When Fewer Means More:

Impact of One-Child Policy on Education of Girls

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Abstract

Do fewer children to give birth in the future induce more educational investment at present? Using the temporal and regional variation in One-Child Policy (OCP) implementation in China, we find that stricter fertility policies during teenage years induced higher female educational attainment. The impacts of the policies on female education are also associated with those on female labor force participation, non-manual occupation, delayed marriage and childbearing, and attitudes regarding children and gender equality. The findings suggest that the expected fertility play an important role in educational attainment of girls and contribute a new explanation for the empowerment of women in last century. (*JEL* codes: I20, J13, J16, J18)

Keywords: One-Child Policy, Education of Girls, Expectation

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1 Introduction

The rise in the educational attainment of women has been one of the most significant changes during the past century in many countries (Goldin et al., 2006; Goldin and Katz, 2009; Duflo, 2012).[1] It was accompanied by an increased involvement of women in the economy and an enhancement of their socioeconomic status. These changes, named "Quiet Revolution" by Goldin (2006), have brought hot discussion over the potential impacts on the economic development.

Although the phenomenon has been well documented, the forces responsible for the "Revolution" are not as clear. The various explanations in the literature indicate no "silver bullet" answer to the question across nations.[2] For example, Goldin and Katz (2002) found that the oral contraceptives pills contributed much to women's increased education and rising role in the labor market in the United States. However, the power of pills may not apply in East Asian countries like China because of a much smaller proportion of women taking contraceptive pills.[3]

This paper provides a new explanation by establishing the relationship between the implementation of the birth control policies during teenage years (i.e., 10-19 years of age) and educational achievement of girls.[4] The birth control policies during the teenage years may matter to the educational attainment of girls in several aspects.[5] First, the girls (or their parents) would re-optimize the timing of marriage and fertility of the girls. Because stricter fertility policy indicates fewer

[1] Goldin and Katz (2009) showed in their Figure 1.2 (pp. 17) that the male-to-female ratio in secondary school enrollment is less than one for most countries.

[2] Jayachandran and Lleras-Muney (2009) found that the sudden reduction in maternal mortality rate as a result of health policies in Sri Lanka led to a convergence in the education level of boys and girls because parents expect that investment in girls will be relatively more valuable. Chiappori et al. (2009) emphasized the role of the labor market and the marriage market in investment in education for women. Jensen (2012) pointed out that (future) labor market opportunities for women influence educational investment in India.

[3] Only 1.7 percent of women of reproductive age (15 to 49 years) in China take contraceptive pills, compared to 15.6 percent in the United States (UN, 2006).

[4] For simplicity, we use "teenage years" and "10-19 years of age" interchangeably in this paper.

[5] The birth control policies restricted the fertility of millions of couples in a number of countries for many decades (Miller and Babiarz, 2014) and an established literature has investigated the quantity-quality trade-off phenomenon, but the potential effects of policy implementation at adolescent ages or teenage years on women's education received relatively less attention from researchers. Specifically, the literature on quantity-quality trade-off mainly focused on the effects of number of siblings on the educational attainment but this paper mainly examined the effects of the OCP implementation *during age 10-19* on the girls' education with controlling for the dummies of number of the siblings. In addition, the previous literature using the OCP (e.g., Qian, 2009; Rosenzweig and Zhang, 2009) found weak or no evidence on quantity-quality trade-off effects.

children to give birth when the girls enter fertility ages in the future, they would likely delay their marriage and childbearing, which thus lowers the costs for a longer duration of high school education (Field and Ambrus, 2008). In addition, with fewer children to care for in the future, women may have face less restriction from family, and thus have more chances to involve in labor market activities. The expectations, once formed, would motivate the girls or their parents to invest more in education. Third, women less participate in the labor market than men do and thus financially rely on their husbands or children more when they get old. Thus the expectation of being supported by fewer children during old age is likely to generate an incentive to acquire more education, land a better job, and save for retirement. The asymmetric fertility-related costs and benefits between men and women are important: women bear the major share of the costs of childbirth and are generally the primary caregivers; while men participate more in labor force, are more financially independent and thus less rely on their children. These suggest smaller or no effects of the fertility policies for men, implying that the fertility policies could presumably explain the narrowing of the gender gap in education.

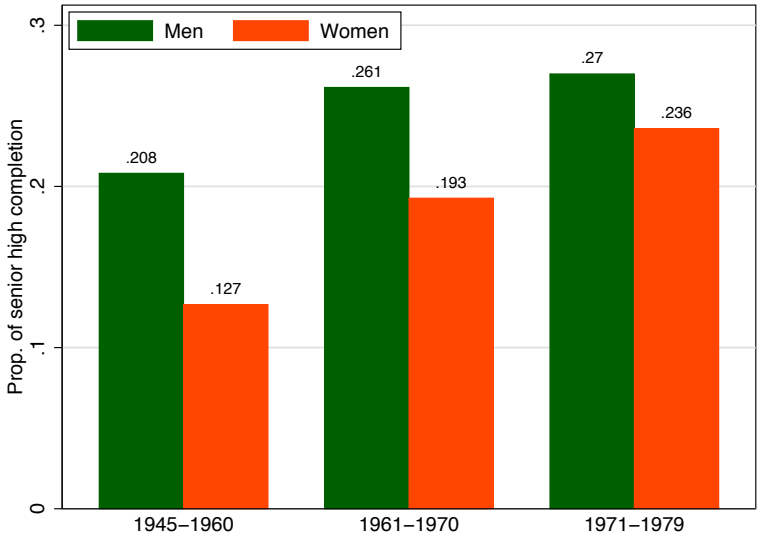
China provides a natural setting to investigate the relationship between women's rising education and fertility policies. Similar to other countries, China experienced a rapid increase in female education and a convergence of the gender gap in the late 20th century (Rosenzweig and Zhang, 2009). Figure 1a shows that the senior high school completion rate for women almost doubled from 13 to 24 percent among those born between 1945 and 1979, and the gender gap narrowed by half from 8.1 to 3.3 percentage points. Figure 1b presents a similar pattern for college completion.

Different from other countries, however, the birth control policies in China, also named as "One-Child Policy" (OCP), was known as one of the most *strictly executed* birth control policies in the world, which *compulsorily* assigned a "one-birth" quota to each couple in general.[6] It can also be seen in Figures 1a and 1b that the gender gap in education started to narrow among the 1960s cohorts, who were just in their teenage years when the policy started.

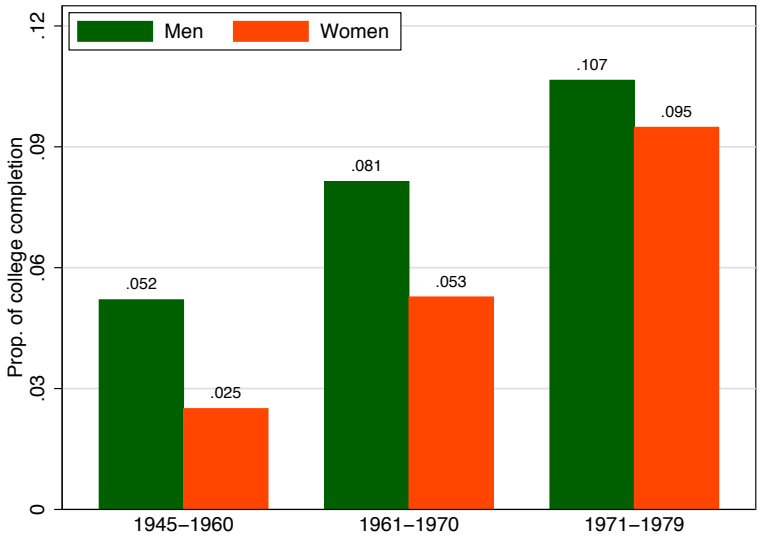
[6]Some rural households may face "One-and-Half-Birth" and "Two-Birth" quota, which mainly depends on which province the households are living in. The effects of the birth control policies were obvious. This policy led to the involvement of hundreds of millions of couples in China in a strict family-planning program that lasted more than 30 years. Accordingly, the total fertility rate dropped from 2.81 in 1979 to 1.51 in 2000 (World Bank).

Figure 1: Senior high school and college completion over birth cohorts, by gender

(a) Senior high school completion rate over birth cohorts



(b) College completion rate over birth cohorts



NOTE: Data source is Census 2000 and 2005 Population Study Sample of China. Mean rates of senior high school (or college) are calculated in the birth cohort groups and labeled above the bars.

