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Essays on Fertility, Gender Preference and Family Planning in Iran

by

Negar Ghobadi

A Dissertation submitted in partial satisfaction of the
requirements for the degree of

Doctor of Philosophy

in

Agricultural and Resource Economics

in the

Graduate Division

of the

University of California, Berkeley

Committee in Charge:

Professor Jeremy Magruder, Chair
Professor Edward Miguel
Professor Peter Berck

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Negar Ghobadi

Abstract

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Doctor of Philosophy in Agricultural and Resource Economics

University of California, University of California, Berkeley

Professor Jeremy Magruder, Chair

There is a large body of economic literature that documents the existence of son preference and its negative impact on girls' accumulation of human capital. Some studies have found that gender preference is exacerbated when fertility declines. Many studies have also looked at the impact of availability of family planning on fertility. My work contributes to this literature by linking these together and measuring the impact of fertility control policies on gender preference at birth. Also, it presents the first quantitative study of gender preference at birth in Iran.

In the first essay, I provide a short history of fertility policies and population transition in Iran. In the second essay, I look at the government provided family planning program and its impact on the fertility decline in rural Iran. I estimate the association between a woman's age of exposure to a clinic and her total number of children. I find that exposure to a health clinic at her most fertile ages (20-35) is associated with a 20% reduction in total number of children born to a woman, a significant drop (equivalent to one child).

In the third essay, I examine the extent of gender preference at birth in Iran and its impact on fertility decisions, using gender composition of first two children as a random experiment. I find that parents with a first born daughter will, on average, have more children; daughters are followed more quickly with another birth; and among all gender compositions, mothers with two daughters are most likely to continue child bearing.

I exploit the quasi-experimental expansion of rural health clinics providing family planning services in rural Iran. Using a difference in difference method, (with village fixed effects), I estimate the impact of access to family planning on gender biased fertility decisions. Availability of family planning is associated with a 12-17% reduction in probability of subsequent birth for mothers with two

children. However, there is no difference in this probability based on gender composition of children. I find that access to family planning does not exacerbate son preference expressed through fertility in rural Iran.

In memory of Maman Gorgani and Taji Joon

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Chapter 1

Introduction

This Thesis consists of three closely related essays on Fertility, Gender Preference, and Family planning in Iran. As an example of an Islamic state and an influential country in the Middle East, the fertility transition in Iran deserves more attention that it has received. Confounding all conventional wisdom, the fertility rate in the Islamic Republic of Iran fell from 7 births per woman in 1979 to 1.9 births per woman in 2006. The fact that the largest and fastest fall in fertility ever recorded, should have occurred in one of the world's few Islamic Republics, demands explanation(Abbasi-Shavazi et al., 2009). The three chapters study various causes and implications of this transition. Together, the chapters paint a clear picture of the Iranian fertility transition and the country's experience with family planning.

Chapter two studies the Iranian population transition and provides a history of population control and family planning in Iran and puts in perspective, using the framework of economic development. It starts from the time that first data set on population became available. It shortly reviews the policies prior to the Islamic revolution to familiarize us with the context in which the transition under study occurred. The focus of the chapter, however, is on the events that followed the Islamic revolution. The chapter reviews the government's policies and their transformations in face of the economic reality of the country. The chapter also discusses, using the economic demand theory of fertility, several mechanisms that worked together to bring about such an amazing drop in fertility in a very short period of time. Overall, the first chapter surveys the events and policies that led to the fertility transition, and sets the cultural context in which the phenomenon can be studied.

Chapter three focuses on one of the important contributors to the Iranian fertility decline, which is the government provided family planning program. In fact, the chapter focuses mainly on one aspect of the multidimensional program,

namely the rural health clinics. One should note that, though they are very interrelated, there is a subtle distinction between expansion of rural health clinics and availability of family planning. The former provided basic mother and child care, and later on (after 1989) incorporated family planning services as well. This chapter focuses on the aggregate effect of having a health clinic. In other words, the chapter measures the impact of both active (after 19899) and passive (before 1989) delivery of family planning. The chapter focuses on the impact of age at exposure and length of exposure to a health clinic on rural women's total fertility. We also look at the probability of giving birth a year after a woman gets a health clinic in her village.

Chapter four looks at the existence of gender preference in Iran and its impact on fertility. Also, in light of the findings of the previous chapter, it studies the impact of availability of family planning on the interaction between gender preference and fertility. In particular, I study three outcomes. First, I look at the impact of having a girl (or two daughters) on the total number of children born to women. Furthermore, I look at the impact of gender of the first two children on the years parents wait before having another child. Finally, I look at the probability of having a third child given the gender composition of prior children. An important contributor to this "gender biased stopping rule"could be availability of family planning. In other words, if it is the case that families stop having children once they have two sons because they prefer to do so, availability of family planning should make this practice easier. In this chapter, I look to see whether the difference in fertility stopping behavior is more magnified in villages with access to family planning. I use the quasi-experimental expansion of rural health clinics providing family planning services in rural Iran. Using a difference in difference method, (with village fixed effects), I estimate the impact of access to family planning on gender biased fertility decisions.

Overall, my dissertation provides a comprehensive study of population transition, fertility control policies and gender preference at birth in Iran. The main contribution of my work to this literature is linking the study of gender preference at birth to availability of family planning, and measuring the extent to which access to fertility control can affect son preference expressed through fertility.

Chapter 2

A Short History of Family Planning and Population Control in Iran

2.1 Introduction

All relevant data sources indicate that during the past four decades, average family size in Iran has been declining and that this decline has been significantly more rapid in recent years. During the 30 year period of 1966 to 1996, the average family size decreased by a mere 3.4 percent. But in the ten-year period between the last two national censuses (1996 to 2006) the average family size decreased by 16.5 percent (SCI, 1967, 2004). Barring the success of the new movement to abandon family planning, spearheaded by the current president, this trend towards smaller families is bound to continue. A surprising factor about this decline is that the biggest drop in fertility rate occurred in rural areas, declining from 8.1 in 1976 to 2.4 in 2000. Also, the urban-rural gap dropped from nearly 2 children in 1985 to 0.5 children in 2000 (Roudi-Fahimi, 2002).

The experience of Iranian Population transition provides an interesting case study of fertility control policies and population decline. This is mainly because of the speed of the transition as well as the cultural and economic context in which it occurred. figure 2.1 shows the annual population growth (%) from 1960 to 2010. The population was increasing prior to the revolution, and we can see the trend it would have followed had the Islamic revolution not interrupted in 1979. The revolution was followed shortly by an eight year war with Iraq. In the first few years of war, and in particular prior to 1985, Iran experienced a population boom. Once the consequences of such high population growth became known

both to families and to policy makers, a country-wide effort began to stop it. The population growth rate of near 4% in 1985 dropped to close to two by 1990, an amazing achievement for a country that had just experienced a regime change and an eight year war.

Although the government provided family planning program must have had an important role in bringing about this reduction, we can see in figure 2.1 that the sharp decline of fertility occurred before the family planning program began to operate. Figure 2.2 shows annual GDP growth(%) from 1966 to 2009. An interesting pattern emerges, where the sharp decline in fertility more or less coincides with the onset of a great decline in GDP growth of the country. Together, the two figures suggest that there is also a demand-side explanation for this population transition.

In this essay, I will try to understand the factors that could have led to this decline, using economic demand theory of fertility. Demand theory provides a framework for analysis of fertility decisions by parents. Becker (1960) argues that children are a source of satisfaction (emotional and financial) and as such can be considered (durable) consumption goods. He further claimed that in cases where children provide monetary income, they can be seen as a production good as well. similar to any other good, the demand for children falls when the costs exceed the benefits. He also introduced the concept of quality vs. quantity trade off in deciding number of children parents want. Modernization has increased the cost of children , as parents have to invest more in children's education, and decreased their role as old age providers for parents, hence leading to a decline in demand for children.

To understand the unique population transition path that Iran has taken, I first look at the recent history of population policies and their outcomes. The focus of the chapter, though, is on the events following the Islamic Revolution and the eight year war with Iraq. Throughout the chapter, I try to discuss various elements that had a role in making the Iran fertility transition a success using the development economic framework and in particular, demand theories of fertility.

2.2 Before the Islamic Revolution

The findings of the first nation-wide census in Iran were released in 1956. Prior to this date, all available statistics on different aspects of the Iranian society and economy are unreliable and considered educated guesses at best. This applies to population statistics as well, about which many estimates are available. During the last decade of the 19th century, Lord Curzon, Viceroy of India and later Great Britton's foreign secretary, travelled throughout Iran and studied the country

for three years. He estimated Iran's population at 9 million. Other observers have given different figures around the same time. A Russian writer refers to four estimates for the country's population, which were made between 1884 and 1910, and vary between 6 to 10 million(Issawi, 1971). In recent years, Statistical Center of Iran has released its estimates for the country's population, including its breakdown into rural and urban residents, since the beginning of the 20th century. The figures relating to the years prior to 1956 (when the first national census was conducted) are based on various estimates by different people or institutions. Table 2.1 shows the population of Iran, broken down by rural and urban areas for selected years from 1901-1976.

In 1925, the Last king of the Ghajar dynasty was overthrown and Reza Shah Pahlavi ascended the throne and founded the Pahlavi dynasty. Prior to Reza Shah's reign, Iran had experienced the "Constitutional Revolution" (in 1905), had gone through the first World War and was in total disarray, with insurgencies in several provinces and lack of security throughout the country. Reza Shah followed a nationalistic, secular policy and tried to modernize the country. He went so far as making women's hejab (cover) illegal, thus facing fierce opposition from the religious community. Modern education, complete overhaul of the judiciary, and improvements in the infrastructure of the country were among developments that occurred during his time in power. But gradually he turned into an absolute dictator who repressed the free press and all but eliminated political freedom. During his reign, however, there were some improvements in public health, causing a reduction in mortality rate and an increase in the country's population. Population of Iran, which was about 10.4 million when Reza Shah took the crown, increased to 12.8 million at the time of his abdication, indicating a rate of growth of the population of about 1.4 percent per year during his 15 year reign (SCI, 2004).

Mohammad Reza Shah replaced his father in September 1941. However, he did not play a significant role in the country's affairs until the occupying forces left Iran; in fact, not before the mid 1950s and the successful "Coup d'eta" (orchestrated by the CIA and the British intelligence in 1953) which deposed the popular Prime Minister (Dr. Mossadegh) and brought the Shah back to the country. By 1963, he announced his "White Revolution", a multifaceted program that included land reform as well as giving women the right to vote and hold elected offices. One of the principles of this revolution was the formation of the "Literacy Corps". The program sent young people with a high school diploma to rural areas to serve as teachers (in lieu of their two year military duty, which was mandatory for all young Iranians). This was deemed highly important for the Shah's modernization plans. At the time, most of the country's population was living in

rural areas (about 69 percent in 1956 and 62 percent in 1966) and the majority of rural population was illiterate. According to the census taken in 1963, nearly 73 percent of the population of the country (above the age of 10) was illiterate. This ratio was 60.6 percent among men and 84.8 percent among women. But in the rural areas, where total illiteracy rate was 84.7 percent, more than 95 percent of women were illiterate (SCI, 1967). The White Revolution was opposed by religious establishment and their devout followers on the ground that it was a plan dictated by foreigners. The clergy was particularly opposed to the women's right to vote, as well as to the land reform. Violence broke out in some parts of the country in opposition to these programs but was suppressed rather easily.

Later on, other sub-programs were added to the original principles of the White Revolution. The formation of the "Health Corps" was the first principle to be added to the original plan. Its goal was to extend public health care throughout the rural areas by sending trained personnel and facilities to rural areas.(The time served in the Health Crop could also be counted as a replacement for the mandatory military service). Free and compulsory education for children until the age of 14 was later added to the program as well. The White Revolution was relatively successful in some areas but many of its principles were merely political public relation schemes.

Despite the fact that the White Revolution was not very successful, there is no doubt that during the reign of the Shah, Iran experienced progress in some areas. Its economy expanded at rapid rates, particularly after the late 1960s and the increase in the price of oil. Improvements in general education and public health were also notable and infant and child mortality dropped significantly. During 1962 to 1967, the country's population growth was 2.6 percent per year. This rate of population growth was less than that of the previous decade. Still, the growth rate was considered high and there was strong desire among policy makers to bring it down. The increase in population in this period was mostly due to the fall in infant mortality, which had declined from 217 per 1000 in 1951 to 148 in 1966. It must be emphasized that until the mid 1960s, there was no official policy of family planning or population control in Iran and no mention of such programs in the principles of the White Revolution.

In 1966, policy makers decided to take certain steps to reduce the high fertility rate, and the first formal family planning program was inaugurated in 1967. That same year, the government acknowledged family planning as a human right issue. They emphasized the role of family planning in promoting economic development and the welfare of families and of the society (Roudi, 1999). Professional staff was recruited and were given special training about family planning and various methods of contraception. A country-wide advertising campaign was launched

to explain the advantages of smaller families on the welfare of the citizens. The slogan " fewer children, better life"(which in Farsi is a rhythmic phrase) was put on billboards and repeatedly mentioned in radio and television programs. Family planning became an integral part of maternal and child health services nationwide. By the mid 1970s, about 37 percent of married women were practising family planning, 24 percent of them using modern methods. But the program was not highly successful. The total fertility rate, although declining, remained high, at more than six births per woman(Roudi-Fahimi, 2004). The rate of population growth seems to have experienced a small decline after the implementation of the family planning program, but was still high at more than 2.7 percent per year.

There are many reasons for the unenthusiastic reaction of the citizens to the family planning program of the Shah's regime, especially in the rural areas. During the late 1960s and the 70s, opposition to government policies was strong. The religious community felt completely alienated by the Shah's modernization campaign. The religious leaders were particularly hostile towards such social issues as women's rights and freedom, which they considered to be against Islamic teachings. In this context, Family planning was seen as endangering the sanctity of the family and its traditional Islamic values. It was also seen as a scheme dictated by the Western powers to meddle in the Muslim's affairs and to prevent the increase of the Shiite population. A few religious figures who supported the government on this issue were seen as puppets of the regime and lost the support of the masses. Even the intellectual community, especially the university students, distrusted the regime and opposed all its policies regardless of their contents. The selection of Shah's notoriously corrupt twin sister as the head of the Women's Organization of Iran, was used by the intellectual community to oppose all of the regime's policies in regards to women.

More importantly, it seems that the regime's population policy targeted mainly the middle class urban residents, thus excluding a large part of the population from the effects of this policy. In 1978, the year before the Islamic Revolution, still 52.2 percent of the country's population was living in the rural areas. The total literacy rate (of those above the age of 6) was 49.3 percent, meaning that more than 50 percent of the country's population was still illiterate. In the rural areas, the rate of illiteracy was almost 68 percent. More significantly, 81.3 percent of rural women were illiterate(CB, 1977). Women play a big role in the prevalence of contraceptive use and birth control, and that urbanization and especially female literacy are important factors in the success of family planning and fertility control. The disappointing results of the Shah's family planning program is, therefore, not surprising given the state of affairs in Iran.

2.3 After the Islamic Revolution

With the victory of the Islamic Revolution, family planning of the former regime was all but abandoned. The revolutionary government had many problems on its hands, including several insurgencies in different parts of the country. In that context, family planning did not seem particularly important. Many of the revolutionaries did not believe in the necessity of family planning and population control. Moreover, less than a year after the new government took power, the Iran-Iraq started. The war threatened the very existence of the new regime and occupied the total attention of government officials. For the next eight years it also used up a large part of the available resources of the country.

The war casualties are not exactly known. It has been estimated that about 500,000 people, both soldiers and civilians, lost their lives and many more suffered various kinds of injuries. Young volunteers from all over the country left for the front, many of whom had to fight with rudimentary equipment. It was a war in which mostly men fought one another, and modern weaponry was of secondary importance. It is, therefore, understandable why having more young people in the country was considered a valuable asset. Some revolutionaries believed that the war with Iraq was only the beginning of a series of wars which would not end until the final victory of Islam. That, they thought, would need an even stronger army.

