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Does A Child Quantity-Quality Trade-Off Exist? Evidence from the One-Child Policy in China

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Abstract. Evidence on the existence of a trade-off between child quantity and child quality, as suggested by Gary S. Becker, is still inconclusive. This also holds true for empirical studies on China that exploit for identification the country's One-Child Policy (OCP) as an exogenous source of variation in the number of offspring. However, this body of literature suffers from a number of shortcomings, in particular measurement error in the key policy variable (a household's coverage by OCP) and in the outcome variable of interest (schooling choices, i.e. child quality). Using census data for China and a continuous OCP variable that can address these shortcomings, the results provide evidence for the existence of a sizeable quantity-quality trade-off within households with mothers who are Han and have agricultural Hukou.

Keywords: Quantity-Quality Trade-Off, One-Child Policy, China.
JEL Classification: J13, J18, I2.

1 Introduction

In recent decades, social scientists have shown great interest in the relationship between child quantity and child quality. Gary Becker (1960) developed a quantity-quality model with a non-linear income budget constraint. The marginal cost of child quality is increasing with respect to the child quantity, which explains the negative relationship between them (Becker, 1960; Becker and Lewis, 1973). Researchers also attempted to test the quantity-quality trade-off in empirical studies. Some of them found a negative relationship, but some found no effect of child quantity on quality, and some even a positive effect. Because the number of children and the investment in children are determined by parents in the household, both child quantity and quality are endogenous. The causality between them could be reversed. In order to solve this endogeneity problem, researchers use instrument variable for child quantity, such as twin birth, sibling size, birth control policy (Black, Devereux and Salvanes, 2005; Lee, 2008; Qian, 2009). It is also found that such negative relationship is more pronounced in developing countries (Li, Zhang and Zhu, 2007). In developed countries, people have relatively better welfare system. They may be provided with more education chance and better education system. Thus, the quantity-quality trade-off is less obvious in these countries.

After the founding of People's Republic of China in 1949, Chinese population has changed dramatically. The implementation of One-Child Policy (OCP) contributes to such a change. Meanwhile, more and more children have chance to have higher level education. One-Child policy has been implemented in most provinces since 1979. Parents are usually allowed to have only one child, except for some special cases. Following this policy, people have much fewer children than before.

One-Child Policy is determined by the central government and local governments. It makes the number of children in some households exogenous, which means that the child quantity is not the choice of parents any more. One-Child Policy is a good instrument variable for child quantity on quantity-quality trade-off issue. Qian (2009) and Liu (2013) use OCP to instrument child quantity and estimate the effect of quantity on quality. Qian (2009) measures child quantity by number of siblings and child quality by school enrollment. She finds that a second child increases school enrollment of the first child in rural China, which is not a trade-off[1]. Liu (2013) has a new way to measure child quality, height-for-age z-score by gender, and child quantity is measured by number of children. Liu (2013) uses self-reported OCP information, provided by survey data, and finds that the number of children has a significant negative effect on children's height and his finding is in support of quantity-quality trade-off.

A contribution of this study is the use of a new instrument variable for child quantity, a continuous OCP variable that can indicate the intensity of being covered by One-Child Policy in a household, to identify the effect of quantity on quality. The generating of this instrument variable takes the changes of Family Planning Regulations in 31 provinces and also the prime fertility age of women into consideration.

[1] Qian (2009) argued that she only observed the marginal effect of having a second child on the quality of the first one. It is not the standard quantity-quality trade-off issue.

The paper proceeds as follows. Section 2 provides background and section 3 introduces the One-Child Policy and different ways to construct the policy variable. Section 4 describes the data and identification strategy used in the empirical analysis. Section 5 presents the regression results and section 6 concludes.

2 Background

Previous studies try to find the causal effect of child quantity on quality by using data in different countries. Rosenzweig and Wolpin (1980), using twin births to identify the effect, focus on the data in India and they find that larger family size drives down the children's education attainment, which supports quantity-quality trade-off. Black et al. (2005) attempt to isolate this effect by using Norway data and find that one more child reduces the average educational attainment of children, but this effect becomes smaller when family background characteristics are controlled, and, however, it is close to zero when birth order is controlled. They also use 2SLS approach with twin births as an instrument variable and find that family size has only negligible effect on child quality. The shortcoming of using twins as instrument variable is that 2SLS approach is biased towards finding the trade-off (Black et al. 2005). Since the spacing between twins is 0 and parents are likely to shift more resources towards non-twin children, the quantity-quality trade-off may be biased (Rosenzweig and Zhang 2009; Li, Zhang and Zhu 2007). Moreover, it should be noticed that Norway is a developed country. Due to better education system and social welfare, the quantity-quality trade-off may not be obvious in Norway (Li, Zhang and Zhu 2007). Lee (2008) estimates quantity-quality trade-off by using data in Korea, using the parents' monetary investment in children's education as a measure of child quality, since monetary investment directly reflects the parental decisions. Due to son preference in Korean society, using the first child's gender as an instrument variable for child quantity, the result of 2SLS regression shows a trade-off between quantity and quality and this effect gets larger if the number of children in the household increases (Lee 2008).

Some studies also focus on China on this issue. Li, Zhang and Zhu (2007), using Chinese Census 1990, find that quantity-quality trade-off exists in China and this trade-off is more pronounced in rural area than in urban area. They restrict the sample to children aged 6-17 years old and their mother aged 35 or younger. It is possible that some mothers didn't complete fertility when the census was conducted, which cannot reflect the real preference of parents on the number of children. Qian (2009) only focuses on the quantity effect on the first child quality in rural China and finds no trade-off and uses exemption from One-Child Policy as an instrument variable, constructed by triple interaction of the gender, birth year and region of the first child. But using child's gender could be endogenous (Li, Zhang and Zhu 2007), which may make the instrument invalid. Liu (2013) focuses on data from 1993 CHNS[2] and uses exemptions from One-Child Policy and the amount of fines due to unsanctioned birth as instrument variables, and he finds that the number of children

[2] China Health and Nutrition Survey

has a significant negative effect on children's height.