Our analysis shows that the above finding is not a mere coincidence. We use the average financial penalties for one unauthorized birth in the 30 provinces over 20 years from 1979 to 2001 as measures for the OCP implementation, and match the data to a individual level and nationally representative sample from census data of China. Using the regional and temporal variation in fertility penalties (Ebenstein, 2010; Wei and Zhang, 2011), we find that an increase in the OCP fines by one year of local household income during teenage years predicts an increase of 2.2 percentage points in the rate of senior high school completion among women of Han ethnicity. However, among men of Han ethnicity, the effects are much smaller and insignificant. These estimates suggests that the fertility policy explains 30 percent of the increase in women's education and 50 percent of the narrowing of the gender gap in the birth cohorts from 1945 to 1979.

The identification assumption of exogenous variation of the fertility penalties should not be taken for granted. By looking into the historical documents, we first show that the changes in the fertility penalties are coincident with the central government's attitudes towards the fertility restrictions, and are closely relevant to the promotion motivation of provincial government officials. For example, 12 out of the 16 largest changes in the fertility penalties exactly happened in the first two years of the tenure when new officials coming into power, just after the central government included the performance in the OCP execution into officer evaluation.

In order to check the exogeneity of the fertility penalties, we provide more results and also conduct a series of empirical tests. First, we control for local population growth and regional assignment of educational resources and find robust results. Second, we find greater effects in the regions or among people with stricter OCP implementation. For example, the effects of OCP are larger in urban areas than those in rural regions, and greater effects of the OCP are also found when parents have a higher level of education, work in the public sector, or have a higher rank in administration since these individuals face stricter enforcement and strengthened fertility regulations. Third, we also investigate the effects of the fertility fines in two comparison groups: (1) women of minority groups, because they are less subject to the fertility policy; and (2) men of Han ethnicity. And we consistently find no significant effects of the fines in either group. Finally, to

alleviate the reversal causality concern that fine rate may be affected by education level of women, we conduct a placebo test and find that the education level of local women has no predictive power on the future fertility fine rate changes.

Finally, we examine the possible mechanisms by exploring the correlations between the effects of fertility fines on girls' education and the effects on later marriage and labor market outcomes of the girls. We find that, the larger effects of the policy fines on girls' education are associated with the greater effects on late marriage (as measured by marriage by 25 years of age), the larger effects on late fertility (as measured by whether the woman ever had a child at the time of survey), and the larger effects on labor force participation and employment in a professional (or white collar) job. In addition, we also finds consistent evidence for attitudes on gender equality and dependence on children. These associations shed some light on the mechanisms for policy-induced higher education of the women.

The most relevant study to this exercise is Miller (2010), who found that the policy introduction during fertility ages increases the women's socioeconomic status in Colombia. Our study provides new evidence on the effects on education and the possible mechanisms. This study also builds up the literature in several aspects. First, it contributes to the literature on women's empowerment (e.g., Goldin and Katz 2002; Goldin et al. 2006; Goldin 2006; Goldin and Katz 2009; Duflo 2012) by providing a new explanation from the policy side that the implementation of the OCP during the teenage years increases women's educational attainment. Second, it also contributes to the literature on educational investment (e.g., Chiappori et al., 2009; Jensen, 2000, 2010, 2012; Bursztyn and Jensen, 2015) by examining the effects of fertility policies. Finally, these findings are also relevant to the effects of expectations for the future on current behaviors (e.g., Manski, 2004; Jayachandran and Lleras-Muney, 2009; Oster et al., 2013). Specifically, the finding that the expected fertility would affect the current educational investment provide new insights in the literature estimating the effects of education of mothers on fertility (e.g., David Lam, 1999; Breierova and Duflo, 2004; McCrary and Royer, 2011).

2 Background and One-Child Policy

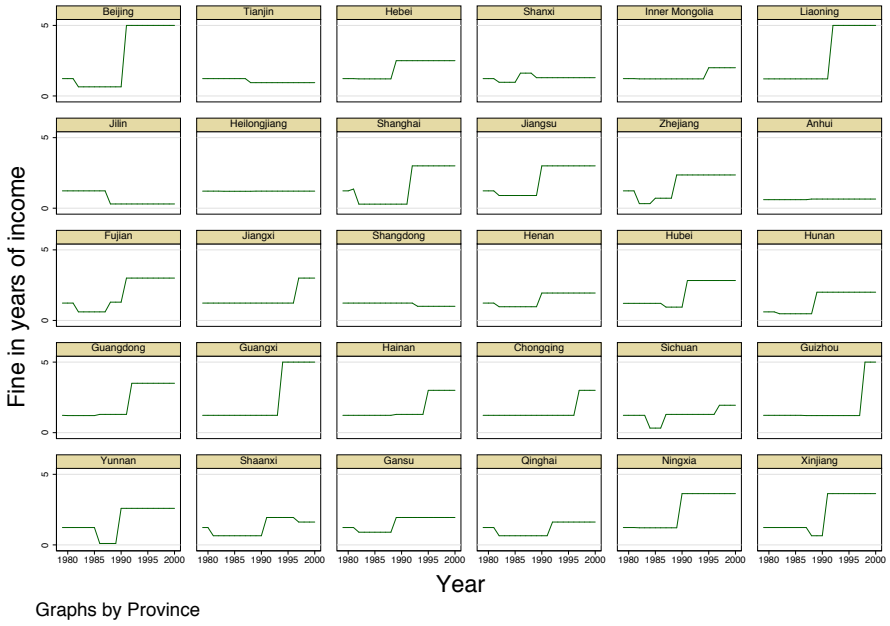
In the 1970s, after two decades of explicit encouragement of population growth, policy-makers in China enacted a series of measures to curb population growth, especially within the Han ethnicity. The OCP was formally conceived in 1979, enforcement gradually tightened until it was firmly established across the country in 1980, and appeared in the amended Constitution in 1982. (Banister, 1991). This was the first time that family planning policy formally became one article in the laws of China.

2.1 Different Implementation by Ethnicity and Type of *hukou*

In recognition of the diversity of demographic and socioeconomic conditions across China, the central government issued "Document 11" in February 1982 to allow the local governments to issue specific regulations. Two years later, the Central Party Committee further issued "Document 7". The document stipulated that regulations regarding birth control were to be made in accordance with local conditions and to be approved by the provincial Standing Committee of the People's Congress and provincial-level governments, which devolved responsibility from the central government to the local and provincial governments (Baochang et al., 2007).

The OCP in principle restricted a couple to having only one birth. However, the de facto regulations vary among different ethnicities and types of *hukou* (urban/rural). First, implementation of the OCP differs for Han and for minorities. It is mainly focused on the Han ethnicity, which is the largest ethnic group in China and makes up 92 percent of the population. In all provinces, most minorities are allowed to have a second birth or face no restrictions. Second, the regulations of the OCP also differ by urban and rural *hukou*. The policy is strictly enforced in urban areas but less so in rural areas. For people with urban *hukou*, the policy that one couple is only allowed to have one child is strictly enforced; whereas couples with rural *hukou* are allowed to have a second child if the first is a girl, which is also named the "One-and-Half Children Policy." In this study, we use the different implementation by ethnicity and type of *hukou* to verify to the consistency of the results.

Figure 2: The OCP Fertility Fine Rates over Year, by province



NOTE: Data source is Ebenstein (2010). The unit of penalties is times of local household annual income.

2.2 Different Implementation across Region over Time

Since the central government allowed the local governments to have specific fertility policy regulations in the start of OCP, there has been a large variation in the policy implementation across province over time. One measure used in the previous studies is the monetary penalties and subsidies that have been implemented since 1979 (Ebenstein, 2010; Wei and Zhang, 2011). We use the average monetary penalty rate for one unauthorized birth in the province-year panel from 1979 to 2000, which is formulated in multiples of local household annual income. It is called a "social child-raising fee" in China, and this paper uses "policy fine" or "fertility fine" for the sake of brevity. Figure 2 shows the pattern of policy fines from 1979 to 2000 in each province.[7]

Since the fertility penalties are mainly used in this study, we do some search in the official

[7]The amount of the policy fine collected were not made public until recent years: the total was about 20 billion RMB yuan (3.3 billion US$) among 24 provinces that reported in 2012. For example, Guangdong, one of the richest provinces in China, collected 1.5 billion. In comparison, the total local government expenditure on compulsory schooling was 10.5 billion, suggesting that the policy fines composed a sizable part of the local fiscal revenue.

archives and find the changes in the fine rates are closely relevant to promotion incentives of local officials. At the very beginning of the OCP, vice premier Chen Muhua proposed that it would be necessary to pass new legislation imposing an extra child "tax" on excess children. However, the subnational leaders, rather than the central government, faced the practical difficulties in collecting high penalties and bore the pressure from resistance and complaints directly. For example, Guangdong province received more than 5,000 letters complaining the implement of One-Child Policy in the single year of 1984. Therefore, the central government fully authorized the provincial governments to determine their "tax rates" according to their localities. Since the local governments concerned the social stability and face large resistance from the mass, they had little incentive to design a high fine rate. Consistent with Figure 2, the period before 1989 witnessed few changes in the fertility fine rates.

