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Abstract

Breastfeeding is associated with many benefits both for the mother and the child. Nevertheless, it is not unusual for mothers to wean their children early. We hypothesize that breastfeeding exhibits gender bias and aim to investigate the implications for child health in Central Asia. The results of this study will have direct policy implications for the healthcare and gender policy.

**Keywords:** breastfeeding, son preference, child gender bias, child health

**JEL Codes:** I1, J13, J16

1 Introduction

One of the primary aims of nutrition and public health programs across the world is promotion of breastfeeding. For example, the World Health Organization advocates exclusive breastfeeding to at least 6 months postpartum and exclusive breastfeeding has been recognized as the single most effective intervention to reduce under-five mortality\(^1\). Despite well-documented evidence that breastfeeding is associated with many benefits both for the mother and the child it is not unusual for mothers to wean their children early. This research project

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\(^1\)See the statement by the Assistant Director-General of the World Health Organization at the World Breastfeeding Week 1-7 August 2011 (available at [www.who.int](http://www.who.int)).
aims to investigate whether there are underlying gender biases in breastfeeding patterns and the implications for child health in some of the Central Asian countries of the former USSR. Child gender bias has been a highly important topic of research in social sciences. Particularly since the gender equality on one side and child health on the other were declared as the Millennium Development Goals by the United Nations\(^2\).

Medical literature has suggested multiple mechanisms through which breastfeeding promotes health for infants and young children in developing countries. First, breast milk contains glycans that are believed to protect the gastrointestinal tract from various infections (Morrow et al., 2005). Second, breastfeeding protects child from contaminated water and food. Especially in poor communities with lack of sanitation (Habicht et al. 1988). Breastmilk can remain uninfected even if the mother ingests contaminated food (Isaacs, 2005). Perhaps most importantly, breastfeeding has been shown to be associated with lower child mortality in Latin America (Betran et al. 2001), China (Chen et al. 1988), Bangladesh (Briend et al. 1988) among others. Retherford et al. (1989) argue that controlling for breastfeeding largely eliminates the negative correlation between infant mortality and subsequent birth spacing in Nepal. According to the estimations of The World Health Organization (2000) in developing countries, mortality risk between ages one and two is twice as high if a child is not being breastfed.

There is vast medical literature showing the benefits of breastfeeding even in the countries with developed economies and infrastructure. For example, Sacker et al. (2006), based on a sample of 14660 singleton infants in the UK\(^3\), found that infants who had been breast-fed exclusively for at least 4 months were significantly less likely to have gross and fine motor delays than infants who had never been breast-fed. Moreover, the proportion of infants who were delayed significantly decreased with duration of breast-feeding. Authors argue, controlling for advantaged social position, education, or parenting style, that the protective effect of breastfeeding on the attainment of gross motor milestones is attributable to some component(s) of breast milk or feature of breastfeeding. In a related study, Quigley et al. (2011) administered British Ability Scales tests to children at age 5 years (naming vocabulary, pattern construction, and picture similarities subscales) and found that mean scores for all

\(^2\)See http://www.un.org/milleniumgoals for more information.

\(^3\)In their study, infants requiring a special-care nursery at birth were excluded.
subscales increased with breastfeeding duration. They found that breastfeeding is associated with improved cognitive development, particularly in children born preterm. In particular, there was a significant difference in mean score between children who were breastfed and children who were never breastfed. Somewhat surprisingly, in Denmark, Mortensen (2002) finds a significant positive association between duration of breastfeeding and intelligence among young adults as well.

In this study we are to employ the approach proposed by Jayachandran and Kuziemko (2011) to test whether families in post-soviet Central Asia, populated predominantly by relatively conservative population, where son preference prevails, exhibit child gender bias in breastfeeding patterns. To that end we shall use the datasets of the Demographic and Health Surveys (DHS). DHS datasets are available for several Central Asian countries, however the most recent ones are Azerbaijan and Uzbekistan: 2006 and 2002 respectively. Therefore we have decided to focus on these two countries as datasets for other countries of the region, such as Kazakhstan and Kyrgyzstan for example, are rather outdated, i.e. from the 1990’s.

