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GENDER-BIASED BREASTFEEDING IN EGYPT: EXAMINING THE FERTILITY PREFERENCE HYPOTHESES OF JAYACHANDRAN AND KUZIEMKO (2011)

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SUMMARY

Jayachandran and Kuziemko (Why do mothers breastfeed girls less than boys? Evidence and implications for child health in India. *Quarterly Journal of Economics* 2011; **126**(3): 1485–1538) develop and empirically validate a theory showing son preference in India generates 'passive' parental bias against girls in breastfeeding due to gender-differentiated birth spacing and fertility stopping. I scientifically replicate their empirical exercises to test the validity of the theory in Egypt, where there is also high prevailing son preference, but little research on its implications for child health investments. I additionally examine whether using the exclusive breastfeeding rate as an alternative outcome yields supportive evidence for the theory. I find the theory is strongly supported by empirical results from Egyptian data, bolstering its policy relevance for developing countries besides India.

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Supporting information may be found in the online version of this article.

1. INTRODUCTION

Breastfeeding involves a trade-off between protecting a child's health, and the contraceptive effects and caloric costs of nursing.[1] Theory and empirical findings for India in Jayachandran and Kuziemko (2011) show that son preference combined with these properties of nursing alters breastfeeding duration as mothers' desire for more children evolves over their fertility cycle. A 'passive' form of discrimination between children of differing gender and birth order may inadvertently arise in breastfeeding, with potentially adverse consequences for future welfare due to poorer early-life health. I empirically test the robustness of this theory in Egypt, which also has high prevailing son preference. Egypt is a predominantly Islamic country, unlike India, which is mainly Hindu, so the two nations are culturally very dissimilar. Yet son preference is pervasive in both, making Egypt a good alternative setting to validate the policy relevance of the theory outside the Indian context.

I augment existing findings by investigating fertility impacts on exclusive breastfeeding of infants. This is arguably a more important outcome than breastfeeding duration, as exclusive breastfeeding in the first 6 months of infancy is crucial for immune system development and protection from disease in early childhood, particularly in developing countries (Clemens *et al.*, 1999).[2] The exclusive breastfeeding rate is thus a relevant alternative outcome to further test the theoretical framework.

My empirical results are qualitatively identical to those in Jayachandran and Kuziemko (2011), providing support for their theory. Breastfeeding duration increases with birth order and increases again sharply when women achieve ideal total fertility, indicating declining desire to conceive again

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[1] See the online Appendix (supporting information) for a detailed discussion of the relevant medical evidence.

[2] WHO country statistics show that diarrhoea alone accounted for 7% of total under-5 mortality in Egypt in 2010. The under-5 child mortality rate was 22 per 1000 live births in 2010.

with each successive birth and a further steep decline at ideal family size. Having older brothers increases breastfeeding duration and reduces the breastfeeding gender gap, reflecting a reduced desire for more children once sons are born. Children born in excess of ideal fertility are also less likely to be exclusively breastfed during ages 0–6 months. This is important evidence in favour of the theory, as an alternative explanation for ‘excess’ children being breastfed longer is that mothers care more about later-born children. However, I find excess children are given foods besides breast milk before age 6 months as well as being breastfed longer in childhood, verifying that mothers breastfeed these children for longer to limit fertility rather than to give them increased protection.

The rest of the paper is organized as follows. Section 2 describes the data and methodology I use. Section 3 presents the estimation results. Section 4 concludes.

2. DATA AND METHODOLOGY

I use data from five waves of DHS surveys from Egypt for the analysis.[3] The data come from interviews with women aged 15–49 years, and collects information on their fertility history, education, marital history, and child health and mortality outcomes. The survey also records the number of months a child is breastfed for all children born in the past 5 years to each woman. My final sample consists of 48,304 children born to 34,346 women during 1990–2008.

2.1. Empirical Strategy: Breastfeeding Duration

To investigate the presence of gender bias in months of breastfeeding and variation in breastfeeding duration by birth order, I use the following specification:

$$\begin{aligned}\text{Breastfeed}_i = \alpha + \gamma\, \text{Male}_i + \beta_1\, \text{Birth order}_i \\ + \beta_2\, \text{Birth order}_i^2 + \delta X_i + \theta_i + \epsilon_i\end{aligned} \tag{1}$$

where the dependent variable Breastfeed_i is the number of months child i is breastfed. Male_i is a dummy variable taking value 1 when child i is a boy, and 0 otherwise. The coefficient γ captures any gender difference in breastfeeding. The β coefficients capture linear and quadratic birth order effects.[4] X_i is the standard vector of controls, which are linear and quadratic terms of the mother's age, dummy variables for the mother's educational attainment, linear and quadratic controls for child birth year[5] and a dummy variable for whether the mother resides in a rural area. θ_i is a vector of age-in-months fixed effects that corrects for right-censoring in breastfeeding for recently born children. ϵ_i is an idiosyncratic error term. I also interact the birth order terms with the male child indicator to identify changing gender gaps in breastfeeding at different stages of the fertility cycle.