Things started to change in the end of the 1980s, when the central government established the relationship between the OCP performance and promotion of local officials. As Greenhalgh and Winckler (2005) wrote in the book Governing China's Population:

> *"Addressing governors in spring 1989 Li Peng (current premier) said that population remained in a race with grain, the outcome of which would affect the survival of the Chinese race. To achieve subnational compliance, policy must be supplemented with more detailed management by objectives (ME 890406). At a meeting on birth policy in the premier's office, Li Peng explained that such targets should be 'evaluative'."*

According to Figure 2, the fine rate level increased from 0.82 to 2.99 yearly household incomes on average in the period of 1989-1992, *just* after the speech, which was significantly larger than any other period. Moreover, 16 out of all the 21 significant increases in the history occurred in this period.[8] Indeed, family planning was listed among the three basic state policies in Eight Five-Year Plan passed by National People's Council in March 1991.[9] This document explicitly set an object that the natural growth rate of population should be controlled less than 1.25 percent on

[8]The "significant increase" in fine rate here is defined as an increase higher than one-year household incomes.
[9]The other two state policies are protecting arable land and protecting the environment.

average in the following decade. To achieve such a challenging objective, the national leaders employed a management-objective "responsibility system" to induce subnational leaders to set high fine rates and compel local cadres to enforce. We checked the official documents and found a significant coincidence between fine rate increases and new provincial officers just coming into power. Among the 16 significant increases, 12 happened exactly in the first two years of new provincial governors tenures.[10] The average age of these 16 provincial governors was 56 years old, which was significantly lower than the average age of other provincial governors, i.e., 58 years old. These numbers suggest that the promotion incentive of provincial governors could be the main force driving the change of fine rate and the strength of such an incentive depended on the governor's personal characteristics, such as inauguration time and age.[11]

The facts above suggest a strong relationship between incentives of local officials getting promoted and the increase in OCP fine rates. In our analysis below, we further compare results from different subsamples (e.g., rural vs. urban, men of Han ethnicity vs. women of minorities), and conduct a series of empirical tests to further justify our conclusions in this paper.

2.3 One-Child Policy Enforcement

The public expectation for the number of births can be formed only under clear awareness and harsh enforcement. The fertility policies in China meet these requirements. Population and Family Planning Commissions (PFPC) were set up at every level of government to raise awareness and to carry out registration and inspection work. A large-scale public campaign about the law was launched during the 1980s, and an effective curb on population growth became the highest priority

[10]The average tenure of these 16 provincial governors was about 6 years. And they on average had higher chance of being promoted than their peers. For example, two of them finally became the standing members of the Political Bureau of Central Committee of the Communist Party (CCCP): one was promoted as executive vice premier and the other was promoted as the chairman of Chinese People's Political Consultative Conference (CPCCC).

[11]One potential concern is the possibility that the predecessors of these governors were replaced due to bad performance in the OCP implementation (e.g., higher fertility rates). Therefore we also investigate the placements of former governors whose successors raised fine rate by more than one-year household incomes. We find that these former governors were at least as successful as their peers in political career. In some sense, these former provincial governors were more successful than their peers. Several of them, such as Rongji Zhu, Changcun Li and Guanzheng Wu, even became political leaders of the central government. And we do not find any information showing that one provincial governor was displaced due to bad performance in the OCP implementation.

for local officials. To ensure the enforcement of the fines on violation, those who had an unauthorized birth but did not pay the fine could be sued by the local PFPC and the fine would be collected compulsorily. The provincial governments also set up detailed regulations to ensure the effective collection of policy fines. For example, the unauthorized-born child cannot be registered to the *hukou* system if the fines are not paid; thus, the child cannot go to school because the *hukou* is a requirement for school entrance. Property can also be confiscated for nonpayment of policy fines. In an extreme case in Shaoyang City, Hunan Province, the "illegal" birth children themselves were confiscated and settled in the social welfare institution because the policy fine was not paid.[12]

3 Data

3.1 Population Census 2000 and 2005 One-Percent Population Survey

The main data used in this study are taken from the 2000 Population Census and the 2005 One-Percent Population Survey (Censuses 2000 and 2005, hereafter). Both datasets contain gender, education level, year and month of birth, type of *hukou* (urban/rural), *hukou* province, ethnicity (Han/Minorities), marital status, number of siblings, and relation to the head of household.[13] For married respondents, the data also provide the year and month of the first marriage. For ones older than 16 years of age, the data also provide information about labor market participation, including working status, occupation, and the number of days of work in the past week. Because the sampling rate differs in the two datasets, sampling weights are applied throughout this analysis.

For the analysis of education, we keep respondents aged between 26 and 55; thus the earliest birth cohort in our analysis is 1945 and the latest 1979. We keep those aged over 25 because most of them finished the education before the survey. We also keep all of the cohorts are born before the OCP formally implementation to avoid the identified effect of the OCP originating from a smaller

[12]Source in Chinese: http://baike.baidu.com/subview/5708887/5757115.htm

[13]The number of siblings is provided for those below 30 years of age in 2005, i.e., those born later than 1975 in 2005 data. The results are nearly the same regardless of whether the number of siblings is controlled.

number of siblings.[14]

Education is divided into six levels: illiterate, primary school, junior middle school, senior middle school, college, and graduate or above. We combine the highest three categories into "senior high or above" and choose it as our main outcome of interest for at least three reasons. First, the number of dropouts after finishing junior high (i.e., just before senior high) is the largest at any stage of education, implying that this is likely to be the most responsive margin regarding educational investment. In particular, the dropout rate is 68 percent, whereas that just after primary school is only 36 percent; second, the compulsory schooling laws initiated in 1986 require 9 years of school (i.e., junior high school) in China, and we wanted to prevent our estimates from being affected by the laws; third, the college completion rate is fairly low for these cohorts (i.e., less than 6 percent) and thus may not have large variation for identification. But we still explore college completion to check for robustness in this study.

3.2 China General Social Survey (CGSS)

The CGSS, launched in 2003, gathered longitudinal and nationally representative data on social trends in the mainland of China, with the targeted population being civilian adults 18 years of age and above. The CGSS provides subjective evaluation on certain aspects of life of interest to our study. Four survey questions are relevant to our analysis and are consistently measured in 2010 and 2012 waves.[15] The first two questions concern attitudes toward children: "Do you agree that the happiest thing is watching children growing up?" and "Do you agree that adult children are important support for old people?" The answers are 1 = "strongly disagree," 2 = "disagree," 3 =

[14]The average spaces between births in China is about 2 years, and thus the sample we used here should not be driven by the quantity quality trade-off since all of them are born earlier than 1980. We also use the sample born no later than 1975 and the results are consistent. In our analysis below, we include the number of siblings to control for the quantity-quality trade-off, and we do not find any material changes when we drop the number of siblings here. We also compare the results using the 2000 census when no sibling information is provided and those from the 2005 population study survey with the number of siblings controlled and find that the two sets of results are nearly the same. These suggest that the results should not be driven by the channel of number of siblings.

[15]Since 2003, the CGSS has three different sampling designs and has used three sets of sampling frames: 2003 to 2006, 2008, and 2010 to the present. Thus the two waves 2010 and 2012 used in this study are consistently surveyed under the same sampling frame.

"neither agree nor disagree," 4 = "agree," and 5 = "strongly agree". Similarly, the respondents are also asked "Do you agree that men and women have equal housework duty?" We use the answers coded from 1 to 5 directly. In addition, there is another question: "What is the optimal arrangement in the presence of a preschool child at home?" We code the answer as 1 if the respondent chose "Women at home and men work outside" and 0 for other answers that indicate that men share the responsibilities of child rearing.

To make the analysis consistent, we confine the sample with the same birth cohorts as that of Census. The rate of senior high school completion is 24 percent for women and 31 percent for men. The difference between the CGSS sample and the Census is likely to originate from different sampling frames. Caution should be used when comparing the results of CGSS to those of the censuses.

4 One Child Policy and Women's Educational Attainment

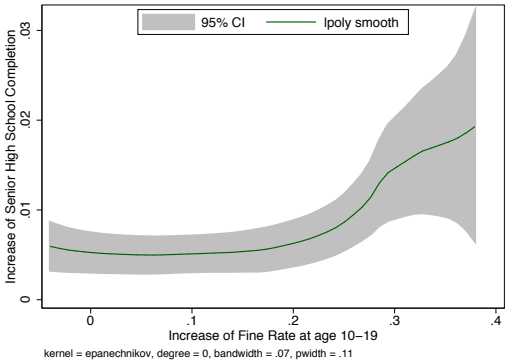
4.1 Educational Attainment Response to Fertility Policy Fines Changes

We begin the analysis by investigating how educational attainment responds to the variations in the fertility fine. We show how the changes in the senior high school completion rate are correlated with the changes in the fine rate during the teenage years. The changes are calculated using two consecutive birth cohorts with the same *hukou* province and the same type of *hukou* (urban/rural).

