SON PREFERENCE, FERTILITY AND CHILDREN'S QUALITY: THE CASE OF PAKISTAN

By

Qaisar Khan

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfillment of the requirements

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To my parents who made me who I am today. To them, I dedicate my thesis, with love and respect.

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Chapter 1. Overview of Son Preference in Pakistan

1.1. Introduction

Recent census conducted in 2017 ranked Pakistan as the fifth most populous country of the world with population of over 207 million (Pakistan Bureau of Statistics 2017)[1]. Pakistan's population have experienced an increase of 57 percent since the last census conducted in 1998[2]. In the past, population growth rate remained high, however, it declined from 3.17 percent in 1980 to 2.4 percent in 2017[3] because of modest transition in fertility. Fertility rate declined significantly from 6.6 births per women in 1980 to 3.8 births per women in 2013 with rural women have one child more on average[4], and this is still above the replacement level making it the second highest in the region after Afghanistan. Although fertility is declining but the pace of decline is very slow, and it will take 35 years for Pakistan to achieve replacement level fertility (Zaidi & Morgan 2016). By that time, Pakistan's population would reach to 300 million that will maintain its rank among six of the ten most populous countries of the world (United Nations 2015). High population in future will provide additional challenges for a country that still have a long way to cope with challenges associated with education, health care and family planning as evident from human development and gender parity indexes.[5]

Pakistan recognized the threat of population growth since its inception in 1947, and in late 1950 the government initiated the population welfare program. Despite long history, these programs have achieved limited success in achieving the fertility targets (Pakistan Population Policy 2010). A number of factors can be attributed to the limited success of these programs, including but not limited

[1] This census conducted after 19 years, since the last census in 1998. According to 1998 census, Pakistan was the 7th most populous country of the world.
[2] According to 1998 census, Pakistan's population was 130 million
[3] National Institute of Population studies (NIPS) Pakistan
[4] Pakistan Demographic and Health Surveys (1991,2007,2013)
[5] Pakistan is in the bottom quartile of human development index and top quartile in gender parity index

to, lowest contraceptive prevalence rate, women's illiteracy and strong patriarchy/ son preferences (Fikree et.al 2000; Sathar et.al 2015; Zaidi & Morgan 2016). In 1990s, government interventions diverted from supply to addressing factors associated with demand, for instance increasing women knowledge about family planning and reproductive health care. These interventions endeavored to some positive development, for instance fertility rate declined from 5 births per women in 1990 to 4 births in 2006 and 3.8 births in 2013 (PDHS 2012-13). On the other hand, knowledge about contraception became universal among women, however, failed to ground in producing actual fertility outcomes. According to successive Pakistan Demographic and Health Surveys (PDHS)[6], there is a slight increase in contraceptive prevalence rate since 1990 to 2013. Contraceptive prevalence rate slightly increased from 20 percent by any method in 1991 to 30 percent in 2007. Similarly, contraceptive prevalence by modern method increased from 16 percent in 1991 to 20 percent in 2007. According to PDHS-2013, currently 26 percent of women use modern methods while 35 percent use contraceptives by any method. This is the lowest contraceptive prevalence rate compared to other countries in the region (Figure 1-1). Despite considerable investment in family planning in the past two decades while limited response in achieving desired outcomes, needs a thorough investigation of factors that constrain fertility decline in Pakistan.

One of the most influencing factor is the persistence of strong patriarchy/son preferences that contributes to larger families in Pakistan (Casterline et.al 2001; Sathar et.al 2015; Zaidi & Morgan 2016). A more direct evidence of son preference can be obtained from the Pakistan demographic and health surveys (PDHS), which ask respondents about their desired number of sons and daughters. Figure 1-2 represent the intensity of son preference in Pakistan from PDHS 2007 and 2013. Desire for sons is much higher compared to desire for daughter. If women implement their preferences

[6] Pakistan Demographic and Health Surveys conducted in 1990,2006 and 2013

completely (Pritchett 1994), son preference has a strong effect on fertility. Why sons are valued and what are the potential channels for achieving son preference in Pakistan?

1.2. Son Preference

Son preference has been one of the major practices that have been rooted in the Asian countries since decades. This has been widely argued by many researchers, and the most notable among them is Amartya Sen, who argued that more than 100 million women are missing particularly in Asia due to differential treatment (Sen 1990; Oster 2005). In societies with pro-male biases, the differential treatment by gender has created disparities in educational attainment, health and labor market outcomes apart from other many, and these gaps are widening in the conservative settings and particularly in Asia even today. There are many potential reasons that initiate family's preference for sons. For instance, sons are preferred to carry family name and honor (Chakraborty & Kim 2010; Sathar 2015), provide support to parents during their old age (Das 1987; Arnold 1997), and increase women's bargaining power in household decision making (Li & Wu 2011). There are also other factors associated with economic gains from gender. Sons are valued because of their comparative advantage in terms of higher productivity in farming in rural areas, while in urban areas they benefit from more job opportunities in labor market. On the other hand, daughters are considered economic burden because of prevailing dowry system which involves transfer of parental property when they are married out (Zubair et.al 2006; Royan & Zaidi 2011). Furthermore, there are considerable gaps in labor force participation between genders in Pakistan. Only 25 percent of women participate in labor market with majority in urban areas (ADB 2016). Majority of women are dependent on men and have very limited contribution to household's income. All these factors increase the economic incentives of son preference which consequently contribute to disparities in education, health and job opportunities.

1.3. Implementation of son preference

Son preferences are implemented using two ways i.e. stopping rule or sex selection. In countries, where technology is widely available, women implement their preferences for sons through sex selective abortions for instance China, South Korea and India (Leung 1994; Park & Cho 1995; Lu & Treiman 2004; Kugler & Kumar 2013). On the other hand, women who have no or limited access to sex selection, they practice stopping rule i.e. they continue to produce children until their desired number of sons are achieved at the cost of large family size. Son preference has been studied widely and suggested common in the region from North Africa to Asia (Khan & Sirageldin 1977; Arnold 1985; Arnold & Liu 1986; Edlund 1999; Clark 2000; Jensen 2002; Das 2010). Son preference increases fertility in context where couples practice stopping rule, which consequently contribute to demographic challenges in terms of elevated sex ratios and marriage squeeze (Guilmoto 2011; Dyson 2012; Bogaarts 2013). Some previous studies have suggested that son preference increases national fertility by roughly 10 percent in India (Bairagi & Langsten 1986; Das 1987; Chowdhury & Bairagi 1990; Bairagi & Koenig 1993).

Whether stopping rule or sex selection, both behaviors are used to meet family's preference for sons. Sex selection affect sex ratios at birth (SRB) while stopping rule has more pronounced effect on sex ratios at last birth (SRLB) (Bongaarts 2013). Stopping rule increases family size because women who wants more sons spend their whole reproductive life to achieve their desires, regardless of family size (Park & Cho 1995; Hesketch & Xing 2006). What is the likely path of Pakistani families to achieve their preferences?

1.3.1 Stopping Rule

Bongaarts (2013) in a cross country comparison using Demographic and Health Surveys data ranked Pakistan as highest in desired sex ratio at birth (DSRB)[7] and sex ratio at last birth (SRLB)[8], however, modest in sex ratio at birth (SRB). In the absence of census data from the last two decades, we have presented SRB, SRLB and DSRB using three rounds of demographic and health surveys of Pakistan in Figure 1-3. Pattern of SRB has been modest in 1991 and 2013, however elevated in 2007. There is no consistent pattern which confirms that the elevated SRB in 2007 is suggestive of sex selective abortions (see for example Zaidi & Morgan 2016). However, SRLB is showing a pattern above normal in all three surveys. According to Bongaarts (2013) high SRLB is a sensitive indicator of differential stopping behavior i.e. women stop childbearing if they have achieved their desired number of sons, and contraceptives are used as a tool to implement son preferences.

Contraceptive use

A number of studies attribute the low or no use of contraceptives to preferences for male offspring, their findings suggest that couples with fewer children or only daughters don't use contraceptives and want to continue childbearing (Arnold & Liu 1986; Das 1987; DeSilva 1993; Arnold 1997; Fikree et.al 2000;). Some other studies have found that number of living sons is associated with future fertility choices and use of contraception (Sathar & Casterline 1998; Hussain et.al 2000; Channon 2015). There are some studies who argued that contraceptive use depends on the sex composition of previous children, contraceptive use increases with the birth of a son than birth of a daughter (Arnold 1997; Retherford & Roy 2003).

[7] Pakistan has the second highest DSRB after Mauritania based on available DHS data
[8] Pakistan has the fifth highest in SRLB

We have presented the differential use of contraceptives among women based on the parity and sex composition of previous children in Figure 1-4 and Figure 1-5. Data used in the figures comes from two rounds (2007 and 2013) of Pakistan demographic and health surveys (PDHS). Figure 1-4 and Figure 1-5 depict proportions of women who use contraceptives (plotted on vertical axis) in three different scenarios based on sex composition of previous children for survey years 2007 and 2013 respectively. In scenario one, presented in Figure 1-4, we focused on mothers who have at least one kid, mother's contraceptive use was then compared based on the gender of their first kid which is depicted as "first kid". Contraceptive use for mothers with first born son is 32 percentage points compared to 30 percentage points for mothers with firs born daughter. In scenario two, we furthered our focus to mothers who have at least two kids presented as "second kid" and "first two kids" in figure 1-4. Contraceptive use among mothers with second born son compared to second born daughter is 36 percentage points and 33 percentage points respectively. Similarly, contraceptive use decreases with first two daughters (32 percentage points) while increase with first two sons (36 percentage points). The same pattern persists in scenario three, presented as "first three kids" in Figure 1-4. Contraceptive use increases with first three sons (39 percentage points) while decreases with first three daughters (31 percentage points). Figure 1-5 reports contraceptive use for survey year 2013 present the same pattern as in 2007. Details about sample selection and comparison based on sex composition using formal two sample t-test is provided in appendix 1-1.

It is evident from both surveys in years 2007 and 2013 that contraceptive use increases after the birth of sons and decreases after the births of daughter. This pattern is consistent with literature documented on differential use of contraceptives in Pakistan (Fikree et.al 2000; Zaidi & Morgan 2016). The pattern reflected in this section suggest that contraceptives are used as a tool for implementing differential stopping rule to achieve the desired number of sons.

Parity progression

After having discussed about differential use of contraceptives, next we move to parity progression to further investigate women's future reproductive behavior. Women decision to stop, delay or continue childbearing are driven by preferences, for instance preferences for mixed sex (Angrist & Evans 1998) and preferences for sons (Kynch & Sen 1983; Das 1987; Jensen 2002; Bongaarts 2013; Kugler & Kumar 2015). One way to measure the preference for son is to examine the decision of women who want to continue childbearing based on the sex composition of previous children. PDHS provides information about this measure by asking women about their fertility preference i.e. if they want to have another child. Using PDHS 2007 and 2013, we examined women's progression to next parity. Figure 1-6 and Figure 1-7 present women responses in survey years 2007 and 2013 respectively. Values on vertical axis represent proportion of mothers who want to have another child while horizontal axis represent sex composition of previous children. Women decision to have another child is examined in three scenarios as discussed in the case of Figure 1-4. There is a declining trend in women's preferences for another child from 2007 to 2013, which can be attributed to trends of smaller families as a result of fertility decline from 4.1 births in 2007 to 3.8 births in 2013. However, the decision to continue childbearing increases with the births of daughters compared to the births of sons in both years (details are provided in appendix 1-2). This pattern suggests the persistence of son preference over years, although with fertility decline and smaller family size.

Whether sex of previous births affect women's desire to limit childbearing, we examined responses of women within the same period (2007 and 2013) from PDHS in Figure 1-8. We restricted our sample to families with at least one child, two children, three children and four children family. Proportion of women who want no more children is plotted on vertical axis. Women's desire to limit childbearing is strongly associated with sex of previous births in both survey years. The desire to limit childbearing increases with number of sons in the family, for instance the proportion of women who wants no more children with three sons is much higher compared to women who have three daughters. This is another evidence which shows that sons are the main contributing factor in shaping women's behavior to future childbearing.

In the absence of census data from almost last two decades, demographic and health surveys provide enough information to examine women's fertility preferences and the factors that influence these preferences (Fikree et.al 2000; Sathar et.al 2015; Zaidi & Morgan 2016). Our analysis based on the data is consistent with previous studies that son preference strongly persist among families in Pakistan (Tray 1984; Nag 1991; Fikree et.al 2000; Bongaarts 2013; Sathar et.al 2015; Zaidi & Morgan 2016).

In this section, we explored the role of son preference on contraceptive use, progression to next parity, and women's desire to limit childbearing. Based on our analysis from two rounds of surveys, women preferences for future fertility is strongly associated with sons. We also examined that contraceptive use increases with the births of sons compared to daughters suggesting the role of contraceptives as a tool for implementing son preferences (Bongaarts 2013).

1.3.2 Sex Selection

Besides stopping rule, sex selection is another way through which women implement their son preferences. Sex selection is practiced in contexts where technology is widely available and women have access to prenatal sex determination and abortions (Park & Cho 1995; Junhong 2001; Zhu et.al 2009). According to two rounds (2007 and 2013) of PDHS, ultrasound examination increased from 66 percent in 2007 to 89 percent in 2013. If ultrasound examination results in sex selective abortions, then it should elevate sex ratio at birth as previous research has shown in the case of China, India and South Korea (Park & Cho 1995; Roy et.al 2003; Oster 2005). However, this is not the case in Pakistan. Pakistan has a modest SRB, however, its SRLB and DSRB is among the highest in the world

(Bongaarts 2013). Some other studies suggest that sex selective abortions are much less acceptable and available in Pakistan due to cultural and religious norms (Hesketch & Xing 2006; Dubuc & Coleman 2007). Lack of evidence of sex selective abortion is also in line with the fertility behaviors of Pakistani communities in Europe and North America (Bhat & Zavier 2003; Almond et.al 2013; Desai & Temsah 2014).

In Pakistan abortion is only allowed to save a woman's life, all other forms of abortion are treated illegal and leads to punishment.[9] According to a recent research, 67 percent medical professionals don't agree with abortion and 81 percent of them want the introduction of stricter policies for abortion in Pakistan (Sathar et.al 2015). Furthermore, the midwifery tutor guide (2011) published by the Pakistan nursing council prohibits its members in providing information regarding abortion or encouraging any women to go for abortion. In a wider range of research conducted so far in the context of Pakistan has one observed association common, and that is, women continue childbearing until their desired number of sons is achieved (Sathar & Casterline 1998; Hussain et.al 2000; Channon 2015; Zaidi & Morgan 2016).

A simple way to examine whether ultrasound examination helps women to achieve their son preference is to check their futility outcomes (son). In other words, if ultrasound examination helps women to choose gender of the child, then in context where son preference is strong, pregnancy should end up with a male child. We performed a two sample t-test to see if there is systematic difference in fraction of women who had her last birth as boy based on ultrasound examination (details of the test are provided in appendix 1-3). We couldn't find any evidence of sex selection even after restricting our sample to rural and urban women.

[9] Population policy data bank, department of economic and social affairs United Nations

1.4. Cost of son preference

Previous research has shown that son preference create demographic problems such as imbalanced sex ratio in the population (Park & Cho 1995; Roy et.al 2002; Oster 2005; Bongaarts 2013), elevate fertility (Chowdhury & Bairagi 1990; Bairagi & Koenig 1993). So preference also create severe social problems for future, for instance some studies argue that in the next 20 years, there will be 10-20 percent more men than women in China and India (Hesketh & Xing 2006). More importantly in contexts where women practice stopping rule such as in Pakistan, son preference increases birth rate which consequently contribute to population growth and fiscal burden (Zaidi & Morgan 2016).

