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Family Size and Educational Attainment: The Case of China

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Abstract

In China, the population policy has been a major item on the political agenda since the early 1970s. Given the importance of human capital as an engine for economic growth, the question of how changes in birth rates affect human capital is particularly important for macroeconomic policy. Extant studies have presented contrasting views on the relationship between the number of children and educational investment in households. Some suggest a negative relationship due to the quantity/quality trade-off occasioned by limited resources within the family, while other studies point out a positive relationship caused by economies of scale. This study empirically analyzes the relationship between the number of children and educational attainment in households in China. More specifically, we estimate the effect of the number of siblings on the number of education years among individuals born since 1970, using the China General Social Survey (CGSS) and the Chinese Household Income Project Survey (CHIP). We estimate the causal impact of the number of siblings by exploiting exogenous variation in the number of siblings caused by family planning policies ("Later, Longer, Fewer") that started in the early the 1970s. The results support the assertion that the number of siblings has a negative effect on educational attainment in China.

Keywords: Quantity-quality trade-off, Demographic Economics, Education, Fertility, Family Planning, China

JEL Classification: I00, I25, J10, J13, P20

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1. Introduction

Given the importance of human capital as an engine for economic growth (Schultz, 1961; Nelson and Phelps, 1966; Romer, 1986), the question of how changes in birth rates affect human capital is particularly important from a macroeconomic perspective. Previous studies have presented contrasting views on the relationship between the number of children and educational investment in the household (e.g., Becker, 1964; Schultz, 2007). While some studies suggest a negative relationship due to the quantity/quality trade-off associated with limited resources within the family, other studies point out a positive relationship caused by economies of scale. This debate has attracted substantial interest in studies of China, where active population policies have been traditionally implemented.

The fertility rate or, more specifically, the number of children per family, has been a major concern in China's economic policy since the early 1970s. In 1979, China introduced the famous one-child policy, which strictly controlled the number of children in each family. While it was an unprecedented policy, a recent study suggests that the fertility rate in China had already sharply declined before its implementation (Zhang, 2017). In fact, China had enacted active family planning policies beginning in the early the 1970s. The one-child policy, which was relaxed in stages beginning in the mid-1980s, lasted more than three decades until it was abolished in 2015 when the Fifth Plenary Session of the 18th Central Committee introduced the second-child policy. Despite these tremendous efforts to control birth rates, there is no clear consensus about the causal impacts of changes in the birth rate on human capital in China.

This study attempts to identify the relationship between the number of children in a family and educational attainment in China. Specifically, it uses the data from the China General Social Survey (CGSS) to estimate the causal effect of the number of siblings on years of education by exploiting regional variation in the effects of the family planning policies that had started in the early the 1970s. To check the robustness of the estimated results, we also conduct a similar analysis using data from the Chinese Household Income Project Survey (CHIP).

The contributions of this study are two-fold. First, we examine the causal effects of

the number of siblings on educational attainments by exploiting an instrumental variable derived from a unique policy experience in China. So far, only a handful of empirical studies of China have focused on the endogeneity of the number of siblings while estimating its effect on educational attainment. To address this issue, we utilize regional variation in the family planning policy during the 1970s that preceded the one-child policy in China. Second, we carefully control for potential factors that affect educational attainment. Prior studies tend to control for the effect of family conditions on educational investment using data collected long after the investment decisions were made. We control for the family condition at the time these decisions were made using unique information from the data sets.

The structure of the paper is as follows. Section 2 describes previous studies on the relationship between the number of siblings and educational attainment. Section 3 describes the data and the setting. Section 4 presents our methodology for estimating the effect of the number of siblings on educational attainment and for dealing with endogeneity bias. Section 5 presents the main results and a robustness test. Section 6 concludes.

2. Literature Review

2.1 The Quality-Quantity Tradeoff

Extant literature offers competing views on the relationship between the number of children in a family and their educational attainment. On one hand, a number of studies suggest a tradeoff between quantity and quality (Becker, 1964; Blake, 1981). Parents must choose between quantity, or family size, and quality, or the amount of economic resources each child receives. Households with fewer children are able to provide more care and resources to each child. Consequently, an increase in the number of siblings reduces the probability of college admission, completing higher education, or gaining an additional year of schooling.

The hypothesis of the quality–quantity tradeoff has been tested in empirical studies,

which present substantial evidence in support of it. For example, Karwath et al. (2014) use longitudinal data from the BiKS-8-14 study at the end of elementary school in Germany and find that the number of siblings has a negative effect, particularly in families with lower educational backgrounds. Kugler and Kumar (2017) use data from nationally representative household surveys to test whether there is a trade-off between the number of children and their educational achievement in Indian families. The results indicate that children from larger families are less educated, less likely to have previously enrolled in school, and less likely to be currently enrolled in school. They also find that the effects are larger for rural, poorer, and low-caste families and for families with less educated mothers. Klemp and Weisdorf (2011) use data from Anglican parish registers to investigate the causal relationship between family size and offspring literacy status. They document a significant negative effect of family size on children's literacy in the UK.

