climate change, typhoons are expected to increase in both frequency and magnitude, making it important to understand their impacts. This study uses DHS data from the Philippines and a unique Filipino typhoon data set covering the years 1989-2008 to explore how typhoons affect household allocation of basic human capital investments, such as breastfeeding duration. Using OLS estimation and a distributed lag model, I find that children are significantly breastfed about 4.8 months less on average in the year following a storm. This effect is mostly seen in lower socioeconomic households, suggesting that loss of income and adaptive behaviors of wealthier households are channels for these allocation decisions. No apparent gender differences were observed.

# 1. Introduction

Natural disasters are a global problem for both developed and developing countries with it being notably more difficult to fully recover from these disasters for less developed countries. One type of natural disaster that causes serious short and long term destruction is typhoons. The Philippines, an island country located in the Pacific Rim, experiences about 10 typhoons a year and is the most exposed country in the world to these tropical storms. The most recent of these calamities, Typhoon Haiyan, occurred in November 2013, where 5,209 people died, 1,611 people are still missing, 4.3 million people have been displaced from their homes with 1 million of those being children, and an estimated \$288 million worth of damages incurred from the storm (Smith, NBC World News). This extreme example of devastation isn't uncommon in the Philippines. Another large-scale typhoon, Typhoon Bopha, hit the southern part of the Philippines in December 2012, causing similar structural devastation and loss of life. Fatalities and property damage are only a few of the immediate impacts of typhoons. Natural disasters have long term effects as well, including reduction in children's health or schooling investments, increased negative in utero impacts (pre-term births and low birth weights), and lower GDP for the entire country (Datar, Liu, Linnemayr, & Stecher, 2011). In particular, the question of how essential human capital investments, like breastfeeding, for children are impacted due to typhoons is important because it affects both present and later-life education, health, and economic success. Also, with global climate change, typhoon exposure is expected to increase in both frequency and intensity, therefore an understanding of how damaging these storms are can help people adapt and prevent some of the negative impacts of typhoons.

Anttila-Hughes and Hsiang (2013) have documented the economic impacts of typhoons for Filipino households, in particular how households are being affected a year after a storm. Reductions in expenditures because of income loss occurred mostly in human capital investments, such as medicine, education, and high nutrient foods. They also show that one year after typhoon exposure, infant mortality rose with a majority of the infant deaths being female. These female deaths are an underlying source of motivation for this research: gaining a better understanding on the potential mechanism for why these deaths are occurring and to develop policies in order to prevent these outcomes. Ergo, this research seeks to answer the question how do typhoons impact intra-household resource allocation of health investments among children. We also want to further our understanding of how breastfeeding practices differ amongst sons and daughters after a natural

disaster, especially in a society where gender inequality is negligible. Lastly, we aim to learn which households are the most vulnerable to these storm shocks and are more likely to reduce health investments as a coping mechanism.

As a proxy for health investments, this study will use breastfeeding duration since it is a basic but critical investment for the development of young children (Kramer, 2008). Exclusive breastfeeding for children is recommended for the first six months of life continuing until the child is one year old. Yet, only one-third of Filipino children are exclusively breastfed under six months of age (DHS, 2009). I utilize the Demographic and Health Surveys (DHS) that were conducted in the Philippines between 1993 and 2008 to construct a panel data set in order to specifically examine factors that influence breastfeeding behaviors for children under the age of five between 1989-2008. Specifically, the duration, in months, that a mother breastfeeds her child is recorded with the DHS. Twins and children born to migrant mothers were excluded from the sample following practices from previous research. The DHS data was merged with a comprehensive typhoon data set (Hsiang, 2010) in order to match typhoon exposure with children's health outcomes in the Philippines for every year between 1989-2008. Within the typhoon data set, maximum wind speed, precipitation, and temperature measures were recorded for each storm.

The analytical approach I utilize to empirically identify the impact of typhoons on breastfeeding behavior is standard OLS estimation and a distributed lag model with year and region fixed effects. Through this approach I am able to estimate, on average, how many months breastfeeding duration is reduced one year after exposure to a typhoon. I also use this method to estimate gender differences in resource allocation of health investments (breastfeeding duration) within Filipino households by stratifying the sample by gender. The main results of this research indicate that in the year following a typhoon children are significantly breastfed less on average. Specifically, breastfeeding is reduced by 4.8 months. Also, children in lower socioeconomic spheres are more likely to be affected than those born into wealthier households. No pronounced gender differentials were observed.

The rest of the paper will be organized as follows: Section 2 is a review of the current and relative literature. Section 3 identifies the data and the empirical strategy for analyzing the data. Section 4 discusses the empirical model and the results obtained from the model. Section 5 presents a summary of robustness checks for the main analyses. Sections 6 and 7 conclude the paper with a

final discussion of the results, limitations of the research, suggestions for future research, and policy implications.

## 2. Literature Review

### *2.1 Breastfeeding: An Important Human Capital Investment*

Proper health care investments for children are important to improve later life outcomes. There are critical and sensitive periods in the development of the child where some skills or traits are more readily acquired at certain stages than other traits (Cunha & Heckman, 2007). This suggests that poor health during childhood is a potentially important indicator of future education and economic status because poor child health likely affects future health and therefore productivity (Currie, 2008). These negative health and economic outcomes are also negatively associated for future generations (Almond and Currie, 2010).

Child health care investments include vaccinating children, providing necessary vitamin supplements, and breastfeeding. Breastfeeding is extremely important for young children because of the nutrients found in breast milk. These nutrients help reduce infant morbidity and have also been shown to have small cognitive benefits and increase motor development (Dewey, Cohen, Brown, and Rivera, 2001). These essential nutrients aren't found in breast milk substitutes nor does formula contain the antibodies that protect infants against diseases (UNICEF, 2011). Exclusive and partial breastfeeding is also associated with enhanced child growth, reduced diarrhea morbidity and under-5 infant mortality rates (Liu, Mroz, and Adair, 2009; WHO, 2009). Compared to children who were formula fed, breastfed infants experience less severe cases of diarrhea, bronchitis, and meningitis and have a lower risk of child disability (Ball and Bennett, 2001; Wehby, 2014). Similarly, Kramer et al (2008) in a clustered randomized controlled trial showed that exclusive breastfeeding was strongly and positively associated with better child cognitive development, higher IQ scores and academic performance. Smith, Durkin, Hinton, Bellinger, and Kuhn (2003) find that children who are breastfed compared with children who were never breastfed have higher intellectual functioning, visual-spatial skills, visual-motor skills and verbal abilities. These findings lend support to the significant long term benefits of child cognitive development gained from breastfeeding.

Not only is breastfeeding important for a child's health it also contributes to the well-being of the mother. Women who breastfeed their children are less susceptible to developing ovarian

cancer and bone demineralization (Ball & Bennett, 2001). Because of these health benefits and its accessibility and affordability, breastfeeding is a cost-effective investment that parents can make for their children.

## *2.2 Breastfeeding and Household Resource Allocation*

There are various reasons why households choose to allocate health resources differently among children. As with many aspects in life, human capital investments come with trade-offs. These include quantity-quality decisions, responding to the physical development of children, son biased preferences, or mothers' labor participation. In most households constrained by a budget, the number of children affects the amount of quality investments the child receives. This creates a unique dynamic between quantity vs. quality that has implications across different types of investments and later-life outcomes. The most influential discussions on the theory behind the quantity-quality trade-off come from Becker (1960), Becker and Lewis (1974), and Becker and Tomes (1976). In the same manner that consumer goods have varying levels of quality, so do children, with "higher quality" children being more expensive. Children are categorized as being normal goods and close substitutes; meaning that families with excess children would spend less on the quality of each child than other families with equal income and tastes. It is assumed that parents care about the quality of their children's human capital, therefore they have to make investment decisions that can take the form of goods and time, such as breastfeeding duration (Rosales, 2013). In a different approach to the quantity-quality trade-off, Cunha and Heckman (2007) create a model where skill formation develops through investments and occurs in multiple stages of childhood. This model stresses that parental influences are key for child development. Children possess a vector of abilities (cognitive and noncognitive) at each age where inputs or investments at each stage or period produces outputs in subsequent stages. Current investments create a dynamic complementarity with investments in other periods, meaning that skills or abilities acquired in a previous period make investment in the current period more productive for the child. Because of this dynamic complementarity, detrimental effects in one stage may aggregate over numerous stages decreasing the future productivity of that child.

Empirically we see investment behaviors being a combination of both the quantity-quality trade-off and the dynamic complementary models. Liu et al (2009) examined parental compensatory behaviors for young children in the Filipino region of Cebu. They found that Cebu parents altered

their behavior in response to their children's early health outcomes. For example, mothers breastfed low birth weight children on average longer than children who were not low birth weight. Another factor affecting investment decisions may come from the health of the mother. Mothers may not be healthy enough to breastfeed their children due to pregnancy complications or poor nutrition. Natural disaster impacts, such as a flood contaminating the water supply, also affect maternal health by increasing risk of disease. This would lead to a decrease in the duration of breastfeeding for the child (Rosales, 2013). Lastly, the fertility-stopping hypothesis predicts that breastfeeding duration increases with birth order (Jayachandran & Kuziemko, 2009). This means that mothers who want more children will breastfeed the current child for a shorter amount of time in order to minimize the reduction in fertility caused by breastfeeding. The fertility-stopping hypothesis may have a strong presence in the Philippines because a large proportion of births take place after a short birth interval, which has negative implications for maternal and child health and survival (DHS, 2009).

### *2.3 Gender, Breastfeeding, and Household Resource Allocation*

In the gender literature, there have been numerous studies examining son-biased preferences, meaning that households allocate more resources to sons rather than to daughters because of the belief that investments in sons have higher returns. Leung and Zhang (2008) develop a model examining health investments and gender preferences. Their model suggests conflicting effects on the level of parents' investments in sons and daughters when there is a rise in the sex ratio. Overall, parental investment will increase as parents' preference becomes son-biased, which could lead to rise in the sex-ratio (more males than females). The sex-ratio may appear due to decreased daughter health investments, but it's also possible even in the presence of a rise in the sex-ratio that health investments for daughters will also increase. This occurs because of a positive spillover effect of son-biased parental investments. If parents prefer to invest in sons, they receive higher health investments than daughters, but how they affect investments for daughters, either positively or negatively, depends on whether health investments are viewed as strategic complements or strategic substitutes. Health investments viewed as strategic complements will increase daughter investments, while health investments viewed as strategic substitutes will decrease daughter investments. Breastfeeding as a health investment is an interesting anomaly when examining it simultaneously with an income shock. The income effect implies that mothers would be able to spend less time breastfeeding their children because they need to increase work to supplement the loss. But the substitution effect implies that breastfeeding is cheaper because it's free (Rosales, 2013).

When empirically examining son-biased preferences, Barcellos, Carvalho, and Lleras-Muney (2011) examined son-biased preferences for different health investments in India and found that sons receive significantly more childcare time and are more likely to be breastfed longer compared to daughters. Similarly, preference for having a future son can contribute to a gender difference in breastfeeding for the current child because breastfeeding can affect future fertility (Jayachandran & Kuziemko, 2009). Jayachandran & Kuziemko (2009) also examined breastfeeding behavior in India and saw that the youngest child is breastfed longer than the oldest sibling, sons are breastfed longer than daughters, and having older brothers also significantly increases how long a child is breastfed.

