The Great Expectations: Impact of One-Child Policy on Education of Girls*

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Abstract

The rise of women in education is an emerging worldwide phenomenon. Using the temporal and regional variations in financial penalties of One-Child Policy in China, we find that higher fertility fines during girls’ teenage years raised their educational attainment, which explained 30% of the increase in education of women born 1945-1980. We also find that the impacts on women’s education are consistently associated with those on female labor force participation and non-manual occupation, delayed marriage and childbearing, and attitudes regarding children and gender equality. These findings highlight the role of fertility policies in women’s empowerment in the past century. (JEL codes: D84, I20, J13, J16, J18)

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I. Introduction

The rise in the educational attainment of women has been one of the most significant changes during the past century in many countries of the world (Goldin et al., 2006; Goldin and Katz, 2009; Dulfo, 2012). It was accompanied by an increased involvement of women in the economy and an enhancement of their socioeconomic status both in society and in the family. For example, women comprised 10% of first-year law students in the United States in 1970 and 36% in 1980 (Goldin and Katz, 2002). 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. For example, Goldin and Katz (2002) and Bailey (2006) 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 pills’ power may not apply in East Asian countries like China because a much smaller proportion of women take contraceptive pills.

This paper builds up the literature by investigating the impact of the implementation of the birth control policies during women’s teenage years on their educational achievement. Although these policies restricted the fertility of millions of couples for many decades (Miller and Babiarz, 2014), the potential effect of them on women’s education has received relatively less attention from researchers. This study aims to fill this gap.

1Goldin 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 in the world. This is especially true for countries with a real gross domestic product per capita greater than $3000 (PPP 2000 $).

2For other explanations, 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. (2011) 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.

3The United Nations Population Division (2006) shows that only 1.7% of women of reproductive age (15 to 49 years) in China take contraceptive pills, compared to 15.6% in the United States (United Nations Population Division, 2005). In addition, the maternal mortality rate in China in 1990 was less than 0.097%, which is much lower than that quoted by Jayachandran and Lleras-Muney (2009).

4One exception is Miller (2010), which found that the policy introduction during fertility ages (i.e., 15 to 49 years of age) decreases fertility and increases the women’s socioeconomic status in Colombia.
Why do the birth control policies during the teenage years matter to the educational investment of women? Similar to the ideology of previous literature (e.g., Jayachandran & Lleras-Muney, 2009; Jensen, 2010; Oster et al., 2013), the motivation of educational investment may increase because the policies lowered the expected quantity of children and raised the perceived return of education. The mechanisms could have multiple aspects. First, with fewer children to care for, women are more likely to become involved in labor market activities. Second, with the expectation of lower fertility, women (or their parents) will re-optimize the timing of their marriage and fertility. They will most likely delay their marriage and childbearing, which lowers the costs for a longer duration of high school education (Field & Ambrus, 2008). Third, 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. Finally, these birth control policies may, on the whole, increase women’s socioeconomic status including education (Chiappori & Ore, 2008). The asymmetric fertility-related costs between genders are worthy of note: women bear the major share of the costs of childbirth and are generally the primary caregivers. This implies no or smaller effects of the fertility policies for men, suggesting that the effects could presumably explain the narrowing of the gender gap in education.

China provides a unique opportunity to investigate the relationship between women’s rising education and fertility policies. For one thing, China experienced a rapid increase in female education and a convergence of the gender gap in the late 20th century (Rosenzweig & Zhang, 2013). Figure 1a shows that the rate of senior high school completion for women almost doubled from 13% among those born between 1945 and 1960 to 24% for those born in the 1970s. Meanwhile, the rate of senior high school completion for men only increased from 21% to 28%; thus, the gender gap narrowed by half from 8 to 4 percentage points. Figure 1b shows a similar pattern for college completion.