The results of this study will have direct policy implications for the healthcare sector as well as gender empowerment. For example, if gender bias against girls is detected in breastfeeding then the government and healthcare workers (midwives, lactation consultants, pediatricians, etc.) should exert more effort and resources on encouraging mothers of the newly born girls to breastfeed longer. The academic paper based on the results of this study shall be positioned in the interdisciplinary literature on health economics, gender issues and pediatrics.

The rest of the proposal is structured as follows: the following section discusses the relevant literature on child gender bias, Section 3 reviews the theoretical model and Section 4 describes the data to be used in this study. The document ends with specification of implementation details followed by the list of references.

2 Related Literature

Since we have already discussed some of the important medical publications on breastfeeding, in this Section we focus on the problems of studying the child gender bias in household survey data. Relative conservatism here is implied with respect to other regions of the CIS.
data. Early attempts to study child gender bias using household data came from Deaton (1989, 1997), who proposed intuitively very appealing way to indirectly estimate whether girls are allocated less resources than boys in the family. He noted that when a child was born, the household, in effect, became poorer in real terms—there was now one more person to feed, who would remain unproductive for a long while. It meant that the adults in the household would have to reduce their own consumption of so-called “adult goods” to make room for the new expenditures.

However, estimation of the extent of child gender discrimination in household survey datasets represents a serious methodological challenge. Even in the countries where the preference for boys is strongest, it is hard to find evidence that girls receive less resources than boys under normal circumstances. Specifically because households under observation are likely to change their behavior and/or when asked to keep diaries of how much each member receives over a given period, households may misreport their data (Duflo, 2005). So far, Deaton’s approach, known as the outlay equivalent analysis, has by and large failed to detect significant discrimination based on child gender. Most of the studies based on this approach, including the above mentioned papers by Deaton (1989, 1997), report no or insignificant evidence of discrimination between boys and girls based on household survey datasets (Deaton and Subramanian, 1991; Haddad and Reardon, 1993). Discussion of methodological nuances leading to the failure to detect discrimination through outlay equivalent analysis that is presumed to exist a priori is offered in Rose (1999), Ahmad and Morduch (2002), Jensen (2002) and Kingdon (2005).

Recently, Jayachandran and Kuziemko (2011) proposed an ingenuous method to test for differential treatment of girls and boys using household data. In many developing countries son preference is common and results in a stop-after-a-son fertility pattern: When a daughter is born, parents are more likely to want to have more children in order to have another child hoping for a son (Das, 1987). At the same time, it is known that breastfeeding inhibits post-natal fertility. Putting these two results together, Jayachandran and Kuziemko (2011) argue that, in countries with son preference, girls will be weaned earlier than boys since

\(^5\)Some of the studies that have been successful in detecting some gender bias in the allocation of household resources to children include among others Thomas (1994), Gibson and Rozelle (2004) and Nhate et al. (2005).
parents want to "try again" for a son. They develop a simple dynamic programming model of breastfeeding that incorporates its contraceptive properties and confirm child gender bias using data from the 1992, 1998 and 2005 waves of the National Family Health Survey (NFHS) in India. Most importantly, they find that child survival exhibits patterns similar to the observed gender based discrimination in lactation, especially in settings where the alternatives to breastmilk are unsanitary. In the following Section we discuss their model.

3 The Model

In this section we briefly describe the theoretical model and the estimation strategy following Jayachandran and Kuziemko (2011).

In a dynamic setting, a mother faces an infinite horizon with a discount rate $\beta$. Her objective is to maximize the infinite sum of discounted per-period expected utility $u(n, s)$, where $n$ is the number of children and $s$ is the number of sons she has. The utility function is given by $u(n, s) = \varphi f(n) - c(n) + \lambda g(s)$, where $\varphi f(n)$ is the benefits with $\varphi > 0$ parameterizing the demand for children and $c(n)$ is the costs of having $n$ children, both subject to some regularity conditions.

