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Abstract

How does future expected fertility affect current educational investment? Theory suggests that expected fertility can impact both returns to education and the resources available for parental consumption. Using policy data about varying eligibility criteria for second child permits during the One-Child-Policy in China, I investigate the effect of eligibility status on fertility and education. In the 1990s, second child permits increased the likelihood of having a second child by 11 percentage points. Being allowed to have a second child increased schooling by 0.7 years on average, an effect that is likely concentrated in the subset of individuals for whom the permit constraint is binding.

Keywords: Fertility, Schooling Investment, Family Planning, China

JEL Classification Numbers: I25, I26, J13, J24, O15.

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1 Introduction

Is there a trade-off between having children and acquiring education? Most empirical literature suggests a negative relation between a parent's educational level and the number of children. There is strong evidence indicating that women tend to have fewer children once educated. However, this does not answer the question of whether men and women that expect to have several children in the future choose to pursue a higher or lower level of education than those who expect none or few. Theory suggests that expected fertility can influence schooling investment through two economic channels: life-time returns to schooling, and family consumption. However, as the two channels can have opposite effects, the overall effect on education is ambiguous, and an empirical investigation is required.

China's One-Child-Policy provides a unique opportunity to evaluate empirically the effect of expected fertility on educational investment: having a second child was allowed with a "second child permit" and the eligibility criteria for these permits were set on the provincial level. The provincial and temporal variation in the opportunity to have a second child without having to pay fines provides quasi-exogenous individual variation in the cost of the second child. After establishing that eligibility for a second child permit is a strong predictor of having a second child, I use the eligibility status of an individual at secondary education age as a proxy for expected fertility in order to investigate its effect on educational investment.

The answer to this question is important for policy makers considering how reforms that affect fertility potentially influence educational investment. Policy makers might be concerned that policies that encourage individuals to have children, such as parental leave or free child care, have the side effect of keeping future parents from investing in education. This paper argues that under certain circumstances, higher expected fertility can actually increase educational investment.

Basic educational decisions are typically taken before individuals have children, however, these individuals and their families might take into account how many they expect to have in the future. A basic two period model is used to motivate the empirical analysis and illustrate two channels

through which fertility expectations can affect educational investment: First, when having children is seen as costly (rather than as an investment), children decrease future parental consumption and thereby increase the incentives to use educational investment to transfer consumption to the future. Second, children can affect the time their parents can spend working in the labour market and in this way impact lifetime returns to education. When the second mechanism is relatively weaker than the first, planning on having more children can increase educational investment.

For the empirical investigation, I use variation in the provincial regulation during the One-Child-Policy in China that sets the number of children an individual is allowed to have based on observable characteristics. During the One-Child-Policy in China, while monetary fines, disciplinary measures and social penalties were employed to discourage having more than one child, some couples had the possibility to apply for a permit allowing them to have a second child. Falling into one of the exemption categories can increase expected fertility from one to two children. It can, however, also relieve an individual planning on having two children in the future, regardless of the penalties, from having to pay income-dependent fines.

Utilizing provincial and temporal variations in the eligibility criteria for second child permits, I calculate the number of children an individual is allowed to have at age 16 when individuals finish junior high school and the decision to continue with senior high school is taken. Using a triple-differences approach, I am able to compare similar individuals within a province before and after second child permit reforms with individuals in the same province who do not experience a change in their eligibility status. Provinces that did not change policies during that time help to control for the effect of eligibility characteristics as well as annual national or provincial trends.

First, using an older cohort that had finished their main reproductive stage in 2010, I find that being allowed to have two children increases the likelihood of having a second child on average by 11 percentage points. Next, I look at individuals that turned 16 during the 1990s and subsequently have not finished their reproductive stage by 2010 but did finish their educational stage. I find that being allowed to have two children instead of one at the age of 16 increases significantly the years of education undertaken for both men and women by 0.7 years on average. Eligibility for a

second child permit significantly increases the likelihood to finish junior and senior high school[1].

Furthermore, I want to determine who is most affected by the second child permit reforms. Some individuals might plan to have one child or two children independent of eligibility for second child permits. I use the older cohort to find regional and individual level predictors for fertility outcome and use those to predict the likelihood of having a second child without the permits. I find that those who react to the reforms with an increase in educational investment have a medium range likelihood of having a second child absent of second child permit. I argue that the overall positive effect on schooling investment is driven by those for whom the permit constraint is binding, meaning those who increase their fertility expectations from one child to two as a response to being eligible for a second child permit.