#### *2.4 Natural Disasters*

Extreme weather events, such as typhoons, droughts, floods, also have influential human capital investment impacts. Anttila-Hughes & Hsiang (2013) documented the economic impacts of typhoons for Filipino households. Income loss a year after typhoon exposure was matched with a reduction of household expenditures, which decreased by 7.1% for the average Filipino household in the average year. This reduction in expenditures occurred mostly in human capital investments, such as medicine, education, and high nutrient foods. All of the affected investments are particularly important for the healthy development of young children. Household health outcomes were examined using infant mortality and it was found that typhoons cause infant mortality to rise one year after a typhoon and that a majority of these infant deaths are female. These negative household health outcomes, especially for female infants, coupled with the reductions in human investments suggests that the negative economic impacts from typhoons are causing households to allocate human capital resources differently among children following a typhoon in the Philippines. Similarly, Baez and Santos (2007) found that natural disasters have a large and negative effect on children's nutritional status. Specifically, children were twice as likely to be undernourished due to being exposed to a hurricane. On the other hand, there is some evidence that suggests that families can maintain a critical level of health investments for children by shifting spending away from other goods or investments. After examining evidence from a Super Typhoon that hit the Filipino island of Cebu, Deuchert and Felfe (2013) found no decline in objective or subjective health investments for children; affected human capital investments pertained more towards decreases in education.

Lastly, Rosales (2013) investigates the impacts of El Niño floods on human capital investments in Ecuador. She examined impacts on both exclusive and total breastfeeding duration as



the disruption in early environment caused by a negative shock can alter parental investments for children. This study finds that for each additional month of exposure to floods, average exclusive breastfeeding declines by -0.06 months for children under 2 years of age. Interestingly, Rosales (2013) saw an increase in the duration of total breastfeeding. Mothers adapted to the income shock by introducing solid foods and formula earlier to children, but not stopping breastfeeding altogether. Although this study is progressive in the breastfeeding and natural disaster literature, it does not break down exclusive and total breastfeeding duration by child gender to compare differences between male and female children.

Much of the previous research regarding breastfeeding decisions comes from the gender literature and takes place in societies where son-biased preferences are prominent. Many studies do not take into account impacts of natural disasters and if they do, they are short-term, observational or case studies. Also, health investments are examined through other proxies, like vaccinations, which may not be the most reliable, or height for age and weight for age measures that are influenced by various factors that can be difficult to control. This research contributes to the previous literature on gender differential breastfeeding practices but in a gender equal society. It also contributes to the growing body of literature on natural disasters and health investments, specifically examining impacts of typhoons on breastfeeding behavior, which has not been thoroughly researched. All types of natural disasters are expected to increase in frequency and intensity; it is imperative that we understand both long and short term consequences and discover ways to attenuate their damages, especially when it revolves around the health of children.

### 3. Data

#### *3.1 Demographic and Health Surveys*

The Demographic and Health Surveys (DHS) are cross-sectional surveys conducted in the Philippines every five years. The surveys are conducted as a joint effort between USAID and the Philippines National Statistic Office (NSO). Currently, there are four rounds of DHS data from 1993, 1998, 2003, and 2008 with the fifth round being completed in 2013. The surveys are highly standardized allowing them to be used within a country over time and are representative at both the national and regional level of the Philippines. The DHS surveys interview randomly selected households throughout the Philippines asking questions regarding demographic and socioeconomic characteristics of households, maternal health related questions, and child health related questions.

More specifically, the survey gathers information on fertility levels, marriage characteristics, fertility preferences, use of family planning methods, breastfeeding practices, nutritional status of women and young children, childhood mortality, and other basic maternal and child health components.

This research will only use the first four rounds of the survey, covering the period between 1993-2008, in which women between the ages of 15-49 were interviewed. After all of the data has been collected, the surveys are subsequently divided into a “women’s recode” and a “children’s recode”. I utilize the children’s recode to construct a panel data set to specifically examine factors influencing breastfeeding behaviors. In the children’s recode, there is one entry for every child of an interviewed woman that was born within the previous five years. Survey questions regarding duration of breastfeeding, birth intervals, maternal health and socioeconomic characteristics will be examined for this analysis. When all four rounds of the DHS surveys are merged, a sample of 30,995 children are included in the data set before sample restrictions are introduced. Following Anttila-Hughes & Hsiang (2013) and Jayachandran & Kuziemko (2009), children born to migrant mothers and multiple birth children (i.e. twins) are excluded from the sample, leaving the data set with 11,688 observations. Breastfeeding duration is measured in months and the average duration of breastfeeding is 24 months or 2 years for the combined data set. Refer to Table 1A for DHS summary statistics.

### *3.2 Typhoon Data*

A comprehensive data set regarding typhoon behavior in the Philippines was also used. This data set was taken from Hsiang (2010). In this data set, the Limited Information Cyclone Reconstruction and Integration for Climate and Economics (LICRICE) model was used to reconstruct wind fields for 2,246 storms that were recorded between 1950-2008. In order to match typhoon exposure with children’s health outcomes, a single observation of typhoon exposure was generated for every location in the Philippines for every year between 1989-2008 and the maximum wind speed was averaged within an administrative unit to create annual typhoon exposure for provinces and regions. This statistic is referred to as wind speed and is measured in the units of meters per second (or 2.24 miles per hour). During the period that corresponds with the DHS surveys (1989-2008), the average region was exposed to maximum wind speeds of 16.99 m/s. Refer to Table 1B for typhoon exposure summary statistics for the Philippines and for each region.

## 4. Methodology

### *4.1 Identification Strategy*

I apply an OLS regression to empirically estimate the impact of typhoons on breastfeeding behavior. Only observing breastfeeding duration for infants in different households creates an endogeneity problem, as some children may receive higher levels of investment based on their gender, household income, birth order, or interval of time between siblings. Typhoon exposure is considered exogenous because in nature it is fundamentally random. This randomness arises because storm formation and storm trajectory are indiscriminate. Anttila-Hughes & Hsiang (2013) demonstrate that there is strong variation in typhoon exposure year-to-year in individual provinces and between provinces within the Philippines, allowing us to use typhoon exposure as being an exogenous source of variation in our identification strategy. Although typhoons occur annually, they are still considered rare and unpredictable events. It could be argued that storm exposure isn't completely exogenous because households could choose to live in places based on seasonal typhoon forecasts. Previous literature (Palmer and Ralsanen, 2002 and Carmargo, Barnston, Klotzbach, and Landsea, 2007) discuss that forecasting location-specific seasonal risk to typhoons has almost no predictive power and the currently developed models lack ability in predicting impacts at the city or county level. The best models can only predict typhoon risk a few days prior to a storm. Therefore, it can be assumed that households aren't choosing to live in certain locations based on seasonal typhoon forecasts, as their accuracy is not reliable. Also, the sample has been restricted to children of non-migrant mothers, meaning that households haven't recently relocated due to past exposure to or beliefs about typhoons. We are able to distinguish non-migrant mothers from migrant mothers because the DHS specifically asks the woman if "she has ever moved". Restricting the sample to non-migrant mothers also allows us to directly avoid any type of sorting behavior (Anttila-Hughes & Hsiang, 2013). The constructed DHS panel allows specific children to be followed over time because they are each given a unique identification number. Therefore, there are no compositional changes in the DHS driven by typhoon exposure during a child's life. The final sample doesn't include "multiple birth" children (e.g. twins). Multiple births are excluded because birth order is difficult to establish in multiple birth cases and duration of being breastfed might systematically differ than in single birth cases (Jayachandran & Kuziemko, 2009). Therefore typhoons are random conditional on the location of housing for families and on the fixed effects that are used in the empirical model (region and year fixed effects).

Another strategy for identifying the impact of typhoons on breastfeeding behavior will be modeled after Barcellos et al (2011) who rely on the assumption that in the absence of sex-selective abortion, the gender of the child is random at birth for children that are “young” enough. The absence of sex-selective abortion can be applied in the Philippines context for all rounds of the DHS because abortion is currently illegal in the Philippines. This assumption allows families to look identical and any gender differences in inputs (breastfeeding duration) can be attributed to an underlying “son-preference bias”. This occurs because in many cases boys and girls live in families with different observed and unobserved characteristics. For example, girls on average have more siblings than boys (Barcellos et al 2011). If family size were just controlled for in the model, the assumed son-biased stopping rules would cause systematic issues. Son-biased stopping occurs when families stop having children when they have a boy. Therefore girls would be in families that want girls more than other families and child gender would not be exogenous. Barcellos et al (2011) show that the assumption that gender is as good as “randomly assigned” among the youngest children 15 months and younger using India’s DHS data. Therefore, a restricted sample of children 2 years and younger will be examined as an alternative method to estimate gender differences in resource allocation within households.

#### *4.2 Empirical Model*

In order to examine the relationship between typhoon exposure and breastfeeding duration, a simple ordinary least squares regression was developed. This model estimates the probability that increased typhoon exposure through higher wind speeds will reduce breastfeeding duration. The simple model is:

$$Z_{krt} = \alpha W_{rt} + \beta T_{rt} + \gamma R_{rt} + \varepsilon_{krt} \quad (1)$$

Where k indexes a non-twin child under the age of five born to a non-migrant mother. Here, Z is the duration in months that a woman reported breastfeeding her child, W is typhoon wind speed, T is temperature, and R is rainfall in region r at time t.

Equation (1) was expanded in order to clearly identify the full impacts of typhoon exposure on breastfeeding. Because we have data on typhoon exposure for every year from 1989-2008, a distributed lag model was formed. The distributed lag model allows us to estimate the affect typhoon exposure has on breastfeeding duration the year of a child’s birth and the subsequent four years.

The distributed lag model is:

$$Z_{kjrt} = \sum_{L=0}^4 [\alpha_L W_{r,t-L} + \beta_L T_{r,t-L} + \gamma_L R_{r,t-L}] + \tau_t + \mu_r + \zeta X_h + \delta M_{jrt} + \varepsilon_{kjrt} \quad (2)$$

Where k indexes the child, r indexes region, t indexes year, and j indexes mother. In this model, W is typhoon wind speed (level of typhoon exposure). As mentioned above, lags are included to examine the effect of typhoon exposure for the four years after a storm hits a region and are indexed by L. Our primary outcome of interest will be the t-1 lag for W, wind speed, which indicates the impacts on child's breastfeeding duration one year after typhoon exposure. Controls for temperature and precipitation were again included in this model.<sup>1</sup> Specific mother characteristics, such as age and education, and other household characteristics such as living in a rural or urban area are also included in the regression as control variables. Some household characteristics such as household size or the total number of children in a family may seem like good variables to control for in the model as they impact breastfeeding duration decisions. But, they are excluded from the model because they may be endogenously related to typhoons and there is no way to tease out their impacts.<sup>2</sup>

In this model, region and year fixed effects are included to control for any time invariant region or year specific unobservable characteristics regarding typhoon exposure. More specifically, they are included in the model in order to control for time trends and eliminate any unobserved time invariant typhoon exposure effects that could be correlated with breastfeeding practices, which could confound identification (Datar et al, 2011). These fixed effects allow for a more precise estimation of duration of breastfeeding for each child.<sup>3</sup> The standard errors are clustered at the region, survey-year level in order to account for the fact that all children in a region are coded as receiving the same typhoon exposure and to account for any serial correlation within or between children in the same region and during the same round of the survey. In order to test for gender bias, breastfeeding duration was examined separately for males and females. Refer to Table 1 in the appendix to see the progression of the model specification.

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<sup>1</sup> Regressions were run without the temperature and precipitation controls and no apparent differences were observed between estimations with temperature and precipitation included.

