Family Size and Parental Health: Evidence from One-Child Policy in China

Xiaoyu Wu*

University of Maryland

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Abstract

In this paper, I examine the impact of family size on parental health outcomes by exploiting the tremendous change in family size under the One-Child Policy in China. Using the China Health and Nutrition Survey in 1993, 1997 and 2000, I construct an instrument for number of children in a family and estimate its impact on maternal health outcomes. The results show that family size significantly affects measures of health, such as weight and blood pressure. Mothers with fewer children have a lower probability of being underweight and having low blood pressure; meanwhile, they have a higher probability of being overweight and having high blood pressure. These seemingly contradictory health outcomes would occur if smaller family size increases the food consumption of mothers, leading to underweight women attaining a normal weight and normal weight women becoming overweight. I also find that the impact of the number of children is larger for mothers who are less educated or have a lower level of family income. For comparison, father's health status is also examined. I find similar effects of the number of children on the father's weight and blood pressure. This suggests that family size has influences on the food consumption and health of all family members.

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1 Introduction

In the past three decades, poverty and under-nutrition were greatly alleviated, especially for some developing countries that use family planning policy to control the rapid growth of population. For example, in China, the total fertility rate[1] decreased from 5.9 in 1970 to 1.8 in 2002, due to the One-Child Policy launched in 1979. This drop in fertility rate might contribute to the alleviation of under-nutrition problem. In the context of developing countries, family resources are very limited. Family size directly determines resources that could be allocated to each member. Fewer children in one family could significantly increase the quality of children through a higher expenditure on health and education. Figure 1a shows that the fraction of underweight women decreased significantly from 1993 to 2000. People are healthier since the probability of having diseases associated with underweight is much lower. However, at the same time, the fraction of women who are overweight increased for all ages (Figure 1b). Due to the decline of family size in Chinese society, the family resources that is available for each member increases and the probability to be overweight becomes higher. The impact of family planning on these health indicators is examined in this paper.

It is well known both theoretically and empirically that family size has negative impact on children's quality. However, few studies explore whether the number of children in a family affects the health of their parent, especially the mothers who give births to those children. Given the constraint of family income and the increasing cost of raising children, the resource that could be spent on mothers is directly affected by the number of children they have. The more children one woman has, the fewer resources that could be allocated to herself. This budget effect tends to be larger for people in developing countries where family resource is often binding. In this paper, I attempt to answer the following question: does number of children a woman have an impact on her

[1] Total fertility rate is the average number of births that a woman would give to over her lifetime.

health outcomes through this budget mechanism?

The existing literature only discusses the biological influence of number of births on mother's health outcomes, such as whether breast-feeding decreases women's weight (Chopra and Camacho, 1970). Most studies concentrate on how the maternal mortality is affected. Generally, they find that high birth parity and short birth spacing is associated with a high maternal mortality rate (Winikoff, 1983; EcKholm and Newland, 1977; Royston and Armstrong, 1989). However, few studies have examined the long-term impact of births on mother's health. This paper would focus on how family size affects health through the economic budget constraint.

To identify the impact of family size on maternal health outcomes, there are two main difficulties. First, the causal relation between number of children and her health outcomes is hard to identify due to the endogeneity of family size. Generally, number of children is not exogenous to mother's health outcomes. Healthier mothers would be able to bear more children. This induces a non-zero correlation between family size and the error term in the identification of the effect of number of children on health. Failure to solve this problem leads to an inconsistent estimation for this effect. The exogenous change in family size due to the One-Child Policy helps to address this problem. Under this policy, the maximum number of children one couple can have is only one and the penalty for above quota birth is severe. The penalty could be either in the form of unaffordable fines or through the negative impact on people's employment if they are working in the public sector. This policy was unforeseeable before the introduction and had variations in the enforcement, allowing me to construct instruments for the number of children one woman has. A consistent estimate for the effect of family size on maternal health outcomes could be identified using a two-stage least square estimation. The empirical results with instruments show that family size significantly affects

maternal health, such as weight and blood pressure. The mothers with fewer children have a lower probability to be underweight and have low blood pressure. At the same time, they have a higher chance to be overweight and have high blood pressure. I also find that these impacts are larger for less educated women and for mothers with a lower level of family income.

The second difficulty is to differentiate the budget effect from the biological influence of child-bearing. The diseases, such as high blood pressure and diabetes, are not direct related to the child-bearing. However, maternal weight and body mass might be affected either through weight gain during child-bearing or through children's consumption of mothers' energy after the baby was born. To solve this problem, I use men as a comparison group and compare the impacts of quantity of children on father's health outcome with those on mothers. I find that family size has a very similar effect on wife's and husband's health. Thus, the biological influence of child-bearing on maternal health outcome is not supported by my results. This suggests that the impact of number of children on women mainly comes from the economic budget mechanism.

This paper exploits the exogenous change in family size under the One-Child Policy, which is the most influential population policy in the world. However, there are not many empirical studies related to it. The lack of survey data at individual level might be the main reason for that. It was only in the recent years that the literature related to it emerges. Nevertheless, considering for its large influence on people's life, it's still under-explored. Besides China, this paper also has an important implication for other developing countries that have a large population and a low level of human capital accumulation. In those countries, family budget is often binding. The resource constraint affects not only children's education and health, but also mother's health and her labor supply. Currie and Madrian (1999) found that the connection between health and labor supply is more intense in developing countries where many prime-age adults are

under-nourished and in poor health, especially in areas where malnutrition and infectious diseases are prevalent. Thus, understanding the factors that affect maternal health outcome is very important. The results of this paper could shed light on how the human capital accumulation could be increased in the developing countries.

The organization of this paper is the following. Section 2 briefly introduces the background and summarizes the literature. Section 3 describes the data. Section 4 specifies the empirical strategies. Section 5 reports the estimation results with the instruments for quantity of children. Section 6 discusses the health difference between husbands and wives. Section 7 concludes.

2 Background

2.1 Child-bearing and Health Outcome

There are two mechanisms for the impact of quantity of children on maternal health. One is the biological influence associated with child-bearing. For example, health outcome indicators like underweight and overweight might be directly affected. On the one hand, mothers gain weight during their pregnancy; on the other hand, child consumes mother's energy and nutrition. It's hard to say which one dominates the other. Chopra and Camacho (1970) found that the mean weight of lactating women appeared to be slightly lower than that of nonlactating women in Central America and Panama. However, there is no evidence for the long-term biological impact of number of births on maternal health. What's more, child-bearing itself doesn't induce specific diseases, especially the ones that are discussed in this paper, such as high blood pressure and diabetes. Another mechanism for the impact of family size is through the economic budget constraint. Mothers also have to face the competition of family resources. The more children they

give birth to, the fewer resources they could have for their own. In a larger family, mothers might have smaller investment on their health, and the pressure of caring for the kids could also deteriorate their health status. If this is true, I expect to see a negative impact of number of children on maternal health outcomes.

The existing literature only discusses the biological influence on mother's health, such as whether lactating decreases women's weight. Chopra, Kevany and Thomson (1970) use the data from Central America and Panama and find that the mean weight of lactating women is slightly lower than that of nonlactating women. Most of the related studies focus on how the birth parity and birth spacing affect maternal mortality rate. Generally, they find that women with higher birth parity face greater risks in pregnancy. For example, a woman who has been pregnant five times before might have a much higher risk of dying when she gives a sixth birth than a woman who has been pregnant only once. Winikoff (1983), EcKholm and Newland (1977), Royston and Armstrong (1989) find evidence of high mortality rate for the mothers with high parity births. The obstetrical risks are the most well-known mortality risk for the mothers with extremely high parity births. However, for the health indicator of weight, Prentice, Whitehead and Paul (1981) use the evidence from Gambia and find that neither increasing parity nor decreasing birth intervals have impact on weight. Several studies try to look at the impact of family planning policy on maternal mortality rate, since those policies directly decreases the number of times a woman becomes pregnant and could decrease the pregnancy risk for mothers. Boerma (1987) and Chen et.al (1974) find that maternal mortality is reduced significantly under family planning. Very few studied ever looked at the long term impact of number of births on health through the budget mechanism, which is the focus of this paper.

2.2 Family Planning and One-Child Policy in China

In order to control the rapid growth of population, some developing countries launched family planning in the last 3 decades. One-Child policy was introduced in China in 1979 as a response to the rapid population growth and a desperate prediction about its consequence. Generally, couples can not have a second baby after 1979. If couples already have more than one child at that time, they are not allowed to have any more. Thus, the quantity of children that one couple can have is significantly decreased by this policy. Above quota births are heavily penalized. If people violate the policy, they need to pay a very high penalty fee[2] and lose a lot of benefit associated with one child, such as the subsidy for the One-Child family from the government. Some of the SOE (State Owned Enterprises) and government employees would also jeopardize their employment status or the chance to be promoted in the future. By erecting such an economic incentive which was very effective for most of the families in China at that time, the population growth was under control. Fertility rate and family size was significantly reduced in Chinese society.

In order to keep population growth for certain groups of people, there are some exemption rules in the implementation of this policy. Ethnic minorities are allowed to have a second child while ethnic Han, which accounts for more than 90% of the total population, could not. Couples could have a second child if any of them belongs to the minority group. People live in poor and remote area, such as the mountainous area where the population is sparse, could have a second child. Disabled couple or the one who have hazardous occupation could have a second child. Except for the difference between ethnic groups, the implementation of the One-Child policy is less strict in rural area. First, there is a relaxation rule issued in the late of 1980s for the people living in some rural

[2] The above quota birth fine is either a one-time or a regular payment.

area[3] if their first child is a girl. Second, the chance to be detected if couples violate the policy is lower in rural area where hiding kids is comparatively easy. Thus, One-Child policy leads to a larger decline in fertility for ethnic Han and the people who live in urban area. This provides variations in family size and makes the identification of its impact much easier. Due to the lack of survey data at individual level, there are not many studies empirically discussing the consequences of One-Child Policy. It was only in recent years that literature related to it emerges. Most of them have been focused on the impact of this policy on fertility rate. Li and Zhang (2003) analyze the role of fine in the determination of fertility. They find that the effect of fine on above-quota births differs substantially across wealth levels. The fertility rate for rich family is more affected by One-Child policy than the poor family since the fine is based on the income of the family and poor parents don't have much to lose if they need to pay fine to have above-quota child.

About the impact of this policy on human capital accumulation and labor supply, Qian (2004) use the relaxation of One-Child Policy in China to estimate the effect of family size on school enrollment and find that additional sibling significantly increases school enrollment of the first child. Li, Zhang and Zhu (2005) find negative correlation between family size and child educational attainment. Li, Zhang and Zhu (2006) examined the effect of fertility on parental labor supply and did not find that the exogenous variation in fertility had a significant effect on the labor supply of either men or women in rural China. My paper focuses on the impact of number of children on maternal health outcome, which has not been discussed so far in the literature.