The existing literature estimates quantity-quality trade-off in China and in other countries, and different results are found. How to deal with the identification problem is a big issue. One-Child Policy has been used to deal with this problem in the research on China. Therefore, a good measure of the policy is quite necessary. The exemptions from One-Child Policy will also be used in this paper. The next section will introduce One-Child Policy.

3 One-Child Policy (OCP)

3.1 History

In contemporary China, the implementation of family planning policy is a strategic decision made by the government, which is conducive to the development of the national economy and the improvement of people's living standards. Family planning has become a basic policy in the whole country.

Because of the burden of child-rearing, more and more people living in the urban areas began to demand for birth control. Households with low income but many children had problems with children's schooling and women's health. The reality of rapid population growth and people's demand for birth control attracted the attention of the government gradually. The document "*Instructions on the Population Control*" in 1955 pointed out that the Communist Party was in favor of family planning. Party committees in all provinces should publicize this policy among people (except minority people) properly so that people could have a correct attitude toward birth control (Yang 2003). This is China's early population control policy.

On March 5th 1978, National People's Congress adopted Article 53 of "*The Constitution of People's Republic of China*" that the country advocates and promotes family planning (Yang 2003). This is the first time that family planning is written in the fundamental law of the country. One-Child Policy was formally announced in 1979. At the very beginning, the number of children was not strictly restricted to 1 in all provinces. It was an advocation for most people. But couples with only one child were rewarded. This policy was unwaveringly advocated in the urban areas. Family planning in the rural areas focused on the elimination of multiple births and the planned arrangement of the second birth in accordance with policies, so that One-Child Policy could also be gradually implemented in rural areas later.

Since 1982, local governments have permitted a second child in some specific households (Qian 2009). On April 13th 1984, the 7th document names "*Report on the Family Planning Work*" was issued. Some specific regulations on family planning were adjusted and improved. According to the relevant provisions, a second birth was allowed with permission in rural areas. Multiple births or the second birth that was not allowed were strictly prohibited. Appropriate policies should be implemented among minority people. For example, people from nations with total population below 10 million were allowed to have a second child and certain of them were permitted to have a third one.

In 1990s, children from families under One-Child Policy entered marriage and fertility age. The policy that both spouses who are already subject to OCP are allowed to give a second birth if they have only one child, has been implemented in most provinces. In November 2013, the policy was adjusted again. If one spouse is the only child in his/her family and both spouses have only one child, a second birth is permitted. Such policy was first implemented in some provinces. It is conducive to maintaining a reasonable size of labour force, delaying the speed of population aging, balancing the sex ratio at birth and promoting a sustained economic development.

3.2 One-Child Policy Measurement in Previous Studies

In existing studies, One-Child Policy has been used to check the quantity-quality trade-off, the effect of family size on the first child's education, the imbalance in sex ratio at birth, and so on. There are different ways to define the policy variable. Bulte, Heerink and Zhang (2011) define a policy dummy variable with value equal to 1 if the child was born after 1979, the year when OCP started to be implemented, and 0 otherwise. Li, Yi and Zhang (2010) generate two dummy variables for ethnic (H) and birth cohort (T), separately, and H equals 1 for a Han child and T equals 1 for a child born after 1979, so the estimated diff-in-diff reflects the effect of One-Child Policy on the outcome variable. As mentioned in section 2, Qian (2009) generates a triple interaction of gender, birth year and region of the first child to denote the policy and Liu (2013) also uses the relaxation of the policy that is obtained from a survey data.

One-Child Policy is a very important factor on some research questions. How to accurately measure the policy becomes an issue. 31 provinces have different family planning regulations and not all households should follow the One-Child Policy. If some certain conditions are met, parents could have a second child: for example, (1) the first child has non-genetic diseases; (2) both parents are minority; (3) both parents are agricultural and the first child is female; (4) both parents are already subject to OCP. Such articles are different in the family planning regulations in different provinces in different time.

In 1979, some provinces and municipalities, such as Beijing, Tianjin and Shanghai, implemented One-Child Policy strictly. Other provinces introduced it later. Hence, the different time of implementing this policy should be considered. Therefore, the measurement by Bulte, Heerink and Zhang (2011) seems to be very rough. Moreover, it should be noticed that the family planning policies might change over time, which may result in the different eligibility status of couples. Hainan province was set up in 1988 and people from this province belonged to Guangdong province before. Hence, they should follow the family planning policies in Guangdong before 1988. Chongqing became municipality again in 1997 (it used to belong to Sichuan province in 1954-1996), so before this year, people from Chongqing should follow policies in Sichuan. This time-variant and area-variant factors also need to be considered. Liu (2013) used CHNS Data that can tell whether a household was covered by OCP or not in a certain year. It cannot reflect the changes of OCP. Meanwhile, this survey provides data only in certain provinces (maybe selective) and this might be a limitation.

In many provinces, couples from rural areas are allowed to have a second child if the first one is a girl. This kind of exemption has been used in existing studies. Directly using the gender of the first child will bring an endogeneity problem, as mentioned before. Since people can know the gender of child by an ultrasound scan, they can then decide whether they keep this child or not. It is more problematic in countries with son preference. The possible solution to this problem will be discussed in the next section. Some people think One-Child Policy is only implemented among Han. Actually, in some provinces, minorities are not allowed to have a second birth neither, or only certain of them are allowed to. Hence, the measurement by Li, Yi and Zhang (2010) might not be accurate.

3.3 New Measurement of One-Child Policy

Table 1 shows the exemptions from One-Child Policy till 2000, made according to the Family Planning Regulations in province level. 31 provinces in the mainland are mentioned here, since Hong Kong, Taiwan and Macau don't have such a policy. The first column is province and the second column is the time when OCP was introduced. According to the specific circumstances, each province can make its own family planning policy. Four types of households exempt from OCP are listed here: both spouses are minority, one spouse is minority, both spouses have agricultural Hukou, and both spouses have agricultural Hukou and the first child is a girl. In the forth type, the gender of the first child is not directly used because of the endogeneity problem. Households living in a province that has such an exemption have 50% possibility to have a second child. Therefore, agricultural households in such provinces are exempt. Whether the first child is a boy or girl is not considered. In some provinces, besides these gross classifications, some more detailed restrictions are needed and they are marked in the table and the explanations for them are listed under the table. A large amount of variations across region and time can be seen. Of course, there are also other exemptions. For example, the household is exempt from OCP if parents are already subject to OCP, but such parents must be very young and they are not important for this study. Another example that the child has non-genetic diseases, makes only very small proportion and could be ignored.