<sup>2</sup> Regressions were estimated with and without the endogenous control variables and no differences were seen in the estimations.

<sup>3</sup> Clustered fixed effects were also used in place of region fixed effects. With the clustered fixed effects estimations, the coefficient for breastfeeding for both males and females in the year one lag remained negative and significant. Also, the magnitudes of the coefficients did not notably decrease.

### 4.3 Hypotheses

Using the expanded empirical model (equation 2), I am able to test two hypotheses that examine the relationship between typhoon exposure and breastfeeding duration. The primary hypothesis is tested as follows:

$H_0$ : There is no significant difference in breastfeeding duration one year after typhoon exposure.

$H_1$ : There is a significant reduction in breastfeeding duration one year after typhoon exposure.

The secondary hypothesis is tested as follows:

$H_0$ : Females are significantly breastfed the same or more in the year after typhoon exposure.

$H_1$ : Female children are significantly breastfed less one year after typhoon exposure.

To examine different subpopulations in regards to breastfeeding behavior, Equation (2) was manipulated according to different subgroups. Following Barcellos et al. (2011), the first subpopulation explored was breastfeeding duration for children under 2 years of age (e.g. children who are “young enough”). The overall sample was also stratified by mother’s education attainment. Finally, the variable initiation of breastfeeding was created to further explore at what point does breastfeeding behavior change due to typhoons. According to the World Health Organization, children should be first breastfed within the first hour of giving birth. Therefore, four categories of initiating breastfeeding were created- immediate (within the first hour of birth), beginning within one day, beginning within one week, and beginning within one month- to explore this facet of breastfeeding.

## 5. Data Analysis

### 5.1 Sample Description

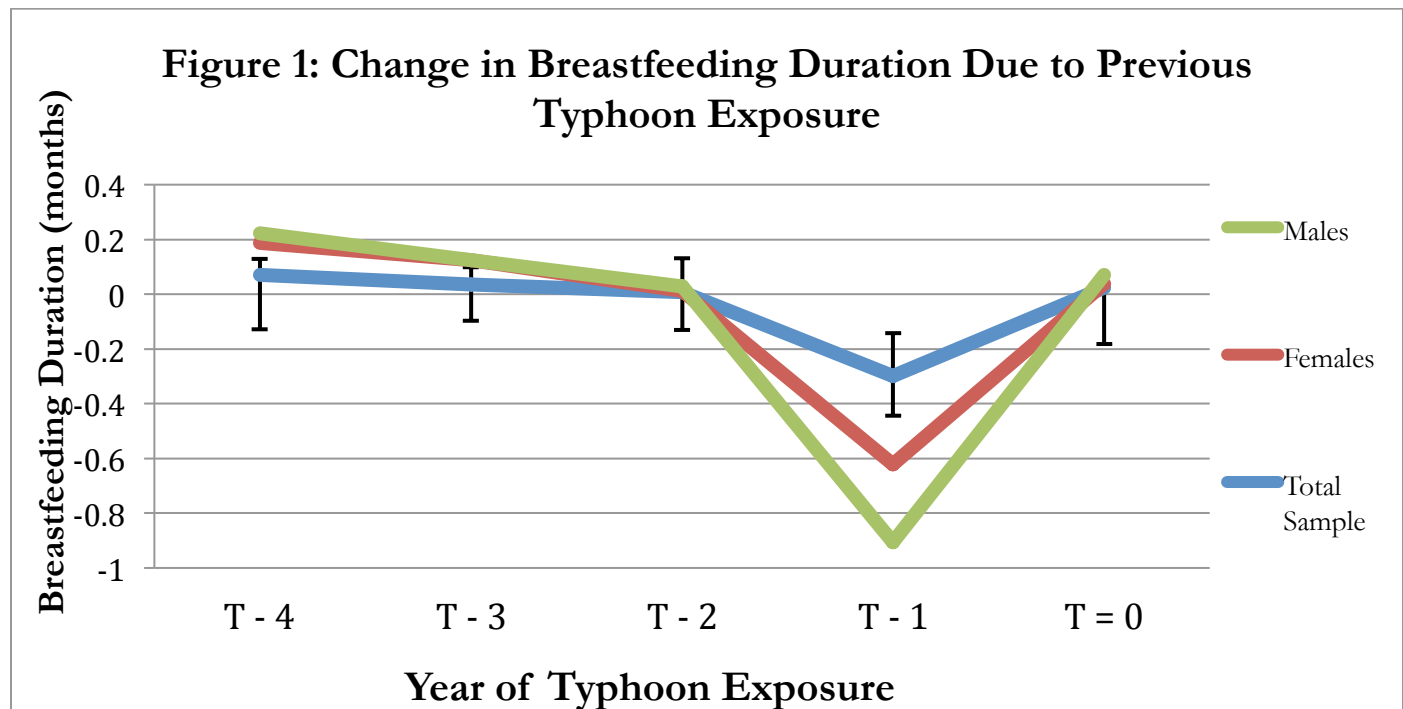
The DHS data set is comprised of women between the ages of 15 to 50, with the mean age being 30.6. The children in the sample are all under the age of 5 with a mean age of 2.59. The average duration of breastfeeding was 10.26 months. For boys the average duration was 9.94 months and 10.53 months for girls. Within the sample, households are slightly more likely to be located in a rural area than in an urban setting. This is not surprising because there are only a few large metropolitan areas located throughout the Philippines. During the time that corresponds with the DHS surveys, the average region in the Philippines was exposed to maximum wind speeds of 16.9 m/s, which is our measure of typhoon exposure. We are primarily interested in the year after

typhoon exposure because at this point household decisions on resource allocation is due to economic losses from the storm and we can better ascertain the lasting damages from these storms. The average temperature for the average region was 27.4 °C and the average precipitation was 73.1 mm/day. The overall sample size for the analysis was 11,688 observations after sample restrictions were established. Below are a few of the pertinent summary statistics for the analysis, but refer to Tables 2A and 2B in the Appendix for a complete set of summary statistics.

	Mean	Std. Deviation	Min.	Max.
Breastfeeding Duration (months)	10.26	8.71	0	58
Female Breastfeeding Duration (months)	10.53	8.80	0	58
Male Breastfeeding Duration (months)	9.94	8.61	0	56
Childrens Age (years)	2.57	1.48	0	5
Mothers Age (years)	30.70	6.69	16	50
Mothers Highest Level of Education (years)	7.81	4.09	0	25
Max Wind Speed (m/s)	16.9	10.14	0	43.53
Temperature (C°)	27.42	0.74	25.23	28.82
Precipitation (mm/day)	73.06	13.51	42.38	105.33

Total Observations: N = 11,688

## 5.2 Main Results



Note: Confidence intervals shown only for total sample.

Following Anttila-Hughes & Hsiang (2013), all breastfeeding duration outcomes are reported as months of breastfeeding reduced due to average typhoon exposure for a region (16.9 m/s), this means that the coefficient is multiplied by 16.9 in order to determine the average impact. In the fully specified model, the main regression estimates a significant decrease in breastfeeding duration for children. Figure 1 above, presents a clear representation of the main results, a significant reduction in breastfeeding in only the year after typhoon exposure. Specifically, we find that children are breastfed about 4.8 months less on average. This result is statistically significant at the 1% level and is seen only in the year following the storm (t-1), our primary outcome variable of interest. Therefore, the main results indicate that in the year after a storm, parents are choosing to reduce child health investments. Subsequently, the sample was divided into males and females to examine gender differences in breastfeeding duration and the regression results are reported in Columns (2) and (3) of Table 3. We observe that in the year after a storm, breastfeeding duration is negative and significant at the 1% level for both males and females, with males being breastfed 4.48 months less on average and females are breastfed 5.15 months less. This suggests that the reduction in



breastfeeding seen in the overall population is not driven by a son-preference bias as there is no observed preferential gender behavior.

OLS Regression of Breastfeeding Duration for Overall Sample			
	(1)	(2)	(3)
VARIABLES	Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration
Max Wind Speed	0.02 (-0.09)	0.01 (-0.09)	0.03 (-0.09)
MWS T - 1	-0.30*** (-0.08)	-0.32*** (-0.09)	-0.28*** (-0.07)
MWS T - 2	0.01 (-0.0656)	0.01 (-0.0684)	0.02 (-0.0748)
MWS T - 3	0.04 (-0.05)	0.09* (-0.05)	-0.001 (-0.05)
MWS T - 4	0.07 (-0.06)	0.12* (-0.07)	0.03 (-0.07)
Temp & Precip Controls	X	X	X
Region & Time FE	X	X	X
Full Set of Controls	X	X	X
Constant	-512.2*** -71.62	-514.1*** -85.3	-520.2*** -67.28
Observations	11,668	5,608	6,060
R-squared	0.184	0.2	0.179

All errors are clustered at the region x survey year level

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### 5.3 Children Under the Age of 2

In order to thoroughly investigate the possibility of unequal resource allocation due to a son preference-bias in the Philippines, the sample was restricted to only children under the age of two as seen in Table 4 (Barcellos et al, 2011). We estimate that for the overall “young enough” sample, reductions in breastfeeding are not statistically different from zero and this is also seen when we look at only females. In both of these cases, we observe a negative coefficient on breastfeeding

duration in the year following a storm, but it is not significant. Interestingly, we observe a statistically significant decrease of 1.6 months for boys who are “young enough”. This finding does not support the initial hypothesis that a son preference-bias manifests following typhoon exposure, but may point to a bias against sons. It is also possible that the female deaths were found in Anttila-Hughes & Hsiang (2013) are not being observed in this sample, therefore we are missing important breastfeeding duration for these females, which could be biasing the results.

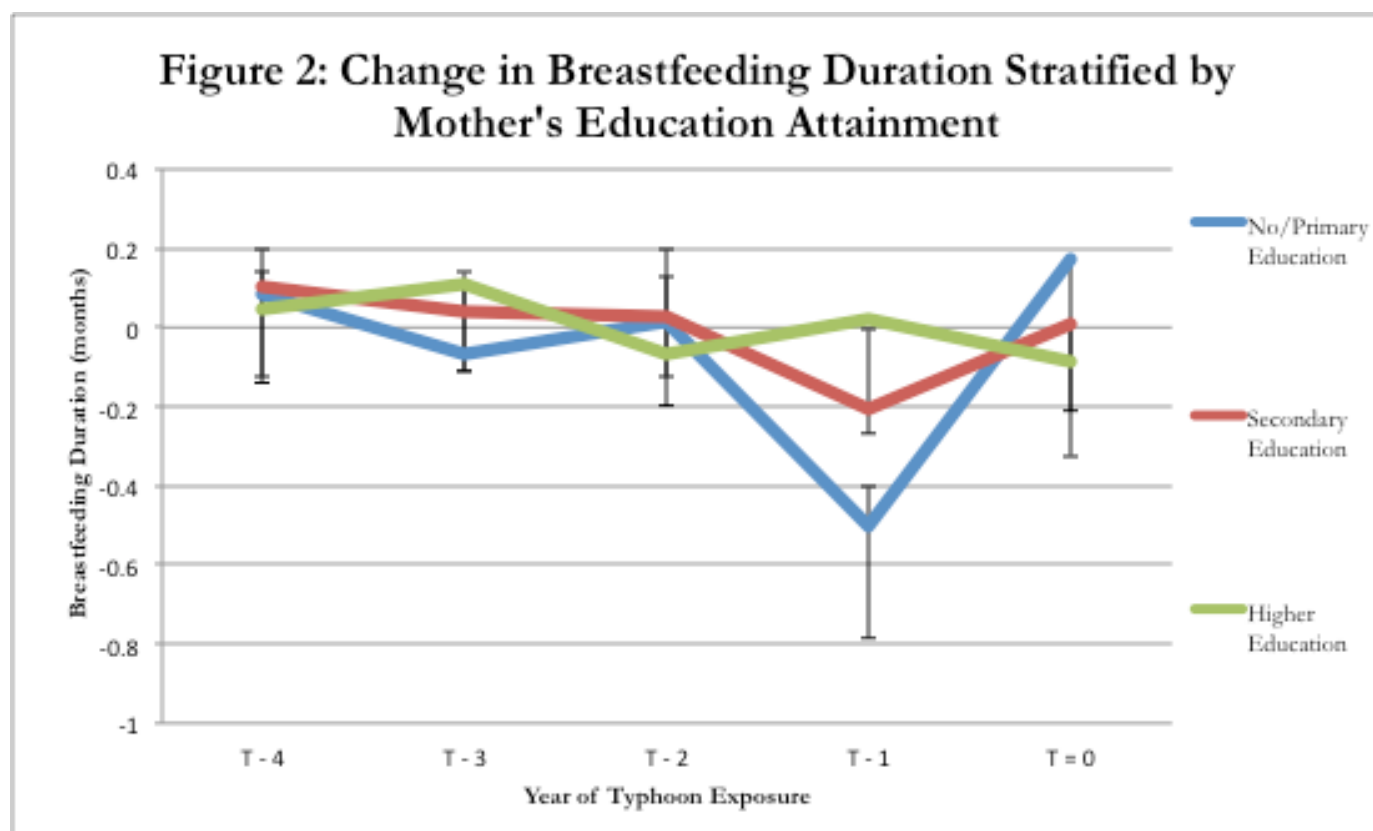
OLS Regression of Breastfeeding Duration for Children "Young Enough"