2.3 Endogeneity of Family Size

[3] Relaxation of One-Child policy is that the rural couple can have second child if the first child is girl after 1986. Greenlaugh (1986)

This paper tries to estimate the impact of family size on women's health. However, maternal health status might affect the number of children they have. On one hand, healthier mothers are able to bear more children. On the other hand, the mother with bad health tends to receive lower wage and have lower labor force participation. Thus, the opportunity cost of child-bearing is low and they tend to give birth to more children. Thus, mother's health would negatively impact the family size. The overall influence of women's health on their fertility is ambiguous. Family size is not completely exogenous when we examine its impact on maternal health. Failure to solve this endogenous problem leads to an inconsistent estimate for the coefficient of number of children.

Existing studies that discuss this endogeneity problem only focus on the causal relation between children's quality and family size. Rosenzweig and Wolpin (1980) use the natural occurrence of twins at the first birth to identify the effects of fertility on labor supply. Angrist and Evans (1998) use parental preferences for a mixed sex sibling composition to construct instruments for number of children. The way that I address this problem is to exploit the One-Child Policy in China, which is unpredictable at the time of introduction. Under this policy, the maximum number of children one couple can have is only one and the penalty for above quota birth is severe. Instruments for number of children are constructed and a consistent estimate for the impact of family size on maternal health could be identified in a two-stage least square regression.

3 Data Description

3.1 Data Set

The data set I am using is China Health and Nutrition Survey (CHNS) in 1993, 1997 and 2000. This survey is collected by the Carolina Population Center at the University of North Carolina at Chapel Hill, the National Institute of Nutrition and Food Hygiene in

Beijing, and the Chinese Center for Disease Control and Prevention. It is conducted in nine provinces in China, including the rapid developed east coast area and the southwest inland. Those provinces vary substantially in geography, economic development and public resources. Four counties and 167 communities are randomly selected in each province. There are 4400 households with a total of 16,000 individuals in each survey. The advantage of this data set is that it not only contains a physical examination which provides health indicators but also has the information about women's marriage and birth history.

CHNS consist of several questionnaires. The questionnaires related to this study are Household Survey (HHS), Physical Examination (PE), and Ever-Married Women Survey (EWS). HHS contains the information about household economic activities, such as household annual income. Physical Examination is taken by all the adults and children in the survey and provides the main health outcome variables examined in this paper. Ever-Married Women Survey (EWS) is available for surveys after 1993 and includes the information about women's histories of marriage, birth and pregnancy. The data set constructed in this empirical study is restricted to the married woman who has ever given birth to at least one child in her life. Since the birth, pregnancy and marriage information are collected in the Survey of Ever-Married Women Under Age 50, the sample is restricted to the women aged 18 to 50.

In the sample, the women who have larger number of children are generally older than the one who has only one child. Figure A in the appendix shows the age distribution of the women with different number of children. The median age for the woman with one child is 33, for the woman with two children is 39, for the woman with three children is 44 and for the woman with four children is 47. Age and number of children are highly correlated. In order to adjust the uneven distribution of age for different parity group, weights are constructed and are used in the empirical analysis in this paper. The age

distribution of each parity group is made to be the same as the one child group.

3.2 Health Indicators

Health outcome variables include underweight and overweight indicators which are generated from Body Mass Index (BMI), low/high blood pressure indicators and diagnosed disease outcomes. BMI is a measure of body fat based on height and weight and applies to both adult men and women. It equals to weight divided by height-square. Since most Chinese, especially the women, are very slim, I didn't use the standard normal range of BMI, which is from 20 to 25. Another lower bound, a BMI of 18.5, is used for the definition of underweight and normal weight. Underweight woman is the one with BMI below 18.5; Overweight woman has BMI above 25. The people with BMI above 30 are considered to be obese.

The blood pressure information includes systolic pressure and diastolic pressure. The normal range is between 90 mmhg and 120 mmhg for systolic pressure, and between 45 mmhg and 80 mmhg for diastolic pressure. Low blood pressure which is also called hypotension is usually not a serious problem, although in some case it could be life threatening. Hemorrhage and insufficient fluid intake like starvation could induce hypotension. High blood pressure is also called hypertension, which is one of the risk factors for strokes and heart attacks. Aging and diet that is high in fat and salt could induce this problem. Another set of health indicators are self-reported health outcomes, such as whether people are diagnosed with high blood pressure or diabetes.

3.3 Descriptive Statistics

Table 1 reports means and standard deviations of health outcome variables, number

of children and control variables. 19.5% of the mothers in the sample are underweight; 20.3% are overweight, and 2.6% are obese. The share of underweight women declines and the share of overweight women increases from survey 1993 to survey 2000. Similar trend is found for blood pressure indicators. The fraction of mothers with low blood pressure decreased from 8.5% in survey 1993 to 4.9% in survey 2000. The proportion of high blood pressure women is 16.9% in survey 1993, 27.6% in survey 1997 and 30.3% in survey 2000. The mean for the self-reported high blood pressure indicator is much lower than the indicator generated from the blood pressure records in physical examinations. The reason might be that some people who have high blood pressure do not see a doctor and not know they have it. It could be due to the symptoms associated with high blood pressure are not severe or they do not have convenient access to medical services. For diabetes indicators, only 0.2% of the mothers are diagnosed with it. The average number of children one woman has is 1.97 in the whole sample. 68.56% of them live in the rural area and 11.69% are ethnic minorities.

Figure 2 and 3 describe the correlation between number of children one woman has and her health status related to BMI and blood pressure. As the quantity of children decreases, the fraction of mothers who have normal weight and normal blood pressure increases. For the women who have only one child, 72.63% of them have normal weight and 72.45% of them have normal blood pressure. For the women with four children, those two numbers declines to 69.45% and 62.86%, respectively. In the graph for underweight, as the quantity of children increases from 1 to 2, the fraction of women who are underweight declines a little bit and starts to increase as the quantity of children increase to 3. In the graph for overweight, change in fraction of overweight women fluctuates with the quantity of children. It increases from 21.01% to 22.91%, as the quantity of children changes from 1 to 2, and goes back to the fraction for One-Child women group as the quantity increases to 3. For high blood pressure (hypertension)

indicator, the share of women who have hypertension increases from 24.59% to 34.19% as the number of children changes from 1 to 4. The fraction of women who have low blood pressure does not vary much with the change in the quantity of children. Based on these graphs, mothers in a smaller family tend to have a better health outcome since the proportion of them to have normal weight and normal blood pressure is much higher.

4 Empirical Strategies

In order to estimate the effect of number of children on maternal health, consider the following baseline model for OLS regressions:

$$Y = \beta_0 + \beta_1 Q + \beta_2 X + \beta_3 Z + \beta_4 P + \beta_5 U + \sum_{\substack{t=1993,\\ 1997,2000}} \alpha_t S_t + \sum_{\substack{t=1993,\\ 1997,2000}} \gamma_t S_t * U + \varepsilon \qquad (1)$$

Y is a binary health outcome indicators, such as whether a woman is underweight. Q is number of children she has at the time of survey. X includes a set of woman specific characteristic variables, such as age, birth year dummy, education, occupation and health habits, household annual income, etc. Among those variables, birth year dummies and age are used to capture cohort and aging effect. Z contains the variables related to children's characteristics, including the gender of the first child and the age of the youngest children. Child-bearing might have impact on mother's weight in the short run. The age of the youngest child could be used to capture this short term effect. Given the preference for son in Chinese society, gender of the first child could affect mother's bargaining power within the family. The woman whose first birth is a boy might have a higher bargaining power and, as a result, could have more resources allocated to herself or spend more on health-related products for all family members. Thus, the gender of

children, especially the first one, could impact women's health outcome and is controlled in the main regression. P is a set of province dummies and U is a indicator for living in urban area or not. They are used to capture the geographical difference in the provision of public health. S_t is a binary variable for each survey year to control the time effects. Considering the fact that time effect might be different for the urban area and rural are, the interactions of survey year dummies and urban indicator are included.

Due to the endogeneity of family size, the number of children one woman has needs to be instrumented. On the one hand, healthier mothers are able to bear more children. On the other hand, mothers with bad health tend to have lower accumulation of human capital and might receive lower wage and have lower job participation. Thus, their opportunity cost of child-bearing is low and this might lead to a higher fertility rate. What's more, the low 'quality' mothers tend to be from a low-income family, where the price of children's quality is not high. This further increases the number of children in those families. Thus, to solve this endogeneity problem, an exogenous change in family size would be very helpful. One-Child policy gives us an opportunity to achieve this. After the policy was implemented, if one woman already has one child or more, she is not allowed to have another one. Thus, couples who get married after the policy and couples who have their first child born after the policy would be the most affected people. Policy dummies are constructed and used as an instrument for number of children in the estimation for the impact of family size on maternal health outcome.

Since ethnic minorities have very low population, One-Child Policy was exempted for them. They are allowed to have a second child if they want. Although ethnic minorities are also encouraged to have less number of children, they are much less affected comparing with ethnic Han, which accounts for around 92%[4] of all the

[4] Data is from 1% sample of 1990 China Census.

population in China. For the people living in rural area, they are less affected than the urban population. The implementation of the policy is stricter in urban area. Except for the penalty fee, the couple who are working in public sector might lose the benefit associated with one child family and their future promotion opportunities if they have above quota births. The relaxation of One-Child policy in late 1980s allows couples in some rural areas to have a second child if their first child is female. Thus, the indicators for ethnic Han and whether living in urban area are interacted with the policy dummy and the interaction terms are used as the instruments for number of children one woman has.

Thus, the specification of two-Stage least square regression is the following:

$$Q = b_0 + b_1 Policy + b_2 Policy * Han + b_3 Policy * Urban + b_4 X + b_5 Z + b_6 P + b_7 U + \sum_{\substack{t=1993,\\1997,2000}} \alpha_t' S_t + \sum_{\substack{t=1993,\\1997,2000}} \gamma_t' S_t * U + \varepsilon \quad (2)$$

$$Y = \beta_0 + \beta_1 \hat{Q} + \beta_2 X + \beta_3 Z + \beta_4 P + \beta_5 U + \sum_{\substack{t=1993,\\1997,2000}} \alpha_t S_t + \sum_{\substack{t=1993,\\1997,2000}} \gamma_t S_t * U + \varepsilon \quad (3)$$

Three sets of instruments for number of children are used. Each set contains a policy dummy, an interaction between the policy dummy and the indicator for ethnic Han, an interaction term between the policy dummy and the indicator for living in urban areas. Different definition for the policy dummy is used in each set of those instruments. They are defined based on the time of marriage, the time when they have their first child and when they are born.