This paper adds to the vast literature on schooling investment and fertility. Theoretical growth models and country level empirical work usually connect low fertility rates and high human capital investment (Becker et al. [1990], Rosenzweig [1990], Kalemli-Ozcan [2003]). On an individual level, female education in particular is usually associated with lower fertility rates (Osili and Long [2008], Lam and Duryea [1999], Schultz [1997], Duflo et al. [2015] among others). The main economic argument is that the opportunity costs of having a child for an educated woman are higher than for a non-educated woman (based on Becker [1981]). Educated individuals on average have higher earnings that they might have to forgo when childbearing. Other explanations are that education increases the knowledge of contraception methods (Rosenzweig and Schultz [1989]) and increases the bargaining power of women who might want to have fewer children than men (Manser and Brown [1980]).

Many studies establishing the causal relationship between high human capital investment and low fertility focus on high fertility countries (like Duflo et al. [2015], Osili and Long [2008], Duflo et al. [2017]). Developed countries often face fertility rates below the replacement rate and aim to raise their fertility levels. At the same time, governments want high educational investments

[1]While primary and secondary education is completed before the reproductive stage in this context (marriage is only allowed after 20 (women) and 22 (men)), tertiary education overlaps with the reproductive stage, making analysis theoretically different. This paper focuses solely on secondary education.

and might wonder if this contradicts their fertility goal. This paper looks at the effect of expected fertility on schooling investment in a low fertility setting and presents the case that wanting a family in the future does not necessarily hold one back from education. However, labour market conditions are important. If parents can easily return to the labour market after childbirth and do not have to fear lower returns to education than their childless co-workers, wanting children should not have a negative effect on educational decisions. This applies to China where women are relatively well integrated in the labour market and where grandparents play an important role in raising children (Chen et al. [2011]). It is also important to note that this paper looks at the intensive margin of expected fertility (having one more child) and not at the extensive margin (having the first child). As such, the results are in line with studies that find that having one more children has no or only a weak effect on the mother's earnings in the long run (Angrist and Evans [1996], Jacobsen et al. [1999], Lundborg et al. [2017]).

A distinct but connected strand of literature looks at the effect of contraception on the educational investment choices of women (Goldin and Katz [2002], Ananat and Hungerman [2012], Miller [2010]). The idea is that contraceptive methods give women certainty over the pregnancy consequences of sex and thus decrease the risk of tertiary schooling investment. This paper assumes, however, that individuals can plan their fertility outcome as well as the timing of their pregnancies, an appropriate assumption for many high and middle income countries, including China.

This paper also adds to the literature on the One-Child-Policy (OCP) in China and has implications for the effect of the current changes in fertility policies allowing two children. There is an ongoing discussion about how effectively fines and campaigns decreased fertility rates during the OCP (McElroy and Yang [2000], Li [1995]). Data related to the OCP has been used to investigate the relationship between education and fertility outcome, mostly addressing the quality-quantity trade-off that parents face when they decide how many children they want to have and how much they want to invest in each child (Qin et al. [2016], Li and Zhang [2016], Rosenzweig and Zhang [2009]). The exemption from the strict OCP for some ethnic minorities has been used to study inter-ethnic marriages (Huang and Zhou [2015]) and ethnic identity (Jia

and Persson [2017]). To the best of my knowledge, the only paper discussing a similar idea and using variation in the enforcement in the OCP as an identification mechanism is the recent work by Huang et al. [2016]. However, they only use the regional variation in monetary fines that, in the data set I use, has no effect on either schooling investment or on fertility choice. Furthermore, they assume that an increase in monetary fines decreases expected fertility without discussing that it might also increase the cost of having a second child while keeping expected fertility constant.

2 Exogenous determinant of fertility: The One-Child-Policy in China and second child permits

The empirical identification of the effect of expected fertility relies on an exogenous variation in the cost of having another child, which in turn leads to individuals changing their expected fertility. The One-Child-Policy in China between 1979 and 2015 was based on the goal of one child per family, setting out fines and penalties for the birth of a second child. At the same time, regulations for second child permits were issued at the provincial level and changed over time providing the necessary variation. This section describes the policy and its regulations, as well as the functioning, motivation and implications of second child permits.

