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The advantage of being youngest: Education inequalities and the quantity-quality tradeoff in Pakistan

Qaisar Khan[a] and Jack Hou[b,c]

[a]School of Education, Lahore University of Management Sciences (LUMS), Lahore, Pakistan; [b]School of Economics, Huazhong University of Science and Technology, Wuhan, China; [c]Department of Economics, California State University, Long Beach, CA, USA

ABSTRACT

We explore how sex preference affects family size, and whether there is a tradeoff between family size and educational outcomes. Taking into account the endogeneity in family size and allowing for heterogeneous effect, family size has a negative impact on measured educational outcomes. Each additional sibling reduces years of education by almost two years, decreases the probability of completing primary and secondary education, suggesting a strong quantity-quality tradeoff. Birth order has a sizeable positive effect, i.e. children in the higher birth order (later born) achieve educational outcomes. Due to the cultural son-preference in Pakistan, a strong negative education gender gap is found. However, our finding suggest that the birth order effect tends to mitigate this gender gap. Several channels are conjectured; further research is warranted.

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1. Introduction

Household resource allocation has long been studied in the context of parental investment in children with reference to education and economic policies. Considerable literature has accumulated on the causal linkage between family size and a child's level of educational attainment. Becker and Lewis (1973) hypothesized a negative impact, i.e., the larger the family size, the lower the level of a child's educational attainment. This hypothesis asserts a quality-quantity trade-off, implying that the per-child share of parental investment decreases with the addition of each new birth in the family. However, one of the main obstacles in establishing causality between family size and child outcome is the parental preferences for the sex of children that differ across families and countries. In patriarchal societies, these preferences are reflected in an attempt to achieve the desired number of sons. Sex preference is a major barrier to fertility decline if parents continue to have children until they achieve the sex composition or the number of sons they desire. A broad range of empirical evidence has suggested a close relationship between son preference and fertility (Arnold, 1997; Chakraborty & Kim, 2010; Gupta, 1987; Sathar et al., 2015).

This paper tests the empirical validity of the quantity-quality tradeoff using data on family size and educational outcomes in Pakistan. In doing so, this review will also examine whether sex preference affects the family size, whether the difference in educational outcomes is due to birth order, and whether birth order effects are symmetric or asymmetric across gender. To account for potential endogeneity in family size, and identification strategy was used based on the sex composition of the first two children. The idea of using this identification strategy is that parents with the first two daughters should have higher fertility than those with other sibling sex compositions. Likewise, parents with the first two sons should have a low chance of having another child because they have

CONTACT Jack Hou jack.hou@csulb.edu School of Economics, California State University, Long Beach, 1250 Bellflower Boulevard Long Beach, CA 90840, USA

already achieved at least one son. This identification is similar to that of Angrist and Evans (1998) but differs in parental preferences for sons. Using two girls as an instrumental variable is more relevant given the strong son preference in Pakistan compared to the United States. After taking into account the endogeneity in the family size and allowing heterogeneous effect, the results yield two main conclusions. First, children from larger families demonstrate lower educational outcomes compared to children from smaller families. With each additional sibling, the probability of completing primary and secondary education decreases. Each additional sibling reduces years of education by almost two years, suggesting a striking tradeoff compared to other studies in a similar context.[1] Second, birth order has a sizeable positive effect on educational outcomes. Children in the higher birth order (later born) perform better compared to children in the lower birth order (older children). Given the persistence of strong son preference in Pakistan, the analysis is further expanded to see whether this effect favors only male offspring or is gender-neutral. The interaction with the gender of a child with birth order is used to see the pattern of education inequalities between boys and girls within households. Results suggest that gaps in educational attainment decrease between latter-born daughters and sons compared to early-born children (older children). This pattern is suggestive of a dual life cycle effect. Children of lower birth order may be born when their parents' careers are in the initial phase and may have lesser resources to invest in their child; however, they may be affluent by the time their younger children are born which in turn can lead to better resources for the young (Parish & Willis, 1993). Though we felt there may exist alternative causes, and speculate about related explanations on the potential channels in the discussion below, it is certainly a fertile research field for the future.

This study makes an important contribution to the existing literature concerning quantity-quality tradeoffs along the gender-specific birth order ladder. Exploiting a dataset from Pakistan, this study seeks to expand our understanding of whether a higher birth order can advantage a girl-child in terms of education. Investigating this tradeoff is important, not only because Pakistan is the fifth most populous country in the world, but because it has the widest education inequalities and hosts the second-largest out-of-school children and third-largest female illiterates worldwide. In addition, Pakistan's current performance in education, as measured by Sustainable Development Goals (SDGs), is below the median for developing economies. From a public policy standpoint, it is particularly important to investigate potential channels affecting education to change the status of SDGs in Pakistan.

This paper is organized as follows. Section 2 provides an overview of demographics and son preference in Pakistan. Section 3 presents a literature review. Section 4 describes the data. Section 5 explains the identification strategy and validity of the instrument. Section 6 describes the econometric framework. Lastly, section 7 presents the results of outcome measures, such as completion of primary, secondary, and higher secondary education, and total years of education attained. Section 8 is a discussion and section 9 concludes.

2. Context of Pakistan

Like much of the rest of Asia, Pakistani couples hold a strong preference for sons. The desire for sons is a dominant cultural value practiced in many parts of the country. Many potential reasons initiate a family's reliance on sons. For instance, sons carry family names and honor (Chakraborty & Kim, 2010; Sathar et al., 2015), provide support to parents during their old age (Arnold, 1997), and increase women's bargaining power in household decisions making (Li & Wu, 2011). The imperfect labor market is another important factor that contributes to son preference in Pakistan. There are

[1]See for example Kugler and Kumar (2017) in Indian context. Their estimates show a reduction of 0.28 years of education with an additional child in the Indian families, when they control for number of girls, the years of education reduces by 0.89 years. However, as they have mentioned, their estimates on controlling for the number of girls in a regression with family size are somewhat noisy because of the collinearity between family size and number of girls. Our results show a reduction of 1.11 years of education with an additional child in Pakistani families.

considerable gender gaps in labor force participation (LFP), merely 25% of the women compared to 82% of men participate in the labor force, and this proportion drops down to 15% for married women.[2]

According to Bongaarts (2013), Pakistan has the second-highest desired sex ratio for boys out of a total sample of 61 countries. Our estimates in Table A3 based on two rounds of Pakistan Demographic and Health Surveys validate Bongaarts' findings on son preference in Pakistan. This review showed women's decision to have another child was conditional on the gender of the previous child. Our estimates showed that women's decision to continue childbearing increases with the birth of daughters while it decreases with the birth of sons in both survey years. These estimates provide suggestive evidence that son preference is one of the potential determinants of fertility—couples achieve their preferences for sons at the cost of larger families.