Compared to the study by Bulte, Heerink and Zhang (2011) and the study by Li, Yi and Zhang (2010), more exemptions are included. Liu (2013) and Qian (2009) only considered OCP in some provinces, but this table shows the policies in all provinces in the mainland.

Households that violate the One-Child Policy have to pay fine. People may argue that rich families don't care this amount of money and they pay fine if they want to have more children. Therefore, the number of children may be positive correlated with the income of family. Before the main analysis, a test of the income effect on child quantity is done with CHNS data wave 2000. Only minor negative effect[3] is found.

[3] This effect is also negative and very close to 0 in urban and rural area, respectively.

Table 1: Relaxation of One-Child Policy

Province	**OCP from**	**both spouses minority**	**one spouse minority**	**both spouses agricultural**	**both spouses agricultural with a girl**
Beijing	1979				
Tianjin	1979				
Hebei	1982	1984–1994 1995[a] –			1989–
Shanxi	1982	1982–			1990–
Inner Mongolia	1982		1982–1995 1996[a] –		1988–
Liaoning	1980	1982-1984 1985[b] –		1985[c] –	1985–
Jilin	1984	1994[a] –	1985–1993		
Heilongjiang	1979	1981–1993 1994[a] –			1990–
Shanghai	1979				
Jiangsu	1979				
Zhejiang	1982	1990[d] –	1982–1989		
Anhui	1981	1981–			1988–
Fujian	1984	1984–1991[d] 1992[e] –			
Jiangxi	1981	1990–			1985–
Shandong	1980	1984–			1986–
Henan	1981	1990[f] –			1990–
Hubei	1984				1988–
Hunan	1982	1990[g] –		1990[h] –	1987–
Guangdong	1980	1980–		1986–	
Guangxi	1982	1989[a] –	1985-1988[a]		1989–
Hainan	1980	1980–1989	1990[d] –	1986–	
Chongqing	1980				
Sichuan	1980				
Guizhou	1988	1988–1998		1988[h] –	1998–
Yunnan	1979			1979–	
Tibet					
Shaanxi	1981	1981–			1986–
Gansu	1982	1982–1989 1990[f] –			1990–
Qinghai	1982	1986[f] –	1986[i] –		
Ningxia	1982		1982–	1982–	
Xinjiang	1992		1992–	1992–	

[a] only minorities with total population under 10 million (Manchu and Zhuang have population over 10 million.)
[b] Female spouse must be agricultural.
[c] One spouse must be minority, whose total population is under 10 million.
[d] except the minority Zhuang
[e] Both spouses must be agricultural and should not be minority Zhuang.
[f] Both spouses must be agricultural.
[g] One spouse must be agricultural.
[h] One spouse must be minority.
[i] Both spouses must be non-agricultural.

4 Data and Empirical Strategy

4.1 Data and Descriptive Statistics

The data used in this paper comes from a 0.95‰ sample of the 5th Chinese Census in 2000. Several features of the 2000 census data are advantageous for an analysis of the quantity-quality trade-off in China. First, the census data contains information on individual's schooling level, from which we can get the information on the post-compulsory education choices of children and it is essential for the construction of the outcome variable child quality, the probability to have obtained or be enrolled in post-compulsory schooling. Second, the census data contains information on households from all 31 provinces in China, rather than only a (possibly selective) subset of regions. This allows us to consider the whole China in the analysis. It also permits us to exploit in the analysis the great heterogeneity in actual OCP coverage and changes cross time, among provinces, cohorts, nationalities and household types. Third, this data provides the real number of children a woman has. Even though the old children had moved out when the census was conducted, they were also counted. Forth, the nationality of each person (not only Han or non-Han) is provided, which is conducive to set up the policy variable.

From the information this data provides, mother, father and offspring in a household can be identified, the OCP variable can be set up and the quantity and quality of children can be measured. Given focus on voluntary, i.e. post-compulsory education choices, the estimation sample is restricted to households, in which there is at least one child aged 15 or older in the survey year 2000 and their mothers were aged 35-50. Compulsory schooling in China includes primary school and junior secondary school education, which together amount to nine years of schooling. Children attend primary school at age six. Hence, children who are at least 15 are old enough to obtain senior secondary school education or other post-compulsory education, which is the choice of the family. The whole restricted sample consists of 92,078 children (born between 1965-1985) in 65,689 households.

Child quantity, child quality and OCP are three key variables and they will be explained in turn. Child quantity is measured by the number of siblings a child has, which equals the number of children a mother has minus one. Child quality is measured by the enrollment in post-compulsory education. It is 1 if the child had post-compulsory education in 2000 and it is 0 otherwise. OCP coverage is a function of mother's region, age, nationality, Hukou type and introduction of OCP and exemptions cross regions and time. The prime fertility age of women is 21-35 in China. Women are allowed to get married when they are 20 years old. Therefore, the lower bound is set to 21, one year after the earliest marriage age. I look at children whose mothers were born in 1950 or 1951[4], and 86.4% of them were born when their mothers were between 21 and 35 years old and 95.05% were born when their mothers aged between 21-40[5]. Then, only households, in which the number

[4]Mothers aged 49 or 50 years old in 2000 had completed fertility according to the definition of fertility age of women.