The Islamic Revolution and the eight-year war also had indirect effects on family planning and population control through economic incentives. Essential food items were rationed and distributed (at subsidized prices) via coupons according to the size of the families. Workers received extra wages for each additional child. Government assistance and subsidies (including free land for home building and subsidized housing) were provided in proportion to family size. Education was free at all levels and children were treated at government run health clinics for free or at very little costs. All these meant that " fewer children, better life" was in fact no longer true and there was little incentive for people to have smaller families.

The consequences of these policies became clear only after the results of the 1986 census were released. According to this census the population of the country, which was 33.7 million in 1976, had increased to 49.4 million by 1986. This implied an average of 3.9 percent per year of growth in the population during the previous ten-year, a shockingly high number. About 0.5 percent of the yearly growth of the population was due to migration (of Afghan and Iraqis refugees), and 3.4 percent of it was due to natural population growth. This rate of population growth was nearly a world record. For those who were familiar with the Iranian economy's

myriad problems, such a high rate of population growth was extremely alarming. Comparing the results of the 1976 census (covering the 10 year period of 1966 to 1976) and the 1986 census (covering the period of 1976 to 1986) government officials could observe another set of important changes. The 1976 census showed that the birth and mortality rates in the previous 10 years had been 39 and 12 per 1000 respectively. The 1986 census, on the other hand, showed that the birth rate in the previous 10 years had increased, on average, to 42 per 1000 and mortality had decreased (mainly due to the fall in infant mortality) to 7 per 1000 (Malekafzali, 2004). The combination of these two facts explain part of the population "boom" that had occurred.

All of this meant that Iran was moving towards an untenable situation and that drastic measures needed to be taken immediately. Being involved in a devastatingly long war, the country's condition was disastrous. Due to the rapidly growing population, primary schools had to work two or three shifts. Food was scarce and rationed. Many factories were either closed or working at much less than full capacity. Unemployment was high and inflation was galloping. With all these problems, abandoning the family planning program and population control had brought upon Iran a 3.9 percent rate of population growth. The war years had depleted government coffers and normal economic activities had been seriously impaired. Family planning and population control policies were abandoned. The clergy were given free hands at citing quotations from the Shiite saints in support of large families and condemning birth control as interference with God's will. As expected, birth rate has increased.

This was first reflected in an acute shortage of baby milk powder (baby formula), nearly all of which had to be imported. About 100 million dollars of baby formula was imported each year, putting pressure on the fast decreasing foreign exchange reserves of the central Bank (Anvari, 2010). Many religious leaders would resist any move towards population control during the early years of the Islamic revolution even though Ayatollah Khomeini (the leader) had issued a Fatwa (religious edict) in 1980 approving birth control as long as the mother and child were not harmed. Still, many religious figures were suspicious and hostile towards the Shah's social, political and economic policies. This made any meaningful discussion about the old regime's positive undertakings difficult, if not impossible. In their views, whatever the Pahlavi regime had done was sacrilegious and dictated by the Western powers and family planning was one of them. They believed that population control and the slogans such as " fewer children, better life" were Jewish schemes to reduce the Muslim population. Their own view was that the followers of Prophet Mohammad should be multiplied (Anvari, 2010).

Government officials, however, had different priorities. They were faced with every day problems of the severely damaged economy, the country's depleted resources and the growing needs of the rapidly rising population. They were convinced that immediate action to slow the population explosion was crucial for the survival of the Islamic Republic. In the fall of 1986, while the war was still going on, the minister of the Plan and Budget Organization (PBO) organized a seminar in the city of Mashhad, in which academicians, policy makers and representatives of 48 different organizations were invited. Ministers, high government bureaucrats, as well as academicians attended the seminar. They all unanimously emphasized the retarding effects of the rapid population growth on welfare of the people and the burden it laid on the growth of the economy. They called for serious and systemic efforts by the government to control the rapid growth of population. The participants in that seminar specifically demanded that the issue of population growth be included in the development plan of the country.

In December 1989, more than a year after the war had ended, a new family planning program was formally inaugurated. The aforementioned Fatwa of 1980 was re-emphasized by the Minister of Health in 1988 to support the family planning programme. Ayatollah Khomeini's stance on this issue was the most important factor in bringing other religious leaders, as well as doubting government officials, on board(Anvari, 2010). The family planning program had three main goals. The goals were 1) to discourage pregnancies of women below the age of 18 and above the age of 35; 2) to encourage a 3 to 4 year interval between pregnancies and 3) to try to limit the number of children in each family to a maximum of three. At the same time, the ministry of Health and Medical Education (MOHME) started a countrywide campaign to encourage families to have no more than one or two children (Aghajanian and Mehryar, 2005).

In line with these efforts, MOHME was made responsible to expand the number and the facilities of family clinics. They also gave free advice and services to married couples and tried to convince families that 2 or 3 children are enough. The high judicial court declared (in 1990) that sterilization of men or women were not against Islamic principles. In 1993 the Majlis (Parliament) finally passed the family planning bill, prepared four years earlier, and family planning and population control officially became the country's law. According to one of the articles of this law, all governmental services meant to improve the living condition of the citizens, would be limited to 3 children in each family. Examples of such services were social security and health benefits, extra wages of the workers for their children and subsidized food items. Previously, these benefits were offered based on a headcount of the family. After this law, the fourth child would no longer receive any of these privileges.

Meanwhile a country-wide advertising campaign started with the goal of promoting family planning and population control. After Ayatollah Khomeini's favorable position on this issue was advertised, many other religious figures issues similar comments. Their comments on advantages of small families were published in great numbers and distributed throughout the country (Anvari, 2010). At the "Friday Prayers" , held weekly in every city and town throughout the country, the "Friday Imams" were advised to explain the merits of family planning and population control to their audiences. Even the Expediency Council (consisting of more than two dozens of the country's high religious and political figures chosen by the Supreme Leader) gave its support to the population control policies. Government owned TV and radio stations throughout the country were ordered to elaborate on the need and the urgency of family planning and its effects on people's welfare and the country's development. Various signs and billboards on street corners were quoting comments favorable to family planning by the Shiite saints, many of which were of dubious authenticity.

The extent of success of this multidimensional program is reflected in the astonishingly rapid and continuous drop in the rate of growth of population during the past two decades. Table 2.2 shows population growth rate pattern of the country from 1946 to 2006. According to the results of the 1996 census, the rate of population growth had decreased to 1.96 percent per year after having less than eight years of family planning. During the next 10 years the declining trend of the population growth continued, reaching 1.61 percent per year according to the 2006 census.

2.4 Some Explanations

Neither the religious Fatwas nor the widespread propaganda campaigns, though having considerable effects, could have made the Iranian family planning so successful alone. A combination of these and many other favorable factors brought about such success in a relatively short amount of time. Nearly every factor known to be effective in population control and family planning policies seems to have had a part in bringing about this success. Most important among them are as follows.

2.4.1 Social Insurance Explanations

During the first half of the 20th century, both the rates of fertility and mortality were high in Iran. To have three or four sons on whom the parents could rely on in their old age, it was necessary for the wife to give birth to as many children as

she could. Iranians used to call their sons "canes to lean on in their old age", a kind of retirement benefit prevalent in nearly all developing countries. Although improvements in the country's general health condition had started during the Shah's regime, The Islamic Republic went much further along this road. They by establishing several policy changes that extended health services as well as basic infrastructure to rural areas. Figure 2.3 shows the trends in Infant mortality in Iran from 1951 to 2006 . Infant mortality rate, which was 217 per 1000 live births in 1951, decreased to 112 in 1976. While in the 25 years between 1951 and 1976 infant mortality was reduced to about half, during the next 25 years (1976-2001) it declined by 75 percent to 28 deaths per 1000 live births. Reduction in the infant and child mortality meant that parents could be more confident that their children would survive to adulthood, thus reducing the need to have many children in order to ensure having a few of them around in their old age. Note that a fall in child mortality does not necessarily lead to lower fertility. But the fact remains that there are no recorded cases of countries where fertility has fallen rapidly in the context of continuing high infant and child mortality (Abbasi-Shavazi et al., 2009).Thus falling child mortality must be recognized as a necessary (though not sufficient) condition for falling fertility.

Another important factor is the expansion of various social security schemes and retirement benefits. This is an ongoing trend, decreasing parents' reliance on their children's financial support in their old age. All government employees (roughly 6 million) plus nearly all workers in public and private sectors have social insurance and a type of retirement benefits. Even those who are not government employee can purchase individual social insurance at subsidized rates and receive medical services. In fact, by paying more, they can be eligible for pension as well. Retirement benefits are not generous and the social insurance has many shortcomings. Still, there are heavy subsidies on drugs and many essential commodities. Therefore, most retired families can make ends meet and usually do not have to depend as much on their children for survival as they did in the past. In fact, with the current state of the economy and lack of proper employment opportunities, it seems that many more youths depend on their parents' support for living, than vice versa.

2.4.2 Urbanization and Investments in Human Capital

Institutional changes, and in particular improvements in education, have been important factors in the decline in fertility and the success of the population control policy in Iran. It is difficult to imagine such drastic reduction in fertility rate without improvements in education, especially among women in the rural

areas. According to the first national census of Iran, in 1956, only 31 percent of the country's population was urban. During the next two decades the share of urban residents increased to 47 percent in 1976. According to the latest national census, by the year 2006, 68.5 percent of the population lived in urban areas. This increase in urbanization was itself a factor in reducing fertility rate and decreasing family size, as it has been the case in many other countries. However, available data also shows that during the two decades when the fertility rates and the rate of population growth in Iran were dropping at great speed, a considerable part of the country's population was still living in rural areas. The percentage of people living in rural areas was 45.7 in 1986, 38.7 in 1996 and 31.5 in 2006 (SCI, 1967).

In the year 1956, only 14.6 percent of the Iranian population above the age of 10 was literate. This figure was the whole country's average for both men and women. In that year, the literacy rate for urban residents was 33.3 percent and for rural residents it was 6 percent. The situation for women was much worse, as 99 percent of rural women were illiterate. Even in 1977, only two years before the Islamic Revolution, 81.3 percent of women living in rural areas were illiterate (SCI, 1967; CB, 1977). As it was mentioned before, the discouraging results of the Shah's family planning program had a lot to do with the widespread illiteracy among rural women who did not grasp the importance of this program for their families' welfare.

The Islamic Republic has an impressive record in improving rural education, especially among women. Table 2.3 shows the improvements in education for women of prime reproductive ages in both urban and rural areas during the past four decades. As can be seen from the table, the improvement in women's education in the past three decades, especially in the rural areas, has been tremendous. In year 1966, only about 5 percent of rural women aged 25-29 were literate. This figure increased to 65 percent by 1996 . In fact, despite the various pressures exerted upon women in the Islamic republic, and the discriminations against them in many spheres of social life, women's achievements in education at all levels has surpassed men's. Since 1998, the number of girls admitted to government-run universities has been more than boys. In 2001, about 62 percent of admitted students were girls, causing some conservative politicians calling for a rationing system to limit girls' admission to universities(Abbasi-Shavazi et al., 2009).

2.4.3 Family planning Program

In such a setting, the post war governments increased the budgets allocated for family planning program leading to an expansion in the number and the wherewithal of the health clinics. These clinics, which were responsible for the primary

health care of the rural population, were officially given the responsibility of enforcing the population control policies after 1989. However, clinic staff would advise and provide help for women inclined to use contraceptive even before the new policy of birth control was introduced. The Islamic republic's new policy reinforced these existing practices, increasing their budgets and promoting breast feeding and primary health care as well as aggressive family planning.

After 1989, all kinds of contraceptives such as pills, condoms, IUD, Norplant, vasectomy and vasectomy were available at the clinics and were being used by both women and men. Vasectomy was free. Vasectomy was not only free but any one who took a woman to a clinic for such an operation received some money as rewards. Health clinic personnel were given special training to enhance their skills. Recently, university students are offered an elective course that explains the merits of family planning and inform students about different family planning mechanisms. High school students also receive lessons in population control and family planning. About 50,000 female volunteer workers are participating in the various areas of family planning, making it easier for rural women to access those services (Malekafzali, 2004). As a consequence of all these efforts, over 80 percent of rural residents have access to family planning services through the Rural Health Network. Villages that don't have a health house or are difficult to access, for lack of roads, etc., receive family planning and health care services through mobile clinics.

Table 5 shows contraceptive prevalence rate among Women aged 15-49 In Iran. In 1976, two years before the Islamic Revolution, only 37 percent of women used contraceptives of any kind. This figure for women living in rural areas was 20 percent. By the year 2000, a little more than a decade after the start of family planning in the Islamic Republic, almost 74 percent of all women used some kinds of contraceptive. More importantly, the percentage of rural women using contraceptives was raised from 20 to more than 67. In other words, while at the start of the family planning program, the ratio of urban to rural women using contraceptives was more than two to one; by 2000 this ratio had decreased to 1.15. This implies that the extension of the services and information to rural areas has played an important role in the success of the family planning program.

2.4.4 Cost-Benefit Analysis

Another important factor is the quality-quantity trade-off that Iranian families were (and still continue to be) faced with. Having many children as support for the old age, as we have seen, has lost its former significance. On the other hand, the cost of having many children has increased considerably. Parents have real-

ized that their children's success in life depends upon the investment they make in them. Education is almost free in government schools and is not a heavy burden on the families. However, private schools offer a much better quality of education.They offer smaller class size, better quality of teachers, and more personalized attention to the students. Students who attend public high schools usually need private lessons. The competition for the university entrance exam is fierce. There are millions of students competing for only a dozen high quality public universities. Given the level of family income, the fewer children a family has, the higher the chances for the children to get better quality education and more parental attention and supervision. Children who benefit from these privileges usually have a higher chance to get their desired job or even a better spouse. In the present Iranian society, having children with good education and respectable careers is a significant source of prestige and satisfaction for the parents. This is true even though parents may not need the financial support of their children (although some families still do).

2.4.5 Earlier Marriage

Another contributing factor to the drop in fertility is the rise in the age of marriage. Since women can only have children until they reach menarche, later marriage, decreases the years they are at risk of pregnancy. For a number of reasons, the age of the first marriage has increased in Iran. Shortly after the Islamic revolution, the age of marriage for girls was raised from 9 to 13 (with the permission of her father or if he is dead, her grandfather). Boys can get married at 15. However, the average age at which boys and girls get married have increased significantly during the past three decades. According to the Islamic Parliament Center for Research, during the three decades of the Islamic regime, the average age of first marriage for boys has increased by 2.1 years and for girls by 3.5 years. According to the data provided by the Statistical Center of Iran, in the year 1976, the average age of first marriage in Iran for men was 24.1 and for women it was 19.7. In 2001, the corresponding figures were 26.1 (for boys) and 23.4 for (women).

There are many reasons for the rise of the first marriage age in Iran. One is the desire of the young people to continue their education to higher levels. In recent years, more than one million students participate in the graduate school entrance exams every year. This is partly the result of the poor job market for college graduates at bachelor level and partly a reflection of the personal ambitions of the young Iranians. But perhaps the more important factor for the delayed marriages has been the deteriorating state of the economy during the past decade (reflected in high unemployment and high inflation). The age of first marriage has been

increasing continuously. In addition, there has been an increase in the number of men and women who never marry and choose to remain single. This was extremely rare in the past and would have been considered an anomaly, especially for women. Ironically, remaining single is more prevalent among women (relative to men) and among rural women relative to their urban counterparts. According to the available government data, the proportion of unmarried women aged 30 to 39 in the rural areas is greater than that of urban women and also greater than the rural and urban men (SCI, 2004).

2.5 Conclusion

Despite the governments remarkable success in population control, the Islamic republic of Iran has had a poor record in many of its economic and social programs. In the late 1960s, Iran was ahead of countries such as South Korea and Turkey and performing much better than Malaysia, Indonesia and Thailand in nearly all indicators of economic development. Today Iran is still a developing country with little similarity to South Korea or Turkey. It also lags behind such countries as Malaysia and Indonesia. Considering the fact that Iran is extremely rich in natural resources, most notably in oil and natural gas, and has a young and educated population, its economic failure is surprising.

These facts make the exceptional success of the Iranian family planning and population control program all the more perplexing. The Islamic Republic has had a highly successful family planning program, unparalleled in any country in the Muslim world or even in any other developing country. Policy makers were faced with many challenges within the country, among them the deeply rooted beliefs of the religious community, and the never ending hostilities with the outside world. Their success in this important battle seems astonishing under such circumstances.