	(1)	(2)	(3)
VARIABLES	Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration
Max Wind Speed	0.04 (-0.03)	0.02 (-0.04)	0.06 (-0.04)
MWS T - 1	-0.05 (-0.03)	-0.01 (-0.061)	-0.09*** (-0.04)
MWS T - 2	-0.01 (-0.04)	-0.02 (-0.04)	0.002 (-0.06)
MWS T - 3	-0.04** (-0.02)	0.026 (-0.03)	-0.09*** (-0.02)
MWS T - 4	0.02 (-0.02)	0.0765*** (-0.03)	-0.02 (-0.03)
Temp & Precip Controls	X	X	X
Region & Time FE	X	X	X
Full Set of Controls	X	X	X
Constant	-115.4*** -40.29	-201.6*** -55.86	-63.84 -65.31
Observations	5,706	2,739	2,967
R-squared	0.302	0.31	0.305

All errors are clustered at the region x survey year level

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 5.4 Education



Note: Confidence intervals shown for only primary and secondary education.

The DHS asks mother questions regarding their education attainment: specifically if they never attended school, attended primary school, attended secondary school, or attended school beyond secondary school. Therefore the sample was stratified using these indicator variables. No and primary education was combined in order to increase sample size; there were not many mothers in the data without any education. A mother's education attainment level is exogenous and determined years before the DHS survey was administered and shouldn't be affected by typhoon exposure. While, looking at socioeconomic status is difficult because of endogeneity concerns with typhoons. Therefore, it isn't unreasonable to assume that individuals with higher education attainment may be part of wealthier households as income is highly correlated with education.

The analysis in Table 5 is broken down by education and gender. First, there is no gender difference in reduction of breastfeeding. Second, as can be seen in both the graph and regression table, the impact is only observed for households in the year after a storm and in households with mothers who have secondary education or less. For mothers in the first two education groups (from

no education to secondary school education), there is a significant decrease in breastfeeding duration in the year following a storm. On average, mothers with none or primary education breastfeed their children by 8 months and mothers with primary education breastfeed their children about 3.5 months less. Although both reduce investments, the stronger impact is with mothers who have the least education. On the other hand, households with a mother who has attended school past a secondary education do not reduce breastfeeding duration. Despite the coefficient not being statistically significant, breastfeeding duration may have a positive impact in the year after a storm for children in these households. This may suggest that higher educated women know the importance of breastfeeding and choose to reduce other expenditures when budgets are constrained or they have the financial resources to diminish the impacts of typhoons. Overall, these results suggest that households with more educated mothers are less likely to reduce investments for children and that households with lower educated women aren't able to adapt as quickly as reductions are being seen in the year after a storm. It is possible that in the year after a storm, mothers in lower educated households have to increase their labor outside of the home in order to make-up for lost income. By increasing labor, this may decrease the amount of time a mother can devote to her children. This is a conceivable explanation because mothers with lower education tend to be part of poorer households. A loss of income from typhoons is more damaging and they don't have the financial means that richer households have to attenuate these losses so mothers have to increase their labor.

Table 5: OLS Regression of Reduction in Breastfeeding Duration Divided by Education and Gender

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Breastfeeding Duration	Male Breastfeeding Duration	Female Breastfeeding Duration	Breastfeeding Duration	Male Breastfeeding Duration	Female Breastfeeding Duration	Breastfeeding Duration	Male Breastfeeding Duration	Female Breastfeeding Duration
	No/Primary Education			Secondary Education			Higher Education		
Max Wind Speed	0.17 (-0.16)	0.19 (-0.17)	0.12 (-0.16)	0.01 (-0.11)	0.05 (-0.10)	-0.01 (-0.12)	-0.09 (-0.08)	-0.10 (-0.11)	-0.08 (-0.12)
MWS T - 1	-0.50*** (-0.12)	-0.41*** (-0.14)	-0.57*** (-0.12)	-0.21*** (-0.07)	-0.23*** (-0.07)	-0.22** (-0.10)	0.02 (-0.08)	0.003 (-0.10)	0.04 (-0.11)
MWS T - 2	0.02 (-0.10)	0.00 (-0.12)	0.04 (-0.10)	0.03 (-0.06)	0.07 (-0.07)	0.00 (-0.08)	-0.07 (-0.07)	-0.05 (-0.09)	-0.07 (-0.09)
MWS T - 3	-0.07 (-0.07)	-0.09 (-0.07)	-0.03 (-0.08)	0.04 (-0.05)	0.00 (-0.05)	0.087 (-0.07)	0.11* (-0.06)	0.0978 (-0.07)	0.14* (-0.08)
MWS T - 4	0.08 (-0.08)	0.07 (-0.08)	0.10 (-0.08)	0.10 (-0.07)	0.06 (-0.08)	0.15** (-0.08)	0.05 (-0.07)	0.01 (-0.06)	0.10 (-0.11)
Temp & Precip Controls	X	X	X	X	X	X	X	X	X
Region & Time FE	X	X	X	X	X	X	X	X	X
Full Set of Controls	X	X	X	X	X	X	X	X	X
Constant	-634.8*** -84.67	-687.8*** -87.11	-597.2*** -100.3	-566.3*** -90.01	-527.9*** -79.44	-598.6*** -137.4	-432.9*** -120.7	-396.9*** -137.9	-491.8*** -162.8
Observations	5,016	2,584	2,432	4,180	2,177	2,003	2,492	1,309	1,183
R-squared	0.175	0.164	0.204	0.144	0.135	0.175	0.127	0.129	0.149

All errors are clustered at the region x survey year level

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Mother's education is not included in this regression

### 5.5 Initiating Breastfeeding

The World Health Organization recommends that children be breastfed within the first hour after birth. Therefore, to further explore breastfeeding behavior, when a mother chooses to first breastfeed her child is examined. Table 6 found in the Appendix presents the impacts of typhoon exposure on the stage at which a mother first chooses to breastfeed her child and stratified by gender. Below, is an abbreviated version of Table 6. The most important regression here is the period corresponding to children being breastfed within the first hour of life. We observe that mothers choose to significantly (at the 10% level) wait to start breastfeeding; fewer children are being immediately breastfed in the year after a storm. When the sample is disaggregated by gender we observe that girls are statistically being breastfed less in beginning time periods of life in the year following a typhoon (within the first hour or first day of life). These results support the possibility of a bias against females. They also suggest that females are driving the result for the overall population

in the immediate initiation stage. On the other hand, we also note that in the year of a storm, girls are statistically more likely to be first breastfed within the first week or first month of life. This may be due to normal feeding practices being interrupted in the wake of a typhoon and as a consequence mothers are waiting until later periods to begin breastfeeding.

Table 6: OLS Regression of the Period When Children are First Breastfed (Abbreviated Version)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Overall	Female	Male	Overall	Female	Male
	Immediately Started Breastfeeding			Started Breastfeeding W/in 1 Day		
Max Wind Speed	0.004 (-0.004)	0.003 (-0.006)	0.006 (-0.004)	0.005 (-0.003)	0.006 (-0.004)	0.004 (-0.003)
MWS T - 1	-0.006* (-0.004)	-0.007** (-0.003)	-0.005 (-0.004)	-0.003 (-0.003)	-0.005* (-0.0023)	-0.003 (-0.003)
MWS T - 2	-0.005 (-0.003)	-0.005* (-0.003)	-0.004 (-0.003)	0.005** (-0.003)	0.005** (-0.002)	0.004 (-0.003)
MWS T - 3	-0.008*** (-0.002)	-0.01*** (-0.002)	-0.007*** (-0.002)	-0.0002 (-0.002)	0.0002 (-0.002)	-0.001 (-0.002)
MWS T - 4	0.005* (-0.003)	0.004 (-0.003)	0.005** (-0.003)	-0.003* (-0.002)	-0.002 (-0.002)	-0.004** (-0.002)
Temp & Precip Controls	X	X	X	X	X	X
Region & Time FE	X	X	X	X	X	X
Full Set of Controls	X	X	X	X	X	X
Constant	-17.01*** -5.38	-14.09** -5.45	-19.22*** -5.483	-7.483 -5.014	-6.035 -5.125	-8.832* -5.134
Observations	11,750	5,637	6,113	11,750	5,637	6,113
R-squared	0.308	0.324	0.299	0.152	0.153	0.158

All errors are clustered at the region x survey year level

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## *5.6 Robustness Checks*

### *5.6.1 Migrant Women*

For the previous OLS estimations, we restricted our sample to only non-migrant women in order to keep our results from being biased due to potential sorting or migratory behaviors. This restriction is relaxed by expanding the sample to include women who have lived in the same area for at least 5 years prior to being interviewed for the DHS survey. Doing this, almost doubles the initial sample size, increasing the total number of observations to 22,556 children. The first three columns in Table 8 present the regression results for the overall sample and when it is divided by gender. These results are consistent with those in Table 3 and the increase in sample size does not affect significance or magnitude. These estimations lend support to our main results that breastfeeding duration significantly decreases one year after typhoon exposure. Similarly, we analyze the expanded sample to children only under the age of two in order to again test the “young enough” hypothesis and are presented in Table 8. The last three columns in Table 8 are consistent with those reported in Table 4 although the magnitude and significance of the result slightly decrease. A significant reduction in breastfeeding duration one year after a storm is still only observed for boys under the age of two, suggesting a possible male bias. Again this is not what we would expect if we believe that typhoons may foster a bias towards females, but these findings are comparable to those reported in the previous section.