Son preference creates disparities in health and education particularly for girls (Zhuang & Burgess 2001; DeJong & Basu 2006; Wang 2005; Jayachandran & Pande 2015; Choi & Hwang 2015; Hatlebakk 2016). Some other studies have argued that the marginal cost of additional birth resulting from son preference adversely affect children's health and educational outcomes (Jensen 2002; Kugler & Kumar 2015). Since son preference contribute to larger family size, therefore every new birth in the family restrain the family resources resulting in lower investment on quality of each child. In simplest form, families with more children to feed, face a tradeoff in quality (for instance education and health) and quantity (number of children) due to resource constraints (Becker 1960; Becker & Lewis 1973; Becker & Tomes; 1976).

Pakistan is not an exception to this list. The cost of son preference is even more severe in Pakistan which is evident from its status in the bottom quartile of human development index (low levels of education and health), and top quartile in gender parity index (major vulnerabilities for women and girls). According to Education for All (EFA) global monitoring report (2012), Pakistan has the second highest out of school children (two-thirds are girls) worldwide.[10] Literacy rate of the population stands at 60.7 percent with 71.6 percent male and 49.6 percent female making it the third largest globally.[11] There are considerable gaps in education attainment by gender in the country. Primary net enrollment rose from 58 percent to 74 percent, however, still the ratio of girls is 14 percentage points behind than for boys (UNESCO 2012). According to Pakistan Social and Living Standards Measurement (PSLM 2011), about 53.4 percent of the female have never attended school while only 42.5 percent female compared to 57.5 percent male are currently attending school. Similarly, only 36 percent of the female can read and write with understanding in any language while 39 percent can solve simple math.[12]

Son preference also affect the efficiency of family planning policies/programs. Bongaarts (2013) in his work on "transition in son preference" argued that, with socio-economic development and family planning programs, fertility will decline further that will establish trend for smaller families. He further argued that, with fewer children to produce while bearing sons, women will implement their son preferences through sex selective abortions. This pattern is evident from family planning policies/programs in China, India and South Korea (Hesketh & Xing 2006). In China and India family planning policies contributed to fertility decline but at the cost of elevated SRB i.e. reverting women to sex selective abortions (Park & Cho 1995; Sen 2003). However, South Korea being the first country with the highest SRB in the region, showed a significant decline due to strong policy enforcement coupled with family planning awareness campaigns (Das et.al 2009).

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10 Education for All (EFA) global monitoring report, published by United Nations Educational, Scientific and Cultural Organization (UNESCO)

11 Labor Force Survey 2014-15. Literacy rate of population 10 years of age and above who can read and write with understanding in any language

12 According to definition of literacy and numeracy in Pakistan, any person who can read and write with understanding in any language is called literate.

1.5. Summary

The main objective of literature review and our analysis based on data presented in this chapter is, to examine whether son preference exist in Pakistan? And what are the mechanisms (channels) through which son preference is implemented? The main conclusion of our analysis suggests the persistence of strong son preference in Pakistan, and women practice stopping rule instead of sex selection to implement their preferences. This in other words mean that women achieve their desire for sons regardless of the number of children. We also found that sex composition of previous children affect women's future reproductive behaviors. As we explained in above sections, women with previous birth of a daughter is more likely to have another child compared to women with previous birth of a son. Furthermore, desire to limit childbearing is strongly associated with previous birth of a son. We showed that women with the last birth of a son is more likely to have no more children compared to women with a daughter.

Based on our discussion in this section, the following chapters of our dissertation further focuses on two specific issues in the context of Pakistan. In chapter2, we investigated the cost of son preference on children's quality (educational outcomes) through its effect on family size. Our 3rd chapter evaluates the family planning program implemented through lady health workers in rural Pakistan. Our analysis explores the effect of this program on women's fertility preferences and reproductive health care, and draws relevant policy implications.

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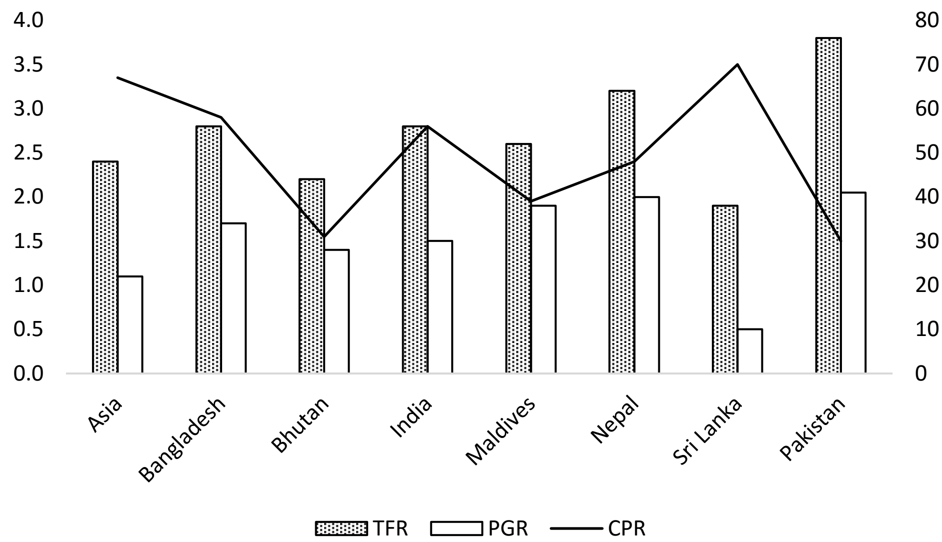
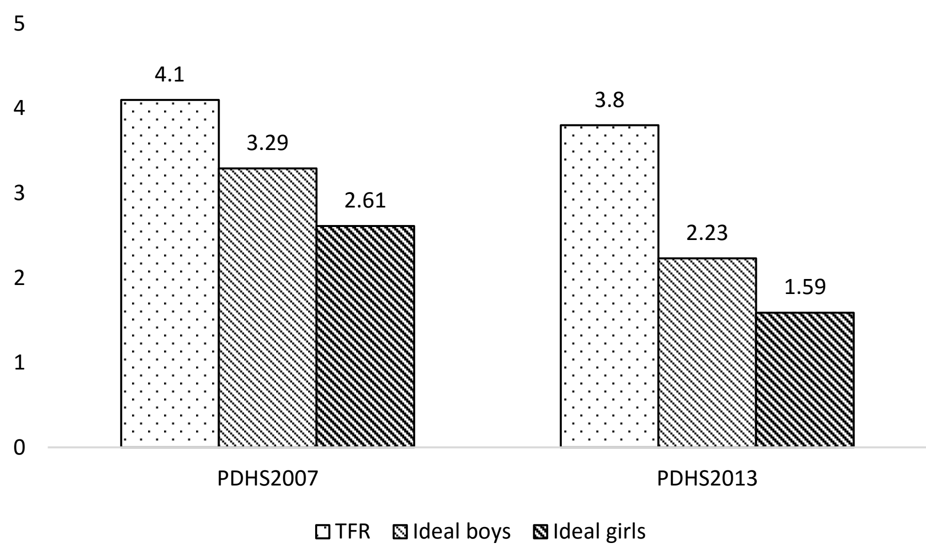


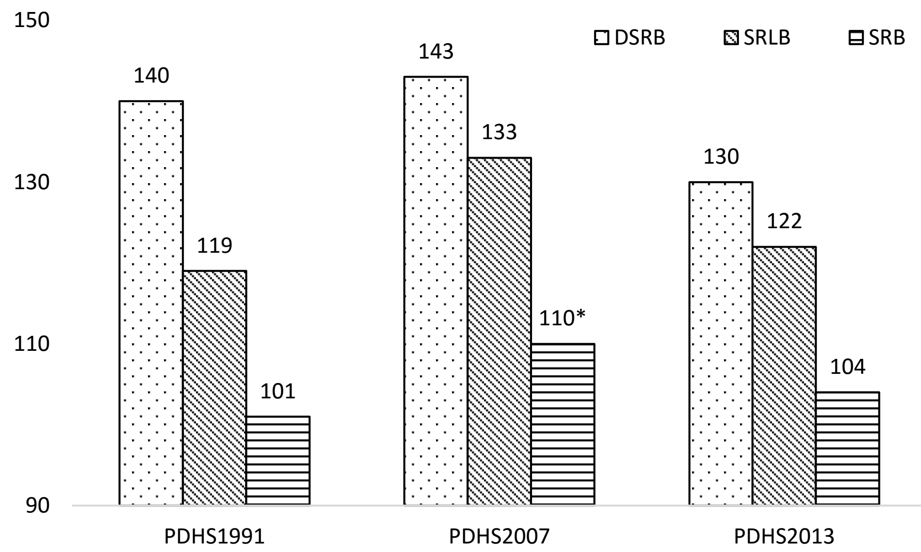
Note: Data in the graph is from World Bank, world development indicators (WDI). Period reported is for the year 2014. TFR, PGR, and CRP represent total fertility rate, population growth rate, and contraceptive prevalence rate respectively.

Figure 1-1 Comparative demographic picture of Pakistan in the region



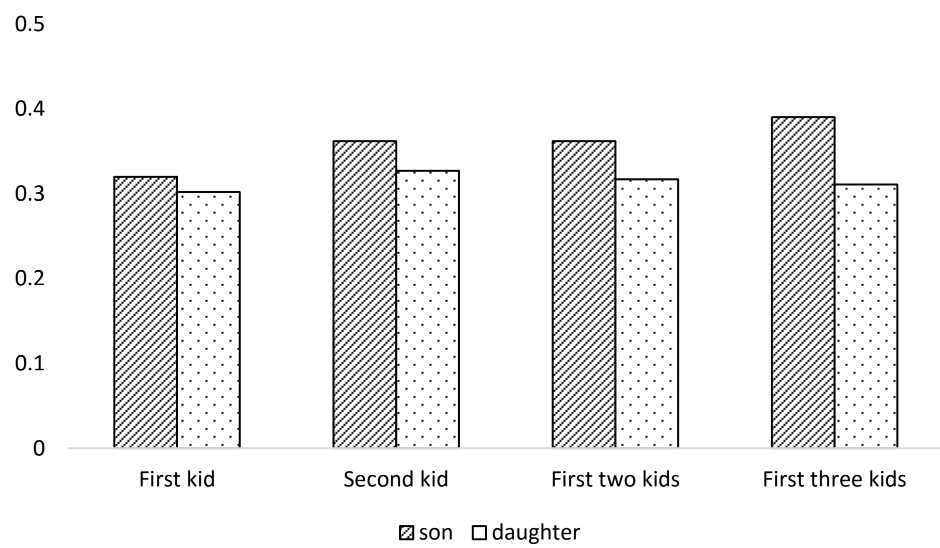
Note: Data in the graph comes from PDHS 2007 and 2013.TFR is total fertility rate. Ideal boys is mean ideal number of boys, and ideal girls is meant ideal number of girls taken from the survey questions from respondents in PDHS 2007 and 2013.

Figure 1-2 Women desire for boys and girls in PDHS 2007 and 2013



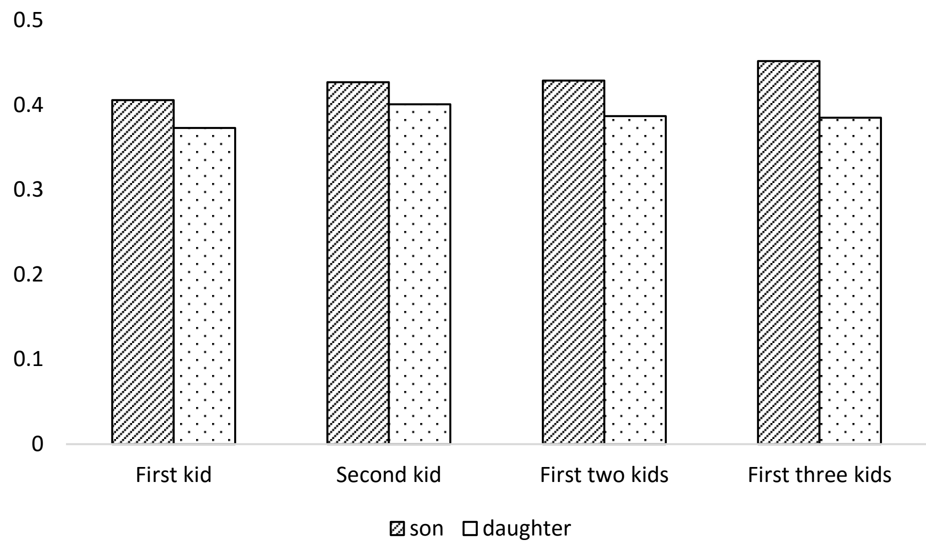
Note: DSRB is calculated from mothers below 35 years of age, SRLB is births in five years preceding the survey to mothers want no more children, SRB is births in the five years preceding the survey

Figure 1-3 Desired sex ratio at birth (DSRB), Sex ratio at last birth (SRLB), and Sex ratio at birth (SRB) from Pakistan demographic and health surveys (1991, 2007, and 2013)



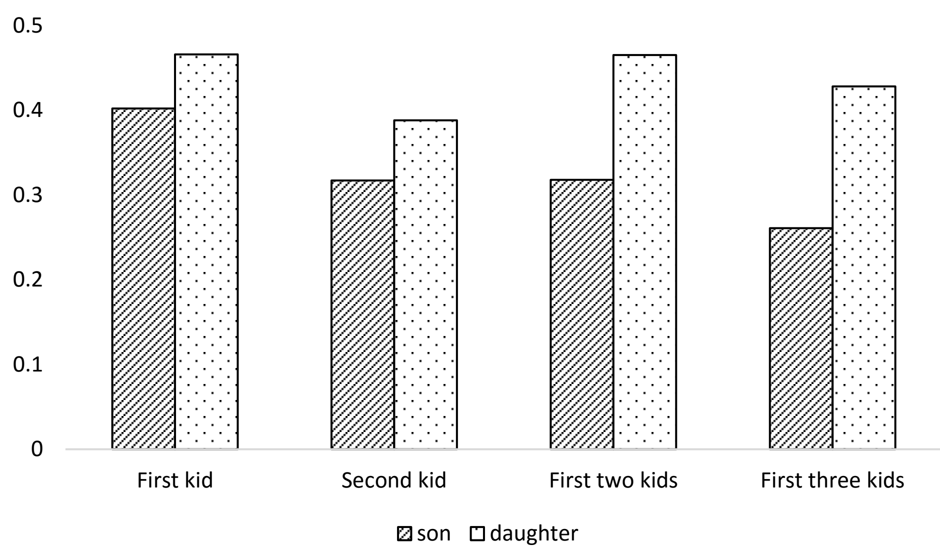
Note: Data in the graph comes from PDHS 2007.Y-axis represent contraceptive prevalence among mothers by any method. Sample is balanced among all parties. X-axis represent parity and sibling's sex composition i.e. First kid (first born son or daughter), Second kid (second born son or daughter), First two kids (first born two son or daughter), First three kids (first born three son or daughter).

Figure 1-4 Contraceptive prevalence among mothers conditional on parity and sex composition of their previous children based on data from PDHS 2007



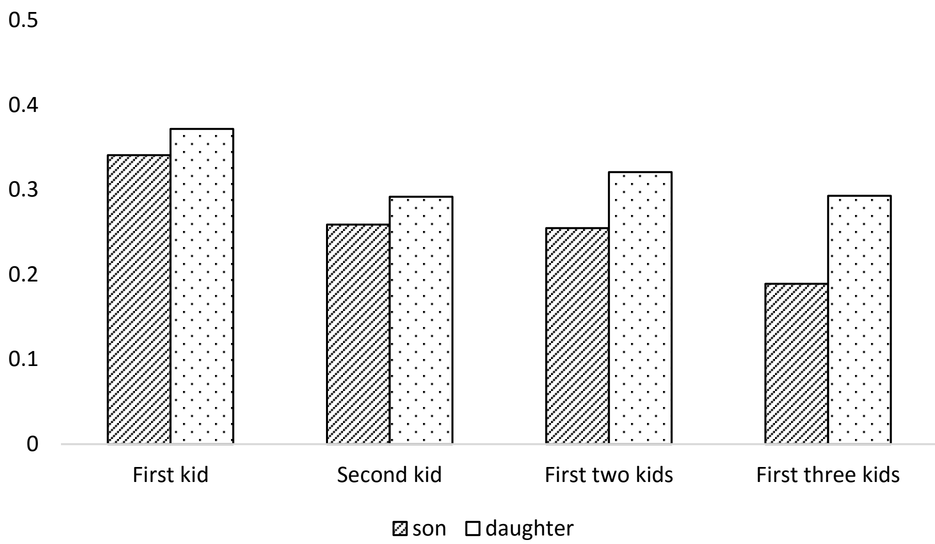
Note: Data in the graph comes from PDHS 2013.Y-axis represent contraceptive prevalence among mothers by any method. Sample is balanced among all parties. X-axis represent parity and sibling's sex composition i.e. First kid (first born son or daughter), Second kid (second born son or daughter), First two kids (first born two son or daughter), First three kids (first born three son or daughter).