According to a recent census report, Pakistan's population is over 207 million, which makes it the sixth-largest worldwide. Pakistan's population has experienced an increase of 57% since the last census (1998). The population growth rate remains quite high; though it fell from 3.17% in 1980 to 2.4% in 2017, consistent with the global trend on fertility. The fertility rate was drastically reduced from 6.6 births per woman in 1980 to 3.6 births per woman in 2018, which can be attributed to the government's targeted investment in girls' education in recent decades. Figure A presents historic trends in fertility and female education over time. The government of Pakistan initiated several cash support programs to encourage education enrollment for girls. The Female School Stipend Program (FSSP) was introduced in Liddell et al. (2003), and more recently, the Secondary Education Cash Program (SECP) for girls. Besides, girls' education also increased as a result of dramatic growth in female labor force participation. In 1990, the government of Pakistan initiated the Lady Health Workers Program (LHWP) which brought significant improvements in family planning services and birth control (Khan & Wang, 2021).

While the fertility rate is declining, the rate of decline is slow and it will take 35 years before Pakistan reaches a replacement level of fertility. By then, Pakistan's population would have reached 300 million, which will likely maintain its ranking as the sixth most populous nation. This large population will continue to pose additional challenges for the country that still has a long way to go to cope with the challenges in education, health care, and family planning as evident from human development and gender parity indexes. According to the Education for All (EFA) global monitoring report (2012), Pakistan has the second-highest out-of-school children (two-thirds are girls) worldwide. The literacy rate of the population stands at 60.7%, with 71.6% male and 49.6% female, making it the third-largest globally.

3. Literature review: Family size, birth order, and children's quality

Empirical studies on the quantity-quality tradeoff in the debate about family size and human capital have generated a sizable literature in the last few decades (Angrist et al., 2010; Baez, 2008; Black et al., 2005; Blake, 1989; Booth & Kee, 2009; Conley & Glauber, 2006; De Haan, 2010; Downey, 1995; Kugler & Kumar, 2017; Lee, 2008; Lu & Treiman, 2008). These studies are based on the fundamental economic principle of "tradeoff" that families face due to budget constraints. They generally suggest a negative relationship between family size (quantity) and educational outcomes (child quality). These studies established the causality between family size and children's quality by exploiting the natural occurrence of twin births and sibling sex composition as an exogenous source of variation in family size.

Understanding the fact that household or parental resource allocation between siblings is unlikely to be equal or similar opens a new dimension to this debate. Investigating family composition reveals

[2]Pakistan lies in the bottom quartile of human development index and top quartile in gender parity index (major vulnerabilities for women and girls). For Human Development Index, see http://hdr.undp.org/en/statistics/hdi/. For Gender Inequality Index, see http://hdr.undp.org/en/statistics/gii/.

that birth order is a key variable in understanding child quality in general and especially his/her educational attainment. A generally accepted hypothesis is that birth order is negatively linked to child educational outcomes. This implies that the first-born child is most likely to have a higher education attainment level than his or her younger siblings. It is argued that the first-born not only claims the highest share in financial capital but other parental investments such as time and attention as well. Testing the credit dilution model, De Haan (2010) found that with the birth of each younger sibling, per-child share in household resources declines, and the levels of educational attainment decline for children with higher birth order. An extensive amount of literature traces a negative causal relationship between birth order and a child's outcome (Barclay, 2018; Booth & Kee, 2009; Esposito et al., 2020).

However, most of these studies are on more developed (middle income or above) countries. Recent studies have shown that later-born children have better educational attainment in developing countries (De Haan et al., 2014; Emerson & Souza, 2008; Rammohan & Dancer, 2008; Seid & Gurmu, 2015). This suggests that socio-economic constraints not only have implications on family size but also on a child's education and educational outcomes. This raises valid questions about the context of birth order as well (see for example Lafortune & Lee, 2014). This would be against the generally hypothesized and empirically attested negative linkage between the order of birth of a child and their educational attainment levels. An important contribution to the literature concerning the dimension of economic constraints came from Parish and Willis (1993). They found a negative correlation between birth order and educational outcomes of children in Taiwan and expounds it through the growth curve. They argued that the children of lower birth order may be born when their parents' careers are in the initial phase and may have lesser resources to invest in their child; however, they may be affluent by the time their younger children are born which in turn can lead to better resources for the young.[3]

The literature has shown heterogeneous impacts of birth order on a child's level of educational attainment with respect to gender. While Emerson and Souza (2008) concluded that last-born males are less likely to be engaged in child labor as compared to first-born males and females in Brazil, literature shows that this relationship is not universal as the socio-cultural mechanism plays a pivotal role. In countries with widely accepted specialized gender roles and perceptions of economic productivity, it is plausible to observe a deviation from the regular pattern of cultures without such specificities. Allocation of education resources in a household may be guided by a policy of stringent compliance to socio-cultural norms, which can be referred to as bet-hedging. Liddell et al. (2003) analyzed a cohort of subsistence farmers in South Africa and found that despite the prevalence of gender equity in schooling within the region (mainly because of lower financial risk and opportunity losses), parents would invest more in sons' education as compared to daughter due to their complex social conceptions related to child-rearing.

Oliveira (2018) studied the gender-specific causal impact of birth order on a child's educational attainment in China. It exploits the data before the enforcement of the one-child policy and explains that cultural preferences were a key factor in parental investment choices. The empirical analysis highlights the heterogeneous effects of birth order. It is found that earlier-born daughters were worse off in terms of educational attainment as compared to earlier-born sons. It shows that earlier-born girls had lower while earlier-born boys had higher levels of educational attainment if they had younger siblings, holding the family size constant. She concludes that China's one-child policy may have helped reduce gender disparity in educational attainment due to birth order in the country.

A study more closely related to our context is Rammohan and Dancer (2008), who examined the child-specific birth order causal effects on the number of years of schooling in Egypt. The children

[3]According to World Bank (2018), married women are 7% less likely to participate in the labor force compared to unmarried women. On the other hand, married men are 8–10% more likely to participate in the labor force compared to unmarried men. The report can be accessed here; https://documents1.worldbank.org/curated/en/444061529681884900/pdf/Female-labor-force-participation-in-Pakistan-what-do-we-know.pdf.

from rural households and earlier-born girls are found disadvantaged in household resource allocation and education attainment. They also show that an increase in parental education is positively related to better age-appropriate education attainment. Another interesting result of their analysis is that the interaction between birth order and gender shows that a girl-child with higher birth order in Egypt is more likely to have a higher education attainment level as compared to a male counterpart.

Binder and Woodruff (2002) found a similar result, but from an inter-generational perspective. They found that there is no significant impact of birth order on years of schooling for the first family cohort when looking at intergenerational mobility, but there is a significant increase for the fourth cohort, but with a significantly stronger effect for females as compared to males. This shows that greater educational achievement does hold for later-born children but in a specific economic setting, which in this case is a developing country. These results underscore a very important policy question related to gender-specific birth order effects and family size effects on child quality. Exploiting a dataset from Pakistan, this empirical study seeks to expand our understanding of whether a higher birth order can advantage a girl-child in terms of education.