Table 7: OLS Regression of Breastfeeding Duration with Mothers who Have Lived in the Area for At Least 5 Years

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration	Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration
	Total Sample			"Young Enough" Children		
Max Wind Speed	-0.003 (-0.09)	0.02 (-0.10)	-0.03 (-0.09)	-0.03 (-0.03)	-0.01 (-0.04)	-0.05 (-0.04)
MWS T - 1	-0.36*** (-0.08)	-0.41*** (-0.10)	-0.31*** (-0.07)	-0.05 (-0.03)	-0.02 (-0.04)	-0.06** (-0.03)
MWS T - 2	0.01 (-0.06)	-0.01 (-0.07)	0.02 (-0.06)	-0.01 (-0.02)	-0.05* (-0.03)	0.03 (-0.03)
MWS T - 3	0.05 (-0.05)	0.07 (-0.06)	0.04 (-0.04)	0.02 (-0.01)	0.03* (-0.02)	0.01 (-0.02)
MWS T - 4	0.06 (-0.06)	0.08 (-0.07)	0.05 (-0.06)	0.03* (-0.02)	0.05** (-0.02)	0.01 (-0.03)
Temp & Precip Controls	X	X	X	X	X	X
Region & Time FE	X	X	X	X	X	X
Full Set of Controls	X	X	X	X	X	X
Constant	-518.3*** -77.39	-509.9*** -97.67	-535.0*** -69.22	-58.16* -34.51	-79.15* -43.09	-47.21 -52.68
Observations	22,556	10,910	11,646	10,545	5,092	5,453
R-squared	0.166	0.175	0.162	0.297	0.312	0.289

All errors are clustered at the region x survey year level

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

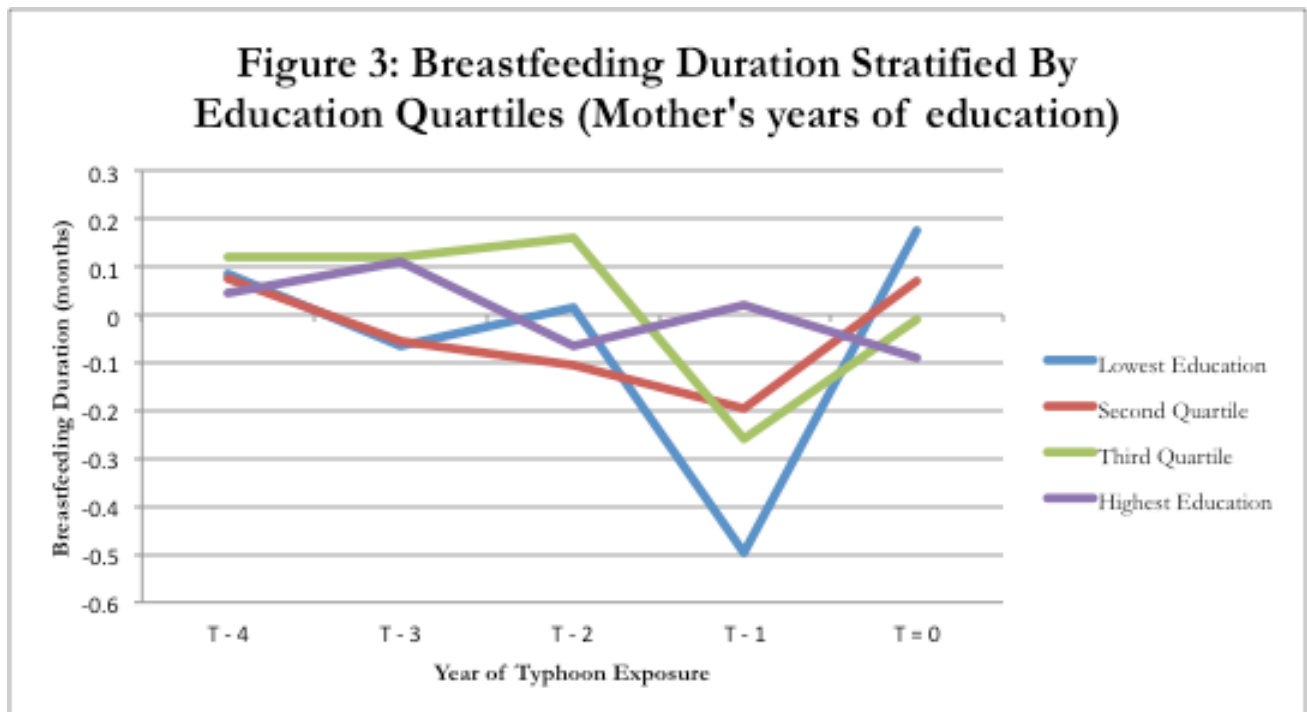
### 5.6.2. Rural vs. Urban Settings

There may be differences in breastfeeding practices for children depending on where they live, which is why breastfeeding duration was examined after dividing the sample into rural and urban populations. For the overall sample, breastfeeding duration significantly decreased for children living in both rural and urban areas around 4 months. This suggests that there is no difference between the impacts of a typhoon one year later in urban and rural locations. As seen in



Table 8 in the Appendix, similar patterns emerge when the sample is further divided by gender. The lack of difference in breastfeeding duration between urban and rural locations is what we would expect. Anttila-Hughes & Hsiang (2013) also did not find a difference in infant mortality in the year after a storm between urban and rural areas and we would expect our results to be consistent with theirs. Additionally, these findings further support the main results of declining human capital investments following typhoon exposure.

### 5.6.3 Mother's Years of Education



The DHS also includes how many years a women has attended school. In order to check the education analysis using the education indicator variables, the sample was divided into four education quartiles based on the amount of education years women reported in the DHS. Again a mother's education attainment level is exogenous and predetermined. The graph above is very similar to Figure 2. The primary impact is being observed when a household was exposed to a typhoon before the child was born. Also, the impact is being seen in households with mothers with lower education attainment with the largest impact being observed with those who have the lowest education.

An interesting pattern emerges with the regression analysis and can be seen in Table 9. For mothers in the first three quartiles (from no education to secondary school education), there is a significant decrease in breastfeeding duration in the year following a storm. The only section where a gender difference emerges is in the second quartile. Boys are significantly breastfed for a shorter duration. The regression in which education is divided by gender can be viewed in Table 12 in the appendix. Interestingly, there is no significance found in the highest education attainment strata, but all of the coefficients are positive. This supports the idea highest educated women know the importance of breastfeeding and choose to reduce other expenditures when budgets are constrained or they have the financial resources to diminish the impacts of typhoons. Overall, these results suggest that households with more educated mothers are less likely to reduce investments for children and that households with lower educated women aren't adapting as quickly as reductions are being seen in the year after a storm.

Table 9: OLS Estimation of Breastfeeding Duration By Years of Education

VARIABLES	(1) Breastfeeding Duration in Lowest Education Quartile	(2) Breastfeeding Duration in Second Education Quartile	(3) Breastfeeding Duration in Third Education Quartile	(4) Breastfeeding Duration in Highest Education Quartile
Max Wind Speed	0.17 (-0.16)	0.07 (-0.13)	-0.01 (-0.12)	-0.09 (-0.08)
MWS T - 1	-0.50*** (-0.12)	-0.20** (-0.09)	-0.26*** (-0.09)	0.02 (-0.08)
MWS T - 2	0.02 (-0.10)	-0.11 (-0.07)	0.16** (-0.07)	-0.07 (-0.07)
MWS T - 3	-0.06 (-0.07)	-0.06 (-0.05)	0.12* (-0.07)	0.11* (-0.06)
MWS T - 4	0.09 (-0.08)	0.07 (-0.08)	0.12 (-0.08)	0.05 (-0.07)
Temperature	1.11 (-1.57)	1.66 (-1.75)	1.17 (-1.78)	0.25 (-1.40)
Precipitation	0.21*** (-0.05)	0.16*** (-0.04)	0.21*** (-0.05)	0.08 (-0.05)
Lagged Temperature Controls	X	X	X	X
Lagged Precipitation Controls	X	X	X	X
Region FE	X	X	X	X
Time FE	X	X	X	X
Full Set of Controls (No Woman's Education Control)	X	X	X	X
Constant	-636.7*** -85.16	-617.0*** -85.32	-508.3*** -111.5	-431.2*** -120.6
Observations	5,002	1,916	2,261	2,489
R-squared	0.174	0.173	0.148	0.126

All errors are clustered at the region x survey year level

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

#### 5.6.4. Socioeconomic Status

As a robustness check for education, breastfeeding duration was divided into five socioeconomic quintiles. Although specific questions on a woman's or household's income aren't directly included in the DHS, other socioeconomic (SES) indicators are available allowing for the construction of a proxy SES factor, following Anttila-Hughes & Hsiang (2013). This SES proxy is comprised of questions ranging from whether the household has electricity to if anyone in the household owns a car. Within each of the SES quintiles, breastfeeding duration was also examined by gender. Table 10 shows that in the year after a storm, breastfeeding duration for the entire sample significantly decreases in the first two quintiles or the poorest stratifications of the population. In the poorest quintile, breastfeeding duration decreases by 7.6 months in the year after a storm, while in the second poorest quintile breastfeeding duration significantly decreases by 10.2 months on average following typhoon exposure. This suggests that households in the poorest strata of the population mediate the effects of being exposed to a storm by reducing human capital investments. Interestingly, we also observe a reduction in duration of breastfeeding (at the 5% significance level) for children in the year of the storm for the richest sect; this estimation leads to around a 4.6 reduction in breastfeeding. Overall, these findings suggest that wealthier households can adapt quicker than poorer households following a typhoon.

Table 13, found in the Appendix, shows each of the SES quintile regressions divided by gender. In the first two quintiles of Table 13, we don't see a gender difference in breastfeeding duration. For both males and females, breastfeeding duration decreases significantly in the year after a storm. A bias emerges in the middle (third) SES quintile and suggests that boys are significantly breastfed about 5.52 months less on average in the year following a storm. Still, these observations suggest that breastfeeding reductions are primarily being seen among poor households as a way to cope with being affected by typhoons. Also, that a gender bias against females in breastfeeding may not be the mechanism behind the increased female infant mortality rates observed in the year after a typhoon.

The SES estimation may not be the most exogenous analysis as it is difficult to determine if households were poor before the typhoon occurred or the typhoon made households poor. But the findings seem to match up with the education results, supporting the idea that wealthier households

have been able to adapt, while poorer households are still recovering from storms even a year after they occurred.

