Development, Modernization, and Childbearing: The Role of Family Sex Composition

Deon Filmer, Jed Friedman, and Norbert Schady

Does the sex composition of existing children in a family affect fertility behavior? An unusually large data set, covering 64 countries and some 5 million births, is used to show that fertility behavior responds to the presence—or absence—of sons in many regions of the developing world. The response to the absence of sons is particularly large in Central Asia and South Asia. Modernization does not appear to reduce this differential response. For example, in South Asia the fertility response to the absence of sons is larger for women with more education and has been increasing over time. The explanation appears to be that a latent demand for sons is more likely to manifest itself when fertility levels are low. As a result of this differential fertility behavior, girls tend to grow up with significantly more siblings than do boys, with potential implications for their well-being when quantity–quality tradeoffs result in fewer material and emotional resources allocated to children in larger families. JEL codes: J16, J13, O15

A family preference for sons over daughters may manifest itself in various ways. An especially stark dimension is the excess mortality among girls documented in several Asian countries (see, for example, Zeng and others 1993 for China; Muhiri and Preston 1991 for Bangladesh; and Das Gupta 1987 for India). A similar phenomenon has been documented in the Middle East (Yount 2001). Son preference can also manifest itself through lower investments in the human capital of girls. Pande (2003) documents lower nutrition and immunization rates among girls in India. School enrollment and attainment among girls

Deon Filmer (corresponding author) is a lead economist in the Development Economics Research Department at the World Bank; his email address is dfilmer@worldbank.org. Jed Friedman is a senior economist in the Development Economics Research Department at the World Bank; his email address is jfriedman@worldbank.org. Norbert Schady is a senior economist in the Development Economics Research Department at the World Bank; his email address is nschady@worldbank.org. The authors thank Monica Das Gupta, Peter Lanjouw, Cynthia Lloyd, T. Paul Schultz, and three anonymous referees for valuable comments and suggestions, and Ryan Booth and Nicholas Ingwersen for outstanding research assistance. They are grateful for financial support from the Hewlett Foundation's Trust Fund on Fertility, Reproductive Health, and Socioeconomic Outcomes and the Government of Norway.

THE WORLD BANK ECONOMIC REVIEW, VOL. 23, NO. 3, pp. 371–398 doi:10.1093/wber/lhp009
Advance Access Publication October 23, 2009

lags behind that of boys in many South Asian, Middle Eastern, and North African countries (Filmer 2005).[1]

This study focuses on one manifestation of a "preference" for sons—a greater propensity for continued childbearing given an all-female rather than an all-male composition of existing children in the family. Such behavior could be the result of taste-based sex discrimination or of economic concerns, such as higher costs of investing in girls than in boys or lower pecuniary returns to investments in girls than in boys. Therefore, while differential fertility-stopping behavior is related to preferences, it is the result of a larger set of factors.

There are numerous possible reasons for observing differential fertility-stopping behavior in the developing world. Typically, they derive from conditions found in many traditional rural societies, such as inheritance systems that pass assets to sons, intergenerational insurance systems in which sons care for parents in old age, or production systems with low pecuniary returns to women's work (and to investments in women's human capital). General development processes and modernization, including urbanization, the dissolution of traditional rural communities, and increasing female education and labor force participation, are expected to work against these pressures for differential fertility-stopping behavior in settings where it exists (see, for example, Chung and Das Gupta 2007). This article explores the extent of son-preferred differential fertility-stopping behavior in the developing world; how it varies across countries and regions; whether it is associated with measures of modernization, such as urbanization, women's education, and wealth; and its potential consequences for household demographic composition and the investment in girls' human capital.

A handful of empirical studies have investigated differential fertility-stopping behavior at various levels of economic development. Hank and Kohler (2000) focus on European countries. Using Fertility and Family Surveys for 17 countries, they find substantial heterogeneity across countries, with a tendency toward a mild preference for a mixed-sex composition of children in a family. Their data suggest a preference for girls in the Czech Republic, Lithuania, and Portugal. Andersson and others (2006) use historical data from Denmark, Finland, Norway, and Sweden to show no effect of sex on fertility for second births, a desire for sex balance at third births, and heterogeneity across countries at fourth births (son preference in Finland and daughter preference in the other three countries).

For developing countries, most of the literature has focused on individual Asian countries with a prevalence of discrimination against women.[2] An

1. See World Bank (2001) for a more general discussion of differences between boys and girls in inputs and outcomes.

2. For example, Park (1983), Arnold (1985), Bairagi (1987), and Larsen, Chung, and Das Gupta (1998) show the strong impact of son preference on future fertility in the Republic of Korea; Arnold, Choe, and Roy (1998), Drèze and Murthi (2001), and Jensen (2007) find evidence that son preference affects fertility behavior in India; Haughton and Haughton (1995) show a similar pattern in Vietnam; while Pong (1994) and Leung (1998) document the pattern among ethnic Chinese in Malaysia. One study addresses the issue in Egypt, with a similar finding of son preference affecting fertility behavior (Yount, Langsten, and Hill 2000).

important exception to these country-specific studies is Arnold (1992, 1997), who considers the impact of sex ratios on subsequent fertility behavior across many developing countries. Arnold (1992) shows that the most typical pattern in the 26 countries he studied is of a preference for at least one son and one daughter. He finds some weak evidence for son-preferred differential fertility-stopping behavior in North Africa and Sri Lanka. Arnold (1997) analyzes data for 44 countries but focuses largely on the effect of sex ratios on *stated* fertility preferences and on some fertility behaviors, such as current pregnancy status and average birth spacing. He finds regional variation in the extent of an association between sex ratios and the outcomes he analyzes, with the strongest results suggesting son-preferred differential fertility-stopping behavior for the Asian and North African countries.

This article uses information on 5 million births by 1.3 million mothers in 64 countries to analyze how the sex mix of children in a family affects fertility decisions in the developing world. The article extends the literature in important ways. The analysis includes a large number of developing countries from disparate regions. The article documents not only regional patterns in son-preferred differential fertility-stopping behavior, but also within-region differences by location (urban or rural), education (women who have completed primary school and those with less schooling), wealth levels (above and below the median of a composite measure of assets), and over time (different birth cohorts of mothers). The article analyzes the extent to which observed patterns in son-preferred differential fertility-stopping behavior strengthen or weaken as the total number of children decreases. Moreover, finally, the results are linked to the wider literature on sex composition and resource dissolution in larger families.

I. Methods and Data

This section describes the methodology, starting with a model for estimating the impact of the sex balance of children in a family on the probability of subsequent births. It then details the data used for the analysis.

Estimating the Impact of Sex Balance on Fertility Behavior

The basic model estimates:

$$B_{wn+1} = a + b_{mn} \cdot M_{wn} + b_{fn} \cdot F_{wn} + u_{wn} \quad \text{for } n \geq 2 \qquad (1)$$

where B_{wn+1} is a zero or one outcome variable indicating a birth for woman w with a preexisting number of children n; M_{wn} is a variable equal to one if woman w had no sons at family size n; F_{wn} is a variable equal to one if woman w had no daughters at family size n; and the term u_{wn} is a random error. This regression is run separately for each existing family size.

The omitted category in the regression is women who have at least one son and one daughter. The coefficients b_{mn} and b_{fn} can therefore be understood as probabilities of additional childbearing for women who have children of only one sex, relative to those who have children of both sexes. Positive coefficients are evidence of preferences for a sex mix of children over children of one sex only. A significantly positive difference between the two coefficients ($b_{mn}-b_{fn} > 0$) indicates that a woman is more likely to have another birth if she has no sons than if she has no daughters. As in much of the literature (see Keyfitz 1968 and Repetto 1972 for early examples), this is referred to as son-preferred differential fertility-stopping behavior. Though sometimes referred to here as "son preference," the meaning refers exclusively to fertility decisions, as described above, rather than to other possible manifestations of differential behavior toward sons and daughters after birth, as might be evident in differences in mortality, nutritional status, or school enrollment by sex. A negative difference ($b_{mn}-b_{fn} < 0$) indicates daughter preference in childbearing.