4. Data

This study utilizes data collected from the Pakistan Social and Living Standards Measurement (PSLM) survey initiated by the Federal Bureau of Statistics in 2004. PSLM is a nationally representative cross-sectional survey that collects information from 18,000 households across the country. The survey contains demographic characteristics such as education, health, income, consumption and population welfare, etc. This study uses six waves of the PSLM (2004 to 2014) to form a pooled cross-section. The survey provides detailed information about the household roster, month of birth, year of birth, age, and relationship to the head of the household. From the relationship to the head of the household, the individuals are identified as "son/daughter." Family size is estimated by counting the number of children in each household merged with their biological parents. The birth order and sex composition of the first, first two, and three children are calculated from the year of birth and age variables in the data. With the information given on the relationship, children under 25 years of age are matched with their biological mothers.

The data provides rich information about the education, literacy, and numeracy of children and their parents. We provide estimates on four dependent variables of interest: (i) primary school completion, (ii) secondary school completion, (iii) higher secondary school completion, and (iv) years of education. In Pakistan, primary education (grade one to grade five) starts at age five and completes at age 10. Students complete their secondary education (grade six to grade 10) after securing the Secondary School Certificate (SSC) from the respective board of education at the age of 16. Higher secondary education (grade 11 to grade 12) completes at the age of 18 years. The years of education in the analysis range from grade one to grade 14. In the previous education system, students used to complete a two-year degree in arts/science (grade 13 to grade 14) as regular students or private students. The binary outcome variables included in the analysis are: whether a child has completed primary education, secondary education, and higher secondary education. Years of education are a continuous variable that represents the years of education children between ages four to 24 have attained.

Table 1 presents the summary statistics of the key variables. Using the gender of the first two children, the sibling sex composition is constructed as the first two oldest girls in families (this will be discussed in more detail later). Summary statistics showed that the number of children born to mothers with two children at least is 4.7, which is higher than that reported in previous studies (see for example Angrist & Evans, 1998; Conley & Glauber, 2006). The composition of children in the household was balanced with a slight difference for boys, 52% for the first son and 26% for the first two sons.[4]

[4]According to Bongaarts (2013) findings using UN estimates, Pakistan has a modest sex ratio at birth, roughly 108 males for every 100 females, which is fairly consistent with many Asian countries. In addition, sex ratio at first and second birth from two rounds of demographic health surveys is presented in Table A3 appendix A, and the results are consistent with the data employed under this study.

Table 1. Descriptive statistics of children and parental characteristics.

Variables	Mean	Std.Dev.	Min	Max
Fertility (Number of children ever born)	4.775	1.558	2	11
First child girl	0.480	0.499	0	1
First two girls	0.238	0.426	0	1
Child age	13.56	4.546	4	24
Completed primary	0.817	0.386	0	1
Completed secondary	0.406	0.491	0	1
Completed higher secondary	0.395	0.489	0	1
Years of education	5.905	3.713	0	14
Mother's age	39.53	5.709	21	49
Father's age	44.42	6.668	23	60
Mother's years of education	7.585	3.285	0	16
Father's years of education	10.03	3.679	0	16
Log Income	12.169	0.712	5.75	15.19
Rural	0.327	0.469	0	1
Observations	15068			

Sample includes children younger than 25 years born to mothers 21 to 49 years of age.
Source: Pakistan Social and Living Standards Measurement (PSLM) Survey 2004–2014.

The mean age of children in the sample is 13 years. Almost 82% of children have completed primary education, 41% have completed secondary education, and 39% have completed higher secondary education. The average years of education in the sample are six years for children under 25 years. Fathers are more educated (10.03 years of education) compared to mothers (7.58 years). 33% of the samples are rural households. Log income is the transformation of family income in the data.

5. Econometric framework

5.1. Ordinary least squares (OLS) estimates

We start by exploring the relationship between fertility and education using the following linear model:

$$EDU_{ijt} = \beta_0 + \beta_1 F_{ijt} + \beta_k X_{ijt} + \mu_s + \tau_r + \gamma_b + \varepsilon_{ijt} \quad (1)$$

EDU_{ijt} is the educational outcomes of individual i residing in family j observed in the survey year t period. F_{ijt} is the endogenous fertility variable representing several children ever born? X_{ijt} is a set of control variables including children, parental, and family background characteristics. β_k are parameters $[k = 2, \ldots .K]$ estimated for each control variable. μ_s is survey year fixed effect, γ_b is the cohort of birth fixed effect,[5] while τ_r is the region of birth fixed effect. ε_{ijt} is the error term. Estimating this equation by OLS is likely to produce biased results because, first, educational outcomes and fertility are jointly determined. Second, the omitted variable, such as parental characteristics and preferences, is plausibly correlated with both educational outcomes and fertility. Nevertheless, it provides a baseline and can be compared more directly with the literature.

5.2. Instrumental variables estimates

This study then uses two approaches to disentangle the causal link between family size and educational outcomes. First, including the control for children's characteristics (age, gender, and birth order), parental characteristics (age, education), and family background characteristics (socioeconomic status,

[5]We are using six waves of Pakistan Social and Living Standards Measurement (PSLM) surveys and in each wave we have restricted our sample to children under 25 years of age. Cohort of birth represents year of birth of children corresponding to each wave of the survey.

place of residence) to see the effect of family size on educational attainment in the presence of these observables. Second, including the two-stage least squares (2SLS) by using the first two daughters as an exogenous source of variation in the family size. Families with the oldest two daughters will continue to have an additional child to achieve their preferences for sons.

The first stage equation is given as follows;

$$F_{ijt} = \varphi_0 + \varphi_1 TWOGIRLS_{ijt} + \delta_k X_{ijt} + \mu_s + \tau_r + \gamma_b + \vartheta_{ijt} \quad (2)$$

F_{ijt} is the fertility variable representing the number of children ever born in a family j observed in survey year t. $TWOGIRLS_{ijt}$ is a binary variable (equal to one, if the first two children are girls).X_{ijt} is a set of control variables including children, parental, and family background characteristics.δ_k are parameters $[k = 2, \ldots .K]$ estimated for each control variable. μ_s is survey year fixed effect, γ_b is the cohort of birth fixed effect, while τ_r is the region of birth fixed effect.

Several studies suggested son preference as one of the potential determinants of family size in Pakistan (Hussain et al., 2000; Sathar et al., 2015; Zaidi & Morgan, 2016). Zaidi and Morgan (2016), using demographic and health surveys, reported that if families have daughters in their earlier parities, they will continue to produce children in the search for sons. In patriarchal societies, such as Pakistan, men play a dominant role in decision-making and have a comparative advantage in the labor market. In addition, there is a strong social perception about the return on education in financial terms for daughters, as their ability to repatriate any pecuniary return to their parents becomes limited after marriage; therefore, parental investment in their human capital is lower than sons. Taking this into account, son preference is used as an exogenous source of variation in family size. If parents have female children in the earlier parities, they will continue to produce children compared to other sibling compositions. We assert that if families have the two oldest children as daughters, they will continue to have an additional child. In other words, the fertility of families is affected by their preferences for boys. This identification strategy is similar to Angrist and Evans (1998) but differs in parental preferences for sons. As the Pakistani context is different and parents have strong preferences for sons, the first two daughters can be an influential source of exogenous variation in family size. The correlation between sibling sex composition and fertility are presented in Table A1 to justify this assertion.