Table 10: OLS Regression of Breastfeeding Duration By Socioeconomic Status

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Breastfeeding Duration Quintile 1	Breastfeeding Duration Quintile 2	Breastfeeding Duration Quintile 3	Breastfeeding Duration Quintile 4	Breastfeeding Duration Quintile 5
Max Wind Speed	0.11 (-0.14)	-0.12 (-0.19)	0.05 (-0.11)	-0.07 (-0.11)	-0.27** (-0.12)
MWS T - 1	-0.48*** (-0.13)	-0.64*** (-0.11)	-0.11 (-0.11)	0.15 (-0.13)	-0.04 (-0.12)
MWS T - 2	-0.26** (-0.11)	0.12 (-0.09)	-0.14 (-0.10)	0.01 (-0.10)	0.02 (-0.12)
MWS T - 3	-0.22* (-0.12)	0.18** (-0.08)	0.02 (-0.09)	-0.04 (-0.07)	0.08 (-0.08)
MWS T - 4	0.06 (-0.08)	0.20** (-0.10)	0.10 (-0.06)	-0.02 (-0.08)	-0.04 (-0.11)
Temp & Precip Controls	X	X	X	X	X
Region & Time FE	X	X	X	X	X
Full Set of Controls	X	X	X	X	X
Constant	-528.6*** -153.8	-535.2*** -132	-536.2*** -155.8	-222.6 -157.3	-470.2** -197.3
Observations	2,489	2,714	2,329	2,413	1,695
R-squared	0.185	0.189	0.16	0.162	0.113

All errors are clustered at the region x survey year level

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

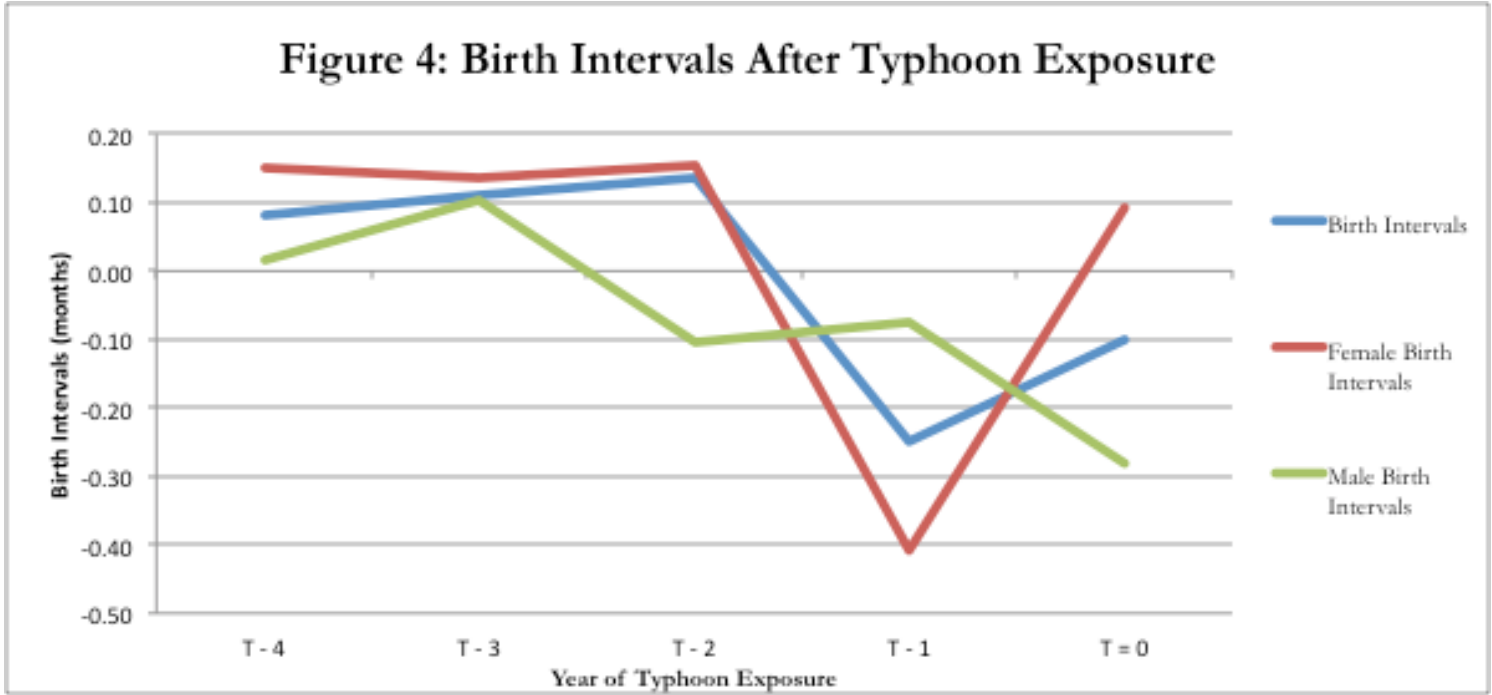
#### 5.6.5 Succeeding Birth Order

Because breastfeeding reduces a mother's fertility, a woman may choose to allocate time spent breastfeeding differently if she wants to have more children. Succeeding birth interval is the amount of time (months, years) between births. If succeeding birth intervals are impacted due to typhoons we would expect to see similar results as in the breastfeeding regression because birth

intervals and breastfeeding are related. Consequentially, if a mother wants to have another child, she will reduce the length of time breastfeeding the current child and the birth interval between the siblings will be short. By looking at succeeding birth intervals we may also be able to check some of the gender differences observed in the above analyses.

The succeeding birth interval analysis in Table 11 in the appendix yields some interesting results. First, shorter birth intervals are observed in the year of a typhoon and in the year one lag, but the coefficients are only significant in the year one lag. On average, birth intervals are shortened by about 4 months in the year following a storm. This is comparable to the reduction in breastfeeding observed for the main results. Coupled with the primary breastfeeding results, the analysis indicates that mothers are investing less in the health of their children. By decreasing birth intervals between children, Filipino mothers are increasing their chances of having a high-risk pregnancy, which is currently a major hazard in the Philippines.

When stratifying the sample by gender, an interesting gender dynamic emerges. In the year of a storm, boys have significantly shorter birth intervals. On average, the reduction in birth intervals is about 4.5 months for boys. While in the year after a storm, females have significantly shorter birth intervals. On average, daughters have a reduction in birth intervals by about 6.5 months. Overall, reductions are evident for both girls and boys, again supporting the Philippines' reputation of gender equality. But the results do lend evidence that breastfeeding duration is reduced due to typhoon exposure. Breastfeeding affects a mother's fertility so if she wants another child quickly (short birth intervals between children) then she will reduce breastfeeding.



## 6. Discussion

The main findings that typhoons significantly reduce breastfeeding duration for children are consistent with conclusions from Anttila-Hughes & Hsiang (2013) who find that expenditures on human capital goods, such as nutritious foods, decrease in the year following a storm. Further, we can infer that since these reductions are almost exclusively being seen in the year following a storm, recovering from income losses incurred from storms could be driving the observed human capital disinvestment. Especially since we show some evidence that the reductions are occurring among households in lower economic spheres. This is concerning because of the financial costs associated with having to purchase infant formula. It is estimated that the minimum costs of formula feeding an infant per month is around PPH 2,000 (UNICEF). This is clearly a huge monetary expense and one that could be easily avoided if mothers choose to exclusively breastfeed her children.

Another possible explanation for the decline in breastfeeding duration could be increased labor participation by mothers. Anecdotal evidence indicates that mothers stop breastfeeding early on because of having to return to work. Mothers may need to go work following a typhoon in order to supplement lost income or help pay for damages incurred from the storm. This increase in labor participation may reduce the time a mother can spend breastfeeding her children.

A secondary theory behind the observed reduction in breastfeeding duration also comes from anecdotal evidence. Without considering typhoons, most experts note that mothers who are more educated and wealthier tend to use breast milk substitutes and infant formula more than lower educated and poorer mothers. This may be why no impacts of typhoon exposure are observed for households with higher educated and wealthier mothers in the year after a storm. Still, this supports the idea that these mothers are able to adapt or they have a safety net because their decisions regarding breastfeeding behavior aren't significantly impacted by typhoon exposure. Overall, the reduction in breastfeeding observed is consistent with a growing body of literature regarding the negative impacts of natural disasters on human capital investments (Rosales, 2013, Datar et. al, 2012, Anttila-Hughes & Hsiang, 2013).

The auxiliary question this paper asked was if there was a bias against girls in the Philippines in the wake of a typhoon. The Philippines is an interesting country to examine this question because of its reputation as being gender equal, but one that should be explored because of the large female infant mortality findings seen in Anttila-Hughes & Hsiang (2013) as differential breastfeeding practices could potentially be the mechanism behind those findings. The results presented here are mixed, but suggest that there isn't a bias against girls in the Philippines. When the sample is restricted to children who are "young enough", we see that boys are breastfed less and there are several explanations for why this is observed. First and most simple, it is possible that there is a slight bias against males in the Philippines. Second, we may be looking at the female bias in the wrong way. Liu et al (2009) report that parents compensated for children who were viewed less healthy by breastfeeding them more and spending more time with them compared to children who were viewed as more healthy. It's possible that girls are viewed as weaker and therefore need more parental investments. Although this is a plausible scenario, we don't observe positive coefficients for female breastfeeding duration in the year after a storm so it's unlikely. The most likely explanation behind this outcome is that breastfeeding data for the female infants who died in Anttila-Hughes & Hsiang (2013) are not observed in this sample. This could be biasing the result towards males.

## 7. Conclusions

Overall the analysis provides evidence that in the year after a typhoon, Filipino households are choosing to reduce health investments for children. This reduction can be observed across genders, environments and predominantly within lower socioeconomic spheres. A clear son-bias



preference cannot be established as different analyses yielded different results. Therefore, further exploration is still needed in order to more closely determine if there is a gender bias in resource allocation following a typhoon. This includes researching how allocation behavior of other types of investments alters after typhoon exposure. These include vaccinations for children, buying medicine if a child is sick and continuing to visit a doctor after the child is born. One limitation of this study is that breastfeeding duration cannot be disaggregated between exclusive and partial breastfeeding practices which would further enhance our analyses and provide us with more of an explanation for the observed breastfeeding behavior of mothers in the Philippines. Future research could also expand upon when a mother introduces other liquids and solid food into the child's diet, as these may be introduced earlier if exposed to a typhoon.

Another limitation of this research is that the sample is restricted to non-migrant mothers. By doing this we are potentially missing important breastfeeding behaviors of mothers in migratory households. By including migrant mothers we would comprehensively be able to portray how breastfeeding decisions alter due to typhoons. Lastly, in the data set there is no information regarding later life outcomes of the children, such as academic grades, IQ scores, or incomes. One future research area that could have profound implications is linking this investment research with later life outcomes research. This would give a more complete picture of how reduction in breastfeeding affects the child both presently and in the future.

### *7.1 Policy Implications*

Clearly the results suggest that there are extensive and lasting human capital impacts due to typhoons because our primary results are observed in the year following a storm. Even the basic finding that breastfeeding duration significantly decreases following a typhoon is surprising because breastfeeding is a cheap, easy, and readily accessible source of nutrients for babies. Therefore, policies should be focused on continuing to educate mothers about the numerous benefits of breastfeeding and the disadvantages of using baby formula or substituting other foods in a child's diet before it is recommended. After Typhoon Haiyan, many news stations were broadcasting pictures and videos showing mothers and fathers scouring refugee shelters searching for clean water to dilute infant formula. These stories coupled with recent reports indicating that children in areas heavily damaged by Typhoon Haiyan are suffering from a lack of nutrition and stunting, its clear that breastfeeding needs to be strongly promoted after a storm. Not only by having separate, private

areas where mothers can breastfeed in shelters, but also preventing the illegal distribution of infant formula and other breast milk substitutes in relief packages. In many cases, breast milk substitutes donated as humanitarian aid often end up on the local market and can have negative influences on feeding practices within the community. Finally, policies aimed at helping families mitigate losses from typhoons may help families not have to make tough decisions regarding allocating important human capital investments. Extensive insurance and “safety nets” in place will help families in poorer households recover faster from damages. This is important because the negative impacts from typhoons are being observed a year after a storm, indicating that these safety nets aren’t a reality and need to be more secure.

In conclusion, appropriate breastfeeding practices are critical for a child’s present health, future health, and future economic success. Diminishing this important health investment reduces a child’s human capital accumulation and the child’s future productivity (Currie, 2008). Exposure to a typhoon in the year before a child’s birth has the largest and most significant impact on breastfeeding reduction. This means that damages from storms are not just immediate but also persistent. Without change, the expected increase in both frequency and intensity of typhoons will be devastating to human capital formation of children within the Philippines.