[Figure 1a and 1b about here]

In addition, China formally initiated birth control policies in 1979, also known as the “One-Child Policy” (OCP) (Greenhalgh, 1986). Unlike birth control policies in many other countries, the OCP compulsorily assigned a “one-birth” quota to each couple in general,
and there was great variation in its implantation across regions and ethnicities and over time. 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 fertility rate dropped from 2.81% in 1979 to 1.51% in 2000 (World Bank). It can also be seen in Figure 1a and 1b that the gender gap in education narrowed with the 1960s and consequent birth cohorts. The 1960s birth cohorts were in their teenage years when the policy was initiated.

Our analysis shows that the above finding is not a mere coincidence. Using the regional and temporal variations in the average monetary penalty rate for one unauthorized birth in the province–year panel from 1979 to 2000 (Ebenstein, 2010; Wei & Zhang, 2010; Huang et al., 2015), we find that an increase in OCP fines by 1 year of household income during the teenage years (i.e., 10 to 19 years of age) predicts an increase of 2 percentage points in the rate of senior high school completion among women of Han ethnicity. The magnitude of the estimates is large, indicating that the fertility policy explains 30% of the increase in women’s education and 50% of the narrowing of the gender gap in the birth cohorts from 1945 to 1980. The results are robust to a series of econometric models.

The identification assumption of exogenous variations of the penalties should not be taken for granted. We thus conduct a series of empirical tests. First, our results are robust to also control for local population growth and regional assignment of educational resources. Second, we investigate the regional heterogeneous effects in urban and rural areas in which the strictness of policy implementation differed and consistently find greater effects in regions with stricter implementation of the policy. Finally, we investigate the effects of the fines on two plausible placebo groups: (1) women of minority groups, because they are less subject to the fertility policy and (2) men of Han ethnicity, who, as noted earlier, take less responsibility for childcare and presumably less affected by the fertility policy. We consistently find no effects of the fines in either group.

Further investigating the heterogeneity by family background with the China General Social Survey (CGSS) data, we find greater effects of the OCP when parents have a higher level of education, work in the public sector, or have a higher administrative rank. These

\[5\] In our preferred model, with consideration of the heterogeneous time trends in development and feminist attitudes toward women’s education and careers across regions, we also control for province-specific linear trends in birth cohorts in addition to the fixed effects for both regions and calendar years.
findings are consistent with the implementation of the policy: individuals who work in the public sectors or have a higher level of socioeconomic status face stricter enforcement and strengthened regulations.

We further explore whether the effect of policy fines on girls' education are corresponding with the effects on their later outcomes. We consistently find that the greater positive effects of the policy fines on girls’ education are associated with greater positive effects on late marriage, as measured by marriage by 25 years of age; late fertility, as determined by whether the woman ever had a child; labor force participation, as determined by working status; and employment in a professional (or white collar) job. The results are consistent with those of Goldin & Katz (2002), Bailey (2006, 2010), and Miller (2010). Parallel analysis also finds consistent evidence for attitudes on gender equality and dependence on children. For one thing, these associations may provide possible explanations for fertility policy–induced higher education under the assumption that the later outcome is likely to reflect the change of the \textit{ex ante} expectations. For another, the estimates may also imply the long lasting effects of the fertility policies on women’s social status through increased educational levels.

This study builds up several literatures. First, it contributes to the literature on women’s empowerment (e.g., Goldin et al., 2006; Goldin & 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 education investment (e.g., Chiappori et al., 2009; Jensen, 2001, 2010, and 2012; Bursztyn & 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 & Lleras-Muney, 2009; Oster et al., 2013).

The paper is organized as follows. The next section introduces the background and our measurement for the OCP. Section III introduces the micro level data used in the analysis, including the Population Census 2000, the 2005 One-Percent Population Survey, and the...