On the other hand, several empirical studies suggest that the number of siblings has no effects or even positive effects on educational attainment (Black et al., 2005, Angrist et al., 2010, Schultz, 2007; Qian, 2009). This positive relationship can be explained by the effects of economies of scale in childcare and education. Increases in the number of children in a family can increase the quality of their experience by allowing them opportunities to learn from each other. Alternatively, there may simply be economies of scale in costs for childcare or for items such as clothes and textbooks, such that an additional child lowers the marginal cost of care for all children. For example, Black et al. (2005) use Norwegian data to examine the effects of family size and birth order on the educational attainment of children. After controlling for birth order and using twins as an instrumental variable, they find no evidence that family size affects educational attainment. However, they find that birth order has a significant negative effect on children's educational attainment. Similarly, Angrist et al. (2010) use multiple births and same-sex siblings as instruments for family size in Israel. The results also show no evidence of a trade-off between quantity and quality.

2.2 The Effect of Number of Children on Educational Attainment in China

The quality–quantity trade-off has been tested in the case of China in the literature. Most studies report a negative correlation between the number of siblings and educational attainment in China. Furthermore, they identify specific conditions that can strengthen the associations. Hannum and Xie (1994) finds that the relationship between the number of siblings and school enrollment is negative, especially for girls. In addition to the number of siblings, gender composition and birth order also affect educational attainment (Chu et al., 2007; Hannum and Xie, 1994; Ye and Wu, 2011). Ye and Wu (2011) find that both having brothers and having sisters have negative effects on educational attainment, though the negative effect of brothers is greater than the effect of having sisters.

However, testing the causal link of the quality–quantity trade-off is not straightforward. A major problem for estimating the causal effect of the number of siblings on educational attainment is that the number of siblings can be an endogenous variable. For example, parental preferences can affect both the number of children and educational investment. If parents who value education also prefer to have fewer children, then the correlation between quantity and quality will be driven by parental preferences rather than by family size. Endogeneity may also arise from the educational level of the first child. Parents may be more likely to have a second child when the educational level of the first child is high. These unobservable factors bias ordinary least squares (OLS) estimates of the family size effect upwards.

The results of existing studies of the causal impacts of child quantity on child quality in China are rather mixed. So far, only a handful of studies have attempted to estimate the causal impacts of family size in China. The most common strategy in these studies is to utilize external variation in the number of siblings caused by the incidence of twins or China's one-child policy and its relaxation during the 1980's (Li and Zhang, 2008b; Rosenzweig and Zhang, 2009; Qian, 2009; Liu, 2014). Rosenzweig and Zhang (2009) exploit the incidence of twinning to estimate the effect of fertility changes induced by the one-child policy on other outcomes. Using the Chinese Child Twins Survey conducted in 2002 in Kunming City, they show that the fertility decline induced by the one-child policy had a moderately positive effect on children's human capital. Similarly, Li and Zhang (2008b) use data from the Chinese Population Census and find a negative impact of

family size on the educational attainment of children after controlling for the birth order effect and instrumenting the number of siblings with the exogenous variation induced by a twin birth. They also argue that the negative effect of family size is more prominent in rural China, where the public education system is poor.

On the other hand, some studies find conflicting results. Qian (2009) exploits exogenous changes in family size caused by relaxations in the one-child policy to estimate the effect of family size on school enrollment of the first child. The results show that, for one-child families, an additional child significantly increases the school enrollment of first-born children. Liu (2014), using variation in fertility induced by cross-community variations in the one-child policy, finds no significant effects of child quantity on educational outcomes such as school enrolment or years of schooling, but does find a quantity–quality trade-off when children's height is used as a quality variable.

While using the incidence of twins in the context of the one-child policy and subsequent relaxation policies as natural experiments is worthwhile in identifying the causal link of quantity-quality trade-off, some methodological concerns remain. Using twins only allows the estimation of the effect of having two children instead of one under the assumption that there is nothing inherently different about twins. However, twins may not be comparable to singletons (for example, twins are more likely to have low birthweight). Also, recent studies question of the actual effects of the one-child policy on fertility rates in China (McElroy and Yang, 2000; Zhang, 2017; Chen and Huang, 2018). If the policy effects are ambiguous, the instrumental variable constructed from the one-child policy may not be valid. Since the fertility rate in China had already sharply declined before the initiation of the one-child policy due to family planning policies in the early the 1970s, exploiting the effects of these family planning policy during may be more appropriate for examining the quantity–quality trade-off in China.

2.3 Other Factors Affecting Educational Attainment in China

Many studies have identified important determinants of educational attainment in China apart from the number of siblings. Among them, the importance of family background, such as the income and education levels of parents, has been highlighted in the literature

(Han, 2005; Zhang and Qi, 2013). Zhang and Qi (2013), for example, examines the determinants of children' s education levels using the CGSS2008 dataset and finds that family income and parental education levels have positive effects on educational attainment. Zheng (2015) argues that family welfare has historically affected parents' preference for educational investment in China, showing that during the economic stagnation in the 1960s and the 1970s, gender inequality in education increased. However, one of the difficulties of controlling for those family backgrounds is the need to consider the period in which parents make decisions about educational investment. Decisions about educational investments for children are made when they are still very young. It follows that the family condition that must be controlled is the welfare level of the parents at the relevant age of the children. However, household survey data usually does not include the economic condition of parents a decade prior to the interview.

3. Data and Setting

3.1 The Data

This study examines the relationship between the number of siblings and educational attainment using data from the 2008 CGSS and 2013 CHIP. The CGSS data were collected by the China National Survey Data Archive (CNSDA), which is supported by the International Social Survey Program (ISSP) and the East Asian Social Survey (EASS). The data cover both urban and rural areas and include information on individual educational attainment and family background. The survey used four-stage stratified (district/county, township/street, neighborhood/village, and household) unequal probability sampling methods. The samples included 29 out of 34 provinces. To test the robustness of our empirical results, we also conducted analyses using data from the 2013 CHIP, the details of which will be provided in Section 5.3.