[5]There are 15266 children in 9531 households. Children that were born when their mothers were younger than 15 are dropped in order to exclude adopted children and stepchildren.

of children living in the household is equal to the number of children the mother has born, are kept. The oldest and the youngest children can be easily figured out. Among these households[6], 97.94% have age difference between the oldest and the youngest children smaller or equal to 15 and 99.63% smaller or equal to 20, which means most mothers finished their fertility within 15 years or 20 years. Hence, the higher bound of prime fertility age is set to 35 in the main analysis. In the robustness check, the higher bound will be released to 40. A household is exempt from OCP if the mother is minority and there are exemptions for minorities in her province and in her prime fertility age, or if the mother has agricultural Hukou and there are exemptions for agricultural people in her province and in her prime fertility age. It could be endogenous if the nationality and Hukou type of both spouses are observed. For example, a minority woman would like to marry a man who is also minority if she would like to have 2 children. Hence, mother is the unit considered when OCP variable is constructed. OCP variable is equal to the number of years covered by OCP during women's prime fertility age over the total number of women's prime fertility years and it is a consecutive number between 0 and 1.

The sample is firstly restricted to children at least 15 years old, whose mother are at least 35 years old. 92,078 children from 65,689 households are in this sample. Table 2 shows the percentage of households that are covered by OCP for different amount of years.

TABLE 2: Sources of OCP Coverage at Household Level (in %)

(1) **years**	(2) **mother minority**	(3) **mother agricultural**	(4) **complete**
0	3.19	5.32	6.48
1	0.61	1.03	1.38
2	1.49	2.06	2.81
3	1.76	2.49	3.50
4	2.44	8.54	8.38
5	3.47	11.67	10.97
6	5.42	14.97	14.41
7	6.49	12.29	11.26
8	7.52	6.71	6.57
9	7.61	7.46	7.36
10	7.70	4.00	3.92
11	8.02	4.47	4.35
12	7.43	3.42	3.37
13	6.72	3.13	3.04
14	6.19	2.94	2.87
15	23.95	9.52	9.32
	100.00	100.00	100.00

Previous literature only uses nationality information or agricultural information to construct OCP. Hence, these two methods are used as alternative measurements, which can also show the OCP coverage sources by comparing them to the complete OCP variable. The unit here is household in the restricted sample (65,689 households). The first column shows the amount of years covered by OCP in women's prime fertility age. The second column is a construction of OCP by only using mother's nationality information and exemptions for minorities, while the third column is the other

[6]2134 households are observed.

alternative construction of OCP by using mother's Hukou type and exemptions for agricultural people. The last column is the combination of these two alternatives, which is also the complete OCP variable used in the main analysis. Since minorities make 10% of the whole population, only using nationality information to construct OCP variable may lead to misclassification. Agricultural people make 80% of the whole population, so the exemptions for agricultural people cannot be ignored. Column 3 and 4 are very similar to each other. Therefore, a correlation among all three OCP measurements is done (see Table 3). It can be seen that mother agricultural alternative is highly correlated with the complete OCP variable, which can give us a hint that if nationality information cannot be obtained, only using the Hukou type and the exemptions for agricultural people could be a good measurement for OCP. Exemptions are mainly for agricultural people and it is a very important aspect that cannot be ignored.

TABLE 3: Correlations between different OCP measurements at household level

	mother minority	**mother agricultural**	**complete**
mother minority	1.0000		
mother agricultural	0.3851	1.0000	
complete	0.4741	0.9610	1.0000

For the main analysis, the estimation sample is restricted further to households where mothers are Han and agricultural, which is still the majority of the whole population. In this sample there are 67,953 children from 46,814 households. Table 4 provides summary statistics for the restricted sample.

TABLE 4: Summary Statistics for Restricted Sample

	Observation	Mean	Std. Dev.	Min	Max
number of siblings	67953	1.6494	0.9945	0	9
enrollment of post-compulsory education	67953	0.1524	0.3594	0	1
OCP	67953	0.4557	0.2246	0	1
mother education (enroll. of post-comp. edu.)	67953	0.0374	0.1897	0	1
father education (enroll. of post-comp. edu.)	67953	0.1181	0.3227	0	1

4.2 Empirical Strategy

To treat an independent variable as endogenous, 2SLS approach is firstly used. As the dependent variable (child quality) is dichotomous, IV probit approach is also applied to identify the effect of child quantity on child quality[7]. Child quantity is instrumented by One-Child Policy in the first stage.

$$Q_i = \delta_0 + \delta_1 N_i + \delta_2 X_i + \varepsilon_{i2} \qquad \text{(2nd stage)}$$

$$N_i = \theta_0 + \theta_1 \mathrm{OCP}_i + \theta_2 X_i + \varepsilon_{i1} \qquad \text{(1st stage)}$$

[7]The results of IV probit estimates will be shown in the appendix.

where N_i is the number of siblings of child i, Q_i is the quality (post-compulsory education enrollment) of child i, OCP_i, the instrument variable, carries the policy coverage information in the household with child i, and X_i is a vector of child i's and his/her parents' characteristics. ε_{i1} and ε_{i2} are error terms.

In the first stage, the longer a household is covered by OCP, the fewer children the parents may have. θ_1 is predicted to be negative. If child quantity-quality trade-off exists, δ_1 in the second stage is also predicted to be negative. The vector X_i includes child age, mother age, province dummy and parents' education (post-compulsory education enrollment). Parents with higher education are predicted to have fewer children because they may delay births because of relative longer schooling time and their children are more likely to have higher quality.

5 Results

5.1 Main Results

The main analysis focuses on households with agricultural and Han mothers, so the OCP variation in this estimation sample comes from the OCP introducing year and the various exemptions for agricultural people. The starting point of the regression analysis is a 2SLS estimate of the effect of child quantity on quality, controlling for mother age and province dummy (see column 1 in Table 5).

Table 5: 2SLS Estimates of the Effect of Number of Siblings on Child Quality

	1	**2**	**3**
2nd stage			
sibling number	-0.26***	-0.22***	-0.17***
	(0.04)	(0.04)	(0.04)
mother education		0.09***	0.10***
		(0.01)	(0.01)
father education		0.12***	0.12***
		(0.00)	(0.00)
1st stage			
OCP	-0.29***	-0.28***	-0.32***
	(0.03)	(0.03)	(0.03)
mother education		-0.26***	-0.28***
		(0.02)	(0.02)
father education		-0.01	-0.02**
		(0.01)	(0.03)
mother age	Yes	Yes	Yes
province dummy	Yes	Yes	Yes
child age	No	No	Yes
F-statistics	99.58	91.83	122.84
observation	67953	67953	67953

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50

Province dummy controls for time-invariant differences in child quantity and quality within provinces. Mother age controls for the percentage of years covered by OCP for mothers in different cohorts, since mothers born in earlier cohorts are less likely to be covered by OCP and the value of OCP variable could be relative smaller. The result shows that the longer a household is covered by OCP, the fewer children they have, and one more child in the household will significantly drive down the possibility to have post-compulsory education.