I then explore how breastfeeding changes as women near or exceed their ideal number of children in the following specification:

$$\begin{aligned}\text{Breastfeed}_i = \alpha + \gamma\, \text{Male}_i + \tau_1\, \Delta\text{Ideal}_i + \tau_2\, \mathbb{1}(\Delta\text{Ideal}_i \geq 0) \\ + \tau_3\, \mathbb{1}(\Delta\text{Ideal}_i \geq 0) * \Delta\text{Ideal}_i + \delta\, X_i + \theta_i + \epsilon_i\end{aligned} \tag{2}$$

where ΔIdeal_i measures the distance from the mother's reported ideal total fertility, which is defined as $(\text{Birth order}_i - \text{Ideal})$, where Ideal is the mother's reported ideal number of children. τ_1 captures the effect on breastfeeding as the woman approaches her ideal fertility, and τ_2 will identify any

[3] The years of data collection are 1995, 2000, 2003, 2005 and 2008.
[4] The specification including birth order dummy variables rather than linear and quadratic terms yields the same qualitative results. These are available from the author upon request.
[5] All results are robust to the inclusion of child birth year fixed effects instead.

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discrete change in breastfeeding once a woman reaches this fertility level. τ_3 captures the effect of distance from the ideal number of children once a woman has exceeded it, which allows for differential trend effects below and above the ideal fertility ceiling. The remaining regressors are the same as in equation 1.[6]

Finally, I examine whether breastfeeding duration changes with the sex composition of older siblings in the following specification:

$$\begin{aligned} \text{Breastfeed}_i = \alpha + \gamma\,\text{Male}_i + \chi_1\,\text{Male fraction}_i \\ + \chi_2\,\text{Birth order}_i + \delta\, X_i + \theta_i + \epsilon_i \end{aligned} \tag{3}$$

where Male fraction$_i$ is the fraction of older siblings of child i that are male, conditional on birth order. χ_1 will capture any impact of son preference on breastfeeding separately from that of total fertility identified in χ_2, as a higher fraction of male offspring is likely to increase subsequent birth intervals and therefore also increase breastfeeding duration under son-biased fertility preferences. I also investigate whether the presence of just one son among the older siblings alters breastfeeding duration by replacing the regressor Male fraction$_i$ with $\mathbb{1}(\text{Male fraction}_i > 0)$. The remaining regressors are the same as in equation. 1 and (2).

I estimate all specifications using ordinary least squares and cluster the standard errors by mother. Since breastfeeding duration is right-censored, I also present results from a Cox proportional hazard duration model. The failure event in the Cox model is defined as a child being weaned. As pointed out in Jayachandran and Kuziemko (2011), the ordinary least squares (OLS) estimates capture impacts on *observed* breastfeeding. Several children in the sample are too young to have completed breastfeeding, biasing these estimates downwards. I therefore plot breastfeeding ‘survival’ curves by child gender for children aged 36 months or less as in the original study, and examine how the breastfeeding gender gap changes with age to account for the censoring. I report the difference in mean completed breastfeeding duration between girls and boys assuming no child is breastfed longer than 36 months.[7]

2.2. Exclusive Breastfeeding Rates

To examine whether fertility preferences affect exclusive breastfeeding rates among children aged 0–6 months at the time of the survey, I explicitly measure violation of exclusive breastfeeding using information on solid food and liquids given to the child in the week preceding the survey.[8] I define binary outcome variables taking value 1 if the child has been given any solid food or liquids besides breast milk, and 0 otherwise. I estimate the main specifications with these binary indicators as outcome variables using probit models, and include regional, interview month and child birth year fixed effects. The short 1-week window before the survey reduces concerns of recall bias regarding nutrients given to the child.[9]

[6] There are potential issues with the Ideal variable as mothers may report lower desired fertility if they expect to or already have sons early in the fertility cycle. Also, women may update their reports of ideal fertility to match actual fertility outcomes. However, the latter is not an apparent concern, as 49.71% of the 42,572 children for whom we have this information are reported as excess.

[7] This top coded value for breastfeeding duration is reasonable as 98.95% of children have completed breastfeeding by age 36 months, and facilitates comparison with the original study that makes the same assumption.