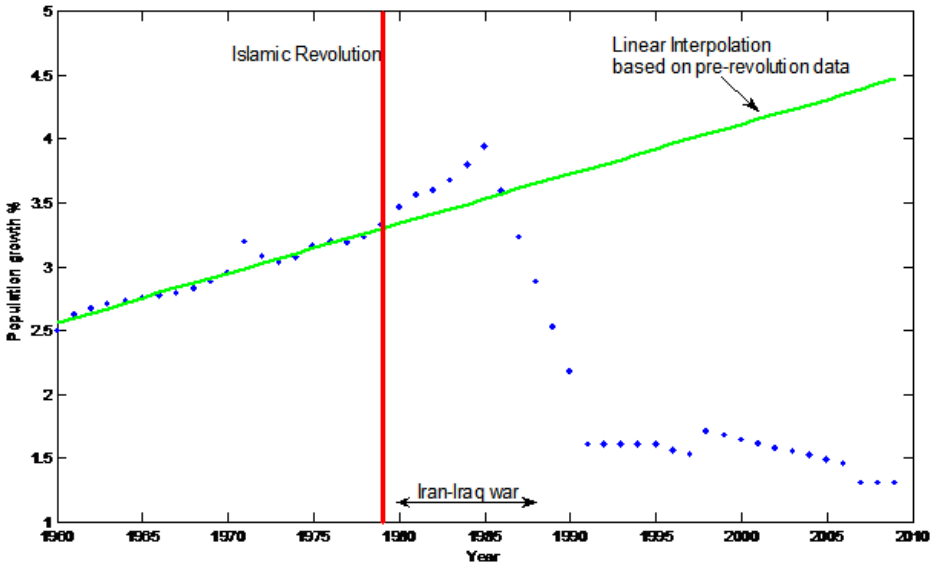
The parallel efforts of policy makers and the tens of thousand of people who participated in the family planing program contributed greatly to this achievement. They, in fact, succeeded in preventing a disaster that was threatening the future development of the country. The sharp decline in the fertility was also brought about by several other factors that made the transition possible. Some of these factors include decreased child mortality, increased social security benefits, increases in women's educational attainments as well as increased age of marriage..

During recent months voices that are being heard denying the threats of uncontrolled population growth and even rewarding people for having larger families. The president has announced that the government will deposit an equivalent of $1000 in a bank account opened for each new born baby. They will then add a yearly sum to these accounts until the babies reach the age of 20. Fortunately, the

present government's call for reversing the country's population control policies has not been received enthusiastically by the people. Many policy makers criticized it severely and openly. The parliament has called this policy illegal and is trying to annul it. The public's reaction has been,at best, lukewarm but mostly hostile.

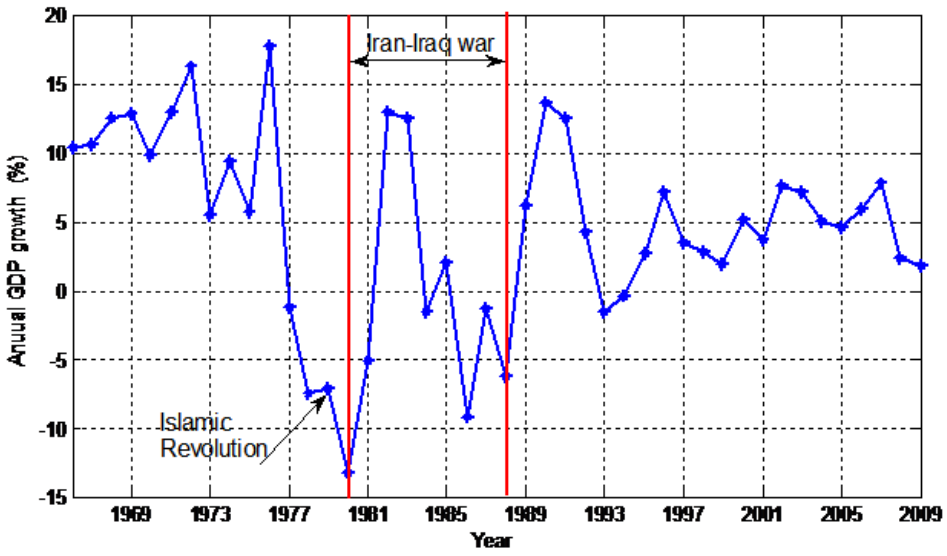
Iran has gone through an institutional transformation during the past two decades. A much better health infrastructure is established, particularly in the rural areas. People's attitudes toward family planning has changes, as they have come to realize the advantages of smaller family size. It is, therefore, doubtful that fertility would rise significantly as a result of the president's new ideas.

Figure 2.1: Annual Population Growth (%)



Source: The World Bank

Figure 2.2: Annual GDP Growth (%)



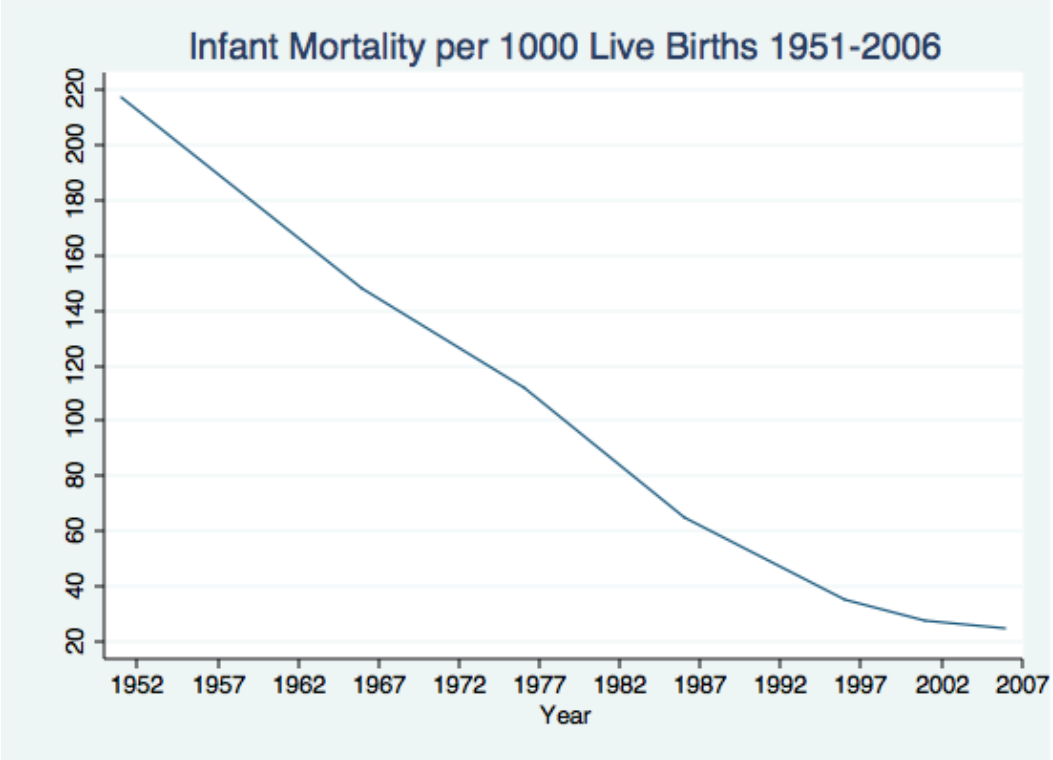
Source: The World Bank

Table 2.1: Population of Iran 1901-1976

Year	**Total Population** Millions	**Urban** (%)	**Rural** (%)
1901	8.6	21	79
1936	11.9	21	79
1941	12.8	22	78
1956	18.9	31	69
1966	25.8	38	62
1976	33.7	47	53

Source: Annual Report, 2004, Statistical Center of Iran

Figure 2.3: Infant mortality



Source: Statistical Center of Iran

Table 2.2: Population Growth in Iran 1946-2006

Years	**Population Growth** (% per Year)
1946-1951	2.8
1951-1956	3.1
1956-1966	3.1
1966-1976	2.7
1976-1986	3.9
1986-1996	1.96
1996-2006	1.61

Source: Annual Report, 2004, Statistical Center of Iran

Table 2.3: Literacy rate for women in by Residency and Age Groups

Age Groups	**1976**		**1986**		**1996**		**2006**	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
15-19	75.4	19.8	85.8	53.0	96.9	86.4	98.3	93.2
20-24	59.4	10.1	75.8	36.5	93.8	77.9	97.9	90.5
25-29	49.4	4.9	65.5	22.0	89.5	65.4	96.3	84.1

Source: Annual Report, 2004, Statistical Center of Iran

Chapter 3

The Expansion of Rural Health Houses and its Impact on Fertility

3.1 Motivation and Introduction

As one of the most populous countries in the Middle East[1], Iran's population transition has been a subject of great interest. Throughout the 1980s, Iran had one of the fastest growing populations in the world, only to have the fastest declining in the 1990s. More notably, the biggest drop in total fertility rates occurred in rural areas, declining from 8.1 in 1976 to 2.4 in 2000. The relative decline in rural areas was so fast that the urban-rural gap dropped from nearly 2 children in 1985 to 0.5 children in 2000 (Roudi-Fahimi, 2002).

Many scholars suggest that active participation of the government in the expansion of rural Health Clinics (health houses, hereafter) as purveyors of contraceptives and information were the primary reason for the dramatic decline in fertility(Roudi-Fahimi, 2002; Bongaarts and Sinding, 2009). In support of this argument, Erfani and McQuillan (2007) argue that the expansion of contraception use was the main proximate factor in the fertility decline, accounting for 61% of the reduction in fertility from its theoretical maximum. Supporters of argument suggest that the availability of health and family planning services in remote areas lowers the cost of obtaining contraceptives, thereby making family planning a viable option for those who demand it. In addition, they argue that the availability of family planning services encourages the uptake of family planning practices for those who are newly exposed to these services. Such services can

[1]It's the third most populace country in the Middle East after Egypt and Turkey respectively

also empower women by educating them about different methods of family planning, which may increase their negotiating power and alter their roles within the household (Miller, 2005; Schultz, 2007). Taken together, these types of arguments suggest that the availability or supply of family planning services explains a great part of the decline in fertility.

Others believe that the substantial increase in female education and labor force participation explains most of the observed decline in fertility(Mehryar et al., 2007). Supporters of this second argument propose that education and labor opportunities can contribute to the decrease in demand for children. Still other scholars argue that above all, the difficult socio-economic situation in Iran during the late 1980s (a shrinking GDP and the Iran-Iraq war) led to a decline in demand (Abbasi et al., 2002). These arguments focus on women'ss demand for children. The real explanation is most likely a combination of all these forces. For example, contraception may be supplied most where demand is high and may in turn create more demand by informing the population and reducing the cost of accessing fertility control. Thus, a variety of mechanisms may have simultaneously served to reduce fertility for different groups of women in Iran.

In this paper, we assess a version of the supply side story. We examine whether early access to health houses(clinics that provide family planning services and basic healthcare to the rural population) had an impact on rural women's fertility in Iran. We focus on rural areas because the bulk of the transformation occurred there, and also because health-houses strictly served rural areas. To avoid selection issues regarding placement of Health Houses, where existing demand may have been higher, we compare outcomes for women in the same village who were exposed to health houses at different ages, and hence at different points in their reproductive cycle. We look at the association between women's age of exposure to a Health House and their total number of live births.

Because availability of health houses varied across villages and over time, we can use the combination of variation in access among women of the same age but in different villages as well as women of different ages in the same village to estimate the effects of exposure to a health house. A preliminary examination of the secular trends in Total Marital Fertility and number of health houses/million rural population, suggests that timing of expansion of health houses coincides with the drop in mother's total fertility rate (See Figure 3.1). We hypothesize that controlling for a women's individual, household, and village level characteristics, those exposed at earlier ages will have a larger decline in number of kids ever born. Consistent with this hypothesis, we expect to see a progressive reduction in the number of children born to mothers who were exposed to health houses earlier. In addition, we examine if the probability of having a birth for a woman

is related to the presence of an operating clinic in her village the previous year. Again, we control for individual and village characteristics of the mother.

3.2 Literature Review

Many studies have attempted to identify and measure the causal impact of family planning services on fertility outcomes. In doing so, researchers face an important struggle, namely the difficulty of identifying the program affect in face of endogeneity. This is because both the placement of family planning services as well as the uptake level is thought to depend on the demand for children in the recipient communities. In situations where program placement is randomized or even quasi-experimental, researchers can exploit the design to identify the true effect of the programs.

A well-known case of this methodology, though applied to a different scenario, is the evaluation of primary school construction in Indonesia (Duflo, 2001). She used a difference in difference method to measure the impact of school construction on education and subsequent earnings of children, exploiting the variation in geographical expansion of schools combined with the variation in children's exposure to treatment (i.e. primary school) to identify the program effect.

Many studies applied this identification strategy to the question of fertility and family planning, and they have mostly found a small to moderate impact from family planning programs on total fertility. Estimated program impacts on fertility reduction range from 5 to 15%. Joshi and Schultz (2007) studied the family planning and maternal and child health program in Matlab, Bangladesh and found a 15% reduction in fertility due to to expansion of rural health clinics and embedded family planning programs.[2]. Miller (2005) exploits the arbitrary geographic expansion of PROFAMILIA (a family planning organization) in Colombia. Using different birth cohort dummies for women, he studies the impact of exposure to family planning program at different ages (and hence for different lengths) on subsequent fertility. He finds that family planning was responsible for about 7% of the decline in fertility during Colombia's demographic transition.

In a recent study of rural Iran,Salehi-Isfahani et al. (2009) focus on one aspect of family planning program, namely the expansion of rural clinics and its impact on child-to-woman ratios in villages. They find estimates of program impact in the range between 4% to 20% of the total fertility reduction in 1986 to1996. Our paper builds upon their work, but differs from it in the sense that our analysis is

[2]Note that they mentioned that the assignment of treatment and controls were not completely random, presenting some bias in their results

at the individual level (i.e. our unit of observation is a woman/mother). Using three different sources of data, we look at the age of first exposure to the health house (for those who have been exposed at some point in their lives) and measure the impact of their age of exposure on total number of kids they have. Also, for a sub-sample for which we have complete birth histories, we estimate whether the probability of a woman giving birth was associated with present of an operating health house in her village the previous year. The two specifications are detailed in the methodology section.

3.3 Background and Institutional Setting

3.3.1 Population Policy Changes in Iran

The Iranian government officially began its family planning activities in 1967, when the Under-secretary of Population and Family Planning was established within the Ministry of Health. The population growth rate declined to 2.7% per year during the period 1966 to 1976. The pre revolutionary family planning program contributed to a moderate fertility decline and offset the large impact of mortality decline on the population growth rate. It also diffused knowledge of family planning methods and contraceptive use through much of the country. Although the program did not achieve its goals fully during the 1970s, it laid a foundation for the success of the post-revolutionary family planning program (Abbasi-Shavazi et al., 2009).

In the years immediately following the Islamic revolution, several socio-cultural and economic policy changes were made that discouraged fertility control. First, the office of Under Secretary of Population and Family Planning was abolished, and family planning staff members were moved to other departments within the Ministry of Health. Second, the minimum legal age at marriage, which was increased by the Family Protection Laws, was again reduced to 13 and 15 for girls and boys, respectively. The reduction of age at marriage was considered to be necessary to prevent further moral and social corruption. Religious leaders emphasized marriage and family formation as basic Islamic virtues, and the government was urged to adopt economic policies that would facilitate and encourage early and universal marriage (Hoodfar and Assadpour, 2000). In spite of these policy changes, the Ministry of Health continued to offer other forms of contraception through Family Health clinics such as birth control pills, Intrauterine Device (IUD), and condoms and the information about these services where provided through the maternal and child health services in the primary health clinics (Aghajanian and Merhyar, 1999). Motivated couples were also able to obtain

contraceptives from the private health sector. Condoms were in fact easily available through drug stores or even major supermarkets. However, these services were limited, and accordingly, the 1986 census revealed a rapid post-revolution population growth

Concern over the necessary resources to accommodate the expanding population led to an important population conference in city of Mashad in September of 1988. Scholars and policy makers addressed the population boom and its potential consequences by mandating family planning program that was launched in December of 1989. This program had three major goals: (1) to increase the age at first birth and the spacing between children, (2) to discourage pregnancy among young women, and (3) to decrease family size. In 1993, the legislature passed a family planning bill and removed most of the economic incentives for large families that existed during the war years. The program also focused on increasing female education and labor force participation, as well as on addressing child health indicators, such as infant mortality. This program was incorporated into the existing and expanding primary health care system of Iran (PHC), including the Health Houses. As the PHC had a focus on rural areas, the incorporation of family planning program combined with the expansion of the Health Houses allowed for widespread access to family planning services in rural Iran.