Because calculating separate estimates for each pre-existing family size produces a large number of coefficients for b_{mn} and b_{fn}, for most results the focus is on averages across different family sizes—for individual countries or regions and for specific groups (by education, location, wealth, and birth cohort). For this purpose, the means b_m and b_f are defined as follows:

$$b_g = \sum_{n=2}^{\infty} w_{gn} \cdot b_{gn} \quad \text{for } g = m, f \tag{2a}$$

where w_{gn} is the relative weight for family size n (and the weights sum to one). With independence assumed across parities, the corresponding standard error of b_g can also be calculated as follows:

$$s_g = \sqrt{\sum_{n=2}^{\infty} w_{gn}^2 \cdot v_{bgn}} \quad \text{for } g = m, f \tag{2b}$$

where v_{bgn} is the square of the estimated standard error of b_{gn}.[3]

One concern is that including in this analysis women who have not yet completed fertility may bias the results if women who enter childbearing at later ages have different preferences from those who begin childbearing earlier or if birth spacing is partly a function of the sex mix of existing children. To

3. A related alternative approach is to pool all observations at different parities and estimate a model that relates the probability of an additional birth as a function of the share of sons among existing children. Since women appear more than once if they progress beyond three children—for example, a woman with four children would appear twice, once for the transition from two to three children and again from three to four—the model would also include additional controls for the existing family size at each observation. This model can be supplemented with other observable information, such as the location and education of the mother. Analysis of this model serves as a robustness check for the main results and is discussed later.

overcome this problem, the sample is generally limited to women ages 40–49, on the assumption that these women have completed their lifetime fertility (the data do not include women older than 49). To highlight the largely consistent estimates obtained with the two approaches, results based on the entire sample are occasionally compared with those for women ages 40–49.

An important part of the analysis is the exploration of heterogeneity. In addition to heterogeneity by family size, the article explores differences based on location, education, and wealth. In the case of rural or urban location, the following regression is run:

$$B_{wn+1} = a + R_w + b_{mn} \cdot R_w \cdot M_{wn} + b_{fn} \cdot R_w \cdot F_{wn} + c_{mn} \cdot (1 - R_w) \cdot M_{wn} + c_{fn} \cdot (1 - R_w) \cdot F_{wn} + u_{wn} \quad \text{for} n \geq 2 \tag{3}$$

where the R_w is an indicator variable equal to one for women in rural areas; $R_w \cdot M_{wn}$ and $R_w \cdot F_{wn}$ equal one for women in rural areas who have had no sons or no daughters; and $(1 - R_w) \cdot M_{wn}$ and $(1 - R_w) \cdot F_{wn}$ are equal to one for women in urban areas who have had no sons or no daughters. The aggregated coefficients b_m, b_f, c_m, and c_f are reported, along with tests for significant differences between them (based on the formulas in (2a) and (2b)). This arrangement enables testing whether any observed son (or daughter) preference differs in rural and in urban areas by testing whether $(b_m - b_f) = (c_m - c_f)$, a test of difference-in-differences. A similar logic applies to differences by education levels and wealth.

A woman's reported current residential location defines the indicator variable used to test for differences between women in urban and rural areas. To test for differences by education, the indicator variable used splits the sample into those who have completed fewer than six years of schooling and those who have completed six or more. (Six years of schooling corresponds to completing primary school in most countries in the sample.[4]) The analysis by household wealth is based on a composite measure of household durable goods—an approach popularized by Filmer and Pritchett (2001).[5] For each country, the indicator variable divides the sample according to whether the household falls above or below the median household wealth scale.

To investigate whether son-preferred differential fertility-stopping behavior increases or decreases over time across birth cohorts of women, differential

4. A different approach was also used, calculating the median years of education for women in each country and dividing the sample into those above and those below the median. These results were very similar to those reported here.

5. One drawback with this measure is that it reflects household wealth only at the time of the interview, whereas this study considers the full fertility history of each mother—a history that can stretch back 20 years or more. Thus, the wealth index is not an entirely accurate measure of resources available to mothers at the time of decisions about fertility continuation, although there is a positive correlation between current and previous levels of wealth. Considering these interpretive difficulties, this article does not stress the results based on wealth. Early applications of this asset index approach include Pollitt and others (1993) and Rivera and others (1995).

fertility-stopping behavior is calculated within each country for every one-year birth cohort—for example, women in India born in 1945—and then the corresponding regional averages in each year are calculated—for example, for women in South Asia in 1945. A first step is to graph these regional averages. As a more formal test of changes in differential fertility-stopping behavior, separate regressions are run on a set of five-year birth cohort dummy variables by region, to test for differences in these dummy variables. One concern with these estimates is that any observed changes in differential fertility-stopping behavior across birth cohorts could be driven by changes in the countries that make up the regional averages—some countries have surveys only in earlier years and therefore enter only into calculations of regional averages for early birth cohorts, while other countries have surveys only in later years and enter only into regional calculations for later cohorts. Thus, estimates are also presented that keep fixed the countries in each regional sample and the weight given to each in calculating the regional average.

As a final step in the analysis, a multivariate framework is applied based on location–education–cohort cells. This is done primarily because, as shown, prevailing fertility rates have a significant effect on estimated differential fertility-stopping behavior and are correlated with other observable factors. The basic regression is then:

$$(b_m - b_f)_{rht} = \beta_r D_r + \beta_h D_h + \beta_t D_t + \beta_F F_{rht} + u_{rht} \tag{4}$$

where $(b_m - b_f)_{rht}$ is the measure of differential fertility-stopping behavior, as before, for a given location–education–birth cohort cell; D_r and D_h are dummy variables for women in rural areas and high-education women; D_t is a measure of a woman's birth cohort (in practice, birth cohorts in this part of the analysis are aggregated over three years, to keep the sample sizes reasonable); and F_{rht} is the average number of children born to women in a given location–education–birth cohort cell.[6] The resulting sample includes 3,456 observations for 64 countries. Each country-year contributes four observations corresponding to the four location–education groups for women born in that year. In estimating equation (4), observations are weighted by N, the number of women in each cell. By giving greater weight to cells with larger sample sizes, this method more precisely estimates values of differential fertility-stopping behavior.

Data

Data are from 158 Demographic and Health Surveys (DHS) for the 64 countries listed in the appendix. The data contain the complete retrospective fertility histories of 1.3 million women in the 64 countries, as well as socioeconomic

6. Household wealth is not included in this analysis because of the limitations discussed earlier; however, results are largely unchanged when wealth is included.

information such as educational attainment, ownership of durable goods, and household location.[7]

For comparisons across developing country regions, countries are assigned to geographic regions following World Bank definitions: East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa (see the appendix). Note that the countries observed in the East Asia and Pacific region include only countries in Southeast Asia and that those in the Europe and Central Asia region include only countries in Central Asia, and hence these regions are referred to here as Southeast Asia and Central Asia.

In general, observations in each survey are weighted by their expansion factors, which reflect differences in the probability that households are sampled in the DHS.[8] When regional averages are constructed, observations are reweighted so that each country contributes its relative population share to the regional sample; population estimates for 2000 are used.[9] A series of robustness tests show that the findings are largely similar regardless of whether weighted or unweighted regional averages are used.

II. Effects of the Sex-mix Composition of Existing Children on Fertility Behavior

This section presents results for the effects of the sex-mix composition of existing children on fertility behavior by region, mothers' characteristics, mothers' birth cohort, and implications for gender differences in the number of siblings.

Differential Stopping Behavior by Global Region

Table 1 presents the results by region. For each region, the 2+ family size row presents the averages across all family sizes. Although the averages include the results for all family sizes, size-specific coefficients are reported only for family sizes of 2–5 children because the results for higher numbers of children are very noisy and represent less than 5 percent of the total number of births.

7. Supplemental appendix table S1 presents further descriptive statistics for the study populations including total fertility for women ages 40 and older, the mean son–daughter ratio, the percentage of households without a son, the percentage of households without a daughter, and the ratio of reported "ideal" number of sons to "ideal" number of daughters.