Figure 1-5 Contraceptive prevalence among mothers conditional on parity and sex composition of their previous children based on data from PDHS 2013



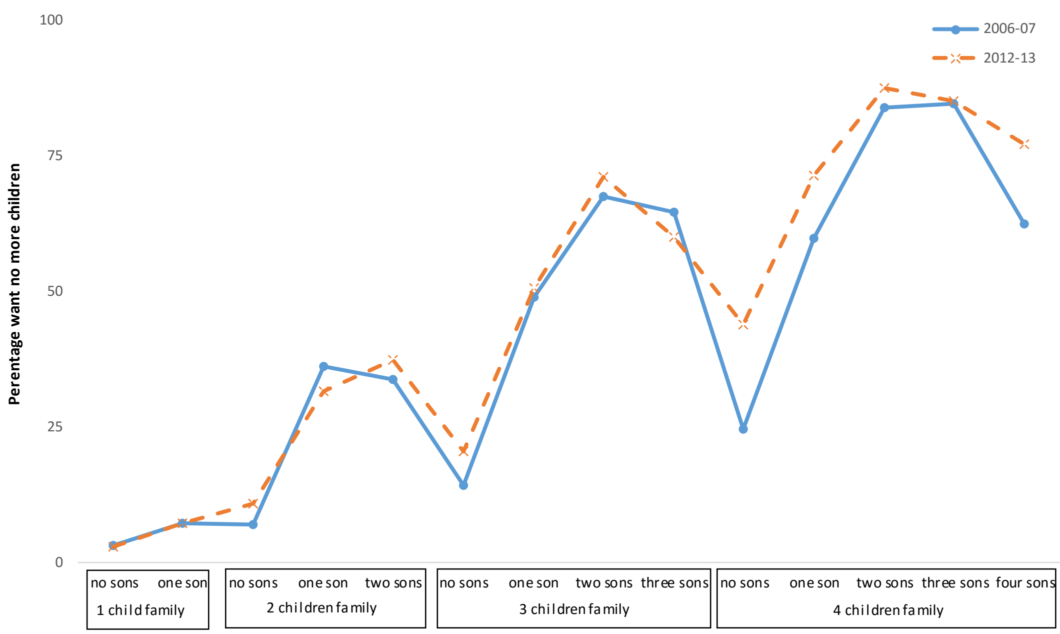
Note: Data in the graph comes from PDHS 2007. Y-axis represent mothers of reproductive age want to have another child. Sample is balance among all parties. X-axis represent parity and sibling's sex composition i.e. First kid (first born son or daughter), Second kid (second born son or daughter), First two kids (first born two son or daughter), First three kids (first born three son or daughter).

Figure 1-6 Fraction of mothers want to have another child based on parity and sex composition of their children (PDHS 2007)



Note: Data in the graph is from PDHS 2013. Y-axis represent mothers of reproductive age want to have another child. Sample is balance among all parties. X-axis represent parity and sibling's sex composition i.e. First kid (first born son or daughter), Second kid (second born son or daughter), First two kids (first born two son or daughter), First three kids (first born three son or daughter).

Figure 1-7 Fraction of mothers want to have another child based on parity and sex composition of their children (PDHS 2013)



Note: The data in the graph is used from two rounds (2007 and 2013) of Pakistan demographic and health surveys. Y axis represent proportion of women want nor more children based on parity and sex composition of children in one, two, three and four children family on x-axis.

Figure 1-8 Percentage of women wants no more children based on parity and sex composition of children

Appendix 1-1 Fraction of mothers using contraceptives conditional on parity and sex composition of their children

Sibling sex composition	Fraction of mothers who use contraceptives by parity and sex composition of previous children	
	PDHS- 2007	PDHS-2013
Panel A. Families with one or more children		
(1) First boy	0.320	0.406
	(0.007)	(0.006)
(2) First girl	0.302	0.373
	(0.007)	(0.006)
Difference (1) – (2)	0.018*	0.031***
	(0.009)	(0.008)
Observations	8796	11965
Panel B. Families with two or more children		
(1) Second boy	0.362	0.427
	(0.008)	(0.007)
(2) Second girl	0.327	0.419
	(0.008)	(0.007)
Difference (1) – (2)	0.034***	-0.007
	(0.011)	(0.009)
(1) Two sons	0.362	0.429
	(0.010)	(0.009)
(2) Not two sons	0.339	0.421
	(0.006)	(0.005)
Difference (1) – (2)	0.023*	0.007
	(0.012)	(0.010)
(1) Two daughters	0.317	0.387
	(0.011)	(0.010)
(2) Not two daughters	0.355	0.434
	(0.006)	(0.005)
Difference (1) – (2)	-0.048***	-0.048***
	(0.013)	(0.011)
Observations	7375	1030
Panel C. Families with three or more children		
(1) Three sons	0.390	0.452
	(0.016)	(0.015)
(2) Other compositions	0.365	0.438
	(0.007)	(0.005)
Difference (1) – (2)	0.025	0.015
	(0.017)	(0.016)
(1) Three daughters	0.311	0.385
	(0.019)	(0.016)
(2) Other compositions	0.376	0.446
	(0.006)	(0.005)
Difference (1) – (2)	-0.064***	-0.061***
	(0.020)	(0.017)
Observations	5963	7947

Notes: * Indicates statistical significance at 10%. ** Indicates statistical significance at 5%. *** Indicates statistical significance at 1%. Standard errors are in parenthesis.

Appendix 1-2 Fraction of mothers want to have another child conditional on parity and sex composition of their children

	PDHS 2006-07		PDHS 2012-13	
	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

Notes: * Indicates statistical significance at 10%. ** Indicates statistical significance at 5%. *** Indicates statistical significance at 1%. Standard errors are in parenthesis.

Appendix 1-3 Fraction of mothers who had a boy conditional on ultrasound examination

	Fraction of women who had boy	
	PDHS 2007	PDHS 2013
Panel A: Whole sample		
(1) had ultrasound examination	0.539	0.519
	(0.013)	(0.007)
(2) no ultrasound examination	0.537	0.507
	(0.010)	(0.018)
Difference [(1)-(2)]	0.002	0.012
	(0.017)	(0.019)
Panel B: Urban sample		
(1) had ultrasound examination	0.552	0.500
	(0.014)	(0.020)
(2) no ultrasound examination	0.567	0.473
	(0.022)	(0.082)
Difference [(1)- (2)]	-0.015	0.026
	(0.027)	(0.084)
Panel C: Rural sample		
(1) had ultrasound examination	0.528	0.518
	(0.014)	(0.010)
(2) no ultrasound examination	0.520	0.529
	(0.016)	(0.022)
Difference [(1)- (2)]	0.008	-0.010
	(0.022)	(0.024)
Observations	3,524	5,550

Notes: data used in table come from Pakistan demographic and health surveys 2007 and 2013. Table reports information of women who had ultrasound examination before their last pregnancy. Standard errors are in the parenthesis.

Chapter 2. Son Preference, Family Size and Children's Educational Outcomes

2.1 Introduction

High level of fertility and population growth has been considered as a potential harm to economic growth particularly in developing countries. Ever since Malthus proposed a systematic theory of population in the late eighteenth century, there is a wide literature documented on the link between population and economic growth (Kelley 1988; Birdsall 1988; Pritchett 1994; Brander & Dowrick 1994; Kennedy 1998; Becker et.al 1999; Nayab 2006). Over the past few decades, a number of birth control policies have been formulated in the developing world[13] with the aim to reduce poverty, and increase the living standards of the population through better education and health services, and to ensure an inclusive economic development. This policy development has contributed to demographic transition in many countries around the world. Some countries have achieved dividend from these policies and enjoyed a remarkable trajectory of economic growth like East Asian countries including Taiwan, Singapore and South Korea (Bloom et.al 1998; Bloom & Williamson 2000). However, studies in the context of some other developing countries, such as Bangladesh, suggest that fertility decline cannot be regarded as a precondition for economic development (Kamal et.al 1994; Caldwell et.al 1999). The mixed results of these studies suggest that fertility decline can be viewed as a necessary condition but not a sufficient condition. There are complementarities in fertility decline and achieving an inclusive growth, and to achieve this equilibrium there is a need of better education and health services, and increased economic opportunities to transform the demographic bulge into a social and exceptional dividend. There is one association common from the initiatives undertaken for population control during the past few decades that, families with large number of children have

[13] Countries like Malaysia, Indonesia, Bangladesh, Tunisia, Mexico, China, India etc.

lower living standards. This is because of the budget constraints that make them trade-off between quantity of children and quality per each child.

Exploring whether family size is a central determinant of investment in children's human capital and their economic success is an issue of greater importance in population literature today. There are a number of studies have been documented in this area since Becker (1960) and Becker and Lewis (1973) and Becker and Tomes (1976) introduced standard quantity-quality model of fertility. According to these models, families face resource constraints which make them tradeoff between the number of children (quantity) and quality per each child. The more the number of children means the household resources will be allocated among many siblings in the family, thus contributing to lower investment on each child and/or lower quality of children. Research efforts have been made so far aimed at exploring the causal link between family size and children's quality, however, the results presented so far are mixed which we will explain in section 2.2.

In this chapter, we examined the relationship between family size and children's education, to test the empirical validity of quantity-quality trade off within families in Pakistan. Based on our discussions in previous chapter, one of the main reasons for larger families is the persistence of strong son preference in Pakistan. Women practice differential stopping rule to achieve their preferences for sons regardless of the family size. Building our basis on this behavior, we exploited son preference as an exogenous source of variation in family size and its effect on children's educational outcomes.

2.2 Background: Family Size and Children's Quality

Quality-Quantity tradeoff has attracted renewed interest in family size and human capital debate in the empirical literature since the last few decades (Blake 1989; Downey 1995; Angrist et.al 2010; Black et.al 2005; Haan 2005; Conley & Glauber 2006; Lu & Treiman 2008; Baez 2008; Lee 2008; Booth & Kee 2009; Kugler & Kumar 2015). These studies argued their findings based on the fundamental economic principle “tradeoff” that families face due to budget constraints. Most of the researches find a negative association between family size and children’s quality within countries and within households.

A wider range of empirical literature documented generally suggests a negative relationship between family size (quantity) and educational outcomes (child quality) (Rosenzweig & Wolpin 1980; Conley & Glauber 2006; Caceres-Delpiano 2006; Lee 2008; Li et.al 2008; Booth & Kee 2009; Kugler & Kumar 2015). These studies have established the causality between family size and children’s quality by exploiting natural occurrence of twin births and sibling sex composition as an exogenous source of variation in family size. Using Indian data, Rosenzweig & Wolpin (1980) used twin births as an instrument for fertility and suggested a negative relationship between family size and children’s quality. However, the sample size of the study was very small comprised of 1,633 households with only 25 twin pairs.

Some studies tried to disentangle birth order and family size effect. Conley (2004) used data from US census and estimated the effect of family size on private school attendance, and the probability of child is held back. He used first two same-sex children as an instrument for family size, parents with first two same sex children are more likely to have a third child. His findings suggest significant negative relationship between family size and private school attendance as well as the probability of child is held back. By further including first born and later born children, however, the effect was significant for later born children. In a recent study, Black et.al (2005) used a rich data set of entire population of Norway. They used twin birth as an exogenous source of variation in the family size, and finds a negative relationship between family size and children’s education, however, after including indicator for birth order the effect reduced to almost zero. Their findings suggest that family size itself has little impact on the quality of child, and impact only through the birth order effect.

Contrary to these findings, Booth & Kee (2009) used data from British Panel Household Survey and investigated the effect of family size and birth order on educational attainment by using twin births as an instrument for family size. Their results suggest that family size effect doesn't vanish after including indicator for birth order control, and found that family size has strong negative impact on educational attainment.

There are some studies who used son preference as an instrument for family size (Jensen 2002; Lee 2008; Kugler & Kumar 2015). Lee (2008) used sex of the first child as instrument for family size and its effect on education in South Korea. His findings suggest that family size has a strong negative effect on educational investment per child. Jensen (2002) and Kugler and Kumar (2013) used Indian data and investigated the effect of family size on educational attainment by using gender of the first kid as an exogenous variation in the family size. Since fetal sex determination and sex selective abortion is common in India, therefore they used restricted sample before the introduction of technology. Their findings suggest a significant negative association between family size and educational outcomes in India.

Nevertheless, there are some other studies that don't support the tradeoff between quantity and quality. These studies suggest an inverse relationship between family size and children's educational outcomes. For instance, Gomes (1984) used cross sectional data from rural Kenya and found that family size had no effect on children's educational achievements. Kessler (1991) used longitudinal data in US, and investigated the effect of family size and birth order on labor market outcomes. His results suggest that neither family size nor birth order has any effect on the level or growth of wages. There are some studies who suggest a negative relationship between family size and children's educational outcomes due to selection process. Parents with high cognitive abilities chose fewer children than parents with low cognitive abilities that make family size endogenous (Grotevant et.al

1977). Some studies tried to address this endogeneity through sibling fixed effect model (Guo & VanWey 1999). Their results suggest an insignificant relationship between family size and children's educational outcomes. However, the methodology (sibling fixed effect) they used cannot fully address the endogeneity due to parental choices that can adjust their behaviors in response to the quality of their earlier children, or other unobservable variables that vary over time. Angrist, Lavy and Schlosser (2005) exploit exogenous variation in family size by including both multiple births and sibling sex preferences using Israeli data, and found no evidence of the quantity-quality tradeoff.

In a nutshell, the empirical literature is mixed about the quantity-quality tradeoff. This study is contributing to the literature concerning quantity-quality trade off and finds exogenous variation in family size through sibling sex composition particularly in the context of son preference. This instrumental variable was first proposed by Angrist and Evans (1998) in their study of adults' labor market outcomes in United States. Conley and Glauber (2006) used this instrument for sibship size on boys' probability of private school attendance in United States. There are some other recent studies that have used sibling sex composition as an exogenous source of variation in family size. For instance, Goux and Maurin (2005) in their studies of overcrowded housing and children's educational performance, and Currie and Yelowitz (2000) used this instrument in their analysis of public housing and children's school performance. Sibling sex composition may help in mitigating the risks of biases that come from twin births where zero spacing in birth may put additional burden on family's resources (Angrist & Evans 1998; Conley & Glauber 2006). There is, however, some limitations of using same sex siblings i.e. parents can benefit from economies of scale particularly in schooling cost, then instrumental variable estimates might be biased (Rosenzweig & Wolpin 1980). However, some studies suggest that sisters raised with brothers perform better on measured educational outcomes than raised with any sister (see for example Butcher & Case 1994). Another worry is the availability of sex selection technology, where couples can chose the gender of the kids and achieve the desired sibling composition; in this case the IV estimates might be biased because it cannot hold the attributes of being random anymore.

This study makes an important contribution to the existing literature concerning quantity-quality trade off. Our work is the first to attempt this trade off in Pakistan. Investigating this tradeoff is important not only that Pakistan is the fifth most populous country of the world, but also it has the widest education inequalities, and hosts the second largest out of school children and third largest female illiterates worldwide (UNESCO 2012).

