Changing Patterns of Son Preference and Fertility in Pakistan

Rashid Javed, Mazhar Mughal

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Abstract

Using data from two representative Demographic and Health Surveys, we examine the change in son preference over the past three decades and its effects on Pakistani women's fertility. We analyse a number of indicators and employ different empirical methods to come up with strong and persistent evidence for both the revealed and stated preference for sons. This disproportionate preference for boys is visible in increasing desired sex ratio and worsening sex ratio at last birth. Reliance over differential birth-stopping has significantly increased over time as couples are more likely to stop childbearing once the desired number of boys is achieved.

Keywords: Son preference; Fertility; parity progression; Pakistan.

JEL codes: D13; J13; O15; C13; Z13.

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1. Introduction

The practice of preferring sons over daughters is widespread in South and East Asia. In the patriarchal societies of Asia, sons are considered an asset: sons carry forward the family name, take up family business, care for parents in their old age and protect and provide for the dependent members in the extended family. In societies with a dowry-based virilocal setup, sons add to family assets through marriage. Daughters, in contrast, are perceived as a financial liability as the family is required to prepare sufficient dowry for their wedding. Son-preferring households see daughters as a futile investment as girls will move to their husband's homes after marriage and add into the capital of his household (N K Purewal, 2010). Once married, women in such traditional societies are expected to bear sons. This expectation could have important consequences for themselves and for existing girl children. Women in Pakistan with at least one son are reported to have significantly more say in everyday household decisions (Javed & Mughal, 2019). In China and India, giving birth to a first-born son is reported to improve the mother's nutrition intakes and reduce her likelihood of being underweight (Kishore & Spears, 2014; Li & Wu, 2011). According to Milazzo (2018), morbidity and mortality among adult women in India can be partially explained by the prevailing son preference.

It is therefore not surprising that the practice of son preference manifests itself in abnormally high sex ratios through sex-selective abortions, female infanticide and neglect of girls' health and nutritional needs (A. Sen, 1990). World Bank (2011) reported that around two million girls under the age of five were estimated to be missing every year, most of them in Asia. Moreover, in societies where sex-selective abortion is not deemed acceptable, parents continue their fertility as long as the desired number of sons is not attained (Basu & De Jong, 2010). According to Ojha (2021), If fertility decisions are driven by a desire to have a certain number of boys, then girls end up in larger families on average.

In this study, we examine the phenomenon of son preference and its fertility implications for women of childbearing age in one such society, namely that of Pakistan. Pakistan is the world's fifth most populous country with a population of 220 million (World Bank, 2020). The country has a skewed sex ratio of 108 male per 100 female (World Bank, 2019). There is little evidence for sex-selective abortion in Pakistan (Zaidi and Morgan, 2016). Abortion is allowed in case of danger to mother's life. Section 338 of the Pakistan Penal Code

prescribes a punishment of upto three years for carrying out abortion with mother's consent and upto ten years without her consent. In this study, we show that the main fertility manifestation of son preference in Pakistan is differential stopping. Pakistani women with one or more sons are significantly less likely to continue childbearing compared to women with no son. The probability of discontinuing childbearing also increases in the number of sons born. This differential stopping behavior has grown in strength over time. Using data from two rounds of Pakistan Demographic and Health Survey carried out in 1990-91 and 2017-18, we examine the changes in various aspects of both the revealed and stated preference for son that have occurred in the country over time. PDHS 1990-91 was the country's first DHS survey whereas PDHS 2017-18 is the country's latest.

Zaidi & Morgan (2016) examines son preference manifested in Pakistani women's fertility intentions, patterns of contraceptive use and parity progression ratios by taking the three rounds of DHS (1990-91, 2006-07 and 2012-13) datasets. Our study complements their analysis by focusing on some other aspects of son preference: The primary scope of this study is to chart the evolution of the phenomenon since the 1990s. During this period, Pakistan's demography has undergone significant changes: The country's Total Fertility Rate (TFR) was estimated at 5.4 in 1990-91, which declined to 3.6 in 2017, a 33% reduction in the two and half decades (Javed & Mughal, 2021). The Contraceptive Prevalence Rate (CPR) increased from 12 percent in 1990 (PDHS 1990-91) to 34 percent in 2017 (PDHS 2017-18). The mean age at first marriage of women of child-bearing age increased from 17.9 years to 19.2 years. Economically, the country graduated from low-income to middle-income country as the per capita GNI in PPP dollar terms rose from $2,060 in 1990 to $5,830 in 2017 (World Bank, 2019).

In this paper, we overview the history of son preference in Pakistan before focusing on the changes in the preference over time. We examine a number of different dimensions of the phenomenon to draw a clear picture of the changes: actual preference vs desired preference, the role of birth order and differential birth stopping, and difference in the attitudes of men and women. We study the country's Sex Ratio at Birth (SRB), Sex ratio at Last Birth (SRLB), child sex ratio, Parity Progression Ratio (PPR) and Desired Sex Ratio (DSR). We describe the prevalence of son preference among different demographic and geographical subgroups. We also determine the probability of differential birth-stopping

decision resulting from the disproportionate preference for the male offspring. We establish the robustness of our analysis by using a number of indicators and applying different sample restrictions and empirical methods.

In the following, we briefly overview the historical background of the son preference phenomenon in Pakistan and report relevant literature in Section 2. Data and empirical methodology are discussed in Section 3. Section 4 describes son preference in light of revealed and stated preference measures. In Section 5, parity-wise effects of son preference on additional fertility are reported and the role of son preference in determining the desire for having no more children is estimated. Section 6 presents a number of robustness checks. The final section interprets the results and draws conclusions.

2. Background and relevant literature

Written accounts of female infanticide in the Indian Subcontinent go as far back as the late eighteenth century (Bhatnagar et al., 2005). From the mid-nineteenth century, officers of the British East India Company began identifying Indian tribes and castes practicing traditions of female infanticide. The 1921 population census carried out by the colonial British India government classified castes into two categories, namely, castes having "a tradition" of female infanticide and castes without such a tradition' (S. Vishwanath, 2004). The province of Punjab, which extends over large parts of today's central Pakistan and north-western India, was considered the land of missing girls (Navtej K Purewal, 2010). In 1851, it was reported that 400 Sikh Khatri families had destroyed all their female children from the last 400 years[1]. Female infanticide was reported to be common among the Kharral tribe in Montgomery district (present-day Sahiwal in Pakistani Punjab). The practice of female infanticide was considered to be less common among Muslims. M. Gubbins, a British colonial official, stated: "The Mussulman is found to sympathize least with child-murder" (S. Sen, 2002). The 1870 Female infanticide act declared the practice of female infanticide as illegal.

[1]In the words of Purewal (2010): "The Bedis, a Sikh khatri caste who claimed direct descendancy to Guru Nanak and who were ranked highly among other Sikh khatri families, received girls from other lower-ranking khatri families but refused to marry their daughters to boys from lower-ranked families and hence resorted to female infanticide"

Although female infanticide is practically inexistent in present-day Pakistan, other manifestations of son preference persist. In an early empirical study on the country, Khan & Sirageldin (1977) analysed data from a national survey conducted in 1968-1969 and reported the presence of strong son preference both among men and women. Later on, Ali (1989) analysed data from Pakistan National Survey 1979-80 and suggested that having at least one son in the family influenced the demand for additional children. In the same vein, Hussain, Fikree, & Berendes (2000) concluded that sex of surviving children in Karachi, Pakistan was strongly correlated with subsequent fertility and contraceptive behaviour. Zaidi & Morgan (2016) found no significant evidence for large-scale sex-selective abortion in Pakistan and suggested that couples mainly relied on continuing fertility to attain the desired number of sons. Channon (2017) showed that the association of son preference with parity progression and modern contraceptive use had become stronger in Pakistan over time.

Javed & Mughal (2020) analyse data from the 1990-91, 2006-07 and 2012-13 rounds of Pakistan Demographic and Health Survey (PDHS) using a set of parametric, semi- and non-parametric estimation techniques, and find strong evidence for differential birth spacing at early parities throughout the examined period. Besides, they reported a higher probability of risky births (subsequent birth interval below 18 months) resulting from disproportionate preference for sons[2].

3. Data and methodology

3.1 Data description

Data for this study come from two rounds of the nationally representative Pakistan Demographic and Health Survey (PDHS). The survey was carried out by the National Institute of Population Studies (NIPS), Islamabad with technical and financial assistance from US Agency for International Development (USAID). The survey contains comprehensive data on reproductive behaviour of ever-married Pakistani women aged 15-49. The first round (PDHS 1990-91) is based on interviews with 6,611 women from 7,193 households. A two-stage stratified sample design was adopted with 407 primary sample units (PSU), 225 of which were from urban areas and 182 from rural areas. The latest

[2] For detailed, see Javed (2019).

round (PDHS 2017-18) covers 15,068 women from 14,540 households. This sample contains data from 580 PSU, 285 from urban areas and 295 from rural areas. The survey data is described in the online appendix (Table A1). For the purpose of our analysis, we restrict the sample to women who have completed their childbearing (i.e. women who gave the answer "want no more children" in response to the question "Do you desire more children?", those who or whose spouse had undergone sterilization, and those who report to be infecund) and have at least one child. Women with multiple births are excluded from the sample. This leaves us with a sample of 2614 individual observations in 1990-91 and 6373 observations in 2017-18.