8. When a country has more than one survey, all surveys are pooled and the sampling weights are adjusted so that each survey is equally weighted. For example, surveys were administered in Cambodia in 2000 and 2005. To derive the Cambodia database, data from the two surveys were pooled and the survey weights were adjusted so that each survey contributed half the weighted observations to the analysis. Pooling data across surveys enables increasing the number of observations for each country and therefore increases the precision of the estimates.

9. In other words, if one country has twice the population of another in the same region, it will contribute twice the weighted observations to the analysis.

TABLE 1. Differential Fertility-stopping Behavior among Women Ages 40–49 at the Time of the Survey, by Region (Probability of an additional birth as a function of sex-mix composition of existing children)

Region and family size[a]	Probability of additional childbearing after zero sons (b_m; b_{mn})	Probability of additional childbearing after zero daughters (b_f; b_{fn})	Differential fertility-stopping behavior ($b_m - b_f$; $b_{mn} - b_{fn}$)	Significance of difference (p-value)	Mean number of children	Mothers' ideal ratio of sons to daughters[b]
Latin America and Caribbean						
2+	0.030***	0.019	0.011	0.541	5.08	0.97
2	0.026***	0.016	0.009	0.457		
3	0.020***	0.011	0.009	0.211		
4	0.041***	0.048***	−0.007	0.724		
5	−0.013**	0.048***	−0.061	0.003***		
Middle East and North Africa						
2+	0.074***	0.016**	0.058	0.000***	6.04	1.13
2	0.018**	0.014***	0.004	0.520		
3	0.037***	0.013	0.024	0.033**		
4	0.037***	0.009	0.028	0.065		
5	0.056**	0.030*	0.026	0.225		
Central Asia						
2+	0.118***	0.022	0.096	0.000***	4.14	1.02
2	0.089***	0.032***	0.057	0.039**		
3	0.122***	0.011***	0.110	0.001***		
4	0.166***	0.060***	0.106	0.004***		
5	0.168***	0.032	0.136	0.002***		
South Asia						
2+	0.107***	0.029***	0.078	0.000***	4.94	1.37
2	0.054***	−0.007**	0.060	0.010***		
3	0.107***	0.012	0.095	0.062		
4	0.137***	0.020***	0.116	0.034**		
5	0.142***	0.047***	0.095	0.010**		

Southeast Asia						
2+	0.052***	0.015	0.037	0.040**	4.74	1.01
2	0.035**	0.016***	0.019	0.354		
3	0.031	0.042***	−0.011	0.785		
4	0.068	0.020**	0.048	0.341		
5	0.099**	0.047***	0.053	0.317		
Sub-Saharan Africa						
2+	0.024***	0.024***	0.000	0.982	6.63	1.08
2	0.005**	0.002	0.003	0.543		
3	0.012	−0.005	0.017	0.005***		
4	0.021***	0.010	0.011	0.276		
5	0.004	0.010	−0.006	0.740		

**Significant at the 5 percent level; ***significant at the 1 percent level.

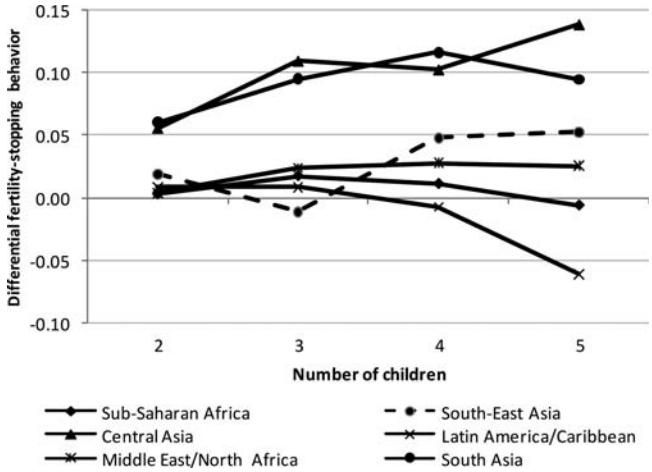
Note: Table reports the estimated probability of an additional birth as a function of having no boys and no girls. Models are estimated at the region level and include country dummy variables. The sample is limited to women ages 40–49, who are most likely to have completed their fertility.

a. Family size 2+ estimates are weighted averages for family sizes of two or more children (see text for details).

b. As reported by mothers to survey enumerators, who routinely ask mothers for their "ideal" number of children, separately for boys and girls. The ratio is the mean desired number of boys divided by the mean desired number of girls.

Source: Authors' analysis of DHS data shown in the appendix.

FIGURE 1. Differential Fertility-stopping Behavior by Region and Parity (Five-year Moving Averages)



Source: Authors' analysis of DHS data shown in the appendix.

The results show clear evidence that many families in all regions in the developing world prefer a mixed-sex composition of children. All the regional averages of b_m and b_f are positive, and many are significant: relative to families with both boys and girls, who are the omitted category in the regressions, families with only boys or only girls are more likely to have another birth.

In addition, the results shows a son-preferred differential fertility-stopping behavior in many regions in the developing world (see table 1, columns 3 and 4). The largest effects are found for Central Asia, where families are 9.6 percentage points more likely to have an additional child if they have had no sons than if they have had no daughters, and South Asia, where the corresponding difference is 7.8 percentage points. Significant, but smaller degrees of son-preferred differential fertility-stopping behavior are apparent in the Middle East and North Africa (5.8 percentage points) and in Southeast Asia (3.7 percentage points). There is no clear evidence of a son-preferred differential in fertility-stopping behavior for either Sub-Saharan Africa or Latin America and the Caribbean.[10]

Because it is difficult to take in all of the coefficients at a glance, the parity-specific results shown in table 1 are summarized in figure 1. Son-preferred differential fertility-stopping behavior appears to grow with the number of children in the two regions where it is most pronounced, Central Asia and South Asia. For example, families in South Asia who have already had four or five

10. Country-specific analyses were also conducted. In the two regions with the clearest evidence of son-preferred differential fertility-stopping behavior (Central Asia and South Asia), these results hold equally for almost all countries in the regions (see supplemental appendix table S2). For the other regions, there is more variability in the country-level results.

children are approximately 14 percentage points more likely to have an additional child if all of their children have been girls rather than boys.

This increase in differential fertility-stopping behavior by number of children is perhaps not surprising: the mean number of children is 4.1 in Central Asia and 4.9 in South Asia. Since the average family expects to have a reasonably large number of children, the sex of children in families with fewer children does not matter as much in determining future fertility because parents expect to have more children, regardless of the sex of their children at the time. In families with more children, however, parents are closer to achieving their total desired number of children, and hence the sex-mix composition of children already born becomes an important determinant of future childbearing. Such patterns are less apparent in the Middle East and North Africa, Southeast Asia, and Latin America, in line with either the smaller degree of son-preferred differential fertility-stopping behavior or the absence of such preference in these regions.[11]

In addition to identifying differences across cohorts in these basic patterns, table 1 is informative about the extent to which the "ideal" balance between the number of boys and girls reported by mothers is a good indication of fertility behavior. This can be seen by comparing columns 3 and 6 of table 1. A clear subjective preference for sons is apparent in South Asia and Middle East and North Africa, as is a clear behavioral preference for sons with regard to the decision to continue child bearing. However, another region that exhibits a significant pattern of son-preferred differential fertility-stopping behavior, Central Asia, reports a subjective preference for a near equality of sons and daughters. In contrast, mothers in Sub-Saharan Africa report a subjective preference for sons, but families do not exhibit son preference in actual fertility behavior.[12] In Latin America and the Caribbean, mothers express a slight preference for daughters,

11. Given the preferred parameterization—binary controls for "no sons" and "no daughters"—aggregating results for family sizes of one child with those of family sizes of two or more children would create an inconsistency. With a family size of one child, the model can include only one dummy variable (either "no sons" or "no daughters"). The two models would need to be estimated separately, and the coefficients on the two variables would merely be transformations of one another. The excluded category in these models would be a family with one son or one daughter. This is unlike the main estimations, where families with children of at least one of *each* sex serve as the excluded group. The interpretation is therefore slightly different, and so families with only one child are not included in the analysis. A related model was estimated, however, that investigates the probability of an additional birth, controlling for the sex of the first child. Supplemental appendix table S3 reports these results, which also show son-preferred differential fertility-stopping behavior in South Asia even for decisions after the first child. However, the analysis shows that families in Latin America are significantly more likely to stop child bearing after the first birth if that birth is a daughter rather than a son.