2.3 Data, sample selection and summary statistics

2.3.1 Data

The data employed in this study comes from Pakistan Social and Living Standards Measurement (PSLM) survey initiated by the Federal Bureau of Statistics in 2004. PSLM is a nationally representative cross sectional surveys that collect information from 18,000 households across the country. The survey collects rich information about demographic characteristics, education, health, income, and consumption and population welfare etc. PSLM collects information at district level and provincial level every alternative year. Provincial level surveys collect information on key social indicators as well as income and consumption. This study uses six waves of the PSLM from 2004 to 2014 which collects information on social indicators as well as income and consumption and forms a pooled cross section to have bigger sample and increase explanatory power on the outcomes of interest. One advantage of these surveys over other surveys is the income and expenditure data of each household which can help us generating socioeconomic conditions of the families for budget constraints function in the quantity-quality trade off. The survey provides detailed information about the household rosters and month of birth, year of birth, age and relationship to the head of the household. From the relationship to head of the household, the individuals are identified who are labelled as "son/daughter" and estimated the family size by counting the number of children in each household and merged this data with parent's information. Consequently, with this information in hand, we can accurately calculate the birth order and sex composition of the first, first two and three children for each family.

The sample is restricted to individuals who are either mother/father (head or spouse) or son/daughter in the household roster. Furthermore, the sample is restricted to households with at least two children residing in home, and there are no children other than the biological children of the parents in the household. There are no subfamilies included in the sample.[14] With given information about the relationship, I matched the children who are younger than 22 years of age present at home to their biological mothers between 21 years and 49 years of age. I excluded mothers less than 21 years of age because very few (less than 15 mothers) have two children.

The data provide rich information about education, literacy and numeracy of children and their parents. Main outcome of interest under this study are (i) primary school completion, (ii) secondary school completion, (iii) higher secondary school completion, and (iv) years of education. In Pakistan primary education (grade 1 to grade 5) starts at the age five and completes at age ten. Students complete their secondary education (grade 6 to grade 10) after securing Secondary School Certificate (SSC) from the provincial boards at the age of 16. Higher secondary education (grade 11 to grade 12) completes at the age of 18 years. The upper bound 21 is included because of delayed enrollment, grade repetition in lower level of schooling. The binary outcome variables included in the analysis are; whether a child has completed primary education, secondary education, and higher secondary

[14] For instance, son-in-law/daughter-in-law, grand-children, brother, brother-in-law etc. are excluded from the sample

education. Years of education is continuous variable representing years of education children between age 4 and age 21 have attained.

Furthermore, we used a set of control variables in our analysis including children age, gender, birth order, father and mother age, education and socioeconomic status of the households across regions and different period of times. Summary statistics of the data used in our analysis is discussed in below sections.

2.3.2 Summary Statistics

Summary statistics of fertility is presented in table 2-1. Fertility (number of children ever born) has been used as the primary variable of interest in this study. Similarly, using the gender of the first two children, we constructed the sibling sex composition as first two girls if families have oldest two children as girls. Summary statistics shows that number of children ever born to mothers with at least two children are 4.7 which is higher than other studies (see for example Angrist & Evans 1998; Conley & Glauber 2006) because of high fertility rate in Pakistan. About 87 percent have a third child indicated by variable more than two children. The composition of children with at least two children in the household is balanced with slight difference for boys, 51.9 percent for first male child and 26 percent for first two male children.

Table 2-2 provides summary statistics about children, parents and family background characteristics. Mean age of the children is 13 years. Almost 82 percent of the children have completed primary education, 41 percent have completed secondary education while 39 percent have completed higher secondary education in the sample. Mean years of education in the sample is 6 years for children younger than 22 years of age. Years of education of mother are less than father with 7.58 and 10.03 years respectively. Similarly, almost 33 percent of the sample comes from rural areas. About 13 percent of the households come from low income, 47 percent from middle income while 40 percent are from high income families.

2.4 Identification Strategy

Several population studies have identified son preference as a potential determinant of family size in Pakistan (Hussain et.al 2000; Sathar et.al 2015; Zaidi & Morgan 2016). Zaidi and Morgan (2016) in a recent study using demographic and health surveys suggested that, if families have daughter in their earlier parities they continue to produce children in the pursuit of sons. We have also provided evidence for this pattern in our previous chapter. In patriarchal societies like Pakistan, male paly a dominant role in decision making as well as have comparative advantage in labor market and job opportunities. Daughters on the other hand become part of the other family when they marry, therefore investment in their human capital are less as compared to sons.

Taking into account this differential behavior in Pakistani context, we used son preference 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 composition. Our analysis are based on the estimates that if families have the oldest two daughters, they will continue to have an additional child. In other words, we say that fertility of the families have been affected because of their preferences for boys. This identification strategy is similar to Angrist and Evans (1998) but they have used same sex as an instrument using data from US. Since Pakistani context is different based on evidence of strong son preference from population literature and our analysis in previous chapter, we believe that first two girls can be an influential source of exogenous variation in family size in Pakistan.

2.4.1 Instrument Relevance

In order for our instrument to be valid, it should satisfy two conditions i.e. the relevance condition and exclusion restrictions. The former condition requires that our instrument (first two daughters) should be strongly correlated with our endogenous variable (number of children in the family). This is empirically proven that estimation with weak instruments may perform poorer than OLS (Stock et.al 2002). Table 2-3 reports this correlation in terms of the effect of sibling sex composition on fertility. Panel A of table 2-3 reports families with at least one child who had another child based on the sex of previous child. The table reports that, 48.1 percent of the families have a first born girl while 52 percent have a first born boy. It is evident from the table (column 3) that families with first born girl are more likely to have second child compared to those with first born boy. The difference is statistically significant at one percentage point.

Panel B of table 2-3 reports families with at least two children who had a third child based on the sex of previous two children. First two rows represent the sibling sex composition if families have second born boy or second born girl. Next four rows represent sex composition, whether families have first two sons or first two daughters compared to any other compositions. The last two rows represent mixed and same sex siblings. As evident from the table, having daughter in the parity increases the probability of another child. In the first two rows, families with a second born daughter increases the likelihood of another child compared to second born son.

Similarly, families with first two children of the same sex are more likely to have a third child compared to mixed sex siblings. 90 percent of the families with same sex sibling composition have a third child compared to 89 percent of those who have mixed sex sibling composition. However, the difference is small suggesting that variations in the same sex sibling come from oldest two girls.

Moreover, the probability of additional childbearing increases with oldest two daughters compared to other compositions. This difference is strong and statistically significant. More precisely, 91 percent of the families with first two daughters are more likely to have a third child compared to 86.6 percent of families with any other compositions.

2.4.2 Exclusion Restrictions

In order for our analysis to generate unbiased estimates, we must address some concerns regarding our identification strategy. First, if couples practice sex selective abortions and can chose the gender of the child, then our estimates can yield biased results. Second, some researchers argue that same sex siblings can produce gains for families (economies of scale) which can reduce investment per child. Therefore, if there are returns to scale because of same sex siblings in the family, then IV estimates will be biased (Rosenzweig & Wolpin 1980). We have explained this with reference to Butcher and Case (1994) study in US in above section.

Our approach to the first concern is based on theoretical and empirical evidence. Pakistan has a strict abortion policy since its independence in 1947. The law states that “abortion is illegal and a crime until and unless performed to save a pregnant woman’s life”, it further states under article 312 that “anyone who performed illegal abortion will be subject to imprisonment for three years and/or fine”.[15] The imprisonment is subject to seven years, if a woman caused herself to miscarry a child or “quick with child”[16]. Further explanations about this part is discussed in detail in our preceding chapter under sex selection.

We also checked whether ultrasound examination help women to choose the gender of the child. The data under analysis provide no information about access to ultrasound technology, however,

[15] Extract from Population policy of Pakistan, Population division of economic and social affairs, United Nations
[16] A stage of pregnancy when movements of the fetus have been felt

PDHS 2007 and 2013 provide detailed information about ultrasound examination before last birth. We used this data to see, whether ultrasound examination help women to achieve their son preferences. We restricted the sample of women who had ultrasound examination prior to their last birth. We examined this effect at various birth order i.e. if the last birth was women's first, second, third or fourth child. After controlling for parental characteristics, regions, year of birth and survey years fixed effect, we find no evidence of sex selection. We further restricted our sample to urban residents and employed same controls, but the results didn't change. These results are presented in table 2-4.

Another concern for exclusion restriction is correlation of our instrument with demographic characteristics. To investigate, whether our instrument (first two daughters) is likely exogenous, we run a regression of demographic characteristics on our instrument. If our instrument affects educational outcomes only through its effect on family size, then there should be no correlation between our instrument and demographic characteristics. Table 2-5 shows that all explanatory variables are insignificant except mother's education which is partially significant at 10 percent. The more educated the mother is, the higher the probability to have first two daughters. However, this wouldn't be a big issue as we have included a set of controls including mother's education in our main analysis. Based on the findings from table 2-5, it is reasonable to argue that our instrument is likely exogenous.

2.5 Econometric Framework

2.5.1 Ordinary Least Squares (OLS) Estimates

In this section, we presented the OLS estimates of fertility on educational outcomes by using the following linear model;

$$EDU_{ijt} = \beta_0 + \beta_1 F_{ijt} + \varepsilon_{ijt} \qquad (1)$$

EDU_{ijt} is the educational outcomes of individual i residing in family j observed in survey year t period. F_{ijt} is the endogenous fertility variable representing number of children ever born and ε_{ijt} is the error term. Estimating this equation by OLS will likely produce biased results, first because educational outcomes and fertility is jointly determined. Second, omitted variable such as parental characteristics and preferences are plausibly correlated with both educational outcomes and fertility. Results from OLS estimates are presented in table 2-6, and explained in results section below.

2.5.2 Instrumental Variables Estimates

This study will use two approaches to disentangle the causal link between family size and educational outcomes. In the first place, we included control for children characteristics (age, gender, and birth order), parent's characteristics (age, education) and family background characteristics (socioeconomic status, place of residence) to see the actual effect of family size on educational attainment in the presence of these observable characteristics. Secondly, we used two-stage-least squares (2SLS) by using first two daughters as an exogenous source of variation in the family size. The families with the oldest two girls will continue to have an additional child in the pursuit of son. The first stage equation is given as follow;

$$F_{ijt} = \varphi_0 + \varphi_1 TWOGIRLS_{ijt} + \delta X_{ijt} + \mu_s + \tau_j + \vartheta_{ijt} \qquad (2)$$

F_{ijt} is the fertility variable representing the number of children ever born in family j observed in survey year t. $TWOGIRLS_{ijt}$ is a dummy variable equal to one if a family has oldest two children as girls and zero otherwise (other composition). X_{ijt} is a vector of control variables including children characteristics, parent's characteristics, and family background characteristics. μ_s is survey year fixed effect while τ_j is regions fixed effect.

The second stage equation given as follow;

$$EDU_{ijt} = \pi_0 + \pi_1 F_{ijt} + \gamma X_{ijt} + \mu_s + \tau_j + \varepsilon_{ijt} \qquad (3)$$

EDU_{ijt} is outcome of interest whether a child completed primary, secondary and higher secondary education, and years of education. Only years of education is continuous variable and all the rest of the outcomes are binary.

2.6 Results

Table 2-6 and Table 2-7 report OLS estimates on completion of primary, secondary, higher secondary and years of education by controlling for children, parents, socioeconomic characteristics, regions and years fixed effect . The results are aligned with the findings of previous studies, suggesting negative correlation between family size and children's quality. Column (1) and column (4) of table 2-6 report results of primary and secondary completion with controlling only for children's characteristics. The results suggest that one additional child in the family reduces the probability of primary completion by 1 percentage point secondary completion by 2.5 percentage points. In Column (2), (3), (5) and (6) we control for parents age, education and income, the results become almost zero and insignificant for primary while fall by half (1.2 percentage points) for secondary completion suggesting trade-off for less educated and poor families.

Table 2-7 reports results of OLS estimates of completion of higher secondary education, and years of education. Column (1) and column (4) of table 2-7 report results of higher secondary completion, and years of education with controlling only for children's characteristics. The results in column (1) suggest that one additional child in the family reduces the probability of higher secondary completion by 3.8 percentage points and further falls to 2.2 percentage points (column (2) and column (3)) after controlling for parental characteristics, income and regions and survey year fixed effect. Similarly, in column (4) point estimate (-15.7) suggest that families with six more siblings end up with one year less education. However, after controlling for parental characteristics, socioeconomic status and regions and year fixed effect the effect falls and become insignificant. These results suggest that children from educated and richer families are more likely to complete their education.

However, as discussed previously in this paper that OLS are more likely to create biased estimates due to preferences (son preference in our case) of families which makes variable *number of children* endogenous.

In Table 2-8, we instrumented the endogenous family size with first two daughters and estimated its effect on children's probability of primary and secondary completion. First stage results are presented in column (1) to column (6) of Panel B. The first stage results are strong and significant at 1 percent level and has expected sign suggesting positive effect on fertility. The F-*statistics* reported in the last two rows of Panel B is greater than 10 suggesting that our estimates are not confounded by weak IV problems. Column (1) to column (3) of Panel A report 2SLS results of fertility on children's probability of completion of primary education. Results in column (1) suggest that one additional child in the family reduces the probability to complete primary education by 21.7 percentage points after controlling for children age, gender and birth order. Results are strong and significant with slight decrease of 16.4 percentage points in column (3) after controlling for parental characteristics, family income and regions and years fixed effect. Endogeneity test statistics are reported in all regressions suggesting that OLS estimates are inconsistent. Column (4) to column (6) of Panel A report results on the probability that a child has completed secondary education. Results suggest a negative relationship between family size and secondary completion. More specifically one more child in the family decreases the probability of secondary completion by 22.8 percentage points after controlling for children characteristics. Point estimates fall to 15 percentage points after controlling for parental characteristics, family income and regions and years fixed effect. Secondary completion is subject to passing the examinations administered by provincial boards and after qualifying the exams students are awarded Secondary School Certificates (SSC). Passing this exam is considered important for admissions in colleges. Results from column (4) to column (6) suggests that children from educated and comparatively rich parents are less likely to suffer from trade-off compared to less educated and poor families.

Table 2-9 reports IV estimates of family size on completed higher secondary and years of education. First stage results are presented in column (1) to (6) of Panel. B. First stage has the expected sign and significant at 1 percent level. The F-statistics reported in the last two rows of Panel B is greater than 10. Column (1) to column (3) of Panel A report 2SLS results of family size on children's probability of completion of higher secondary education. Results for secondary education is insignificant although the sign is negative as expected. Higher secondary education is usually attained in either higher secondary schools or colleges and needs financial support which restrain families' resources. Other explanation could be that children becomes old enough resulting in less support from their families and joins labor force to become counterpart in household income particularly in large families. Column (4) to column (6) report results of family size on years of education. Results in column (1) suggest a decrease of almost 2 years in education with one more child in the family after controlling for children age, gender and birth order. Results change slightly and fall to almost 1.71 years in column (6) when we control for parental characteristics, socioeconomic status of the families and regions and years fixed effect. The F-*statistics* for the instrument is larger than 10 and endogeneity test suggest that OLS is inconsistent. The trade-off is slightly less for educated and comparatively richer households but still it is big enough in magnitude. Putting in another words, one more child reduces the quality (years of education) by almost two years validating the quality-quantity trade off in Pakistani families.

In table 2-10, we turn our discussion to the birth order effect. The birth order effect is positive and statistically significant same as reported in previous tables, which suggest that younger children have on average more likely to complete primary and secondary education and have on average more years of education than older children. In societies like Pakistan, sons are preferred based on the financial security to their parents to contribute in the parent's production function (Neher 1971; Cochrane 1975; Oliveira 2016). This intergenerational transfer compensate younger siblings to have better educational outcomes compared to older siblings. As the price of children rises in the long run, expenditure per child or parental investment diverts to children who have greater utility (Becker 1960). According to Basu and de Jong (2007), when couple practice differential stopping rule, boys are born relatively younger in the family. Therefore, in a country with strong son preference and widest education inequalities, we expect that intergenerational transfer will divert to boys only. In table 2-10, we interacted female with the birth order to investigate the educational outcomes of younger born daughters. The results suggest that younger born daughters perform worse on measured educational indicators compared to their brothers, suggesting the differential treatment of gender within families in Pakistan.