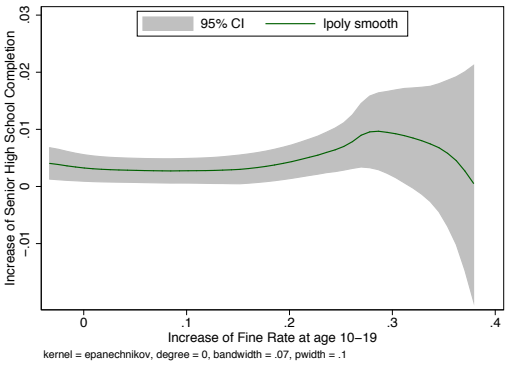
Figures 3a-3c report the nonparametric estimation when plotting the changes in the senior high school completion rate against those in the fine rate, in three separate samples - Han women, Han men, and minority women, respectively. For all the samples here, we only retain the ones born no earlier than 1965 because the change in the fine rate during the teenage years for these earlier cohorts is almost zero. Therefore, the number of observations is 900, as there are 30 provinces, 2 types of hukou, and 15 birth cohorts, except in the case of minority women, for whom some observations are missing. The results here are weighted by the population in each birth cohort-province-hukou type.

Figure 3: Associations between Increase of policy fine rate and increase of senior high school completion, by gender and ethnicity

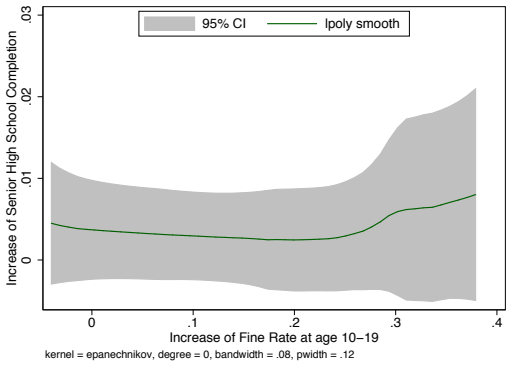
(a) Women of Han



(b) Men of Han



(c) Women of Minorities



NOTE: Data source is Census 2000 and 2005 Population Study Sample of China. Birth cohorts from 1965 to 1979 are kept. The figures plot the change in the senior high school completion rate in two continuous birth cohorts in the same hukou province-type of hukou group against the change in the fertility fine rate in the corresponding two continuous birth cohorts. Kernel-weighted local polynomial smoothing is applied.

Figure 3a show a significant positive correlation between an increase in the fine rate during the teenage years and an increase in the rate of senior high school completion. In contrast, Figures 3b and 3c suggest much weaker correlations either among Han men or among minority women.[16]

4.2 Effects of the OCP on Educational Attainment

To obtain a more precise estimation, we control for potential individual heterogeneity and conduct the following regression:

$$Senior_{ijbt} = \beta_0 + \beta_1 Fine_{jb}^{10-19} + \beta_2 X_i + \delta_{bt} + \delta_j + T_j + \varepsilon_i \quad (1)$$

where subscript i denotes individuals, j *hukou* provinces, b the year of birth, and t the year of the survey. The dependent variable $Senior_{ijbt}$ is an indicator for individual i born in year b in j *hukou* province in survey year t who completed senior high school. $Fine_{jb}^{10-19}$ denotes the mean value of the fine rate in *hukou* province j in the years in which birth cohort b was between 10 and 19 years of age. The coefficient of it, β_1, is of our main interest because it presents the impacts of the OCP fine rate during the teenage years on the educational attainment. We use the fine rate in the province in which an individual registered her residency (*hukou*) because the respondents are more likely to have obtained education in their *hukou* province than in the province in which they currently lived.[17] We use the fine rate at 10-19 years of age because it is when households (or girls) make decisions for their children's (or their own) education - senior high school starts at 15-17 years of age and college at around 18-21. The section 4.3 examines the effects of policy implementation at different ages and finds consistent results.

[16]The OLS estimates, though not reported here, suggest that one yearly household income increase in fine rate is significantly associated with 2.1 percentage points increase in senior high school completion. But the associations are much weaker in the other groups. In the later sections, we use the full sample so that we can control for the pre-trends in each province.

[17]Inter-province migration could be a potential issue because it is possible that the *hukou* will be moved to another province. The census 2005 data provide information on the birth province, which shows over 95 percent of people have the same *hukou* province as the province where they were born and that over 93 percent of individuals are living in the same province in which they were born. It is noteworthy that the results are consistent if we use the birth province to match.

The set of control variables, X_i, includes the indicators for type of *hukou* (urban/rural) and number of siblings.[18] δ_{bt} denotes the indicators for the birth cohorts, the year of the survey, and the corresponding interactions between the two. We control for the interactions to avoid any systematic sampling difference in a specific birth cohort between the 2000 and the 2005 survey. δ_j and T_j denote the dummies for *hukou* province that capture the time-invariant heterogeneity across provinces, and the province-specific birth linear time trends to control for any potential province-specific trends in feminist views or attitudes toward women's education and careers, respectively.

By controlling for the above covariates, we use the variation of $Fine_{jb}^{10-19}$ across provinces over birth cohort to identify the effects of OCP. The exogeneity of this variation may not be taken for granted. As mentioned above, the largest changes in the fertility penalties are coincident with the inauguration of the new provincial officials, just after the central government considering the performance of OCP as an additional evaluative factor. It is reasonable to assume they are independent of the individual or household educational investment. In addition, we also investigate in both treated and comparison groups (i.e., women of han, men of han, women of minorities) to rule out the other confounding factors that are correlated with both the fertility penalties and outcome variables. Since the variation in fine rates used in equation 1 is at province-year of birth (YoB) level, we follow Goldin and Katz (2002) and report two sets of standard errors for all the regression results: those clustered at province-YoB level and more conservative ones clustered at province level.

Panels A and B of Table 1 present the OLS estimation among women and men of Han ethnicity, respectively. The estimates in column 1 indicate that the one unit increase in OCP fines (i.e., one year local household annual income) during the teenage years is positively associated with a 2.2 percentage points increase in the likelihood of completing senior high school for women (11 percent of the mean). The magnitude implies that the increase in the OCP fine among the women

[18] We include the number of siblings to control for the quantity-quality trade-off. One potential issue is that the fine rate at ages 10-19 may affect fertility behaviors of the parents of the girls and thus the number of siblings is endogenous. We argue this may not be the first order issue: according to the census data, the mean space between births in China is around 2 years, and the proportion of parents giving birth to another baby when their elder offspring is over 10 years old is even less than 1 percent. In addition, we do not find any material changes when we drop the number of siblings here.

born between the 1945 and 1979 (i.e., 1.4 times of local household annual income) contributes a 2.8-percentage-point increase in the senior high school completion rate for them, suggesting that the OCP explains about 30 percent of the educational increase for the women born during that time.

Based on the benchmark analysis, we include a series of control variables to further address the potential issue that the fertility fine might be correlated with other factors that drive female educational attainment. We additionally control for the logarithm of the population sizes in the local *hukou* province when the respondent was 10 and 19 years of age. The estimates are very close to the first column for both men and women, suggesting that the incentive to raise the policy fine caused by a potential population increase is not an important confounding factor.

Since the significant increases in fertility penalties were usually accompanied with new provincial officials coming into power, and it could be possible that the new officials also realized the importance of education and thus put more resources in the education. We thus include a series of variables including (the logarithm of) the number of primary schools and junior high schools in column 3 to capture the government support on education. The coefficient changes little. The robust results suggest that the fertility policy–induced education mainly originate from the forces of the demand side of education such as the higher policy-induced incentive in educational investment.[19]

Because men bear smaller costs for childbirth and are more financial independent when getting older, we expect smaller or no effects for men if our story is correct. Therefore, men compose a natural comparison group. By doing so, we are able to address the concern that the omitted regional and birth cohort level variables (e.g., preferences of local officials), which may be both correlated with education and the OCP implementation, may drive the results. The estimates in Panel B

[19] All of these results are robust when using logit estimation. We also interact the survey year dummy (equals 1 if the respondent is surveyed in 2005) with the policy fine at 10 to 19 years of age to test for a difference between the sample from the 2000 census data and that from the 2005 population survey. The coefficient on the interaction term is small and insignificant, indicating roughly similar effects of OCP fines on women's educational attainment in the two survey years. For the other, we interact the policy fine from 10 to 19 years of age with birth cohorts no earlier than 1969 to test whether the effect of the OCP is heterogeneous across different birth cohorts, with the concern that changes in social norms across the birth cohorts may be correlated with both the increase in the fine rate and the education of women. The results show no evidence for this concern. These results are not provided here but are available upon request.