Table 1 describes relevant variables in the dataset. In 2017-18, 52% of the women reported their first-born to be a boy. 76% of the women reported having at least one son at parity 2, 88% had at least one son at parity 3 and 94% had at least one son at parity 4. The figures for the 1990-91 dataset are similar: 52% of the women had a first-born son, 77% had at least one son at parity 2, 89% had at least one son at parity 3 and 95% had at least one son at parity 4. In 2017-18, 13% of the women at parity 3 reported having three sons, 38% having two sons while 36% reported having one son. Corresponding figures in 1990-91 were 15%, 38% and 35% respectively. At parity 4, 6% of the women in 2017-18 report having sons only, 27% having three sons, 37% having two sons and 23% having just one son. Corresponding figures in 1990-91 were 8%, 25%, 40% and 20% respectively.

Majority of women in the two samples possessed no formal education (51% in 2017-18, 77% in 1990-91). In contrast, a lower proportion of husbands (30% in 2017-18, 48% in 1990-91) reported possessing no formal education. Women are increasingly acquiring university education: about 11% of the women in 2017-18 reported having acquired tertiary-level education compared with only 1% in 1990-91. In comparison, 18% and 5% of the husbands in 2017-18 and 1990-91 possessed higher education. Average household size during the period was around eight (7.9 in 2017-18, 8.4 in 1990-91). About two-thirds of the households (60% in 2017-18, 61% in 1990-91) lived in rural areas.

3.2 Methodology

Our analysis proceeds as follows:

In the first step, we present measures of revealed and stated son preference. Revealed or actual preference is measured through Sex Ratio at Birth (SRB), Sex Ratio at the Last Birth (SRLB), Child Sex Ratio (CSR) and Parity Progression Ratio (PPR). SRB corresponds to the number of boys born alive per 100 girls born alive, and is calculated by birth order and by sex of first and second births by following Almond & Edlund (2008). CSR is the number of males per 100 females in the age group 0-5 years, alive at the time of the survey. PPR corresponds to the proportion of women at a given parity who proceed to a higher parity, and is computed as follows:

$$PPR = \frac{Women\ with\ n+1\ children}{Women\ with\ n\ children}$$

Stated son preference is measured using Desired Sex Ratio (DSR), defined as the ratio of ideal number of sons the woman would have liked to have if she could go back to the time she did not have any child to ideal number of daughters she would have liked to have.

In the second step, we estimate the impact of son preference on the probability of subsequent birth at parity n. Here, two indicators are used to represent son preference, the first a binary indicator accounting for the presence of at least one son, and the other taking the number of sons at parity n. The first indicator aims at observing the presence of son preference while the second tries to gauge its strength. We show parity-wise analysis of the first four parities, i.e. from the second to the fifth live births. The outcome variable is subsequent birth at the parity n. This binary variable takes the value of 1 if a women has more than n children and 0 otherwise.

Finally, we estimate the impact of having one or more sons on the stated desire to discontinue reproduction. Here, the outcome variable is complete fertility which is based on the response “want no more” to the question: "After the child you are expecting now, would you like to have another child, or would you prefer not to have any more children"?

In all sets of estimations, we control for individual, household and locational factors which influence fertility decisions. The control factors considered include the respondent woman's age, age difference with husband, woman's and husband's education level,

woman's employment status, exposure to electronic media, household size, household wealth status[3], and the region and area of residence. The base line model can be given as,

$$Y_{ij} = \alpha + \beta\,(SP)_{ij} + \delta \mathrm{X}_j + \varepsilon_{ij}$$

Where Y_{ij}represents fertility choice (subsequent birth at parity i / complete fertility) for the woman j, SP stands for son preference at parity i for woman j, X_j represents the set of household characteristics that can affect a woman's reproductive behaviour and ε_{ij} is the error term.

3.3 **Techniques employed**

We begin by obtaining our empirical estimates using Probit, both without and with the set of controls. Additionally, we account for the possibility that households with sons may differ from those without in ways that could be considered non random by using three matching techniques, namely Propensity Score Matching (PSM), Inverse Probability Weighting (IPW) and Augmented Inverse Probability Weighting (AIPW). These matching estimators are based on the Rubin Causal Model with assumptions of unconfoundedness and overlap (Rosenbaum & Rubin, 1983). For this purpose, the sample is divided into two groups: treatment (based on the variable of interest) and control (non-treatment).

The first matching technique, the PSM matches the treated individuals to the non-treated based on a propensity score for participation given observable characteristics of the individual. Propensity-score matching uses an average of the outcomes of similar individuals who get the other treatment level to impute the missing potential outcome for each individual (StataCorp, 2013).

We use Stata's teffects psmatch command to obtain the PSM estimates with the default 1:1 Nearest Neighbour method. After the PSM estimations, balancing of the treatment groups is checked using Kernel density plots. Plots for the first set of estimations (based on the

[3] The household wealth variable is generated by constructing a principal component analysis index of household assets such as home ownership, floor type, water source, electricity availability, durable consumer goods etc. The quintiles of the generated variable indicate the economic status of the household.

presence or otherwise of at least one son at parity n) are given in the online appendix. The covariates of the groups are found to be well balanced.

The second technique, the IPW improves on PSM by according a higher weight to individuals receiving an unlikely treatment. This reweighting helps assign higher weights to individuals lying in the middle of the probability distribution and lower weights to those at the extremes (Wooldridge, 2007) .

AIPW, the last matching technique, combines both the properties of the regression based estimator and the IPW estimator, requiring either the propensity or outcome model (but not necessarily both) to be correctly specified (Cao et al., 2009).

For each of the three matching routines, we obtain average treatment effect (ATE) which provides difference between the expected outcomes with and without treatment. We use appropriate weights to ensure the representativeness of the sample.

4. Son preference

We begin by presenting evidence for son preference in Pakistan in light of the aforementioned indicators.

4.1 SRB and SRLB

On average, there are 105 boys at birth per 100 girls in a human society. An abnormally-high ratio points to the presence of female-specific abortion at a given time period. Figure 1 shows sex ratio by parity and sex composition of previous children. The ratios in these given parities is close to 105. This suggests no clear pattern of change in the ratio over time. The lack of consistent evidence for skewed sex ratios reflects limited presence of pre-natal female-specific sex selection.

However, there is a high and increasing recourse to differential birth control as seen in the skewed figures for SRLB (Table 2). The country's overall SRLB increased from 117 in 1990-91 to 126 in 2017-18, suggesting that Pakistani couples are increasingly resorting to differential birth-stopping in the presence of persistent preference for male offspring. Pakistan's SRLB is among the highest in the world (Bongaarts, 2013). The ratio is

significantly higher in the rural areas (124 in 1990-91, 128 in 2017-18) than in the urban areas (108 in 1990-91, 121 in 2017-18). The increase in the ratio over time has been greater in the urban areas. The ratios with respect to women's employment status show interesting variation: In 1990-91, women with no employment had a sex ratio at last birth of 118 compared with 114 for working women. This trend has reversed by 2017-18 with the latter now showing a higher ratio than the former (128 vs 115).

SRLB with respect to household wealth has also evolved: In 1990-91, households belonging to the middle (third) wealth quintile had the highest ratio at last birth (153) of all the wealth groups. In 2017-18 in contrast, the highest ratio of 133 male births per 100 live female births was found among the wealthier group of households (second quintile) followed by the middle-class households (132.43). The rates appear to be converging across wealth groups.

4.1 Child Sex Ratio

Another manifestation of Pakistan's changing sex imbalance can be seen in the boy to girl ratio for under-five children. Child sex ratio has come down from 103.5 in the 1990-91 sample to 99 in the 2017-18 (Table 3). This corresponds to a 4% decrease over a quarter of a century. The bias in child sex ratio used to be much higher in the rural areas (106) than in the urban centres (97 according to 1990-91 PDHS). The trend has since reversed, with urban areas now showing more sex imbalance than the urban areas (97 vs 103). This reversal is also evident in terms of women's educational attainment. CSR used to bbe the highest among women with no education, whereas today, the highest ratios are found among women with secondary education. There is also some evidence of convergence on the regional and household wealth basis.

We can see the imbalance in boy to girl ratio more clearly by focusing on women who report their fertility to be complete after giving birth to two, three or four children. Child sex ratio for women respondents with two to four living children shown in Table 4 ranges from 126 to 191 in 1990-91 and from 125 to 170 in 2017-18. The ratios are invariably lower in 2017-18 than those in 1990-91, reflecting a declining preference for sons. These

abnormally high figures give a strong indication of differential birth stopping[4]. The ratio is the highest among women with two children (191 in 1990-91, 170 in 2012-13), suggesting that women stop child-bearing more often when one or both of their two children are boys compared to the situation where they only have girls. This discriminatory behaviour does not depend on women's employment status. Women living in urban areas have comparatively lower sex ratios than those living in rural areas. Besides, women with some education often have lower sex ratios compared with women with little or no education.