Moreover, our identification is based on the fact that first two daughters change the fertility preferences of families to go for another child, to achieve their desires for sons. Then in the context of son preference, families with first two sons should less likely continue their fertility, and the effect of two sons should go in opposite direction i.e. reduction in family size. In order to check the robustness of our main identification (first two daughters), we used first two sons as an instrument for family size. By using two sons as an instrument, we expect a mirror image of two daughters' instrumental variable regression. We have reported the findings from this regression in table 2-11.

As shown in table 2-11, we instrumented our endogenous family size with the first two sons rather than first two daughters. Panel B reports the first stage results, and as expected we have a sign switch pattern. First two sons have a strong negative effect on the family size. F-statistics in all three regressions is greater than 10 suggesting the strength of our instrument i.e. first two sons. Panel A reports the second stage results of family size on measured educational outcomes. Family size has a negative effect on all measured educational outcomes i.e. completed primary, secondary and years of education.

2.7 Conclusion

Testing the theoretical and empirical validity of the tradeoff between number of children and investment in their education and health has attracted great attention in the policy circle nowadays. Using nationally representative data from Pakistan Social and Living Standards Measurement (PSLM), we tested the empirical validity of quantity-quality tradeoff. We found strong evidence of son preference in Pakistani families. Women continue to produce children until their desired number of sons is achieved. We argued that if women face female kids in the earlier parity, they will continue childbearing in search of son. Using first two born daughters as an exogenous source of variation in family size, our results suggest that an extra child in the family reduces the probability of a child to complete primary education by 16.4 percentage points, and secondary education by 15 percentage points. Our results suggest that one additional child in the family reduces years of education by almost 2 years validating the validity of quantity-quality tradeoff within families in Pakistan. Furthermore, our findings suggest that parental investment reduces for younger born daughters compared to younger born sons. Younger born daughters on average perform worse on measured educational indicators compared to their brothers.

The results presented in this paper present strong support for Becker quantity-quality tradeoff and its prevalence in Pakistan. There exist a tradeoff between number of children and investment in their human capital within Pakistani families. Finding provides strong evidence for developing countries, and particularly for countries where strong pro-male biases exist. 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 socioeconomic development. From a policy perspective, it is important to know the extent population control policies/programs can improve the quality of human capital and labor force for a country.

Our next chapter focuses on one of the population control program called Pakistan's lady health workers program (LHWP) implemented through community driven strategies. This program started in 1994, with the aim to improve family planning services and reproductive health care among rural women. Main motivation behind this study is to evaluate the effectiveness of LHWP in terms of behavioral change in fertility and reproductive health care, and suggest relevant policy implications.

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Table 2.4-1: Descriptive statistics of two or more children born to mothers aged 21 to 49 years of age

Variables	Mean
Fertility (Number of children ever born)	4.775
	(1.558)
More than two children (=1 if three or more children)	0.875
	(0.330)
First child boy	0.519
	(0.499)
First child girl	0.480
	(0.499)
Second child boy	0.501
	(0.500)
First two girls	0.238
	(0.426)
First two boys	0.261
	(0.458)
Same sex (=1 if first two children of the same gender)	0.498
	(0.500)
Mixed sex (=1 if first two children of opposite gender)	0.502
	(0.500)
Observations	3,056

Notes: Sample include children younger than 22 years born to mothers 21 to 49 years of age. Standard deviations are in parenthesis.

Table 2.4-2: Descriptive statistics of children and parental characteristics

Variables	Observations	Mean
Child age	15374	13.56
		(4.546)
Completed primary (age>=10)	12695	0.817
		(0.386)
Completed secondary (age>=15)	10881	0.406
		(0.491)
Completed higher secondary (age>=17)	5139	0.395
		(0.489)
Years of education	15068	5.905
		(3.713)
Mother's age	15374	39.53
		(5.709)
Father's age	15374	44.42
		(6.668)
Mother's years of education	15374	7.585
		(3.285)
Father's years of education	13501	10.03
		(3.679)
Low income	15374	0.126
		(0.332)
Middle income	15374	0.470
		(0.499)
High income	15374	0.402
		(0.490)
Rural	15374	0.327
		(0.469)

Notes: Sample include children younger than 22 years born to mothers 21 to 49 years of age. Standard deviations are presented in parenthesis.

Table 2.4-3 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		
One boy	0.520	0.959
		(0.001)
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 third child conditional on parity and sex composition of 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	0.244	0.909
		(0.003)
Not two daughters	0.759	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	

Notes: * Indicates statistical significance at 10%. ** Indicates statistical significance at 5%. *** Indicates statistical significance at 1%. Standard errors are in parenthesis.

Table 2.4-4 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	-0.022	-0.061	0.078
	(0.053)	(0.058)	(0.066)	(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	0.152	0.024	0.065
	(0.087)	(0.095)	(0.107)	(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

Notes: Dependent variable is gender (Male=1) at first birth, second birth, third birth and fourth and onward births. Table reports whether ultrasound examination impact sex selection at first, second, third and fourth birth order. Data used from Pakistan Demographic Health Survey (DHS) 2007 and 2013. Robust standard errors are in the parenthesis. Parent's controls include parent's age, education and socioeconomic status. Regions, children's year of birth and survey years fixed effects are included.

Table 2.4-5 Regression of first two daughters on demographic characteristics

	First two daughters
Father's years of education	-0.002
	(0.002)
Mother's years of education	0.004*
	(0.002)
Father's age	-0.002
	(0.002)
Mother's age	-0.000
	(0.002)
Middle income	0.015
	(0.022)
High income	0.019
	(0.024)
Rural	0.011
	(0.016)
Region dummies	Yes
Survey year dummies	Yes
Observations	11926

Notes: Dependent variable is first two daughters. *, **, and *** represent significance levels of 10, 5, and 1 percent. Robust standard errors are reported in parenthesis. Data used come from Pakistan Social and Living Standards Measurement Surveys (PSLM) 2004-2014.

Table 2.4-6 OLS estimates of number of children on completed primary and secondary education

	Completed Primary			Completed Secondary		
	(1)	(2)	(3)	(4)	(5)	(6)
Number of children	-0.010***	-0.001	0.000	-0.025***	-0.012***	-0.012***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Child age	0.048***	0.042***	0.043***	0.081***	0.082***	0.083***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	0.032***	0.029***	0.028***	0.096***	0.080***	0.081***
	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)	(0.008)
Birth order	0.010***	-0.004	-0.005	0.012***	0.002	-0.001
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
Father's education		0.004***	0.004***		0.013***	0.012***
		(0.001)	(0.001)		(0.001)	(0.001)
Mother's education		0.007***	0.007***		0.016***	0.016***
		(0.001)	(0.001)		(0.001)	(0.001)
Father's age		0.002**	0.002**		0.001	0.001
		(0.001)	(0.001)		(0.001)	(0.001)
Mother's age		0.004***	0.004***		-0.001	-0.000
		(0.001)	(0.001)		(0.001)	(0.001)
Income		0.012**	0.011**		0.034***	0.034***
		(0.005)	(0.005)		(0.007)	(0.007)
Regions FE	No	No	Yes	No	No	Yes
Survey years 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

Notes: *, **, and *** represent significance levels of 10, 5, and 1 percent. Robust standard errors are presented in parenthesis. Number of children represented two or more children younger than 22 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 have completed (grade 1 to grade 5), and (grade 6 to grade 10) respectively according to education system in Pakistan. Regions and survey years fixed effects are included.

Table 2.4-7 OLS estimates of number of children on completed higher secondary and years of education

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

Notes: *, **, and *** represent significance levels of 10, 5, and 1 percent. Number of children represents two or more children younger than 22 years born to mothers aged 21 to 49 years of age. Robust standard errors are in parenthesis. Completed higher secondary education is binary takes value=1 if a child have completed grade 11 to grade 12 attained in junior college. Years of education is continuous represent years of education an individual has attained. Regions and survey years fixed effects are included.

Table 2.4-8 IV estimates of Number of children on 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	-0.217**	-0.155**	-0.164**	-0.228**	-0.150*	-0.150*
	(0.089)	(0.074)	(0.075)	(0.093)	(0.081)	(0.082)
Child age	0.062***	0.059***	0.059***	0.093***	0.096***	0.095***
	(0.006)	(0.009)	(0.008)	(0.006)	(0.009)	(0.008)
Female	0.076***	0.062***	0.065***	0.142***	0.113***	0.114***
	(0.021)	(0.017)	(0.018)	(0.023)	(0.021)	(0.022)
Birth order	0.121**	0.091**	0.094**	0.115**	0.082*	0.078*
	(0.048)	(0.046)	(0.046)	(0.048)	(0.047)	(0.047)
Father's education		0.002	0.002		0.012***	0.010***
		(0.001)	(0.002)		(0.002)	(0.002)
Mother's education		-0.007	-0.008		0.003	0.003
		(0.007)	(0.007)		(0.008)	(0.008)
Father's age		-0.001	-0.001		-0.001	-0.001
		(0.002)	(0.002)		(0.002)	(0.002)
Mother's age		-0.002	-0.002		-0.006*	-0.005
		(0.003)	(0.003)		(0.004)	(0.003)
Income		0.026***	0.025***		0.049***	0.048***
		(0.010)	(0.009)		(0.012)	(0.011)
Regions FE	No	No	Yes	No	No	Yes
Survey year FE	No	No	Yes	No	No	Yes
Observations	12695	11126	11126	10881	9511	9511
R^2	-0.459	-0.110	-0.152	-0.086	0.229	0.235
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 number of children						
First born two daughters	0.114***	0.125***	0.125***	0.131***	0.139***	0.137***
	(0.034)	(0.035)	(0.035)	(0.038)	(0.039)	(0.039)
F-stats	10.90	12.16	12.52	11.87	12.26	12.24
p-value	0.001	0.000	0.000	0.000	0.000	0.000

Notes: *, **, and *** represent significance levels of 10, 5, and 1 percent. Number of children represents two or more children younger than 22 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 have completed (grade 1 to grade 5), and (grade 6 to grade 10) respectively according to education system in Pakistan. Regions and survey years fixed effects are included.

Table 2.4-9 IV estimates of Number of children on completed secondary and years of education

	Completed Higher Secondary			Years of Education		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Two-stage Least Square Estimates						
Number of children	-0.089	-0.087	-0.080	-2.222**	-1.432**	-1.718**
	(0.078)	(0.070)	(0.069)	(1.180)	(0.783)	(0.842)
Child age	0.059***	0.057***	0.056***	0.889***	0.868***	0.875***
	(0.005)	(0.007)	(0.007)	(0.112)	(0.102)	(0.096)
Female	0.158***	0.134***	0.137***	0.919***	0.661***	0.721***
	(0.016)	(0.018)	(0.020)	(0.246)	(0.169)	(0.187)
Birth order	0.039	0.041	0.033	1.567**	1.099**	1.181**
	(0.040)	(0.039)	(0.037)	(0.708)	(0.528)	(0.559)
Father's education		0.026***	0.023***		0.105***	0.085***
		(0.003)	(0.003)		(0.011)	(0.015)
Mother's education		0.019**	0.020**		0.051	0.034
		(0.008)	(0.008)		(0.067)	(0.069)
Father's age		0.000	0.000		-0.004	-0.010
		(0.002)	(0.002)		(0.014)	(0.015)
Mother's age		-0.008**	-0.007*		-0.061**	-0.055**
		(0.004)	(0.004)		(0.029)	(0.028)
Income		0.084***	0.085***		0.059	0.045
		(0.017)	(0.017)		(0.072)	(0.071)
Regions FE	No	No	Yes	No	No	Yes
Survey years FE	No	No	Yes	No	No	Yes
Observations	5139	4472	4472	15066	13228	13228
R^2	0.060	0.166	0.185	-0.095	0.429	0.372
Hausman test of Endogeneity						
Chi-squared statistics	16.85	5.353	3.290	12.50	12.93	9.801
p-value	0.000	0.020	0.069	0.000	0.000	0.001
Panel B: First-stage results for number of children						
First born two daughters	0.208***	0.236***	0.238***	0.091***	0.102***	0.105***
	(0.058)	(0.060)	(0.059)	(0.030)	(0.031)	(0.030)
F-stats	12.84	15.47	15.84	8.56	10.75	10.57
p-value	0.000	0.000	0.000	0.003	0.001	0.001

Notes: *, **, and *** represent significance levels of 10, 5, and 1 percent. Number of children represents two or more children younger than 22 years born to mothers aged 21 to 49 years of age. Robust standard errors are presented in parenthesis. Completed higher secondary education is binary takes value=1 if a child have completed grade 11 to grade 12 attained in junior college. Years of education is continuous represent years of education an individual has attained. Regions and survey years fixed effects are included.

Table 2.4-10 IV estimates (academic risks of younger children)

	Completed Primary	Completed Secondary	Years of Education
	(1)	(2)	(3)
Panel A: Two-stage Least Squares Estimates			
Number of children	-0.139**	-0.131*	-1.452*
	(0.068)	(0.077)	(0.743)
Child age	0.057***	0.094***	0.846***
	(0.007)	(0.007)	(0.084)
Female	0.101***	0.145***	0.989***
	(0.024)	(0.028)	(0.216)
Birth order	0.089**	0.076*	1.075**
	(0.043)	(0.045)	(0.501)
Female × birth order	-0.019***	-0.017***	-0.143***
	(0.006)	(0.007)	(0.041)
Father's education	0.002	0.010***	0.088***
	(0.002)	(0.002)	(0.014)
Mother's education	-0.006	0.005	0.056
	(0.007)	(0.008)	(0.061)
Father's age	-0.001	-0.001	-0.005
	(0.001)	(0.002)	(0.014)
Mother's age	-0.001	-0.005	-0.047*
	(0.003)	(0.003)	(0.025)
Income	0.023***	0.046***	0.030
	(0.008)	(0.011)	(0.064)
Regions FE	Yes	Yes	Yes
Survey years FE	Yes	Yes	Yes
Observations	11126	9511	13228
R^2	-0.033	0.281	0.469
Panel B:First-stage results for number of children			
First born two daughters	0.131***	0.142***	0.098***
	(0.035)	(0.039)	(0.031)
F-stats	13.48	12.81	8.28
p-value	0.000	0.000	0.004

Notes: *, **, and *** represent significance levels of 10, 5, and 1 percent. Number of children represents two or more children younger than 22 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 have completed grade 1 to grade 5, and grade 6 to grade 10 respectively according to education system in Pakistan. Years of education is continuous represent years of education an individual has attained. Regions and survey years fixed effects are included.

Table 2.4-11 IV estimates of children's educational outcomes (using first two boys as instrument)

	Completed Primary	Completed Secondary	Years of Education
	(1)	(2)	(3)
Panel A: Two-stage Least Square Estimates			
Number of children	-0.085*	-0.064*	-1.024**
	(0.051)	(0.036)	(0.467)
Child age	0.051***	0.087***	0.796***
	(0.005)	(0.005)	(0.053)
Female	0.047***	0.093***	0.574***
	(0.013)	(0.016)	(0.109)
Birth order	0.046	0.029	0.717**
	(0.031)	(0.032)	(0.310)
Father's education	0.003**	0.011***	0.095***
	(0.001)	(0.002)	(0.010)
Mother's education	-0.001	0.011**	0.091**
	(0.005)	(0.005)	(0.039)
Father's age	0.000	0.000	0.002
	(0.001)	(0.001)	(0.010)
Mother's age	0.001	-0.002	-0.034**
	(0.002)	(0.002)	(0.016)
Income	0.018**	0.040***	0.001
	(0.007)	(0.009)	(0.049)
Regions FE	Yes	Yes	Yes
Survey years FE	Yes	Yes	Yes
Observations	11126	9511	13228
R^2	0.158	0.392	0.591
Panel B: First-stage results for number of children			
First born two sons	-0.148***	-0.163***	-0.116***
	(0.033)	(0.035)	(0.029)
F-stats	20.43	20.48	16.06
P-value	0.000	0.000	0.000

Notes: *, **, and *** represent significance levels of 10, 5, and 1 percent. Number of children represents two or more children younger than 22 years born to mothers aged 21 to 49 years of age. Instrumental variable used is first two sons. Robust standard errors are presented in parenthesis. Completed primary education and secondary education are binary takes value=1 if an individual have completed grade 1 to grade 5, and grade 6 to grade 10 respectively. According to education system in Pakistan. Years of education is continuous represent years of education an individual has attained. Regions and survey years fixed effects are included.