It is important to note that the expansion of the Health Houses and the availability of family planning services in Iran never stopped entirely despite the government's efforts to discourage fertility control following the Islamic revolution. Although religious figures encouraged larger families and discouraged family planning, they never formally announced that family planning was against Islam(Roudi-Fahimi, 2004). Moreover, the health house data indicates that about 47% of all health houses (functioning in year 2006) were built prior to 1989, and this figure rises to 68% in 1993. Presumably, prior to 1989 some basic family planning information and services was being provided through the maternal and child services of health houses, however these services were likely to be limited. Still, after the decisive Mashad conference, policy makers pushed to gain explicit religious approval for a government provided family planning program. These efforts culminated in the initiation of an active family planning program in 1989, which was passed by the legislature and formally became the law in 1993. Once the family planning became a law, family planning services were incorporated into the already expanding health houses. This new phase of the family program became much more comprehensive and provided active delivery of contraception through health houses (Salehi-Isfahani et al., 2009).

We recognize the distinction between passive and active delivery of contraception services, the former referring to health services before active family planning

became legally incorporated into them (i.e. pre 1989). However, in this paper, we focus on the impact of existence of a health house, rather than the "active" delivery of fertility control, on number of kids ever born to a woman. Even if no contraception was being provided, family planning information was provided through the maternal and child health services as community health workers were trained in family planning practices; thus constituting passive delivery of family planning services(Nasseri et al., 1991).

Figure 3.1 shows estimates of total marital fertility rates (TFR) for Iran from 1972-2000 in both rural and urban areas using the own child method.[3] They employ own child estimates where mother's are linked to their children in each household and the age of the mother and child are taken together to estimate age specific fertility trends.These own child TMFR are based on three sources, (1) the 1986 census, (2) 1996 censuses and (3) 2001 Iranian Demographic and Health Survey (IDHS). The overlapping and non-linear shapes of the TMFR curves are particularly interesting because they show an increase in TFR rates in the early 1980s (post-revolution) then the marked downward trend by 1985 throughout the country. While there are slight differences in some years, the estimates are remarkably similar. Using all three gives a long-term view of fertility trends in Iran. Figure 3.1 also shows the number of Health Houses operating per million rural inhabitants in a given year. Graphically it seems as though the second wave of rapid expansion of the Health Houses in 1985 coincides with the onset of the rapid fertility decline.[4]

3.3.2 Iran's Current Health System

There are currently more than 16,000 Health Houses in Iran covering around 95 percent of the rural population. Additionally, mobile clinics bring health services to people living in the most remote areas. Each Health House serves around 1,500 people usually consisting of the people in the central village (where the Health House is located) and those in satellite villages that are within an hour's walk(Roudi-Fahimi, 2002). Health Houses are the smallest health units in the country. In rural Iran, each village has a Health House staffed mostly by two trained "*behvarz*" or community health workers (one male and one female). The

[3]The own-children method uses the reverse-survival procedure to estimate fertility measures for the years prior to a census or household survey. Based on the information on the household record, children under the age of 15 are matched to women aged 15-64 in the same household, with the assumption that the women are the mothers of the children enumerated in the same household. This information is then used to estimates age-specific fertility rates.

[4]After several years of problems post revolution, in 1983 the health house program was revived.

health workers are selected from the local population and undergo two years of training. Health Houses, which are the basic building blocks of Iran's primary health network, are the health system's first point of contact with the community in rural areas.

Depending on different attributes of the geographical location, in particular population and communication potentials (i.e. roads, phone, etc.), each Health House covers the village it is located in and up to five other satellite villages, usually no farther away than an hour walk. Each Health House keeps files on all covered residents, and no one outside of the covered population is allowed to seek treatment in a clinic. A team of health workers regularly visits the satellite villages. In addition, there are Rural Health Centers, which house a physician, a health technician and an administrator to deal with more complex health problems; on average, there is one Rural Health Center per 7,000 inhabitants. Likewise, similarly distributed urban health posts and Health Centers have been established in urban areas.

The entire network is managed and administered through District Health Centers answerable to the Ministry of Health and Medical Education. The duties of the *behvarz* include but are not limited to registration of health information, health education, the provision of maternal and child care, school health, immunization, oral health, occupational and environmental health, home visits, and offering rehabilitation services(Malekafzali, 2004; Aghajanian and Merhyar, 1999).

While there has been much speculation about the role of rural health houses impact on Iran's fertility transition, the empirical assessments have been limited. Given that there is vast variation in fertility by province and level of regional development, any attempt to assess the impact of Health Houses has been hindered by the possible endogeneity of clinic placement.[5] This study will use a combination of variation across villages and over time to account for this problem by comparing the effects of clinic exposure on women who did get a health house in their village. We further discuss this issue in the methodology and results section.

3.4 Data

This analysis is based on three separate sources of data. The first dataset is a 2% random sample of the latest round of the National Population and Housing Census (NPHC), conducted in 2006-2007. The census is implemented every 10 years, and has basic individual level information such as age, literacy, employment, religion, marital status, total number of live children, total number of live births,

[5]This has been discussed in detail by(Salehi-Isfahani et al., 2009)

and migration, as well as basic household level information. The sampling frame is simple random sampling, and individual, household, and housing unit weights are provided (as we are using a 2% sample and not the entire census). Also, there is geographical location information available for the census data at the level of city block for urban areas and village level at rural areas.

The second source of data is the 2001 Iranian Household Expenditure and Income Survey (HEIS), a nationally representative survey carried out by the Statistical Center of Iran. HEIS includes individual level characteristics and the precise geographical location of each rural cluster. This survey is done annually. It uses a stratified sampling and divides the sample by province and urban/rural location to ensure representative estimates at the province and urban rural level. The population was divided into 54 strata. Within each stratum several primary sampling units (PSU) were selected, and 30 households per PSU were selected using cluster sampling for the survey. We use all 93 rural clusters in the survey as Health Houses serve only the rural area.

The third source of data contains the location of each rural Health House in Iran and the time they first opened. This dataset comes from the Ministry of Health and Medical Education, (MOHME). When a Health House is established, the provincial university who is in charge of the Health House will report it to the Office of Resource Development in Tehran. Once the *behvarz* start work, the university also reports it to the Office of Network Development (OND), which then acknowledges it as a functioning Health House. The Health House data has been compiled from both electronic and paper forms, and it has the name of locations and not the geographical address available in the other data sets.

We merge the health house data with the other two datasets on names of the village. About 70% of village names in health house records are matched with those in the census. Detailed description of the matching is available from the authors. Merging each of these data sets with the health house data allows us to know, for every rural village in our samples, if there is a Health House in the village (by 2001, or by 2006), and if so, when it started to operate.

Our analytical samples from both data sets consist of rural, non-migrant,ever married women aged 15-49 for whom we have complete information on number of live births, literacy, age, age at first marriage, and ownership of household assets and amenities.

Table 3.1 presents the summary statistics. The first two columns are from the census, consisting of 61,405 women, of whom 34,332 have a health house in their village at the time of the survey. Sub-samples of women with and without health house in their villages don't seem to differ from one another in age and age of first birth. Women living in villages with health house are more literate, have more

assets, and have fewer children, and their average age of first exposure to health house is 18. The overall average age in the sample is about 34, and age at first birth is 21. The next two columns are from HEIS. There are 1890 women in that sample of whom 1,306 have a health house in their village of residence. In general, relative to the census, HEIS women are less literate, have more children and have a lower age at first birth and assets.[6] The last two column focuses on a sub-sample of women for whom we have complete birth histories. We could find complete birth histories with years of birth of all their children for only 1357 women in the HEIS sample, and these women are very different from the entire sample. They are younger, have fewer children and have their first child at a later age, are more literate, and are more likely to have a health house in their village. We could not, however, find complete birth histories for the census sample. Details of birth history construction will be discussed in the methodology section.

3.5 Estimation Strategy

In our first and main specification, we look at the impact of timing of exposure to health house on the total number of children born to a woman. The sample under study consists of ever married, non-migrant, 15-49 year old, women who have been exposed to a health house at some point in their lives. Here we are assuming that among ever-married women in Iran at these ages, there is very little selection into motherhood beyond the natural infertility rate for married women. In fact, in the HEIS data only 2% of married women do not have any children and these women are concentrated in the two lowest age categories, age 15-20 and 20-25. About 1% of ever-married women who have not migrated in the last year and live in rural areas report no births in the census. We focus only on women who have a health house in their village at the time of survey survey and use the temporal variation in age at exposure to a health house to assess their effects. This procedure allows us to use village fixed effects to control for the vast heterogeneity across villages.

We want to estimate the impact of age at first exposure on the total number of children born to a woman. To do so, we first create 5-year age groups for each woman based on when a Health House first became available in her village. We also include village level fixed-effects to control for all area-level variables that could confound our estimates as well as the potential endogenous placement of Health Houses. We also control for other individual level independent variables

[6] This is likely due to secular trends because the HEIS survey was conducted 5 years before the census.

including (1) demographic characteristics (age and age at first marriage) and (2) socio-economic characteristics (literacy and ownership of household assets; we use dummy variables for access to amenities such as having a car, TV, phone, etc.). Using a Poisson model, we estimate:

$$N_{ij} = \beta X_{ij} + \lambda \sum R_{ij} + \mu_j + \epsilon_{ij} \tag{3.1}$$

Where N is number of children ever born to a woman i in village j. R_{ij} is a set of seven dummy variables that capture a woman's age at exposure to a health house. For example if a women was exposed at age 43 for the first time, she would have the R_{ij} 40-44 set to 1 and R_{ij} 0-14, R_{ij}15-19, R_{ij} 20-24, R_{ij} 25-29, R_{ij} 30-34, R_{ij} 35-40 , and R_{ij} 45-49 set to zero. X_{ij} includes the woman's individual and household variables. μ_j are village fixed effects. We run this regression for both the census and the HEIS.

In a second specification, we focus on a smaller sub-sample of the HEIS data set in which we could find complete birth histories for all women. Since fertility histories were not a part of the Iranian Household Expenditure and Income Survey, we must infer these data from other variables within the survey. Given that 1985 was the beginning of the dramatic fertility decline, we first recreate fertility histories for the last 16 years for each woman in our sample (16 years from 2001, the year of the survey). To do this, we use the household roster, which enumerates for each child if his or her mother lives in the household. We retain all children younger than 16 from the household rosters and we use measures of age at first birth and age at last birth, which allows us to accurately impute years of birth even when all children are not enumerated in the household roster. Note that the census does not have info on age at first birth, and we can only calculate it by subtracting age of the oldest child in the household at the time of survey (and not necessary the oldest child born to the woman). Therefore, we only carry out this analysis using the HEIS data. There are five cases in specific for which we can confidently back out the birth years over this 16-year time period in the dataset. In the simplest case, where all children ever born are present in the household roster, we use children's ages in the roster to calculate their birth years. If the number of children ever born is one greater than the number of children in the roster, then the birth year of the missing (presumably the oldest) child can be calculated from the mother's age at first birth. If a women reports two or fewer children ever born, but there is no matching data in the household roster, then we impute children's birth years from mother's age at first birth and age at last birth. Finally, if the year of last birth for the mother was greater than 16 years ago, we are certain that she had no births in the last 16 years.

Of the 1890 non-migrant, rural, ever married women in 2001, for whom the variable children ever born and age at first birth are not missing, we can recreate fertility histories for approximately 1357 women. For these women with complete histories in the last 16 years, we will create a yearly observation as our binary dependent variable,$Birth_{ijt}$, which will be equal to 1 if woman i living in village j gave birth in year t. We will create these yearly outcome variables based on the mother's age going back to when she was 16 years old to incorporate only years that she is at risk of a pregnancy. For example, a woman aged 17 in 2001 would only contribute 1 observation year whereas a 49 years old woman would contribute 33. We will then estimate the following Logit regression:

$$Birth_{ijt} = \beta X_{ijt} + \gamma H_{ijt} + \mu_j + \lambda_t + \epsilon_{ijt} \tag{3.2}$$

where $Birth_{ijt}$ is equal to 1 if a woman i living in area j gives birth to a child in year$t$; H_{ijt} is a dummy equal to 1 if area j has an operating clinic in the village as of the previous year. μ_j are village fixed effects and λ_t are year fixed effects. The variables in X_{ijt} include the woman's age, the stock of children she has living in the household up to year t, her marital status, age at first marriage, her literacy status, and her household asset dummies, and a dummy variable for whether or not she gave birth in year t-1.

3.6 Results

We first report results for the association of children ever born and age at exposure for both data sets in Table 3.2. Estimated patterns are very similar in both datasets and suggest that earlier exposure to a health house significantly and progressively decreases the number of children ever born relative to women exposed between 45-49. Magnitudes of the coefficients, however, vary significantly across the two samples. While age trends by birth cohort are nearly identical in both databases, the Census estimates for age at exposure to Health Houses are about half the size of those from the HEIS. Focusing on the census estimates, women exposed during their most fertile years (20-34 age group) had a 20% reduction in number of children. Since the average number of children ever born to mothers in this age group is 4.6, the 20% reduction is equivalent to 3.6 kids or an average of approximately one child less. An F-test shows that coefficients for all the age at exposure groups are significantly different from one another with one exception. Exposure at ages 40-45 does not seem to be different from exposure at ages 46-49. Relative to women without family planning access during their fertile years, lifetime access is associated with about 40% fewer births (the coefficient

on the 15-19 age group). However, this group includes many young women with incomplete fertility. We repeat the analysis for a sub-sample of women over the age of 40, who presumably have nearly completed fertility. We find similar results in patterns, and in fact slightly stronger coefficients, confirming our findings in the larger sample of women (not shown, but available upon request).

We believe the census estimates are more realistic for several reasons. First, because of its large sample size, the census allows us to capture many more villages and more women. Second, 31% of the HEIS clusters were exposed to health houses pre-1985. This figure is 24% in the census. Higher presence of early adopters in the HEIS may cause an overestimation of the effects because early adopting villages may have more women with higher demand for fertility control. Third, the wealth indicators are bigger for HEIS-perhaps because access to some of the amenities was a stronger signal of wealth in 2001 relative to 2006, Irrespective of these differences, the patterns are very similar suggesting that age at exposure does matter, which is why we report HEIS estimates.

We next explore differences by literacy status only in the census sample. This is because we are more confident in the census data set, and because it offers bigger sample size and variation. Table 3.3 shows the results of the same regression run separately for literate and non-literate women. Regression results suggest that birth reduction was more significant for literate women. These differences are greater for women exposed between ages of 25-39, suggesting that literate women of this age group (those in their most fertile years) might have had a higher demand for fertility control. The difference between literate and non-literate groups is smaller, yet still significant, for women exposed to health house at younger ages.

As an additional specification test, we examine whether having a clinic in one's village was associated with age at first marriage, as age at first marriage might respond to Health House supply, which would bias our results. Having a clinic in your village at age 15 or 20 (the range in which most women were married in the HEIS sample) is not related to age at first marriage (controlling for age, literacy, wealth and area fixed effects) in this sample. However, we could not check this for the census because the data does not include age at first marriage. Finally, we looked to see if women of higher wealth and who were exposed earlier to clinics had significantly different number of children, as was the case with literate and non-literate women. In our samples, we did not find a significantly different effect for wealthier women. (tables available upon request).