[8] The liquids besides breast milk on which data are collected include plain water, sugar water, herbal tea, commercial baby formula, tinned or powdered milk, fresh milk and fruit juice. These data are only available for the 1995, 2000and 2003 surveys.

[9] I also do estimations measuring exclusive breastfeeding with a binary indicator for whether children aged 0–6 months at the time of the survey have been weaned. These results are also highly supportive of the theory, and are discussed in detail in the online Appendix.

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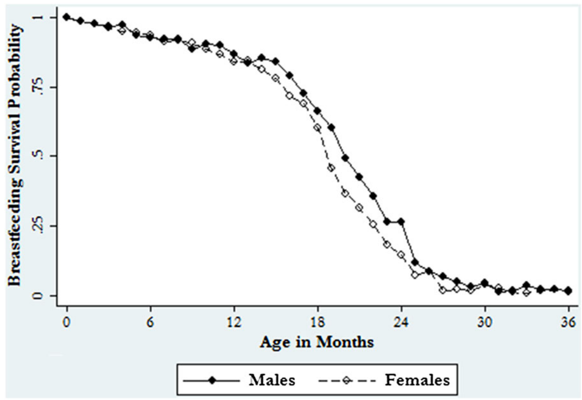

Figure 1. Child gender and completed breastfeeding. The figure shows breastfeeding survival curves for boys and girls aged 0–36 months. 98.95% of children are no longer breastfed after age 36 months. Using 36 months as the top coded value for breastfeeding, I find that male children receive 18.47 months of completed breastfeeding on average and female children receive 17.37 months, yielding a male advantage of 1.10 months in completed breastfeeding

3. RESULTS

3.1. Completed Breastfeeding by Child Gender

Figure 1 shows the gender-specific probability that a child is still being breastfed during ages 0–36 months. The breastfeeding survival curves indicate that boys begin to have a breastfeeding advantage at approximately 9 months of age, and have greater likelihood of being nursed until approximately age 30 months, by which time both boys and girls are almost universally weaned. Using age 36 months as the top coded value for breastfeeding duration, I find boys receive 18.47 months of completed breastfeeding on average, whereas girls receive 17.37 months, yielding a male breastfeeding advantage of 1.10 months. This is nearly identical to the male advantage of 0.93 months found for India in Jayachandran and Kuziemko (2011), with boys being breastfed for 23.26 months on average and girls being breastfed for 22.33 months.

3.2. Fertility Outcomes and Breastfeeding Duration

The effects of birth order on observed breastfeeding duration estimated from equation 1 are shown in Table I. In column (1) I find the male advantage in breastfeeding is 0.652 months on average and highly significant. The linear and quadratic controls for birth order show increased breastfeeding with each birth that diminishes at higher birth orders. In column (2) I introduce the standard set of covariates, with little effect on the estimates. In column (3) I interact birth order with the male child indicator, and find the male advantage in breastfeeding peaks in the middling birth orders and then declines as the theory predicts. The Cox proportional hazard results in column (4) reflect the same pattern as the OLS estimates in column (1), showing girls are 2.5 percentage points more likely to be weaned than boys, and that the probability of being weaned declines at a diminishing rate with increasing birth order.

Child frequencies and initial impact estimates from equation 2 are depicted in Figure 2. The estimates show a discontinuous increase in breastfeeding for children of birth order equal to mother's ideal fertility as the theory predicts. The full regression results are shown in Table II. In column (1) I find breastfeeding duration increases by 0.196 months with each child that brings the mother closer to her ideal fertility. Once she reaches this fertility there is a sharp additional increase in breastfeeding of 0.600 months. These results are qualitatively identical to those for India. The same pattern is found

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Table I. Breastfeeding by birth order and gender

	Months of breastfeeding			
	OLS			Cox
	(1)	(2)	(3)	(4)
Male	0.652***	0.642***	—	−0.025**
	(0.054)	(0.054)		(0.011)
Birth order	0.982***	1.007***	0.804***	−0.186***
	(0.060)	(0.068)	(0.072)	(0.038)
Birth order^2	−0.065***	−0.076***	−0.052***	0.009*
	(0.008)	(0.008)	(0.010)	(0.005)
Male* Birth order	—	—	0.392***	—
			(0.045)	
Male* Birth order^2	—	—	−0.046***	—
			(0.009)	
Observations	45,358	45,358	45,358	44,827
Covariates	No	Yes	Yes	No
R^2	0.470	0.477	0.477	—

Note:Robust standard errors clustered by mother in parentheses. Covariates include linear and quadratic terms of mother's current age, dummy variables for mother's educational attainment, linear and quadratic terms of child's birth year, a dummy variable for whether the mother lives in a rural area, and child age-in-months fixed effects. ***p < 0.01; **p < 0.05; *p < 0.10.