In addition to differential stopping, a possible reason for this imbalance could be the discrimination in the allocation of household resources among children. Boys in Pakistan are significantly more likely to receive full vaccination course, get treated for cough or be breast-fed than girls do (Javed et al., 2021). Girls in Pakistan and India are 30 to 50% more likely to die from poor nutrition, lack of preventive medicine or access to healthcare (Fikree & Pasha, 2004).

4.2 Parity progression ratio

In societies with higher preference for sons, the decision to continue fertility depends on the sex of children born. Couples are less likely to continue childbearing once the desired number of sons is attained. This effect can be observed in skewed values of parity progress ratio (PPR) shown in Table 5. While women with or without a son both have similar PPR at parity 1, their ratios are substantially different at higher parities. For example, women with no son out of the first two children had a PPR of 0.97 in 2017-18 compared with a much lower value of 0.90 for women with one or two sons. Likewise, the PPR at the third parity for women with no son is 0.92 which drops to 0.76 and 0.79 for women with two or three sons respectively. PPR at second and higher parities have fallen over time regardless of the number of sons born, reflecting overall falling fertility rates.

[4] An alternative explanation could be under reporting of girls in the survey. See for reference (Sathar et al., 2015). However, it is hard to conceive how and indeed why mothers with two children would under-report their daughters more than mothers with three or four children.

4.3 Desired sex ratio

Next we focus on the desire for sons stated by women. According to Bongaarts (2013), Pakistan had the second highest desire sex ratio among 61 developing countries examined. Table 6 presents desire sex ratio (DSR) for women with complete fertility. We can again see strong preference for boys: overall desired sex ratio, which was 113 in 1990-91 is estimated to be a much higher 138 in 2017-18. The ratio diverges sharply by education and location of women, and shows divergent trends over time. DSR is the highest among women with no schooling (120 in 1990-91, 152 in 2017-18). The desire for sons has increased over time across the education levels. The ratio has also increased during the 25 years since the first round of PDHS regardless of the women's work status. In 1990-91, non-working women showed greater desire for sons compared to working women. The difference had disappeared by 2017-18. Another change observed over time is that in 1990-91, the highest desire for sons was expressed by women from middle-class households (those belonging to second, third or fourth quantiles of the wealth distribution). In contrast, women with highest DSR in 2017-18 belonged to the bottom two quantiles. The ratio for women living in rural areas in 1990-91 was much higher compared with those living in urban areas (130 vs 106). The difference between the two groups of women did not decrease according to the 2017-18 sample with ratios of 145 for women living in rural areas and 127 for women living in urban areas respectively. DSR also continues to differ greatly between women from the four provinces. In 1990-91, the values of DSR ranged from a high of 150 in the province of KPK (then called NWFP) to a low of 106 in Sindh. The range was similarly large in 2017-18 with a maximum of 172 found again in the province of KPK followed by Sindh (139.86), Balochistan (139.81) and Punjab (128).

5. Impact on subsequent childbearing

From the ratios discussed above based on aggregate data on children, child births and birth orders, we estimated the incidence of son preference and its strength. The patterns of revealed and stated son preference observed so far point to the existence of strong differential stopping effects. In the following, we use data on surveyed women and their husbands to estimate the impact of son preference on actual (or revealed) and stated fertility and establish the strength of differential birth stopping.

5.1 Actual fertility

Table 7 shows Probit estimates of the effect of having one or more son at a given parity on the probability of proceeding to subsequent birth while tables 8 and 9 show the ATE for the three corresponding sets of matching estimations. In all the tables, panels 1 to 4 show results for parity 1 to 4, i.e. the probability of proceeding to second, third, fourth and fifth birth, respectively.

We find no significant effect of the sex of the first child on the probability of the second birth, neither in 1990-91 nor in 2017-18. This finding is in line with the parity progression ratio for women at first parity shown in Table 5 which does not vary regardless of the sex of the first-born. In contrast, we find negative and mostly significant impact of having one or more sons on the likelihood of proceeding to higher parities. The marginal effects evaluated at means given in Table 7 show that the presence of at least one son at parity 2 is associated with 5.7% (with controls) and 6.3% (without controls) lower probability of giving birth to another child (2017-18 sample). In other words, women one or both of whose first two children are boys are 5.7-6.3% less likely to continue childbearing compared to those women who have no son. The likelihood is likewise lower in 1990, but somewhat less important (3.5-4.4%). The corresponding results for Probit estimations with controls for parities 3 and 4 respectively show 10% and 17% lower likelihood of subsequent birth in the presence of one or more sons (2017-18 sample). The effects for the 1990-91 sample are smaller.

The ATE for the three matching routines that estimate the impact of the presence of one or more sons at the four parities range from 5% to 18% (PSM), 4% to 16% (IPW) and 4% to 16% (AIPW) (table 8-9). Findings of the Probit and the three matching estimates are highly similar in significance, direction and magnitude, and give strong evidence in favour of son preference observed in differential birth stopping. Results for the 1990-91 dataset are analogous to those of the 2017-18 dataset with the exception that estimates for parity 3 are invariably found to be insignificant.

To estimate son preference's size effect, we change our variable of interest 'presence of at least one son' to number of sons at given birth order. Table 10 reports results for the impact of number of sons at a given parity on the probability of continuing childbearing.

These results, while similar to those discussed so far, shed light on another dimension of the son preference – fertility relationship. We find that women with more sons at a given parity are more likely to stop child-bearing compared with women with fewer sons. For example, while the likelihood of subsequent birth for women with one son at parity 4 does not significantly differ from that of women without a son, it does so significantly at higher birth orders. While women with two or three sons out of the first four children are respectively 21% and 19% less likely to proceed to the fifth birth, those whose four children all are boys are 17% less likely to do so (2017-18 estimations with controls). The evidence for differential stopping is stronger in 2017-18 than in 1990-91. For instance, the decrease in likelihood of the fifth birth in the case of the latter is 11% and 12% for women with two or three sons, and 9% in case of four sons (1990-91 estimates with controls).

5.2 Stated fertility intentions

One final piece of evidence pertains to women and men's stated fertility intentions in the presence of son preference. Table 11 shows results of Probit estimates without and with the set of controls for women and their husbands' intention to discontinue fertility for the 1990-91 and 2017-18 samples. The outcome variable "stated completed fertility" is a binary variable which takes the value of 1 if the respondent states her fertility to be complete (i.e. those who gave the answer "want no more children" in response to the question "Do you desire more children?"), 0 otherwise. We find a significant association between the presence of one or more son and intention to stop child-bearing. Women with at least one son are found to be 36% more likely to state no desire to have an additional child compared with women with no son (2017-18 estimates with controls). The corresponding figure for the 1990-91 sample is 29%. Likewise, husbands with at least one son are found to be 30% more likely to state no desire to have an additional child compared with husbands with no son (2017-18 estimates with controls). The likelihood is not found to be significant in 1990 though.

These results again indicate significant effect of son preference on fertility outcomes which manifest themselves mainly in the form of differential stopping.

6 Robustness measures

In this section, we examine the robustness of our baseline results to a variety of additional checks.

6.1 Sex-selective abortion

A possible threat to our methodology could be from sex-selective abortion. In the presence of son preference, couples conscious of family size may go for sex-selective abortion if the firstborn is a girl. There is little evidence suggesting widespread practice of sex-selective abortion in Pakistan (Sathar et al., 2015; Zaidi & Morgan, 2016). However, reliable data are scarce, as women are reluctant to report abortion given the social stigma attached to the practice. It is possible that women who had an abortion report the missing child as dead or miscarried. We explore this possibility by using two strategies:

First, we limit our sample to the women who do not report any child death. We obtain results not dissimilar to those hitherto found (Table A2). As before, birth stopping is found to be stronger in 2017-18 than in 1990-91.

Second, we estimate the effect of son preference on the likelihood of subsequent births on the sample of births that took place prior to 1990. The logic here is that foetal sex determination through ultrasound technology become widely available in Pakistan in the 1990s. The role of sex-selective abortion can therefore be eliminated by restricting the sample to pre-1990 births. The results are again similar to those discussed previously (result not shown). The negative impact on childbearing is again stronger in 2018 compared to that in 1991.

6.2 Additional controls

Many of the controls included in our model relate to women's spousal household which may confound the fertility impact of son preference. We account for this possibility by only including pre-treatment controls, namely woman's age at first birth, age at marriage, mother tongue and whether she worked before she got married.

The results of estimations using this model are comparable to the previous results (Table A3). As before, the negative fertility effect of child sex is found to be stronger with the 2017-18 sample compared to the 1990-91 sample.

6.3 Pooled sample estimation

The number of observations pertaining to higher parities can be small for individual subsamples. We tackle this issue by pooling the two samples. The pooled sample consists of 8987 women of child-bearing age. The results are shown in table A4. As before, the impact of son preference on subsequent birth is insignificant at the first parity and significant for higher parities. Women, one or both of whose children are boys, are 5% less likely to proceed to third birth (Column 2). Likewise, women with one, two or three boys out of the total three children are 8% less likely to continue childbearing, while those with one, two, three or four boys out of the four children are as much as 16% less likely to go for fifth child.