\footnote{For example, Miller (2010) suggested that lowering the costs of first-birth postponement enable young women to obtain more education and to work more and live independently later in life.}

\footnote{Different from the findings of previous studies that examined the effects of fertility policies on human capital accumulation through the quantity-quality trade-off theory (e.g., Qian, 2009; Rosenzweig & Zhang, 2009), this paper emphasizes the effects of policy implementation during the teenage years on human capital accumulation by forming expectations and increased motivation in education.}
CGSS. Section IV shows the empirical results for the effects of the OCP on educational attainment, and Section V provides additional results for possible mechanisms, and Section VI concludes.

II. 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, and enforcement gradually tightened until it was firmly established across the country in 1980 (Banister, 1987). This was the first time that family planning policy formally became one article in the laws of China. Enforcement varies across regions. Studies have found that the strictness of enforcement is well reflected by the monetary penalties and subsidies that have been implemented since 1979 (Goodkind, 2011). The measure used for the OCP in this study is the average monetary penalty rate for one unauthorized birth in the province–year panel from 1979 to 2000, which is taken from Ebenstein (2010). The OCP regulatory fine is formulated in multiples of annual income (Ebenstein, 2010; Wei & Zhang, 2010; Huang et al., 2015). It is called a “social child-raising fee” in China, and this paper uses “policy fine” for the sake of brevity. Appendix Figure A1 shows the pattern of policy fines from 1980 to 2000 in each province.\(^8\)

The OCP in principle restricts a couple to having only one child. However, the de facto regulations vary among different regions and ethnicities. In 1984, the Central Party Committee issued “Document 7” in recognition of the diversity of demographic and socioeconomic conditions across China. 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 (Gu et al., 2007). On the one hand, implementation of the OCP differs for Han and for

\(^8\)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.
minorities. It is mainly focused on the Han ethnicity, which is the largest ethnic group in China and makes up 92% of the population. In all provinces, most minorities are allowed to give birth to another child or have no restrictions. On the other hand, the regulations of the OCP also differ in urban and rural areas. 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 many 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 general, enforcement of the OCP in rural areas is also looser than in urban regions. Our analysis also exploits the different policy implementations to testify to the consistency of the results.

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 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 for local officials (Liang, 2014). To motivate local officials to implement the OCP, the local performance in its implementation is closely correlated with officials’ chances for promotion (Serrato et al., 2015). To ensure the fine’s enforcement upon violation, those who have an “illegal” birth but do not pay the fine can be sued by the local Population and Family Planning Commissions and the fine will be collected compulsorily. The provincial governments also set up detailed regulations to ensure the effective collection of policy fines. For example, the illegal birth child cannot be registered to the residency, also called hukou, system if the fines are not paid; thus, the child cannot go to school because the hukou is a requirement at school entrance. Property can also be confiscated for nonpayment of policy fines.\footnote{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. (Source in Chinese: http://baike.baidu.com/subview/5708887/5757115.htm)}

The publicity of the OCP disseminated information from two aspects: the harsh punishment to deter excess fertility, and the equal status and equal rights of women in the next generation. The latter is meant to alter the incentive behind excess fertility. The attempt can
be reflected by a few widely used slogans (See Appendix Figure A2). For example, a typical poster in the 1980s portrays proud parents watching their young girl studying happily and imagining the girl’s bright future. The slogan reads “Labor is the most glorious, and women can be heroes too. We are in a different time, and the children’s sex does not matter much.”

The change in expectations for girls can be also revealed by the names of girls born during the 1970s and 1980s, when the OCP was most intensive. As in English, male and female names used to be easily differentiated in Chinese before the OCP (Watson, 1986). However, for the generations born during the family planning policy, the parents expected their baby girls to fulfill roles that used to be filled by boys and gave neutral names to their daughters. It also became common for girls to be named Nan, which means “male” in Chinese. 