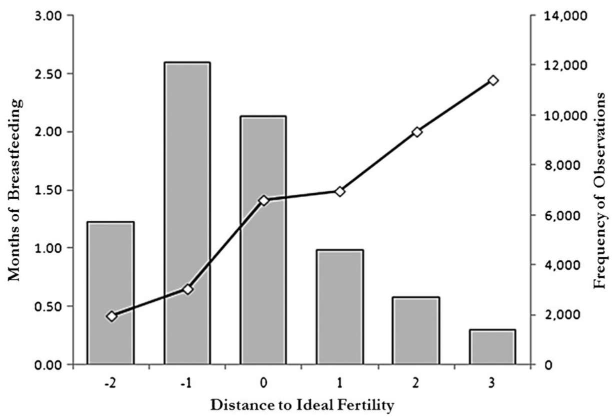

Figure 2. Ideal fertility and breastfeeding duration. The solid line shows coefficients from a regression of months of breastfeeding on distance to ideal fertility dummies with age-in-months fixed effects included. The columns indicate frequency of children

in column (2), where I allow the effect of distance to ideal fertility to vary beyond the ideal total. In column (3) I include the standard regressors and the results persist, albeit with smaller magnitudes.

The results from specification (3) are shown in Table III. In column (1) I find breastfeeding increases by 0.424 months when the child has an older male sibling. Column (2) reveals girls with an older brother receive 0.327 more months of breastfeeding than boys, eliminating 50.93% of the 0.642-month male breastfeeding advantage in column (1). In column (3) I replace the older brother indicator with male fraction of older siblings to examine whether breastfeeding increases with rising share of boys among older siblings. I find that an increase in the fraction of older brothers increases breastfeeding, with a maximum increase of 0.510 months when all older siblings are male. Column (4) shows that girls are breastfed increasingly longer than boys as the male fraction of older siblings increases, with

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Table II. Breastfeeding by ideal fertility

	Months of breastfeeding		
	(1)	(2)	(3)
Male	0.655***	0.659***	0.647***
	(0.058)	(0.058)	(0.057)
ΔIdeal	0.196***	0.100**	0.168***
	(0.027)	(0.040)	(0.041)
$\mathbb{1}(\Delta\text{Ideal} \geq 0)$	0.600***	0.680***	0.420***
	(0.085)	(0.089)	(0.093)
$\mathbb{1}(\Delta\text{Ideal} \geq 0)$ * ΔIdeal	—	0.174***	−0.102*
		(0.054)	(0.057)
Observations	40,120	40,120	40,120
Covariates	No	No	Yes
R^2	0.462	0.463	0.473

Note:Robust standard errors clustered by mother in parentheses. All specifications are estimated with OLS. Covariates include linear and quadratic terms of mother's current age, dummy variables for mother's educational attainment, linear and quadratic terms of child's birth year, a dummy variable for whether the mother lives in a rural area, and child age-in-months fixed effects. ***p < 0.01; **p < 0.05; *p < 0.10.

Table III. Breastfeeding by sibling sex composition

	Months of breastfeeding					
	OLS				Cox	
	(1)	(2)	(3)	(4)	(5)	(6)
Male	0.642***	0.801***	0.642***	0.820***	−0.172***	−0.173***
	(0.054)	(0.076)	(0.054)	(0.072)	(0.035)	(0.035)
$\mathbb{1}(\text{Male fraction} > 0)$	0.424***	0.592***	—	—	−0.278***	—
	(0.069)	(0.090)			(0.035)	
Male* $\mathbb{1}(\text{Male fraction} > 0)$	—	−0.327***	—	—	—	—
		(0.107)				
Male fraction	—	—	0.510***	0.776***	—	−0.262***
			(0.072)	(0.099)		(0.044)
Male* Male fraction	—	—	—	−0.519***	—	—
				(0.132)		
Observations	45,358	45,358	45,358	45,358	44,827	44,827
Covariates	Yes	Yes	Yes	Yes	No	No
R^2	0.477	0.477	0.477	0.477	—	—

Note:Robust standard errors clustered by mothers in parentheses. Additional regressors include birth order, standard covariates and child age-in-months fixed effects. ***p < 0.01; **p < 0.05; *p < 0.10.

a maximum relative female gain of 0.519 months when all older siblings are male. This is 80.84% of the male breastfeeding advantage in column (1). The estimates in columns (1) and (3) reflect the same qualitative impacts of sibling sex composition as those found for India. The Cox regressions results in columns (5) and (6) show the same qualitative results as columns (1) and (3).[10]

[10] I perform robustness checks to rule out alternative mechanisms driving all these results using child vaccinations as a non-fertility-related alternative outcome, and also examining the probability of having a younger sibling. The results are robust to both these checks, which are described in detail in the online Appendix.