Adding parents' education dummies (see column 2 in Table 5), the OCP effect on child quantity doesn't change much, but the trade-off effect decreases a little bit. As predicted, parents' education drives down the number of siblings and pulls the child quality upwards. In column 3, children age is included to control for differences in child quantity and quality over children's various birth cohorts. F-statistics in all three 2SLS regressions are very large, which shows that the instrument is not weak. A significant trade-off between child quantity and quality can be observed in households with agricultural and Han mothers. The results of the IV probit estimates of the same specification as above are shown in Table A-1 in Appendix.

The policy is made at province level. Households from the same province may be correlated to each other. So I run regressions again and cluster at the province level. This will affect the standard errors but not the estimated coefficients. Part A of Table A-2 in appendix shows the result. The standard errors increase a little, but the significance is not affected.

Although the policy is made at province level, the characteristics of mother is also used to generate OCP. Therefore, I generate a group variable by using province, mother age, mother's nationality and mother's Hukou type. So all households in the same group have the same structure, i.e. living in the same province, mother at the same age, mother having the same nationality and the same Hukou type. Then I run regressions again, clustering at group level, since children from households with the same structure could be correlated to each other. The results still show a significant negative effect of quantity on quality (see Table A-2 part B).

In the previous analysis, more than 1 child from the same household can be observed. So now, I run regressions clustering at household level because children from the same household could be correlated to each other and they all have the same OCP background. The results still support the existence of the quantity-quality trade-off (see Table A-2 part C).

5.2 Robustness Checks

In the robustness check, the quantity-quality trade-off will be estimated in different subsamples. Besides, the higher bound of mother's prime fertility age will be increased to 40.

5.2.1 Excluding Never/Fully OCP-Constrained Mothers

Households that are never or fully covered by One-Child Policy are different from others? In this section I will run regressions by using different subsamples. Firstly, households that are never covered by OCP are excluded, and secondly households that are fully covered by OCP are excluded, and in the end both of the above cases are excluded. Table 6 shows the results. It seems that there is no big difference compared to the main results and the quantity-quality trade-off exists in all these subsamples. IV probit estimate results are shown in Table A-3 in Appendix and the same conclusion can be drawn.

Table 6: 2SLS Estimates of the Effect of Number of Siblings on Child Quality among Households Excluding Never/Fully OCP-Constrained Mothers

	OCP∈(0,1]	**OCP∈[0,1)**	**OCP∈(0,1)**
2nd stage			
sibling number	-0.18***	-0.19***	-0.22***
	(0.04)	(0.04)	(0.04)
1st stage			
OCP	-0.34***	-0.41***	-0.43***
	(0.04)	(0.05)	(0.05)
mother age	Yes	Yes	Yes
province dummy	Yes	Yes	Yes
mother education	Yes	Yes	Yes
father education	Yes	Yes	Yes
child age	Yes	Yes	Yes
F-statistics	72.36	66.19	67.86
observation	65219	64263	61529

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50
Cluster at household level.

5.2.2 The Oldest Child

In the previous analysis, all children aged 15 or older in one household are observed, but they may be correlated to each other due to the same background. In this section, only one child in a household will be observed, the oldest one. It should be noticed that the oldest child may not be the first-born child and it is the oldest child living in the household when the census was conducted. The first-born child might have moved out. The older children usually play an important role in the family. They may need to take care of younger siblings and may not have too much time in schooling or studying at home, especially in rural areas. But on the other hand, parents may educate them more strictly so that they can become a good example to younger siblings. Also, siblings could share books or other stationery and they could even share clothes if they have the same gender. The economies of scale may lead to a positive effect of child quantity on child quality (Qian 2009).

Now, the effect of the number of siblings on the oldest child's quality will be estimated. If there are twins or triplets among these oldest children, only one of them will be chosen[8]. All other restrictions are the same as in section 5.1. Since we don't need to consider correlation within

[8]The child that has the smallest household member number is chosen.

household, I just cluster at group level. Table 7 shows the results and a significant quantity-quality trade-off is found. IV probit regression results are shown in Table A-4 in Appendix.

Table 7: 2SLS Estimates of the Effect of Number of Siblings on Child Quality by Observing the Oldest Child

	1	**2**	**3**
2nd stage			
sibling number	-0.32***	-0.28***	-0.23***
	(0.08)	(0.08)	(0.08)
1st stage			
OCP	-0.27***	-0.26***	-0.23***
	(0.03)	(0.03)	(0.03)
mother age	Yes	Yes	Yes
province dummy	Yes	Yes	Yes
mother education	No	Yes	Yes
father education	No	Yes	Yes
child age	No	No	Yes
F-statistics	26.15	23.52	21.17
observation	46814	46814	16814

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50
Cluster at group level.

5.2.3 Prime Fertility Age 21-40 & Mother Aged 40^+

Increasing the higher bound of mother's prime fertility age to 40, the total fertility years of women goes up to 20. OCP variable is still from 0 to 1, but a household could get different OCP value according to different definition of prime fertility age. Now, fewer mothers had finished fertility in 2000 compared to the previous definition. Only children of these mothers are considered[9].

Table 8 shows the estimation results of the model using the new sample. A significant trade-off between quantity and quality can be observed and this effect is similar to the ones using the previous definition of prime fertility age of women. The result is robust. IV probit estimation results are shown in Table A-5 in Appendix.

[9] Children at least 15 years old from households, in which mothers were at least 40 years old in 2000.