The second stage equations each for binary and continuous outcome variables are given as follows:

$$(EDU\_BINARY)_{ijt} = \pi_0 + \pi_1 \hat{F}_{ijt} + \gamma_k X_{ijt} + \mu_s + \tau_r + \gamma_b + \varepsilon_{ijt} \quad (3)$$

$$(EDU)_{ijt} = \pi_0 + \pi_1 \hat{F}_{ijt} + \gamma_k X_{ijt} + \mu_s + \tau_r + \gamma_b + \varepsilon_{ijt} \quad (4)$$

Equation (3)measures education as a binary outcome variable—whether a child completed primary (= 1 if completed grade 5, = 0 otherwise), secondary (= 1 if completed grade 10, = 0 otherwise), higher secondary (= 1 if completed grade 12, = 0 otherwise). Equation (4)measures years of education a child attained.

The threat that instrumental variables might produce biased estimates if couples practice selective abortions should not be of concern in the Pakistani context. Pakistan had a strict abortion policy since its independence in 1947. The law states that "abortion is illegal and is a crime until and unless it is performed to save the life of a pregnant woman." In addition, we also examined data on ultrasound examination from two rounds of Pakistan Demographic and Health Surveys to determine whether it is used to help women choose the gender of the child. This effect is examined at various birth orders—whether the last birth was the first, second, third, or fourth child of a woman; no evidence of sex selection was found (Table A2).

6. Empirical results

Tables 2 and 3 report OLS estimates on the completion of primary, secondary, higher secondary, and years of education. All estimation results include controls for children, parents, socioeconomic characteristics, region of birth, the cohort of birth, and survey years fixed effect. Column 1 and column 4 of Table 2 report the results of primary and secondary completion with controls for children's characteristics. The results suggest that an additional child in the family reduces the probability of primary completion by 1% point and secondary completion by 2.5% points.

Columns 2, 3, 5, and 6 include control for age, education, and income of the parents, and the results become almost zero and insignificant for primary, while they fall by half (1.2% points) for secondary completion. Table 3 reports OLS estimates for completion of higher secondary education and years of education. Column 1 and column 4 report the results of higher secondary completion and years of education with controls for children's characteristics. The results in column 1 suggest that an additional child in the family reduces the probability of higher secondary completion by 3.8% points but falls to 2.2% points (column 2 and column 3) after control variables are added. Similarly, in column 4, the point estimate (−0.157) suggests that families with three more siblings end up with half-year less education.

As discussed in the previous section, the relationship between family size and children's educational outcomes is causal. Therefore, OLS is more likely to produce biased estimates due to heterogeneous preferences of families, which makes the variable number of children endogenous. Table 4 reports 2SLS estimates on the probability of children completing primary and secondary education.[6] First stage results presented in column 1 to column 6 of Panel B are strong and significant at a 1% level and have expected signs suggesting a positive effect on fertility.[7] Column 1 to column 3 of Panel A report 2SLS results of fertility on children's probability of completing primary education. As can be seen, the results are strikingly different from the OLS estimates presented in Table 2. Column 1 suggests that one additional child in the family decreases the probability to complete primary education by 23.2% points, as compared to a mere 1%. Results are strong and significant with a slight decrease to 17.7% points (much higher than the corresponding OLS estimates in Table 2) in column 3 after controlling for parental characteristics, family income, regions, and years of fixed effect. Column 4 to column 6 of Panel A report results on the probability of whether a child has completed secondary education; and the pattern continues. Results show a negative relationship between family size and secondary completion. More specifically, one more child in the family decreases the probability of secondary completion by 23.8% points. Point estimates fell to 16% points after controlling for parental characteristics, family income, regions, and years of fixed effect. Secondary completion is subject to passing exams administered by the educational boards; whereby, after qualifying for the exams, students are awarded Secondary School Certificates (SSC). The grades of this exam are considered important for college admissions. Results from column 4 to column 6 suggest that children from educated and relatively rich parents are less likely to suffer from trade-offs compared to less educated and poor families, as suggested by the larger and more significant coefficients of the father's education and family income, in contrast to columns 2 and 3.

Table 5 reports 2SLS estimates of family size on completed higher secondary and years of education. First stage results are presented in columns 1 to 6 of Panel B. Columns 1 to column 3 of Panel A report 2SLS results of family size on the probability of children completing higher secondary education. Results for higher secondary education are insignificant, although the sign is negative as expected (and again, substantially larger than the OLS estimates). Higher secondary education is generally attained in higher secondary schools or colleges and needs financial support that restrains family resources, hence the expected negative coefficient. A possible explanation for why the coefficients are insignificant could be that by then, older children can join the labor force and contribute to

[6]e`Hausman test statistics of endogeneity reported in Tables 4 and 5 suggest that OLS estimates are inconsistent.
[7]We also conduct IV-probit regressions, considering the binary nature of our three outcome variables (whether a child completed primary education, secondary education, higher education). The results are consistent, as reported in Table A4.

Table 2. OLS estimate of the number of children who completed primary and secondary education.

	Completed Primary			Completed Secondary		
	(1)	(2)	(3)	(4)	(5)	(6)
Number of children	−0.010*** (0.002)	−0.001 (0.002)	0.000 (0.002)	−0.025*** (0.002)	−0.012*** (0.003)	−0.012*** (0.003)
Child age	0.048*** (0.001)	0.042*** (0.001)	0.043*** (0.001)	0.081*** (0.001)	0.082*** (0.001)	0.083*** (0.001)
Female	−0.032*** (0.006)	−0.029*** (0.006)	−0.028*** (0.006)	−0.096*** (0.008)	−0.080*** (0.008)	−0.081*** (0.008)
Birth order	0.010*** (0.003)	−0.004 (0.004)	−0.005 (0.004)	0.012*** (0.003)	0.002 (0.004)	−0.001 (0.004)
Father's education		0.004*** (0.001)	0.004*** (0.001)		0.013*** (0.001)	0.012*** (0.001)
Mother's education		0.007*** (0.001)	0.007*** (0.001)		0.016*** (0.001)	0.016*** (0.001)
Father's age		0.002** (0.001)	0.002** (0.001)		0.001 (0.001)	0.001 (0.001)
Mother's age		0.004*** (0.001)	0.004*** (0.001)		−0.001 (0.001)	−0.000 (0.001)
Income		0.012** (0.005)	0.011** (0.005)		0.034*** (0.007)	0.034*** (0.007)
Regions FE	No	No	Yes	No	No	Yes
Survey years FE	No	No	Yes	No	No	Yes
Cohort of birth FE	No	No	Yes	No	No	Yes
Observations	12695	11126	11126	10881	9511	9511
R^2	0.250	0.268	0.271	0.356	0.416	0.418

*, **, and *** represent significance levels of 10, 5, and 1%. Robust standard errors are presented in parenthesis. The number of children represented two or more children younger than 25 years born to mothers aged 21 to 49 years of age. Completed primary education and secondary education are binary takes value = 1 if an individual has completed (grade 1 to grade 5), and (grade 6 to grade 10) respectively according to the education system in Pakistan. Regions and survey years' fixed effects are included. Source: Pakistan Social and Living Standards Measurement (PSLM) Survey 2004–2014.

household income, particularly in large families, and thus loosen the resource constraints. This will be explored further below.