Instrument #1: Marriage before or after the One-Child Policy

The first instrument for number of children is based on the year when a couple got married. The policy dummy equals to 1 if a woman got married after 1974 and equals to 0 if married before 1974. Generally, the couple who got married after 1979 is definitely subject to the policy since the maximum number of children they can have is only one. There are still some couples who married in the middle of 1970s and don't have any child or have only one child before 1979. Their number of children is constrained by the One-Child policy as well. Before the policy was enforced, the mean interval between marriage and the first birth is 2.77 years (median interval is 2 years) and the mean interval between the first birth and the second birth is 3.59 years (median interval is 3 years). Thus, there are averaged 6 years between marriage and the second birth and I chose 1974 to be the cutoff year for the policy affected and unaffected group.

Figure 4 shows that the fraction of having a second child starts to decline after the middle of 1970s. From the comparison of the people who live in urban area and who live in rural area, there is an enlarged gap in the fraction of having a second child after 1974. People living in cities, where the implementation of the policy is very strict, have much larger decline in the fraction to have a second child. Similarly, the comparison of proportion to have a second child between ethnic minority group and ethnic Han also indicates that the people who got married after the middle of 1970s are the most affected group. This supports the choice of 1974 to be the cutoff year for the definition of the policy dummy. Different critical years around 1974 are tested in the robustness check. There is no big difference in the estimates in the second stage for the cutoff years range from 1972 to 1976, but 1974 gives the best prediction for number of children in the first stage.

Instrument #2: Have the First Child before or after the One-Child Policy

The second instrument is defined based on the time when a woman has her first child. The policy dummy equals 1 if woman gives her first birth after 1976 and equals 0 if before 1976. Generally, if one woman has her first child after 1979, she's not allowed to have another one. These women are considered to be policy affected group. For some woman who had one child born before 1979 might plan to have a second child several years later but could not do so due to the unexpected introduction of the One-Child policy in 1979. They should also be included in the policy affected group. Before the policy was enforced, the mean interval between the first birth and the second birth is 3.59 years. This is one of the reasons why I choose 1976 to be the cutoff year for the definition of the policy instrument. Figure 5 describes how the fraction of having a second child changes with the year of first birth. The fraction of women who have more than one child starts to decrease for the mothers who have their first child born after 1976. There is a larger decrease for the people live in urban area, where One-Child policy is more strictly implemented. The ethnic Han has a bigger decline in the fraction of women who have a second child after 1976. This reinforces the arguments for the choice of 1976 to be the cutoff year for the definition of the policy dummy. In the Robustness check, I choose the years from 1974 to 1978 as the alternative cutoff years to see whether the estimates are sensitive. Results show that there is no big difference in the coefficient for number of children, but the cutoff year of 1976 gives the best prediction for the number of the children in the first stage.

Instrument #3: Policy Affected Cohort or Unaffected Cohort

Since marriage decision and birth decision is made by the couple themselves, they might not be completely exogenous and correlate with woman's health status. Thus, an instrument that is based on the birth year could address this problem. Figure 6 shows that the fraction of people who have more than one child start to decrease faster for Han

women who were born after 1949. Similarly, for the people living in urban area, there is a larger decline in the proportion to have more than one child after 1949. Thus, 1949 is chosen as the cutoff year and a cohort dummy is defined to be equal to 1 if one woman was born after 1949 and equal to 0 if before 1949. Other years close to 1949 are tested in the Robustness check.

Figure 7 is the distribution of women by childbearing age. 90.3% of women have their first child born when they are younger than 30 years old. Among the mothers who have a second child, 74.5% of them gave the second birth before the age of 30. In 1979, the women who were born after 1949 are younger than 30 years old. These women are more affected by the One-Child Policy since they are in the ages that bear most of the births in a woman's life. This evidence supports the choosing of 1949 to be the cutoff year for the definition of policy dummy.

Table 2 shows the statistics for the number of children with different definition for policy affected and unaffected group. The average number of children for mothers who got married earlier than 1974, who had her first child before 1976, and who was born before 1949 is around 2.92 to 2.98. For the policy affected couples, their number of children is about 1.81 to 1.85. Thus, family size is much smaller for them. Except for age, which is controlled in the main regression, there is no big difference in the means for the other explanatory variables.

5 The Impact of Family Size on Maternal Health

This section reports the estimation results for the effect of number of children on maternal health by using a two-stage least square estimation. Newey's (1987) minimum chi-squared estimation for Probit model are tested to see whether the regression results

are consistent under different model setup. The estimates under Probit model are very similar and are not sensitive to the model I use in the regression.

5.1 Main Results: The Impact of Number of Children on Maternal Health

Table 3 reports the results in the first stage with different instruments. Each column represents a separate regression. Column 1 is the coefficients with the policy dummy generated from the time of marriage. Generally, the couple who got married after 1974 tends to have a much smaller family size. Their number of children is 28.6% smaller than the couple who married earlier. The interaction of marriage dummy and whether the mother lives in urban area has a coefficient of -0.155, which means that the One-Child policy significantly decreased the number of children for urban women. The coefficient of the interaction of marriage dummy and Han indicator is -0.084. The Han family is smaller for the couple that got married after 1974.

Column 2 is the results for using the set of instruments based on the time of first birth. For the woman who has her first child after 1976, their number of children is decreased by 16.4%. The coefficient for the interaction of Han and first birth dummy is -0.213 which indicates that the Han couple who has their first child after 1976 tends to be more affected by the One-Child policy and has a much smaller family. Column 3 is the first stage with instruments based on birth cohorts. For the Han woman who was born after 1949, their number of children is lower by 16.7%. Couples living in urban area also tend to have fewer children.

For all of these instruments, the R-squared in the first stage regression is around 0.51-0.53. The F statistics is very high and the corresponding P-values are 0.000, which suggests that the instruments are generally very powerful in the first stage. For the other

control variables, the coefficient for the gender of the first child indicates that giving birth to a girl at the first birth has significant positive impact on fertility level. Couples would like to have more children if their first kid is not a boy. People living in rural area have more and educated people have fewer.

Table 4 reports the main results in second stage of 2SLS. Women's age, health habit (smoke or not), live in rural/urban area, birth year dummies, education, household income, gender of the first child, the age of the youngest child, survey year dummies, province dummies, etc, are controlled. For each health outcome indicator, the coefficients for number of children with different instruments are listed. Column 1 is the results for the health indicator of underweight (BMI<=18.5). The coefficients for number of children are around 0.138 to 0.174. In other words, one more child in the family increases the probability for the mother to be underweight by about 13.8% to 17.4%. Mothers with only one child are healthier since they are less likely to be underweight. However, in the regression for the health indicator of overweight, having fewer children is associated with higher probability of being overweight. One less child significantly increases the probability of being overweight by 8.2% to 12.3%. The chance to be obese is negatively correlated with the quantity of children as well, although the effects are not significant. It's hard to find a significant impact of family size on the indicator of obesity since only 2.6% mothers have BMI above 25.

Comparing the results without instruments, the magnitude of the estimate is much larger after using the policy dummies. In column 1, the coefficient for number of children without IV is only 0.028, which is much lower than the estimates with policy instrument. This suggests that the error term in OLS is negatively correlated with number of children. Healthier mothers tend to be able to bear more children. The results tend to be underestimated without using the instruments. Similarly, for the indicator of overweight,

the effects are larger in 2SLS than the estimates without using the instruments. The Hausman test statistics for those estimates are very high and have corresponding p-value equal to 0.000. This suggests that exogeneity does exist and the using of instruments is very necessary; otherwise, biased impact of number of children on maternal health outcome is estimated. Over identification test for the instruments supports the validity of these instruments.

In summary, mothers with fewer children have a lower probability of being underweight and have low blood pressure; at the same time, they have a higher chance to be overweight and have high blood pressure. These seemingly contradictory results would occur if smaller family size increased food consumption of mothers leading to underweight women attaining a normal weight but normal weight women becoming overweight. Thus, these results for BMI are consistent with the budget mechanism. Fewer children under One-Child policy decrease the resource competition within the household. Not only children but also mothers themselves can have higher expenditure in food and health related commodities. Under-nutrition problem in China is largely alleviated. We observe women are less likely to be underweight in a small family. However, the increased probability of being overweight indicates that the over-nutrition problem might emerge in the One-Child family.

The fourth and fifth column in Table 4 are estimates for health indicator related to blood pressure. The number of children has positive impact on the probability to have low blood pressure and negative impact on the chance to have high blood pressure. In Column 4, one less child decreases the chance to have low blood pressure by about 5.0%. Thus, on the one hand, One-Child mothers are healthier since they are less likely to have low blood pressure. On the other hand, the family planning makes mothers less healthy since it increases the chance to have high blood pressure. For health indicator of high

blood pressure, the coefficients for quantity of children are around -0.045 to -0.053. The last two columns in Table 3 are the estimates for self-reported health outcome indicators, such as whether an individual has ever been diagnosed with high blood pressure and diabetes. Results show that smaller family size increases the chance to have high blood pressure but decreases the probability to be diagnosed with diabetes. Since there are only 2% of the women in the sample diagnosed with high blood pressure and only 0.2% of them diagnosed with diabetes, it's hard to find the effects to be statistically significant.

5.2 Sensitivity Test

Next, I do a Robustness check to test the sensitivity for the definition of the instruments. I use different cutoff years for each policy dummy. For the policy dummy based on the time of marriage, in addition to using 1974 as the cutoff year for the policy-affected group and unaffected group, I define another two sets of policy dummies with cutoff year 1976 and 1974. The estimation results with those instruments are listed in Table 5 and Table 6. Table 5 is the estimates in the first stage. The first three columns are the coefficients for the policy dummy and its interaction with ethnic Han and urban dummy. With the other two cutoff years, policy dummy is significant in explaining the quantity of children. But, the magnitude of estimates is smaller and R square of the regression is a little bit lower than the original cutoff year of 1974.

Second stage results of the Robustness check are reported in Table 6. Each estimate corresponds to a β_1 in a different regression. With different cutoff years, the estimates are very similar and the variance of the estimates in the original setup for the instruments is a little bit smaller than the other ones. Similarly, for the policy dummies based on the year of first birth and birth cohort, I do the same sensitivity test. Columns 4 to 6 in Table 5 are the first stage results for the first birth dummy. The cutoff year of 1976 makes a

better prediction for the number of children one woman has. The standard error for the estimates in the second stage is also a little smaller. Columns 7 to 9 in Table 5 are the results for birth cohort dummy. Using the year of 1949 as the cutoff year for policy affected and unaffected group fits quantity of children better than the other cutoff years. There is no big difference in the second stage regression for the impact of number of children on the maternal health outcomes.