Table 8: 2SLS Estimates of the Effect of Number of Siblings on Child Quality with Prime Fertility Age 21-40

	1	**2**	**3**
2nd stage			
sibling number	-0.20***	-0.20***	-0.15***
	(0.05)	(0.05)	(0.04)
1st stage			
OCP	-0.63***	-0.62***	-0.73***
	(0.09)	(0.09)	(0.09)
mother age	Yes	Yes	Yes
province dummy	Yes	Yes	Yes
mother education	No	Yes	Yes
father education	No	Yes	Yes
child age	No	No	Yes
F-statistics	52.41	51.31	69.86
observation	55304	55304	55304

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 40-45, 46-50
Cluster at household level.

5.2.4 Alternative Quantity Measure - Sibling Dummy Variable

I generate a dummy variable for siblings to measure child quantity. It equals 1 if the child has siblings and 0 otherwise. Since the endogenous regressor is now a binary variable, I will do 2SLS and biprobit instead of IV probit to estimate the effect of child quantity on child quality.

Table 9 shows the results. The sample used in the first column is the same as main analysis. The new quantity measure indicates the probability to have an older or younger siblings. The longer a household is covered by OCP, the probability to have siblings decreases in the first stage. In the second stage, a quantity-quality trade-off is found in the househuolds where mothers are agricultural and Han. In the second column, the sample is changed to households, in which all the children were still at home when the census was conducted. Therefore, the oldest child in such household is also the first child and the new quantity measure indicates the probability to have younger siblings. A quantity-quality trade-off is still found.

The findings by using sibling dummy variable as a measure of child quantity is similar to findings by using the number of siblings. Robustness checks are also done for the use of sibling dummy. Table A-7, A-8 and A-9 in appendix show the estimation results among households with different OCP constrained mothers, by observing the oldest child and by using the definition of prime fertility age 21-40, respectively, and they support the existence of child quantity-quality trade-off.

Table 9: 2SLS Estimates of the Effect of Having Siblings on Child Quality

	1	2 (first child)
2nd stage		
sibling dummy	-0.47***	-0.69**
	(0.10)	(0.29)
1st stage		
OCP	-0.11***	-0.05***
	(0.01)	(0.01)
mother age	Yes	Yes
province dummy	Yes	Yes
mother education	Yes	Yes
father education	Yes	Yes
child age	Yes	Yes
F-statistics	213.06	22.85
observation	67953	45708

Notes: Dependent variable is siblings dummy in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50

5.3 Estimations within Other Types of Households

In the previous analysis, I only focus on the households with agricultural and Han mothers. In this section, I try to estimate the effect of child quantity on child quality with prime fertility age 21-35 within the other three groups, i.e. households with non-agricultural and Han mothers, households with agricultural and minority mothers and households with non-agricultural and minority mothers. Child quantity is measured by the number of siblings a child has. Table 10 shows the estimation results.

Table 10: 2SLS Estimates of the Effect of Number of Siblings on Child Quality within Other Types of Households

	non-agricultural & Han	agricultural & minority	non-agricultural & minority
2nd stage			
sibling number	0.68***	0.64	2.92
	(0.19)	(1.55)	(7.84)
1st stage			
OCP	-0.41***	0.15	-0.10
	(0.08)	(0.34)	(0.27)
mother age	Yes	Yes	Yes
province dummy	Yes	Yes	Yes
mother education	Yes	Yes	Yes
father education	Yes	Yes	Yes
child age	Yes	Yes	Yes
F-statistics	25.51	0.19	0.14
observation	16398	6649	2020

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50
Cluster at household level.

In the 1st category for mothers being non-agricultural and Han, the variation in OCP variable comes from the different policy introducing time. They have no chance to have a second child after

OCP was introduced. OCP variable has a significant negative effect on the number of siblings in the first stage. But it is very surprising to see a positive effect in the 2nd stage. The story might be that non-agricultural people, who are mainly living in the urban areas, are relative rich and child quality investment might not be a burden for them if a second child is allowed. It is similar to the argument in the literature that quantity-quality trade-off is more pronounced in less developed areas. The 2nd and the 3rd category show the results in households where mothers are minority. The instrument is very weak in the 1st stage, so we can ignore the positive effect in the 2nd stage. Minority people may behave very differently. In the sample for agricultural and minority mothers about 50% of the children are from households that are fully exempt from OCP and in the sample for non-agricultural and minority mothers about 40% are fully exempt. The variation in OCP variable is relative small in these two samples. IV probit estimates results are shown in Table A-10 in appendix. Although a positive effect is found in the second stage, the instrument variable in the first stage is not significant, neither.

6 Conclusion

This paper estimates the effect of child quantity on child quality. Child quantity is measured by the number of siblings in the household and the child quality is indicated by the fact whether the child has post-compulsory education. In China, the implementation of One-Child Policy makes the reproductive decision exogenous, which can solve the endogeneity problem of child quantity. Accurately constructing the policy variable is quite important. This paper is the first one to consider the mother's fertility age when the policy variable is generated. Mother's nationality, Han or minority, and her Hukou type, agricultural or non-agricultural, are two aspects used to construct OCP variable. This paper is also the first one to generate a continuous OCP variable, instead of a dummy variable. Due to the change of status of OCP coverage, a continuous variable can better describe the intensity of the policy effect. The OCP variable presents the Family Planning Regulations in different provinces over time. The specific situations in each province and the modification of the regulations are taken into consideration, which makes the generating of this variable more accurate. Meanwhile, it brings a large amount of variations in OCP variable. The measure of OCP coverage can be fruitfully employed also in other applications (studying e.g. tilted sex ratios at birth, marriage behavior, or criminal activity in China). Data availability may be more limited in other applications. In additional explorations, which make use of only a subset of the individual background information and family planning regulations at province level, I gauge the relative importance of different factors for obtaining a measure of OCP coverage that is highly correlated with the measure of OCP coverage which makes full use of all relevant information.

Controlling the cohort and region effects and the parents' characteristics, a significant negative effect of child quantity on quality is found in households with agricultural and Han mothers and the results don't change much if we cluster at different levels. In the robustness check, after excluding households that are fully and/or never covered by OCP, we can still find a significant quantity-quality trade-off, which means those households don't behave differently. This negative effect can also be obtained if only the oldest child in the household is observed. After the upper bound of women's prime fertility age is released to 40, the result is still robust. Estimations for other types of households show that only a positive effect of quantity on quality is found in the sample with non-agricultural and Han mothers. Compared to the main analysis, the results suggest that quantity-quality trade-off is more pronounced in agricultural households.