Table 1: Effects of the OCP Fertility Fines on Senior High School Completion

	(1)	(2)	(3)
Dependent variable	Senior High School Completion (Yes = 1)		
Panel A. Female sample	*Mean of Dep. Var. = 0.18*		
Fertility fine rate at age 10-19	0.0221**	0.0220**	0.0236**
	(0.0046)	(0.0046)	(0.0046)
	[0.0111]	[0.0109]	[0.0109]
Observations	788,585	788,585	788,585
R-squared	0.33	0.33	0.33
Panel B. Male sample	*Mean of Dep. Var. = 0.23*		
Fertility fine rate at age 10-19	0.0058	0.0064	0.0058
	(0.0046)	(0.0046)	(0.0046)
	[0.0090]	[0.0089]	[0.0086]
Observations	772,757	772,757	772,757
R-squared	0.29	0.29	0.29
Covariates controlled for in both panels			
Basic control	Yes	Yes	Yes
Population size and increase	No	Yes	No
Education supply condition	No	No	Yes

NOTE: Data source is Census 2000 and 2005 Population Study Sample of China. "Basic control" includes indicators for type of hukou, number of siblings, hukou province, year of birth, survey year, interactions between year of birth and survey year, and provincial year of birth (YoB) linear trends. "Population size and increase" includes the logarithm of the population sizes in the local hukou province when the respondent was 10 and 19 years of age. "Education supply condition" includes the number of schools in middle high school in the local province when the respondent was 15 years of age. Sampling weights are applied. Robust standard errors in parentheses are clustered at province-year of birth level. Based on this setting, the F-statistics for the differences in coefficients in Panel A and Panel B are 17.57, 15.99, and 20.73, respectively, and the P-values are consistently smaller than 0.001. More conservative standard errors in brackets are clustered at province level.
*** $p < 0.01$, * $p < 0.05$*

shows the results for Han men. Consistent with our expectation, fertility fine rate at 10-19 years of age is insignificantly associated with men's senior high school completion rate. The magnitude is much smaller as well, which is one scale smaller than that among women. The differences in the coefficients for men and women are significant. Comparing the effects for women and men, the OCP explains about 50 percent of the narrowing of gender gap in education shown in Figure 1a.

Table 2 conducts the parallel analysis for college attainment. The results are highly consistent. One unit increase in OCP fines during the teenage years predicts a 0.83 percentage points significant increase in the likelihood of completing college for women (21 percent of the mean). In contrast, the estimates for men are insignificant and smaller, no matter in absolute (0.48 percentage points) or relative (6 percent of the mean) scale. However, because of the low college completion rate, the magnitudes of the coefficients here are much smaller for women, and the F-tests show that the gender differences are insignificant.

4.3 Effects of Fertility Policies at Different Ages

The above analysis established the relationship between the policy restriction during the teenage years and girls' education, and thus it is natural to ask whether policy changes at other ages matter. Because the decision to go to senior high school is made when children are teenagers, it is reasonable that policy changes that occur at these ages yield largest effects. Investigation of the relationship between policy changes at even younger ages also shed light on the question of whether the effect of the OCP is time-accumulative or whether changes at certain ages matter most.

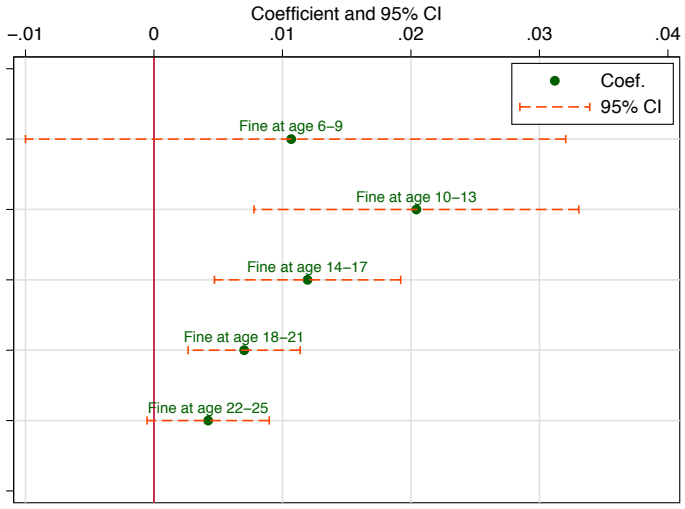
To answer the question above, we replace the fertility fine at 10 to 19 years of age with a series of fertility fines at different ages (i.e., fertility fines at 6-9, 10-13, 14-17, 18-21 and 22-25 years of age) in the regression, and report the results in Figure 4. The results are consistent with the patten of schooling ages in China: children generally begin senior high school at around 15-17 years of age and begin college at around 18-21 years old. These results suggest that a change in the policy fine rate matters mostly when it happens during the teenage years, the most critical time when households (or girls) make decisions for their children's (or their own) education. The

Table 2: Effects of the OCP Fertility Fines on College Completion

	(1)	(2)	(3)
Dependent variable	College Completion (Yes = 1)		
Panel A. Female sample	*Mean of Dep. Var. = 0.040*		
Fertility fine rate at age 10-19	0.0083**	0.0073**	0.0070**
	(0.0024)	(0.0024)	(0.0024)
	[0.0044]	[0.0046]	[0.0047]
Observations	788,585	788,585	788,585
R-squared	0.16	0.16	0.16
Panel B. Male sample:	*Mean of Dep. Var. = 0.076*		
Fertility fine rate at age 10-19	0.0048	0.0044	0.0040
	(0.0027)	(0.0027)	(0.0027)
	[0.0052]	[0.0054]	[0.0054]
Observations	772,757	772,757	772,757
R-squared	0.18	0.182	0.18
Covariates controlled for in both panels			
Basic control	Yes	Yes	Yes
Population size and increase	No	Yes	No
Education supply condition	No	No	Yes

NOTE: Sample is from Censuses 2000 and 2005. Variables definition is the same as that in Table 1. Sampling weights are applied. Robust standard errors in parentheses are clustered at province-year of birth level. Based on this setting, the F-statistics for the differences in coefficients in Panel A and Panel B are 1.53, 1.03, and 1.17, respectively, and the corresponding P-values are 0.22, 0.31 and 0.28. More conservative standard errors in brackets are clustered at province level.
*** $p < 0.01$, * $p < 0.05$*

Figure 4: Effects of the OCP Fertility Fines at Different Ages on Senior High School Completion



NOTE: Data source is Census 2000 and 2005 Population Study Sample of China. We conduct the regression by replacing the fertility fine at 10 to 19 years of age with a series of fertility fines at different ages (i.e., fertility fines at 6-9, 10-13, 14-17, 18-21 and 22-25 years of age) in equation (1). The covariates are the same as those in column 1 of Table 1. Both coefficients and confidence intervals are reported. The confidence intervals are calculated based on the standard errors clustered at province-YoB level.

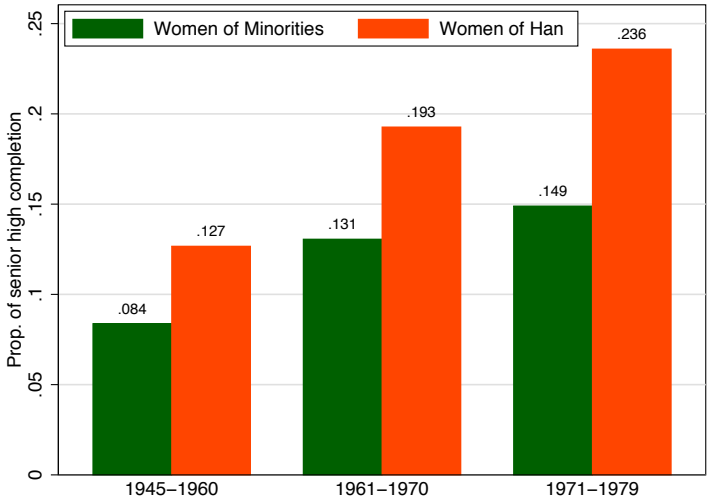
small and insignificant coefficient of fines at 6-9 years of age suggest the effects of OCP not time-accumulative.

4.4 Heterogeneity: By Ethnicity and Type of *Hukou*

Because of political reasons, most minorities are exempted from the restrictions of the policy (Baochang et al., 2007). This paper follows the ideology from prior research to use minority women as another comparison group for the effects of OCP (Li et al., 2011; Huang et al., Forthcoming). Figure 5 shows the senior high school completion rate for women of Han and those of minority, respectively. The senior high school completion rate among minority women is lower in general. Consistent with the OCP implementation, the education of Han-ethnicity women increased more in the post-1960 cohorts and the gap between the two groups expanded significantly.