7 Discussion and conclusion

In this study, we examined son preference and its fertility effects in Pakistan. We based our analysis on two rounds of Pakistan Demographic and Health Survey (PDHS) to chart the evolution of son preference patterns over time. We began by presenting the changes in different aspects of revealed and stated preference for sons by using a number of indicators. Following this descriptive analysis, we studied the impact of son preference on actual and desired fertility outcomes observed in 1990-91 and 2017-18. We used presence of at least one son at parity n and the number of sons at parity n as indicators of son preference and considered first four birth parities.

We find strong and persistent evidence for both the revealed and stated preference for male offspring. Son preference decreases in couple's level of education. It is more intense among middle-class and rural households. Besides, parity progression slows with number of sons born. We found that reliance over differential birth-stopping has significantly increased over time, as couples are more likely now to stop childbearing once the desired number of boys is achieved. Pakistan's sex ratio at last birth has increased from 117 boys

per 100 girls in 1990-91 to 126 in 2017-18. The increase in the ratio over time has been particularly high in the urban areas. This disproportionate preference for boys is also visible in the desired ratio of boys and girls, which has grown from 113 in 1990-91 to 138 in 2017-18.

We found that although the likelihood of second birth does not appear to vary with the sex of the first-born, women with one or more sons are found to be upto 17% less likely to pursue additional fertility compared with women with no son. This probability is greater at higher parities and among women with more sons. These findings corroborate evidence from Asian countries supporting strong effect of the sex of existing children on women's subsequent fertility (Chowdhury & Bairagi, 1990; Das, 1987; Hoq, 2019; Jiang et al., 2016; Kugler & Kumar, 2017). Our findings are also in line with those of Javed & Mughal (2020) who report strong evidence for differential birth-spacing occurring in Pakistan as a result of disproportionate preference for male children. In addition to these actual differential birth-stopping effects, we also found support for stated desire for stopping child-bearing among women with one or more sons.

All in all, our research provides fresh evidence that Pakistani couples continue child-bearing as long as at least one son is not born. Son preference continues in Pakistan and it remains a strong predictor of women's fertility behaviour. Pakistan's continuing skewed sex ratios and the country's slow rate of demographic transition can be understood in light of these findings. Though the country's population growth has slowed, the rate remains one of the highest in Asia. Policy measures that promote equal treatment of boys and girls can prove helpful in curbing the rapid rate of increase in the country's population.

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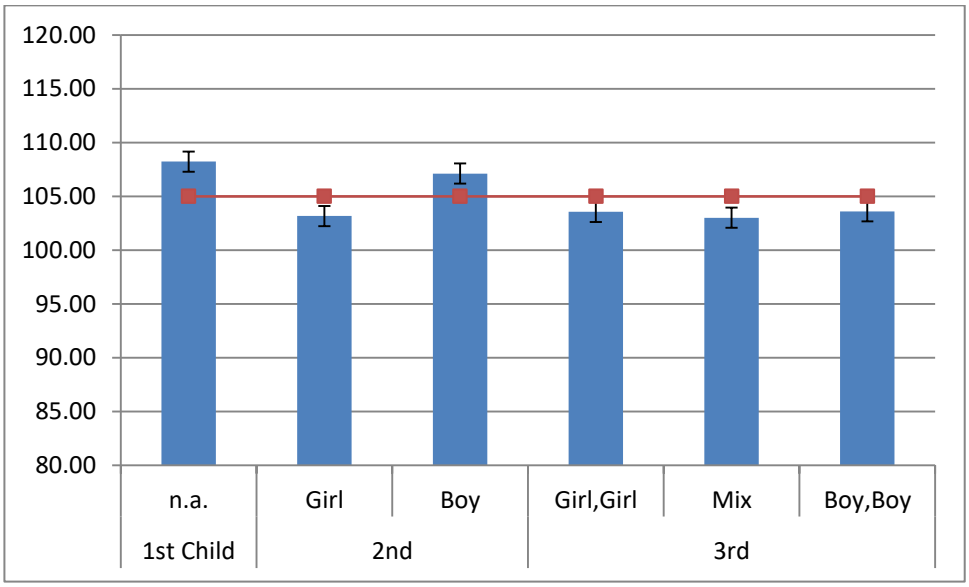
Figures and tables:

Figure 1: Sex ratio by parity and sex of previous child



Source: Authors' calculations using pool PDHS data. Observations with multiple births are omitted. The final pooled sample consists of 37,002 individual observations.

Table 1: Data description

Variables	Description	Proportion/Mean	
		PDHS 1990-91	PDHS 2017-18
Birth			
1	Dummy variable, takes the value of 1 if the woman has more than one children, 0 otherwise	0.96	0.96
		0.03	0.03
2	Dummy variable, takes the value of 1 if the woman has more than two children, 0 otherwise	0.90	0.88
		0.09	0.11
3	Dummy variable, takes the value of 1 if the woman has more than 3 children, 0 otherwise	0.79	0.70
		0.20	0.29
4	Dummy variable, takes the value of 1 if the woman has more than four children, 0 otherwise	0.66	0.49
		0.33	0.50
Stated completed fertility			
Women	Dummy variable, takes the value of 1 if respondent stated fertility is completed, 0 otherwise.	0.42	0.46
		0.57	0.53
Men	Dummy variable, takes the value of 1 if respondent stated fertility is completed, 0 otherwise.	0.36	0.37
		0.63	0.62
Revealed Son Preference			
1	Dummy variable, takes the value of 1 if female have at least 1 son at parity 1, 0 otherwise	0.52	0.52
		0.47	0.47
2	Dummy variable, takes the value of 1 if female have at least 1 son at parity 2, 0 otherwise	0.77	0.76
		0.22	0.23
3	Dummy variable, takes the value of 1 if female have at least 1 son at parity 3, 0 otherwise	0.89	0.88
		0.10	0.11
4	Dummy variable, takes the value of 1 if female have at least 1 son at parity 4, 0 otherwise	0.95	0.94
		0.04	0.05
Number of sons			
1	Dummy variable, takes the value of 1 if the woman has a son at parity 1, 0 otherwise	0.52	0.52
		0.47	0.47
2	Categorical variable, takes the value of 0 if the woman has no son at parity 2, 1 if 1 son, 2 if 2 sons	0.22	0.23
		0.48	0.48
		0.29	0.27
3	Categorical variable, takes the value of 0 if the woman has no son at parity 3, 1 if 1 son, 2 if 2 sons, 3 if 3 sons	0.10	0.11
		0.35	0.36
		0.38	0.38
		0.15	0.13
4	Categorical variable, takes the value of 0 if the woman has no son at parity 4, 1 if 1 son, 2 if 2 sons, 3 if 3 sons, 4 if 4 sons	0.04	0.05
		0.20	0.23
		0.40	0.37
		0.25	0.27
		0.08	0.06
Age	Woman's age in completed years	35.92	37.04
Age difference	Age difference between husband and wife in years	7.07	5.64

Education	Categorical variable, takes the value of 0 if the woman has no education, 1 if the woman possesses primary education, 2 if the woman possesses secondary education, 3 if the woman possesses higher education	0.77	0.51
		0.09	0.17
		0.12	0.20
		0.01	0.11
Spouse education	Categorical variable, takes the value of 0 if the husband possesses no education, 1 if the husband possesses primary education, 2 if the husband possesses secondary education, 3 if the husband possesses higher education	0.48	0.30
		0.15	0.16
		0.30	0.34
		0.05	0.18
Employed	Dummy variable, takes the value of 1 if the woman is employed, 0 otherwise	0.16	0.19
		0.83	0.80
Media exposure	Dummy variable. PDHS 1990-91: takes the value of 1 if the woman listens radio or watches television once a week, 0 otherwise; PDHS 2012-13: takes the value of 1 if the woman watches television occasionally, weekly or daily, 0 otherwise	0.45	0.63
		0.54	0.36
Household size	Total number of family members in the household	8.40	7.95
Place of residence	Dummy variable, takes the value of 1 if the household resides in urban area, 0 otherwise	0.38	0.39
		0.61	0.60
Region	Categorical variable, takes the value of 1 if the household lives in Balochistan, 2 if the household lives in Punjab, 3 if the household lives in Sindh, 4 if the household lives in KPK	0.01	0.04
		0.63	0.57
		0.21	0.21
		0.14	0.15
Wealth Status	Categorical variable, takes the value of 1-5 for households belonging to poorest, poorer, middle, rich and richest household wealth groups.	0.14	0.15
		0.14	0.19
		0.17	0.21
		0.24	0.20
		0.29	0.22

Source: Authors' calculations using PDHS 1990-91 and PDHS 2017-18. Sample weights are used.