We now turn to our second specification looking at whether having a clinic operating in a woman's village was related to the probability that she would have a birth the following year. Table 3.4 presents the odd ratios from the logistic regression outlined in Equation 2. Note that we only use the HEIS, as this could

not be done with the census sample. We find that having a clinic operating in a woman's village is negatively but not significantly associated with the probability that she will give birth in the following year. Though not significant, the magnitude of the odds ratio is 0.91, which corresponds approximately to a 9% decrease in probability of birth in the following year. We also used the same model to examine whether our choice of one year was reasonable. We examine the probability of birth in the following two and three years, and the results did not change (not shown). However, these estimates are less generalizable because the sample of women for whom we have complete histories is not representative of the overall sample. As we saw in Table 3.1, they are younger and more literate, have fewer children, and more of them live in villages with an operating health house. In addition, the entire HEIS sample consists of a higher portion of villages with early adopters. Nonetheless, the the direction of the estimated coefficient of having an operating health house the year before the birth is consistent with the results found earlier in Table 3.2.

3.7 Discussion and Conclusion

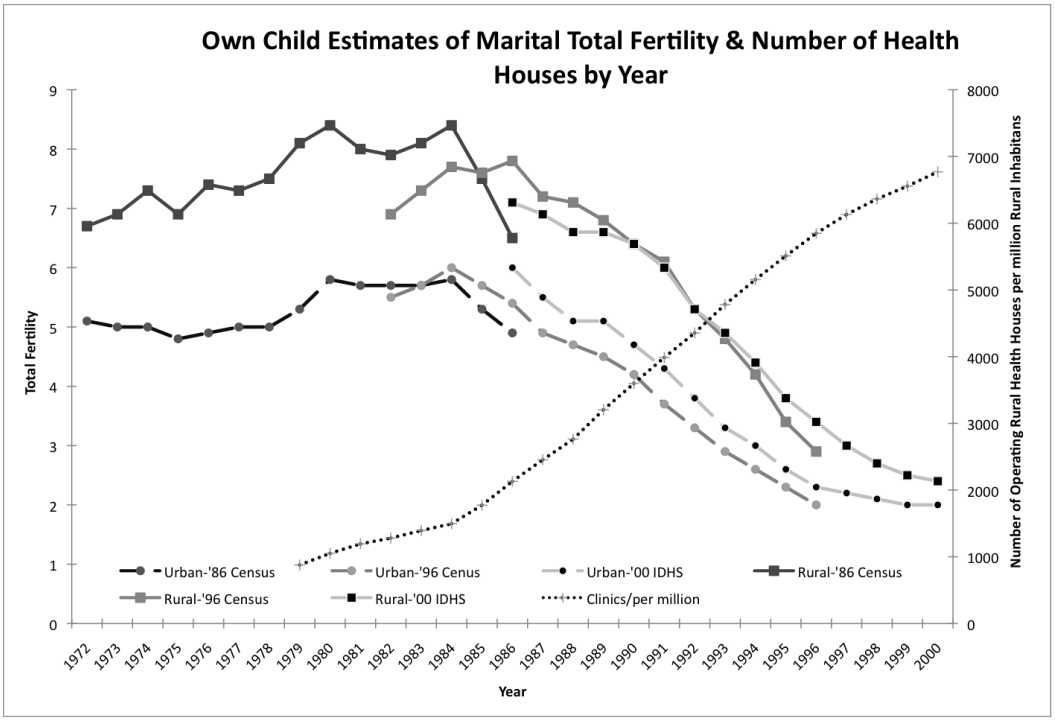
Our results tell a nuanced story. Overall, we find that early life access to Health Houses has a moderate but significant affect on rural women's fertility. Women exposed to a health house during their most fertile years (ages 20-34), experience a 20% reduction in their number of children ever born relative to those exposed after the age of 40. Controlling for individual and village characteristics of the mothers, we find that length of exposure has a significant negative impact on total number of children born to women, as we see that the coefficient on age at exposure groups get progressively smaller. We also find that these effects vary by literacy status, having a stronger effect for literate women. Our findings are consistent with existence of both supply and demand side effects. Women exposed during their most fertile years have a significant reduction in their number of children. This confirms that the supply of health houses did have an effect on their fertility reduction. Our sample only includes non-migrant rural population. To the extent that migration is correlated with family's demand for fertility control, our results underestimate the true impact of family planning. In other words, we are looking at a group that is less interested in migrating to places with better access to family planning, (i.e. those with potentially smaller demand for fertility control), but see such a reduction in fertility. This is, again, consistent with supply side arguments. At the same time, there is a demand side argument as well. We see that the impact is stronger for literate women. This difference in effects by literacy is particularly large for women exposed between ages of 25-39, suggesting that literate women of

this age group (those in their most fertile years) might have had a higher demand for fertility control. Also, the fact that length of exposure to health clinics matters is consistent with demand-side stories. It is important to note that we look at the combination of passive and active delivery of fertility services. After 1989, active planning was incorporated into the health houses, but some family planning was available prior to that time (passive delivery). We recognize the distinction, but measure the combined effects by focusing only on the existence of health houses and not the active provision of family planning service after 1989. However, we do look to see if the effect sizes were different pre & post-1989, and the patterns were again largely the same. In fact, the patterns were somewhat stronger pre 1989. Our results have some limitations that deserve scrutiny. First, while we attempt to account for some endogenous placement of health houses, if there was widespread targeting of clinics to areas with higher demand for contraception then our estimates may still be biased. Second, we have looked at the (relatively) short-term impact of Health House on fertility behavior. For a more complete picture of the impact of Health Houses on fertility, we need to look at total completed fertility by cohort.

The impact of family planning programs can be overstated if the program initially increases the interval between births, but not in the long run. Therefore, only a long-term study across a series of birth cohorts could assess the impact on the final number of children ever born and their birth spacing. Third, a serious in this literature is that the response to fertility programs differs by a woman's reproductive goals, number of children desired, age, fecundity, etc. It can be argued that, women who already have a high desire to limit their fertility choose to use the Health Houses more than the rest of the population. To understand the nature of heterogeneity in response to clinics, we included a number of interactions between women's characteristics and the clinic variable (such as literacy, wealth, etc.). To the extent that these variables are strong proxies for desired number of children, these interactions can help address this self-selection concern. Finally, catchment areas we use, namely the village of residence, may not be the exact area served by these Health Houses. Insofar as some villages have access to Health Houses in nearby villages, there may be measurement error in estimating the impact of having a Health House in one's village. We may incorrectly categorize a village as not having access to a clinic, when in fact it does because it has access to a clinic in a nearby village. In that case, our results underestimate the impact of having a Health House in a woman's village on her fertility reduction. However, populations who generally reside within close proximity of the clinic are completely identified.

In spite of these limitations, we present one of the very few empirical assessments of the impact of the rural Health Houses on the fertility decline in rural Iran. We find evidence suggesting that both supply and demand forces worked simultaneously to successfully bring down rural fertility in Iran. Access to Health Houses at most fertile years did have a significant impact on lowering women's fertility. At the same, time, this impact was stronger for literate women, who presumably have a higher demand for fertility control.

Figure 3.1: Estimates of Total Fertility Based on the 1986 and 1996 Censuses, and 2001 IDHS, and the Expansion of Health Clinics



Source: Jalal Abbasi-Shavazi, M. and P. Mcdonald. 2006. "Fertility Decline In The Islamic Republic Of Iran: 1972 - 2000"

Table 3.1: Summary Statistics For All Samples

	Census				HEIS					
	All Sample		Have HH		All Sample		Have HH		Fertility Hist.	
Variables	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age	34.82	8.08	34.93	8.07	34.09	8.62	33.95	8.56	31.22	7.71
Age at First Birth	21.52	4.39	21.56	4.34	19.78	3.70	19.977	3.73	20.16	3.79
Literate	0.623	0.48	0.67	0.47	0.55	0.50	0.55	0.50	0.66	0.47
Total Live Births	3.59	2.31	3.53	2.28	4.12	2.78	3.97	2.70	2.95	1.89
Computer	0.06	0.25	0.07	0.25						
Car	0.23	0.42	0.24	0.43	0.10	0.30	0.090	0.29	0.17	0.31
Motor Bike	0.69	0.46	0.76	0.43	0.17	0.37	0.15	0.35	0.17	0.38
Telephone	0.41	0.49	0.45	0.50	0.31	0.46	0.34	0.47	0.33	0.47
Health House in Village	0.56	0.50	1.00	0.00	0.55	0.50	1.00	0.00	0.56	0.50
Age when health house opened	17.95	10.38	19.93	10.38						
Number of Observations	61405		34332		1890		1036		1357	

Source: Iranian census, 2006; Iranian HEIS 2001

Table 3.2: Regression of total children ever born on mother's age at first exposure to a health house

	HEIS(2001)		**Census(2006)**	
Age HH Opened in Village	No-FE	FE	No-FE	FE
(Omitted group: 45-49)				
Age 0-14	-0.56***	-1.42***	-0.23***	-0.43***
	(0.081)	(0.117)	(0.033)	(0.050)
Age 15-19	-0.51***	-1.20***	-0.18***	-0.33***
	(0.061)	(0.098)	(0.033)	(0.047)
Age 20-24	-0.43***	-0.10***	-0.14***	-0.26***
	(0.051)	(0.078)	(0.033)	(0.045)
Age 25-29	-0.38***	-0.85***	-0.12***	-0.20***
	(0.046)	(0.063)	(0.033)	(0.044)
Age 30-34	-0.35***	-0.72***	-0.09***	-0.14***
	(0.040)	(0.041)	(0.033)	(0.043)
Age 35-39	-0.34***	-0.56***	-0.07**	-0.08**
	(0.054)	(0.047)	(0.034)	(0.042)
Age 40-44	-0.38***	-0.44***	-0.02	0.00
	(0.052)	(0.026)	(0.035)	(0.044)
Birth Cohort (Omitted group: 1977-1981)				
1987-1991			-0.60***	-0.61***
			(0.022)	(0.026)
1982-1986	-0.35***	-0.37***	-0.36***	-0.38***
	(0.047)	(0.058)	(0.011)	(0.011)
1977-1981				
1972-1976	0.55***	0.44***	0.35***	0.34***
	(0.043)	(0.042)	(0.008)	(0.009)
1967-1971	0.82***	0.64***	0.61***	0.59***
	(0.052)	(0.044)	(0.008)	(0.010)
1962-1966	1.13***	0.87***	0.86***	0.82***
	(0.072)	(0.059)	(0.010)	(0.014)
1957-1961	1.24***	0.86***	1.09***	1.02***
	(0.078)	(0.066)	(0.015)	(0.018)
1952-1956	1.44***	0.94***		
	(0.098)	(0.083)		
Number of Observations	1035	1035	34332	30951
Number of Cluster ID	51		6664	

Source: Iranian census, 2006; Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Robust Standard errors in Parenthesis; controls: age at first birth, literacy, and asset ownership dummies. 3381 observations were dropped (in Census) for having only one observation in group when we use Fixed Effects

Table 3.3: Regression of Total Children Ever Born on Mother's Age at First Exposure to a health house: Literate Vs. Illiterate

	Literate	**Illiterate**
Age HH Opened in Village		
(Omitted group: 45-49)		
0-14	-0.53***	-0.57***
	(0.076)	(0.086)
15-19	-0.43***	-0.45***
	(0.074)	(0.076)
20-24	-0.39***	-0.34***
	(0.072)	(0.069)
25-29	-0.33***	-0.27***
	(0.071	(0.064)
30-34	-0.26***	-0.18***
	(0.070)	(0.060)
35-39	-0.21***	-0.10*
	(0.070)	(0.056)
40-44	-0.11	-0.01
	(0.077)	(0.062)
Birth Cohort		
(Omitted group: 1977-1981)		
1991-1987	-0.66***	-0.46***
	(0.0262)	(0.128)
1986-1982	-0.38***	-0.35***
	(0.012)	(0.044)
1976-1972	0.343***	0.30***
	(0.010)	(0.030)
1971-1967	0.62***	0.48***
	(0.012)	(0.032)
1966-1962	0.87***	0.69***
	(0.016)	(0.037)
1961-1957	1.12***	0.84***
	(0.022)	(0.044)
Number of Observations	19631	7814

Source: Iranian census, 2006; Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Robust Standard errors in Parenthesis: controls: Asset Ownership dummies and Age at First Birth

Table 3.4: Regression of Probability of Birth Given There is Clinic Operating in village in Previous Year

Variables	**Coefficients**	95% Confidence Interval	
	(Odd Ratios)	Lower Bound	Upper Bound
Clinic Operating Previous Year	0.91	0.760	1.099
# children < 16 in household in year	0.70***	0.675	0.737
Literate	0.81***	0.724	0.906
Age at First Birth	0.93***	0.917	0.944
Age Group at Birth			
Age 20-24	2.53***	2.223	2.880
Age 25-29	2.87***	2.444	3.3728
Age 30-34	2.71***	2.225	3.305
Age 35-39	1.38**	1.068	1.792
Age 40-44	0.39***	0.231	0.647
Age 45+	0.07***	0.009	0.494
Number of Observations	17541		
Number of Mother IDs	1357		

Source: Iranian HEIS,2001; Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Robust Standard errors in Parenthesis; Regression includes year and village fixed effects; controls: Asset Dummies

Chapter 4

Does Availibility of Family Planning Exacerbate Gender Preference?

4.1 Motivation and Introduction

The United Nations Children's Fund (UNICEF) estimates that more than one million female babies die each year as a result of inequitable access to health care, differential feeding and other forms of gender-based neglect. In China, cohorts born between 1980 and 2000 included 22 million more men than women as a result of sex-selective abortion, a phenomenon known as the "missing girls"(Ebenstein and Sharygin, 2009), and similar patterns are found in Korea and India (Park, 1983). In addition to such blatant discrimination, more subtle forms of son preference exist and persist worldwide. For example, in many parts of the world, families admit to wanting at least one son (or even two sons). If parents continue child bearing until they have their desired number of sons, girls, on average, will have a larger number of siblings (Yamaguchi, 1989). Even in the absence of gender based discriminatory behaviour by the parents, the mere fact of living in larger households puts girls at a disadvantage in terms of access to resources and formation of human capital (Jensen, 2005). While reliable data on direct discriminatory behaviour towards girls is difficult to obtain, studying fertility patterns provides an opportunity to detect gender preference at birth using standard, available data sources.

The male-preferring stopping rule hypothesis assumes that families have relative control over their fertility decisions. In the absence of this assumption, number and timing of children would be random, and hence independent from

gender composition of children. Subscribing to this view, then, implies that availability of family planning can impact the relationship between gender preference and fertility. Those families who want to stop having children once they have a son can more successfully do so once they have better access to birth control. Also, when people have access to birth control and are encouraged (or in some cases forced) to have fewer children, gender preference can become more amplified and have stronger consequences. Arnold (1985) shows that in Korea, the effects of sex preference are larger at lower birth parities, as parents who have many children will most likely reach their desired gender composition by chance. China, is another example where access to pre-birth gender screening and pressure to have fewer children, have led to extreme practices of gender bias.(Ebenstein and Sharygin, 2009). Similar patterns are found in Korea (Park, 1983) and India (Sen, 1992, 2003). The impact of family planning services on fertility outcomes has long been a subject of interest for demographers, economists and policy makers. Recent studies have found a small to moderate impact of family planning on fertility (Joshi and Schultz, 2007; Miller, 2005; Salehi-Isfahani et al., 2009). If it is the case that family planning programs are effective (be it moderately), then what is their impact on gender preference that is exercised through fertility?

In this paper I study the issue of gender preference in Iran from two angles. First, I look at the existence of son preference and its impact on fertility. I use a modified version of existing fertility models that explain future fertility decisions based on current gender composition of children and test the model's prediction with Iranian data. I look at the probability of having another child and total number of children a woman has as a function of gender composition of her prior children. I also look at spacing between children as a function of the older child(ren)'s gender. Secondly, I look at how this relationship changes once family planning services become widely available to the rural population.

According to the World Health Organization (WHO), the Middle East is among regions where son preference is most apparent and persistent, and anecdotal evidence of son preference in Iran is abundant.Also, in the past two decades Iran has undergone a dramatic population transition. Throughout the 1980's, Iran had one of the fastest growing populations in the world, only to have the fastest declining one in the 1990's. In a span of 15 years, from the mid 1980s to 2000, the total fertility rate (TFR) dropped from about 8 births per woman to about 2 in rural Iran(Abbasi-Shavazi et al., 2009). After the Islamic revolution of 1979, and during the eight-year war with Iraq that immediately ensued, the government encouraged higher fertility and adopted pro- natal policies. They reversed this approach at the end of 1980s once the first round of census data made it clear that such a high rate of population growth was not sustainable. Faced

with this challenge, the government implemented an ambitious family planning program consisting of educational and informational campaigns and expanded construction of rural health clinics that provided free family planning services to the rural population.