The findings in this paper suggest that a proper and successful population policy is very important to the increase of people's quality. One-Child Policy in China successfully decreased the child quantity in the household and slowed down the population growth. People's education level also increased and the economic development from the perspective of demographic dividend was promoted.

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Appendix

Table A-1: IV Probit Estimates of the Effect of Number of Siblings on Child Quality

	1		**2**		**3**	
	coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect
2nd stage						
sibling number	-0.89***	-0.28***	-0.86***	-0.27***	-0.74***	-0.24***
	(0.07)	(0.02)	(0.08)	(0.02)	(0.09)	(0.02)
mother education			0.16**	0.05**	0.22***	0.08***
			(0.06)	(0.02)	(0.06)	(0.03)
father education			0.35***	0.12***	0.39***	0.14***
			(0.04)	(0.02)	(0.03)	(0.02)
1st stage						
OCP	-0.29***		-0.28***		-0.32***	
	(0.03)		(0.03)		(0.03)	
mother education			-0.26***		-0.28***	
			(0.02)		(0.02)	
father education			-0.01		-0.02*	
			(0.01)		(0.01)	
mother age	Yes		Yes		Yes	
province dummy	Yes		Yes		Yes	
child age	No		No		Yes	
observation	67951		67951		67951	

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50

Table A-2: 2SLS & IV Probit Estimates of the Effect of Number of Siblings on Child Quality Clustering at Province, Group and Household Level

A: province level

	2SLS			IV Probit					
	1	**2**	**3**	**4**		**5**		**6**	
				coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect
2nd stage									
sibling number	-0.26**	-0.22**	-0.17**	-0.89***	-0.28***	-0.86***	-0.27***	-0.74***	-0.24***
	(0.11)	(0.11)	(0.08)	(0.16)	(0.03)	(0.19)	(0.04)	(0.23)	(0.05)
1st stage									
OCP	-0.29***	-0.28***	-0.32***	-0.29***		-0.28***		-0.32***	
	(0.06)	(0.06)	(0.06)	(0.06)		(0.06)		(0.06)	
mother age	Yes	Yes	Yes	Yes		Yes		Yes	
province dummy	Yes	Yes	Yes	Yes		Yes		Yes	
mother education	No	Yes	Yes	No		Yes		Yes	
father education	No	Yes	Yes	No		Yes		Yes	
child age	No	No	Yes	No		No		Yes	
F-statistics	22.53	20.33	25.09						
observation	67953	67953	67953	67951		67951		67951	

B: group level

	2SLS			IV Probit					
	1	**2**	**3**	**4**		**5**		**6**	
				coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect
2nd stage									
sibling number	-0.26***	-0.22***	-0.17***	-0.89***	-0.28***	-0.86***	-0.27***	-0.74***	-0.24***
	(0.07)	(0.06)	(0.05)	(0.10)	(0.02)	(0.12)	(0.03)	(0.14)	(0.03)
1st stage									
OCP	-0.29***	-0.28***	-0.32***	-0.29***		-0.28***		-0.32***	
	(0.04)	(0.04)	(0.04)	(0.06)		(0.06)		(0.06)	
mother age	Yes	Yes	Yes	Yes		Yes		Yes	
province dummy	Yes	Yes	Yes	Yes		Yes		Yes	
mother education	No	Yes	Yes	No		Yes		Yes	
father education	No	Yes	Yes	No		Yes		Yes	
child age	No	No	Yes	No		No		Yes	
F-statistics	26.96	24.60	24.60						
observation	67953	67953	67953	67951		67951		67951	

C: household level

	2SLS			IV Probit					
	1	**2**	**3**	**4**		**5**		**6**	
				coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect
2nd stage									
sibling number	-0.26***	-0.22***	-0.17***	-0.89***	-0.28***	-0.86***	-0.27***	-0.74***	-0.24***
	(0.05)	(0.05)	(0.04)	(0.08)	(0.02)	(0.09)	(0.02)	(0.10)	(0.03)
1st stage									
OCP	-0.29***	-0.28***	-0.32***	-0.29***		-0.28***		-0.32***	
	(0.04)	(0.04)	(0.04)	(0.04)		(0.04)		(0.04)	
mother age	Yes	Yes	Yes	Yes		Yes		Yes	
province dummy	Yes	Yes	Yes	Yes		Yes		Yes	
mother education	No	Yes	Yes	No		Yes		Yes	
father education	No	Yes	Yes	No		Yes		Yes	
child age	No	No	Yes	No		No		Yes	
F-statistics	54.72	50.37	67.55						
observation	67953	67953	67953	67951		67951		67951	

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50

Table A-3: IV Probit Estimates of the Effect of Number of Siblings on Child Quality among Households Excluding Never/Fully OCP-Constrained Mothers

	OCP∈(0,1]		**OCP∈[0,1)**		**OCP∈(0,1)**	
	coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect
2nd stage						
sibling number	-0.76***	-0.25***	-0.77***	-0.24***	-0.81***	-0.25***
	(0.10)	(0.02)	(0.10)	(0.02)	(0.09)	(0.02)
1st stage						
OCP	-0.34***		-0.41***		-0.43***	
	(0.04)		(0.05)		(0.05)	
mother age	Yes		Yes		Yes	
province dummy	Yes		Yes		Yes	
mother education	Yes		Yes		Yes	
father education	Yes		Yes		Yes	
child age	Yes		Yes		Yes	
observation	65219		64261		61529	

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50
Cluster at household level.