Column 4 to column 6 report the results of family size on years of education, and the pattern continues in the sense that the magnitude of the coefficients is substantially larger than the OLS estimates. Column 4 suggests a decrease of almost 2.83 years of education with one additional child in the family after controlling for children's age, gender, and birth order. The results change slightly and drop to almost 1.11 years in column 6 with additional controls added. The trade-off is slightly lower for educated and comparatively richer households, but it is still large enough in magnitude-one additional child reduces the quality (years of education) by almost one year validating the quantity-quality trade-off within families.

We now turn our attention to one of the key points of interest in this study: the birth order effect. This is presented in Table 6. The birth order effect is positive and statistically significant across all specifications. Results suggest that younger children (with higher birth order), on average, are more likely to complete primary and secondary education and attain more years of education than their older siblings. The question remains as to whether the birth order effect comes mainly from the sons or is gender-neutral. This pertains to how the educational gender gap changes over time. To this end, we compared the child's gender with the birth order.

Column 1 to column 3 in panel A report considerable gaps in educational attainment between older sons and daughters (the negative coefficient for females, and the positive birth order effect). The interpretation of these gender-specific gaps comes from budget constraints in the utility maximization function: under limited resources, parents invest in children who guarantee the highest utility/return (Becker & Tomes, 1976, 1979; Becker, 1960; Cochrane, 1975). However, the education gender gap decreases between younger children (as shown by the gender and birth order interaction term). This may be the case that older children leave home at an early age and contribute to the household production function, and inequality in the household's income and intergeneration mobility approach equilibrium levels over time (Becker & Tomes, 1979).

7. Discussion

In this paper, we provide estimates of the effect of family size and gender-specific birth order on children's educational outcomes in a developing country context. This review showed that children's educational outcomes suffer dramatically in larger families. Our results yield three main conclusions. First, the

Table 3. OLS estimate of the number of children who completed higher secondary and years of education.

	Completed Higher Secondary			Years of Education		
	(1)	(2)	(3)	(4)	(5)	(6)
Number of children	−0.038*** (0.004)	−0.021*** (0.004)	−0.022*** (0.004)	−0.157*** (0.014)	−0.019 (0.017)	−0.020 (0.016)
Child age	0.056*** (0.003)	0.051*** (0.004)	0.051*** (0.004)	0.662*** (0.004)	0.672*** (0.006)	0.683*** (0.006)
Female	−0.152*** (0.013)	−0.122*** (0.013)	−0.125*** (0.013)	−0.442*** (0.040)	−0.352*** (0.040)	−0.363*** (0.039)
Birth order	0.013* (0.008)	0.006 (0.009)	0.003 (0.009)	0.138*** (0.017)	0.079*** (0.019)	0.055*** (0.019)
Father's education		0.027*** (0.002)	0.025*** (0.002)		0.118*** (0.008)	0.109*** (0.007)
Mother's education		0.026*** (0.002)	0.026*** (0.002)		0.179*** (0.012)	0.172*** (0.011)
Father's age		0.001 (0.002)	0.001 (0.002)		0.021*** (0.005)	0.018*** (0.005)
Mother's age		−0.005** (0.002)	−0.004** (0.002)		−0.008 (0.006)	−0.002 (0.006)
Income		0.073*** (0.012)	0.076*** (0.012)		−0.047 (0.043)	−0.060 (0.042)
Regions FE	No	No	Yes	No	No	Yes
Survey years FE	No	No	Yes	No	No	Yes
Cohort of birth FE	No	No	Yes	No	No	Yes
Observations	5139	4472	4472	15066	13228	13228
R^2	0.092	0.214	0.221	0.642	0.701	0.707

*, **, and *** represent significance levels of 10, 5, and 1%. The number of children represents two or more children younger than 25 years born to mothers aged 21 to 49 years of age. Robust standard errors are in parenthesis. Completed higher secondary education is binary and takes value = 1 if a child has completed grade 11 to grade 12 attained in junior college. Years of education are continuous and represent years of education an individual has attained. Regions and survey years' fixed effects are included. Source: Pakistan Social and Living Standards Measurement (PSLM) Survey 2004–2014.

preference for sons increases family size in Pakistan. Women continue to produce children to achieve their desired number of sons. Second, birth order has a positive and statistically significant effect on measured educational outcomes. Younger children tend to attain more education compared to older children. This is consistent across all of our dependent variables. Third, this review allowed the interaction of gender with the birth order to see the educational outcomes of boys and girls across the birth order ladder. It was found that the gaps in educational outcomes decrease between younger boys and girls. The narrowing of the education gender gap over time, i.e. higher-order girls tends to receive more education than their older sisters is perhaps the most interesting and important aspect of our study.

Our findings were shared on the positive effect of birth order with very few studies conducted in other developing countries, such as India, Egypt, and Ecuador (De Haan et al., 2014; Kugler & Kumar, 2017; Rammohan & Dancer, 2008). It was concluded that the negative relationship between birth order and education may not hold in the context of a developing country as has been in the case of developed countries (See for example Black et al., 2005; Booth & Kee, 2009; Barclay, 2018; De Haan, 2010; Esposito et al., 2020). This review did not provide any causal evidence to this claim; however, our arguments were linked to related explanations that are common in developing countries, such as child labor due to high poverty rates, low levels of parental education, and high teenage pregnancy rates (De Haan et al., 2014). These explanations are very much interlinked in developing countries. For example, parents face a trade-off between investment in education and consumption when they are young and there are many mouths to feed. Due to family budget constraints, children reaching working ages are forced out of school and made to work to contribute to family income; the parents have had time to accumulate savings that may help finance the education of the younger children (Parish & Willis, 1993). This pattern is quite obvious from the positive correlation between age and child labor in our analysis presented in Table 7.

Exploring potential channels, this review undertakes a preliminary inquiry into the child labor situation. Child labor is quite prevalent in Pakistan, as is in most other nations in the region. According to UNICEF (2017), about 3.3 million children are tapped into child labor in Pakistan. A restricted sample of children between ages 5–14 was used from the Punjab multiple indicator cluster surveys (MICS), 2017–18, and presented evidence of child labor and its prevalence among male and female children. As shown in Table 7, the prevalence of child labor is higher among male children as compared to female children; and the probability increases as he grows older. This indicates that male children leave school at an early age to contribute to family income and hence may help to compensate for their younger female siblings' education.

Table 4. IV estimate of the number of children who completed primary and secondary education.