Family planning has been of particular importance to the Chinese government for the past decades. The experience of the Great Famine during 1959-1961 is said to be a trigger for the ambitious family planning policies that followed, including the "Later, Longer, Fewer" campaign from 1971-1979, the OCP from 1979-2015 and the recent two-children policy. During the "Later, Longer, Fewer" campaign later marriage, longer birth intervals and fewer children were promoted [2].

During the OCP, the central government urged provincial governments to enact rules to substantially decrease fertility rates. While the goal of one child per family was introduced between 1978 and 1980 by the central government, implementation was lagging behind, particularly in rural areas where the one-child limit met significant resistance (Baochang et al. [2007]). Between

[2] One child per family was advocated as optimal, two was acceptable but three was considered too much.

1982 and 1984, provincial governments started to issue more or less formal guidelines under which married or remarried couples could apply for a second child permit, thereby relaxing the one child per family limit significantly, mainly in rural areas (Scharping [2013]). Between 1986 and 1991, provincial governments produced official family planning regulations outlying in detail different exemptions. Most of them were revised at least once in the 1990s and again after 2001.

Couples that had a second child without falling into an exemption category were subject to monetary fines and potentially non-monetary penalties. Scharping [2013] collects information about the monetary fines and monetary bonus employed to reach the OCP goals. Fines and bonuses were set as a function of the income of the parents. Parents with higher income thus had to pay higher fines in absolute terms. Additionally, parents potentially faced non-monetary penalties such as losing their job or having their career opportunities restricted.

Eligibility criteria for second child permits varied on the provincial level and between rural and urban areas. The household registration status of the parents (the *hukou* status), which is either agriculture/rural or non-agricultural/urban, determined whether and under what conditions a married couple was able apply for a permit. Most exemptions from the strict one child policy also required that the applying couple had to respect late child birth (after 24 years old for women) and an acceptable birth interval (between 4 and 7 years). While officially couples had to obtain the second child permit before having the second child, this posed a significant financial burden to local governments, particularly in rural areas, so second child permits were presumably given out after birth if the couple fell into a specific category (Scharping [2013]). It should also be noted that, officially, married couples had to obtain a permit for having their first child as well and that permits were not given to unmarried individuals or couples.

The most used exemption is likely the one that allowed couples in rural areas whose first-born was a girl to have a second child. In five provinces, couples living in rural areas were always allowed to have two children (Baochang et al. [2007])[3]. Couples from ethnic minorities were often

[3]The provinces are: Hainan, Yunnan, Qinghai, Ningxia and Xinjiang. In the province of Guangdong, couples with rural household status were also allowed to have two children until 1998 (Scharping [2013]).

allowed to have two children or were even completely exempted from the policy. However, this depended on the province, if the couple lived in a rural or specific minority area and sometimes even on the size of the minority population. Specifically autonomous regions[4] had more lenient fertility constraints for minority couples.

Most provinces introduced the criterion stipulating that if one or both spouses are an only child they are eligible for a second child permit at some point, following a statement from the central government. This policy was motivated by the idea that the one-child-per-family policy should only hold for one generation.

There were also some specific exemptions for certain occupational groups such as fishermen, mine workers, veterans, couples that already adopted a child or that had their first child oversees that are not taken into account here. The category of couples with "real difficulties" is the most vague and potentially flexible one, making it impossible to evaluate without having governmental application and acceptance data.

The exemptions I use for my empirical analysis are:

1. In five provinces, couples in rural areas could have two children. In the province of Quangdong, second child permits were given to couples in rural areas until 1998.

2. Couples living in rural areas whose first child is a girl had an a priori expected number of children of 1.5[5].

3. Couples in which one or both spouses belong to a national minority (either in the whole province or living in rural or specific areas) can have two children.

4. Couples in which one or both spouses are an only child could have two children.

[4] Tibet, Inner Mongolia, Ninxia, Xinjiang and Guanxi

[5] Specific exemptions I also use: In Jiangsu province, men can have a second child if the first born is a girl and they do not have a brother. In Jilin province, in rural areas, if one spouse is an only child and the first born is a girl, the can have a second child.

The expected number of 1.5 is an approximation. However, there are no reports of couples falling into that exemption that tried to avoid having a son as the first child. The main simplification is that I ignore sex differences in the costs-benefit analysis of parents.

Empirical identification of the effect of the reform changes relies on geographical and temporal variation in the eligibility criteria. Figure 1 illustrates the share of individuals that were allowed to have only one child, two children or "1.5 children in expectation". There was high variation at the beginning of the OCP between 1982 and 1990 and some changes around 1997, when provinces revised their family planning regulations.