Iran's patriarchal society, its dual family planning policies and the sharp fertility transition that followed, make it an ideal setting for carrying out the analysis on gender preference, fertility, and how their relationship is influenced by availability of family planning. Despite being an illuminating case in fertility and family planning research, both theoretically and in terms of applicability to the greater Middle East, Iran remains an understudied country mainly due to lack of data.

This paper contributes to the existing literature in two important ways.First, it presents the first study of gender preference at birth in Iran. Secondly, although gender bias and fertility have been documented in many countries, to my knowledge, no one has ever looked at the interaction of gender preference with availability of family planning to a population. I use a uniquely rich combination of data sets to study the relationship between gender preference and fertility as well as the impact of family planning program on that relationship. The main data set I use is a 2% sample of the most recent Iranian Census (2005).The secondary data is the Demographic and Health Survey (DHS), 2000. This is a smaller data set but has complete fertility information for women in the sample. For the study of family planning program, I match village addresses in the census to a dataset of rural health clinics for all villages of Iran. The combination of these sources allows me to carry on the analysis for a large sample of women, and test the robustness of my findings with auxiliary data . Beyond the interest in understanding gender preference and fertility patterns in Iran, the finding of this work can also be used as an instrument in disentangling the relationship between fertility and labor force participation for Iranian women, as previously done by Angrist and Evans, (1989)

It is worth noting that a particular(and narrow) definition of "son preference" is used throughout this paper. Here, I define son preference as the desire to have a (positive, non-zero) number of sons such that it influences parent's decision to continue child bearing even after the ideal number of children is reached. It is possible that even though parents prefer sons or want to have at least one son, they are non-discriminatory in treatment of their children based on gender once they are born. However, although the male-preferring stopping rule that results from this would not be a case of direct discrimination, it still has a long lasting negative impact on growth and productivity of girls. The remainder of the paper proceeds as follows: Section 2 reviews the related literature and explains the cultural and institutional setting of Iran. Section 3 describes the data sources. Section 4 presents a model of gender preference and fertility. Section 5 discusses estimation

strategy and main findings on the relationship between gender preference and fertility. Section 6 analyzes how this relationship is influenced by availability of family planning services. Section 7 concludes.

4.2 Review of the Literature

4.2.1 Consequences of Gender Preference

Gender and its relationship with economic outcomes have become an important part of the development literature in recent years. In a seminal paper, Amartya Sen wrote about the phenomenon of "missing women". The term refers to shortfall in the number of women relative to the number that would be expected if there was no sex-selective abortion or female infanticide or differential access to health care and nutrition. Many researchers have since looked at gender in this context and found discrepancies in outcomes based on gender all across the world. Jayachandran et al. (2009) find that mothers breastfeed girls less than boys because they believe they will not become pregnant while breastfeeding. Parents with daughters want to have another child soon, hoping it will be a son, and therefore breastfeed their daughters for a shorter period of time (if at all). This can cause a number of health concerns for the daughter. They estimate that about 14 percent of excess female child mortality in India can be explained by gender gap in breastfeeding. Pande (2003) looked at the impact of gender composition of children on subsequent children's nutrition and immunization. She found that although there is a desire for mix of children, preference for sons persists and boys who are born after multiple daughters have the best outcome in terms of nutrition and immunization.

4.2.2 Gender Preference and Fertility

There is a large body of literature on gender composition and its impact on fertility. Broadly, studies can be divided into two categories based on their approach to the issue. The first group of studies focuses on developing theoretical models that explain fertility decisions and their interactions with gender composition of surviving children (GCSC). These studies provide theoretical background against which the econometric analysis of the relationship between gender preference and fertility can be assessed and justified. Becker (1960) andBecker and Lewis (1973) pioneered this analysis by modelling fertility decisions in an economic framework and introducing the quality-quantity trade off that parents face when making fertility decisions. In the basic model, couples get utility from the number of children

they have, child quality and consumption of a composite (and/or home produced) good, and face a budget constraint, a time constraint for each member (allocated among the labor market, home production, child rearing and production of child quality), and a child quality production function (with purchased inputs and child and parental time as arguments). Parents choose number of children to have and the quality(time and resources spent) per child and face the trade off that having more children means lower consumption and/or lower quality per child. The basic model, does not address preferences over the gender of children, but that can be added to the model. Ben-Porath and Welch (1976)expanded the model and introduced a one-period model where parents have full control over fertility and analyzed how sex composition of children impacts demand for additional children in the Unites States. Yamaguchi (1989) came up with a dynamic model in which parents are homogeneous in their probability of having sons and continue childbearing until they reach their desired(positive) number of sons. His model predicted that girls, on average would have more siblings than boys, because of their parents' son preferring stopping rule. Leung (1991)developed a stochastic, dynamic model to study the relationship between parental sex preferences and fertility building upon the work of Heckman et al. (1974). He concluded that econometric tests can establish sex preference but cannot distinguish boy from girl preference. He recognized, however, that a negative impact on subsequent births of number of boys at every parity could be taken as evidence of son preference.

The second category of research addresses the existence and persistence of son preferring stopping rule in fertility among different countries at different time periods. The measure that is mostly used to test for gender preference is parity progression ratios: proportion of women of a given parity who move on to a higher parity(Ben-Porath and Welch, 1976; Das, 1987; Arnold, 1992). The transition from second to third parity is particularly emphasized, partly because most families have at least two children, and perhaps also because two is the replacement fertility level. Differential use of family planning methods in response to current gender composition of children is another commonly used measure(Arnold, 1985). Chowdhury and Bairagi (1990)used data for ten years (1977-1988) in Bangladesh to study the impact of child gender composition on total fertility. They found a preference for mix of genders but noticed that higher number of sons was associated with higher usage of contraception, and lower subsequent fertility. In western societies, a strong preference for mix of genders has been found(Yamaguchi and Ferguson, 1995; Teachman and Schollaert, 1989).Ben-Porath and Welch (1976) found that parents have a desire for mix of genders and are significantly more likely to continue child bearing if they have two children of the same gender.Angrist and Evans (1998) also found a preference for a gender mix using U.S. data. They use

the relationship between gender mix and fertility as an IV to measure the impact of having a third child on labor force participation of women. Following their work,Cruces and Galiani (2007)found that that Angrist and Evans estimates for the US can be generalized both qualitatively and quantitatively to the populations of Mexico and Argentina as well.

In general, although a preference for mixed gender in children emerges in most countries, it coexists with a strong preference for at least one son in many of them. This is true even in more modern societies such as the United States. Dahl et al. (2004)show that first-born daughters caused approximately 5500 more births each year, or 220,000 additional births over the past 40 years in the U.S. They also find that this effect is almost seven times larger for Asians compared to White people, once the population is broken down into subgroups.Arnold (1992) looks at the impact of sex ratios on probability of subsequent birth across many developing countries. He measures both the move to higher parities as well as patterns of contraception use. He mainly focuses on "declared" fertility preferences and finds a preference for at least one son and one daughter in the majority of countries he studied. He documents son preference in Asian and North African countries, most notably Egypt and Sri Lanka.Yount et al. (2000)also found that presence or absence of at least one son affects contraceptive use and fertility significantly in Egypt. China, and India are also widely studied and are established as having strong patterns of gender preference (Jensen, 2005; Drèze and Murthi; Park, 1983; Arnold, 1985; Leung, 1988). Leung (1988)finds strong evidence of son preference in the Chinese population living in Malaysia. In the middle East, son preference is documented in Egypt(Arnold, 1992);Yount et al. (2000)also found that presence or absence of at least one son affects contraceptive use and fertility significantly in Egypt. This study contributes to the literature of gender preference in general, and gender bias in the Middle East in particular. The case of Iran has so far been absent in the literature mainly for lack of data.

4.3 Case of Iran

4.3.1 Institutional Setting

Throughout the 1980's, Iran had one of the fastest growing populations in the world, only to have the fastest declining one in the 1990's. Interestingly, the biggest drop in total fertility rates occurred in rural areas, declining from 8.1 in 1976 to 2.4 in 2000 (Roudi-Fahimi, 2002). This figure is currently 1.7. Iran has been a theocracy since 1979, when the Islamic Revolution took over the power from the Pahlavi dynasty. In the early years of revolution and during the eight

year war with Iraq, the government of Iran favored pro-natalist attitudes. Families were encouraged to have many children, and the popular slogan advocated a 20 million Persian army to defend the country. During the first decade after the revolution (1979-1988), the family planning program was suspended and government propaganda stressed early marriage and reproduction as basic Islamic values, especially in a time of war. (Aghajanianand Mehryar, 2005).

In spite of such policies, family planning was never considered illegal, and families could obtain services, albeit not easily, in rural areas. The Quran does not prohibit birth control, nor does it forbid a husband or wife to space pregnancies or limit their number. The population of Iran, however, grew at a remarkable rate during 1980's. In 1988, once the latest birth rate data was revealed, policy makers realized the potential problems the boom could cause for the war struck infrastructure of the country, and reacted with all their force. At around 1989, multidimensional family planning program was launched, and government rhetoric underwent a dramatic change. The new slogan read "Fewer children, better life"! The actual family planning law was not passed until 1993, at which time the decline of fertility had already started. One of the more well known and innovative aspect of the Iranian family planning program was the building and expansion of rural "health houses",. Health houses were clinics that provided the rural population with basic health services, free family planning, as well as mother and child health care. Salehi-Isfahani et al. (2009) evaluated the impact of these health houses on fertility in rural Iran and have found a moderate effect, in tune with similar findings in Latin America. In this paper, I also look at the interaction of family planning and gender preference. Gender-biased stopping rule hypothesis assumes that families have-relative- control over their child bearing decisions. In the absence of this assumption, number and timing of children would be random, and hence independent from gender composition of children. Subscribing to this view, then, implies that availability of family planning can potentially have an impact on the relationship between gender preference and fertility. Those families who want to stop having children once they have a son can more successfully do so once they have better access to birth control. In this paper, I also look at the potential impact of these health houses on the extent to which parents can exercise gender preference in their fertility behavior.

4.3.2 Presence of Gender Preference in Iran

There is strong anecdotal evidence on the presence of gender preferences in Iran. it is the son who carries the family name in Iran, and at the very least, not having a son is a source of vulnerability for parents. "May your first child be a

masculine child" is a common well wish. Some men would re-marry in order to have a son if they don't have it in their first marriage. Son preference can exist for a variety of reasons. In many traditional societies, women are seen as financial burdens on their families, and as such are less desired. In Iran, the women's family is responsible for providing basic household items for the bride at the time of her marriage (Jahaz). Mostly in rural areas, a bride is "obtained" in exchange of a "bride price" or "shirbaha". This practice is not legally established nor is it enforced. It is mainly a part of rituals and can vary or be non-existent depending on families and locations. However, there is an amount of money (Mehrieh) that the groom has to legally agree to pay the bride "at any time the bride wishes". This has come to reflect the price of the woman, and many families demand astronomical sums to establish their daughter's "worth". Theoretically, it is a source of financial support for women in case of divorce. De facto, this money is rarely paid, and at best, it is used for increasing women's bargaining power at the time of divorce. Women generally give up the money to "buy" their way out of the marriage, as the right to divorce is automatically men's unless they sign otherwise at the time of marriage. If the woman asks for the money and the husband refuses to pay, he will be punished by jail and has to offer a payment plan. The payment plans are mostly formalities, as they can be as low as 25 dollars a month for the rest of a man's life. The high price of "mehrieh" has been identified as one of the biggest obstacles to marriage for men, and the Parliament is currently debating to prohibit "unreasonable" amounts of mehrieh.

Although having a daughter does not have strong financial disincentives for the family, legally, women are at a great disadvantage relative to men. A daughter only inherits half the amount a son will unless explicitly mentioned in the will. In fact, a woman is legally worth half a man. Blood price for women is half that of men. For witness, two women are needed to count as one man, and the list continues. Overall, The Iranian legal and socio-cultural system is developed within a long-standing patriarchal social organization (Aghajanian, 1998). Women lead lives that are dramatically more restricted than their male counterparts in almost any aspect. In such settings, it is not unreasonable to expect parents to prefer sons if they strictly care about the well being of their children and the ease of their lives in the society. However the direction of causality is not clear in such a complex setting. Moreover, understanding the root causes of gender preference and moral consequences of it is beyond the scope of the present work. Here, I focus on the impact of gender of children on continuation of child bearing and birth spacing. In Iran, the majority of women indicated that their ideal number of children is two. Interestingly, even couples who had more children considered two as the ideal number of children (Abbasi-Shavazi et al., 2009). I focus the

analysis on this transition (from two to three children) but will look at families with one child as well as those with higher parities.

4.4 Data

Three sources of data are available at hand to address the question of gender preference at birth in Iran. My main source of data is a 2% sample of the latest round of the National Population and Housing Census (NPHC) data in Iran, conducted in 2006-2007. The census is implemented every 10 years , and data as well as relevant documentation is obtained from the Statistical Center of Iran (SCI). The Census has basic individual level information such as age, literacy, employment, religion, marital status, total number of live children, total number of live births, geographic location and migration, as well as basic household level information. The sampling frame is simple random sampling, and individual, household, and housing unit weights are provided(as I'm using a 2% sample and not the entire census). The census offers a large sample size and is recent. Also, there is geo-code information available for the census data at the level of city block for urban areas and village level at rural areas. This allows for complete geographical identification and matching with local area statistics. Using this data set, I can look at the impact of rural health houses on the presence and extent of gender preference. To do so, I merge it with a data set on rural health houses to obtain my final working sample.

The health-house data is collected over time by the Ministry of Health and Medical Education(MOHME). When a health house is established the provincial university who is in charge of the province health houses reports it to the headquarters in Tehran (the Office of Resource Development). Village health houses are mostly staffed by two trained health workers(Behvarze), one male and one female from the same village. Once the behvarz start their work, the university reports it to the Office of Network Development (OND), which will acknowledge it as a functioning health house. The data set at hand has records of dates on which health facilities in Iran began operating, covering years 1934-2006. The health house data does not have geographical code for locations, but only the names of the province, provincial, university, health center, and rural health house as well as the date the health house opened. The SCI provided me with a file that had complete geographical information (both name and numeric addresses), population and literacy status by gender for all villages in Iran. Both these files were in Farsi. I transliterated them into English and matched on (words of) all area information to create the final health house data set that included complete geocode address, health house info , population and literacy information for all villages in

Iran. In 2005, there were 16,715 villages in Iran with an active health house. This covers about 90% of the rural population and about 30% of all villages(Salehi-Isfahani et al., 2009). Of these, I was able to match 15,111 of them (92%) to the village geocode file. My health house data includes 63,107 villages of which 15111 (about 24%) report having a health house. The "matched" villages are divided into subcategories by the strength of the word matching. Those with exact matches are 11,327 (68%). The rest are matched on how close the names in the two files are. I repeat my analysis both for exact matches and all matches. I merge the village level health house file with the 2% sample of individual level census data to get my final sample. Detailed description of the data construction is available from the author upon request. The other source of data is the Iranian DHS. The DHS was done by the Ministry of Health and Medical Education (MOHME) and the Statistical Center of Iran (SCI). The DHS provides very detailed and rich fertility history information. However, relative to the census data, the sample size of eligible women in the DHS is smaller, and it's also not as recent as the census. Also, geo-code information is not available beyond the province level for this data set . Taking into account the benefits and costs of using each source of data, I have decided to use the census as main source of data. I use the DHS for two of the regressions and for comparison and robustness check throughout this study. A detailed description of the DHS is provided in the Appendix.