There are unique advantages to using the 2008 CGSS for the present study compared to data from other standard household surveys. First, the 2008 CGSS provides the employment status of the parents when the respondents were 14 years old. China has a system of nine-year compulsory education, when is near completion at the age of 14. The

employment status and occupation type of the parents when the individual was 14 represent their background when they made decisions additional educational investment. This information is collected exclusively in the 2008 CGSS, and this is the main reason this study uses this data. Second, it has information on the respondent's siblings even when they were raised in different households. The data include whether the siblings are older or younger, which identifies the individual's birth order.

Table 1 shows the summary statistics of our samples from the 2008 CGSS. Since we focus on the exogenous variation induced by China's family planning policy in the early the 1970, we restrict our sample to individuals born after 1970. We also dropped individuals born after 1988, since they might still have been enrolled in higher education institutions at the time of the survey and their educational attainment (or years of education) cannot be evaluated correctly. After dropping observations of other generations, the sample included 5,680 individuals.

[Table 1 here]

Figure 1 represents the relationship between the number of siblings and the average years of education calculated from our sample. It clearly shows a negative association that is consistent with the quality–quantity trade-off hypothesis. Furthermore, it also shows that the average years of education declined as the number of siblings increased from zero to one, one to two, and two to three. The negative marginal effects of child quantity gradually decline. The effects of the number of siblings beyond one or twins are considered worthwhile, even in the context of the one-child policy in China. In fact, our data show that more than 20% of individuals born in the first half of the 1980s have two or more siblings in the rural area. However, the above association cannot be interpreted as a causal relationship, and the impact of the number of children needs to be examined carefully.

[Figure 1 here]

3.2 Family Planning Leading Group and One-child policy

Figure 2 shows the average number of siblings by year of birth for our sample. It is confirmed that the decline in the fertility rate started around the beginning of the 1970's, far ahead of the initiation of the one-child policy. This finding is consistent with recent studies on the effects of the one-child policy (McElroy and Yang, 2000; Zhang, 2017; Chen and Huang, 2018). It is well-known that China started its one-child policy in 1978, initially restricting the number of children in a family to one. However, most of the decline in fertility in China occurred before the one-child policy. Indeed, the Chinese government had already started a family planning policy in the early the 1970s and had begun the nationwide "Later, Longer, Fewer"' campaign. Here, "later" suggests that the age of marriage should be over 25 years old for males and 23 years old for females; "longer" suggests having at least a four-year interval between births; and "fewer" means having fewer children. To implement the campaign, provincial governments started establishing the Family Planning Leading groups (FPLs) in their provinces at different times, and these organizations strongly promoted regional fertility policy. Chen and Huang (2018) confirm that variation across provinces in the year the provincial FPL was established significantly affected provincial-level changes in fertility rates. Based on these findings, the present study exploits the regional variation in fertility induced by the establishment of FPLs throughout the 1970s for our estimation of the effect of the number of children on their educational attainment.

[Figure 2 here]

4. Methodology

4.1 OLS Estimation of the Relationship between the Number of Siblings and Educational Attainment

The baseline model for estimating the association between the number of siblings and educational attainment is as follows:

$$\boldsymbol{Y_i = \alpha + \beta_1 S_i + X_i' \gamma + \varepsilon_i} \ , \tag{1}$$

where Y_i represents the educational year for individual *i*; S_i is the number of siblings for individual *i*; X_i' is a vector of household characteristics; and ε_i is the error term.

The vector X_i' indicates the factors that affect educational attainment and includes the following variables: gender, birth order, residential register (Hukou-Note), a dummy variable for whether the individual was born before 1979, the parents' birth years, the parents' years of education, and the parents' occupational status when the individual was 14 years old. The birth order is included because previous studies suggest that it affects educational attainment. The residential register is a dummy variable set to 1 for individuals registered in rural areas and 0 otherwise. We use information from the residential register rather than the current residence because the former reflects the actual residence of the individuals at the time when they were children and educational investment decisions were made by their parents. The dummy variable for born before 1979 and the birth years of parents are included to control for the possible effect of the one-child policy and other generation effects. The parent's occupation types are included as dummy variables related to the parents' job type when the respondent was 14 years of age. The stable jobs concerning the civil servant and the state enterprise have specific dummy variables and the category of "other" includes other private, unstable or minor jobs, while the unemployment status was used as the reference category. Furthermore, provincial fixed effects are included based on the information of the residential register.

4.2 The Instrumental Variable Approach

The baseline model can suffer from endogeneity bias, and β_1 cannot be simply regarded as a causal impact of the number of siblings on educational attainment. If unobservable characteristics affect the number of siblings and educational investment in the same

direction, it is possible that OLS estimation of the baseline model will not yield a negative effect of S_i, even if one is present in our sample. For example, it is possible that an unobservable environment preferable to child-raising allows families to have more children and better education. On the contrary, if unobservable characteristics such as parental preferences affect the number of siblings and educational investment in opposite directions, β_1 can be negative and significant even if the number of siblings has no actual effect. Indeed, families with more liberal values tend to prefer to have fewer children with higher levels of education.