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Table IV. Food and liquid besides breast milk aged 0–6 months

	Given solid food or other liquids							
	Solid (1)	Liquid (2)	Solid (3)	Liquid (4)	Solid (5)	Liquid (6)	Solid (7)	Liquid (8)
Male	−0.001	0.022*	0.005	0.020*	−0.001	0.036**	−0.012	0.018
	(0.020)	(0.011)	(0.022)	(0.012)	(0.028)	(0.016)	(0.037)	(0.015)
Birth order	−0.039	−0.036**	—	—	—	—	—	—
	(0.024)	(0.014)						
Birth order^2	0.005*	0.004**	—	—	—	—	—	—
	(0.003)	(0.002)						
ΔIdeal	—	—	−0.032*	−0.025**	—	—	—	—
			(0.017)	(0.010)				
$\mathbb{1}(\Delta\text{Ideal} \geq 0)$	—	—	−0.006	−0.013	—	—	—	—
			(0.037)	(0.019)				
$\mathbb{1}(\Delta\text{Ideal} \geq 0)^{*}\Delta\text{Ideal}$	—	—	0.064***	0.022*	—	—	—	—
			(0.022)	(0.013)				
$\mathbb{1}(\text{Male fraction} > 0)$	—	—	—	—	−0.010	−0.023	—	—
					(0.032)	(0.018)		
Male fraction	—	—	—	—	—	—	−0.012	−0.046**
							(0.037)	(0.020)
Observations	3238	3238	2743	2743	3238	3238	3238	3238
Other food/liquid	45.2%	76.0%	45.5%	76.5%	45.2%	76.0%	45.2%	76.0%
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note:The regression sample consists of children born within 6 months of the survey. Coefficients are marginal effects from probit estimations. Robust standard errors clustered by mother are in parentheses. Additional regressors include the standard covariates, dummy variables for Governorate and month of interview, and child age-in-months fixed effects. Columns (5)–(8) also include linear birth order controls, and child gender–sibling sex interactions. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.10$.

3.3. Exclusive Breastfeeding Results

The results on consumption of solid food and liquids besides breast milk in Table IV show that children aged 6 months or less are less likely to be given liquids besides breast milk at higher birth orders. They also show that the probability of consuming solid food declines by 3.2 percentage points with each birth approaching the mother's ideal fertility. However, the probability of consuming solid food increases with strong statistical significance by 6.4 percentage points with each birth beyond ideal fertility. The same is true for liquids, with a significant decline in consumption probability of 2.5 percentage points with each birth approaching ideal fertility and a weakly significant increase in probability of 2.3 percentage points thereafter. Therefore, even though breastfeeding duration increases for excess children, mothers exhibit reduced desire to protect these children via exclusive breastfeeding.[11] In column (6) I find a statistically significant decline in the probability of consuming other liquids with an increasing male fraction of older siblings, in line with the results on breastfeeding duration. This is most likely due to both increased desire for contraception and a higher maternal incentive to protect children once they already have sons.

4. CONCLUSIONS

The results show that there is significant gender bias against girls in breastfeeding duration in Egypt. On average, girls are breastfed for 0.642–0.652 months less than boys according to the OLS results, and for 1.10 months less when we take into account completed breastfeeding. The rest of the results strongly support the theory of Jayachandran and Kuziemko linking mothers' desired fertility outcomes

[11] Boys are likelier to be given liquids besides breast milk by a marginally significant 2.0–2.2 percentage points, potentially due to their higher risk of having diarrhoea and greater need for rehydration. However, the gender difference is small considering 76.0% of all children are given liquids and 45.2% are given solid foods besides breast milk at these ages.

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to breastfeeding behaviour under son-biased fertility preferences. The policy implications of the model are hence arguably applicable for contraceptive uptake, family planning and child health in developing countries besides India, where son preference is a social norm. 85.44% of 14,778 women with at least one child interviewed in the last Egypt DHS survey in 2008 had used a modern form of contraception. This suggests that availability of contraceptives may not be the root cause behind the observed gender difference in breastfeeding duration. However, this, along with the roles of household income and institutions governing female labour force participation and inheritance, still remain avenues for further research.

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