3 Model

3.1 Set-up

To give an intuition of how future family planning can affect schooling investment and in order to motivate the empirical analysis, I use a two stage model to investigate the incentives to get educated and have children. In the model, a representative family consisting of two parents and one focus child must decide how much to invest in the education of the focus child in period 1. In period 2, the focus child is grown up, married, earns income together with his/her spouse and the newly formed couple can have children themselves. In the baseline version, I assume that couples have to pay a fine for having a second child and this fine depends on the educational level of the now grown-up focus child. I then show how taking away these fines, as it happens when one becomes eligible for a second child permit, changes the optimal educational level.

It may seem counter-intuitive at first to model both educational decision and fertility decision as made by the family. One can argue that the educational decision is made by the parents and the fertility decision by the focus child. However, there are important interactions that make this simplifying assumption appropriate. For one, the focus child can influence educational investment by making more or less effort and persuading the parents of their school choice at least at the teenager stage. Also, parents can influence the focus child's fertility decision by passing on their own fertility preferences or fertility expectations and by offering their help raising the grand-children. This channel is particularly persuasive in China where the family is still the most important social unit for many individuals.

Parents draw important benefits from having grand-children since they are invested in the

continuation of their family line besides other biological, social and altruistic motivations. However, they may see having grand-children as being particularly costly because their focus child has to invest in raising them and thus may have fewer resources to allocate to the parents when they are retired and have financial and care needs.

It should also be noted that the educational investment stage and the reproductive stage do not overlap. This is realistic with regard to primary and secondary education in China which is usually finished before starting the reproductive stage. In China, the minimum age for marriage is 20 for women and 22 for men and individuals are strongly discouraged from having children without being married. If one wanted to analyse tertiary education, an intermediary period for raising a child or education should be included.

Period 1

In period 1, the family consumes and invests in the education of the focus child. The income of the family is given exogenously. I ignore the possibility to borrow or save[6] and make education the only available investment mechanisms between period 1 and period 2. Utility in period 1 is given by

$$U_1 = u(Y - sI) \tag{1}$$

where $u(.)$ is the utility of consumption, assumed to be strictly increasing and concave, $s > 0$ the constant cost of education, Y the exogenous income, and I years of education of the focus child.

Period 2

In period 2, the focus child has grown up and is married. The income he/she earns is consumed by his/her family[7]. The newly formed couple has n children for whom they have to pay some cost. The available income in period 2 depends on the level of education and on the number of children n the couples has. If the couple has more than one child, they have to pay a fine for each additional child. This fine depends on the educational level of the

[6]Including borrowing and saving would mitigate the effects discussed but not remove them. This would only be the case at corner solutions where families do not invest in education at all.

[7]The model can be easily extended by adding the income generated by the spouse and a term that captures the correlation between the spouses' educational levels.

focus child I, reflecting the fact that monetary fines are dependent on the household income, a function of the individual's educational level, and that couples might have to pay non-monetary fines such as losing their job or not being promoted. Finally, the family gets some utility from having (grand-) children, which I assume to be additively separable from the utility of consumption.

Utility in period 2 is given by:

$$U_2 = u(Y(I,n) - \pi p(I)(n-1)\mathbb{1}(n>1) - \mu f(n)) + \alpha h(n) \tag{2}$$

where $Y(I,n)$ is the income generated by the grown-up focus child available for family consumption, assumed to be strictly increasing and concave in the educational level I[8]. The $p(.)$ function indicates the fine that the family has to pay for having more than one (grand-) child, multiplied by π which incorporates regional variation in those fines. This penalty depends on the educational level of the focus child and has the same properties as the income function. Following, $\mu f(n)$ is the cost of raising n (grand-) children, assumed to be strictly increasing, with μ being a regional or individual cost parameter. Finally, $\alpha h(n)$ represents the utility of having (grand-) children, which is strictly increasing and concave, with α being an exogenous fertility preference parameter.

Overall utility is thus given by:

$$EU = u(Y - sI) + \delta[u(Y(I,n) - \pi p(I)(n-1)\mathbb{1}(n>1) - \mu f(n)) + \alpha h(n)] \tag{3}$$

with δ being the discount factor.