5.3 The Impacts of Number of Children on Women's Height

Since high birth parity is associated with a larger mortality risk for women, the mothers with a small number of births tend to have a higher chance to survive. Thus, healthier mothers would be selected into the sample and this selection problem might bias our estimation. Since women's height is predetermined and would not be affected by number of births, I use height as an alternative health outcome to test whether it is affected by family size. A statistically significant estimate would indicate the selection problem should not be ignored. The results in Table 7 are the estimates for the impact of number of children on mother's height. The estimates are close to zero and not significant at all. This suggests that a smaller family size does not statistical significantly increase women's height. Thus, healthier mothers are not selected into the sample. Selection is not a big problem here and the main results provide consistent estimates for the impact of family size on maternal health outcomes.

5.4 The Impacts of Number of Children by Education and Income Level

So far, I only discuss the average treatment effect of family size. However, its impact might vary for different groups of people. For example, high-income family tends to have rich resources and their health status is less likely to be affected by number of

children since their budget is not binding. I group the mothers in the sample based on their education and income levels and estimate the impacts for each group.

Table 8 reports the first stage results. The upper panel is for mothers grouped by education level. If a mother's years of education are less than 6 years, i.e., her education level is below elementary degree, she is put into the less educated group. More educated group contains the women whose years of education are above 6. The second stage results in Table 9 show that the family size has significant impact on most maternal health outcomes for both less educated and more educated group. For the health indicator of underweight, the effect is larger for less educated women. In the regression results with policy instruments based on the birth cohort, one more child increases the probability to be underweight by 16.1% for more educated women and 17.7% for less educated women. With respect to the other health outcomes, the number of children has bigger effects for less educated group but the difference is not very significant. Overall, less educated women are more affected by family size.

The second stage results for the impact of family size on health outcomes for different income group are listed in Table 10. Low-income group is the one whose household income is below 25 percentile and high-income group is the one whose household income is above 75 percentile. For health indicator of underweight, the impact of family size is much bigger for low-income group. One less child decreases the chance to be underweight by 31.3% to 32.0%. For high-income group, this number is only 8.2% to 12.0%. The impact on the probability to be overweight is significantly negative and the difference in the magnitude between the groups is not very large. The indicators related to blood pressure are less likely to be impacted by child number for both low income and high-income group.

In summary, the impact of quantity of children tends to be larger for less educated women and for mothers with a lower family income. Education increases the knowledge about health and human capital stock; higher income gives more resources that could be invested in health. These could be the reason why we see the different degree of impact for the mothers grouped by education and income levels.

6 Women vs. Men

The consistent estimates for the effects of family size on maternal health are obtained with the help of instruments. However, I still didn't differentiate the biological mechanism from economic budget impact of number of children on health. Child-bearing itself might have a direct impact on body weight. On one hand, women gain weight during pregnancy; On the other hand, child might be 'biologically' taxing mothers' weight through breastfeeding, caring for children, etc. The total impact is not clear because we don't know which direction dominate in the long run. No matter how child-bearing affects maternal health, father's health status should not be biologically influenced by child-bearing. Thus, in this section, I use men as a comparison group and estimate the impact of number of children on father's health outcomes. The regression results for husbands support the budget connection between family size and maternal health.

For all women in the sample, I matched each mother with her husband and put all husbands together to make a comparison group. Table 11 describes health difference between men and women. For the husbands, 18.77% of them has BMI lower than 18.5, 18.97% has BMI over 25, and 2.4% are obese. For the wives, these numbers are 19.61%, 20.37 and 2.6%, respectively. Men are healthier than women since higher fraction of men have normal weight and fewer of them are underweight and overweight. For blood pressure indicators, the fraction of men who have low blood pressure (1.96%) is much

lower than that for women, which is 6.06%. However, 39.59% of fathers have high blood pressure, comparing with a fraction of 25.49% for mothers. For the diagnosed health outcome, 2.87% of men have high blood pressure while only 1.99% of women have it. Based on all of these numbers, fathers are healthier than mothers in terms of BMI and low blood pressure, but, more of them have high blood pressure than their wives.

Table 12 and 13 report estimation results for men. The estimates for women are listed for comparison. Quantity of children is statistically significant (at level 1%) in explaining underweight and overweight indicators for the husbands. Less number of children decreases the probability to have BMI lower than 18.5 and increase the chance to have BMI over 25. The estimate for the impact on the probability to be underweight for men is around 0.115 to 0.160, which is 1-3% lower than that for women. The estimate for overweight is close to the one for women. More children lead to a lower probability to be overweight. In the estimates for blood pressure indicators, there is very small impact of family size on the probability to have low blood pressure for men. With instruments based on birth cohort, men's high blood pressure indicator is impacted by number of children in a similar way as women.

In summary, most health outcome variables, such as underweight, overweight and high blood pressure have very similar estimates for both men and women, while low pressure varies a little. If family resource is equally distributed within the family, the main difference of the impact of number of children on health outcome between men and women is that women bear children while men don't. If child-bearing itself has impact on maternal health, there should be different impact of family size on women and men, especially for the health indicators related to BMI. Since the impact of number of children on health outcome for husbands and wives is very similar, child-bearing itself don't have biological impact on maternal health outcome. This suggests that the

influence of family size on maternal health is mainly through the economic budget mechanism, that is, more children decrease the resource allocated to mothers and affect their health outcomes.

7 Conclusions

In this paper, I examine the impact of family size on maternal health by exploiting exogenous change in family size under the One-Child policy in China. With the data from China Health and Nutrition Survey in 1993, 1997 and 2000 and several sets of instruments based on the One-Child policy are generated and a consistent estimate for the impact of number of children on maternal health outcomes is obtained. Empirical results with instruments suggest that family size has statistically significant effect on maternal health outcomes. Mothers with fewer children have lower probability to be underweight and have low blood pressure. At the same time, they have a higher probability to be overweight and have high blood pressure. These seemingly contradictory results would occur if smaller family size increased food consumption of mothers leading to underweight women attaining a normal weight but normal weight women becoming overweight. Thus, One-Child Policy makes women heavier and contributes a lot to the alleviation of under-nutrition problem in China.

I also find that the impact of number of children is larger for less educated women and for mothers with a lower level of family income. Family income directly affects resource constraint. Rich family is less impacted by family size. This supports the mechanism of budget effect, since this effect should be larger for women with limited family income. Educated people tend to have more knowledge about health and receive higher wages. These might be the reason why the impact of One-Child policy is smaller on them. The empirical results for husbands support that there is no significant biological impact of child-bearing on maternal health. All the effects of number of children mainly

comes from the economic budget mechanism, that is, more children decrease the resource allocated to mothers and affect their health outcomes.

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Figure 1a: A Comparison of the Fraction of Women
Who are underweight in 1993 and 2000

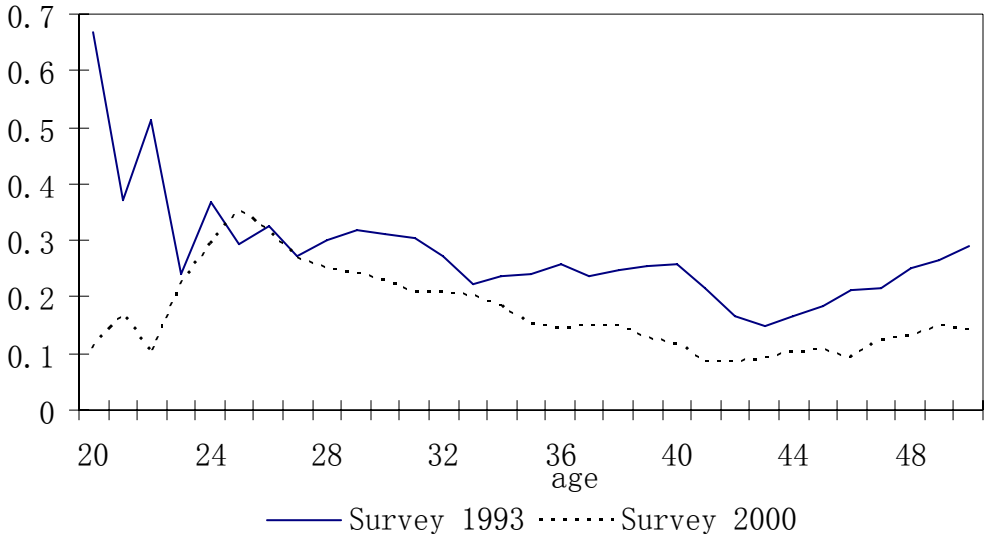
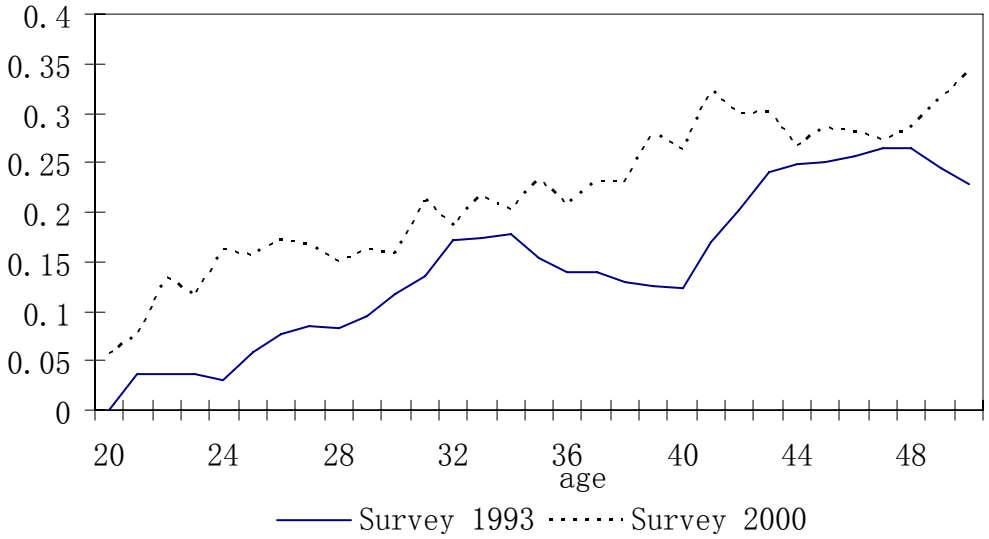
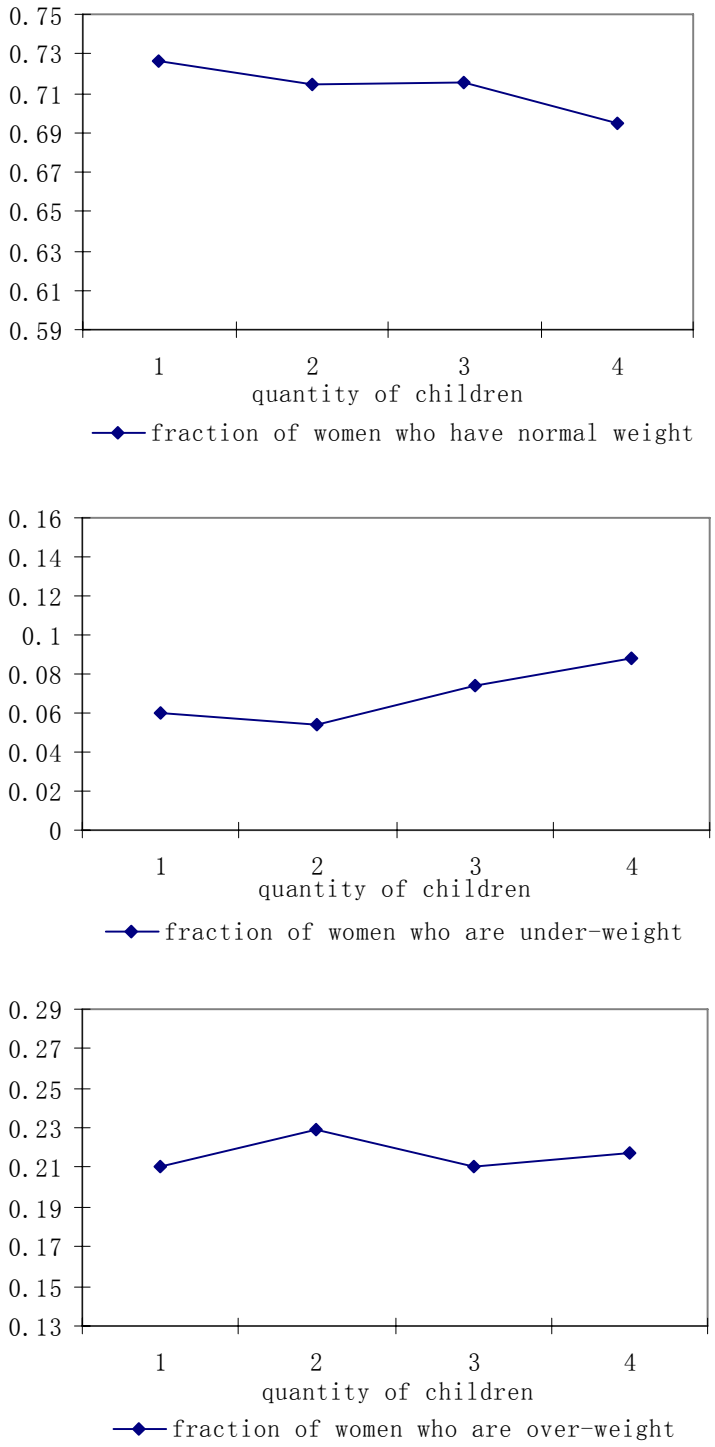