12. The lack of observed differential fertility-stopping behavior in Sub-Saharan Africa could be due to several factors, but one important factor is surely the high level of fertility. Completed fertility in Sub-Saharan Africa is by far the highest and the proportion of households with children of only one sex the lowest across all regions. However, supplemental appendix table S1 also suggests that there is wide variation within Sub-Saharan Africa in the ratio of "ideal" number of sons to "ideal" number of daughters. Therefore, to the extent that reported "ideal" ratio reflects latent sex preference in family composition, Sub-Saharan Africa is not a uniformly son-preferring region, unlike, say, South Asia.

but actual fertility behavior exhibits no distinct pattern. Clearly, subjectively stated preferences over the sex-mix composition of children more accurately predict actual fertility behavior in some regions than in others.[13]

Table 2 presents a series of robustness tests to these basic findings, focusing on the aggregate effects averaged across all family sizes (number of children). The first panel uses the number of women ages 40–49 as the weight for aggregating across countries within regions rather than the total population of a country. These weights are generated using data on the share of women ages 40–49 and applying these estimates to estimates of the total female population.[14] The stability of the results to this alternative approach to weighting is apparent. The only major difference between this first panel and table 1 is that the slight son-preferred differential fertility-stopping behavior found in East Asia is no longer statistically significant.

The results are similar if instead of giving greater weight to countries with larger populations, only the expansion factors in the surveys are used (see table 2, second panel). The only difference is that now son-preferred differential fertility-stopping behavior is slightly muted in South Asia—a difference between b_m and b_f of 4.6 percentage points compared with 7.8 percentage points in table 1. The results are still similar if even these survey weights are disregarded, so that each sample observation in each region is given the same weight (third panel). If anything, these results suggest an even greater degree of son-preferred differential fertility-stopping behavior in Central Asia and South Asia than do the results in table 1. Moreover, finally, son-preferred differential fertility-stopping behavior continues to be apparent in the three regions where it is most pronounced in table 1—Middle East and North Africa, Central Asia, and South Asia—when all women ages 15–49 at the time of the survey are included, not just women who are most likely to have completed their fertility (fourth panel).[15]

Differential Fertility-stopping Behavior by Mothers' Characteristics

This section investigates how the strong son-preferred differential fertility-stopping behavior exhibited in some regions varies across common

13. Supplemental appendix table S4 reports the alternative specification mentioned earlier that pools the parity-specific data and estimates differential fertility-stopping behavior as a function of the ratio of sons to total number of children, controlling for family size. Similar to table 1 in this article, this analysis finds significant son-preferred differential fertility-stopping behavior in the Middle East and North Africa, Central Asia, and South Asia, suggesting that the article's main findings are robust to this alternative measure of differential fertility-stopping behavior. The son-preferred differential fertility-stopping behavior estimates in these three regions actually grow in magnitude when select mothers' observables such as location, education, and age are also controlled for. These results with covariates are presented in the second panel of Supplemental appendix table S4.

14. Both statistical constructs are from a World Bank database accessed at: http://go.worldbank.org/N2N84RDV00.

15. Of course, since this panel includes all women, not just those who have completed their fertility, the total number of children is lower in all regions.

TABLE 2. Differential Fertility-stopping Behavior among Women at the Time of the Survey, with Different Weights, by Region (Probability of an additional birth as a function of sex-mix composition of existing children)

Region	Probability of additional childbearing after zero sons (b_m)	Probability of additional childbearing after zero daughters (b_f)	Differential fertility-stopping behavior ($b_m - b_f$)	Significance of difference (p-value)	Mean number of children	Mothers' ideal ratio of sons to daughters[a]
Women ages 40–49, population of women ages 40–49 adjusted weights						
Latin America and Caribbean	0.030***	0.020	0.011	0.545	5.01	0.97
Middle East and North Africa	0.076***	0.016**	0.061	0.000***	5.99	1.13
Central Asia	0.120***	0.023	0.097	0.000***	4.07	1.02
South Asia	0.109***	0.028***	0.081	0.000***	4.89	1.37
Southeast Asia	0.051***	0.021	0.030	0.115	4.74	1.01
Sub-Saharan Africa	0.023**	0.024***	−0.001	0.925	6.52	1.08
Women ages 40–49, population-unadjusted weights						
Latin America and Caribbean	0.018	0.018	0.000	0.984	5.31	0.93
Middle East and North Africa	0.072***	0.016**	0.057	0.000***	6.46	1.10
Central Asia	0.133***	0.049***	0.084	0.001***	3.77	1.03
South Asia	0.080***	0.034***	0.046	0.001***	5.45	1.41
Southeast Asia	0.055***	0.017	0.038	0.048**	4.84	0.99
Sub-Saharan Africa	0.032***	0.017**	0.015	0.165	6.62	1.04
Women ages 40–49, no weights						
Latin America and Caribbean	0.031***	0.031***	0.000	0.977	5.17	0.92
Middle East and North Africa	0.075***	0.013***	0.061	0.000***	5.82	1.15

(Continued)

TABLE 2. Continued

Region	Probability of additional childbearing after zero sons (b_m)	Probability of additional childbearing after zero daughters (b_f)	Differential fertility-stopping behavior ($b_m - b_f$)	Significance of difference (p-value)	Mean number of children	Mothers' ideal ratio of sons to daughters[a]
Central Asia	0.150***	0.017	0.133	0.000***	3.77	1.05
South Asia	0.119***	0.025***	0.094	0.000***	4.67	1.34
Southeast Asia	0.044***	0.020***	0.024	0.020**	4.95	0.99
Sub-Saharan Africa	0.025***	0.019***	0.006	0.482	6.73	1.06
Full sample of women, population-adjusted weights						
Latin America and Caribbean	0.042***	0.026***	0.016	0.134	5.08	0.95
Middle East and North Africa	0.063***	0.020***	0.043	0.000***	6.04	1.12
Central Asia	0.124***	0.037***	0.087	0.000***	4.14	1.03
South Asia	0.102***	0.013***	0.089	0.000***	4.94	1.35
Southeast Asia	0.046***	0.023***	0.023	0.100	4.74	1.01
Sub-Saharan Africa	0.018***	0.021***	−0.003	0.609	6.63	1.09

**Significant at the 5 percent level; ***significant at the 1 percent level.

Note: Table reports the estimated probability of an additional birth as a function of having no boys and no girls. Models are estimated at the region level and include country dummy variables. Estimates are for families with three or more children (see text for details).

a. As reported by mothers to survey enumerators, who routinely ask mothers for their "ideal" number of children, separately for boys and girls. The ratio is the mean desired number of boys divided by the mean desired number of girls.

Source: Authors' analysis of DHS data shown in the appendix.

measures of "modernization"—rural–urban location, education, and wealth. Although results are reported for all regions, the discussion focuses on Central Asia and South Asia, where the aggregate results show the greatest son-preferred differential fertility-stopping behavior.

The patterns are somewhat different in the two regions. In both South Asia and Central Asia, there is son-preferred differential fertility-stopping behavior in both urban and rural regions, among more and less educated women, and among both households with more and those with less wealth (table 3, columns 3 and 7). However, the difference-in-difference results suggest that in South Asia son-preferred differential fertility-stopping behavior is higher in urban than in rural areas (although not significantly so), among women with more education levels than those with less, and in households with more wealth than in those with less. Some of the differences are quite large: For example, women with six or more years of schooling are 19 percentage points more likely to have an additional child if they do not have boys than if they do not have girls (column 3), while women with less than six years of schooling are only 7 percentage points more likely to do so (column 7).[16] In Central Asia, the picture is more mixed: Son-preferred differential fertility-stopping behavior is also higher in urban than in rural areas, but higher among women with low levels of education than among those who have completed at least primary school. Further, there is no significant difference among households in Central Asia at different wealth levels.