To address this issue, we utilize information on provincial heterogeneity in the implementation of family planning policies during the 1970s. While previous studies tend to utilize differences in the number of siblings caused in the context of one-child polices and its relaxation revisions in the 1980's, actual fertility changes in China started early in the 1970's when provincial governments began establishing the FPLs. Chen and Fang (2018) confirm that the establishment of these organizations actually caused differences in provincial fertility levels; they utilize differences in the timing of the establishment of FPLs to estimate the effects of the number of children on the quality of life of the elderly in China. Meanwhile, it is unlikely that FPLs, which did not focus on educational issues, directly affected the educational attainment of the individuals in the provinces. Therefore, we follow this strategy and utilize the year the provincial FPL was established for our analysis. More specifically, we take the difference between the birth year and the year the provincial FPL was established where the individual was born; we use this variable as an instrumental variable. It takes the value of zero if the group has not yet been established. We also included the squared number of years since the establishment of the FPL in the province because the marginal impacts of years are expected to decrease over time.

Table 2 presents the first-stage estimation results, where the dependent variable is the number of siblings. As in the case of Chen and Fang (2018), the coefficients for years since FPL establishment are negative and significant at the 1% level, while the coefficients for the squared terms are positive. Further, we obtained intuitive results from several other variables. The coefficients for the female dummy variable, birth order, and rural residence show positive and significant results for all models. Parent's education

had negative effects and several of the dummies for parents' occupation type when the individual was 14 show significant results, implying that family status at that time is an important determinant of the number of siblings.

[Table 2 here]

5. Empirical Results

5.1 The Association between the Number of Siblings and Years of Education

Table 3 shows the OLS estimates of the baseline model. We examine four models with or without parents' occupational dummies and provincial fixed effects. The coefficients for the number of siblings are negative and significant at the 1% level for all models, implying the existence of a quality–quantity trade-off. The results of most of the other variables are in line with the findings derived from the existing literature. The negative coefficient of the gender dummy implies that females have fewer educational opportunities than males. The coefficients for parents' years of education are positive and significant at the 1% level, suggesting that educated parents tend to make more educational investments for their children. The negative coefficient of the rural variable means that residents in rural regions face educational disadvantages. Moreover, several of the dummy variables for parent's occupation type when the individual was 14 years old show positive and significant results. The occupational dummies for civil servant and state firms are positive and significant for father, and those for state firms and other jobs are positive and significant for mother. It is suggested that stable occupations and economic status are important factors during childhood that seriously affect the educational attainment of children.

[Table 3 here]

5.2 The Effect of the number of Siblings on Years of Education

Table 4 presents the two-stage least square (2SLS) estimates using instrumental variables. We used years since the establishment of the provincial FPL and its squared value as instruments, as mentioned in the previous section. These variables pass standard tests of validity, as seen in the last three rows of the table. The F-test scores for the first-stage instruments exceed 50. Hausman tests lead to the rejection of the null hypothesis that the number of siblings is exogenous, implying that the OLS estimates are inconsistent.

[Table 4 here]

First, the coefficients for the number of siblings are negative and significant at the 1% level for all models. This suggests that the quantity-quality trade-off hypothesis is supported by the empirical evidence in the case of China even after we address endogeneity bias. The 2SLS estimated coefficients are larger than the OLS estimates and suggest that one additional sibling should reduce an individual's years of education by 1.2 to 1.5 years. As for other independent variables, most of them show similar results compared to the OLS estimation results. Females and those registered in rural areas tend to have lower educational attainment. Parents' years of education positively affects their children's years of education, and the effect of the father's education is larger than the effect of the mother's education. If the father worked as a civil servant during the respondent's childhood, the individual tended to have more years of education, compared to those whose fathers were unemployed or worked for other unstable jobs.

5.3 Robustness Check Using CHIP Data

In order to test the robustness of our empirical results, we conducted similar estimations using data from the 2013 CHIP. The CHIP data were collected as part of a collaborative research project on incomes and inequality in China organized by Chinese and international researchers with assistance from the National Bureau of Statistics (NBS). The CHIP survey data three subsamples: the urban household survey, the rural household survey, and the rural-to-urban migrant household survey.

Table 5 presents the 2SLS estimates using the 2013 CHIP data. As in the prior estimations, we used the years since the establishment of the provincial FPL and its squared value as instruments. These instrumental variables pass standard tests of validity, as seen in the last three rows of the table. We used data on the current jobs of the parents to construct the occupation dummy variables since there was no data on parents' occupation type during the respondent's childhood in the CHIP. As shown in Table 5, the coefficients for the number of siblings are negative and significant at the 1% level for all of the instrumental variable models. The values of the coefficients are close to the estimate in Table 4 and range from 1.5 to 1.6. Most of the other variables show similar results to those in Table 4, though the occupational dummies were not significant for these estimations. Both these results and those in Table 4 support the quality–quantity trade-off hypothesis in the case of China.

[Table 5 here]

6. Conclusion

This study empirically examines the relationship between the number of children and educational attainment in China. More specifically, we analyzed the effect of the number of siblings on the years of education of individuals born after 1970, using the CGSS and CHIP data. To deal with the endogeneity of the number of siblings, we created instrumental variables that captured the exogenous influence exerted on the number of births by the establishment of provincial FPLs, which began in the early the 1970s. The results estimated using both datasets supported the quality–quantity trade-off hypothesis, suggesting that the number of children in Chinese families has a negative effect on educational attainment. It is estimated that one additional sibling reduces an individual's years of education by 1.2 to 1.6 years.