Figure 1b: A Comparison of the Fraction of Women
Who are overweight in 1993 and 2000



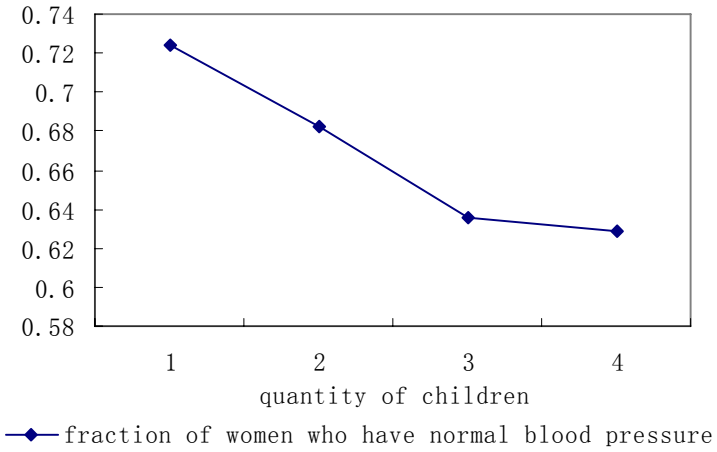
Source: Author's calculations from CHNS.

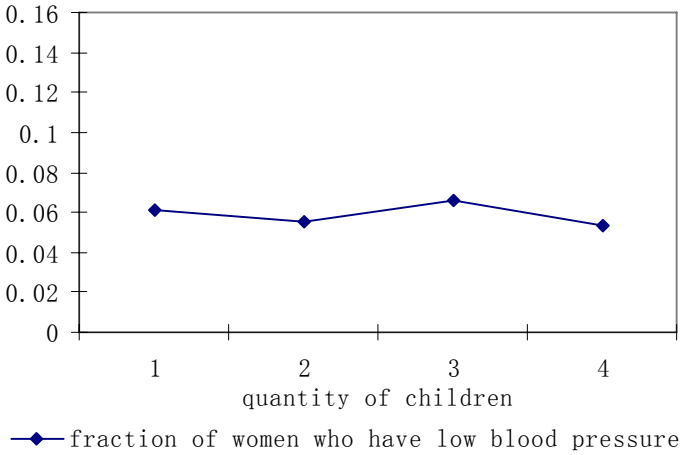
Figure 2: The fraction of women with normal BMI / underweight / overweight and the number of children they have

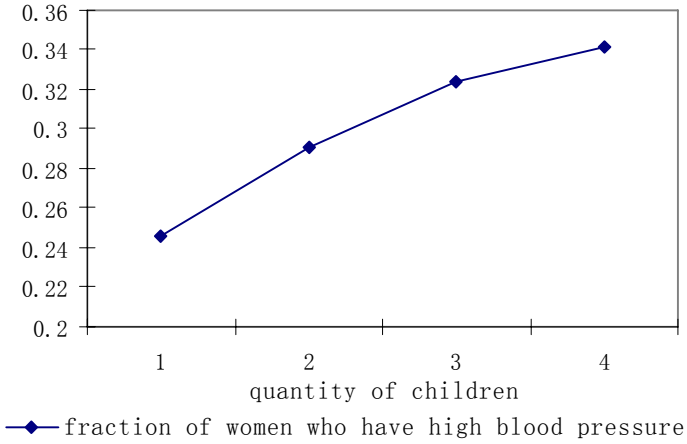


Source: Author's calculations from CHNS, 1993-2000.

Figure 3: The fraction of women with normal blood pressure / low blood pressure / high blood pressure and quantity of children they have