III. Data

3.1 China 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, region of residence (prefecture level), type of hukou (urban/rural), hukou province, ethnicity (Han/Minorities), marital status, number of siblings, and relation to the head of household. 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 the analysis in this paper. For the analysis of education, we keep respondents aged between 25 and 55; thus the earliest birth cohort in our analysis is 1945 and the latest 1980. We keep those above 25 years of age who were born no later than 1980 because (1) most of the respondents have completed their formal education before the survey and (2) we

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10 For example, Shengnan Sun, born 21 January 1987, is a Chinese female professional tennis player. Her given name means “outperforming boys.”

11 Prefecture is the lower level of province. 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.
want to avoid the identified effect of the OCP originating from a smaller number of siblings.\footnote{We further include the number of siblings where available to control for the effect of the OCP on education through the Quantity-Quality trade-off channel. 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; Section 4 shows more details.}

Education is divided into six levels: illiterate, primary school, junior high school, senior high 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%, whereas that just after primary school (i.e., just before junior high) is only 36%; 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 contaminated by the laws’ effect; third, the college completion rate is fairly low for these cohorts (i.e., less than 6%) and thus may not have any valid variation for identification. We explore college completion to check for robustness in this study.

\subsection*{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.\footnote{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.} 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 = “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 to those born between 1945 and 1980. The rate of senior high school completion is 24% for women and 31% 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.

IV. Effect of the OCP During the Teenage Years on Education Attainment

4.1. Education Response to Fertility Policy Fines During Teenage Years

We begin the analysis by applying an “Event Study” to investigate 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 2a-2c 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. All the results are weighted by the population in each birth cohort–province–hukou. Table 1 reports the corresponding OLS results, with the standard errors clustered at the province level. In this part, we only retain the ones born no earlier than 1965 because the fine rate during the teenage years is also unchanged for earlier cohorts. 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.

Both Figure 2a and the first column in Table 1 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. The estimation suggests that a 1-year–household–income increase in the fine rate during the teenage years predicts a 2-percentage-point increase in the rate of senior high school completion. In contrast, Figures 3b and 3c and the remaining columns of Table 1 suggest no correlation either among Han men or among minority women.

[Table 1 about here]

[Figure 2a-2c about here]

4.2 Effect of the OCP During the Teenage Years on Education Attainment

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

\[ Senior_{ijbt} = \beta_0 + \beta_1 Fine_{10-19}^{jb} + \beta_2 X_i + \delta_b + \delta_t + \delta_j + \theta_j Prov_j \times T + \varepsilon_i \]

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.

\( Fine_{10-19}^{jb} \) denotes the mean value of the fine rate in province \( j \) in the years in which birth cohort \( b \) was between 10 and 19 years of age. 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.\(^{14}\)

The set of control variables, \( X_i \), includes the logarithm of the birth cohort size, the sex ratio in the corresponding birth cohort of the local hukou province, and indicators for the type of hukou (urban/rural) and the number of siblings. \( \delta_b \), \( \delta_t \), and \( \delta_{bt} \) denote 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.\(^{15}\) \( \delta_j \) denotes the dummies for hukou province that capture the time-invariant heterogeneity across provinces, and \( Prov_j \times T \) are

\(^{14}\)Inter-province migration is a potential problem. It is also possible that the hukou will be moved to another province. The census 2005 data provide information on the birth province, which shows that more than 93% of individuals are living in the same province in which they were born. The results are consistent if the birth province is used.

\(^{15}\)The results are consistent if we drop the interaction terms.
the province-specific birth linear time trends to control for any potential trend in feminist views or attitudes toward women’s education and careers in each province.

The coefficient $\beta_1$ is of our main interest because it presents the impacts of the OCP fine rate during the teenage years on the likelihood of senior high school completion. Panels A and B of Table 2 present the OLS point estimation for $\beta_1$ among women and men of Han ethnicity, respectively. The standard errors (in parentheses) are clustered at the province–year of birth level, and those in brackets are clustered at the province level. The estimate in column 1 of Panel A indicates that a one-unit increase in the OCP fine for an additional illegal birth during the teenage years is positively associated with a statistically significant increase in the likelihood of completing senior high school for women, but not for men. Note that the coefficient is very close to the result reported in Table 1. In addition, the magnitude is also economically significant: it implies that the increase in the OCP fine (i.e., 1.4 years of local household income) contributes a 2.8-percentage-point increase in the rate of senior high school completion in women for the birth cohorts from the late 1940s to the 1970s, suggesting that the OCP explains about 30% of the educational increase for the women born during that time.