In China, family size has been one of the main policy concerns since the 1970s. In

recent years, China has been facing a declining trend in the number of children, and the government has started to prioritize raising the birth rate. The results of this study highlight the unintended consequences of this type of family planning policy. Based on historical experience, it can be said that larger family sizes might lead to lower educational attainment for new generations. The population policy should be designed along with the relevant education infrastructure. More focus should be placed on policy interventions such as providing equal educational opportunities for vulnerable people, such as women or rural residents, and improving schools and other infrastructure in rural areas.

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Table 1. Summary statistics

VARIABLES	(1) N	(2) mean	(3) s.d.
Years of education	5,512	10.50	3.591
Number of siblings	5,680	0.745	0.963
Gender(female)	5,680	0.552	0.497
Birth order	5,680	2.257	1.512
Birth after 1979	5,680	0.570	0.495
Birthyear of father	3,739	1,947	8.886
Birthyear of mother	3,693	1,949	8.322
Father's years of education	3,856	4.935	3.587
Mother's years of education	3,796	3.553	3.368
Rural	5,674	0.476	0.499
Father's job: civil servant	5,680	0.0254	0.157
Mother's job: civil servant	5,680	0.00739	0.0857
Father's job: state firm	5,680	0.0945	0.293
Mother's job: state firm	5,680	0.0549	0.228
Father's job: other	5,680	0.363	0.481
Mother's job: other	5,680	0.233	0.423

Sources: Author's calculation based on China General Social Survey (CGSS)2008.
Note: The sample is restricted to the individuals who were born after 1970 and before 1988.

Table 2. The first stage estimation results (CGSS2008)

	(1)	(2)	(3)	(4)
			Sibling size	
VARIABLES	OLS	OLS	OLS	OLS
Years since FPL Establishment	-0.116***	-0.118***	-0.119***	-0.122***
	(0.0139)	(0.0135)	(0.0138)	(0.0135)
Squared years since FPL Establishment	0.00344***	0.00288***	0.00383***	0.00328***
	(0.000840)	(0.000813)	(0.000837)	(0.000810)
Gender	0.236***	0.240***	0.226***	0.233***
	(0.0300)	(0.0292)	(0.0297)	(0.0289)
Birth order	-0.198***	-0.220***	-0.206***	-0.226***
	(0.0127)	(0.0129)	(0.0128)	(0.0131)
Birth after 1979	-0.0899	-0.132**	-0.0876	-0.131**
	(0.0620)	(0.0631)	(0.0614)	(0.0625)
Birthyear of father	0.00368	0.0111**	0.00235	0.00984**
	(0.00446)	(0.00454)	(0.00443)	(0.00452)
Birthyear of mother	0.0138***	0.00555	0.0139***	0.00604
	(0.00512)	(0.00517)	(0.00508)	(0.00513)
Father's years of education	0.00127	-0.00116	0.00687	0.00415
	(0.00528)	(0.00516)	(0.00564)	(0.00547)
Mother's years of education	-0.0381***	-0.0275***	-0.0275***	-0.0188***
	(0.00571)	(0.00564)	(0.00606)	(0.00595)
Rural	0.355***	0.317***	0.242***	0.223***
	(0.0341)	(0.0339)	(0.0392)	(0.0386)
Father's job: civil servant			0.0470	0.0219
			(0.0905)	(0.0894)
Father's job: state firm			-0.103*	-0.0917
			(0.0625)	(0.0606)
Father's job: other			-0.0620	-0.0282
			(0.0455)	(0.0439)
Mother's job: civil servant			-0.258*	-0.235
			(0.145)	(0.147)
Mother's job: state firm			-0.247***	-0.222***
			(0.0719)	(0.0689)
Mother's job: other			-0.288***	-0.279***
			(0.0441)	(0.0441)
Constant	-32.54***	-31.08***	-30.10***	-29.50***
	(6.057)	(6.095)	(6.046)	(6.089)
Province dummies	No	Yes	No	Yes
Observations	3,362	3,362	3,362	3,362

Sources: Author's calculation based on China General Social Survey (CGSS)2008.
Note: Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3. The OLS estimates of the effects on educational attainment (CGSS2008)

	(1)	(2)	(3)	(4)
		Years of education		
VARIABLES	OLS	OLS	OLS	OLS
Sibling size	-0.389***	-0.327***	-0.352***	-0.301***
	(0.0528)	(0.0533)	(0.0534)	(0.0540)
Gender	-0.573***	-0.574***	-0.563***	-0.569***
	(0.0964)	(0.0937)	(0.0961)	(0.0936)
Birth order	-0.221***	-0.157***	-0.195***	-0.141***
	(0.0392)	(0.0394)	(0.0391)	(0.0393)
Birth after 1979	-0.752***	-0.593***	-0.759***	-0.606***
	(0.131)	(0.126)	(0.131)	(0.126)
Birthyear of father	0.0104	0.0208	0.0146	0.0239*
	(0.0140)	(0.0139)	(0.0139)	(0.0138)
Birthyear of mother	-0.00333	-0.00545	-0.00400	-0.00609
	(0.0160)	(0.0159)	(0.0158)	(0.0158)
Father's years of education	0.162***	0.151***	0.137***	0.130***
	(0.0172)	(0.0167)	(0.0177)	(0.0173)
Mother's years of education	0.139***	0.118***	0.114***	0.102***
	(0.0184)	(0.0182)	(0.0191)	(0.0188)
Rural	-3.008***	-2.910***	-2.725***	-2.695***
	(0.107)	(0.106)	(0.126)	(0.125)
Father's job: civil servant			0.788**	0.587*
			(0.310)	(0.303)
Father's job: state firm			0.471**	0.491***
			(0.194)	(0.188)
Father's job: other			0.232*	0.199
			(0.138)	(0.135)
Mother's job: civil servant			0.286	0.209
			(0.495)	(0.489)
Mother's job: state firm			0.705***	0.439*
			(0.240)	(0.231)
Mother's job: other			0.569***	0.393***
			(0.150)	(0.150)
Constant	-1.822	-16.56	-8.909	-21.59
	(17.36)	(17.13)	(17.34)	(17.12)
Province dummies	No	Yes	No	Yes
Observations	3,471	3,471	3,471	3,471
R-squared	0.449	0.489	0.455	0.493