Chapter 3. Evaluation of Lady Health Worker Program (LHWP) in Pakistan

3.1 Introduction

The presence of barriers in implementing family planning programs has contributed to a wider range of research since 1960, when it started in developing countries (Freedman & Berelson 1976; Bertrand et.al 1995; Stephenson & Hennink 2004; Cleland et.al 2006). Although considerable progress has been witnessed as a result of these programs, there still exist large variations in fertility across countries. These variations can be categorized into socio-cultural, economic and religious norms that vary across contexts. Some countries started family planning programs earlier, but failed to achieve the desired outcomes mainly because of coercion and poor quality of services (Cleland et.al 2006). Being one of the first countries in adopting a population policy in 1960[17], Pakistan's fertility remained higher than average compared to other countries in the region (Figure 3-1). Since 1990s, however, there is a noticeable improvement observed in the fertility decline, immunization and reproductive health care (see for example; Douthwaite & Ward 2005; Khan & Khan 2012; Closser & Jooma 2013; Afzal et.al 2016; Black et.al 2016). During this arena, family planning programs were implemented more through community driven strategies. These interventions helped in mitigating cultural and religious obstacles faced by Pakistan's family planning programs between 1960 and late 1980s (Sathar 2001).

Based on our analysis in chapter one and chapter two, we argued that fertility is costly and it creates quantity-quality trade off within families in Pakistan. If children from smaller families perform better than children from larger families, then there is a need to introduce/revisit programs targeting fertility.

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[17] Pakistan Population Council (2001)

In this chapter, we focused our discussion on a family planning program implemented through lady health workers in Pakistan, henceforth Lady Health Worker Program (LHWP). To what extent this program changed women's reproductive behavior, particularly about their fertility preferences and reproductive health care? Also, it is important to see how family planning programs operate and endeavor in a country with strong patriarchy/son preferences. In the following of this chapter, we have presented a brief overview of LHWP, and our main findings by evaluating this program in rural Pakistan.

3.2 Lady Health Worker (LHW) Program

Since its inception in 1947, Pakistan's population increased significantly at a rate of 2.7 percent per year until 1960. To address the challenges of population growth, government of Pakistan formulated a national population policy in 1960, with main focus on family planning services. This policy became a milestone for the future family planning programs in Pakistan (Khan 1996). However, this policy couldn't succeed in controlling the population growth till late 1980. During this period, the population growth rate increased to 3.1 percent per year, and total fertility rate continued to increase between six and seven births per woman (Sathar 2001). In 1990, government started a village-based community health worker program to provide family planning services to local communities. These programs had two main features. First, including hiring of local married women. Second, mass media campaigns though radio, television and newspapers to create wider spread awareness about family planning. This program was further strengthened with the introduction of lady health workers program in 1994.

Lady Health Worker Program (LHWP) was initiated by the government of Pakistan under its eighth five years plan (1993-98). The program was materialized after the Prime Minister, Benazir Bhutto's commitment during International Conference on Population and Development (ICPD) in Cairo in

1994. In 1994, Ministry of Health (MoH) initiated the cadre of lady health workers (LHWs), to provide health services to communities at their doorsteps mostly in rural areas. According to WHO (2014), approximately 75 percent of the population served by LHWs live in rural areas. A number of reasons could be attributed to targeting rural areas under LHWP. First, rural area constitute 68 percent of the population in Pakistan[18]. Second, women have limited access to family planning and health services (Douthwaite & Ward 2005; Gupta 2013). Third, even if these services are available, women cannot access due to high illiteracy (Khan 1999; Sultan 2002; Mustafa et.al 2015).

At the outset of implementation, program recruited about 30,000 LHWs (Cleland et.al 2002). The program played significant role in Pakistan's progress towards MDGs, particularly in strengthening primary and universal health care (Douthwaite & Ward 2005; Zhu et.al 2014). These LHWs come from local communities, navigate local customs, and speak local languages, which enable them to interact with local population more effectively.[19] The minimum eligibility criteria for LHWs is eight years of education, and they must be recommended by the local community. After their induction, they receive 15 months training, including a 3 months in class training and 12 months on the job training from local government health facility (Bhutta et.al 2008). Each LHW is responsible for about 200 families (approximately 1000 population) in her area. There are currently 110,000 LHWs deployed in Pakistan, making it the largest worldwide (Peer for Progress 2013). These LHWs deliver services concerning family planning, health promotion and immunization.

The primary aim of initiating the LHWP was to bridge the urban rural disparities, and strengthen and equip the weak health system in rural areas. In a country, where family planning programs in the

[18] According to Pakistan Bureau of Statistics (PBS), 2017

[19] Given the fact that more than half of the women are illiterate (UNESCO 2012), LHWP bridged information gaps through peer support (Peer for Progress 2013).

past have been undermined by religious influences[20], there were raising concerns that the program wouldn't be able to achieve the desired outcomes. Social and religious norms are even stronger in rural areas, and most of the women find it difficult to access family planning services or visit health facilities (Sathar & Kazi 1997; Douthwaite & Ward 2005). Being mindful of these obstacles, LHWP is tailored with some salient features that facilitated the involvement of men and village elders, and ensured their participation in program implementation. First, the recruitment of LHWs is made conditional with the community recommendation. The main aim was to involve communities, and ensure their ownership in program activities. Second, recruited LHWs formed village level committees with the involvement of local community members alongside members from local council administration, and local health departments. This community driven strategy helped in advocacy and campaigns about family planning and reproductive health care. On the other hand, LWHP empowered rural women and presented them as role model in the communities in the shape of lady health workers.

3.3 Review of Previous Literature

Two views about fertility have become the central part of debate in public policy discussions, family planning gaps and differences in desires for children (Becker 1996; Pritchett 1994). The view about gaps in family planning suggest that variation in fertility is largely driven by inadequate contraception due to lack of accessibility, availability, and knowledge and cost. On the other hand, the view about the desire for children suggest that differences in fertility is caused by differential demand for achieving target number of children.

[20] See Ayesha Khan (1996) work on "Policy making in Pakistan's population program"

Pritchett (1994) argued that the "desired fertility"[21] view is valid, and it explains a large variation in fertility across countries. Using cross country regressions, his results suggests that 90 percent of variation in fertility is explained by desired fertility, and a very small effect can be attributed to family planning services. He further argued that "unwanted fertility" or "excess fertility" has little effect on fertility and that it is the desire of having more children that influence fertility. On the other hand, Bongaarts (1994) argued in his paper, that one in four births in the developing world (excluding china) is unwanted, and this trend is declining in most societies because of family planning efforts. By simply presenting lack of association between unwanted fertility and total fertility might have underestimated the development of family planning programs. Other concerns associated with Pritchett's findings is the economic development, which reinforces desired fertility and establish trends among couples to have fewer children. When the desire for children declines, couples stop childbearing at the earlier stage and have more time to expose to risk of pregnancy. To avoid this risk, effective family planning programs can play a substantial role (Bongaarts 1994).

Over the past few decades, a number of family planning programs were implemented in developing countries, using various modes of service delivery. These programs have played vital role in increasing women's knowledge about family planning, for example, in Bangaladesh (Cleland et.al 1994), Nigeria (Bankole et.al 1996), Nepal (Storey et.al 1999), Tanzania (Jato et.al 1999), Malawi (Kane et.al 1999), and Indonesia (Jayachandran 2014). Among these programs, one of the most influential family program was implemented in Matlab district of Bangladesh. This program significantly contributed to increase in the use of contraceptives by mitigating the fear of side effects through information dissemination (Cleland et.al 1994). Some other studies argued that family

[2121] According to Pritchett (1994), women who wants more children, have more children and this is the main determinant of fertility in developing world.

planning workers worked as agents of change for fertility decline in Bangladesh (Simons et.al 1988; Simons 1996). Their qualitative study suggests that family planning workers played a role beyond the simple access to contraceptives, rather they changed the traditional norms about family size by making themselves as a trusted friend with the local communities. According to Caldwell et.al (2002), family planning program in Bangladesh resulted the fall in fertility from 6.3 children to 3.3 children in 20 years.

There are some studies, which have investigated the lady health workers program in Pakistan (Cernada et al. 1993; Khan 1999; Fikree et.al 2001; Cleland et.al 2002; Douthwaite & Ward 2005). In Cleland et.al (2002) study, they examined the uptake of modern contraceptives among rural women in Pakistan. They restricted their sample to women who live within 5 km radius of health and family planning facilities. Their results suggest that women living within the radius of two community based workers were more likely to use modern contraceptives compared to women who had no access. Douthwaite and Ward (2005) conducted a similar study on the uptake of modern contraceptives among rural women. Their results suggest that the presence of lady health workers increase the use of modern contraceptives. There are, however, some limitations of these studies. The former study doesn't explain the effect of LHWP on women who live beyond 5 km radius, while the later study talks about the presence and not the actual exposure of women to lady health workers. Furthermore, these studies doesn't talk about the actual fertility outcomes given the fact that contraceptives are used as a differential stopping rule in Pakistan (our explanation is provided in chapter one).

Our study takes into account a more translated outcomes of the family planning programs i.e. fertility preferences and maternal health seeking behavior. In this study, we used women's actual exposure to lady health workers rather than the availability of these workers. The other issue we addressed in the family planning (FP) exposure is, to take into account the intensity of the family planning program.

As the cultural norms are stronger in the rural areas, therefore it takes time for the lady health workers to implement their activities and advocate about family planning. Secondly, since literacy rate is very low in rural areas (28 percent) in our sample, therefore it is difficult for women to understand and translate knowledge into actual health outcomes without frequent FP exposure. Therefore, we argue that without taking these variations into account the estimated effect will be biased.

3.4 Data and summary statistics

3.4.1 Data

Data under analysis comes from nationally representative Pakistan Demographic and Health Survey (PDHS) 2013. The survey data have been used in numerous studies concerning reproductive behavior and fertility (Garenne 2008; Bongaarts 2013; Zaidi & Morgan 2016). PDHS is a large representative survey, covering information about a number of information regarding childbearing, family planning, exposure to FP information, and frequency of watching television or listening to radio. Information about FP comes from three sources whether a women have ever heard family planning message on (i) radio (ii) television, and (iii) have visited by family planning worker.

Since LHWP mainly target rural areas, therefore we restricted our sample to only rural women. We take community-level average of FP information in the mother's community (primary sampling units in survey) and investigated its effect on fertility preference and reproductive health care. There are 250 PSUs in rural areas in PDHS-2013, which provide us a good opportunity to gauge the spillover effect and assess the intensity of demand driven variations on outcome (Pritchett 1994). The survey provides information around a number of indicators including reproductive history of women aged 15-49 years of age. We restricted our sample to women younger than 35 years of age when they are still in their reproductive age, and can make decisions about their future fertility preferences. This makes the total sample under investigation to 4,331 women in rural areas. We made four measures of fertility preferences as our main outcome variables from the survey. This includes, whether a women want to have another child (i) soon, (ii) within two years, (iii) after two years, and (iv) no more. Survey also provides rich information about women health seeking behavior for the most recent birth i.e. antenatal and postnatal care as measures for reproductive health care, which are important health dimensions for family planning (Franny 2013). For antenatal care, we used (i) whether women have at least 4 visits to avoid pregnancy related complications (WHO 2006c). Similarly we used, (ii) whether the most recent delivery is performed by skilled birth attendants, and (iii) whether the place of delivery was public or private hospital/clinic, or rural health center. For the postnatal care, we used outcome measure whether postnatal checkup has been performed for the baby within two months. Furthermore, information about background characteristics, for instance, age, education, socioeconomic status, place of residence, distance to health facility are provided in the survey that helps us in gauging the effect of demographic characteristics on fertility.

We also used measure for the intensity of son preference. This is included to see the effect of family planning program in the presence of son preferences. Data provide rich information about the strength of son preference by asking respondent about their *"ideal number of sons"*, "*number of living sons*" and "*number of living children*". We have created measure of the *"unmet sons"* by subtracting "*number of living sons*" from the "*ideal number of sons*". This measure provide estimates whether a woman has at least achieved her desired number of sons. This measure is of particular importance in contexts where reproductive behaviors are to a great extent influenced by sons, as is the case in Pakistan. Therefore, we used this measure as a proxy for "desired fertility view".

To gauge variation in FP exposure, we used LHWs per capita in each district by utilizing data from provincial administrative records of provincial health ministries. Population figures in each district is extracted from Pakistan Bureau of Statistics (PBS). We matched these districts with the districts covered in PDHS-2013, and calculated per capita LHWs in each district. This measure is used as the intensity of program in the analysis under this chapter.

3.4.2 Summary statistics

Table 3-1 provides summary statistics of ever married women younger than 35 years in rural areas. All outcome variables are binary. Variables in the first four rows of table 1 are constructed from fertility preferences in the survey questions, whether a women want to have another child soon, child within two year, child after two years or no more children. Next three rows represent antenatal care variables, whether antenatal care is received from skilled health provider, woman has at least 4 antenatal care visits, and whether baby delivered in government or private health facility. Baby postnatal check measured whether postnatal checkup has been performed within two months of the last delivery. Intensity measured as LHW per capita is 0.009 which means that for every 1000 women there are 9 LHWs. Average number of living children in the family is 2.47. Almost 72 percent of the women have an unmet demand for sons i.e. their demand for sons is not achieved yet. Unmet sons' variable takes value equals 1, if the difference between "Ideal number of sons" and "number of living sons" is greater than or equal to zero. Almost 49 percent of the women have exposed to FP information either through radio, television or lady health workers. The data shows that, almost 10 percent of the children have died before age one, this is represented as infant mortality. Mean age of women in the sample is 26 years while mean age at first birth is 20 years. Women on average have less education i.e. 15 percent of the women in the sample are with primary and secondary education while 6 percent have higher education. We have categorized the wealth index into two subcategories i.e. middle income and high income, about 80 percent of the women in the sample come from middle income families.

3.5 Estimation strategy

Ordinary least squares estimates are likely to produce biased results. People with different degree of FP exposure will react differently to LHWP i.e. welcome the government interventions, cooperate with lady health workers and own the government interventions. Second, living in an area with more lady health workers would result in enhanced knowledge about family planning. Even at the first place if lady health worker is available, FP exposure will be different for literate women because literate women can easily understand, practice and translate exposure to actual outcomes. On the contrary, illiterate women will require more time in producing these outcomes unless there is frequent interaction with lady health worker. Therefore, measurement error will be our main concern when measuring FP exposure for these two different groups of women. In such cases, the attenuation in the relative exposure by the effects of measurement error will lead to failure in estimating the effect of FP exposure on outcomes.

Our analysis used two approaches to disentangle the causal relationship between FP exposure and outcomes of interest. First, we include a set of covariates including women's and their husband's education, their ages, women age at first birth, women working status, distance to health facility, infant mortality, and socioeconomic conditions, to see the actual effect of FP exposure on the measured outcomes in the presence of these observables. Second, we used the intensity of LHWP measured as lady health workers per capita as an instrument for FP exposure, and estimated a two-stage least squares model;

$$Y = \pi_0 + \pi_1 FPEXP + \pi_2 UNMET\_SONS + \mu X' + \varepsilon \qquad (1)$$

$$FPEXP = \varphi_0 + \varphi_1 INTENSITY + \omega X' + \vartheta \qquad (2)$$

Y is a binary outcome variable represent two broader outcomes i.e. fertility preferences and reproductive health care. $FPEXP$ is a continuous variable generated by taking the community-level average in woman's community, whether a woman has exposed to FP information through radio, television or lady health worker . $UNMET\_SONS$ is a dummy variable whether a woman have unmet demand for sons. X' is a vector of other covariates including distance from the health center, infant mortality (whether a child died before age 1), women's education, age, age at first birth, working status, husband's education and age, and wealth index.