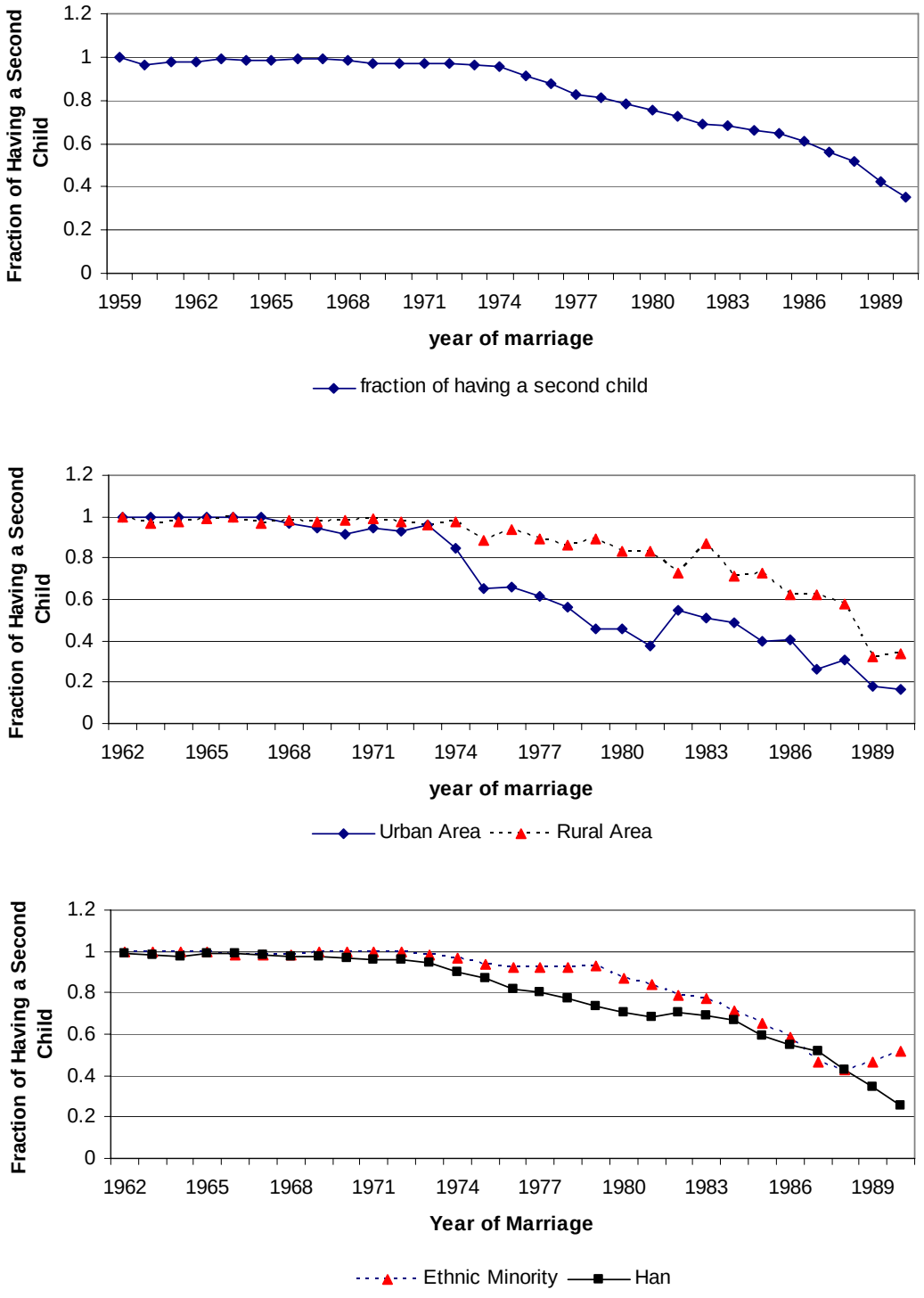






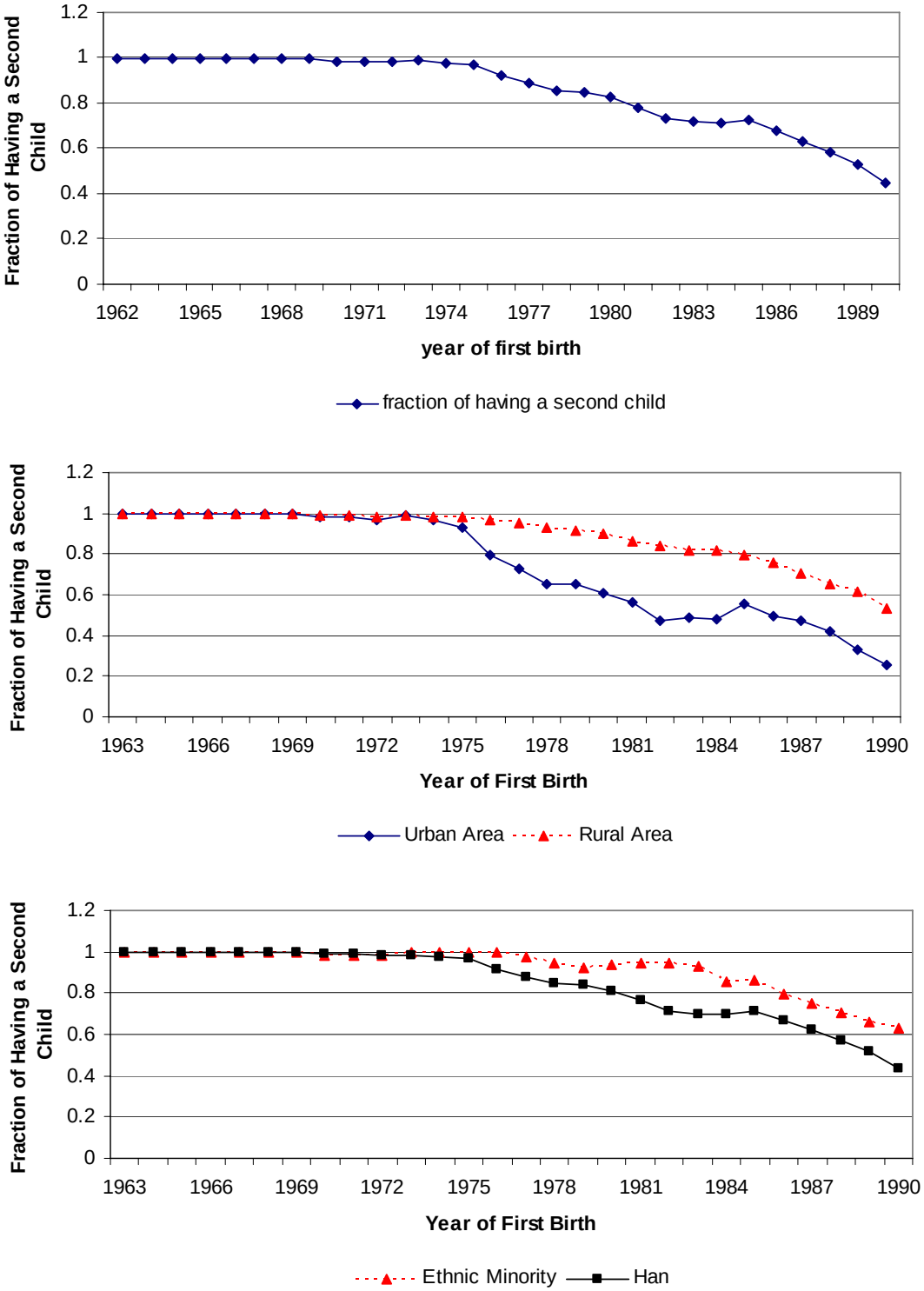
Source: Author's calculations from CHNS, 1993-2000.

Figure 4: Marriage Year and the Fraction of Having a second Child



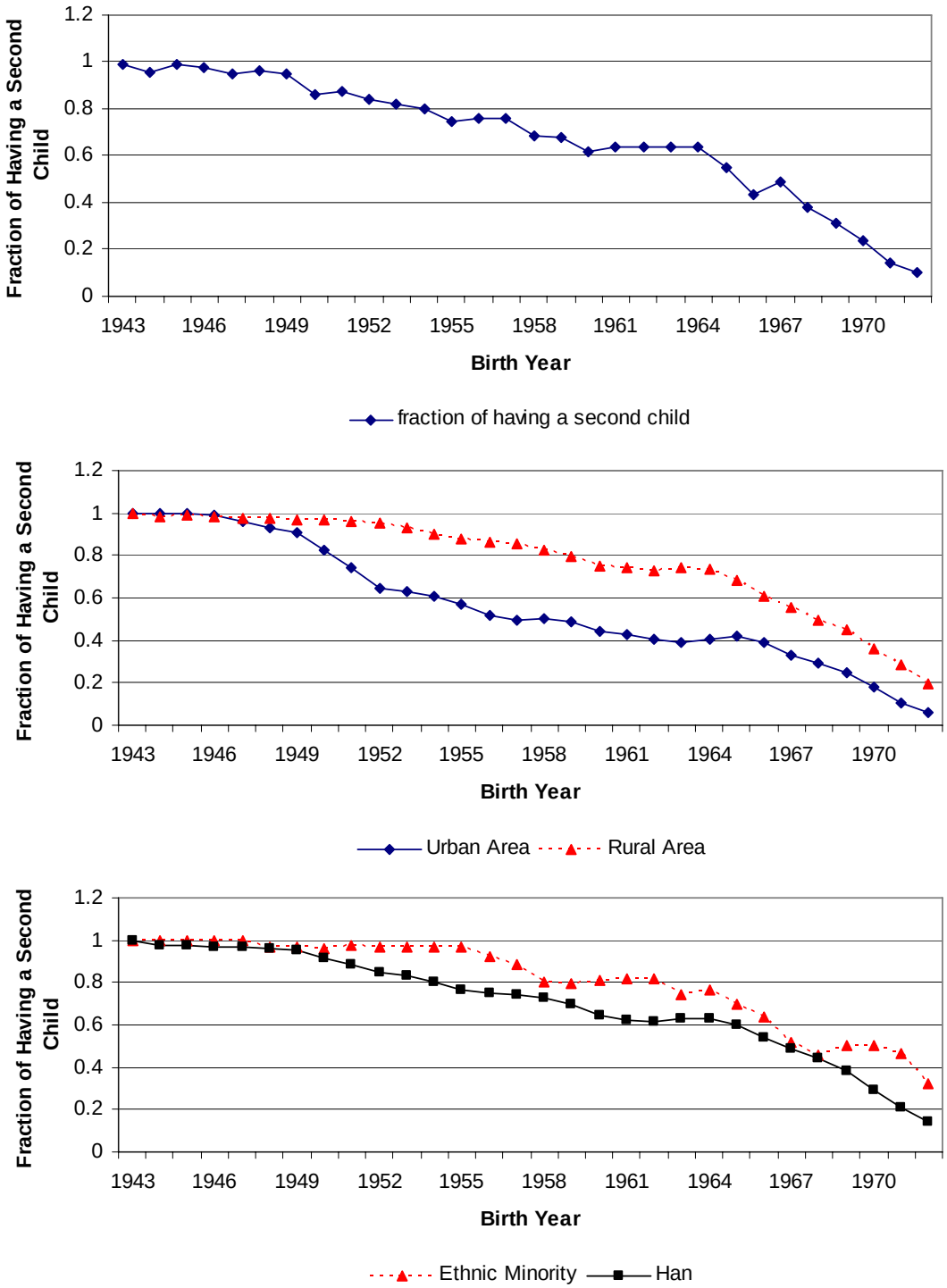
Source: Author's calculations from CHNS, 1993-2000.

Figure 5: Year of First Birth and the Fraction of Having a Second Child



Source: Author's calculations from CHNS, 1993-2000.

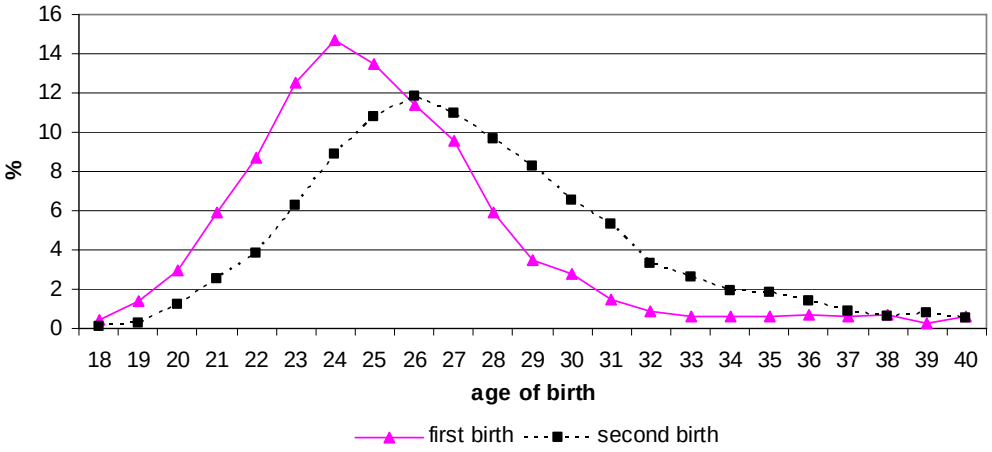
Figure 6: Birth Cohort and Fraction of Having a Second Child



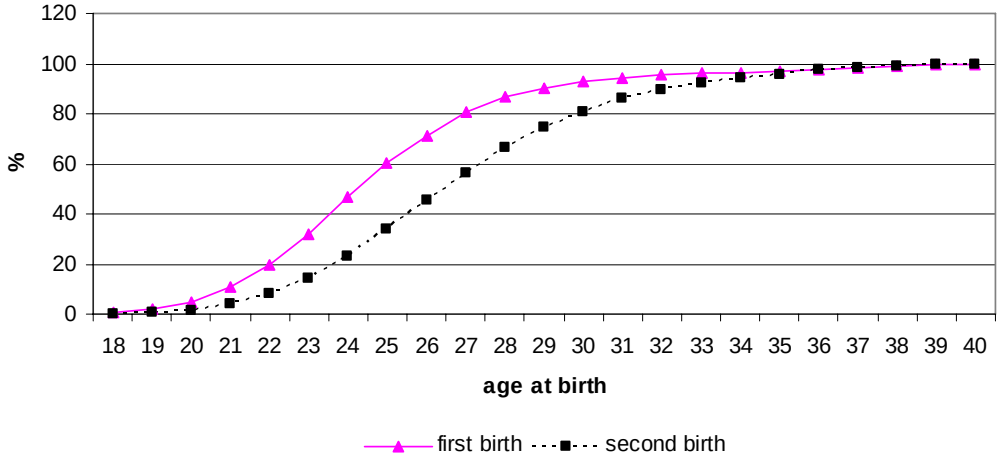
Source: Author's calculations from CHNS, 1993-2000.

Figure 7: Distribution of Women by Birth Age

a. PDF



b. CDF



Source: Author's calculations from CHNS, 1993-2000.

Table 1: Descriptive Statistics of CHNS, 1993-2000.