[Table 2 about here]

Because men bear smaller costs for childbirth and are generally the secondary caregivers, we expect that the effect of the OCP should be smaller for men. The estimate in Panel B shows the results for Han men. Comparing the effects for women and men, the OCP explains about 50% of the narrowing of the gender gap among the sample group. The results in Table 2, Panel B, not only show the contribution of the forces from the OCP to the narrowing of the gender-gap but serve as suggestive evidence that fertility fines was unlikely to be entangled with other policies during the time. If the effect of the fertility policy fine had come from other confounding factors such as education policies or economic development, it is highly likely that we would find a similar effect for men.

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 education attainment. According to the documentation of the OCP, the fertility
policy fine may change according to the population size and its potential increase, which may be correlated with women’s educational level due to competition and other resources allocated by the central government to the province. Therefore, in Table 2, column 2, we also 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, indicating that the incentive to raise the policy fine caused by a potential population increase is not an important confounding factor.

To control for the potential correlation between the fertility fine and government support of education,\textsuperscript{16} we include variables that capture the education supply, including (the logarithm of) the number of primary schools and junior high schools. The results are reported in Column 3. The results show that the effect of the policy fine is quite robust, suggesting that the fertility policy–induced education should mainly originate from the forces from the education demand side, such as the higher policy-induced incentive in education among girls themselves or their parents.\textsuperscript{17} Appendix Table A1 shows the effect of the OCP fine rate on the rate of college attainment. This is a parallel analysis to Table 2. The results are highly consistent. An increase in the policy fine by 1-year household local income predicts an increase in the rate of college completion by 0.65 percentage points among Han women; the coefficient for men is insignificant, with half of the magnitude. The coefficients remain similar when controlling for population size and growth or the number of local primary schools or junior high schools.

The above analysis established the relationship between the policy restriction during the teenage years (i.e., 10 to 19 years of age) 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

\textsuperscript{16}Some confounding factors may originate from such education-supporting policies as Compulsory Schooling Laws in 1986.

\textsuperscript{17}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.
is made when children are teenagers, it should be reasonable that policy changes that occur at older ages should not matter.\textsuperscript{18} In contrast, it is more likely an empirical question of whether policy changes at earlier ages matter because expectations could be formed during a quiet long time span that lasts from childhood to the age of senior high school entrance. 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 policy fine at 10 to 19 years of age with that at 6 to 9 years of age and that at 20 to 23 years of age in the regression. Figure 3 reports the results for women and men accordingly. It is not surprising that all of the estimates are small in magnitude and insignificant. The estimates in the female sample suggest that changes at 10 to 19 years of age matter most, with a significant coefficient of 0.021. The coefficient for the fine rate at 6 to 9 years of age is much smaller (0.010) and has a wider confidence interval. Consistent with our expectation, the estimate for the effect of policy fines at 20 to 23 years of age is also much smaller (0.006), though significant. A possible reason for the significance may be that some students went to school at a later age, but we cannot determine the exact answer without further information. 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.

[Figure 3 about here]

4.3 Further Evidence: Heterogeneity of the Effect of Policy Implementation on Education Attainment

There are officially 56 ethnicities in China; Han are the majority, accounting for 92% of the population in the 2005 census. A large portion of the minorities live in remote areas and have lower socioeconomic status in general. Due to their smaller populations and for

\textsuperscript{18}Generally, children in China begin senior high school at 15 years of age and graduate at 18 years of age, but the age has some variation due to regional policies and social norms. In the 1960s, many children went to school at a later age.
political reasons, most minorities are exempted from the restrictions of the policy (Gu et al., 2007; Li et al., 2010). This paper follows the ideology from prior research to use minority women as a natural control group for the effects of OCP.