The model disregards any level of uncertainty and assumes full information. These are clearly unrealistic assumptions: one is never sure about future income, costs of raising a child, finding a partner and having a child at the desired time. However, to illustrate the basic mechanisms, this

[8] An example for this is an income generation function that remunerates individuals for each hour worked multiplied by their productivity which is a concave function of education: $Y(I,n) = (T-n)P(I)$ where T is the maximum time an individual can work and working hours decrease in the number of children, and $P(I)$ is the productivity of the individual. One could also interpret T as the number of years an individual works in his/her life and the number of children potentially decreases the years of working.

model suffices.

3.2 Optimal educational level and optimal number of children

Maximising with respect to education gives the optimal level of education as a function of the number of (grand-) children n:

$$u'[Y(I^*) - \pi p(I^*)(n-1)\mathbb{1}(n>1) - \mu f(n)]\left[\frac{\partial Y(I^*,n)}{\partial I^*} - \pi\frac{\partial p(I^*)}{\partial I^*}(n-1)\mathbb{1}(n>1)\right] = \frac{s}{\delta}u'(Y - sI^*) \tag{4}$$

We see that the number of (grand-) children can affect educational investment by decreasing family consumption in the second period, by potentially affecting the returns to education directly through $\frac{\partial Y(I^*,n)}{\partial I^*}$ and indirectly through $\frac{\partial p(I^*)}{\partial I^*}(n-1)\mathbb{1}(n>1)$ when the number of (grand-) children is higher than 1.

Maximising utility with respect to n gives us the optimal number of children as a function of education:

$$u'[Y(I) - \pi p(I)(n^*-1)\mathbb{1}(n^*>1) - \mu f(n^*)]\left[\mu p(I)\mathbb{1}(n^*>1) + \pi\frac{\partial f(n^*)}{\partial n^*} - \frac{\partial Y(I,n^*)}{\partial n^*}\right] = \alpha\frac{\partial h(n^*)}{\partial n^*} \tag{5}$$

On the left hand side we have the marginal (opportunity) cost of having n^* (grand-) children which consists of the marginal cost of raising and educating n^* children ($\frac{\partial f(n^*)}{\partial n^*}$), an additional fine if the family has more than 1 (grand-) child, and a potential decrease in income due to shorter working hours. On the right hand side, we have the marginal benefits of having n^* (grand-) children.

The effect of education on the optimal number of children reflects some standard results: Education increases income and thus makes having (grand-) children relatively less costly. However, education also increases the opportunity cost of having (grand-) children through $\frac{\partial Y(I,n^*)}{\partial n^*}$. Higher education also implies having to pay a higher fine for the second (grand-) child, increasing the cost of having another one.

3.3 Effect of falling into an exemption category

The effect of falling into an exemption category is modelled as a removal of the penalties for the second (grand-) child. The term $\pi p(I)(n^* - 1)\mathbb{1}(n^* > 1)$ is replaced by $\pi p(I)(n^* - 2)\mathbb{1}(n^* > 2)$ since the penalties now only have to be paid from the third (grand-) child onwards.

Since the number of (grand-) children is a discrete variable and since there is no fine for the first (grand-) child, falling into an exemption category does not necessarily change the optimal number of (grand-) children given by equation 5. The effect of the exemption thus depends on if the removal of fines changes the fertility choice or not. There are three cases:

1. **Unaffected**[9]: $n^*_{notexempt} \leq 1$ and $n^*_{exempt} \leq 1$

   The optimal number of (grand-) children after the exemption is introduced is the same as before (one or zero). The family is unaffected by the exemption.

2. **Benefiters**: $n^*_{notexempt} = N$ and $n^*_{exempt} = N$ where $N \geq 2$

   The fertility decision is not altered by falling into an exemption category. The family would not want to have another (grand-) child in this case, however, the family benefits from not having to pay the fine for the second (grand-) child any more.

3. **Increasers**: $n^*_{notexempt} = N$ and $n^*_{exempt} = N + 1$ where $N \geq 1$

   By falling into an exemption category, the optimal number of (grand-) children increases by one (grand-) child because the cost of having an additional (grand-) child decreased.

The exemption policy affects educational investment decisions of *Increasers* and *Benefiters* as followed:

Benefiters: $n^*_{notexempt} = N$ and $n^*_{exempt} = N$ where $N \geq 2$

Optimal education before was given by:

$$u'[Y(I^*, N) - \pi p(I^*)(N-1) - \mu f(N)] \left[\frac{\partial Y(I^*, N)}{\partial I^*} - \pi \frac{\partial p(I^*)}{\partial I^*}(N-1) \right] = \frac{s}{\delta} u'(Y - sI^*) \qquad (6)$$

[9] Using policy evaluation terminology, the *unaffected* would be *never-takers*, *benefiters* would be *always-takers* and *increasers* would be called *compliers*. However, since in this policy context one child per family is still the government's ideal, those who have one child in any case can be thought of as compliers. Therefore, a different naming was chosen.