Sources: Author's calculation based on China General Social Survey (CGSS) 2008.
Note: Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4. The 2SLS estimates on of the effects on educational attainment (CGSS2008)

	(1)	(2)	(3)	(4)
		Years of education		
VARIABLES	2SLS	2SLS	2SLS	2SLS
Sibling size	-1.469***	-1.191***	-1.517***	-1.228***
	(0.320)	(0.297)	(0.325)	(0.299)
Gender	-0.330***	-0.368***	-0.317**	-0.359***
	(0.126)	(0.119)	(0.125)	(0.118)
Birth order	-0.449***	-0.364***	-0.453***	-0.368***
	(0.0783)	(0.0812)	(0.0816)	(0.0832)
Birth after 1979	-0.323*	-0.243	-0.309*	-0.237
	(0.184)	(0.174)	(0.183)	(0.174)
Birthyear of father	0.00815	0.0246*	0.0107	0.0269*
	(0.0148)	(0.0145)	(0.0148)	(0.0145)
Birthyear of mother	0.00314	-0.00802	0.00341	-0.00833
	(0.0172)	(0.0168)	(0.0172)	(0.0167)
Father's years of education	0.165***	0.151***	0.147***	0.135***
	(0.0181)	(0.0173)	(0.0189)	(0.0180)
Mother's years of education	0.100***	0.0949***	0.0853***	0.0859***
	(0.0238)	(0.0211)	(0.0230)	(0.0208)
Rural	-2.623***	-2.644***	-2.461***	-2.511***
	(0.160)	(0.144)	(0.158)	(0.146)
Father's job: civil servant			0.831***	0.620**
			(0.316)	(0.302)
Father's job: state firm			0.325	0.360*
			(0.211)	(0.199)
Father's job: other			0.170	0.191
			(0.149)	(0.141)
Mother's job: civil servant			-0.0715	-0.0976
			(0.488)	(0.485)
Mother's job: state firm			0.439	0.254
			(0.269)	(0.250)
Mother's job: other			0.156	0.0677
			(0.184)	(0.175)
Constant	-9.055	-18.24	-14.51	-22.20
	(19.24)	(18.41)	(19.35)	(18.53)
Province dummies	No	Yes	No	Yes
Observations	3,362	3,362	3,362	3,362
R-squared	0.388	0.453	0.385	0.451
F-test on first stage instruments	52.5245	60.4459	51.7066	60.4032
Test of over-identification restriction (p-value)	0.9589	0.9175	0.9209	0.9822
Exogeneity test (p-value)	0.0004	0.0029	0.0001	0.0015

Sources: Author's calculation based on China General Social Survey (CGSS) 2008.
Note: Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5. The 2SLS estimates on of the effects on educational attainment (CHIP2013)

	(1)	(2)	(3)	(4)
		Years of education		
VARIABLES	2SLS	2SLS	2SLS	2SLS
Sibling size	-1.516***	-1.629***	-1.526***	-1.628***
	(0.270)	(0.232)	(0.270)	(0.232)
Gender	-0.363***	-0.340***	-0.357***	-0.335***
	(0.0807)	(0.0747)	(0.0807)	(0.0745)
Birth order	1.036***	1.124***	1.041***	1.122***
	(0.204)	(0.172)	(0.203)	(0.171)
Birth after 1979	-0.471***	-0.405***	-0.478***	-0.414***
	(0.117)	(0.111)	(0.117)	(0.111)
Birthyear of father	0.00570	0.0132**	0.00746	0.0150**
	(0.00611)	(0.00639)	(0.00610)	(0.00636)
Birthyear of mother	0.000642	-0.00166	0.000739	-0.00150
	(0.00419)	(0.00477)	(0.00410)	(0.00467)
Father's years of education	0.128***	0.122***	0.118***	0.112***
	(0.0100)	(0.00996)	(0.0105)	(0.0104)
Mother's years of education	0.108***	0.0870***	0.105***	0.0838***
	(0.0113)	(0.0111)	(0.0113)	(0.0111)
Rural	-2.616***	-2.583***	-2.575***	-2.547***
	(0.0977)	(0.0860)	(0.0992)	(0.0869)
Father's job: civil servant			0.288	0.535
			(0.349)	(0.348)
Father's job: state firm			-0.0284	0.196
			(0.303)	(0.303)
Father’s job: other			-0.338	-0.111
			(0.277)	(0.276)
Mother's job: civil servant			-0.180	-0.212
			(0.439)	(0.430)
Mother's job: state firm			0.390	0.341
			(0.275)	(0.271)
Mothers ‘job: other			0.0241	0.0103
			(0.209)	(0.208)
Constant	0.533	-8.141	-2.746	-11.83
	(10.12)	(10.25)	(10.18)	(10.31)
Province dummies	No	Yes	No	Yes
Observations	8,996	8,996	8,996	8,996
R-squared	0.358	0.365	0.358	0.366
F-test on first stage instruments	67.5014	89.9184	68.1241	90.114
Test of over-identification restriction (p-value)	0.5014	0.2857	0.3870	0.2218
Exogeneity test (p-value)	0.0000	0.0000	0.0000	0.0000