My census sample includes all mothers and their surviving children. I match child information to mothers based on the children's reported mother row number in the household. There are 1,299,825 individuals in the sample, out of which roughly about 648,941(49.9%) are women. The census only includes children who live in the household at the time of survey and not all children ever born to each woman. In order to get at the impact of GCSC on fertility, however, I need to have information on all births. For this reason, I limit my sample to mothers who have all their children currently living at home. This will most likely be a younger sample of mothers and will have more women who have not completed their fertility, exacerbating the potential right censoring problem. To address this, I focus on an older group of mothers who have finished their fertility but have all their children living with them. The concern remains that this sample of mothers is not representative of average women who have completed their fertility. To address this issue, I repeat this analysis using the DHS data set that has full information on all children ever born to a woman as a robustness check. My study focuses on singleton births, and I drop observations that have multiple births in first three births. Twins were less than 2% of all births in my data set. I drop observations that have missing values in dependent or independent variables in my regressions. This is about 5% of the sample. The dropped sample

is younger, less literate, and has a larger family size. The census does not have information on income and wealth. It does, however, ask households about access to basic infrastructure. For example, it asks if the household has or uses bath, kitchen, car, motor bike, phone, computer, Internet. I control for family assets by including these dummy variables in my regressions. My final working sample has information for 134,158 mothers.

Table 4.1 shows basic summary statistics for key variables both for all the sample and also by residence(urban vs. rural). Average age of women in my sample is 32.6, and average age at first birth is 22. Nearly 80 percent of these women are literate (can read and write). 40 percent of these women live in rural areas, and about 34 percent of them have more than two children. Household size is about 4.5. A statistic to note is the percent of families whose last child is a boy, which is 53 in my sample. This may suggest that there may be a tendency to stop childbearing once at least one son is born. Table 4.1 shows the mean for the entire sample, and therefore may include women who have not finished childbearing yet. The rural sample of women is younger, gives birth at a younger age, and is noticeably less literate (69% compared to 86% in urban areas). 23% of the rural sample has finished primary school, as opposed to 16% in the urban areas. The education variable is completed education. Percentage of families whose last child is a boy is the same in both rural and urban areas. As expected, the rural households have relatively lower asset measures and a higher household size. In Table 4.2, I compare key variables among families with different child gender compositions. The sample appears to be balanced on almost all of these variables. Small differences exist, but they are not significant. To interpret the "last child is a son" variable, note that these include families who have more children than two. From this table, I can safely assume that families do not differ strongly based only on their GCSC. According to the breakdown of characteristics based on child gender composition, the sample appears to be balanced. It looks like a gender mix (GB) of children leads to the smallest probability of moving to a higher parity. Two girls is slightly less desired than two boys, but the difference is small. I control for all of these variables in my regressions.

Table 4.3Shows the breakdown of number of children by mothers' age-cohort. Overall, about 33.5% of the population has only one child. The break down by birth cohort confirms the demographic transition that Iran has undergone in the last 30 years. Among mothers 45-55 years of age, 11.8 % have one child, and of mothers 35-45 years of age, only 8.8% have one child. This percentage undergoes a dramatic increase for mothers 25-35 years of age, jumping to 34%. Percent of mothers with only one child rises to 80% in the youngest cohort of mothers. The 25-35 and 15-25 age cohorts, however, consist of mothers many of whom have not

finished childbearing and may move on to having more children in the future. In the DHS, were all births are recorded, the average age of last birth for woman over 45 years of age is about 32.5. In the census sample (were we only see children currently living in the household) that age is 34.4. The analysis that follows focuses on the two more relevant age cohorts of mothers, namely 35-45, and 45-55 year olds, who are at or close to the end of their reproductive cycle. As Table 4.3 shows, about 90% of mothers 35-55 years of age have at least two children. This fact, along with the fact that the majority of Iranian women declared two as their ideal number of children, further establish this transition as a more interesting outcome to study in determining the impact of gender composition on continued fertility in Iran. Therefore, similar to many studies in the literature such asAngrist and Evans (1998), the main focus of this analysis will be on the transition from two to three children, although tables for other parities are sometimes presented as well.

4.5 Conceptual Framework

4.5.1 Basic Gender Preference Model

I will present a modified version of two period model for the relationship between fertility and gender composition of surviving children (CGSC) presented inDahl et al. (2004), which builds and expands upon the work of Becker (1960). For now, I assume family planning is free and available to everyone. Since I'm looking at the transition from second to third parity, I only look at families with at least two children. Parents decide if they want to continue childbearing given the gender composition of their children and their ideal number of children. Both parents are assumed to have quasi-linear utility functions of the form:

$$U(B_t, G_t, C_t,) + X_t \tag{4.1}$$

where B_t and G_t are the number of boys and girls in family at time t. C_t is non-transferable consumption,X_t is transferable consumption. They face a budget constraint :

$$pB + qG + rC_t + X = Y_t \tag{4.2}$$

where p and q, and r are prices for boys and girls respectively, r is the price of non-transferable consumption, and Y is the combined household income. For simplicity, I assume that boys and girls cost the same. I further simplify the model by assuming that the ratio of marginal utility of boys to girls is constant, so I can

define K as the effective number of children. This can be written as $\alpha B + \beta G$, where α and β are positive scalars that weight how each child gender is valued by parents. If parents have no gender preference, effective number of children will be only the equally weighted sum of number of boys and girls. If not, these weights will be unequal. For example, son preference would imply $\alpha > \beta$

I can write:

$$U(B_t, G_t, C_{t,}) = F(K_t, C_t) \tag{4.3}$$

I assume that utility increases at a decreasing rate as the number of effective children increases.

$$\partial U/\partial K > 0; \partial 2U/\partial (K)2 < 0 \tag{4.4}$$

Families start with four possible child gender compositions, namely:GG, GB, BG, and BB. Utility of a family with two girls at time t is written as:

$$U_{GG} = U(\alpha + \alpha, C_t) + X_t$$

and that of a family with two boys would be: $U_{BB} = U(\beta + \beta +, C_t) + X_{t.}$ .The decision to continue fertility depends on the probability of having a boy or a girl in the next birth, here assumed to be equal, and the relative importance of the ideal number of children parents want, given the constraints they face. Families Will move to a higher parity only if the expected utility of doing so exceeds that of their current utility . For example, a family with two daughters will choose to continue child bearing if:

$$1/2U_{GGG} + 1/2\mathrm{U}_{GGB} - U_{GG} > 0 \tag{4.5}$$

and a family with a boy and a girl will face the following inequality:

$$1/2U_{BBB} + 1/2\mathrm{U}_{BBG} - U_{BB} > 0 \tag{4.6}$$

Comparing the two LHS equations, we can see that if θ is an increasing, concave function of K, then son preference,(i.e. α¿,β), all else equal, will predict that a family with two sons will have a lower probability of having another child compared to a family with two daughters. This is so because if α¿,β, the effective number of children ($\alpha B + \beta G$) will be larger in families with two sons than those with two daughters. Since, according to equation 4.4, increase in the effective number of children decreases the utility of an additional birth, probability of birth decreases with the number of boys holding the number of children fixed. Note that 1/2 is "perceived" probability of having a certain child gender in the next period. It is possible that women who have two children of the same gender perceive their probability of having another child of the same gender to be higher

than 1/2 (Ben-Porath and Welch, 1976). In such situations, the decision to move to a higher parity also depends on the probability that the woman assigns to having a child of "desired" gender. Here, I assume this probability is 1/2 for every woman.

4.5.2 Differential Access to Family Planning

So far, the assumption has been that women have perfect control over their fertility. In reality, this is not the case. Fertility control can be added to the model as a form of cost/disutility for the parents. In order to stop having children, women either have to seek birth control devices (IUD, Pill, etc..) or limit intercourse, both of which can cause "disutility". I assume that in the absence of any intervention this cost is the same for all families. Parents' utility function is now :

$$U(B_t, G_t, C_t,) + X_t - C(fp) \tag{4.7}$$

Where $C(fp)$ is the cost of family planning. One of the services health houses provide is decreasing the effort needed for acquiring birth control, by both increasing access and decreasing the cost of family planning. Expansion of fertility clinics over time and in different regions results in a difference in cost/availability of family planning for different women. In the simplest case, clinic placement is completely random, and therefore independent from demand for fertility or gender preference of families. I assume that $C(fp)$ is zero once a village has a health house, and is one otherwise. This specification does now allow for different impacts for different lengths of exposure to clinics, but that can easily be added to the model later. The equation a family with two sons face is now:

$$1/2U_{BBB} + 1/2\mathrm{U}_{BBG} - U_{BB} - C(fp) > 0 \tag{4.8}$$

In general, the introduction of family planning should decrease the probability of having another birth in this specification. All else equal, those for whom the cost of family planning is reduced (in this specification to zero) will have a higher probability of utilizing it. If families have a son preference and practice differential stopping behavior in favor of boys (at second parity), we should see that a higher proportion of BB families s who have access to health house at the time of their decision making, stop child bearing after two births [relative to GG families].

4.6 Estimation Strategy and Findings

I focus on three different fertility outcomes in my regressions. First, I look at the move to a higher parity as a function of mother's current CGC for families

with two children. Secondly, I look at the impact of having a daughter at first birth and first two births on total number of children a woman has. Finally, I focus on spacing between children as a function of child gender composition. I use a linear Probability Model (LPM) with village/city block fixed effects, a Linear probability model without the fixed effects, and a probit model. All regressions control for mothers age(both linear and second power), mother's education, asset dummies, mother's age at first birth, as well as an indicator for literacy of the household head.

In order for the effect of gender compositions to be identified, gender of a child at each birth needs to be fully random and therefore uncorrelated with all other regressors. Reported Sex ratio at birth in Iran is 1.05, which is not different from the natural ratio. (Statistical Yearbook, 1386). The overall male to female ratio in the census data is 50 males to 49 females. I also check male to female ratio by birth cohorts, and specifically for children ages 0-5, and the ratio is balanced for all cohorts, suggesting complete random assignment of gender at birth. In the absence of sex selective abortion, gender of each child is thought to be random. To my knowledge, there has not been any anecdotal evidence or an analytical study that documents presence of sex selective abortion in Iran. Very recently, Some officials have voiced concerns about the over-use of ultrasounds, claiming this may be used for sex-selective abortion. However, this is a very recent trend, even by their claims.

4.6.1 Moving to Higher Parity

I divide my sample of mothers with at least two children into categories based on the gender composition of their first two children. GG, BB, GB, and BG. As can be seen in Table 4.2, these groups are fairly similar in their observable characteristics. I run a linear probability model and a probit model to see the impact of gender composition on the probability of having another child. The regression estimates:

$$Y_i = \alpha + \beta X_i + \delta M_i + \varepsilon_i$$

Where Y_i is a zero/one indicator for having more than two children. α is a constant, X_i is a vector of observable characteristics (of mother and household) and M_i is a matrix of women's child gender dummies. I run this regression for the entire sample of mothers to use as general reference. Table 4.4 presents the estimates from three different regressions for the entire sample, using the census data. Model (1) is a linear probability model with village/city block effects. Model (2) is a simple linear probability model(no fixed effects), and model(3) is a probit

model, reporting marginal probabilities. All three models yield similar results in both the magnitude and the direction of the effect. A clear preference for mix of genders in children emerges. The coefficient on mix genders (GB and BG) are more or less the same, and they are both negative and significant(with the exception of GB in first specification). In other words, relative to a family with two sons (BB), families with mixed genders are about 1% to 3% less likely to continue to a higher parity. The most interesting coefficient, however, is the one on GG. It's relatively large, positive, significant. In other words, a family with two daughters is, on average, 7% to 9% more likely to have a third child than a family with two boys. GG seems to be the least desired gender composition. Literacy is negatively and significantly correlated with probability of having another birth. Both College and high school also seem to impact this decision strongly. For the sake of simplicity, I will use the probit model for the rest of the analysis. I then run the same probit regression for different age cohorts of mothers. Table 4.5 presents the results from these regressions . Mothers between 35 and 45 years of age who have two daughters are about 8% more likely to have a third child than those with two sons. Women who are 35-45 in 2006 have spent most of their reproductive years (20-35) after the revolution (1981-1995) . In the older age group the magnitude of the coefficient is smaller(almost half the size). These women spent most of their reproductive years before the revolution and also before the rapid increase followed by the sharp decrease of fertility trends in the country. The youngest age cohort of women have not finished their reproductive years and may have more children. The strong and significant coefficient on the GG for this group may suggest that those with two daughters have a third child more quickly than those with two sons, but is not conclusive in terms of how the probability of having a third child is impacted differentially by child gender composition. These results are robust to a variety of asset measures and clustering at the city/village block level. It is interesting to see the heterogeneity of "gender- preference" with respect to mother's observable characteristics. I interacted all education variables with gender composition dummies, but none of the interactions were significant, nor did they change the magnitude or significance of gender composition variables. Findings from this data set (both magnitudes and significance levels) are confirmed when I carry out the same analysis using the DHS data set. These tables are available upon request.

4.6.2 Total Number of Children

Here, I look at the impact of having a daughter at first birth, as well as having two daughters for first two children, on the total number of children a woman

will have in her reproductive lifetime. The dependent variable is the log of total number of children a woman has. For this regression, the DHS is a better data source, as it's not limited to mothers for whom all children ever born live in the household, a limitation that exists in the census data set. I will therefore present the DHS results here. I limit my sample to women who have completed their fertility, namely those above 40 years of age. I will use an OLS model with clustered standard errors .

$$Y_i = \alpha + \beta X_i + \delta M_i + \varepsilon_i$$

Where Y_i is the total number of children each woman has. α is a constant, X_i is a vector of observable characteristics (of the mother and the family) and M_i is a matrix of woman's child gender dummies. For all following analysis, the controls are identical to the previous set of regressions hereafter referred to as full set of Controls. Table 4.6 summarizes the results of the regression for families whose first child is a girl, and breaks it down by mother's age cohorts. It's clear from this table that having a first girl is strongly and positively correlated with more children for parents. A first born daughter is associated with a 3% to 4 % increase in the total number of children relative to a first born boy. Similarly, families with two daughters have about 5% to 7% more children in total relative to those with two boys.

4.6.3 Spacing Regressions

Given that women will not be able to have children beyond a certain age (beginning of their menopause), spacing of children will also impact the total number of children a women will have. Therefore, birth intervals can be relevant dependent variables in looking at gender preference in terms of how it's s impacted by gender of the prior child(ren). I use The DHS, as information on month of birth is more complete in this data set. I use an OLS model and run the following regression:

$$Y_i = \alpha + \beta X_i + \delta M_i + \varepsilon_i$$

This time, Y_i is the space, in months between children, α is a constant, X_i is a vector of observable characteristics (of the mother and the family) and M_i is a matrix of woman's child gender dummies . I run this regression for women with two and three children, using space(in months) between the two last births as dependent variable. For women with three children or more, I control for the space between the first two children as well. Table 4.7 presents my findings for both of these regressions. Girl babies are followed by another child more quickly

than boy babies. The average space in months between the first two births in the sample is 31.5(close to three years). The average space between the second and the third births is 35 months. Researchers have looked at the issue of space and gender preference, in particular in cases when a birth of a girl is too quickly followed by another birth. In such situations, the first child may not be breastfed or given the care and attention that she would have otherwise received, endangering her life or her long term development. It appears that this is not the case in Iran. First born daughters are followed by another birth 0.7 months sooner than boys. This difference is bigger when two first children are girls. In that scenario, the third child is born 1 to 3 months sooner than would be the case for two boys. For those with two children, none of the other gender composition seem to be significantly different from two boys. Although the extent of gender-biased spacing is not alarming in terms of early childhood care and nutrition, there is still significant differences between the two genders in terms of spacing.

4.7 Impact of Health Houses on Gender Preference

So far, it appears to be the case that families who have two boys are less likely to continue childbearing than those with two girls. If this is so, the model suggests that these differences will more amplified in areas in which family planning services are more accessible and/or are free. The expansion of rural health clinics (as a component of the family planning program) over time provides a setting in which I can compare villages who have access to family planing to those who don't. Within villages, I can, then compare women who had a clinic at the time of their second birth with those who did not, controlling for their age cohorts.Salehi-Isfahani et al. (2009) look at the impact of health houses on fertility, focusing on villages' child to woman ratio. They find that health houses explain only about 7% of the total decline in rural fertility.

In this paper, I look at the impact of having a health house in a woman's village on the relationship between her fertility and her child gender composition. Ultimately, I'm interested to know if the general pattern observed so far is more amplified in families who had a health house in their village at or before the time of their second birth . My sample is the rural population since health houses are strictly rural. I focus on women age 35-55, most of whom have presumably finished child bearing. First, I briefly explain the institution as well as the expansion rule of the health houses.