When falling into an exemption, optimal education is given by:

$$u'[Y(I^*,N) - \pi p(I^*)(N-2) - \mu f(N)] \left[\frac{\partial Y(I^*,N)}{\partial I^*} - \pi \frac{\partial p(I^*)}{\partial I^*}(N-2)\right] = \frac{s}{\delta} u'(Y - sI^*) \tag{7}$$

Falling into the exemption has two opposing effects: On the one hand, it decreases the marginal utility of consumption ($u'(.)$) due to a decrease in the cost of having (grand-) children by $\mu p(I)$ (positive income effect). This has the effect of decreasing education because the family responds with higher consumption and lower educational investment in period 1. On the other hand, it increases the returns to education by $\mu \frac{\partial p(I^*)}{\partial I^*}$ because the fine for the second (grand-) child is dependent on the income level (positive substitution effect). This leads to an increase in education. Since there are two potential opposing effects, the total effect can be negative or positive.

Increasers: $n^*_{notexempt} = N$ and $n^*_{exempt} = N + 1$ where $N \geq 1$

Optimal education before was given by:

$$u'[Y(I^*,N) - \pi p(I^*)(N-1) - \mu f(N)] \left[\frac{\partial Y(I^*,N)}{\partial I^*} - \pi \frac{\partial p(I^*)}{\partial I^*}(N-1)\right] = \frac{s}{\delta} u'(Y - sI^*) \tag{8}$$

When falling into an exemption, optimal education is given by:

$$u'[Y(I^*,N+1) + \pi p(I^*)(N-1) - \mu f(N+1)] \left[\frac{\partial Y(I^*,N+1)}{\partial I^*} - \pi \frac{\partial p(I^*)}{\partial I^*}(N-1)\right] \tag{9}$$

$$= \frac{s}{\delta} u'(Y - sI^*) \tag{10}$$

Again, falling into the exemption has two effects: On the one hand, it increases the marginal utility of consumption ($u'(.)$) by increasing the cost of having (grand-) children by $\mu[f(N+1) - f(N)]$. Also, the grown-up child might be earning less due to having to care for (grand-) children when $Y(I^*,N) > Y(I^*,N+1)$ (negative income effect). Thus, the family uses education as a way to shift consumption from period 1 to period 2 such that equation 4 holds. On the other hand, the policy change decreases the returns to education if the grown-up child has to cut productive working hours ($\frac{\partial Y(I^*,N+1)}{\partial I^*} < \frac{\partial Y(I^*,N)}{\partial I^*}$) (negative substitution effect). This decreases returns to education and thus decreases the incentives to invest in education. Again, the overall effect of

falling into an exemption category can be positive or negative.

3.4 Comparative statics when restricting the choice set to having one or two children

Theoretical analysis is simplified once the choice set for the number of (grand-) children is restricted to $n = [1, 2]$. In the specific Chinese context, this restriction still encompasses the choice set of the majority of individuals[10]. The choice of the number of (grand-) children absent of any second child permits is dependent on the exogenous or individually different parameters μ, π and α. This gives us the following comparative statics:

- **Fertility preferences α:**

  Fixing μ and π at positive levels, families with a low fertility preference α are *unaffected*, those with a medium α are *increasers* and those with a high α are *benefiters*. This is illustrated in figure 2: Until $\underline{\alpha}$ the family has 1 (grand-) child for fixed μ and π with or without the policy exemption. Between $\underline{\alpha}$ and $\bar{\alpha}$, the family would have one (grand-) child absent of the exemption and two (grand-) children when exempted. Above $\bar{\alpha}$, the family has two (grand-) children in any case. $\underline{\alpha}$ and $\bar{\alpha}$ are defined by equation 5.

- **Cost of raising a child μ:**

  The cost parameter of raising the child represents the same idea as the fertility preferences. Fixing π and α at positive levels, families facing low costs of raising a (grand-) child μ are *benefiters*, those with medium μ are *increasers*, and those with high μ are *unaffected*.