	Completed Primary			Completed Secondary		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Two-stage least squares estimates						
Number of children	−0.232** (0.100)	−0.166** (0.084)	−0.177** (0.086)	−0.238** (0.099)	−0.157* (0.085)	−0.160* (0.088)
Child age	0.064*** (0.007)	0.062*** (0.009)	0.065*** (0.010)	0.095*** (0.007)	0.097*** (0.009)	0.100*** (0.009)
Female	−0.080*** (0.023)	−0.064*** (0.020)	−0.068*** (0.021)	−0.145*** (0.025)	−0.114*** (0.022)	−0.117*** (0.024)
Birth order	0.127** (0.052)	0.098** (0.049)	0.105** (0.049)	0.112** (0.048)	0.083* (0.047)	0.083* (0.047)
Father's education		0.003*** (0.001)	0.002 (0.002)		0.013*** (0.002)	0.010*** (0.002)
Mother's education		−0.007 (0.008)	−0.008 (0.008)		0.003 (0.008)	0.003 (0.008)
Father's age		−0.001 (0.002)	−0.001 (0.002)		−0.001 (0.002)	−0.001 (0.002)
Mother's age		−0.004 (0.004)	−0.003 (0.003)		−0.007* (0.004)	−0.006* (0.004)
Income		0.028**	0.026** (0.010)		0.051*** (0.013)	0.049*** (0.012)
Regions fixed effect	No	No	Yes	No	No	Yes
Survey years fixed effect	No	No	Yes	No	No	Yes
Cohort of birth FE	No	No	Yes	No	No	Yes
Observations	12620	11056	11056	10806	9441	9441
R^2	−0.544	−0.154	−0.202	−0.137	0.206	0.207
Hausman test of Endogeneity						
Chi-squared statistics	10.32	6.279	7.263	8.150	3.907	3.844
p-value	0.001	0.012	0.007	0.004	0.048	0.049
Panel B: First stage results for the number of children						
First born two daughters	0.114*** (0.034)	0.125*** (0.035)	0.125*** (0.035)	0.131*** (0.038)	0.133*** (0.039)	0.137*** (0.039)
F-stats	9.53	9.06	10.47	11.06	11.21	10.78
p-value	0.002	0.002	0.001	0.000	0.000	0.000

*, **, and *** represent significance levels of 10, 5, and 1%. The number of children represents two or more children younger than 25 years born to mothers aged 21 to 49 years of age. Robust standard errors are presented in parenthesis. Completed primary education and secondary education are binary takes value = 1 if an individual has completed (grade 1 to grade 5), and (grade 6 to grade 10) respectively according to the education system in Pakistan. Regions and survey years' fixed effects are included. Source: Pakistan Social and Living Standards Measurement (PSLM) Survey 2004–2014.

Another channel for the narrowing gender gap could be the growth in female labor force participation (FLPFP). According to a study by the World Bank (Amir et al., 2018), between 2000 and 2015, FLFP has increased for all levels of education in Pakistan, but the largest increase is for females with postsecondary education.[8] Whether the female labor market and the increased FLFP are due to a demand-pull or supply push is an interesting issue worthy of investigation. It is not just for Pakistan, but for many neighboring countries. Is it due to economic development, changes in social-cultural attitudes (Serrat et al., 2016), or out of necessity to improve women's bargaining power or for the finances of the household as a whole? Curious minds would like to know.

The narrowing of the gender gap may also be due to the interaction of education and the marriage market. In Pakistan, the practice of dowry is not legally banned but can be interpreted as a protection of women's property rights. It is a practice that the bride is equipped with cash and kind by her parents during her marriage. Literature explores the link between female education and dowry. Evidence suggests that the amount of dowry decreases if the bride is educated (Makino, 2019). An educated female gives her (and her parents) the bargaining power on the amount of dowry before or during her marriage. Parents, therefore, tend to educate their girls to lower their dowry expenditure.

Though gender disparity is still a major issue, Pakistan has come a long way. One of the findings in this study reveals the narrowing of the education gender gap within the family. Though the finding is in terms of intra-family, overall evidence supports this also.[9] There is still a way to go, but this demonstrates that a coordinated effort of government policy and incentives, changes in social-cultural attitudes (which can also be influenced through government policy or guidelines), and general economic development

[8]This is also consistent with the time series data reported in the World Development Indicators (WDI), Post-secondary school attainment grew by 193% for girls compared to 93% for boys, between 2005–2020.

[9]In addition to the aforementioned Post-secondary school attainment, the World Development Indicators also show a growth of 123% for girls primary school attainment compared to 36% for boys between 2005 and 2020. Lower secondary school attainment grew by 146% for girls and 42% for boys.

Table 5. IV estimate of the number of children who completed secondary and years of education.

	Completed Higher Secondary			Years of Education		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Two stage least squares estimates						
Number of children	−0.105 (0.093)	−0.098 (0.084)	−0.089 (0.082)	−2.830** (1.168)	−1.904** (0.839)	−1.112** (0.558)
Child age	0.054*** (0.007)	0.054*** (0.009)	0.054*** (0.009)	0.880*** (0.113)	0.843*** (0.103)	0.646*** (0.085)
Female	−0.161*** (0.018)	−0.135*** (0.020)	−0.138*** (0.022)	−1.017*** (0.268)	−0.759*** (0.191)	−0.472*** (0.132)
Birth order	0.034 (0.041)	0.039 (0.041)	0.035 (0.039)	1.687** (0.689)	1.227** (0.538)	0.656* (0.350)
Father's education		0.026*** (0.003)	0.023*** (0.003)		0.057*** (0.011)	0.050*** (0.011)
Mother's education		0.018* (0.009)	0.019** (0.009)		−0.094 (0.080)	−0.016 (0.052)
Father's age		−0.000 (0.002)	−0.000 (0.002)		−0.007	0.002 (0.009)
Mother's age		−0.008* (0.005)	−0.007* (0.004)		−0.061** (0.030)	−0.034** (0.017)
Income		0.090*** (0.020)	0.089*** (0.018)		0.400*** (0.115)	0.303*** 0.072)
Regions fixed effect	No	No	Yes	No	No	Yes
Survey years fixed effect	No	No	Yes	No	No	Yes
Cohort of birth FE	No	No	Yes	No	No	Yes
Observations	5063	4401	4401	14745	12915	12915
R2	0.023	0.136	0.161	−0.427	0.264	0.650
Hausman test of Endogeneity						
Chi-squared statistics	16.85	5.353	4.290	12.50	12.93	9.801
p-value	0.0000	0.020	0.039	0.0000	0.000	0.001
Panel B: First stage results for the number of children						
First born two daughters	0.184*** (0.058)	0.203*** (0.060)	0.222*** (0.059)	0.082*** (0.030)	0.084*** (0.032)	0.085*** (0.031)
F-stats	9.32	11.12	11.65	6.56	7.09	7.76
p-value	0.002	0.000	0.000	0.010	0.008	0.007

*, **, and *** represent significance levels of 10, 5, and 1%. The number of children represents two or more children younger than 25 years born to mothers aged 21 to 49 years of age. Robust standard errors are presented in parenthesis. Completed higher secondary education is binary and takes value = 1 if a child has completed grade 11 to grade 12 attained in junior college. Years of education are continuous and represent years of education an individual has attained from grade 1 to grade 14. Regions and survey years' fixed effects are included. Source: Pakistan Social and Living Standards Measurement (PSLM) Survey 2004–2014.