	Survey Year			Total
Variables	1993	1997	2000	
Quantity of Children	2.066	1.850	1.672	1.966
	(0.918)	(0.864)	(0.779)	(1.047)
BMI	22.089	22.541	23.017	22.467
	(2.932)	(2.973)	(3.112)	(3.020)
Underweight	0.253	0.183	0.158	0.195
(BMI<=18.5)	(0.435)	(0.387)	(0.364)	(0.396)
Overweight	0.160	0.198	0.243	0.203
(BMI>=25)	(0.367)	(0.399)	(0.429)	(0.402)
Obese	0.017	0.026	0.034	0.026
(BMI>=30)	(0.129)	(0.160)	(0.181)	(0.160)
Low Blood Pressure	0.085	0.051	0.049	0.060
	(0.279)	(0.221)	(0.216)	(0.238)
High Blood Pressure	0.169	0.276	0.303	0.253
	(0.375)	(0.447)	(0.460)	(0.435)
Diagnosed with high	0.017	0.014	0.027	0.020
blood pressure	(0.129)	(0.119)	(0.163)	(0.140)
Diagnosed with diabetes	N/A	0.002	0.003	0.002
		(0.042)	(0.053)	(0.048)
Living in Rural Area	0.714	0.656492	0.689	0.686
	(0.452)	(.4749874)	(0.463)	(0.464)
Ethnic Minorities	0.115	0.1105434	0.125	0.117
	(0.319)	(0.3136388)	(0.331)	(0.321)
Years of Education	6.177	6.75672	7.505	6.854
	(3.898)	(3.881687)	(3.750)	(3.877)
Household Annual	0.0636	1.456	1.252	1.134
Income (10000RMB)	(0.613)	(1.088)	(0.994)	(0.991)
Age	36.960	37.22688	38.187	37.496
	(6.902)	(7.456682)	(7.399)	(7.291)
Birth year	1956.04	1959.773	1961.813	1959.387
	(6.902)	(7.457)	(7.399)	(7.645)
First Child is Female	0.470	0.477	0.479	0.474
	(0.499)	(0.500)	(0.500)	(0.499)
Smoke	0.046	0.049	0.049	0.048
	(0.210)	(0.217)	(0.217)	(0.214)
N	2677	2507	2553	7727

Note: Standard deviations are shown in parenthesis.

Table 2: A Comparison of Number of Children for Policy Affected Group and Unaffected Group (Mean and Standard Deviation)

	IV: marriage		IV: first birth		IV: cohort		Total
	Before	After	Before	After	Before	After	
Number of Children	2.92	1.81	2.98	1.85	2.98	1.82	1.966
	(0.80)	(0.83)	(0.78)	(0.83)	(0.85)	(0.81)	(1.047)
Observations	2128	5599	1821	5906	1784	5943	7727

Table 3: First Stage Results for Number of Children

	Dependent variables: Quantity of Children		
Independent Variable	IV: Marriage	IV: First Birth	IV: Cohort
Instrumental Variables:			
Policy Dummy * Han	-0.084	-0.213***	-0.167***
	(0.052)	(0.053)	(0.064)
Policy Dummy * Urban	-0.155***	-0.056	-0.121**
	(0.042)	(0.042)	(0.052)
Policy Dummy	-0.286***	-0.164***	-0.072
	(0.054)	(0.054)	(0.064)
Control Variables:			
First Child is a Girl	0.199***	0.202***	0.191***
	(0.015)	(0.015)	(0.015)
Han	0.014	0.106**	0.091
	(0.047)	(0.047)	(0.061)
Urban	-0.182***	-0.298***	-0.209***
	(0.049)	(0.053)	(0.060)
Years of Schooling	-0.050***	-0.051***	-0.054***
	(0.002)	(0.002)	(0.002)
Household Annual Income	0.013	0.015	0.030*
	(0.017)	(0.018)	(0.017)
Age	0.126***	0.123***	0.130***
	(0.024)	(0.024)	(0.024)
Age Squared	-0.001***	-0.001***	-0.000**
	(0.000)	(0.000)	(0.000)
Birth Year Dummies	Yes	Yes	Yes
Province Indicator	Yes	Yes	Yes
Survey Year Dummies	Yes	Yes	Yes
Survey Year * Urban	Yes	Yes	Yes
Observations	7727	7727	7727
R-squared	0.53	0.53	0.51
F Statistics	143.02	142.31	141.55
(Prob > F)	0.0000	0.0000	0.0000

Note: Standard errors are shown in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: The Impact of Family Size on Maternal Health
(Coefficients for Number of Children in the 2nd Stage Regression)

	Dependent Variables						
	Underweight (BMI<=18.5)	Overweight (BMI>=25)	Obese (BMI>=30)	Low blood pressure	High blood pressure	Diagnosed High Blood Pressure	Diagnosed Diabetes
IV: Marriage Year	0.138***	-0.091***	-0.003	0.050***	-0.053***	-0.011*	0.001
	(0.016)	(0.015)	(0.005)	(0.010)	(0.016)	(0.006)	(0.003)
IV: First Birth Year	0.144***	-0.082***	-0.005	0.048***	-0.053***	-0.007	0.002
	(0.016)	(0.014)	(0.005)	(0.010)	(0.016)	(0.006)	(0.003)
IV: Birth Cohort	0.174***	-0.123***	-0.005	0.055***	-0.045***	-0.010*	-0.001
	(0.017)	(0.016)	(0.006)	(0.011)	(0.017)	(0.006)	(0.003)
Without IV	0.028***	-0.027***	-0.002	0.009**	-0.007	-0.001	0.002*
	(0.006)	(0.006)	(0.002)	(0.004)	(0.006)	(0.002)	(0.001)
Observations	7727	7727	7727	7727	7727	7526	4516

Note: Standard errors are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Sensitivity Test: First Stage Results

	Dependent variables: Quantity of Children								
Independent	IV: Marriage			IV: First Birth			IV: Cohort		
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Policy Dummy *	-0.084	-0.094	-0.081	-0.213***	-0.246***	-0.208***	-0.167***	-0.174***	-0.152***
Han Nationality	(0.052)	(0.069)	(0.058)	(0.053)	(0.051)	(0.048)	(0.064)	(0.054)	(0.049)
Policy Dummy *	-0.155***	-0.160***	-0.153***	-0.056	-0.059	-0.057	-0.121**	-0.074**	-0.125**
Urban	(0.042)	(0.047)	(0.035)	(0.042)	(0.039)	(0.037)	(0.052)	(0.030)	(0.056)
Policy Dummy	-0.286***	-0.248***	-0.233***	-0.164***	-0.119**	-0.136***	-0.072	-0.065	-0.077
	(0.054)	(0.052)	(0.052)	(0.054)	(0.053)	(0.051)	(0.064)	(0.058)	(0.066)
Observations	7727	7727	7727	7727	7727	7727	7727	7727	7727
R-squared	0.53	0.52	0.52	0.53	0.52	0.52	0.51	0.51	0.51

* Note: Note: Standard errors are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Definition of policy dummy for each regression : (1) Policy Dummy =1 if the mother got married after 1974; 0 otherwise; (2) Policy Dummy =1 if the mother got married after 1976; 0 otherwise; (3) Policy Dummy =1 if the mother got married after 1972; 0 otherwise; (4) Policy Dummy =1 if the mother had her first child after 1976; 0 otherwise; (5) Policy Dummy =1 if the mother had her first child after 1978; 0 otherwise; (6) Policy Dummy =1 if the mother had her first child after 1974; 0 otherwise; (7) Policy Dummy =1 if the mother was born after 1949; 0 otherwise; (8) Policy Dummy =1 if the mother was born after 1951; 0 otherwise; (9) Policy Dummy =1 if the mother was born after 1947; 0 otherwise.

Table 6: Sensitivity Test: The Impact of Family Size on Maternal Health (Coefficient for Number of Children in 2nd Stage)

Cutoff Year	Underweight (BMI<=18.5)	Overweight (BMI>=25)	Obese (BMI>=30)	Low blood pressure	High blood pressure	Diagnosed High Blood Pressure	Diagnosed Diabetes
IV: Marriage Year							
(1). 1974	0.138***	-0.091***	-0.003	0.050***	-0.053***	-0.011*	0.001
	(0.016)	(0.015)	(0.005)	(0.010)	(0.016)	(0.006)	(0.003)
(2). 1976	0.133***	-0.103***	-0.003	0.049***	-0.043***	-0.008	-0.001
	(0.016)	(0.015)	(0.005)	(0.010)	(0.016)	(0.006)	(0.003)
(3). 1972	0.146***	-0.126***	-0.007	0.048***	-0.037**	-0.007	-0.002
	(0.017)	(0.016)	(0.006)	(0.010)	(0.017)	(0.006)	(0.003)
IV: First Birth Year							
(4). 1976	0.144***	-0.082***	-0.005	0.048***	-0.053***	-0.007	0.002
	(0.016)	(0.014)	(0.005)	(0.010)	(0.016)	(0.006)	(0.003)
(5). 1978	0.148***	-0.093***	-0.004	0.050***	-0.029*	-0.003	0.001
	(0.017)	(0.015)	(0.005)	(0.010)	(0.016)	(0.006)	(0.003)
(6). 1974	0.159***	-0.119***	-0.007	0.051***	-0.028	-0.005	-0.001
	(0.017)	(0.016)	(0.006)	(0.010)	(0.017)	(0.006)	(0.003)
IV: Birth Cohort							
(7). 1949	0.174***	-0.123***	-0.005	0.055***	-0.045***	-0.010*	-0.001
	(0.017)	(0.016)	(0.006)	(0.011)	(0.017)	(0.006)	(0.003)
(8). 1951	0.175***	-0.120***	-0.005	0.056***	-0.058***	-0.011*	-0.003
	(0.017)	(0.016)	(0.006)	(0.011)	(0.017)	(0.006)	(0.003)
(9). 1947	0.176***	-0.143***	-0.010*	0.054***	-0.052***	-0.012*	-0.004
	(0.017)	(0.016)	(0.006)	(0.011)	(0.017)	(0.006)	(0.003)
Observations	7727	7727	7727	7727	7727	7526	4516

* Note: Definition of policy dummy for each regression : (1) Policy Dummy =1 if the mother got married after 1974; 0 otherwise; (2) Policy Dummy =1 if the mother got married after 1976; 0 otherwise; (3) Policy Dummy =1 if the mother got married after 1972; 0 otherwise; (4) Policy Dummy =1 if the mother had her first child after 1976; 0 otherwise; (5) Policy Dummy =1 if the mother had her first child after 1978; 0 otherwise; (6) Policy Dummy =1 if the mother had her first child after 1974; 0 otherwise; (7) Policy Dummy =1 if the mother was born after 1949; 0 otherwise; (8) Policy Dummy =1 if the mother was born after 1951; 0 otherwise; (9) Policy Dummy =1 if the mother was born after 1947; 0 otherwise.