3.6 Results

Table 3-2 reports estimates of fertility preferences among women younger than 35 years. All regressions include regions fixed effect and year of birth dummies of the last birth. Odd columns reports estimates without interaction between unmet sons and FP exposure, while even columns report estimates with interaction between two variables. Unmet sons' variable has a statistically significant effect on all outcome measures in odd columns while FP exposure is statistically insignificant, except having a partially significant effect in column (7). When we include the interaction term, FP exposure become significant means that if women have meet their demand for sons FP exposure reduces the probability of another child soon by 22 percentage points, and the probability to have a child after two years by 14 percentage points. These results in column (1) and column (6) suggests that family planning program effect fertility preference only when women have met their demand for sons.

In table 3-3, we presented OLS estimates of reproductive health care. Columns (1-3) reports measures of antenatal care while column (4) reports estimates of postnatal care. All regressions include full set of control variables, regions fixed effect and year of birth dummies of the last birth. FP exposure have a positive and statistically significant effect on antenatal care except for column

(2). More specifically one percent increase in the FP exposure increases the probability that a woman have at least 4 visits by 13.6 percentage points, and delivery of the recent birth in government or private health facility by 23.8 percentage points. FP exposure has also positive and statistically significant on postnatal care, FP exposure increases the probability that postnatal checkup of the baby within two months, by 31 percentage points.

Table 3-4 reports IV estimates of the fertility preference among women younger than 35 years. Panel A and Panel B report first and second stage estimates respectively. First stage results show that our instrument, program intensity measured as lady health worker per capita, has a strong effect on the endogenous FP exposure. F statistics in all four columns is greater than 10, which suggest that our instrument is not confounded by weak IV problems. Second stage estimates of FP exposure is much larger and statistically significant than OLS estimates. This is aligned with our previous discussions about potential measurement error due to attenuation bias in FP exposure. FP exposure in Panel B has a negative and statistically significant effect on women' fertility preference for another child soon, child within two years, and child after two years. Similarly, FP exposure has a strong positive effect on women's desire to limit childbearing measured as, no more children.

Table 3-5 reports IV estimates of reproductive health care among women younger than 35 years. F statistics in Panel B shows that our instrument is not confounded by weak IV problems. FP exposure in Panel A has a positive and statistically significant effect on antenatal care measure, however, insignificant for postnatal care. FP exposure increases the probability of at least 4 antenatal care visits, antenatal care received from skilled health professional and delivery performed in the government or private health facility.

How FP exposure effect women with different educational backgrounds? We have presented this heterogeneity effect in table 3-6. Odd columns report effect on women with no education while even columns report estimates for women with some education. The effect is strong and statistically significant for all outcome measures except column (5) and column (6). FP exposure affect both groups of women, however, the effect for women with some level of education is stronger and almost double in magnitude.

From our findings, it is evident that unmet sons variable is strong and statistically significant in almost all outcome measures of fertility preferences. This variable has been included to gauge the desired fertility view presented by Pritchett (1994). He argued that desired fertility view is more valid than family planning view. We included this variable as proxy for son preference to see whether family planning program is till effective in the presence of this important factor, which has been normally omitted in the previous studies.

To partially reflect on two competing views, "desired fertility" and "family planning" about fertility, we reported our analysis for two subgroups of women. We restricted our sample to women who are aged between 20-34 and 35-49 reported in (Panel A) and (Panel B) of table 3-7 respectively. FP exposure is strong and statistically significant for women aged 20-34, while insignificant for women aged 35-49 years of age. However, unmet sons variable is still positive and statistically significant for all age groups. Based on our findings from table 3-7, we argue that desired fertility view has a positive effect on fertility. On the other hand, the importance of family planning program cannot be isolated on fertility decline (Bongaarts 1994). However, in our case, it works mainly for younger women. There could be two potential interpretations for this differential effect in the context of Pakistan. First, older women may be more conservative than younger women and may hold negative perception about family planning. Second, younger women have relatively longer exposure to family planning information since their early stages of reproductive life.

Lastly, there may be concerns about not including urban women in our sample. As we explained in our previous sections, LHWP is mainly introduced for rural women in order to bridge rural-urban disparities in fertility and reproductive health care. Therefore, the placements of LHWs mainly took place in rural areas. To check robustness of our sample selection, we provided reduced form estimates of LHW per capita on FP exposure in table 3-8. The idea is to examine that if LHW per capita has no effect on FP exposure among urban women, then our sample restriction to only rural women is valid. Column (1) represent whole sample while column (2) and column (3) are restricted to women aged 20-34 and aged 35-49 respectively. None of the results are significant for urban sample, which suggest that LHW per capita affect FP exposure only for rural women.

3.7 Conclusion

Despite considerable progress in family planning programs since 1960, there still exist large variations in fertility across countries. There are a number of influencing factors including social, cultural and economic factors that contribute to large variations in fertility, and these factors have been the central agenda of population conferences in Bucharest (1974), Mexico (1984), and Cairo (1994). Family planning programs played major role in increasing the use of contraceptives, decreasing unwanted pregnancies, and improving mother and child health in developing countries (Bongaarts 1994; Casterline & Sindang 2000; Jayachandran 2014). We live in a world with huge diversities in cultures, religious values, economies and politics and these factors shape our attitudes and behaviors toward achieving our goals. Family planning programs not informed with these factors fails to ground in reality and can lead to coercive implementation and poor quality (Cleland et.al 2006).

In this paper, we investigated the effect of lady health worker program in rural Pakistan. Previous studies have shown that strong eligibility criteria for LHW (minimum 8 years) is too high for some rural areas, which results in low recruitment of workers from those areas (Zhu et.al 2014). Therefore, it is more likely that women living in areas with more lady health workers tend to be more knowledgeable about family planning, and vice versa. Keeping this in mind, we take into account variations in the distribution of lady health workers in each district to measure rural women's exposure to family planning knowledge. Our results suggest that lady health workers have a strong positive effect on women's exposure to family planning. More specifically, our first stage results show that, additionally providing one more lady health worker per thousand population, which is equivalent to 0.001 increase in program intensity, would increase the likelihood of FP exposure by 0.004 percentage points.

Our main findings suggest that FP exposure have a strong and statistically significant effect on behavior change about fertility preferences, and reproductive health care among women in rural areas. More specifically, FP exposure induced through lady health workers reduces the probability of women to have another child soon, to have a child within two years, and to have a child after two years. Furthermore, FP exposure has a positive and significant effect on women's desire to limit childbearing (no more children). Our findings also suggest that FP exposure increases antenatal care visits, antenatal checkup by skilled professionals, and delivery in public/private health centers.

Our findings also suggest that the program, although have higher effect on women with some education, however, it also benefitted women with no education. This is mainly because of the nature of this intervention, lady health workers come from the same communities, share same culture and values and could easily be adjusted among rural women.

Furthermore, infant mortality has a strong positive effect on women's decision to continue childbearing and negative effect on women's desire to limit childbearing as evident from table 3-4. Infant mortality provides incentives for women to produce children (Shapiro & Tenikue 2017).

Although there is considerable progress in reduction of infant mortality, still there is a need for the government to invest more on mother and child health particular in rural areas. Without reducing infant mortality, the pace of fertility decline will further slowdown and the struggle for achieving a demographic dividend wouldn’t be able to materialize into growth outcomes.

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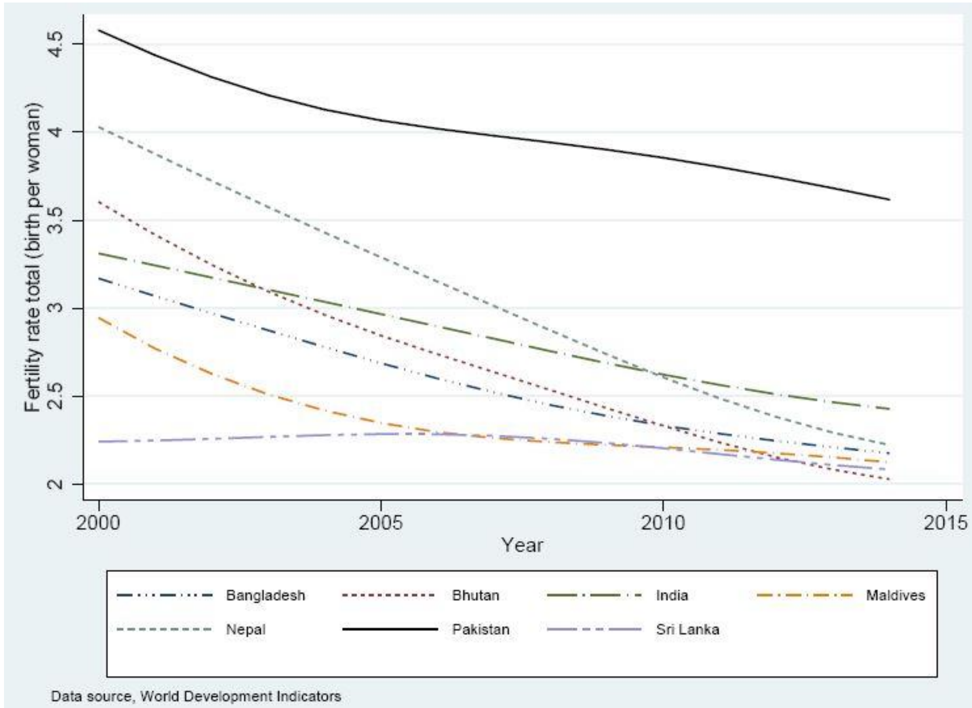

Figure 3-1 Fertility level in Pakistan compared to other South Asian countries

Note: Data in the graph used is from World Development Indicators covering period 2000 to 2014. Values on the vertical axis represent total fertility rate

Table 3-1 Summary statistics, ever married women younger than 35 years

	PDHS-2013
Another soon (=1 want another soon)	0.627
	(0.484)
Within two years (=1 want within two years)	0.314
	(0.462)
After two years (=1 want after two years)	0.331
	(0.479)
No more (=1 no more children)	0.252
	(0.434)
Antenatal care (=1 received from skilled health provider)	0.180
	(0.348)
Antenatal visits (=1 if at least have 4 visits)	0.403
	(0.490)
Place of delivery (=1 government or private health facility)	0.549
	(0.498)
Baby postnatal checkup (=1 if checkup within 2 months)	0.444
	(0.496)
Number of living children	2.471
	(1.998)
FP exposure	0.493
	(0.231)
Intensity (FP worker per capita)	0.009
	(0.007)
Unmet sons (=1 if desired sons not achieved)	0.721
	(0.444)
Distance (=1 if distance is problem)	0.545
	(0.497)
Infant mortality (=1 if child died before age 1)	0.094
	(0.282)
Working	0.154
	(0.353)
Woman’s education level	
Primary education	0.151
	(0.358)
Secondary education	0.150
	(0.357)
Higher education	0.062
	(0.232)
Woman’s age at first birth	19.98
	(3.350)
Woman’s age	26.14
	(4.644)
Husband’s age	31.56
	(7.691)
Middle income	0.803
	(0.397)
Observations	4331

Note: Data used come from PDHS 2012-13. Sample include rural women younger than 35 years old. Standard deviation are in parenthesis.

Table 3-2 OLS estimates of Fertility Preferences among women younger than 35 years

	Another soon		Within two years		After two years		No more	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FP exposure	-0.070	-0.216**	-0.032	-0.079	-0.053	-0.140**	0.115*	0.174
	(0.077)	(0.101)	(0.044)	(0.073)	(0.069)	(0.060)	(0.066)	(0.103)
Unmet sons (=1 if desired sons not achieved)	0.158***	0.077	0.053***	0.027	0.097***	0.050	-0.158***	-0.125*
	(0.033)	(0.061)	(0.019)	(0.046)	(0.025)	(0.040)	(0.033)	(0.061)
Unmet sons × FP exposure		0.192**		0.062		0.113		-0.077
		(0.092)		(0.081)		(0.073)		(0.099)
Infant mortality	0.127***	0.128***	0.111***	0.111***	0.008	0.009	-0.116***	-0.117***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.024)	(0.024)	(0.021)	(0.021)
Woman's age at first birth	0.022***	0.022***	0.011**	0.011**	0.010**	0.010**	-0.019***	-0.019***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Primary completed	-0.036	-0.038	-0.041*	-0.041*	0.006	0.005	0.041**	0.042**
	(0.023)	(0.023)	(0.022)	(0.022)	(0.024)	(0.024)	(0.019)	(0.018)
Secondary completed	-0.047*	-0.050*	-0.059**	-0.060**	0.007	0.005	0.022	0.023
	(0.027)	(0.027)	(0.025)	(0.025)	(0.041)	(0.041)	(0.030)	(0.030)
Higher completed	-0.004	-0.009	-0.029	-0.031	0.027	0.024	0.008	0.010
	(0.028)	(0.028)	(0.033)	(0.034)	(0.029)	(0.030)	(0.036)	(0.037)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3208	3208	3050	3050	3050	3050	3214	3214
R^2	0.295	0.296	0.155	0.155	0.177	0.178	0.249	0.249

Note: Data used come from PDHS 2012-13. Sample include women younger than 35 years of age. All outcome measures are dummy, whether a woman want to have another child soon, within two years, after two years, and want no more children. FP exposure is exposure to family planning information through radio, television or lady health workers averaged across woman's community (PSU). Unmet sons variable is calculated by subtracting "number of living sons" from "ideal number of boys" to assess whether women have an unmet demand for male offspring. Infant mortality variable is binary whether a child has died before age 1. Education variables represent the education level of woman. Other controls include woman age, age at first birth, husband education, age, women working status and socioeconomic status represented by wealth index in PDHS. Region and year of birth dummies are included in all the regressions. Cluster standard errors clustered at woman's community are in the parenthesis.

Table 3-3 OLS estimates of Reproductive Health Care among women younger than 35 years

	Antenatal care			Postnatal care
	Antenatal visits	Antenatal care_ skilled	Delivery_ facility	Baby_ postnatal checkup
	(1)	(2)	(3)	(4)
FP exposure	0.136**	0.040	0.238***	0.308***
	(0.052)	(0.047)	(0.056)	(0.089)
Unmet sons (=1 if desired sons not achieved)	-0.004	0.027	0.032	0.006
	(0.023)	(0.024)	(0.022)	(0.026)
Infant mortality	0.075***	0.004	0.028	0.035
	(0.024)	(0.019)	(0.032)	(0.036)
Middle income	-0.143***	-0.103***	-0.165***	-0.112**
	(0.031)	(0.027)	(0.034)	(0.041)
Age of respondent at 1st birth	0.000	0.009***	0.009	0.004
	(0.004)	(0.003)	(0.005)	(0.005)
Primary completed	0.086***	0.027	0.071**	0.057
	(0.024)	(0.017)	(0.027)	(0.034)
Secondary completed	0.172***	0.035	0.154***	0.100***
	(0.040)	(0.025)	(0.031)	(0.035)
Higher completed	0.247***	0.055	0.230***	0.132***
	(0.050)	(0.039)	(0.052)	(0.035)
Controls	Yes	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes	Yes
Observations	2873	2869	2875	2870
R^2	0.176	0.124	0.206	0.172

Note: Data used come from PDHS 2012-13. Sample include women younger than 35 years. Column 1-3 represent outcome measures of antenatal. Column 1 is antenatal visits is a dummy variable if women have at least four visits before the most recent birth, column 2 is a dummy if women have received antenatal care from skilled health professional, column 3 is dummy variable if the most recent delivery is performed in government or private health facility. Column 4 present outcome measure of postnatal care is a dummy variable if postnatal checkup of new born baby is performed within two months. FP exposure is exposure to family planning information through radio, television or lady health workers averaged across woman's community (PSU). Unmet sons variable is calculated by subtracting "number of living sons" from "ideal number of boys" to assess whether women have an unmet demand for male offspring. Infant mortality variable is binary whether a child has died before age 1. Women working is binary whether a woman is currently working. Other controls include woman and husband education, age, woman age at first birth and socioeconomic status represented by wealth index in PDHS. Region and year of birth dummies are included in the regression columns 2 and 4. Cluster standard errors clustered at woman's community are in the parenthesis.