In each period, a woman gives birth to either one child or no children. A mother who gives birth in period $t$ decides whether to breastfeed the child, $b_t \in \{0, 1\}$. The breastfeeding decision, in essence, acts as a fertility stopping decision: without breastfeeding the current child she will have another child in the next period, and, similarly, with breastfeeding she will not have another child in the next period. If $b_t = 1$, then $n_{t+1} = n_t$ and $s_{t+1} = s_t$. If $b_t = 0$, then $n_{t+1} = n_t + 1$ and, since the next child is equally likely to be a boy or a girl, $s_{t+1} = s_t + 1$ or $s_{t+1} = s_t$, each with probability $1/2$. For the sake of simplicity, henceforth, we drop the time subscript.

A mother that chooses not to breastfeed (continue having children) receives $u(n, s)$ this period and the discounted expected value function over subsequent periods. The value function in the next period is $V(n+1, s)$ or $V(n+1, s+1)$, with equal probability. If the choice is to breastfeed (stop having children)$^6$ and receive $u(n, s)$ in this and each of the infinite

$^6$Mothers are assumed to have access to sterilization, but even if they choose to get sterilized, they breastfeed their last child.
subsequent periods (giving a future lifetime discounted utility of $u(n, s) + \beta \frac{u(n, s)}{1-\beta} = \frac{u(n, s)}{1-\beta}$).

Thus, the decision problem is given by

$$V(n, s) = \max \left\{ \frac{u(n, s)}{1-\beta}, u(n, s) + \beta \left( \frac{V(n + 1, s) + V(n + 1, s + 1)}{2} \right) \right\}$$

Since breastfeeding is modelled as an optimal fertility stopping rule, the model yields the following testable predictions, which are fundamentally predictions about stopping rules:

**Proposition 1** Breastfeeding is increasing in birth order.

**Proposition 2** At any birth order, a child is more likely to be breastfed if, all else equal,

(i) the child is male; or

(ii) more of his or her older siblings are male.

**Proposition 3** The largest gap in breastfeeding of boys versus girls is at middle birth order. In other words, the gap is increasing with birth order for sufficiently low birth order, and decreasing in birth order for sufficiently high birth order.

The intuition behind the Proposition 3 is that at low birth order, mothers are less sensitive to the child gender. They want to continue having children since utility is still increasing in the number of children. At high enough birth order, the cost of childbearing becomes large enough to outweigh the benefits of having a son. In this case, a mother will breastfeed the current child regardless of the gender. At intermediate birth order, breastfeeding is likely to be chosen after a daughter than after a son.

To test these hypotheses, we will test if breastfeeding is a positive function of the mother’s desire to cease childbearing, which increases with birth order. We will estimate the following non-parametric OLS model:

$$Breastfeed_i = \sum_k \beta_k \cdot 1_{\{BirthOrder_i = k\}} + X_i \gamma + a_i + \epsilon_i$$

where:
• Breastfeed$_i$ is the number of months a mother reports having breastfed child $i$,
• $a_i$ is a vector of age-in-months fixed effects (up to 36 months, the maximum value of the outcome)
• $X$ is a vector of covariates and $\epsilon$ is an error term

**Proposition 4** (i) Breastfeeding is constant for birth order below the ideal family size and can strictly increase in birth order only after the ideal family size has been reached.

(ii) There is no gender gap in breastfeeding for birth order below the ideal family size. The gender gap in breastfeeding only arises after the ideal family size has been reached.

Here we will use the following specification:

$$Breastfeed_{ij} = \delta 1_{\Delta Ideal_{ij} \geq 0} + \lambda \Delta Ideal_{ij} + \phi \Delta Ideal_{ij} \times 1_{\Delta Ideal_{ij} \geq 0} + X_{ij} + a_i + \epsilon_{ij}$$

where $\Delta Ideal_{ij}$ is the difference between the birth order of mother $j$’s $i$th child and mother $j$’s ideal family size.

While more hypotheses can be formulated upon the detailed study of the datasets, the main idea of the study is to answer the following questions that have important policy implications:

1. Are girls on average weaned earlier than boys, especially in families with no pre-existing boys?
2. Do children who are breastfed longer exhibit better health characteristics and lower mortality rates?