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Table 1: OLS Model Specification for Breastfeeding Duration of Children Born to Non-Migrant Mothers

VARIABLES	(1) Breastfeeding Duration (Simple OLS)	(2) Breastfeeding Duration	(3) Breastfeeding Duration	(4) Breastfeeding Duration	(5) <b>Breastfeeding Duration</b>
Max Wind Speed	0.0469* (-0.0278)	-0.028 (-0.0492)	0.0806*** (-0.0268)	0.0496 (-0.0987)	0.0239 (-0.0904)
T - 1	-0.0546** (-0.0254)	0.0255 (-0.0407)	-0.208*** (-0.0294)	-0.275*** (-0.0814)	-0.300*** (-0.0776)
T - 2	-0.0729*** (-0.0281)	-0.039 (-0.036)	-0.0786*** (-0.0276)	-0.0111 (-0.0694)	0.00657 (-0.0656)
T - 3	0.00148 (-0.0196)	-0.02 (-0.0266)	0.0315 (-0.0195)	0.0228 (-0.0502)	0.0359 (-0.0485)
T - 4	0.0613*** (-0.0184)	0.0285 (-0.031)	0.0679*** (-0.0182)	0.0809 (-0.0667)	0.0697 (-0.0639)
Temperature	-0.984* (-0.577)	0.21 (-0.728)	-0.665 (-0.731)	1.034 (-1.182)	0.859 (-1.121)
T - 1	3.282** (-1.349)	3.336** (-1.588)	0.597 (-1.393)	5.636** (-2.698)	5.520** (-2.703)
T - 2	4.457*** (-1.522)	0.245 (-2.524)	14.79*** (-2.066)	20.58*** (-5.359)	19.65*** (-4.804)
T - 3	-0.119 (-1.119)	1.201 (-1.596)	-2.459** (-1.157)	-2.679 (-2.771)	-2.048 (-2.551)
T - 4	-5.959*** (-1.126)	0.152 (-1.728)	-11.73*** (-1.345)	-5.290** (-2.146)	-6.085*** (-2.089)
Precipitation	-0.0448*** (-0.0134)	0.00553 (-0.0161)	-0.0290* (-0.0152)	0.173*** (-0.0339)	0.165*** (-0.0322)
T - 1	-0.0666*** (-0.0197)	-0.02 (-0.0224)	-0.0478** (-0.0196)	0.180*** (-0.046)	0.182*** (-0.0443)
T - 2	0.137*** (-0.0324)	0.0104 (-0.0429)	0.268*** (-0.0352)	0.187*** (-0.0629)	0.184*** (-0.0614)
T - 3	-0.192*** (-0.029)	-0.0736* (-0.0394)	-0.258*** (-0.032)	-0.190** (-0.0726)	-0.187** (-0.072)
T - 4	0.0895*** (-0.0192)	0.0308 (-0.0222)	0.0350* (-0.0212)	-0.059 (-0.0412)	-0.0504 (-0.0359)
Region FE		X		X	X
Time FE			X	X	X
Full Set of Controls					X
Constant	-3.473 -5.095	-128.5*** -45.17	-1.999 -5.01	-550.0*** -74.92	-512.2*** -71.62
Observations	11,688	11,688	11,688	11,688	11,668
R-squared	0.011	0.026	0.103	0.132	0.184

Column 4 &amp; Column 5 use clustered standard errors at the region x survey year level

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 2A: Summary Statistics for DHS Data (Excluding Twins and Migrants)

	Observations	Mean	Std. Dev.	Min.	Max.
Breastfeeding Duration (months)	11,688	10.26	8.71	0	58
Female Breastfeeding Duration (months)	5,618	10.53	8.80	0	58
Male Breastfeeding Duration (months)	6,070	9.94	8.61	0	56
Children's Age (years)	10,015	2.57	1.48	0	5
Woman's Highest Level of Education (years)	9,996	7.81	4.09	0	25
Woman's Age (years)	10,015	30.70	6.69	16	50
Father's Age (years)	6,008	33.61	7.77	17	79
Father's Highest Level of Education (years)	9,833	7.33	3.86	0	17
Rural	10,015	0.67	0.47	0	1
Urban	10,015	0.33	0.47	0	1
SES Factor	9,974	-0.13	0.97	-1.87	1.75

Table 2B: Summary Statistic of Typhoons in the Philippines from 1989-2008

Region		Mean	Std. Dev.	Min.	Max.
Bicol	Max Windspeed (m/s)	21.66	8.86	9.40	39.12
	Temperature (C°)	28.26	0.30	27.60	28.82
	Precipitation (mm/day)	79.29	15.08	52.78	105.33
Cagayan Valley	Max Windspeed (m/s)	27.79	8.29	11.95	43.53
	Temperature (C°)	27.28	0.31	26.87	27.99
	Precipitation (mm/day)	70.35	10.83	49.08	95.02
Central Luzon	Max Windspeed (m/s)	21.14	7.90	9.19	34.68
	Temperature (C°)	27.53	0.26	27.19	28.17
	Precipitation (mm/day)	82.77	10.50	56.68	102.00
Central Visayas	Max Windspeed (m/s)	13.16	5.84	5.69	28.22
	Temperature (C°)	27.51	0.26	26.84	27.95
	Precipitation (mm/day)	63.66	13.20	42.38	89.32
Corillera Admin Region	Max Windspeed (m/s)	26.64	8.01	11.68	40.11
	Temperature (C°)	27.12	0.30	26.73	27.84
	Precipitation (mm/day)	73.87	10.24	52.44	96.93

Eastern Visayas					
	Max Windspeed (m/s)	17.67	7.00	6.86	32.10
	Temperature (C°)	28.05	0.26	27.42	28.51
	Precipitation (mm/day)	70.85	14.26	48.18	99.31
Ilocos					
	Max Windspeed (m/s)	23.91	6.67	11.97	36.66
	Temperature (C°)	27.15	0.31	26.75	27.96
	Precipitation (mm/day)	74.51	8.76	54.06	93.06
National Capital Region					
	Max Windspeed (m/s)	20.95	9.32	7.71	39.94
	Temperature (C°)	27.45	0.26	27.07	28.03
	Precipitation (mm/day)	79.92	12.53	52.69	102.46
Northern Mindanao					
	Max Windspeed (m/s)	9.12	3.94	2.36	18.27
	Temperature (C°)	25.62	0.25	25.23	26.37
	Precipitation (mm/day)				
Southern Mindanao					
	Max Windspeed (m/s)	3.14	2.75	0.00	8.65
	Temperature (C°)	26.57	0.18	26.32	27.05
	Precipitation (mm/day)	65.41	13.21	42.52	91.83
Southern Tagalog					
	Max Windspeed (m/s)	16.58	5.32	7.66	26.70
	Temperature (C°)	28.07	0.25	27.64	28.65
	Precipitation (mm/day)	79.45	11.84	54.73	102.27



Western Visayas					
Max Windspeed (m/s)	15.79	6.66	6.84	31.70	
Temperature (C°)	27.83	0.28	27.11	28.33	
Precipitation (mm/day)	71.24	12.86	49.93	94.91	
Zamboanga Peninsula					
Max Windspeed (m/s)	3.40	3.32	0.00	9.77	
Temperature (C°)	28.03	0.19	27.68	28.41	
Precipitation (mm/day)	68.42	13.65	45.36	95.89	
Philippines Overall					
Max Windspeed (m/s)	17.00	10.14	0.00	43.53	
Temperature (C°)	27.42	0.74	25.23	28.82	
Precipitation (mm/day)	73.06	13.51	42.38	105.33	

Summary Statistics of Typhoons in the Philippines from 1989-2008				
	Mean	Std. Dev.	Min.	Max.
Philippines Overall				
Max. Windspeed (m/s <sup>2</sup> )	16.9	10.14	0	43.53
Temperature (C°)	27.42	0.74	25.23	28.82
Precipitation (mm/day)	73.06	13.51	42.38	105.33

Table 6: OLS Regression of the Period When Children Are First Breastfed (Full Version)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Started Breastfeeding	Started Breastfeeding (Female)	Started Breastfeeding (Male)	Started Breastfeeding	Started Breastfeeding (Female)	Started Breastfeeding (Male)	Started Breastfeeding W/in 1 Week
	Immediately Started Breastfeeding			Started Breastfeeding W/in 1 Day			
ax Wind Speed	0.004 (-0.004)	0.003 (-0.005)	0.006 (-0.004)	0.005 (-0.003)	0.006 (-0.004)	0.004 (-0.003)	0.003* (-0.001)
MWS T - 1	-0.006* (-0.004)	-0.007** (-0.003)	-0.005 (-0.004)	-0.004 (-0.003)	-0.005* (-0.003)	-0.003 (-0.003)	0.001 (-0.001)
MWS T - 2	-0.01 (-0.003)	-0.01* (-0.003)	-0.004 (-0.003)	0.01** (-0.002)	0.01** (-0.002)	0.004 (-0.003)	0.002 (-0.001)
MWS T - 3	-0.01*** (-0.002)	-0.01*** (-0.002)	-0.01*** (-0.002)	-0.0002 (-0.002)	0.0002 (-0.002)	-0.001 (-0.002)	0.0004 (-0.001)
MWS T - 4	0.01* (-0.003)	0.004 (-0.003)	0.01** (-0.003)	-0.003* (-0.002)	-0.002 (-0.002)	-0.004** (-0.002)	-0.001 (-0.001)
Temperature	0.26*** (-0.06)	0.26*** (-0.07)	0.26*** (-0.07)	0.19*** (-0.05)	0.18*** (-0.05)	0.20*** (-0.06)	0.03 (-0.03)
Precipitation	0.001 (-0.002)	-0.001 (-0.002)	0.003 (-0.002)	-0.002 (-0.002)	-0.002 (-0.002)	-0.002 (-0.002)	-0.001 (-0.001)
Constant	-17.01*** -5.38	-14.09** -5.45	-19.22*** -5.483	-7.483 -5.014	-6.035 -5.125	-8.832* -5.134	-1.012 -1.204
Observations	11,750	5,637	6,113	11,750	5,637	6,113	11,750
R-squared	0.308	0.324	0.299	0.152	0.153	0.158	0.043

l errors are clustered at the region x survey year level

\* p<0.01, \*\* p<0.05, \* p<0.1

gression also includes lagged temperature and precipitation controls, the full set of other controls, region and year fixed effects

Table 6: OLS Regression of the Period When Children Are First Breastfed (Full Version)

(7)	(8)	(9)	(10)	(11)	(12)
Started Breastfeeding	Started Breastfeeding (Female)	Started Breastfeedin gk (Male)	Started Breastfeedin g	Started Breastfeedin g (Female)	Started Breastfeedin g (Male)
Started Breastfeeding W/in 1 Week			Started Breastfeeding W/in 1 Month		
0.003**	0.01***	0.001	-0.0002	-0.001*	-0.00002
(-0.001)	(-0.002)	(-0.002)	(-0.0002)	(-0.0003)	(-0.0004)
0.001	0.001	0.001	0.0002	0.0002	0.0002
(-0.001)	(-0.002)	(-0.002)	(-0.0002)	(-0.0002)	(-0.0004)
0.002	0.001	0.002	0.0001	0.0002	0.0001
(-0.001)	(-0.001)	(-0.001)	(-0.0002)	(-0.0003)	(-0.0003)
0.001	0.001	-0.0001	0.00004	0.0003	-0.0002
(-0.001)	(-0.001)	(-0.001)	(-0.0001)	(-0.0002)	(-0.0002)
-0.001	0.00001	-0.002**	0.0001	0.0002	-0.0001
(-0.001)	(-0.001)	(-0.001)	(-0.0001)	(-0.0002)	(-0.0002)
0.03	0.004	0.05	0.003	-0.01	0.01*
(-0.03)	(-0.03)	(-0.03)	(-0.004)	(-0.01)	(-0.01)
-0.001	-0.0002	-0.001*	0.0001	-0.00000	0.0002
(-0.001)	(-0.001)	(-0.001)	(-0.0001)	(-0.0002)	(-0.0002)
-1.012	-3.016*	0.647	-0.199	-0.416	-0.0991
-1.204	-1.74	-1.497	-0.239	-0.419	-0.341
11,750	5,637	6,113	11,750	5,637	6,113
0.043	0.045	0.051	0.007	0.013	0.015