Table 2: Sex ratio at last birth

	PDHS 1990-91				PDHS 2017-18			
	Sex Ratio	**N**	**95% CI**		**Sex Ratio**	**N**	**95% CI**	
Overall	117.46	2590	112.93	121.98	126.01	5214	122.58	129.43
Education								
No Education	119.76	1991	114.49	125.02	120.05	2667	115.49	124.60
Primary	118.52	236	103.39	133.64	135.98	892	127.05	144.90
Secondary	108.33	325	96.55	120.10	143.49	1047	134.79	152.18
Higher	-	-	-	-	111.93	604	103.00	120.85
Spouse Education								
No Education	109.06	1246	103.00	115.11	123.84	1596	117.76	129.91
Primary	139.88	391	126.01	153.74	131.42	847	122.56	140.27
Secondary	129.45	787	120.40	138.49	126.13	1800	120.30	131.95
Higher	85.19	150	71.55	98.82	126.49	949	118.44	134.53
Woman employed								
No	118.31	2170	113.33	123.28	128.5	4209	124.61	132.38
Yes	113.78	419	102.88	124.67	115.7	1003	108.53	122.86
Place of Residence								
Rural	123.62	1581	117.52	129.71	128.86	3124	124.34	133.37
Urban	108.49	1007	101.78	115.19	121.87	2090	116.64	127.09
Province/Region								
Punjab	119.23	1642	113.46	124.99	127.54	2999	122.97	132.10
Sindh	109.85	554	100.70	118.99	121.06	1123	113.97	128.14
KPK	124.07	363	111.30	136.83	126.39	772	117.47	135.30
Balochistan	-	-	-	-	137.65	202	118.66	156.63
Economic status								
Poorest	99.49	389	89.60	109.37	125	828	116.48	133.51
Poorer	127.95	367	114.85	141.04	133.41	1013	125.19	141.62
Middle	153.04	458	139.02	167.05	132.43	1111	124.64	140.21
Richer	119.15	618	109.75	128.54	108.77	1071	102.25	115.28
Richest	103.78	754	96.37	111.18	132.03	1279	124.79	139.26

Source: Authors' calculations using PDHS 1990-91 and 2017-18. Sample weights are used. Subgroups with less than 100 observations are omitted.

Table 3: Child sex ratio (0-5 years)

	PDHS 1990-91				PDHS 2017-18			
	Sex Ratio	**N**	**95% CI**		**Sex Ratio**	**N**	**95% CI**	
Overall	103.54	7466	101.20	105.89	99	11572	97.20	100.81
Education								
No Education	105.29	5822	102.58	107.99	99.93	5666	97.33	102.53
Primary	96.06	747	89.17	102.95	95.08	1902	90.80	99.35
Secondary	101.46	828	94.55	108.37	102.97	2529	98.96	106.98
Higher	-	-	-	-	94.07	1473	89.27	98.88
Spouse Education								
No Education	99.08	3450	95.77	102.38	98.93	3358	95.59	102.28
Primary	106.81	1276	100.95	112.67	95.62	1921	91.35	99.90
Secondary	110.57	2371	106.12	115.02	101.74	3948	98.56	104.91
Higher	90.70	328	80.88	100.51	95.19	2153	91.17	99.22
Woman employed								
No	103.96	6284	101.39	106.53	99.82	9845	97.85	101.79
Yes	101.39	1162	95.56	107.22	94.36	1724	89.91	98.82
Place of Residence								
Rural	106.61	5126	103.69	109.53	96.90	7746	94.74	99.06
Urban	97.14	2340	93.20	101.07	103.40	3826	100.13	106.68
Province/Region								
Punjab	109.22	4425	106.00	112.44	103.07	6025	100.46	105.67
Sindh	99.40	1661	94.62	104.18	93.96	2729	90.43	97.48
KPK	98.11	1048	92.17	104.05	91.54	1835	87.36	95.73
Balochistan	90.91	294	80.52	101.30	104.33	613	96.07	112.59
Economic status								
Poorest	99.83	1153	94.06	105.59	95.12	2597	91.46	98.77
Poorer	110.92	1236	104.74	117.11	95.56	2292	91.65	99.48
Middle	106.98	1364	101.30	112.66	101.25	2407	97.21	105.30
Richer	105.96	1660	100.86	111.05	102.18	2224	97.94	106.43
Richest	97.50	2050	93.27	101.72	102.07	2051	97.65	106.49

Source: Authors' calculations using PDHS 1990-91 and 2017-18. Sample weights are used. Subgroups with less than 100 observations are omitted.

Table 4: Child **s**ex ratio by number of children

	PDHS 1990-91									PDHS 2017-18								
	2			3			4			2			3			4		
	Sex Ratio	95% CI		Sex Ratio	95% CI		Sex Ratio	95% CI		Sex Ratio	95% CI		Sex Ratio	95% CI		Sex Ratio	95% CI	
Overall	191.18	169.43	212.92	144.64	134.88	154.40	126.26	119.63	132.88	170.68	159.08	182.29	139.61	134.47	144.75	124.22	120.59	127.86
Education																		
No Education	252.83	216.59	289.07	151.74	138.52	164.96	132.03	123.63	140.43	161.70	141.50	181.91	148.51	138.44	158.59	129.88	124.05	135.71
Primary	125.00	77.85	172.15	137.21	110.58	163.84	126.67	102.08	151.25	257.50	215.29	299.71	139.81	127.48	152.13	133.33	124.00	142.67
Secondary	120.69	91.12	150.26	137.97	118.25	157.70	112.75	100.34	125.16	148.89	129.39	168.39	76.60	70.77	82.42	123.84	116.55	131.13
Higher	-	-	-	-	-	-	-	-	-	163.41	141.62	185.21	142.26	131.26	153.27	101.49	93.84	109.13
Spouse Education																		
No Education	184.62	150.27	218.96	171.84	151.72	191.97	132.51	121.58	143.44	171.19	144.66	197.71	141.89	129.89	153.89	118.97	111.65	126.28
Primary	-	-	-	-	-	-	134.21	114.49	153.93	156.00	117.78	194.22	158.70	142.23	175.16	131.37	121.93	140.80
Secondary	170.27	136.90	203.64	150.38	134.22	166.53	118.33	108.20	128.47	183.06	163.91	202.22	127.61	120.11	135.10	134.40	128.13	140.67
Higher	150.00	100.30	199.70	104.69	86.76	122.61	121.82	100.20	143.43	158.76	139.12	178.40	147.75	137.67	157.83	109.03	102.01	116.05
Women Employed																		
No	202.35	177.61	227.09	155.09	143.81	166.36	128.38	121.16	135.60	170.88	158.28	183.48	144.31	138.42	150.21	126.65	122.48	130.81
Yes	-	-	-	-	-	-	114.29	97.59	130.98	169.57	139.72	199.41	121.90	111.59	132.21	115.65	108.19	123.12
Place of Residence																		
Rural	257.14	215.99	298.29	157.40	142.61	172.19	136.09	126.65	145.54	196.06	176.25	215.88	152.21	144.14	160.28	133.20	127.86	138.55
Urban	145.76	122.04	169.49	132.57	119.69	145.45	114.39	105.20	123.57	152.78	138.74	166.82	129.17	122.57	135.78	114.68	109.77	119.60
Province/Region																		
Punjab	253.19	214.67	291.71	158.41	145.21	171.61	134.00	125.44	142.55	193.66	175.07	212.25	145.30	138.38	152.21	126.10	121.49	130.72
Sindh	-	-	-	110.23	94.34	126.11	113.74	100.42	127.06	145.71	127.93	163.49	129.97	120.22	139.71	110.88	103.76	118.01
KPK	-	-	-	147.50	118.44	176.56	109.72	92.22	127.22	147.83	120.69	174.96	136.55	122.10	151.00	147.69	134.52	160.86
Balochistan	-	-	-	-	-	-	-	-	-	280.00	154.10	405.90	114.29	80.89	147.68	109.80	89.00	130.61
Economic status																		
Poorest	-	-	-	147.83	120.69	174.96	127.43	111.85	143.01	204.00	158.14	249.86	167.05	145.69	188.40	124.79	114.12	135.45
Poorer	-	-	-	-	-	-	120.83	102.05	139.62	155.81	126.70	184.93	126.80	113.46	140.14	150.00	139.23	160.77
Middle	-	-	-	-	-	-	165.00	146.86	183.14	195.65	162.77	228.54	155.98	141.89	170.06	115.52	108.36	122.68
Richer	-	-	-	143.22	126.65	159.79	104.46	93.03	115.89	177.38	154.60	200.16	129.80	120.14	139.46	127.38	119.20	135.57
Richest	-	-	-	158.59	139.16	178.01	120.26	107.42	133.10	154.21	135.88	172.53	138.90	130.64	147.16	115.57	109.22	121.91

Source: Authors' calculations using PDHS 1990-91 and 2017-18. Sample weights are used. Subgroups with less than 100 observations are omitted.