4 **The Data**

Our empirical analysis will use the DHS datasets from Azerbaijan and Uzbekistan from the surveys conducted in 2006 and 2002. The choice of the two countries is driven mainly by data availability as the data for other countries of the region is relatively outdated. The
NFHS data used by Jayachandran and Kuziemko (2011) is also based on the DHS. The questionnaires used in the two surveys are very similar in content. Specifically both collect information about children, past births given by a women as well as for how many months the respondent breastfed each individual child. Information provided by DHS includes child mortality and child health. The latter can be measured by anthropometrics like height or weight (or combinations of these)\(^7\). The surveys also contain a variety of information on desired fertility, contraception, and child health in addition to the standard demographic and household characteristics.

Following Jayachandran and Kuziemko (2011) we will make several sampling restrictions. First, we exclude observations with missing values for duration of nursing, which restricts the survey to relatively recent births since the surveys do not collect retrospective breastfeeding information for older children. Second, we shall exclude mothers who have very high number of children (the 95th percentile for this variable) to reduce composition bias from mothers with unusually large family size. Third, we shall exclude multiple births (e.g., twins) since their birth order is less well-defined and their lactation periods might systematically differ by virtue of their not being a singleton. Finally, for the breastfeeding analysis, we exclude children who have died, as otherwise the nursing period would be censored in a manner that does not reflect mothers’ preferences regarding breastfeeding\(^8\).

The Uzbekistan 2002 sample was designed to provide demographic and health indicators, including fertility and childhood mortality rates, at the national level and for urban and rural areas. The sample design specified a target of 800 female respondents in each of the sampling regions, yielding a target sample size of approximately 5,600 women. A weighted, multistage, stratified, cluster sampling design was employed. In total, 219 sample clusters with approximately 20 households per cluster were selected using systematic random sampling. The selected sample consisted of 4,385 households. The Azerbaijan 2002 sample is a representative probability sample of 7,619 households.

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\(^7\)It has become a convention in the literature to use height normalized by both age and sex. See for example Frankenberg et al. (2005), Nobles and Frankenberg (2009) and Deloach and Lamanna (2011) for some of the recent examples.

\(^8\)In Jayachandran and Kuziemko (2011) this final restriction results in a loss of about five percent of remaining observations.
5 Implementation Specifics

5.1 About the Researcher

The research project will be implemented by Nurmukhammad Yusupov who presently works full time as a lecturer\(^9\) at the Westminster International University in Tashkent. He obtained a PhD in Management from the University of Nantes in France in 2011. He had also completed a two year coursework at Toulouse School of Economics before moving to Nantes in 2007. Detailed information about his past work experience and research output is provided in the CV attached with this project proposal.

5.2 Preliminary Schedule

The implementation of the research project is to be started immediately after the first round of the EERC competition in case of successful selection for participation in the December workshop, that is around November 20, 2011. The plan is to proceed according to the following timetable:

<table>
<thead>
<tr>
<th>Timing</th>
<th>Output to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec. 2011</td>
<td>Thorough literature review, preliminary (but fairly detailed) study of the datasets and formulation of testable hypothesis (for discussion at EERC workshop)</td>
</tr>
<tr>
<td>Mar. 2012</td>
<td>Data cleaning and preliminary regression results for Uzbekistan</td>
</tr>
<tr>
<td>Apr. 2012</td>
<td>Data cleaning and preliminary regression results for Azerbaijan</td>
</tr>
<tr>
<td>June 2012</td>
<td>First draft of the report (for presentation at EERC workshop)</td>
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<tr>
<td>Sept. 2012</td>
<td>Second draft of the report (based on comments from the EERC workshop), start seminar presentations of the results at various research institutions</td>
</tr>
<tr>
<td>Dec. 2012</td>
<td>Final draft of the report (for presentation at EERC workshop)</td>
</tr>
<tr>
<td>Feb. 2013</td>
<td>First version of the academic paper for submission to a journal (end of project)</td>
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Thus, the factual expected duration of the research project is about 15 months: from the

\(^9\) The UK equivalent of Assistant Professor in the US.
end of November 2011 to the end of February 2013. However, the official duration will be set for 12 months: from the end of February 2011 (official announcement of EERC’s final decision) to the end of February 2013.

References