Table 8: OLS Regression of Breastfeeding Duration in Rural or Urban Areas and By Gender

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Breastfeeding Duration	Female Breastfeeding Duration Rural Areas	Male Breastfeeding Duration	Breastfeeding Duration	Female Breastfeeding Duration Urban Areas	Male Breastfeeding Duration
Max Wind Speed	0.08 (-0.11)	0.06 (-0.11)	0.08 (-0.12)	-0.01 (-0.08)	-0.0003 (-0.10)	0.01 (-0.09)
MWS T - 1	-0.30*** (-0.08)	-0.39*** (-0.09)	-0.22*** (-0.07)	-0.32*** (-0.11)	-0.26** (-0.11)	-0.37*** (-0.11)
MWS T - 2	-0.04 (-0.08)	0.03 (-0.08)	-0.08 (-0.09)	0.01 (-0.07)	-0.06 (-0.08)	0.08 (-0.08)
MWS T - 3	0.02 (-0.06)	0.01 (-0.06)	0.03 (-0.06)	-0.02 (-0.05)	0.08 (-0.05)	-0.10* (-0.05)
MWS T - 4	0.14** (-0.07)	0.11 (-0.07)	0.16** (-0.07)	0.01 (-0.07)	0.15* (-0.08)	-0.12* (-0.07)
Temperature	-0.14 (-1.38)	-0.06 (-1.39)	-0.12 (-1.63)	1.59 (-1.25)	-0.23 (-1.54)	3.16** (-1.40)
Precipitation	0.17*** (-0.03)	0.19*** (-0.04)	0.16*** (-0.03)	0.19*** (-0.04)	0.17*** (-0.04)	0.21*** (-0.04)
Lagged Temperature Controls	X	X	X	X	X	X
Lagged Precipitation Controls	X	X	X	X	X	X
Region FE	X	X	X	X	X	X
Time FE	X	X	X	X	X	X
Full Set of Controls (Except Rural/Urban Control)	X	X	X	X	X	X
Constant	-532.9*** -73.18	-522.1*** -83.51	-559.8*** -74.49	-532.5*** -86.93	-496.3*** -92.11	-564.9*** -107.3
Observations	7,489	3,611	3,878	4,179	1,997	2,182
R-squared	0.178	0.2	0.173	0.161	0.171	0.173

All errors are clustered at the region x survey year level

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 11: OLS Regression for Succeeding Birth Intervals

VARIABLES	(1) Birth Intervals	(2) Female Birth Intervals	(3) Male Birth Intervals
Max Wind Speed	-0.10 (-0.10)	0.10 (-0.09)	-0.28* (-0.14)
MWS T - 1	-0.25*** (-0.07)	-0.41*** (-0.07)	-0.07 (-0.12)
MWS T - 2	0.14** (-0.07)	0.15*** (-0.05)	0.10 (-0.10)
MWS T - 3	0.11*** (-0.04)	0.14*** (-0.04)	0.10* (-0.05)
MWS T - 4	0.08 (-0.05)	0.15*** (-0.04)	0.02 (-0.07)
Temp & Precip Controls	X	X	X
Region & Time FE	X	X	X
Full Set of Controls	X	X	X
Constant	87.76 -100.7	89.22 -99.92	89.14 -124.5

All errors are clustered at the region x survey year level

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table: 12 Breastfeeding Duration Divided By Education Level &amp; Gender

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration	Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration
	Lowest Education Quartile			Second Education Quartile		
Max Wind Speed	0.17 (-0.16)	0.12 (-0.16)	0.19 (-0.17)	0.07 (-0.13)	0.08 (-0.13)	0.06 (-0.16)
MWS T - 1	-0.50*** (-0.12)	-0.57*** (-0.13)	-0.41*** (-0.14)	-0.20** (-0.09)	-0.15 (-0.10)	-0.31** (-0.12)
MWS T - 2	0.02 (-0.10)	0.04 (-0.10)	0.002 (-0.12)	-0.11 (-0.07)	-0.11 (-0.07)	-0.13 (-0.09)
MWS T - 3	-0.06 (-0.07)	-0.02 (-0.08)	-0.09 (-0.07)	-0.06 (-0.06)	-0.06 (-0.07)	-0.05 (-0.06)
MWS T - 4	0.09 (-0.07)	0.10 (-0.08)	0.07 (-0.08)	0.07 (-0.08)	0.11 (-0.08)	0.04 (-0.09)
Temperature	1.11 (-1.57)	0.78 (-1.58)	1.44 (-2.06)	1.66 (-1.75)	2.27 (-2.16)	0.60 (-2.08)
Precipitation	0.21*** (-0.05)	0.25*** (-0.06)	0.20*** (-0.05)	0.16*** (-0.04)	0.11** (-0.05)	0.20*** (-0.06)
Lagged Temperature Controls	X	X	X	X	X	X
Lagged Precipitation Controls	X	X	X	X	X	X
Region FE	X	X	X	X	X	X
Time FE	X	X	X	X	X	X
Full Set of Controls (No Woman's Educ Control)	X	X	X	X	X	X
Constant	-636.7*** -85.16	-598.9*** -100.3	-690.6*** -88.2	-617.0*** -85.32	-579.1*** -145.4	-634.9*** -108.2
Observations	5,002	2,424	2,578	1,916	912	1,004
R-squared	0.174	0.203	0.164	0.173	0.231	0.161

All errors are clustered at the region x survey year level

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table: 12 Breastfeeding Duration Divided By Education Level &amp; Gender

(7)	(8)	(9)	(10)	(11)	(12)
Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration	Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration
Third Eeducation Quartile			Highest Education Quartile		
-0.01	-0.10	0.08	-0.09	-0.09	-0.10
(-0.12)	(-0.16)	(-0.13)	(-0.08)	(-0.12)	(-0.11)
-0.26***	-0.40***	-0.20**	0.02	0.04	0.003
(-0.09)	(-0.13)	(-0.09)	(-0.08)	(-0.11)	(-0.10)
0.16**	0.07	0.26***	-0.07	-0.06	-0.05
(-0.07)	(-0.10)	(-0.08)	(-0.07)	(-0.09)	(-0.09)
0.12*	0.17**	0.08	0.11*	0.14*	0.10
(-0.07)	(-0.08)	(-0.07)	(-0.06)	(-0.08)	(-0.08)
0.12	0.17*	0.07	0.05	0.10	0.02
(-0.08)	(-0.10)	(-0.09)	(-0.07)	(-0.11)	(-0.07)
1.17	-1.86	2.98	0.25	1.10	-0.31
(-1.78)	(-2.31)	(-1.98)	(-1.40)	(-1.93)	(-2.06)
0.21***	0.21***	0.22***	0.08	0.05	0.10*
(-0.05)	(-0.06)	(-0.05)	(-0.05)	(-0.07)	(-0.05)
X	X	X	X	X	X
X	X	X	X	X	X
X	X	X	X	X	X
X	X	X	X	X	X
X	X	X	X	X	X
-508.3***	-472.4**	-427.8***	-431.2***	-487.8***	-397.3***
-111.5	-177.1	-141.2	-120.6	-162.2	-138
2,261	1,091	1,170	2,489	1,181	1,308
0.148	0.18	0.161	0.126	0.149	0.129

Table 13: OLS Regression of Breastfeeding Duration by Socioeconomic Status and Gender

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Female Breastfeeding Duration	Male Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration
	Quintile 1		Quintile 2		Quintile 3	
Max Wind Speed	0.06 (-0.13)	0.04 (-0.16)	-0.03 (-0.20)	-0.22 (-0.22)	-0.07 (-0.16)	0.26*** (-0.09)
MWS T - 1	-0.55*** (-0.15)	-0.38** (-0.18)	-0.52*** (-0.10)	-0.75*** (-0.16)	0.08 (-0.15)	-0.35*** (-0.10)
MWS T - 2	-0.20* (-0.10)	-0.29* (-0.16)	0.10 (-0.08)	0.07 (-0.13)	-0.37** (-0.15)	0.14 (-0.10)
MWS T - 3	-0.26 (-0.16)	-0.15 (-0.13)	0.17** (-0.08)	0.18* (-0.10)	0.12 (-0.13)	-0.08 (-0.08)
MWS T - 4	0.09 (-0.11)	-0.04 (-0.09)	0.25*** (-0.09)	0.22* (-0.13)	0.10 (-0.09)	0.15*** (-0.05)
Temperature	-5.51 (-4.28)	-4.60 (-3.18)	-0.15 (-2.42)	-3.22 (-2.94)	-9.90*** (-2.87)	3.31* (-1.97)
Precipitation	0.26*** (-0.06)	0.09 (-0.06)	0.23*** (-0.07)	0.32*** (-0.10)	0.05 (-0.06)	0.22*** (-0.03)
Lagged Temperature Controls	X	X	X	X	X	X
Lagged Precipitation Controls	X	X	X	X	X	X
Region FE	X	X	X	X	X	X
Time FE	X	X	X	X	X	X
Full Set of Controls	X	X	X	X	X	X
Constant	-355.2 -245	-567.7*** -193.7	-593.6*** -137.4	-459.9*** -162.6	-238.3 -218.3	-800.4*** -170.9
Observation	1,178	1,310	1,330	1,372	1,115	1,214
R-squared	0.243	0.167	0.224	0.189	0.182	0.187

All errors are clustered at the region x survey year level

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1



Table 13: OLS Regression of Breastfeeding Duration by  
Socioeconomic Status and Gender

(7)	(8)	(9)	(10)
Female Breastfeeding Duration	Male Breastfeeding Duration	Female Breastfeeding Duration	Male Breastfeeding Duration
Quintile 4		Quintile 5	
-0.15	-0.17	-0.20	-0.24
(-0.15)	(-0.14)	(-0.14)	(-0.16)
-0.04	0.21	-0.11	-0.04
(-0.21)	(-0.18)	(-0.14)	(-0.13)
-0.06	-0.10	0.04	0.04
(-0.14)	(-0.09)	(-0.13)	(-0.15)
0.01	-0.09	0.09	0.10
(-0.14)	(-0.08)	(-0.10)	(-0.11)
0.18	-0.21**	0.05	-0.08
(-0.13)	(-0.10)	(-0.16)	(-0.11)
8.38***	11.18***	0.28	2.53
(-2.75)	(-2.16)	(-3.34)	(-3.30)
0.27**	0.21*	0.09	0.15**
(-0.11)	(-0.11)	(-0.08)	(-0.06)
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X
-212.7	-167.8	-444.8*	-518.3**
-304.4	-170.6	-233.4	-209.7
1,163	1,243	799	896
0.201	0.221	0.164	0.124