Table 3-4 IV estimates of Fertility Preferences among women younger than 35 years

	Another soon	Within two years	After two years	No more
	(1)	(2)	(3)	(4)
Panel A. Two stage least squares results				
FP exposure	-1.315***	-0.762***	-0.682*	1.136***
	(0.430)	(0.254)	(0.353)	(0.328)
Unmet sons (=1 if desired sons not achieved)	0.147***	0.042**	0.097***	-0.150***
	(0.029)	(0.021)	(0.023)	(0.031)
Infant mortality	0.122***	0.113***	0.005	-0.116***
	(0.023)	(0.020)	(0.025)	(0.026)
Woman’s age at first birth	0.019***	0.010**	0.007*	-0.016***
	(0.005)	(0.005)	(0.004)	(0.005)
Middle income	0.012	0.007	-0.027	-0.017
	(0.031)	(0.026)	(0.027)	(0.030)
Primary	0.002	-0.021	0.028	0.009
	(0.033)	(0.029)	(0.030)	(0.027)
Secondary	0.014	-0.016	0.026	-0.016
	(0.037)	(0.036)	(0.050)	(0.034)
Higher	0.129***	0.055	0.092**	-0.115**
	(0.047)	(0.044)	(0.043)	(0.056)
Controls	Yes	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes	Yes
R^2	0.071	0.040	0.110	0.081
Panel B. First stage results of FP exposure				
Program Intensity	3.774***	3.625***	3.623***	3.766***
	(0.941)	(0.944)	(0.944)	(0.938)
F-stats	16.08	14.74	14.74	16.11
P-value	0.000	0.000	0.000	0.000
Observations	3208	3050	3050	3214

Note: Data used come from PDHS 2012-13. Sample include women younger than 35 years of age. All outcome measures are dummy, whether a woman want to have another child soon, within two years, after two years, and want no more children. Instrumental variable used is program intensity measures lady health workers per capita at district level. FP exposure is exposure to family planning information through radio, television or lady health workers averaged across woman’s community (PSU). Unmet sons variable is calculated by subtracting “number of living sons” from “ideal number of boys” to assess whether women have an unmet demand for male offspring. Infant mortality variable is binary whether a child has died before age 1. Education variables represent the education level of woman. Other controls include woman age, age at first birth, husband education, age, women working status and socioeconomic status represented by wealth index in PDHS. Region and year of birth dummies are included in all the regressions. Cluster standard errors clustered at woman’s community are in the parenthesis.

Table 3-5 IV estimates of Reproductive Health Care among women younger than 35 years

	Antenatal care			Postnatal care
	Antenatal visits	Antenatal care_ skilled	Delivery_ facility	Baby_ postnatal checkup
	(1)	(2)	(3)	(4)
Panel A. Two stage least squares results				
FP exposure	1.615***	0.742**	3.099***	0.204
	(0.428)	(0.349)	(0.739)	(0.313)
Unmet sons (=1 if desired sons not achieved)	0.027	0.021	0.083*	0.007
	(0.023)	(0.021)	(0.045)	(0.028)
Infant mortality	0.093***	0.013	0.066	0.037
	(0.027)	(0.022)	(0.050)	(0.036)
Woman's age at first birth	0.001	0.009**	0.014*	0.004
	(0.004)	(0.004)	(0.008)	(0.005)
Middle income	-0.148***	-0.093***	-0.162***	-0.110***
	(0.038)	(0.035)	(0.059)	(0.042)
Primary completed	0.053	0.014	0.009	0.054
	(0.034)	(0.027)	(0.059)	(0.035)
Secondary completed	0.101*	-0.006	0.006	0.112***
	(0.055)	(0.034)	(0.083)	(0.040)
Higher completed	0.125	-0.019	-0.001	0.125**
	(0.081)	(0.055)	(0.118)	(0.049)
Other controls	Yes	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes	Yes
R^2	-0.286	-0.074	-1.017	0.162
Panel B. First stage results of FP exposure				
Program intensity	4.044***	4.035***	4.054***	4.056***
	(0.989)	(0.993)	(0.991)	(0.985)
F-stats	16.70	16.52	16.75	16.95
p-value	0.000	0.000	0.000	0.000
Observations	2747	2743	2749	2744

Note: Data used come from PDHS 2012-13. Sample include women younger than 35 years. Column 1-3 represent outcome measures of antenatal. Column 1 is antenatal visits is a dummy variable if women have at least four visits before the most recent birth, column 2 is a dummy if women have received antenatal care from skilled health professional, column 3 is dummy variable if the most recent delivery is performed in government or private health facility. Column 4 present outcome measure of postnatal care is a dummy variable if postnatal checkup of new born baby is performed within two months. Instrumental variable used is program intensity measures lady health workers per capita at district level. FP exposure is exposure to family planning information through radio, television or lady health workers averaged across woman's community (PSU). Unmet sons variable is calculated by subtracting "number of living sons" from "ideal number of boys" to assess whether women have an unmet demand for male offspring. Infant mortality variable is binary whether a child has died before age 1. Women working is binary whether a woman is currently working. Other controls include women and husband education, age, woman age at first birth and socioeconomic status represented by wealth index in PDHS. Region and year of birth dummies are included in the regression columns 2 and 4. Cluster standard errors clustered at woman's community.

Table 3-6 Heterogeneity by educational level among women younger than 35 years

	Another soon		Within two years		After two years		No more	
	No education	Some education	No education	Some education	No education	Some education	No education	Some education
	(1)	(2)	(3)	(4)	(4)	(5)	(6)	(7)
Panel A. Two stage least squares results								
FP exposure	-0.829*	-2.695**	-0.718**	-2.550**	-0.362	-0.451	0.706**	2.359**
	(0.481)	(1.066)	(0.360)	(1.099)	(0.475)	(0.537)	(0.319)	(0.959)
Unmet sons (=1 if desired sons not achieved)	0.148***	0.142**	0.043*	0.039	0.093***	0.104***	-0.152***	-0.142***
	(0.038)	(0.060)	(0.025)	(0.057)	(0.029)	(0.025)	(0.038)	(0.053)
Infant mortality	0.123***	0.137	0.114***	0.119	0.010	-0.014	-0.115***	-0.130
	(0.026)	(0.086)	(0.025)	(0.085)	(0.024)	(0.048)	(0.028)	(0.093)
Woman's age at first birth	0.023***	0.005	0.010*	0.006	0.010*	0.002	-0.019***	-0.011
	(0.005)	(0.013)	(0.005)	(0.013)	(0.006)	(0.007)	(0.006)	(0.012)
Middle income	-0.014	0.015	0.011	-0.038	-0.075**	0.027	0.002	-0.014
	(0.032)	(0.055)	(0.041)	(0.052)	(0.037)	(0.036)	(0.035)	(0.044)
R^2	0.222	-0.684	0.064	-1.153	0.162	0.171	0.211	-0.560
Panel B. First stage results of FP exposure								
Program intensity	6.584***	1.386***	6.391***	1.112**	6.391***	1.047**	6.584***	1.376***
	(2.374)	(0.453)	(2.436)	(0.457)	(2.436)	(0.467)	(2.374)	(0.450)
F-stats	7.69	9.37	6.88	5.91	6.88	4.99	7.69	9.35
P-value	0.010	0.004	0.014	0.021	0.014	0.033	0.009	0.005
Observations	2109	956	2001	915	2001	915	2112	959

Note: Data used come from PDHS 2012-13. Sample includes women younger than 35 years of age. All outcome measures are dummy, whether a woman want to have another child soon, within two years, after two years, and want no more children. Instrumental variable used is program intensity measures lady health workers per capita at district level. Odd number columns represent outcome measures for women with no education while even number represent for women with some education. FP exposure is exposure to family planning information through radio, television or lady health workers averaged across woman's community (PSU). Unmet sons variable is calculated by subtracting "number of living sons" from "ideal number of boys" to assess whether women have an unmet demand for male offspring. Infant mortality variable is binary whether a child has died before age 1. Education variables represent the education level of woman. Other controls include women's age, age at first birth, working status, husband's education, age, and socioeconomic status represented by wealth index in PDHS. Region and year of birth dummies are included in all the regressions. Cluster standard errors clustered at woman's community are in the parenthesis.

Table 3-7 Heterogeneity in effects by age groups

	Another soon	Within two years	After two years	No more
	(1)	(2)	(3)	(4)
Panel A. Women aged 20-34 years old				
FP exposure	-1.350***	-0.769***	-0.708*	1.165***
	(0.457)	(0.276)	(0.367)	(0.346)
Unmet sons (=1 if desired sons not achieved)	0.145***	0.042**	0.096***	-0.148***
	(0.029)	(0.021)	(0.022)	(0.031)
Infant mortality	0.121***	0.112***	0.005	-0.116***
	(0.023)	(0.020)	(0.026)	(0.026)
Woman's age at first birth	0.019***	0.009**	0.008*	-0.016***
	(0.005)	(0.005)	(0.004)	(0.006)
Other controls	Yes	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes	Yes
Observations	2996	2847	2847	3002
R^2	0.052	0.040	0.103	0.070
Panel B. Women aged 35-49 years old				
FP exposure	0.173	0.185	-0.045	0.146
	(0.203)	(0.186)	(0.100)	(0.303)
Unmet sons (=1 if desired sons not achieved)	0.060***	0.049***	0.016**	-0.053***
	(0.010)	(0.012)	(0.006)	(0.018)
Infant mortality	0.125***	0.130***	-0.006	-0.079**
	(0.021)	(0.025)	(0.010)	(0.033)
Woman's age at first birth	0.009***	0.004**	0.002*	-0.011***
	(0.002)	(0.002)	(0.001)	(0.004)
Other controls	Yes	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes	Yes
Observations	2451	2060	2060	2457
R^2	0.185	0.173	0.109	0.163

Note: Data used come from PDHS 2012-13. Panel A reports women between 20 to 35 years of age, while Panel B reports women aged between 35 to 49 years of age. All outcome measures are dummy, whether a woman want to have another child soon, within two years, after two years, and want no more children. Instrumental variable used is program intensity measures lady health workers per capita at district level. FP exposure is exposure to family planning information through radio, television or lady health workers averaged across woman's community (PSU). Unmet sons variable is calculated by subtracting "number of living sons" from "ideal number of boys" to assess whether women have an unmet demand for male offspring. Infant mortality variable is binary whether a child has died before age 1. Education variables represent the education level of woman. Other controls include women's education, age, and age at first birth, working status, husband's education, age and socioeconomic status represented by middle income is derived from wealth index in PDHS. Region and year of birth dummies are included in all the regressions. Cluster standard errors clustered at woman's community are in the parenthesis.

Table 3-8 Reduced form estimates using urban sample

	Whole Sample	Women (aged 20-34)	Women (aged 35-49)
	(1)	(2)	(3)
Program Intensity	6.159	6.910	4.993
	(11.212)	(12.417)	(10.711)
Unmet sons (=1 if desired sons not achieved)	0.010	0.011	0.008
	(0.009)	(0.017)	(0.010)
Number of living children	0.001	0.004	-0.001
	(0.004)	(0.006)	(0.004)
Other controls	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes
Observations	4607	2314	2293
R^2	0.126	0.138	0.128

Note: Dependent variable is FP exposure. Program intensity measures lady health workers per capita at district level Sample in the analysis is restricted to women residing in urban areas. Column (1) report whole sample, women aged between 20-49 years. Column (2) and column (3) is further restricted to age groups 20-34 and 35-49 years respectively. Other controls include women's education, age, and age at first birth, working status, husband's education, age, and socioeconomic status represented by middle income is derived from wealth index in PDHS. All regressions are run using regions FE. Cluster standard errors clustered at woman's community are in the parenthesis.

Chapter 4. Policy Implications

In this dissertation, we investigated one of the most influencing determinant i.e. son preference on fertility in Pakistan. Furthermore, we explored the mechanisms through which son preferences are implemented. Our findings provide strong evidence of differential stopping rule implemented through differential use of contraceptives. We also found that son preference increases future births represented by women's progression to next parity in chapter one. However, we failed to provide evidence for sex selection among families in Pakistan.

Son preference, either implemented through stopping rule or sex selection, contribute to demographic challenges in future. Pakistan achieved remarkable decline in fertility in the last decades, however, showed very limited progress in changing norms about son preference. As evident from Figure 1-2, the differences in desires for sons compared to daughters didn't change much from 2007 to 2013. Persistence of son preference over time could provide two main implications for future population. First, son preference implemented through differential stopping rule will further slowdown the fertility decline, which will create challenges for Pakistan's goal of replacement level fertility by 2020.[22] Another effect of this behavior will appear in the shape of high SRLB in the population, as more and more women get access to contraception (Bongaarts 2013; Zaidi & Morgan 2016).

Besides, economic development and wider spread awareness about family planning will further decline fertility in future (Pritchett 1994; Bongaarts 1994; Bloom et.al 2009). On the same pace, women will also gain more access to technology. This factor cannot be underestimated in Pakistani context, ultrasound examination increased from 64 percent in 2007 to 89 percent in 2013, as

[22] Pakistan Population Policy (2002)

evident from two rounds of PDHS. With smaller families to implement son preference, women will revert to sex selective abortions and its effect will reflect in the shape of high SRB in the population (Bongaarts 2013). This pattern is also evident from countries with strong son preferences such as China, India and South Korea (Hesketh & Xing 2006).

Whether sex selection or stopping rule, both of these behaviors create inequalities (Zaidi & Morgan 2016). Pakistan is already paying a big cost of this differential treatment. According to Global Gender Gap Report (2014), Pakistan is the second highest (141 out of 142) in the world having gender disparities in economic participation and opportunity, educational attainment, health and survival, and political empowerment. Out of total 142 countries reported, Pakistan is 132^{nd} in educational attainment and 129^{th} in literacy rate.

To further reflect on inequalities, we focused on parental investment on children's education using a nationally representative household survey in chapter two. We empirically investigated that son preference affect family size, and the family size translates into poor educational outcomes of children. We found that children from larger families suffer from resource constraints, and show poor performance on measured educational outcomes. In other words, this means that in larger families resources are more thinly distributed among many children and thereby affecting children's quality, which is a testament of quantity-quality trade off in Pakistan. We further showed that, when parents accumulate resources in the long run, the transfer of resources are diverted to male children leaving female children worse off on measured educational outcomes. We observed this pattern with children in high birth orders. This pattern is consistent with the wider education inequalities in Pakistan (UNESCO 2012). From our findings in chapter two, there are at least two main reasons to invest in women's education. First, more educated mothers tend to have smaller families. Second, children of more educated mothers tend to have higher years of education. Investment in women's education not only could accelerate fertility decline, but also help in providing educated human resource for the country.

In our last chapter (chapter three), we examined whether the ongoing lady health worker program plays its intended role on fertility decline in Pakistan. The program has a strong effect on changing women's behavior about their future fertility preferences and reproductive health care. But this effect mainly emerges from high program intensity areas. Women in areas with high per capita lady health workers are more exposed to FP information, and this exposure reflect into a sizeable effect on delaying/stopping their future fertility. One of the important feature of this program is that, it positively affect women even having no educational background. This is a direct manifestation of door step strategy implemented through LHWP. However, implementing this strategy to cover whole population could be costly and needs to be formulated under a reasonable resource envelop. One way to reach the most underserved could be switching between fixed and doorstep service delivery based on a rigorous study of the context, particularly taking into account the educational status of women in rural areas.

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