4.7.1 Organization and Expansion of Rural Health Houses

Construction of rural health clinics started before the Islamic revolution. After the revolution, the family planning program was suspended, but the construction of health clinics did not stop entirely. In 1985, a law went into effect that mandated building rural health infrastructure[rural Health Network System (HNS)], which lead to an increase in construction of rural health clinics. The health network system focused on mothers and child health, and was very popular in rural areas(Salehi-Isfahani et al., 2009). In 1989, once the family planning program was launched, these services were incorporated in the already existent infrastructure, and rural health clinics continued to expand. The program recruited and trained two local health workers(Behvarz) from each village, one of whom was always a woman. Health workers regularly visited households to ensure service delivery and also to collect new information. For example, if a woman was on the pill, the health worker would make sure that she had her monthly supply on time(Salehi-Isfahani et al., 2009). Before the existence of these health clinics, married woman had access to birth control through mobile units, and through government facilities as well as the private marker in nearby urban areas.

The arrival of health clinics and later the incorporation of family planning program into them made it much easier for rural women to access family planning services, previously available only to women with high demand for fertility control. Each health house would serve about 1500 individuals residing in that village(named"main village ") and a few smaller "satellite" villages in the surrounding area. Mobile health units visit families who are further away from the main village. By 2005, the program had covered about 90 percent of the country's rural population (20.4 million individuals living in 4.2 million households); there were 16,560 health houses staffed by 26,403 health workers, serving about 55,000 villages. The 1984 law required HNS to begin the simultaneous construction of health houses in one district in each of the 25 provinces (now 30 provinces) and then expand to other districts within each province, eventually covering all districts In fact, by 1989, when family planning was added to the HNS mandate, all districts in all provinces had received at least one health house. Figure 1. shows the expansion of health-houses by year. According to the officials of the Ministry of Health and Medical Education (MOHME) clinic expansion rules were (i) the presence of capable local administrators willing to help, (ii) a minimum level of infrastructure (electricity and schools), and (iii) the availability of educated young men and women in the local area who could be trained as health workers. These criteria favored low fertility areas for program placement(Salehi-Isfahani et al., 2009). I control for village population, village literate population and percent of literate females in the village. Note that there is an important distinction between

the family planning program efforts in general and health houses as a particular feature of that program. This study focuses only on rural health houses and not family planning program as a whole. Also, existence of a health house in a village is not equivalent to active delivery of family planning before 1989 but is an indicator of more health services in general and passive delivery of family planning in particular.

4.7.2 Measuring Impact of Health Houses

To understand the impact of availability of family planning on the relationship between CGC and fertility, I use a difference in difference method. I define the following indicator:

$$T_i = \begin{cases} 1 & \text{if Clinic in Village at Second Birth} \\ 0 & \text{if No Clinic in Village at Second Birth} \end{cases}$$

The time variable is also an indicator:

$$t_i = \begin{cases} 1 & \text{if Second Birth was After 1989} \\ 0 & \text{if Second Birth was Before 1989} \end{cases}$$

About half of all rural health houses were built before 1989. However, the family planning mandate started only after 1989. The program incorporated family planning services in the already existent health houses and continued expansion of new ones. First, I look at families who had their first two children before 1989. Among those, I compare the probability of moving to third birth among mothers who had access to a health house at the time of their second birth and those who did not. Prior to 1989, health houses were providing basic mother-child care, and presumably made it easier for rural mothers to access family planning as well, though the delivery was passive. Only mothers who were motivated and sought such services could access them. After 1989, health houses became facilities for active delivery of family planning services, with health workers who visited women and kept track of their family planning needs. For mothers giving birth after 1989, I compare those who did and did not have access to health house at the time of their second birth.The impact of access to such services on the probability of having a third child , therefore can be disentangled through this two-paired comparison, i.e. the difference of these differences.

The underlying assumption for the method to work is the "parallel trends" assumption. I need to assume that in the absence of health houses, the trend of moving to a third child (given the gender composition of a mother's first two children) would have been the same for treatment and control groups. My estimates

would be unbiased (in measuring program impact) if conditional probability of moving to higher birth parity (given current CGC) were the same in villages with and without health clinics prior to 1989. In other words, this assumption would be satisfied if living in a village with a health house at time of second birth does not have an impact on families preference for gender of their children.

I estimate:

$$Y_{ij} = \alpha + \beta X_i + \delta M_i + \sigma t_i + \lambda(T_i) + \theta(t_i * T_i) + \eta(t_i * T_i * M_i) + \gamma(T_i * M_i) + \mu V_j + \varepsilon_{ij}$$

using a linear probability model, with village fixed effects. Y_{ij} is a zero-one indicator that mother i in village j decides to have a third child.α is a constant, X_i is a vector of mother's (and household's) observable characteristics, M_i is , as before, matrix of gender composition dummies. T_i is a zero one indicator for presence of a health house in the village at the time of mother's second birth. t_i is the time dummy, and Vj are village fixed effects. $(t_i * T_i)$ is the treatment indicator, which is equal to one if a woman has a clinic in her village at time of her second birth AND her second child is born on or after 1989, and zero otherwise. The most interesting variable is $(t_i * T_i * M_i)$, which is the interaction of being treated and gender composition dummies. $(T_i * M_i)$ is the interaction of having a health house at time of second birth with gender dummies. The coefficient on these will show marginal probability of having a third child given treatment.

Table 4.8 shows the regression results. I run two regressions. One for all the rural mothers older than 35, and another for all mothers. In the table, I call θ FP for family planning (program). Having a health clinic in village may indicate better overall health infrastructure and services, while the FP refers to health houses after 1989, which is when family planning became actively available. As before, the omitted category is BB. The the The results are very similar in both regressions. The coefficient on GG remains negative and significant. Having a clinic at the time of second birth does not seem to have an impact on probability of third birth before 1989. The program effect is negative and significant. Having access to family planning is associated with a 12% reduction in the probability of having a third child for mothers older than 35. None of the coefficients on interaction of gender composition and FP seem to be important determinants of moving to three children. In other words, although having access to family planning seem to significantly reduce the probability of third birth, it does not seem to have a gender biased impact. Unlike what some studies have suggested, access to family planning does not seem to have exacerbated gender biased fertility decision making in rural Iranian families.

4.8 Discussion and Conclusion

This study shows that families whose first child is a girl end up having more children in total, and the same is true for families whose first two children are girls. Among Iranian families with two children, those who don't have a son are most likely to continue having children. Families with mixed children are slightly more likely to stop childbearing than those with two sons, but that difference is not great or highly significant. This suggests that parents have a mild preference for a mix of genders over having two sons . Also, In terms of spacing, a female birth is more quickly followed by another birth (at least in low parities). Space between children is also significantly smaller if the older child is a girl and more so if the third child follows tow daughters. Still, since the average space between children is about 3 years, the difference in spaces is not alarming in terms of the girls' access to basic care and nutrition in early childhood. Also, consistent with findings of various studies in the literature, I find that availability of family planning is associated with about a 12-18% reduction in possibility of third birth. However, this impact is not different based on gender compositions of previous children. In other words, I find that access to family planning does reduce probability of third birth. However, unlike some studies in the literature have found[See, for example (Arnold, 1985)], I find that access to family planning does not exacerbate gender biased fertility stopping behavior in rural Iranian families.

The combination of all of these statistically significant findings support the hypothesis that Iranian parents are making gender biased fertility decisions. They do prefer a mix of genders in their children, but still strongly desire to have at least one son. To what extend these preferences are existent or practised once the children are born is yet unknown. However, insofar as living in larger families have a negative impact on long term human capital accumulation , girls in Iran are at a disadvantage relative to boys. Also, the findings suggest that the very successful family planning program of Iran did not have a negative impact on gender bias practised through fertility.

Table 4.1: Sample Summary Statistics

	All		**Urban**		**Rural**	
Variables	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age	33.62	9.07	34.01	8.79	33.03	9.45
Age at First Birth	22	4.80	22.13	4.68	21.89	4.97
Literate	0.2	0.4	0.14	0.34	0.30	0.46
Primary	0.31	0.46	0.26	0.44	0.39	0.49
Middle School	0.18	0.39	0.20	0.40	0.16	0.37
High School	0.18	0.39	0.26	0.439	0.11	0.31
College	0.04	0.20	0.06	0.24	0.01	0.10
Post Graduate	0.00	0.05	0.00	0.06	0.00	0.02
Total Kids	2.32	1.38	2.25	1.30	2.43	1.49
Married	0.96	0.19	0.96	0.19	0.92	0.10
Household Head is Literate	0.84	0.37	0.89	0.31	0.74	0.41
Household Size	4.55	1.66	4.44	1.55	4.72	1.80
Has Third Kid	0.35	0.48	0.33	0.47	0.38	0.49
Last Child is a Son	0.53	0.50	0.53	0.50	0.533	0.50
Number of Observations	134158		80,470		53,688	

Source: Iranian census, 2006

Table 4.2: Sample Summary Statistics By Gender Composition

	Boy-Boy		**Boy-Girl**		**Girl-Girl**		**Girl-Boy**	
Variables	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age	36.63	8.01	36.28	7.87	35.52	7.64	35.78	7.88
Age at First Birth	21.37	4.62	21.43	4.51	21.45	4.48	21.47	4.47
Illiterate	0.27	0.44	0.26	0.44	0.24	0.42	0.24	0.43
Primary	0.35	0.48	0.35	0.48	0.35	0.48	0.35	0.48
Middle School	0.17	0.38	0.17	0.38	0.18	0.39	0.18	0.38
High School	0.14	0.34	0.14	0.35	0.15	0.36	0.15	0.35
College	0.03	0.16	0.03	0.16	0.03	0.17	0.03	0.17
Post Graduate	0.00	0.04	0.00	0.04	0.00	0.04	0.00	0.05
Asset	0.72	0.52	0.72	0.52	0.67	0.50	0.70	0.51
Total Kids	3.01	1.27	2.93	1.24	3.06	1.30	2.88	1.20
Household Size	5.19	1.56	5.08	1.51	5.22	1.55	5.03	1.46
Mrried	0.96	0.19	0.96	0.19	0.97	0.17	0.97	0.18
Rural	0.40	0.49	0.40	0.49	0.41	0.49	0.40	0.49
Literate Household Head	0.80	0.40	0.81	0.39	0.82	0.38	0.82	0.39
Has Third Kid	0.54	0.50	0.50	0.50	0.56	0.50	0.49	0.50
N	25,026		22,948		19,433		21,743	

Source:Iranian census, 2006

Table 4.3: Number of Children by Mother's Age Cohorts(percent of population)

Total Number of Children	**All Ages**	**45-55**	**35-45**	**25-35**	**15-25**
One Child	33.55	11.8	8.79	34.29	80.16
Two Children	32.17	20.90	30.79	40.99	16.97
Three Children	17.63	23.85	28.29	16.13	2.15
Four Children	9.15	18.75	17.39	5.77	0.53
More than Four Children	7.51	24.63	14.74	2.82	0.21
Number of Observations	134,158	9,463	36,376	61,074	22,422

Source:Iranian census, 2006

Table 4.4: Probability of Moving to a Higher Parity Given CGC (For Mothers with at Least Two children)

	Model 1	**Model 2**	**Model 3**
Variables	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
GG	0.075***	0.069***	0.095***
	(0.005)	(0.004)	(0.005)
BG	-0.015***	-0.020***	-0.030***
	(0.004)	(0.004)	(0.005)
GB	-0.003	-0.011***	-0.015***
	(0.005)	(0.004)	(0.005)
Age	0.111***	0.097***	0.129***
	(0.002)	(0.001)	(0.002)
Age Squared	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
Age at First Birth	-0.045***	-0.043***	-0.058***
	(0.000)	(0.000)	(0.001)
Household Head is Literate	-0.002	-0.031***	-0.048***
	(0.005)	(0.004)	(0.006)
Primary School	-0.051***	-0.104***	-0.146***
	(0.005)	(0.004)	(0.006)
Junior High	-0.132***	-0.227***	-0.291***
	(0.006)	(0.005)	(0.006)
High School	-0.208***	-0.317***	-0.389***
	(0.007)	(0.005)	(0.006)
College	-0.264***	-0.364***	-0.411***
	(0.011)	(0.009)	(0.008)
Post Graduate	-0.337***	-0.426***	-0.450***
	(0.037)	(0.032)	(0.018)
Number of Observations	89,150	89,150	89,150

Source:Iranian census, 2006; Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; controls: asset dummies

Table 4.5: Probability of Having a Third Child Given CGC by Mothers' Age Cohort for Mothers with Two children

	All Mothers	**Aages 45-55**	**Ages 35-45**	**Ages 25-35**
Variables	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
GG	0.095***	0.045***	0.082***	0.100***
	(0.005)	(0.013)	(0.007)	(0.008)
BG	-0.030***	-0.030**	-0.045***	-0.010
	(0.005)	(0.012)	(0.008)	(0.007)
GB	-0.015***	-0.012	-0.025***	-0.004
	(0.005)	(0.013)	(0.008)	(0.007)
Number of Observations	89,150	8,340	33,178	40,131
GB vs. GG				
GB	-0.113***	-0.062***	-0.114***	-0.105***
	(0.006)	(0.014)	(0.008)	(0.008)
Number of Observations	41,176	3,418	14,723	19,472

Source:Iranian DHS, 2000; Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Probit model with clustered standard errors and full set of controls

Table 4.6: (Log of)Total Number of Children given Gender of First Child by Mother's Age Cohorts

Varibales	**All Mothers**	**40-50**	**30-40**	**20-30**
First Child				
Girl	0.030***	0.030***	0.039***	0.017***
	(0.003)	(0.005)	(0.004)	(0.004)
Number of Observations	72,240	20,895	26,825	22,312
First Two Children				
Gorl-Girl	0.056***	0.049***	0.068***	0.034***
	(0.004)	(0.007)	(0.005)	(0.006)
Boy-Girl	0.006*	0.010	0.008	-0.007
	(0.004)	(0.007)	(0.005)	(0.006)
Girl-Boy	0.012***	0.017***	0.015***	-0.006
	(0.004)	(0.007)	(0.005)	(0.006)
Number of Observations	57,644	20,423	24,546	11,830

Source:Iranian DHS, 2000; Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; OLS model with clustered standard errors and full set of controls

Table 4.7: Regression of Space(in years) Between Children Given CGC by Mother's Age Cohorts

Varibales	**All Mothers**	**45-55**	**35-45**	**25-35**
First Child				
Girl	-0.068***	-0.129**	-0.106***	-0.065***
	(0.015)	(0.055)	(0.025)	(0.022)
Number of Observations	89,150	8,340	33,178	40,131
First Two Children				
Boy-Girl	-0.055*	-0.105	-0.130***	0.018
	(0.033)	(0.078)	(0.049)	(0.055)
Girl-Girl	-0.176***	-0.336***	-0.256***	-0.153***
	(0.032)	(0.080)	(0.050)	(0.052)
Girl Boy	0.023	-0.084	-0.090*	0.118**
	(0.034)	(0.084)	(0.051)	(0.055)
Number of Observations	45,991	6,362	21,978	15,098

Source:Iranian Census, 2006; Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; OLS with clustered standard errors and full set of Controls

Table 4.8: Probability of Moving to a Higher Parity:interaction of gender preference and family planning program (For mothers older than 30 and with at least two children)

	Mothers Older than 35	**All Mothers**
Variables	Coefficient (SE)	Coefficient (SE)
GG	0.047***	0.049***
	(0.016)	(0.010)
GB	-0.021	-0.019*
	(0.015)	(0.010)
BG	-0.014	-0.016
	(0.014)	(0.010)
FP	-0.122***	-0.176***
	(0.034)	(0.025)
FP-GG	-0.052	0.010
	(0.049)	(0.037)
FP-GB	-0.062	-0.037
	(0.049)	(0.038)
FP-BG	-0.041	-0.025
	(0.044)	(0.034)
Time Dummy	-0.162***	-0.309***
	(0.012)	(0.009)
Clinic at Second Birth	0.018	-0.030
Number of Observations	16,287	36007

Source:Iranian Census, 2006; Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; OLS with clustered standard errors and full set of Controls

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