Table 5: Parity progression ratio

Number of children	Number of boys	PDHS 1990-91					PDHS 2017-18				
		Number of families with n children	Number of Families with n+1 Children	Parity Progression ratio (PPR)	95% CI		Number of families with n children	Number of Families with n+1 Children	Parity Progression ratio (PPR)	95% CI	
1	0	1185	1156	0.98	0.94	1.02	2383	2331	0.98	0.95	1.01
	1	1405	1370	0.98	0.94	1.02	2831	2752	0.97	0.94	1.00
2	0	526	513	0.98	0.94	1.02	1070	1036	0.97	0.94	1.00
	1	1208	1130	0.94	0.90	0.98	2517	2276	0.90	0.88	0.92
	2	791	732	0.93	0.89	0.97	1496	1354	0.91	0.88	0.94
3	0	231	216	0.94	0.90	0.98	453	416	0.92	0.89	0.95
	1	823	747	0.91	0.87	0.95	1658	1354	0.82	0.80	0.84
	2	942	796	0.85	0.82	0.88	1895	1431	0.76	0.74	0.78
	3	377	334	0.89	0.85	0.93	656	516	0.79	0.77	0.81

Source: Authors' calculations using PDHS 1990-91 and 2017-18.

Table 6: Desired sex ratio

	PDHS 1990-91				PDHS 2017-18			
	Sex Ratio	**N**	**95% CI**		**Sex Ratio**	**N**	**95% CI**	
Overall	113.22	11970	111.19	115.25	138.34	16467	136.23	140.45
Education								
No Education	119.53	6463	116.62	122.44	151.6	9284	148.52	154.68
Primary	105.17	2579	101.11	109.23	124.6	2693	119.89	129.31
Secondary	107.43	2541	103.25	111.61	122.67	2897	118.20	127.14
Higher	106.42	386	95.80	117.04	121.62	1589	115.64	127.60
Spouse Education								
No Education	124.21	3056	119.81	128.61	152.99	5533	148.96	157.02
Primary	107.49	2853	103.55	111.43	135.27	2438	129.90	140.64
Secondary	110.5	5012	107.44	113.56	128.94	4534	125.19	132.69
Higher	111.43	1036	104.64	118.22	131.03	2430	125.82	136.24
Woman employed								
No	114.28	9741	112.01	116.55	138.61	13102	136.24	140.98
Yes	108.71	2229	104.20	113.22	137.41	3357	132.76	142.06
Place of Residence								
Rural	130.35	3734	126.17	134.53	145.36	10428	142.57	148.15
Urban	106.26	8236	103.97	108.55	127.08	6038	123.87	130.29
Province/Region								
Punjab	113.99	6762	111.27	116.71	128.61	8822	125.93	131.29
Sindh	106	4326	102.84	109.16	139.86	4116	135.59	144.13
KPK	150.45	834	140.24	160.66	172.92	2197	165.69	180.15
Balochistan	123.81	47	88.41	159.21	139.81	988	131.09	148.53
Economic status								
Poorest	108.97	2050	104.25	113.69	158.96	3237	153.48	164.44
Poorer	143.73	641	132.60	154.86	156.34	3576	151.22	161.46
Middle	122.98	1601	116.96	129.00	130.05	3384	125.67	134.43
Richer	113.2	2795	109.00	117.40	122.76	3083	118.43	127.09
Richest	108.59	4879	105.54	111.64	126.14	3184	121.76	130.52

Source: Authors' calculations using PDHS 1990-91 and 2017-18. Sample weights are used.

Table 7: Presence of at least one son and subsequent birth – Probit estimates

VARIABLES	PDHS 1990-91		PDHS 2017-18	
	(1)	(2)	(3)	(4)
Birth order 01 (ref: no son)				
At least one son	-0.0198(0.139)	0.175(0.171)	-0.101(0.098)	-0.102 (0.102)
Marginal effect	-0.001(0.008)	0.007(0.007)	-0.005(0.005)	-0.005(0.005)
Constant	1.976***(0.101)	-2.813***(0.673)	2.014***(0.074)	0.263(0.466)
Controls	No	Yes	No	Yes
Observations	2,573	2,540	6,307	6,291
Birth order 02 (ref: no son)				
At least one son	-0.495***(0.132)	-0.456***(0.150)	-0.546***(0.093)	-0.566***(0.102)
Marginal effect	-0.044***(0.009)	-0.035***(0.009)	-0.063***(0.008)	-0.057***(0.008)
Constant	1.985***(0.121)	-1.153**(0.550)	1.855(0.085)	-0.465(0.316)
Controls	No	Yes	No	Yes
Observations	2,507	2,476	6,180	6,165
Birth order 03 (ref: no son)				
At least one son	-0.375**(0.145)	-0.236(0.165)	-0.612***(0.115)	-0.543***(0.129)
Marginal effect	-0.061**(0.019)	-0.034(0.021)	-0.134***(0.018)	-0.108***(0.020)
Constant	1.529***(0.138)	-1.891***(0.530)	1.399***(0.111)	-0.379(0.277)
Controls	No	Yes	No	Yes
Observations	2,346	2,316	5,723	5,709
Birth order 04 (ref: no son)				
At least one son	-0.879***(0.225)	-0.857***(0.307)	-0.799***(0.172)	-0.707***(0.194)
Marginal effect	-0.138***(0.020)	-0.115***(0.026)	-0.213***(0.031)	-0.170***(0.036)
Constant	1.823***(0.220)	-3.626***(0.592)	1.288***(0.169)	-1.191***(0.329)
Controls	No	Yes	No	Yes
Observations	2,061	2,038	4,807	4,795

Source: Authors' calculations using PDHS 1990-91 and PDHS 2017-18. Columns 1–4 present results for subsequent birth at n'th birth order, first without and then with the set of controls. Controls include woman's characteristics (age, age difference with husband, education, employment status, media exposure), spouse education, household size, wealth status, and geographical features (place of residence, region). Observations with multiple births are excluded. The final sample of the two rounds consists of 2614 and 6373 individual observations respectively. Sample weights are used. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Presence of at least one son and subsequent birth - Propensity score matching

VARIABLES	PDHS 1990-91	PDHS 2017-18
	(1)	(2)
Birth order 01		
ATE	0.102	-0.010
	(0.008)	(0.004)
Observations	2,540	6,272
Birth order 02		
ATE	-0.033***	-0.055***
	(0.012)	(0.008)
Observations	2,476	6,113
Birth order 03		
ATE	-0.022	-0.123***
	(0.025)	(0.018)
Observations	2,316	5,522
Birth order 04		
ATE	-0.102*	-0.188***
	(0.032)	(0.029)
Observations	2,038	4,351

Source: Authors' calculations using PDHS 1990-91 and PDHS 2017-18. . Columns 1–2 present results for subsequent birth at n'th birth order. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Presence of at least one son and subsequent birth – IPW and AIPW estimates

VARIABLES	PDHS 1990-91				PDHS 2017-18			
	Inverse-Probability weights		Augmented IPW		Inverse-Probability weights		Augmented IPW	
	Subsequent birth	POmean	Subsequent birth	POmean	Subsequent birth	POmean	Subsequent birth	POmean
Birth order 01								
ATE	0.000	0.974***	0.000	0.974***	-0.008	0.979***	-0.008	0.979***
	(0.006)	(0.004)	(0.006)	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)
Observations	2,540	2,540	2,540	2,540	6,272	6,272	6,272	6,272
Birth order 02								
ATE	-0.038***	0.965***	-0.038***	0.965***	-0.049***	0.942***	-0.049***	0.942***
	(0.010)	(0.008)	(0.010)	(0.008)	(0.007)	(0.006)	(0.007)	(0.006)
Observations	2,476	2,476	2,476	2,476	6,113	6,113	6,113	6,113
Birth order 03								
ATE	-0.031	0.908***	-0.031	0.908***	-0.127***	0.903***	-0.127***	0.903***
	(0.020)	(0.019)	(0.020)	(0.019)	(0.013)	(0.012)	(0.013)	(0.012)
Observations	2,316	2,316	2,316	2,316	5,522	5,522	5,522	5,522
Birth order 04								
ATE	-0.098***	0.927***	-0.098***	0.927***	-0.160***	0.856***	-0.160***	0.856***
	(0.025)	(0.024)	(0.025)	(0.024)	(0.024)	(0.023)	(0.024)	(0.023)
Observations	2,038	2,038	2,038	2,038	4,351	4,351	4,351	4,351

Source: Authors' calculations using PDHS 1990-91 and PDHS 2017-18. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Number of sons and subsequent birth – Probit estimates