We also conduct the regressions as equation 1 based on gender and ethnicity, and report the

Figure 5: Women's senior high school completion over birth cohorts, by ethnicity



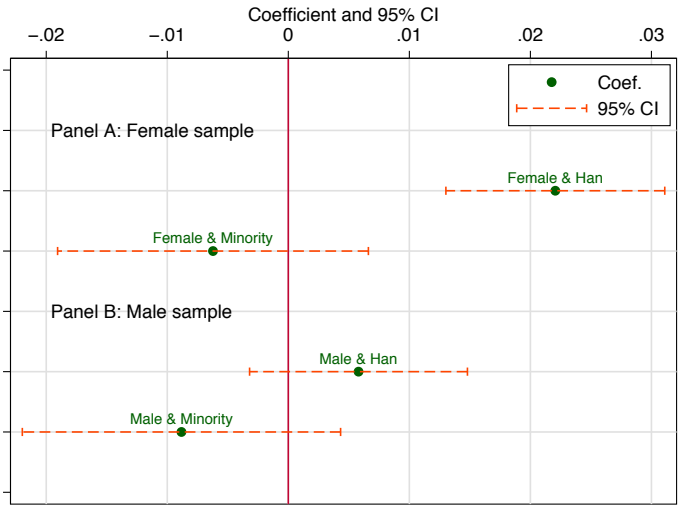
NOTE: Data source is Census 2000 and 2005 Population Study Sample of China. In women of Han and minorities, mean rates of senior high school are calculated specifically in the birth cohort groups and are labeled above the bars.

coefficients and corresponding 90 percent confidential intervals in Figure 6. Panel A in Figure 6a shows that the coefficient for Han women (0.021) is positive and significant but that the coefficient using the sample of minorities (–0.007) is negative, smaller in magnitude, and insignificant. The difference for these two coefficients is significant at 1 percent level (F-statistics = 14.27, and P-value < 0.001). Panel B reports the estimates for Han men and for minority men. The coefficient for Han (0.004) and that for minorities (–0.006) are both statistically insignificant and much smaller in magnitude. In addition, tge difference for these two coefficients is insignificant at even 10 percent level (F-statistics = 2.46, and P-value = 0.12). Thus, the OCP only increased the education of women with Han ethnicity, but did not impact as much for Han men or minority women.

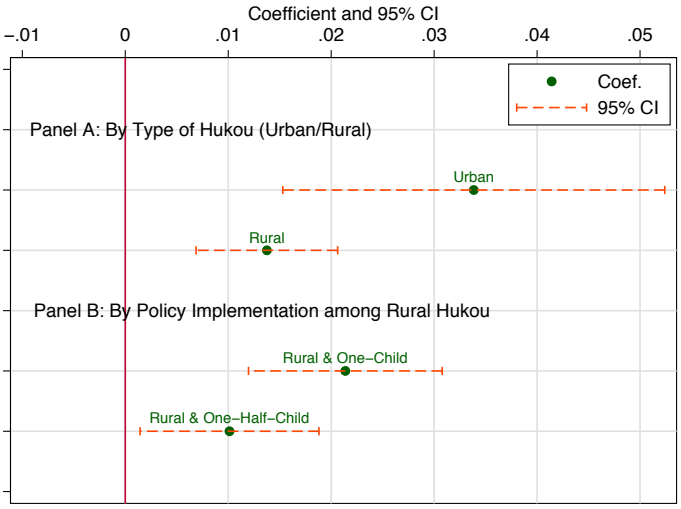
As discussed above, the strictness of OCP differs by urban and rural areas. We keep only women of Han ethnicity, divide the sample by the type of *hukou*, and re-estimate equation 1 in each. The results are reported in Panel A of Figure 6b. We further divide the rural sample according to whether the province implements the "One-and-Half Children Policy" and conduct the same analysis in the two subsamples in Panel B of Figure 6b. Panel A of Figure 6b shows that the

Figure 6: Effects of fertility fines at 10-19 years of age on senior high school completion, by ethnicity, type of *hukou*, and policy implementation

(a) By gender and ethnicity



(b) By type of *hukou* and policy implementation



NOTE: Data source is China Censuses 2000 and 2005. The covariates are the same as those in column 1 of Table 2. OLS regressions are conducted in each corresponding subsample. The confidence intervals are calculated based on the standard errors clustered at province-YoB level.

estimate for urban residents (0.031) is about two times larger than that for rural residents (0.016). This finding is consistent with the looser enforcement and more lenient birth allowance in rural areas. Panel B shows that the effect in the rural areas with a "One-and-Half Children" Policy (0.011) is also smaller than that in rural regions without it (0.020). Consistent with expectation, the results show that the effect of the OCP during the teenage years is greater for regions with stricter policy implementation.

4.5 Placebo Test: Can Education In Earlier Cohorts Predict the Fertility Fine Later?

Another concern is the possibility that the local officials change the fine rate in response to a change in women's education.[20] Although this happens with small likelihood, the associations above would not be interpreted as effects of the OCP had the possibility been true.

We directly examine how much the fine rate would change according to the respective pre-existing educational attainments for women and men. In practice, we regress the fine rate at 24 to 26 years of age on their senior high school completion in our sample, with all the covariates the same as in equation 1. By doing so, we actually examine whether officials will consider the education level of those 24 to 26 years of age as a factor in the design of the current policy fines. Table 3 reports the results.

The first two columns show no evidence for the correlation of the preexisting education level of women with the fertility fines when using all observations and when using the sample composed of the Han majority. The next two columns provide similar results for men. Note that all of the coefficient entries in Table 3 are fairly small: even if the senior high school completion rate, no matter men or women, increases from 0 to 1, the predicted fine rate increase would be smaller than 0.004. The similar coefficients for men and women also suggest that a change in the fine rate may not be correlated with the earlier gender difference in education.

[20] In particular, if the spatial and temporal variation in the OCP fines is affected by the local fertility rate, it may correlate with the preexisting pattern of education of women or the gender difference in education. If this is true, the above results may be driven by this correlation.

Table 3: Placebo Test - Prediction of Education on Fertility Policy Fines in the Future

	(1)	(2)	(3)	(4)
Dependent variable	Policy Fine rate at age 24-26			
Sample	All Women	Women of Han	All Men	Men of Han
Senior High School Completion (Yes = 1)	0.00229	0.000477	0.00406	0.00411
	(0.00337)	(0.00334)	(0.00300)	(0.00299)
	[0.00985]	[0.00977]	[0.00890]	[0.00890]
Observations	826,008	751,781	816,571	741,288
R-squared	0.864	0.869	0.861	0.866
Basic control	Yes	Yes	Yes	Yes

NOTE: Data source is Census 2000 and 2005 Population Study Sample of China. Those from individuals between 26 and 55 years of age are kept. Basic control is the same with that in Table 1. Robust standard errors in parentheses are clustered at province-YoB level, and those in brackets are clustered at province level.
*** p < 0.01, * p < 0.05*

4.6 Evidence from CGSS and Heterogeneous Effects by Family Background

The CGSS provides detailed parental socioeconomic status when the respondents were 14 years of age. We exploit such information to investigate the heterogeneity of the effect across households with different family backgrounds. Because the sample size of minorities is insufficient to conduct any valid regression, we use only the Han sample in the CGSS to double-check the above results by re-estimating equation 1.[21]

The first two columns of Table 4 show the respective results for men and women. Consistent with the analysis using population censuses, we find that the OCP at 10-19 years of age increases education only for women. And the difference between men and women is significant. In column 3, we further control for the parental characteristics when the respondents were 14 years of age, including education (i.e., some formal education), administrative rank (i.e., a rank of subsection chief or higher), and working status (i.e., whether for a state-owned or collective enterprise). The coefficient, however, only changes from 0.042 to 0.040, suggesting that the family background

[21] All of the covariates remain the same except that the CGSS does not have information about the number of siblings, which, as we will show later, is less likely to be a critical issue.

should not bring much bias when ignored.

We investigate the heterogeneous effects by family background because of the strictness of enforcement varies according to family background. For example, individuals employed in state-owned or collective enterprises could risk their jobs and bonded securities and benefits with an illegal birth; party members who violate the regulation face more severe punishment, such as losing their membership, which represents higher social status in China. Thus, these households are more likely to take the fertility control policies more seriously than other households and to form a stronger expectation that their daughters would have low fertility in the future. We include the interaction term of these family background measures with the policy fines in the regression to investigate whether the effects of the OCP are greater for those with higher status, party members, and those who work for state-owned or collective enterprises. Therefore, the results provide consistent evidence that the girls, whose family or parents are in higher SES or facing stricter punishment (other than financial penalties) if violating the fertility policies, would have larger increase in educational attainment when the fertility fines at ages 10-19 increased.[22]

5 Mechanisms

5.1 Econometric Framework

We further explore the later outcomes in the marriage and labor markets and the subjective attitudes toward gender equality and children to examine whether the effect of the fertility policies on the latter outcomes is associated with that on education.[23] It provides some suggestive evidence for the possible explanations for fertility policy-induced higher education under the assumption that the later outcome is likely to reflect the change of the *ex ante* expectations.[24]

[22]However, please bear in mind that the heterogeneous effects have other interpretations: the parents with higher socioeconomic status may be more patient and farsighted, so they would respond more to the OCP even if they faced the same policy enforcement as other people. It is also possible that parents with higher socioeconomic status are more able to pay the tuition for their children's senior high school education.