Many express the belief that as societies and economies develop, the traditional social practices that may enforce or perpetuate a preference for sons weaken. This could happen, for example, if women gain greater autonomy and control a greater share of the household's economic resources (see, for example, the discussions in Haddad, Hoddinot, and Alderman 1997). Under this assumption, greater son-preferred differential fertility-stopping behavior might be expected in rural than in urban areas, among women with less education, and among poorer women. The results here do not support that, however, either overall or for regions in which son preference is most pronounced (see table 3). This is consistent with earlier findings of greater male preference in Indian households with more educated household heads (Behrman 1988).

Differential Fertility-stopping Behavior over Time

To examine changes across birth cohorts, differential fertility-stopping behavior is calculated for each regional cohort cell, as described above. The results

16. Women who are educated or live in urban areas potentially have greater access to technologies that allow them to select the sex of a child. This might affect a small number of the women in the sample (those in the latest cohorts in some countries). However, the effect on estimated differential fertility-stopping behavior is not clear since differential fertility-stopping behavior is by definition a behavior conditional on the existing sex mix of children, regardless of whether that mix arose through natural means or with the assistance of sex-selective technology.

Table 3. Differential Fertility-stopping Behavior by Select Mother or Household Characteristics for Women Ages 40–49, by Region (Probability of an additional birth as a function of sex-mix composition of existing children)

Region	Probability of additional childbearing after zero sons (b_m)	Probability of additional childbearing after zero daughters (b_f)	Differential fertility-stopping behavior (b_m-b_f)	Mean number of children	Probability of additional childbearing after zero sons (b_m)	Probability of additional childbearing after zero daughters (b_f)	Differential fertility-stopping behavior (b_m-b_f)	Mean number of children	Difference-in-difference (column 3–column 7)
	Urban				*Rural*				*Difference*
Latin America and Caribbean	0.041***	0.049***	−0.009	4.46	0.044**	−0.011	0.055	6.05	−0.064
Middle East and North Africa	0.048***	0.009	0.039***	5.08	0.076***	0.019	0.057***	6.94	−0.018
Central Asia	0.125***	0.033**	0.091***	3.55	0.098***	0.036**	0.063***	5.07	0.028
South Asia	0.137***	0.032***	0.105***	4.27	0.098***	0.026***	0.072***	5.22	0.033
Southeast Asia	0.077***	0.023**	0.054***	4.29	0.042**	0.013	0.029	4.94	0.025
Sub-Saharan Africa	0.041***	0.030**	0.012	5.55	0.019**	0.023**	−0.004	7.05	0.016
	Six or more years of schooling				*Less than six years of schooling*				*Difference*
Latin America and Caribbean	−0.003	0.063***	−0.066***	3.46	0.031***	0.006	0.025	5.91	−0.090**
Middle East and North Africa	0.109***	0.044***	0.064***	3.78	0.074***	0.011	0.062***	6.57	0.002
Central Asia	0.107***	0.046***	0.061***	3.64	0.136***	−0.001	0.137***	4.65	−0.076**
South Asia	0.198***	0.004	0.193***	3.32	0.094***	0.029***	0.066***	5.35	0.128**
Southeast Asia	0.062***	0.020	0.042**	4.20	0.049***	0.023	0.026	5.19	0.017
Sub-Saharan Africa	0.047***	−0.007	0.054**	5.10	0.019	0.027***	−0.008	7.05	0.062**
	Above-median-wealth households[a]				*Below-median-wealth households*[a]				*Difference*
Latin America and Caribbean	0.020	0.043**	−0.023	3.55	0.056***	0.053***	0.003	5.07	−0.026
Middle East and North Africa	0.042***	0.037***	0.005	5.17	0.040**	0.008	0.032	6.55	−0.027
Central Asia	0.119***	0.028	0.091***	3.66	0.116***	0.027	0.089***	4.67	0.002
South Asia	0.144***	0.028***	0.116***	4.43	0.086***	0.026**	0.060***	5.54	0.056**
Southeast Asia	0.079***	0.036***	0.043	4.23	0.042**	−0.003	0.045**	4.98	−0.002
Sub-Saharan Africa	0.033***	0.008	0.025	6.31	0.026**	0.019	0.007	6.62	0.018

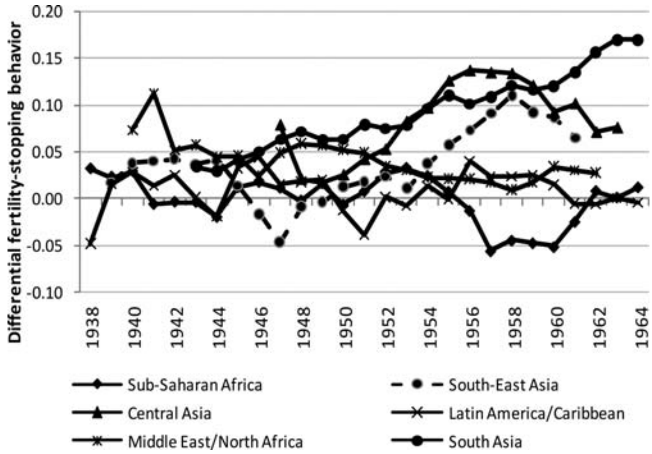
**Significant at the 5 percent level; ***significant at the 1 percent level.

Note: Table reports the estimated probability of an additional birth as a function of having no boys and no girls. Models are estimated at the region level and include country dummy variables. Estimates are for families with two or more children (see text for details).

a. The analysis by household wealth is based on a composite measure of household durable goods, with households categorized as above or below the median of a composite measure of assets.

Source: Authors' analysis of DHS data shown in the appendix.

FIGURE 2. Differential Fertility-stopping Behavior by Region and Mother's Year of Birth (Five-year Moving Averages)



Source: Authors' analysis of DHS data shown in the appendix.

are summarized in figure 2, which shows the five-year moving average of differential fertility-stopping behavior by region. In most regions, there is no systematic pattern. In South Asia, however, son-preferred differential fertility-stopping behavior increases across birth cohorts and is almost 15 percentage points higher for the latest birth cohorts than for the earliest ones. The other region with a high degree of son preference, Central Asia, shows an initial increase in son-preferred differential fertility-stopping behavior, followed by a decrease, although the absolute levels remain high throughout.

To test whether these changes across birth cohorts are significant, differential fertility-stopping behavior is first regressed on a linear cohort trend, separately by region. Each observation is weighted by the number of women in that cohort-year cell, which gives greater weight to the more precisely calculated cell averages. The coefficient on the cohort trend in this regression for South Asia is highly significant (0.007, with a standard error of 0.002), which suggests that son-preferred differential fertility-stopping behavior has been increasing by about 0.7 percentage points with each successive cohort. The corresponding coefficient for Southeast Asia is also significant (0.005, with a standard error of 0.002). None of the other coefficients is close to standard levels of significance.

There are two potential problems with figure 2 and the corresponding regression analysis. The first is that a linear cohort trend may not do justice to the data; this is particularly apparent for Central Asia, with its inverted U-shaped pattern. To address this concern, differential fertility-stopping behavior is regressed on five-year birth cohort dummy variables, again separately by region. The results—the regression analog of the pattern observed in figure 2—again show the clearest pattern for South Asia, where son-preferred differential fertility-stopping behavior rises monotonically across five-year birth cohorts (table 4). The increase is 10-fold, from 0.017 for the cohort born in 1941–45, to 0.170 for the cohort born in 1961–65.

The second, more difficult problem is that the regional averages for different birth cohorts may be driven by different countries, depending on the years in which they conducted the DHS. For example, the data from Sri Lanka, where the only DHS was carried out in 1987, enters the average for South Asia for the early birth cohorts but not for the later ones, while the data for Nepal, where DHS were carried out in 1996, 2001, and 2006, enters the regional averages for the later birth cohorts, but not the earlier ones. To address this concern, the sample was limited to countries with a DHS both in 1995 or earlier and in 2000 or later. This greatly reduces the number of countries, from 65 to 27. However, cohort-specific measures of son-preferred differential fertility-stopping behavior can be calculated for these countries for women born in every year between 1945 and 1960, and thus regional averages can be calculated that keep the weights fixed for each country across birth cohorts. (The sample is limited to women ages 40 and older, as before.)