VARIABLES	PDHS 1990-91		PDHS 2017-18	
	(1)	(2)	(3)	(4)
Birth order 01 (ref: no son)				
1	-0.0198(0.139)	0.175(0.171)	-0.101(0.098)	-0.102 (0.102)
Marginal effect	-0.001(0.008)	0.007(0.007)	-0.005(0.005)	-0.005 (0.005)
Constant	1.976***(0.101)	-2.813***(0.673)	2.014***(0.074)	0.263(0.466)
Controls	No	Yes	No	Yes
Observations	2,573	2,540	6,307	6,291
Birth order 02 (ref: no son)				
1	-0.463***(0.137)	-0.401**(0.157)	-0.547***(0.096)	-0.563***(0.107)
2	-0.541***(0.150)	-0.541***(0.169)	-0.546***(0.104)	-0.572***(0.114)
Marginal effect				
1	-0.040***(0.010)	-0.029**(0.010)	-0.063***(0.009)	-0.057***(0.009)
2	-0.050***(0.014)	-0.044***(0.013)	-0.063***(0.011)	-0.058***(0.011)
Constant	1.985***(0.121)	-1.124**(0.553)	1.855***(0.085)	-0.464(0.316)
Controls	No	Yes	No	Yes
Observations	2,507	2,476	6,180	6,165
Birth order 03 (ref: no son)				
1	-0.214(0.158)	-0.123(0.182)	-0.498***(0.121)	-0.418**(0.135)
2	-0.511**(0.151)	-0.329*(0.169)	-0.708***(0.119)	-0.628***(0.133)
3	-0.327(0.177)	-0.226(0.204)	-0.604***(0.133)	-0.591***(0.148)
Marginal effect				
1	-0.031(0.021)	-0.016(0.024)	-0.102***(0.021)	-0.079**(0.022)
2	-0.091**(0.022)	-0.050*(0.023)	-0.163***(0.021)	-0.130***(0.022)
3	-0.051(0.027)	-0.032(0.029)	-0.132***(0.027)	-0.121***(0.028)
Constant	1.529***(0.138)	-1.824***(0.524)	1.399***(0.111)	-0.357(0.279)
Controls	No	Yes	No	Yes
Observations	2,346	2,316	5,723	5,709
Birth order 04 (ref: no son)				
1	-0.786***(0.238)	-0.859***(0.322)	-0.546**(0.181)	-0.394**(0.203)
2	-0.916***(0.231)	-0.854***(0.311)	-0.910***(0.176)	-0.841***(0.199)
3	-0.924***(0.234)	-0.900***(0.318)	-0.859***(0.178)	-0.778***(0.202)
4	-0.771**(0.318)	-0.715**(0.348)	-0.728***(0.202)	-0.727***(0.229)
Marginal effect				
1	-0.786***(0.238)	-0.115***(0.032)	-0.130**(0.035)	-0.084**(0.038)
2	-0.916***(0.231)	-0.114***(0.028)	-0.254***(0.034)	-0.209***(0.038)
3	-0.924***(0.234)	-0.123***(0.031)	-0.235***(0.035)	-0.190***(0.039)
4	-0.771**(0.318)	-0.089**(0.038)	-0.189***(0.047)	-0.175***(0.050)
Constant	1.823***(0.220)	-3.622***(0.595)	1.288***(0.169)	-1.163***(0.329)
Controls	No	Yes	No	Yes
Observations	2,061	2,038	4,807	4,795

Source: Authors' calculations using PDHS 1990-91 and PDHS 2017-18. Columns 1–4 present results for subsequent birth at n'th birth order, first without and then with the set of controls. Controls include woman's characteristics (age, age difference with husband, education, employment status, media exposure), spouse education, household size, wealth status, and geographical features (place of residence, region). Observations with multiple births are excluded. The final sample of the two rounds consists of 2614 and 6373 individual observations respectively. Sample weights are used. Standard errors in parentheses. *** p<0.01, ** p<0.05,
* p<0.1.

Table 11: Presence of at least one son and stated completed fertility - Probit estimation

VARIABLES	**PDHS 1990-91**				**PDHS 2017-18**			
Sons (ref: none)	Wife		Husband		Wife		Husband	
At least one son	1.517***(0.064)	1.104***(0.078)	-0.0179 (0.112)	-0.048(0.133)	1.755***(0.048)	1.410***(0.061)	1.508***(0.092)	1.172***(0.106)
Marginal effects	0.453***(0.012)	0.288***(0.017)	-0.006(0.042)	-0.015(0.042)	0.534***(0.009)	0.359***(0.012)	0.426***(0.017)	0.300***(0.022)
Constant	-1.450***(0.060)	-5.649***(0.198)	-.340**(0.098)	-3.051***(0.448)	-1.497***(0.045)	-5.443***(0.150)	-1.538***(0.085)	-4.910***(0.351)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	6,193	6,106	1,345	1,268	14,076	14,041	3,629	3,406

Source: Authors' calculations using PDHS 1990-91 and PDHS 2017-18. Estimations are shown, first without, and then with the set of controls. Controls include woman age, age difference with husband, education, spouse education, women employed, media exposure, household size, place of residence, region and wealth Status. Sample is restricted to those women who have at least one child. Sample weights are used. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Table A1: Summary of the two datasets

	1990-91	2017-18
Household sample size	7,193	14,540
Number of women (ever married, age 15 to 49)	6,611	15,068
Women with complete fertility	2,732	6,723
Number of men	1,354	3,691
Number of births	27,369	50,495
Total fertility rate	5.4	3.6

Source: Authors' calculations using PDHS 1990-91 and PDHS 2017-18.

Table A2: Presence of at least one son and subsequent birth- Subsample with no child death

VARIABLES	PDHS 1990-91		PDHS 2017-18	
	(1)	(2)	(3)	(4)
Birth order 01 (ref: no son)				
Son	0.087 (0.171)	0.526**(0.215)	-0.126 (0.109)	-0.136 (0.112)
Marginal effect	0.003 (0.007)	0.015**(0.007)	-0.008 (0.006)	-0.007 (0.006)
Constant	2.039***(0.122)	-3.405***(0.994)	1.978***(0.083)	0.163 (0.523)
Controls	No	Yes	No	Yes
Observations	2,031	2,005	5,033	5,023
Birth order 02 (ref: no son)				
At least one son	-0.601***(0.169)	-0.675***(0.193)	-0.548***(0.110)	-0.578***(0.122)
Marginal effect	-0.052***(0.011)	-0.046***(0.010)	-0.063***(0.010)	-0.059***(0.010)
Constant	2.061***(0.156)	-1.545**(0.742)	1.854***(0.101)	0.014 (0.386)
Controls	No	Yes	No	Yes
Observations	1,768	1,747	4,231	4,224
Birth order 03 (ref: no son)				
At least one son	-0.285(0.177)	-0.159(0.197)	-0.524***(0.151)	-0.588***(0.167)
Marginal effect	-0.051(0.027)	-0.025(0.029)	-0.118***(0.026)	-0.114***(0.025)
Constant	1.398***(0.168)	-1.848***(0.664)	1.325***(0.146)	-0.430(0.386)
Controls	No	Yes	No	Yes
Observations	1,344	1,326	3,088	3,082
Birth order 04 (ref: no son)				
At least one son	-1.002***(0.300)	-1.009***(0.288)	-0.729**(0.300)	-0.621*(0.345)
Marginal effect	-0.136***(0.022)	-0.119***(0.021)	-0.191**(0.055)	-0.146*(0.065)
Constant	1.999***(0.293)	-3.252***(0.787)	1.274***(0.296)	-1.201**(0.546)
Controls	No	Yes	No	Yes
Observations	944	935	1,918	1,914

Source: Authors' calculations using PDHS 1990-91 and PDHS 2017-18. Columns 1–4 present results for subsequent birth at n'th birth order, first without and then with the set of controls. Controls include woman age, age difference with husband, education, spouse education, women employed, media exposure, household size, place of residence, region and wealth Status. Sample is restricted to those women who have at least one child. Sample weights are used. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A3: Presence of at least one son and subsequent birth- pre-treatment controls

VARIABLES	PDHS 1990-91		PDHS 2017-18	
	(1)	(2)	(3)	(4)
Birth order 01 (ref: no son)				
Son	-0.020	-0.067	-0.101	-0.106
	(0.139)	(0.141)	(0.099)	(0.101)
Marginal effect	-0.001	-0.003	-0.005	-0.005
	(0.008)	(0.007)	(0.005)	(0.005)
Constant	1.977***	3.698***	2.014***	2.856***
	(0.102)	(0.402)	(0.074)	(0.389)
Observations	2,573	2,524	6,307	6,304
Controls	No	Yes	No	Yes
Birth order 02 (ref: no son)				
At least one son	-0.496***	-0.556***	-0.547***	-0.568***
	(0.132)	(0.136)	(0.093)	(0.097)
Marginal effect	-0.044***	-0.046***	-0.063***	-0.062***
	(0.009)	(0.009)	(0.008)	(0.008)
Constant	1.986***	2.914***	1.856***	3.028***
	(0.121)	(0.320)	(0.086)	(0.260)
Observations	2,507	2,458	6,180	6,177
Controls	No	Yes	No	Yes
Birth order 03 (ref: no son)				
At least one son	-0.376***	-0.362**	-0.613***	-0.638***
	(0.145)	(0.152)	(0.115)	(0.125)
Marginal effect	-0.061***	-0.055**	-0.134***	-0.126***
	(0.019)	(0.019)	(0.018)	(0.018)
Constant	1.529***	2.340***	1.399***	2.798***
	(0.138)	(0.300)	(0.111)	(1.042)
Observations	2,346	2,333	5,723	5,722
Controls	No	Yes	No	Yes
Birth order 04 (ref: no son)				
At least one son	-0.880***	-0.861***	-0.799***	-0.909***
	(0.226)	(0.237)	(0.172)	(0.180)
Marginal effect	-0.138***	-0.133***	-0.213***	-0.216***
	(0.020)	(0.021)	(0.031)	(0.028)
Constant	1.824***	2.388***	1.288***	2.685***
	(0.221)	(0.354)	(0.170)	(0.300)
Observations	2,061	2,048	4,807	4,805
Controls	No	Yes	No	Yes