Figure 4 shows the senior high school completion rate for women in the birth cohorts between 1945 and 1980 among Han and minority women, respectively. The senior high school completion rate among minority women is lower in general. More importantly, the gap between these two groups expanded in the post-1960 cohorts, i.e., the first cohorts to experience the OCP during their teenage years, suggesting that the OCP during the teenage years is likely to be an important factor contributing to female education improvement.

[Figure 4 about here]

Figure 5a, Panel A shows that the coefficient of the benchmark analysis using the sample composed of 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. 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 than that estimated for the Han women. Thus, we provide evidence that the effect of the OCP on education exists only among Han women, but not among Han men or minority women.

[Figure 5a and 5b about here]

As discussed above in Section II, the strictness differs by urban and rural areas. Therefore, we keep only women of Han ethnicity, divide the sample by the type of hukou, and estimate Equation (1) in each separate sample. The results are reported in Panel A of Figure 5b. We then 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 5b. Panel A of Figure 5b shows that the 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 our expectation, all of the results show that the effect of the OCP during the teenage years is greater for regions with stricter policy implementation.

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

If local officials change the fine rate in response to a change in women’s education or factors related with education,\textsuperscript{19} we should be able to observe the correlation between the educational level and the fertility fine implemented after the teenage years of these birth cohorts.

To test this conjecture, we estimate how much the fine rate would change according to the respective pre-existing educational attainments for women and men. In practice, we estimate the correlation between the local education level of the birth cohorts and the fine rate when these cohorts were 24 to 26 years of age, because almost all individuals have completed their education at 24. We regress the fine rate at 24 to 26 years of age on their senior high school completion (Yes = 1) 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.

[Table 3 about here]

The first two columns show no evidence for the correlation of the preexisting educational 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 increases from 0 to 1, the predicted fine rate increase would be smaller than 0.004 for both men and women. 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.

\textsuperscript{19}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.
4.5 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 regression, we use only the Han sample in the CGSS to double-check the above results by re-estimating equation (1). 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. The first two columns of Table 4 show the respective results for men and women. Consistent with the analysis using population census, we find that in the CGSS data, the OCP during the teenage years affects education mostly for women, and we detect no effect on men. 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), political status (i.e., a party member), administrative rank (i.e., a rank of subsection chief or higher), and working status (i.e., whether for a state-owned or collective enterprise). These measures for parental socioeconomic status are likely to be strongly correlated with the respondents’ number of siblings. The coefficient, however, only changes from 0.042 to 0.040, suggesting that the family background or the number of siblings should not bring much bias when ignored.

[Table 4 about here]

Another motivation to investigate the heterogeneous effect by family background is that 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. The remaining columns of Table 4 provide consistent evidence of this conjecture: all of the coefficients on the interactions are positive and significant. Note, however, that the heterogeneous effects have at least one other interpretation: 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.\textsuperscript{20}

V. Associations of the Effects on Education with Those on Later Outcomes

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.\textsuperscript{21} For one thing, it provides possible explanations for fertility policy–induced higher education under the assumption that the later outcome is likely to reflect the change of the \textit{ex ante} expectations.\textsuperscript{22} For another, this investigation also suggests the long lasting effects of the fertility policies on women’s social status through increased educational levels.