When both the sample of countries and the weight of each country in the regional average are kept fixed, son-preferred differential fertility-stopping behavior still increases across birth cohorts in South Asia, although the pattern is less dramatic and the difference across cohorts is no longer significant (see table 4, bottom panel). In other regions, the patterns are less clear and are generally not significant. What is clear is that there is no decline in son-preferred differential fertility-stopping behavior in any region where it exists for yet another standard measure of modernization—the passage of time.

A Simple Multivariate Framework

The sociodemographic characteristics explored in table 3—mother's education, urban location, and household wealth—are likely correlated with each other. Thus, it is possible that the association between son-preferred differential fertility-stopping behavior and each of these characteristics is really driven by one main social indicator. Furthermore, prevailing fertility levels may have an effect on differential fertility-stopping behavior since in a high-fertility environment fewer families face differential stopping decisions because of the greater likelihood of mixed-sex composition at larger family sizes. This section thus uses the aggregated location–education–cohort cell data described earlier to estimate the multivariate framework given by equation (4).

In bivariate regressions, urban residence and higher educational attainment are both associated with higher differential fertility-stopping behavior, although not significantly so (table 5, columns 1 and 2). These results are consistent with those in table 3. In addition, however, there is a significant negative association between the average number of children and differential fertility-stopping behavior (column 3)—the point estimate implies that

TABLE 4. Differential Fertility-stopping Behavior Regressed on Region Interacted with Five-year Cohorts of Mother Birth Year, for Women Ages 40–49, by Region

Region	Mothers' birth year cohort	Region-cohort interaction[a]	F-test[b]: All interactions equal	F-test[b]: First and last equal
All countries for cohorts 1941–65				
Latin America and Caribbean	1941–45	−0.004	0.784	0.904
	1946–50	0.013		
	1951–55	−0.009		
	1956–60	0.025		
	1961–65	0.001		
Middle East and North Africa	1941–45	0.062	0.851	0.733
	1946–50	0.055		
	1951–55	0.031		
	1956–60	0.010		
	1961–64	0.040		
Central Asia	1946–50	0.017	0.412	0.403
	1951–55	0.085**		
	1956–60	0.141***		
	1961–65	0.094		
South Asia	1941–45	0.017	0.001***	0.000***
	1946–50	0.067***		
	1951–55	0.078***		
	1956–60	0.120***		
	1961–65	0.170***		
Southeast Asia	1941–45	0.024	0.027**	0.874
	1946–50	0.002		
	1951–55	0.013		
	1956–60	0.108***		
	1961–63	0.033		
Sub-Saharan Africa	1941–45	−0.001	0.025**	0.895
	1946–50	0.000		
	1951–55	0.034		
	1956–60	−0.047***		
	1961–65	−0.006		
Countries with differential fertility-stopping behavior for cohorts 1946–60[c]				
Latin America and Caribbean	1946–50	0.020	0.410	0.491
	1951–55	−0.020		
	1956–60	0.000		
Middle East and North Africa	1946–50	0.050	0.593	0.311
	1951–55	0.024		
	1956–60	0.010		
Central Asia	1946–50	0.084	0.710	0.456
	1951–55	0.147***		

(Continued)

TABLE 4. Continued

Region	Mothers' birth year cohort	Region-cohort interaction[a]	F-test[b] All interactions equal	F-test[b] First and last equal
	1956–60	0.148***		
South Asia	1946–50	0.093***	0.219	0.275
	1951–55	0.080***		
	1956–60	0.120***		
Southeast Asia	1946–50	0.007	0.124	0.615
	1951–55	−0.038		
	1956–60	0.024		
Sub-Saharan Africa	1946–50	0.018	0.042**	0.037**
	1951–55	0.016		
	1956–60	−0.035**		

**Significant at the 5 percent level; ***significant at the 1 percent level.

a. The results in this column are the coefficients of the interaction terms.

b. The *F*-tests are region specific. The results are the *p*-values for the *F*-tests. Data are weighted by sample size.

c. Countries include Bangladesh, Bolivia, Burkina Faso, Cameroon, Colombia, Côte d'Ivoire, Dominican Republic, Egypt, Ghana, Haiti, India, Indonesia, Kenya, Madagascar, Malawi, Mali, Morocco, Namibia, Niger, Nigeria, Peru, Philippines, Rwanda, Senegal, Tanzania, Turkey, Uganda, Zambia, and Zimbabwe.

Source: Authors' analysis of DHS data shown in the appendix.

a decrease in average family size of one child more than offsets a switch from rural to urban location and almost offsets a switch from low to high schooling levels.

The key results include the measures of location, education, and the mean number of children for each country, year, location, and education cell (see table 5, columns 4 and 5). Once the average number of children is included in the model, the association between son-preferred differential fertility-stopping behavior and urban residence and between differential fertility-stopping behavior and education becomes negative (column 4). This reverses the bivariate findings and suggests that the higher son-preferred differential fertility-stopping behavior in urban areas and among more educated mothers can be "explained" by differences in overall fertility levels.[17] Including global dummy variables for each birth year, as a way of flexibly controlling for any secular changes, barely affects the results for these three indicators (column 5).

In sum, the cell-level results suggest that the number of children women expect to have over their lifetimes is an important determinant of son-preferred differential fertility-stopping behavior. When fertility levels are high, the

17. This finding is in character with Das Gupta and Mari Bhat (1997), who argue that fertility decline may lead to an intensification of discrimination against girls if the total number of children that couples desire falls more rapidly than the total number of desired sons.

TABLE 5. Multivariate Correlates of Differential Fertility-stopping Behavior

	Regression				
Variable	(1)	(2)	(3)	(4)	(5)
Urban	0.014			−0.023**	−0.021**
	(0.010)			(0.010)	(0.010)
Six or more years of schooling		0.027		−0.026***	−0.022***
		(0.020)		(0.009)	(0.009)
Mean number of children			−0.021*	−0.029**	−0.027**
			(0.011)	(0.013)	(0.012)
Birth year dummy variables	No	No	No	No	Yes
Number of observations	3,456	3,456	3,456	3,456	3,456
R-squared	0.00	0.01	0.04	0.05	0.06

*Significant at the 10 percent level; **significant at the 5 percent level; ***significant at the 1 percent level.

Note: Numbers in parentheses are robust standard errors. Each observation is a country, urban–rural, high–low education, year of birth cell. Data are weighted by sample size and country population in 2000.

Source: Authors' analysis of DHS data shown in the appendix.

absence of boys in earlier births is not an important driver of childbearing decisions—at all but the largest family size, most couples expect to have more children, no matter what the sex-mix composition of earlier births. However, as family size decreases, a higher fraction of couples find themselves having to choose whether to have an additional child at a point when they are already close to their expected family size and all their children are of the same sex. At this point, the sex-mix composition of their children—in particular, whether there is at least one boy—appears to play an important role in their decision.

Sex Differences in Number of Siblings

If families are more likely to have an additional child when they have no sons than when they have no daughters, girls may grow up in households with more siblings than do boys. Of course, the number of siblings that boys or girls have will also be determined by mortality—which may vary with family size and by a child's sex.

The mean number of siblings for girls and boys ages 0–15 years is higher for girls than for boys in regions where there is son-preferred differential fertility-stopping behavior (table 6). For example, in South Asia girls have about 0.13 more siblings than boys, on average; in Central Asia, the comparable number is 0.10. In contrast, in Sub-Saharan Africa, boys and girls have the same number of siblings on average. Moreover, if girls are discriminated against relative to boys after birth in regions where there is son-preferred differential fertility-stopping behavior, like South Asia and Central Asia, and

TABLE 6. Mean Number of Siblings of Children ages 0–15

	Children of women ages 40 and older			All children		
Region	Sons	Daughters	Sons–daughters	Sons	Daughters	Sons–daughters
Latin America and Caribbean	4.99	5.06	−0.07***	3.08	3.14	−0.06***
Middle East and North Africa	5.27	5.29	−0.02	3.67	3.73	−0.06***
Central Asia	4.27	4.37	−0.10**	2.63	2.77	−0.14***
South Asia	4.59	4.72	−0.13***	2.81	2.96	−0.15***
Southeast Asia	4.46	4.52	−0.07***	2.82	2.86	−0.04***
Sub-Saharan Africa	5.49	5.49	0.01	3.55	3.56	−0.01**

**Significant at the 5 percent level; ***significant at the 1 percent level.

Source: Authors' analysis of DHS data shown in the appendix.

therefore suffer excess mortality,[18] these results would generally underestimate the differences in sibship size by sex that result from son-preferred differential fertility-stopping behavior.