Source: Authors' calculations using PDHS 1990-91 and PDHS 2017-18. Columns 1–4 present results for subsequent birth at n'th birth order. We control for pre-treatment factors including woman's age at first birth, age at marriage, mother tongue, and whether the woman worked before getting married. The coefficients of the controls are not reported. Sample weights are used. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

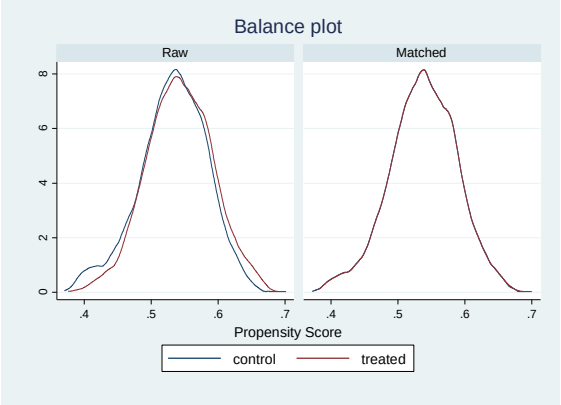
Table A4: Presence of at least one son and subsequent birth- Pooled Sample

VARIABLES	(1)	(2)
Birth order 01 (ref: no son)		
Son	-0.074	-0.051
	(0.082)	(0.091)
Marginal effect	-0.004	-0.002
	(0.004)	(0.004)
Constant	2.000***	-0.906**
	(0.061)	(0.408)
Observations	6,704	6,657
Controls	No	Yes
Birth order 02 (ref: no son)		
At least one son	-0.533***	-0.548***
	(0.078)	(0.090)
Marginal effect	-0.057***	-0.050***
	(0.006)	(0.006)
Constant	1.898***	-1.185***
	(0.072)	(0.289)
Observations	6,533	6,489
Controls	No	Yes
Birth order 03 (ref: no son)		
At least one son	-0.546***	-0.454***
	(0.094)	(0.107)
Marginal effect	-0.110***	-0.081***
	(0.014)	(0.159)
Constant	1.445***	-1.193***
	(0.091)	(0.272)
Observations	6,010	5,968
Controls	No	Yes
Birth order 04 (ref: no son)		
At least one son	-0.616***	-0.756***
	(0.194)	(0.225)
Marginal effect	-0.211***	-0.160***
	(0.057)	(0.041)
Constant	0.835***	-5.270***
	(0.183)	(0.924)
Observations	701	696
Controls	No	Yes

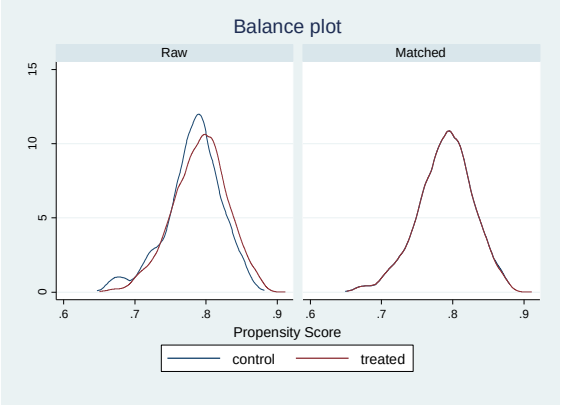
Source: Authors' calculations using pool data from PDHS 1990-91 and 2017-18. Columns 1–4 present results for subsequent birth at n'th birth order, first without and then with the set of controls. Controls include woman age, age difference with husband, education, spouse education, women employed, media exposure, household size, place of residence, region and wealth Status. Sample is restricted to those women who have at least one child. Sample weights are used. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figure B1: Kernel density plots after Propensity score matching (PDHS 1990-91)

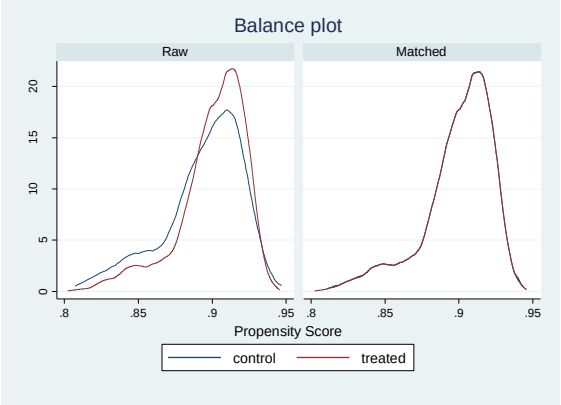
a) Model 1



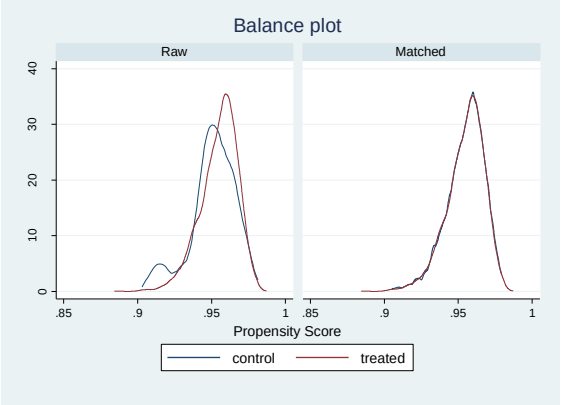
b) Model 2



c) Model 3



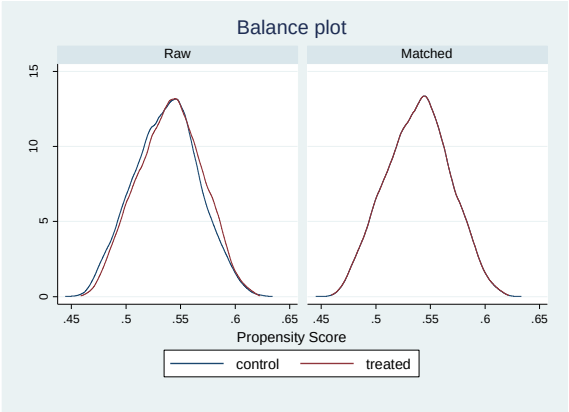
d) Model 4



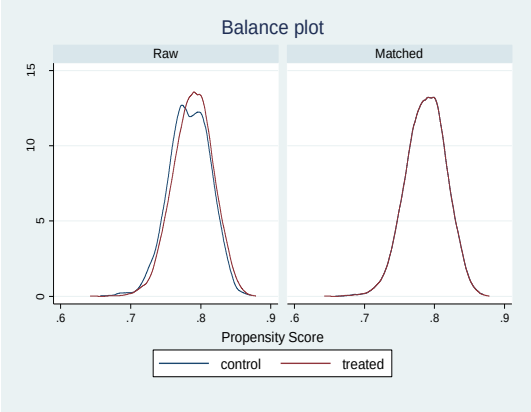
Source: Authors' calculations using PDHS 1990-91.

Figure B2: Kernel density plots after Propensity score matching (PDHS 2017-18)

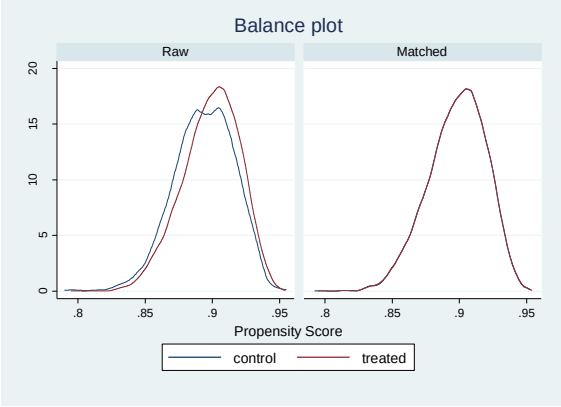
b) Model 1



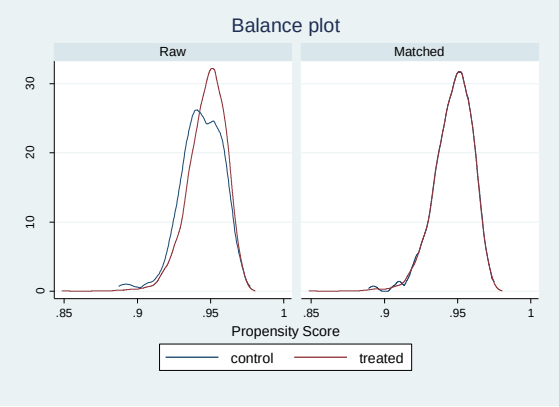
b) Model 2



d) Model 3



d) Model 4



Source: Authors' calculations using PDHS 2017-18.