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:

\begin{align*}
(2 - 1) \quad Senior_{i}^{s} &= \alpha_{0}^{s} + \alpha_{1}^{s} F ine_{j}^{10-19} + \alpha_{2}^{s} X_{i}^{s} + \delta_{b}^{s} + \varepsilon_{i} \\
(2 - 2) \quad Y_{i}^{s} &= \gamma_{0}^{s} + \gamma_{1}^{s} F ine_{j}^{10-19} + \gamma_{2}^{s} X_{i}^{s} + \delta_{b}^{s} + \varepsilon_{i}
\end{align*}

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 $\delta_{b}^{s}$ is a set of birth cohort group dummies (i.e., 1945 to 1960, 1961 to 1970).

\textsuperscript{20}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.

\textsuperscript{21}We thank Professor Lawrence Katz for providing great help and guidance on the methods.

\textsuperscript{22}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 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.
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. 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 $\gamma_1^s$ against $\alpha_1^s$, weighted by the representative population in each sample $s$. If we find a significant correlation between the coefficient $\gamma_1^s$ and $\alpha_1^s$, we can then conclude that the effects on education are associated with those on the later outcomes.

### 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).\[^{23}\] Panel A in Table A2 presents the means and standard deviations for the variables. In particular, 77% of women are married before 25 years of age, 94% have had a child, 75% are working, and 13% hold non-manual jobs.

Figure 6a-6d shows the correlation of the effects on education with those on the four outcomes separately. For example, Figure 6a and 6b 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 educational level are also likely to be unmarried or currently have no child due to the policy. Similarly, Figure 6c and Figure 6d also provide consistent evidence by showing the positive correlations of the effects on education with those on working and professional job occupation. Note that all of the correlations in the four figures are significant at a 1% level.

We then conduct a parallel analysis of the attitudes toward children and gender equality in the CGSS.\[^{24}\] Panel B of Table A2 presents the means and standard deviations for the

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\[^{23}\] A non-manual job is defined as a party leader, firm manager, administrative staff, and highly skilled workers including science researchers, engineers, and professors.

\[^{24}\] Because the sample is much smaller for the CGSS, we only divide the sample by the province and type of hukou.
variables. 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. Figure 7a-7d shows the respective correlations between the effect of the OCP on each measure for the attitudes and those on education.

[Figure 7a – 7d about here]

Figure 7a and 7b 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 7c and 7d consistently show that those with more gender-equal views caused by the fertility policy are more likely to have a higher policy-induced educational level. In other words, the more fertility policies increased on the gender-equality and self-reliability attitude, the more the policies increased girls’ education, although the correlations are less significant (only at a 10% level) 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 provide consistent evidence that the OCP changed the expectations for the future, which induced greater motivation for education investment. Note that these associations are not causal. The effects of the policies on later outcomes may also be consequences of the policy-induced increased education.

VI. 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 variations in the policy’s financial penalties, we show that higher policy fines at 10 to 19 years of age predict a higher likelihood of completing senior high school in women of Han ethnicity. The magnitude explains 30% of the increase in women’s education in the birth cohorts from 1945 to 1980. Meanwhile, the analysis finds no effect of the fertility policies among minorities or men, who are less subject to the policy. Consistent with the findings of previous studies (e.g., Goldin and Katz, 2002; Bailey, 2006, 2010; Miller, 2010), we find some evidence that when the effects of family planning policies on women’s education are larger, the effects of the policies on their future outcomes are also larger. More specifically, the effects of family planning policies on women’s education are 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.

The study has some limitations that bear mention. The first concerns the endogeneity of the fertility fine rate. Without official documentation on the design of the policy fines, we do not have exact information regarding how and why the fine rate changes. Although we cannot rule out the potential endogeneity and the potential bias completely, the empirical tests conducted in this paper show that it may not be the first-order driving factor for our results. The second is about the associations of the effects of the policies on education with those on later ex post outcomes. The evidence can not be fully considered as determinant or causal since the associations may reflect the effects of policy-induced expectations on education as well as the effects of the fertility policies on women’s socioeconomic status through increased educational levels. In addition, although these associations provide some
evidence for the possible mechanisms or consequences of policy-induced education, yet it is still likely we may miss some other important channels or consequences.
References