Table A-4: IV Probit Estimates of the Effect of Number of Siblings on Child Quality by Observing the Oldest Child

	1		**2**		**3**	
	coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect
2nd stage						
sibling number	-0.97***	-0.31***	-0.94***	-0.30***	-0.88***	-0.29***
	(0.09)	(0.02)	(0.11)	(0.03)	(0.15)	(0.04)
1st stage						
OCP	-0.27***		-0.26***		-0.23***	
	(0.05)		(0.05)		(0.05)	
mother age	Yes		Yes		Yes	
province dummy	Yes		Yes		Yes	
mother education	No		Yes		Yes	
father education	No		Yes		Yes	
child age	No		No		Yes	
observation	46812		46812		46812	

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50
Cluster at group level.

Table A-5: IV Probit Estimates of the Effect of Number of Siblings on Child Quality with Prime Fertility Age 21-40

	1		**2**		**3**	
	coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect
2nd stage						
sibling number	-0.65***	-0.24***	-0.65***	-0.23***	-0.53***	-0.20***
	(0.12)	(0.04)	(0.13)	(0.04)	(0.13)	(0.04)
1st stage						
OCP	-0.63***		-0.62***		-0.73***	
	(0.09)		(0.09)		(0.09)	
mother age	Yes		Yes		Yes	
province dummy	Yes		Yes		Yes	
mother education	No		Yes		Yes	
father education	No		Yes		Yes	
child age	No		No		Yes	
observation	55303		55303		55303	

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 40-45, 46-50
Cluster at household level.

Table A-6: Biprobit Estimates of the Effect of Having Siblings on Child Quality

	agricultural & Han		**non-agricultural & Han**		**agricultural & minority**		**non-agricultural & minority**	
	coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect
2nd stage								
sibling dummy	-0.62***	-0.19***	-0.73**	-0.03***	0.77	0.15	1.28***	0.30***
	(0.12)	(0.04)	(0.36)	(0.01)	(0.50)	(0.13)	(0.06)	(0.08)
1st stage								
OCP	-0.37***		-0.69***		-0.47		-0.41	
	(0.06)		(0.18)		(0.62)		(0.33)	
mother age	Yes		Yes		Yes		Yes	
province dummy	Yes		Yes		Yes		Yes	
mother education	Yes		Yes		Yes		Yes	
father education	Yes		Yes		Yes		Yes	
child age	Yes		Yes		Yes		Yes	
observation	67951		16398		6604		1010	

Notes: Dependent variable is siblings dummy in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50

Table A-7: 2SLS & Biprobit Estimates of the Effect of Having Siblings on Child Quality among Households Excluding Never/Fully OCP-Constrained Mothers

	2SLS			Biprobit					
	OCP∈(0,1]	**OCP∈[0,1)**	**OCP∈(0,1)**	**OCP∈(0,1]**		**OCP∈[0,1)**		**OCP∈(0,1)**	
				coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect
2nd stage									
sibling dummy	-0.50***	-2.15***	-2.16***	-0.64***	-0.20***	-0.65***	-0.20***	-0.70***	-0.21***
	(0.10)	(0.62)	(0.56)	(0.12)	(0.04)	(0.15)	(0.04)	(0.15)	(0.04)
1st stage									
OCP	-0.12***	-0.04***	-0.04***	-0.39***		-0.19**		-0.21**	
	(0.01)	(0.01)	(0.01)	(0.06)		(0.08)		(0.08)	
mother age	Yes	Yes	Yes	Yes		Yes		Yes	
province dummy	Yes	Yes	Yes	Yes		Yes		Yes	
mother education	Yes	Yes	Yes	Yes		Yes		Yes	
father education	Yes	Yes	Yes	Yes		Yes		Yes	
child age	Yes	Yes	Yes	Yes		Yes		Yes	
F-statistics	220.08	17.33	21.05						
observation	65219	64263	61529	65219		64261		61529	

Notes: Dependent variable is siblings dummy in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50

Table A-8: 2SLS & Biprobit Estimates of the Effect of Having Siblings on Child Quality by Observing the Oldest Child

	2SLS	**Biprobit**	
		coefficient	marg. effect
2nd stage			
sibling dummy	-0.46***	-0.88***	-0.29***
	(0.12)	(0.15)	(0.04)
1st stage			
OCP	-0.12***	-0.23***	
	(0.01)	(0.05)	
mother age	Yes	Yes	
province dummy	Yes	Yes	
mother education	Yes	Yes	
father education	Yes	Yes	
child age	Yes	Yes	
F-statistics	131.69		
observation	46814	46812	

Notes: Dependent variable is siblings dummy in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50

Table A-9: 2SLS & Biprobit Estimates of the Effect of Having Siblings on Child Quality with Prime Fertility Age 21-40

	2SLS	**Biprobit**	
		coefficient	marg. effect
2nd stage			
sibling dummy	-0.42***	-0.72***	-0.24***
	(0.09)	(0.14)	(0.04)
1st stage			
OCP	-0.27***	-1.10***	
	(0.02)	(0.13)	
mother age	Yes	Yes	
province dummy	Yes	Yes	
mother education	Yes	Yes	
father education	Yes	Yes	
child age	Yes	Yes	
F-statistics	282.90		
observation	55304	55303	

Notes: Dependent variable is siblings dummy in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 40-45, 46-50

Table A-10: IV Probit Estimates of the Effect of Number of Siblings on Child Quality within Other Types of Households

	non-agricultural & Han		**agricultural & minority**		**non-agricultural & minority**	
	coefficient	marg. effect	coefficient	marg. effect	coefficient	marg. effect
2nd stage						
sibling number	1.07***	0.26***	0.84***	0.09***	1.17***	0.23***
	(0.10)	(0.04)	(0.12)	(0.03)	(0.16)	(0.08)
1st stage						
OCP	-0.41***		0.14		-0.11	
	(0.08)		(0.34)		(0.27)	
mother age	Yes		Yes		Yes	
province dummy	Yes		Yes		Yes	
mother education	Yes		Yes		Yes	
father education	Yes		Yes		Yes	
child age	Yes		Yes		Yes	
observation	16398		6604		1010	

Notes: Dependent variable is the number of siblings in the household.
*, **, *** denote statistical significance at 10%, 5% and 1% level.
Standard errors are reported in parentheses.
Child age groups: 15-19, 20-23, 24-27, 28-31, 32-35
Mother age groups: 35-40, 41-45, 46-50
Cluster at household level.