An extensive literature documents associations between larger family size and poorer outcomes for children in developed and developing countries (see, for example, Behrman and Wolfe 1986; Horton 1986; Conley and Glauber 2006, and the references therein). Having more siblings dilutes household and parental resources and may result in quantity–quality tradeoffs. Estimating the causal effect of the number of siblings on child outcomes is difficult, however, because of the likelihood of omitted family characteristics that may bias results. Nevertheless, insofar as some of the association between the number of children and poor outcomes is causal, it suggests that son preference, as manifested in sex-specific differential fertility-stopping behavior, may have adverse implications on the outcomes for girls, who will tend to grow up in larger families. Moreover, the differences in family size by children's sex are largest in regions where girls are more likely to suffer discrimination in other ways, in particular in South Asia (see table 6).

III. CONCLUSION

This article has investigated the fertility response to the sex-mix composition of children in a family using data from 158 DHS carried out in 64 countries. Sex composition of earlier births is a significant determinant of subsequent fertility in many developing countries. Fertility behavior is consistent with son preference in many regions of the developing world, with the clearest patterns apparent in South Asia and Central Asia. Specifically, the absence of sons increases

18. On India, see, for example, Das Gupta (1987), Behrman and Deolalikar (1990), and Rose (1999).

the probability of an additional birth by significantly more than the absence of daughters. This phenomenon is referred to as son-preferred differential fertility-stopping behavior.

Exploration of heterogeneity shows that widely used measures of "modernization," including urbanization, higher education levels, and household wealth, are associated with an increase in son-preference, as captured in differential fertility-stopping behavior. The presumption that this manifestation of son preference will dissipate over time is also not supported by the data. The results from regressions using a simple multivariate framework suggest that this may be a result of reductions in family size with increased modernization. While it is possible that greater urbanization, female education, and household wealth all reduce a latent son preference, the reductions in fertility that accompany modernization also make it more likely that a latent son preference can be detected in behavior. For this reason, social policies that aim to limit fertility may, as an unintended consequence, bring son-preferred differential fertility-stopping behavior to the fore.

Finally, one implication of son-preferred differential fertility-stopping behavior is that girls tend to have more siblings than boys. This is an important finding in itself, as it likely has consequences for the development of boys and girls in infancy, childhood, and adolescence. Moreover, insofar as there are quantity–quality tradeoffs that result in fewer material and emotional resources allocated to children in larger families, son preference in fertility decisions can have important indirect implications for investments and for the well-being of girls relative to boys.

Supplementary Material

Supplemental appendix to this article is available at http://wber.oxfordjournals.org/.

Appendix: Sample Countries, Surveys, and Number of Mothers and Births

Country	Region	Year of survey	Number of mothers observed	Number of births observed
Armenia	Central Asia[a]	2000, 2005	8,648	21,583
Bangladesh	South Asia	1993–94, 1996–97, 1999–2000, 2004	36,169	127,486
Benin	Sub-Saharan Africa	1996, 2001, 2006	22,688	95,989

(Continued)

Continued

Country	Region	Year of survey	Number of mothers observed	Number of births observed
Bolivia	Latin America and Caribbean	1989, 1993–94, 1998, 2003–04	31,431	121,101
Brazil	Latin America and Caribbean	1986, 1991–92, 1996	12,050	37,871
Burkina Faso	Sub-Saharan Africa	1992–93, 1998–99, 2003	19,168	84,320
Burundi	Sub-Saharan Africa	1987	2,777	11,886
Cambodia	Southeast Asia[b]	2000, 2005	20,721	81,447
Cameroon	Sub-Saharan Africa	1991, 1998, 2004	14,243	56,254
Central African Republic	Sub-Saharan Africa	1994–95	4,388	16,936
Chad	Sub-Saharan Africa	1996–97, 2004	10,508	47,187
Colombia	Latin America and Caribbean	1986, 1990, 1995, 2000, 2005	50,573	141,967
Comoros	Sub-Saharan Africa	1996	1,695	7,913
Congo, Rep. of	Sub-Saharan Africa	2005	5,152	16,687
Côte d'Ivoire	Sub-Saharan Africa	1994, 1998–99, 2005	11,895	45,803
Dominican Republic	Latin America and Caribbean	1986, 1991, 1996, 1999, 2002	33,677	113,636
Ecuador	Latin America and Caribbean	1987	3,117	11,835
Egypt	Middle East and North Africa	1988, 1992–93, 1995–96, 2000, 2003, 2005	70,394	276,509
Ethiopia	Sub-Saharan Africa	2000, 2005	19,482	84,055
Gabon	Sub-Saharan Africa	2000–2001	4,499	16,878
Ghana	Sub-Saharan Africa	1988, 1993–94, 1998–99, 2003	14,449	55,788
Guatemala	Latin America and Caribbean	1987, 1995, 1998–99	16,804	72,032
Guinea	Sub-Saharan Africa	1999, 2005	11,672	50,058
Haiti	Latin America and Caribbean	1994–95, 2000, 2005	16,294	63,814
Honduras	Latin America and Caribbean	2005	13,991	50,093
India	South Asia	1992–93, 1998–2000, 2005–06	244,831	800,833

(Continued)

Continued

Country	Region	Year of survey	Number of mothers observed	Number of births observed
Indonesia	Southeast Asia[b]	1987, 1991, 1994, 1997, 2002–03	111,864	370,441
Kazakhstan	Central Asia[a]	1995, 1999	6,013	14,972
Kenya	Sub-Saharan Africa	1988–89, 1993, 1998, 2003	22,504	94,497
Kyrgyzstan	Central Asia[a]	1997	2,776	8,781
Lesotho	Sub-Saharan Africa	2004	4,832	14,708
Liberia	Sub-Saharan Africa	1986	4,231	17,264
Madagascar	Sub-Saharan Africa	1992, 1997, 2003–04	15,447	61,383
Malawi	Sub-Saharan Africa	1992, 2000, 2004	23,353	92,634
Mali	Sub-Saharan Africa	1987, 1995–96, 2001	21,004	98,580
Mexico	Latin America and Caribbean	1987	5,776	22,676
Morocco	Middle East and North Africa	1987, 1992, 2003–04	18,970	80,669
Mozambique	Sub-Saharan Africa	1997, 2003	16,530	63,195
Namibia	Sub-Saharan Africa	1992, 2000	8,490	28,318
Nepal	South Asia	1996, 2001, 2006	23,042	84,505
Nicaragua	Latin America and Caribbean	1997–98, 2001	18,971	70,977
Nigeria	Sub-Saharan Africa	1990, 1999, 2003	17,209	74,438
Niger	Sub-Saharan Africa	1992, 1998, 2006	18,194	87,107
Pakistan	South Asia	1990–91	5,905	27,369
Paraguay	Latin America and Caribbean	1990	3,970	153,46
Peru	Latin America and Caribbean	1986, 1991–92, 1996, 2000, 2004	60,700	217,275
Philippines	Southeast Asia[b]	1993, 1998, 2003	26,609	98,932
Rwanda	Sub-Saharan Africa	1992, 2000, 2005	17,876	771,14
Senegal	Sub-Saharan Africa	1986, 1992–93, 1997, 2005	23,525	102,547
South Africa	Sub-Saharan Africa	1998	8,223	22,934
Sri Lanka	South Asia	1987	5,388	17,701
Sudan	Sub-Saharan Africa	1989–90	5,277	25,805
Tanzania	Sub-Saharan Africa	1991–92, 1996, 1999, 2004	23,504	96,542