Table 7: The Impact of Number of Children on Height
(Coefficient for Number of Children in the 2nd Stage)

	Height
IV: Marriage Year	0.007
	(0.005)
IV: First Birth Year	0.008
	(0.006)
IV: Birth Cohort	0.006
	(0.005)
Without IV	-0.001
	(0.001)
Observations	7727

Note: Standard errors are shown in parentheses.

Table 8: First Stage for Heterogeneous Treatment Effect

	Dependent Variables: Quantity of Children					
	Less Educated Vs. Educated					
	IV: Marriage		IV: First Birth		IV: Cohort	
	Less Educ.	More Educ	Less Educ	More Educ	Less Educ	More Educ
Policy Dummy *	−0. 256***	−0. 136***	−0. 341***	−0. 131***	−0. 239***	−0. 156***
Han	(0. 044)	(0. 039)	(0. 046)	(0. 041)	(0. 038)	(0. 039)
Policy Dummy *	−0. 235***	−0. 382***	−0. 202***	−0. 367***	−0. 210***	−0. 385***
Urban	(0. 038)	(0. 024)	(0. 040)	(0. 026)	(0. 033)	(0. 024)
Policy Dummy	−0. 090*	−0. 127**	−0. 047	−0. 116**	−0. 114**	−0. 016
	(0. 052)	(0. 056)	(0. 054)	(0. 058)	(0. 050)	(0. 059)
Observations	3908	3819	3964	3828	4029	3907
R-squared	0.47	0.45	0.47	0.45	0.45	0.44
	Poor Vs. Rich					
	IV: Marriage		IV: First Birth		IV: Cohort	
	Poor	Rich	Poor	Rich	Poor	Rich
Policy Dummy *	−0. 072	−0. 262***	−0. 083	−0. 288**	−0. 107*	−0. 253***
Han	(0. 067)	(0. 098)	(0. 071)	(0. 113)	(0. 060)	(0. 089)
Policy Dummy *	−0. 114***	−0. 363***	−0. 061	−0. 369***	−0. 114**	−0. 345***
Urban	(0. 031)	(0. 044)	(0. 065)	(0. 050)	(0. 058)	(0. 042)
Policy Dummy	−0. 007	−0. 092	−0. 032	−0. 029	−0. 037	−0. 099
	(0. 082)	(0. 108)	(0. 087)	(0. 124)	(0. 083)	(0. 101)
Observations	1397	1471	1413	1487	1430	1497
R-squared	0.46	0.58	0.45	0.58	0.45	0.57

Note: Standard errors are shown in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. Less Educated: Years of Schooling<=6; More Educated: Years of Schooling>6.Poor: family income is lower than 25 percentile; Rich: family income is higher than 75 percentile.

Table 9: The Impact of Family Size on Maternal Health: Less Educated Vs. More Educated Women
(Coefficient for Number of Children in the 2nd Stage)

	Dependent Variables							
	Underweight (BMI<=18.5)		Overweight (BMI>=25)		Low blood pressure		High blood pressure	
	Less Educ	More Educ	Less Educ	More Educ	Less Educ	More Educ	Less Educ	More Educ
With IV:								
Marriage Year	0.148***	0.138***	-0.090***	-0.085***	0.042***	0.040***	-0.081***	-0.021
	(0.021)	(0.025)	(0.020)	(0.022)	(0.013)	(0.014)	(0.022)	(0.023)
First Birth Year	0.148***	0.128***	-0.088***	-0.082***	0.045***	0.036***	-0.074***	-0.032
	(0.021)	(0.024)	(0.020)	(0.022)	(0.013)	(0.014)	(0.022)	(0.023)
Birth Cohort	0.177***	0.161***	-0.118***	-0.108***	0.046***	0.041***	-0.079***	-0.008
	(0.023)	(0.026)	(0.021)	(0.023)	(0.015)	(0.014)	(0.024)	(0.024)
Without IV	0.065***	0.035***	-0.035***	-0.046***	0.002	0.005	-0.022**	-0.013
	(0.010)	(0.010)	(0.008)	(0.010)	(0.003)	(0.004)	(0.011)	(0.012)
Observations	4029	3907	4029	3907	4029	3907	4029	3907

Note: Standard errors are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1% . Less Educated: Years of Schooling<=6; More Educated: Years of Schooling>6.

Table 10: The Impact of Family Size on Maternal Health: Poor Vs. Rich Women
(Coefficient for Number of Children in the 2nd Stage)

	Dependent Variables							
	Underweight (BMI<=18.5)		Overweight (BMI>=25)		Low blood pressure		High blood pressure	
	Poor	Rich	Poor	Rich	Poor	Rich	Poor	Rich
With IV:								
Marriage Year	0.165***	0.082***	-0.131***	-0.065**	0.050	0.033*	0.129***	-0.052
	(0.046)	(0.031)	(0.036)	(0.030)	(0.032)	(0.019)	(0.043)	(0.032)
First Birth Year	0.173***	0.105***	-0.148***	-0.097***	0.048	0.037**	0.111**	-0.057*
	(0.046)	(0.031)	(0.037)	(0.030)	(0.033)	(0.019)	(0.044)	(0.032)
Birth Cohort	0.179***	0.120***	-0.127***	-0.113***	0.038	0.031	0.108**	-0.030
	(0.046)	(0.033)	(0.036)	(0.033)	(0.032)	(0.020)	(0.043)	(0.035)
Without IV	0.059***	0.033**	-0.025**	-0.017	0.006	-0.002	0.012	-0.043**
	(0.017)	(0.016)	(0.012)	(0.015)	(0.005)	(0.006)	(0.019)	(0.020)
Observations	1430	1497	1430	1497	1430	1497	1430	1497

Note: Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Poor: family income is lower than 25 percentile; Rich: family income is higher than 75 percentile.

Table 11: A Comparison of Women and Men's Health Outcomes

(Mean and Standard Deviation)

Health Indicators	Women	Men
Underweight	.1960614	.1876833
(BMI<18.5)	(.3970443)	(.3904948)
Overweight	.2037359	.1896994
(BMI>=25)	(.402804)	(.3920991)
Obese	.0262091	.0240103
(BMI>=30)	(.1597682)	(.153095)
Low Blood Pressure	.0605659	.0196042
	(.2385499)	(.1386486)
High Blood Pressure	.2548509	.3958944
	(.4358089)	(.4890868)
Diagnosed with high	.0199257	.0287389
blood pressure	(.1397552)	(.1962352)

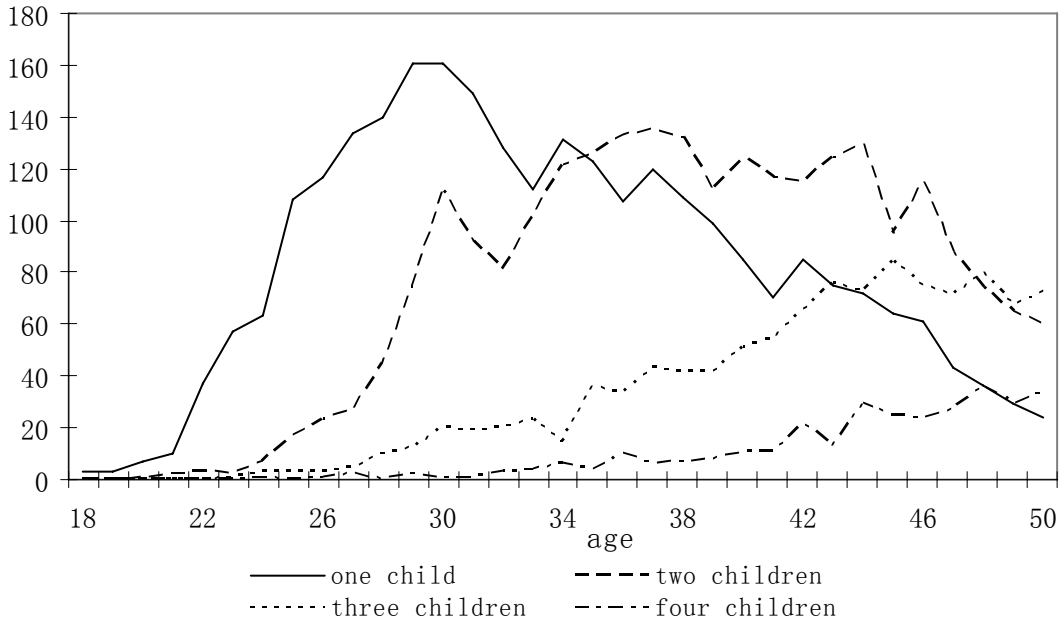
Table 12: First Stage for Men and Women

	Dependent variables: Quantity of Children					
	IV: Marriage		IV: First Birth		IV: Cohort	
	Men	Women	Men	Women	Men	Women
Policy Dummy	-0.082	-0.084	-0.155***	-0.213***	-0.141***	-0.167***
* Han	(0.054)	(0.052)	(0.044)	(0.053)	(0.046)	(0.065)
Policy Dummy	-0.162***	-0.155***	-0.070	-0.056	-0.141**	-0.121**
* Urban	(0.045)	(0.042)	(0.047)	(0.042)	(0.055)	(0.052)
Policy Dummy	-0.245***	-0.286***	-0.169***	-0.164***	-0.088	-0.072
	(0.050)	(0.054)	(0.051)	(0.054)	(0.057)	(0.064)
Observations	7727	7727	7727	7727	7727	7727
R-squared	0.51	0.53	0.51	0.53	0.48	0.51

Note: Standard errors are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 13: The Impact of Family Size on Health Outcomes: Men Vs. Women
(Coefficients of Number of Children in the 2nd Stage Regression)

	Dependent Variables							
	Underweight (BMI<=18.5)		Overweight (BMI>=25)		Low blood pressure		High blood pressure	
	Men	Women	Men	Women	Men	Women	Men	Women
With IV								
Marriage Year	0.128***	0.138***	-0.080***	-0.091***	0.008	0.050***	-0.026	-0.053***
	(0.017)	(0.016)	(0.015)	(0.015)	(0.006)	(0.010)	(0.019)	(0.016)
First Birth Year	0.115***	0.144***	-0.084***	-0.082***	0.005	0.048***	-0.032*	-0.053***
	(0.017)	(0.016)	(0.015)	(0.014)	(0.006)	(0.010)	(0.019)	(0.016)
Birth Cohort	0.160***	0.174***	-0.102***	-0.123***	-0.000	0.055***	-0.064***	-0.045***
	(0.019)	(0.017)	(0.017)	(0.016)	(0.007)	(0.011)	(0.022)	(0.017)
Without IV	0.032***	0.028***	-0.032***	-0.027***	0.003	0.009**	-0.009	-0.007
	(0.007)	(0.006)	(0.006)	(0.006)	(0.003)	(0.004)	(0.009)	(0.006)
Observations	6371	6371	6371	6371	6371	6371	6371	6371

Note: Standard errors are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Appendix A: The Distribution of Age for Each Parity Group