- **Penalties for having more than one child π**

  The effect of the fine is different than the two other parameters. One can see that the fine does not change $\underline{\alpha}$. Thus, at a certain α and μ, families are unaffected independent of the fine amount. Intuitively, if families see one (grand-) child as optimal, penalties for the second (grand-) child are irrelevant. The fine level only changes the threshold between those that are *increasers* or *benefiters*: The higher the penalties, the more families are *increasers*.

[10] In the China Family Panel Survey 2010, I find that that of those being born between 1964 and 1974, less than 3% do not have any children, 42.8% have one child, 42.6% have two children, and only 11.7% have three children or more.

We know that second child permits should not have any effect on the unaffected, but if we find a positive or negative overall effect, we do not know if it is driven by families that are *benefiters*, or those that are *increasers*, or both of them. Indeed, in both cases, second child permit reforms can increase schooling investment. The conditions for a positive effect are summarized in the following proposition. The results from the comparative statics will help to empirically disentangle the overall effect of second child permits on schooling investment, differentiating between the effect it has on individuals that are *increasers* and *benefiters*.

Proposition 1 *The effect of second child permits on schooling investment is positive*

- *on families wanting two (grand-) children independent on eligibility for a second child permit (**benefiters**) when the reduction in the cost for the second (grand-) child (due to the removal of fines) is small relative to the increase in the returns to education (due to the fines being income dependent).*
- *on families increasing fertility expectations due to eligibility for a second child permit (**increasers**) when the reduction in the returns to education due to the second (grand-) child is small relative to the increase in the total cost for raising (grand-) children.*

4 Data

4.1 Individual Data

For my empirical analysis I use individual survey data from the 2010 China Family Panel Study (CFPS). It was designed by a Peking University research team, supported by Peking University 985 funds and carried out by the Institute of Social Science Survey of the Peking University. The data set in English and Chinese is available online.

For the main cohort, I include individuals that turned 16 between 1990 and 2000. This leaves me with 5 405 observations for the main empirical investigation of which 53% are female. Summary statistics are displayed in table 1. The sample is predominantly rural: 67% hold agricultural household status and 30% hold non-agricultural household status. However, according to the census bureau's definition, in 2010, 52% lived in an urban area due to the growth of urban areas.

89% of the sample indicate that they are of Han ethnicity. The other main minorities in the sample are Miao (2.1%), Yi(2.3%) and Man (1.5%)[11]. On average, individuals stayed in school for 7.6 years. Women stayed in school on average 7.1 years and men 8.18 years. At the same time, those with a non-agricultural household status spend nearly twice as many years at school as those with agricultural household status (11.4 compared to 6.1).

One issue is that those in the main cohort, those that turn 16 btween 1990 and 2000 are too young to have finished their reproductive stage at the time of the survey in 2010. Therefore, I am not able to use the number of children allowed at age 16 as instrument for the actual number of children for this cohort. To fill the need for an older cohort that has already finished the reproductive stage at the time of the survey, I use individuals that turned 16 between 1982 and 1990. The assumption is that, though the educational investment of the older cohort has not necessarily been affected by the eligibility for second child permits, the number of children they have should be affected, because their main reproductive age lies within the 1990s. I use this older cohort to establish the effect of second child permits on the likelihood of having a second child and to find predictors for fertility outcomes.

The summary statistics for the older cohort are also displayed in table 1. As expected, educational levels are lower but other characteristics are the same (sex, ethnicity). There are more individuals with an agricultural household registration status.

4.2 Policy exemptions

Data about province level policies are taken from Scharping [2013] and supplemented by Baochang et al. [2007] and official family planning regulation documents accessed on-line in Mandarin Chinese and translated into English[12]. An excerpt of the data is displayed in table 2. Based on this information, the number of children one is officially allowed to have is calculated at the time of the educational decision-making, which is assumed to be 16. The cut-off of 16 is

[11] Not all provinces are represented in the sample. In particular, the sample does not cover the autonomous regions of China (Inner Mongolia, Tibet, Xingjiang and Ninxia) with the exception of Guangxi Zhuang autonomous region which is covered. The main population is sampled from Gansu (12%), Henan (11%), Guangdong (9%), Shanghai (8.5%) and Lioaning (8.4%).

[12] This collection of policy information in English was collected by Wanying Zhao and is available upon request.

chosen because at that time students on average must decide to continue with senior high school after completing compulsory junior high school. The official exemption policy within the province should influence this decision.