(Continued)

Continued

Country	Region	Year of survey	Number of mothers observed	Number of births observed
Thailand	Southeast Asia[b]	1987	6,025	17,803
Togo	Sub-Saharan Africa	1988, 1998	8,825	37,051
Trinidad and Tobago	Latin America and Caribbean	1987	2,440	7,837
Tunisia	Middle East and North Africa	1988	3,856	16,463
Turkey	Central Asia[a]	1993, 1998, 2003	18,861	59,996
Uganda	Sub-Saharan Africa	1988–89, 1995, 2000–2001, 2006	20,946	92,326
Uzbekistan	Central Asia[b]	1996	3,018	96,50
Vietnam	Southeast Asia[b]	1997, 2002	10,742	29,900
Yemen	Middle East and North Africa	1991–92	5,378	29,803
Zambia	Sub-Saharan Africa	1992, 1996–97, 2001–02	17,013	70,726
Zimbabwe	Sub-Saharan Africa	1988–89, 1994, 1999, 2005–06	17,881	62,855
64 countries	6 regions	158 surveys	1,336,484	4,931,081

a. None of the countries observed in this region is in the part of the region traditionally referred to as Eastern Europe, and so this region is referred to in the analysis as Central Asia only.

b. None of the countries observed in this region is in the part of the region traditionally referred to as the Pacific or in the Northeastern region of Asia, and so this region is referred to in the analysis as Southeast Asia only.

References

Andersson, G., H. Karsten, M. Rønson, and A. Vikat. 2006. "Gendering Family Composition: Sex Preferences for Children and Childbearing Behavior in the Nordic Countries." *Demography* 42(2):255–67.

Arnold, F. 1985. "Measuring the Effect of Sex Preference on Fertility: The Case of Korea." *Demography* 22(2):280–88.

———. 1992. "Sex Preference and Its Demographic and Health Implications." *International Family Planning Perspectives* 18(3):93–101.

———. 1997. *Gender Preferences for Children.* DHS Comparative Studies 23. Calverton, Md.: Macro International.

Arnold, F., M. K. Choe, and T. K. Roy. 1998. "Son Preference, the Family-building Process, and Child Mortality in India." *Population Studies* 52(3):301–15.

Bairagi, R. 1987. "A Comment on Fred Arnold's "Measuring the Effect of Sex Preference on Fertility." *Demography* 24(1):137–38.

Behrman, J. R. 1988. "Intrahousehold Allocation of Nutrients in India: Are Boys Favored? Do Parents Exhibit Inequality Aversion?" *Oxford Economic Papers* 40(1):32–54.

Behrman, J. R., and A. B. Deolalikar. 1990. "The Intrahousehold Demand for Nutrients in Rural South India: Individual Estimates, Fixed Effects, and Permanent Income." *The Journal of Human Resources* 25(4):665–96.

Behrman, J. R., and B. L. Wolfe. 1986. “Child Quantity and Quality in a Developing Country: Family Background, Endogenous Tastes, and Biological Supply Factors.” *Economic Development and Cultural Change* 34(4):703–20.

Chung, W., and M. Das Gupta. 2007. “The Decline of Son Preference in South Korea: The Roles of Development and Public Policy.” *Population and Development Review* 33(4):757–83.

Conley, D., and R. Glauber. 2006. “Parental Educational Investment and Children’s Academic Risk: Estimates of the Impact of Sibship Size and Birth Order from Exogenous Variation in Fertility.” *Journal of Human Resources* 41(4):722–37.

Das Gupta, M. 1987. “Selective Discrimination against Female Children in Rural Punjab, India.” *Population and Development Review* 13(1):77–100.

Das Gupta, M., and P. N. Mari Bhat. 1997. “Fertility Decline and Increased Manifestation of Sex Bias in India.” *Population Studies* 51(4):307–15.

Drèze, J., and M. Murthi. 2001. “Fertility, Education, and Development: Evidence from India.” *Population and Development Review* 27(1):33–63.

Filmer, D. 2005. “Gender and Wealth Disparities in Schooling: Evidence from 44 Countries.” *International Journal of Education Research* 43(6):351–69.

Filmer, D., and L. Pritchett. 2001. “Estimating Wealth Effects without Income or Expenditure Data—or Tears: Educational Enrollment in India.” *Demography* 38(1):115–32.

Haddad, L., J. Hoddinot, and H. Alderman. 1997. *Intrahousehold Resource Allocation in Developing Countries: Models, Methods, and Policy.* Baltimore: Johns Hopkins University Press.

Hank, K., and H.-P. Kohler. 2000. “Gender Preferences for Children in Europe: Empirical Results from 17 FFS Countries.” *Demographic Research* 2 (Article1). www.demographic-research.org/Volumes/Vol2/1/2-1.pdf.

Haughton, J., and D. Haughton. 1995. “Son Preference in Vietnam.” *Studies in Family Planning* 26(6):325–37.

Horton, S. 1986. “Child Nutrition and Family Size in the Philippines.” *Journal of Development Economics* 23(1):161–76.

Jensen, R. 2007. “Equal Treatment, Unequal Outcomes? Generating Sex Inequality through Fertility Behavior.” Harvard University, John F. Kennedy School of Government, Cambridge, Mass. http://www.watsoninstitute.org/pub_detail.cfm?id=811.

Keyfitz, N. 1968. *Introduction to the Mathematics of Population*. Reading, Mass.: Addison-Wesley.

Larsen, U., W. Chung, and M. Das Gupta. 1998 “Fertility and Son Preference in Korea” *Population Studies* 52(3):317–25.

Leung, S. 1998. “On Tests for Sex Preferences.” *Journal of Population Economics* 1(2):95–114.

Muhiri, P. K., and S. H. Preston. 1991. “Effects of Family Composition on Mortality Differentials by Sex among Children in Matlab, Bangladesh.” *Population and Development Review* 17(3):415–34.

Pande, R. 2003. “Selective Gender Differences in Childhood Nutrition and Immunization in Rural India: The Role of Siblings.” *Demography* 40(3):395–418.

Park, C. B. 1983. “Preference for Sons, Family Size, and Sex Ratio: An Empirical Study in Korea.” *Demography* 20(3):333–52.

Pollit, E., K. S. Gorman, P. Engell, R. Martorell, and J. A. Rivera. 1993. “Early Supplementary Feeding and Cognition: Effects over Two Decades.” *Monographs of the Society for Research in Child Development*, Serial No. 235, 58(7):1–99.

Pong, S. 1994. “Sex Preference and Fertility in Peninsular Malaysia.” *Studies in Family Planning* 25(3):137–48.

Repetto, R. 1972. “Son Preference and Fertility Behavior in Developing Countries.” *Studies in Family Planning* 3(4):70–76.

Rose, E. 1999. “Consumption Smoothing and Excess Female Mortality in Rural India.” *Review of Economics and Statistics* 81(1): 41–49.

Rivera, J. A., R. Martorell, M. T. Ruel, J. P. Habicht, and J. D. Haas. 1995. "Nutritional Supplementation during Pre-school Years Influences Body Size and Composition of Guatemalan Adolescents." *Journal of Nutrition* 25(4S):1068S–77S.

World Bank. 2001. *Engendering Development through Gender Equality in Rights, Resources, and Voice*. Washington, D.C.: World Bank and New York: Oxford University Press.

Yount, K. M. 2001. "Excess Mortality of Girls in the Middle East in the 1970s and 1980s: Patterns, Correlates, and Gaps in Research." *Population Studies* 55(3):291–308.

Yount, K. M., R. Langsten, and K. Hill. 2000. "The Effect of Gender Preference on Contraceptive Use and Fertility in Rural Egypt." *Studies in Family Planning* 31(4):290–300.

Zeng Yi, T. P., G. Baochang, X. Yi, L. Bohua, and L. Yongpiing. 1993. "Causes and Implications of the Recent Increase in the Reported Sex Ratio at Birth in China." *Population and Development Review* 19(2):283–302.