Sources: Author’s calculation based on Chinese Household Income Project Survey (CHIP) 2013.
Note: Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1

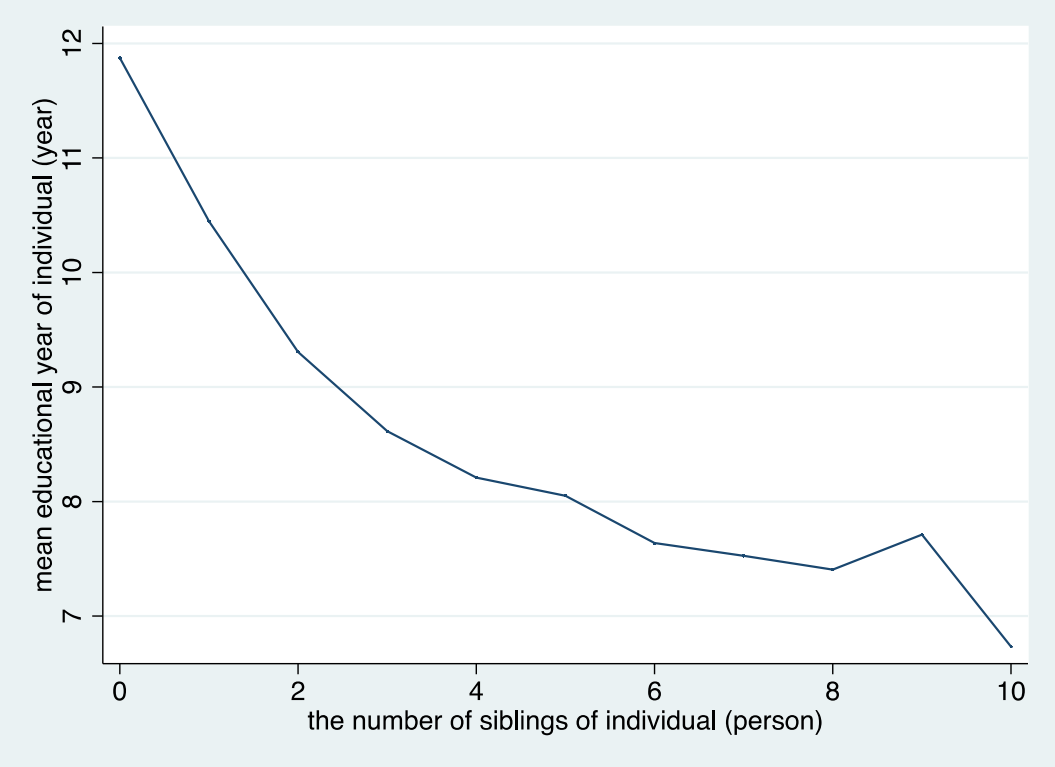

Figure 1. The Relationship between Number of Siblings and Average Educational Years

Sources: Author's calculation based on China General Social Survey (CGSS) 2008.

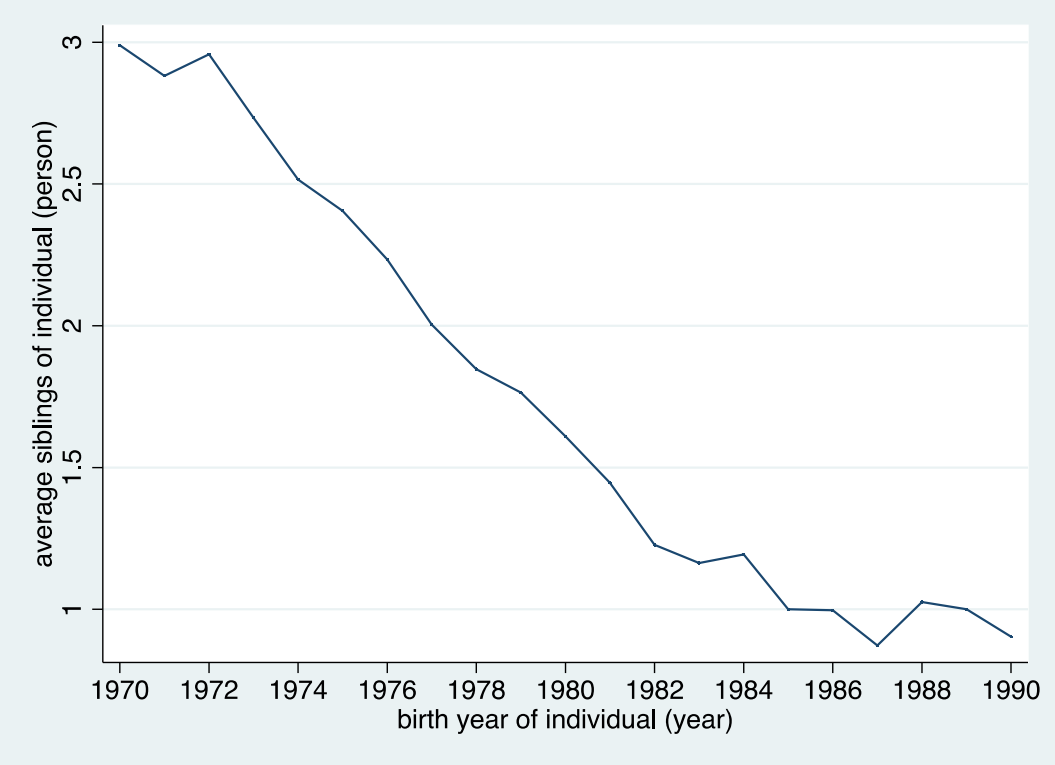

Figure 2. The Birth Year and Average Number of Siblings
Sources: Author's calculation based on China General Social Survey (CGSS) 2008.