[23]We thank Professor Lawrence Katz for providing great help and guidance on the methods.

[24]Ideally, we could examine the role of the policy-induced expectations and subjective attitudes in the fertility policy-education nexus if we had information on them for the same periods as the policy fines. Unfortunately, to

Table 4: Impact of OCP on Education in CGSS

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Senior high or above (Yes = 1)					
Sample	Men	Women				
Mean of dependent var.	0.293	0.222				
Fertility fine rate	-0.0154	0.0416*	0.0396*	0.0142	0.0356	0.0247
at age 10-19	(0.0232)	(0.0199)	(0.0198)	(0.0248)	(0.0197)	(0.0219)
	[0.0275]	[0.0171]	[0.0167]	[0.0222]	[0.0160]	[0.0193]
Parents Condition or SES when respondents were 14 years old						
Either parent had			0.0636**	0.0811**		
some education			(0.0087)	(0.0123)		
(Yes = 1)			[0.00912]	[0.0136]		
Either some				0.0323*		
education × Fine				(0.0163)		
				[0.0170]		
Either parent higher			0.1128**		0.1649**	
administrative rank			(0.0262)		(0.0349)	
(Yes = 1)			[0.0299]		[0.0455]	
Either higher rank					0.0676*	
× Fine					(0.0288)	
					[0.0388]	
Either parent in state-			0.1624**			0.1744**
owned or collective			(0.0150)			(0.0182)
enterprise (Yes = 1)			[0.0234]			[0.0228]
Either in state-						0.0349*
owned or collective						(0.0175)
enterprise × Fine						[0.0177]
Observations	6,901	6,901	6,901	6,901	6,901	6,901
R-squared	0.314	0.314	0.354	0.325	0.326	0.327
Basic control	Yes	Yes	Yes	Yes	Yes	Yes

NOTE: Sample is from CGSS 2010 and 2012. Basic control includes indicators for type of living residence, hukou province, year of birth, survey year, interactions between year of birth and survey year, and provincial year of birth (YoB) linear trends. The higher administrative rank is defined as the rank that higher than "Subsection chief". Robust standard errors in parentheses are clustered at province-YoB level. More conservative standard errors in brackets are clustered at province level.

*** p < 0.01, * p < 0.05*

In practice, we keep the Han women, divide the sample by *hukou* province, the type of *hukou*, and the survey year and then conduct the following regressions in each sample:

$$Senior_i^s = \alpha_0^s + \alpha_1^s Fine_{jb}^{10-19} + \alpha_2^s X_i^s + \delta_b^s + \varepsilon_i \tag{2}$$

$$Y_i^s = \gamma_0^s + \gamma_1^s Fine_{jb}^{10-19} + \gamma_2^s X_i^s + \delta_b^s + \varepsilon_i \tag{3}$$

where the superscript s denotes the subsample s. The term X_i^s includes the male proportion of the birth cohort of the *hukou* province and the number of siblings of individual i in sample s, and δ_b^s is a set of birth cohort group dummies (i.e., 1945 to 1960, 1961 and later).[25] We then test whether the effects of the fine on the outcome tend to be larger if the effect on education is larger by plotting γ_1^s against α_1^s, weighted by the representative population in each sample s. If yes, we then conclude that the effects on education are associated with those on the later outcomes. Please note that this methodology *only* examines how the effects of fertility fines on later outcomes change according to the variation in the effects on education, and it is possible that the *average* effects of fertility fines on later outcomes could be positive or negative.[26]

5.2 Empirical Results

Following the method, we examine the following four *ex post* outcomes: marriage age (i.e., whether married at 25 years of age), fertility (ever having a child), labor market participation (current employment status), and occupation (holding a non-manual job).[27] Panel A in Table 5

the best of our knowledge, no public data regarding individual expectations during the 1980s and 1990s in China are available. The earliest survey year is 2000, when the sample that faced a stricter OCP during their teenage years were at least 20 years of age.

[25]Note that we cannot control for the dummies of each specific birth cohort because within each *hukou* province the identification is based on the time-series variation in the fine rate within each sample s.

[26]For example, it is possible that the *main* effects of fertility fines on women's labor supply may be negative because of bargaining power within marriage or positive because of fewer children. When people expect *relatively* more labor supply in the future (i.e., the coefficients are less negative/more positive) and thus invest in education more, we may still identify a positive correlation between the effects on education and those on the labor supply by using this methodology.

[27]A non-manual job is defined as a party leader, firm manager, administrative staff, and highly skilled workers including science researchers, engineers, and professors.

Table 5: Means and Standard Deviations of the Variables in Census and CGSS for Women of Han

Variables	(1)
Panel A: Census Data	
Married before 25 (Yes = 1)	0.77
	(0.42)
Ever had Child (Yes = 1)	0.94
	(0.23)
Work Now (Yes = 1)	0.75
	(0.44)
Having professional jobs (Yes = 1)	0.13
	(0.34)
Observations	788,585
Panel B: CGSS data	
Agreement with the statement (1-5, higher for agreement)	
"The happiest thing is to look at children growing up"	3.37
	(0.57)
"Adult children are important support for old people"	2.91
	(0.85)
"Men and women have the equal duty for housework"	3.94
	(1.00)
Agree with "Mother should stay at home and father work outside if having a pre-school child at home"(Yes =1)	0.55
Observations	6,901

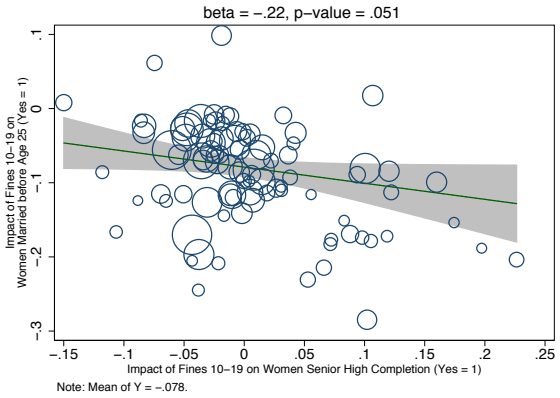
Notes: Standard deviations in parentheses. The sample in Panel A are the same with that in Panel A of Table 1. The sample in Panel B is the same with that in column 2 of Table 4.

presents the means and standard deviations for the variables. In particular, 77 percent of women are married before 25 years of age, 94 percent have had a child, 75 percent are working, and 13 percent hold non-manual jobs.

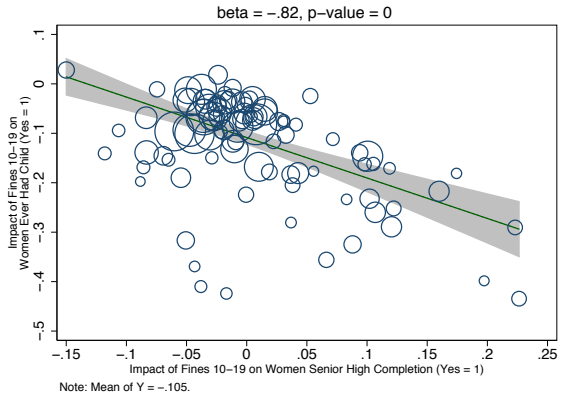
Figure 7a and 7b show a negative correlation between the effects on education and those on the likelihood of being married at 25 years of age and of currently having children, respectively. Such correlations imply that women with a higher policy-induced education level are also likely to be unmarried or currently have no child due to the policy. Similarly, Figure 7c and Figure 7d also provide consistent evidence by showing the positive correlations of the effects on education with those on working and professional job occupation.