(not merely growth), can not only ensure the economic future of Pakistan in general but also improve gender equality and social harmony. This is not true just for Pakistan, but for other nations in the region, in the Middle East, Southeast Asia, and all developing nations in general.

Table 6. Educational outcomes of later-born children.

	Completed Primary (1)	Completed Secondary (2)	Years of Education (3)
Panel A: Two stage least squares estimates			
Number of children	−0.159** (0.080)	−0.157* (0.082	−1.031** (0.515)
Child age	0.063*** (0.009)	0.087*** (0.010)	0.635*** (0.073)
Female	−0.102*** (0.028)	−0.127*** (0.030)	−0.595*** (0.174)
Birth order	0.086* (0.045)	0.076* (0.043)	0.575* (0.315)
Female × birth order	0.016*** (0.006)	0.012* (0.007)	0.112*** (0.044)
Father's education	0.002 (0.002)	0.011*** (0.002)	0.051*** (0.010)
Mother's education	−0.007 (0.007)	0.002 (0.008)	−0.009 (0.048)
Father's age	−0.001 (0.002)	−0.001 (0.002)	0.003 (0.009)
Mother's age	−0.003 (0.003)	−0.007** (0.003)	−0.032** (0.015)
Income	0.024** (0.010)	0.051*** (0.011)	0.295*** (0.067)
Regions fixed effect	Yes	Yes	Yes
Survey years fixed effect	Yes	Yes	Yes
Cohort of birth FE	Yes	Yes	Yes
Observations	11056	9441	12915
R^2	−0.108	0.270	0.673
Panel B: First stage results for the number of children			
First born two daughters	0.120*** (0.036)	0.132*** (0.039)	0.100*** (0.031)
F-stats	11.19	11.26	8.52
p-value	0.000	0.000	0.005

*, **, and *** represent significance levels of 10, 5, and 1%. The number of children represents two or more children younger than 25 years born to mothers aged 21 to 49 years of age. Robust standard errors are presented in parenthesis. Source: Pakistan Social and Living Standards Measurement (PSLM) Survey 2004–2014.

Table 7. Child labor across gender in Pakistan.

	Full sample	Male	Female
Child age			
6	−0.002 (0.004)	−0.001 (0.006)	−0.003 (0.005)
7	0.003 (0.004)	0.006 (0.006)	0.001 (0.005)
8	0.006 (0.004)	0.009 (0.007)	0.004 (0.005)
9	0.010** (0.004)	0.017** (0.007)	0.002 (0.005)
10	0.021*** (0.004)	0.026*** (0.007)	0.016*** (0.005)
11	0.030*** (0.005)	0.038*** (0.007)	0.020*** (0.005)
12	0.030*** (0.004)	0.040*** (0.007)	0.020*** (0.005)
13	0.055*** (0.004)	0.082*** (0.007)	0.025*** (0.005)
14	0.085*** (0.004)	0.130*** (0.007)	0.037*** (0.005)
Controls	Yes	Yes	Yes
Districts FE	Yes	Yes	Yes
Observations	24309	12519	11790
R^2	0.036	0.057	0.019

*, **, and *** represent significance levels of 10, 5, and 1%. The data comes from the Multiple Indicator Cluster Survey (2017–18) Punjab Pakistan. Controls included mothers' and fathers' education, ages, and wealth index. The dependent variable is whether a child is involved in any economic activity.

8. Conclusion

Presently, testing the theoretical and empirical validity of the tradeoff between several children and investment in their education has attracted greater attention in the education policy circle. Using nationally representative data from Pakistan Social and Living Standards Measurement (PSLM), this paper tests the empirical validity of the quantity-quality tradeoff model. The paper presents strong evidence of son preference and gender-specific gaps in education within families in Pakistan. Using the first two daughters as an exogenous source of variation in family size, results suggest that an additional child in the family reduces the probability of a child completing primary education by 18% points and secondary education by 16% points. Moreover, the results suggest that an additional child in the family reduces the years of education by almost two years, validating the quantity-quality tradeoff within families in Pakistan.

Another interesting, and perhaps more important finding, is that gender gaps in education decrease among younger children compared to older children in the family. Results showed that gender gaps in education are more noticeable among older children in the family—parents invest more in older sons than in older daughters. However, this pattern disappears when we examine the educational outcomes among younger children.

There could be several reasons for this. First, parents become more experienced and aware of the importance of education. Second is the family's financial and resource constraints. In their early years, as young parents, they face restrictive budget constraints and hence limit their ability to invest in the education of their older children, but as time advances, perhaps so do the parent's career and financial resources, which is further enhanced when older children contribute to family income and also play a quasi-parental role to compensate their younger siblings. The third is the change in social-cultural attitude. This can be the accumulation of many factors. The most obvious is the result of the economic development of Pakistan, which includes improvement in the standard of living, and employment opportunities, among others, and certainly cannot exclude the importance of government policies.

Finally, we felt our findings not only support Becker's quantity-quality tradeoff and its prevalence in Pakistan but also have strong implications for many developing countries, especially those with strong biases in favor of sons. The causal link between family size and human capital development is essential in shaping and tailoring population, labor market, and education policies to create quality human resources for socio-economic development. In the context of strong son preference, these policies should be complemented with more opportunities for women in the education and labor market to create incentives for parents to invest in their education and well-being.

Perhaps, more importantly, is the narrowing of the education gap, and future research is certainly warranted. The lesson we can learn from such research has implications far beyond Pakistan or the region but is important for most developing nations. It will not only modernize these economies but promote gender equality and social harmony; it will also promote economic development and economic growth as these developing nations can utilize a vastly under-utilized productive factor—a productive and educated female labor force.

ORCID

Jack Hou http://orcid.org/0000-0002-9054-3732

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Appendix A

Source: World Development Indicators (WDI), Barro and Lee (1950-2015)

Table A1. Fraction of families that had another child by parity and sibling sex composition of previous children.

Sex of the first child in families with one or more children	Fraction of the Sample	Fraction that had another child
Panel A: Fraction of the families who had another child conditional on parity and sex composition of first child		
(1) One boy	0.520	0.959 (0.001)
(2) One girl	0.481	0.965 (0.001)
Difference (1) – (2)		−0.005*** (0.001)
Observations	3,674	
Sex of the first two children in families with two or more children	**Fraction of the Sample**	**Fraction that had another child**
Panel B: Fraction of the families who had a third child conditional on parity and sex composition of the first two children		
(1) Second born son	0.501	0.889 (0.002)
(2) Second born daughter	0.499	0.908 (0.002)
Difference (1) – (2)		−0.018*** (0.003)
Two sons	0.259	0.852 (0.003)
Not two sons	0.741	0.884 (0.001)
Difference (1) – (2)		−0.031*** (0.013)
Two daughters	0.238	0.909 (0.003)
Not two daughters	0.762	0.866 (0.002)
Difference (1)- (2)		0.043*** (0.014)
Mixed sex	0.502	0.894 (0.002)
Same sex	0.498	0.900 (0.002)
Difference (1) – (2)		−0.005* (0.003)
Observations	3,056	

*, **, and *** indicate statistical significance at 10%, 5% and 1% respectively. Standard errors are in parenthesis. Source: Pakistan Social and Living Standards Measurement (PSLM) Survey 2004–2014.