Appendix A.

Table A1. The first stage estimation results (CHIP2013)

	(1)	(2)	(3)	(4)
		Sibling size		
VARIABLES	OLS	OLS	OLS	OLS
Years since FPL Establishment	-0.0998***	-0.121***	-0.1000***	-0.121***
	(0.00920)	(0.00948)	(0.00918)	(0.00948)
Squared years since FPL Establishment	0.00394***	0.00449***	0.00395***	0.00450***
	(0.000516)	(0.000510)	(0.000516)	(0.000511)
Gender	0.206***	0.201***	0.207***	0.201***
	(0.0186)	(0.0182)	(0.0186)	(0.0182)
Birth order	0.755***	0.742***	0.755***	0.742***
	(0.00849)	(0.00850)	(0.00847)	(0.00849)
Birth after 1979	-0.0719*	-0.153***	-0.0718*	-0.153***
	(0.0420)	(0.0431)	(0.0419)	(0.0430)
Birthyear of father	0.00575**	0.00851***	0.00584**	0.00846***
	(0.00235)	(0.00195)	(0.00234)	(0.00196)
Birthyear of mother	0.000545	-0.000527	0.000530	-0.000509
	(0.00213)	(0.00128)	(0.00211)	(0.00128)
Father's years of education	-0.0102***	-0.00986***	-0.0115***	-0.0103***
	(0.00298)	(0.00293)	(0.00314)	(0.00309)
Mother's years of education	-0.0194***	-0.0192***	-0.0174***	-0.0174***
	(0.00298)	(0.00296)	(0.00306)	(0.00304)
Rural	0.271***	0.238***	0.275***	0.239***
	(0.0205)	(0.0202)	(0.0207)	(0.0204)
Father's job: civil servant			0.152	0.0749
			(0.101)	(0.0976)
Father's job: state firm			0.0791	-0.0208
			(0.0884)	(0.0850)
Father's job: other			0.0219	-0.0448
			(0.0825)	(0.0787)
Mother's job: civil servant			-0.255**	-0.146
			(0.107)	(0.104)
Mother's job: state firm			-0.297***	-0.214***
			(0.0764)	(0.0754)
Mother's job: other			-0.122**	-0.0362
			(0.0601)	(0.0583)
Constant	-10.66***	-14.19***	-10.71***	-14.05***
	(3.756)	(3.710)	(3.773)	(3.736)
Observations	8,996	8,996	8,996	8,996

Sources: Author's calculation based on the Chinese Household Income Project Survey (CHIP)2013.
Note: Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A2. The OLS estimates of the effects on educational attainment (CHIP2013)

	(1)	(2)	(3)	(4)
		Years of education		
VARIABLES	OLS	OLS	OLS	OLS
Sibling size	-0.389***	-0.343***	-0.387***	-0.341***
	(0.0312)	(0.0314)	(0.0312)	(0.0314)
Gender	-0.591***	-0.592***	-0.588***	-0.587***
	(0.0563)	(0.0551)	(0.0563)	(0.0550)
Birth order	0.192***	0.183***	0.190***	0.180***
	(0.0336)	(0.0332)	(0.0335)	(0.0332)
Birth after 1979	-0.826***	-0.830***	-0.838***	-0.841***
	(0.0767)	(0.0751)	(0.0766)	(0.0750)
Birthyear of father	0.00456	0.0107*	0.00621	0.0126**
	(0.00602)	(0.00569)	(0.00598)	(0.00567)
Birthyear of mother	0.00195	0.00174	0.00208	0.00189
	(0.00457)	(0.00391)	(0.00444)	(0.00382)
Father's years of education	0.140***	0.135***	0.132***	0.126***
	(0.00910)	(0.00898)	(0.00946)	(0.00933)
Mother's years of education	0.131***	0.113***	0.125***	0.108***
	(0.00936)	(0.00930)	(0.00954)	(0.00945)
Rural	-2.922***	-2.889***	-2.889***	-2.855***
	(0.0617)	(0.0614)	(0.0627)	(0.0625)
Father's job: civil servant			0.146	0.473
			(0.319)	(0.313)
Father's job: state firm			-0.116	0.221
			(0.276)	(0.271)
Father's job: other			-0.350	-0.0424
			(0.249)	(0.243)
Mother's job: civil servant			0.0891	-0.0240
			(0.428)	(0.412)
Mother's job: state firm			0.723***	0.624**
			(0.246)	(0.244)
Mother's job: other			0.161	0.0660
			(0.188)	(0.184)
Constant	-1.076	-10.88	-4.339	-14.79
	(9.282)	(9.104)	(9.314)	(9.144)
Observations	8,996	8,996	8,996	8,996
R-squared	0.441	0.468	0.443	0.470

Sources: Author's calculation based on Chinese Household Income Project Survey (CHIP) 2013.

Note: Robust standard errors are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1