Figure 7: Correlation Between Effects of OCP Fines on Education and those on Marriage and Labor Market Outcomes in Census

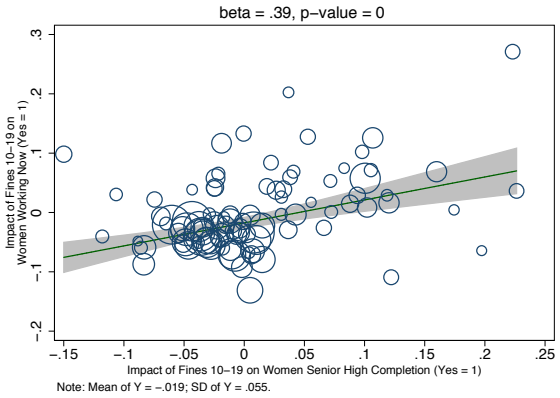
(a) Married before 25



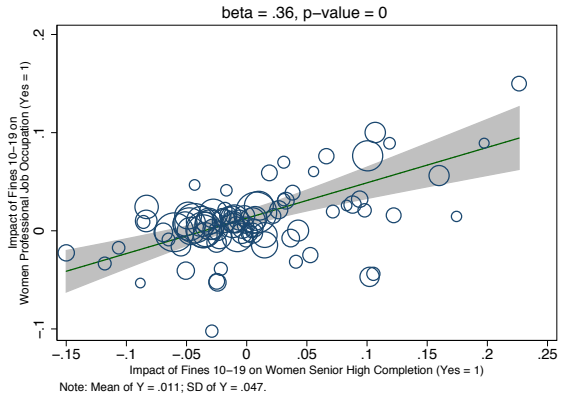
(b) Ever had a child



(c) Working status



(d) Higher-level occupation



NOTE: Data source is Census 2000 and 2005 Population Study Sample of China. The four figures are plotted for different later outcomes, respectively. Each point is plotted based on the effects of fertility fines on senior high school completion (X-axis) and the effects on the later outcomes (Y-axis) in the same subsample. Area of the circles reflects the corresponding population size. The slopes and the P-values are shown on the top of each figure.

We then conduct a parallel analysis of the attitudes toward children and gender equality in the CGSS, and Panel B of Table 5 presents the means and standard deviations for the variables.[28] Figures 8a-8d show the respective correlations between the effect of the OCP on each measure for the attitudes and those on education.

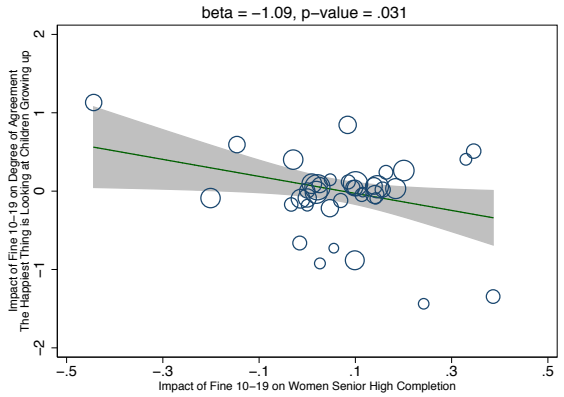
Figure 8a and 8b show that the greater positive effect of the fertility policy on education is correlated with a larger negative (or smaller positive) effect on agreement with the statements that "the happiest thing is to watch children growing up" and that "adult children are important support for old people." Similarly, Figure 8c and 8d consistently show that those with more gender-equal views caused by the fertility policy are more likely to have a higher policy-induced education level. In other words, the more fertility policies increased on the gender-equality and self-reliability attitude, the more the policies increased girls' education. The correlations are less significant due to the much smaller sample size.

To sum up, we find significant associations between the effects of the fertility policies on education and those on outcomes in the labor and marriage markets as well as some subjective attitudes. These results suggest that the OCP-induced expectations for the future could induce a greater motivation for educational investment. However, we should bear in mind that these associations are *not causal or determinant.* The effects of the policies on later outcomes may also be consequences of the policy-induced increased education. We look forward to studies in the future may shed some light on this.

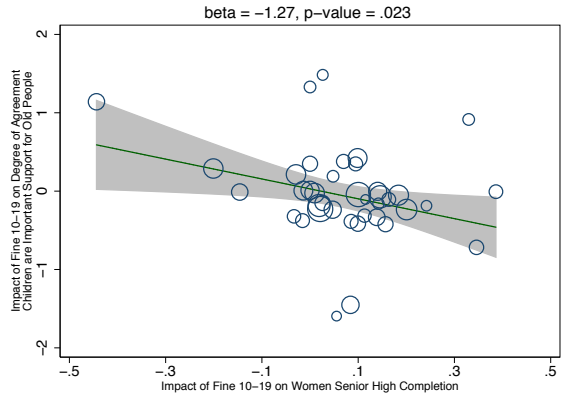
[28] Specifically, the women have almost neutral attitudes toward the importance of children; the mean values of the two measures for children are around 3 when subjects were asked whether they agree that "the happiest thing is to watch children growing up" and that "adult children are important support for old people." Regarding gender equality, they tend to agree that men should have equal duty regarding household work with women, with a mean value of almost 4 ("Agree"), but more than half of the women think that women should stay at home and that the father should work outside the home when there is a pre–school-age child at home. Because the sample is much smaller for the CGSS, we only divide the sample by the province and type of *hukou*.

Figure 8: Correlation Between Effects of OCP Fines on Education and those on Attitudes regarding Children and Gender Equality in CGSS

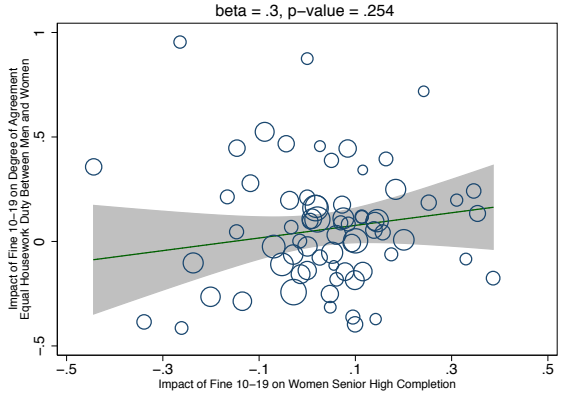
(a) "The happiest thing is looking at children growing up"



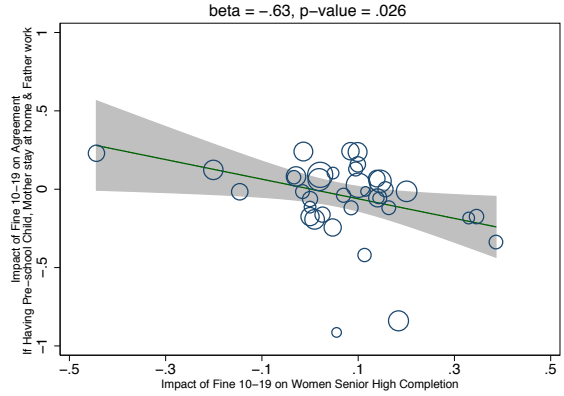
(b) "Adult children are important support for old people"



(c) "Equal housework duty between men and women"



(d) "Mother stay home & father work if having a preschool child"



NOTE: Sample is from CGSS 2010 and 2012. The four figures are plotted for different later outcomes, respectively. Each point is plotted based on the effects of fertility fines on senior high school completion (X-axis) and the effects on the later outcomes (Y-axis) in the same subsample. Area of the circles reflects the corresponding population size. The slopes and the P-values are shown on the top of each figure.

6 Conclusions and Discussion

The past century witnessed a rise in educational attainment for women all over the world and the emergence of fertility policies in many countries. This paper examines the relationship of the two phenomena by investigating the effects of fertility policy implementation during the teenage years on women's education in China.

Using the temporal and regional variation in the financial penalties of OCP, we show a positive effect of the policy fines at 10 to 19 years of age on the likelihood of completing senior high school in women of Han ethnicity. The magnitude, (i.e., 1-year-household-income increase in the fine rate predicts a 2-percentage-point increase in the rate of senior high school completion), explains over 30 percent of the increase in women's education in the birth cohorts studied (i.e., 1945-1979). Meanwhile, the analysis finds no effect of the fertility policies among women of minorities or men of Han, which, first provides some evidence for the exogeneity of the fertility fines used in this paper, and also suggests that the differential effects of OCP could explain 50 percent of the narrowing in gender gap in education.

To shed light on possible mechanisms, we examine the associations between the effects of fertility fines on women's education and the effects of the policies on their future outcomes. Consistent with the previous literature (Goldin and Katz, 2002; Field and Ambrus, 2008; Miller, 2010), we find that the effects of family planning policies on women's education are significantly associated with those on the outcomes, including late marriage, employment and subjective attitudes toward children and gender equality.

Exploiting the unique policy settings in China, we provide a novel explanation to women's rise in education and economy. The evidence from this particular country sheds some light on the emerging worldwide phenomenon by establishing the relationship of the fertility policies with the accumulation of women's human capital and the narrowing of the gender gap in education. Note that the fertility policies were widely implemented in many countries in last century, especially mid- and low- income ones (Miller and Babiarz, 2014), the findings in this paper may put the research in agenda to investigate further evidence from other countries in the future. In addition,

the associations of the effects of the policies on education with those on later *ex post* outcomes provide some qualitative and suggestive evidence on the the possible mechanisms. These basic findings in this paper also call for the studies to further clearly identify the possible mechanisms.

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