Table A2. Access to technology and sex selection (dependent variable=male child).

	First-birth (1)	Second-birth (2)	Third-birth (3)	Fourth-birth (4)
Panel A: Full Sample				
Ultrasound (= 1 if had ultrasound examination)	0.027 (0.053)	−0.022 (0.058)	−0.061 (0.066)	0.078 (0.075)
Region dummies	Yes	Yes	Yes	Yes
Year-of-birth FE	Yes	Yes	Yes	Yes
Survey year dummies	Yes	Yes	Yes	Yes
Parent's controls	Yes	Yes	Yes	Yes
Observations	9239	7306	5395	3832
Panel B: Urban Sample				
Ultrasound (= 1 if had ultrasound examination)	0.036 (0.087)	0.152 (0.095)	0.024 (0.107)	0.065 (0.127)
Region dummies	Yes	Yes	Yes	Yes
Year-of-birth dummies	Yes	Yes	Yes	Yes
Survey Year dummies	Yes	Yes	Yes	Yes
Parent's controls	Yes	Yes	Yes	Yes
Observations	4354	3401	2439	1626

*, **, and *** represent significance levels of 10, 5, and 1%. The dependent variable is gender (Male = 1) at first birth, second birth, third birth, and fourth and onward births. The table reports whether ultrasound examination impacts sex selection in first, second, third, and fourth birth order. Robust standard errors are in the parenthesis. Parent's controls include parent age, education, and socio-economic status. Regions, children's year of birth, and survey years' fixed effects are included. Source: Pakistan Demographic Health Surveys, 2006, 2012.

Table A3. Fraction of mothers who want to have another child conditional on parity and sex composition of their children.

	PDHS 2006		PDHS 2012	
	Fraction of the Sample	Fraction to have another child	Fraction of the Sample	Fraction to have another child
Panel A. Sex of the first child in families with one or more children				
(1) First-born son	0.530	0.402 (0.007)	0.523	0.341 (0.006)
(2) First-born daughter	0.470	0.466 (0.008)	0.476	0.372 (0.006)
Difference (1) – (2)		−0.063*** (0.011)		−0.032*** (0.008)
Observations		7797		11460
Panel B. Sex of the first two children in families with two or more children				
(1) Second-born son	0.529	0.317 (0.007)	0.519	0.259 (0.006)
(2)Second-born daughter	0.470	0.388 (0.008)	0.480	0.292 (0.006)
Difference (1–2)		−0.073*** (0.011)		−0.032*** (0.008)
Observations		7609		9869
First-two daughters	0.234	0.465 (0.013)	0.230	0.321 (0.009)
Other combinations	0.766	0.331 (0.006)	0.769	0.262 (0.005)
Difference (1–2)		0.134*** (0.014)		0.059*** (0.010)
First-two sons	0.259	0.318 (0.010)	0.261	0.255 (0.008)
Other combinations	0.741	0.374 (0.006)	0.740	0.282 (0.005)
Difference (1–2)		−0.056*** (0.012)		−0.027*** (0.010)
Observations		7375		10300
Panel C. Sex of the first three children in families with three or more children				
First-three sons	0.136	0.261 (0.015)	0.136	0.189 (0.011)
Other combinations	0.864	0.289 (0.006)	0.863	0.192 (0.004)
Difference (1–2)		−0.028 (0.017)		−0.003 (0.012)
First-three daughters	0.123	0.428 (0.021)	0.127	0.293 (0.015)
Other combinations	0.877	0.270 (0.006)	0.872	0.179 (0.004)
Difference (1–2)		0.158*** (0.019)		0.114*** (0.013)
Observations		5963		7947

*, **, and *** indicate statistical significance at 10%, 5% and 1% respectively. Standard errors are in parenthesis. Source: Pakistan Demographic and Health Surveys (2012).

Table A4. Instrumental variable estimates on binary measures of educational outcome (IV-probit).

	Completed Primary (1)	Completed Secondary (2)	Completed Higher Secondary (3)
Panel A: Two-stage least squares estimates			
Number of children	−0.218** (0.110)	−0.141* (0.078)	−0.123 (0.082)
Other Controls	Yes	Yes	Yes
Region of birth FE	Yes	Yes	Yes
Survey years FE	Yes	Yes	Yes
Cohort of birth FE	Yes	Yes	Yes
Panel B: First stage results for the number of children			
First born two daughters	0.122*** (0.035)	0.132*** (0.039)	0.204*** (0.060)
Other Controls	Yes	Yes	Yes
Region of birth FE	Yes	Yes	Yes
Survey years FE	Yes	Yes	Yes
Cohort of birth FE	Yes	Yes	Yes
Observations	11056	9441	4401

All outcome measures are binary. Other controls include child age, gender of the child, birth order, father and mother age and education, and family income. All regressions include dummies for the region of birth, survey years, and cohort year of birth. Robust standard errors are in parenthesis. *, **, and *** represent significance levels of 10, 5, and 1%.

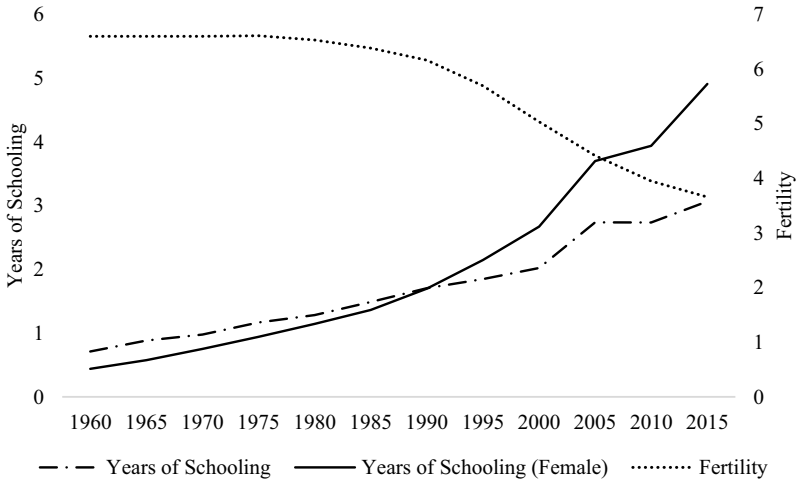

Figure A. Historic trends in fertility and years of schooling in Pakistan. Y1 (vertical axis on the left) represents years of schooling while y2 represents fertility.