For the main analysis, I use those turning 16 from 1990 to 2000. This has two reasons: First, only after 1990 Chinese citizens had official legal documents that they could rely on. Before, conditions for second child permits were only presented as guidelines and it is debatable if implementation and knowledge of exemptions was comparable between provinces. Second, I do not want to mix up the effects of the policy with the implementation time of the 1986 compulsory secondary school reform. The upper cut-off of 2000 is chosen in order to assure that in the year of the survey (2010), all educational investment up to the tertiary level is finished[13].

The number of children an individuals is allowed to have is a result of the province he or she lives in, the household registration status (agricultural or non-agricultural), if he or she has siblings, and if he or she belongs to an ethnic minority. Overall, for those turning 16 after 1990, 32% in the sample are not subject to any exemption when they were 16 and thus have 1 as the number of children allowed. 44% fall into the category that they are allowed to have a second child when the first one is a girl; thus, I define the number of children allowed as 1.5. 23% fall into the category that they are allowed 2 children.

5 Empirical Approach

5.1 Estimating the effect of second child permits

The first question I examine is if second child permits have an effect on fertility outcome. If second child permits had no effect on real fertility outcome, they should not change fertility expectations either. In this case, any effect that the second child permit reforms on education levels would be driven by *benefiters*, those who do not change their expected fertility, but benefit from not having to pay fines for the second child. We would merely learn that income-dependent

[13]The main results are however robust to including those older (turning 16 between 1982 and 1990) and younger (turning 16 between 2000 and 2005). Those that are younger are however less affected.

fines have a negative effect on the educational investment of those that plan on paying them. If the effect was driven by *increasers*, those that increase their expected fertility as a response to the policy change, the policy implications would be more general as it would show how educational investment can vary with fertility expectations.

Since the main cohort is too young to have finished their reproductive phase in 2010, I use men and women that turned 16 between 1982 and 1990. In order to investigate the effect of the policy exemption on the likelihood of having a second child, the analysis is restricted to married[14] individuals that already had one child before 2003, such that they have enough time to have a second child while conforming with promoted birth intervals. Those that have more than 2 children are considered outliers and excluded.

Between 1982 and 1990, some provinces had already introduced exemptions and therefore the number of children allowed at 16 can be used. However, since this was during an adjustment period, the policies were not as formalized as those that are used for the later analysis. For this reason, and to make use of the same variation as for the main cohort, I primarily look at the number of children allowed when the individual turns 30. This is approximately the age at which individuals decide to have a second child if they want to stick to the official birth intervals.

For this exercise, an indicator variable of having a second child in 2010 or not is regressed on the number of children allowed at either age 16 or 30, controlling for individual characteristics that allow eligibility as well as birth year and province fixed effects:

$$\begin{aligned} 2nd\_child_{i\ in\ 2010} = \beta_1 nb\ children\ allowed_{ip\ age(16/30)} + \beta_2 characteristics_i \\ + \beta_3 yearFE_t + \beta_4 provinceFE_p + \epsilon_{ipt} \end{aligned} \tag{11}$$

In an additional specification the number of children allowed is adjusted for the sex of the first child. If the first child is a girl, those that had in expectation 1.5 children are changed to being allowed to have 2 children and those whose first child is a son are changed to being allowed to

[14] Unmarried individuals cannot apply for a second child permit.

have one child. The individual characteristics included are those that determine eligibility for a second child permit: being of an ethnic minority, having a rural household status and being an only child. I also include a dummy for living in an urban area in 2010, which might influence enforcement of the OCP. Education is also used as an explanatory variable. In this way, I control for the indirect effect through education that the official number of children allowed can have on the likelihood of having a second child. Furthermore, I control for the sex of the first child[15].

Identification comes from the assumption that second child policies are quasi-exogenously implemented for a specific sub-sample within a province and from variation in time and between provinces. Since the second child permit reforms are done on the province level but only a subgroup of the province is actually treated, the used approach is the triple difference method (or Differences-in-Differences-in-Differences). I am able to compare those that were eligible for a second child permit at age 16 to those of the same sub-sample that were not eligible at age 16 within the same province if an exemption was introduced or retracted between 1990 and 2000 and compare this difference to those within the province that are not affected by a policy change. Provinces that have already introduced those criteria or introduce them later serve as control for the overall effect of being in a potential treatment group (e.g. ethnic minority, being an only child) and time specific effects.

5.2 Estimating the effect of exemptions on education

The overall effect of eligibility for a second child permit on educational investment is measured in years of education completed in 2010 ($years\ education_{ip\ in\ 2010}$). The outcome variable is later replaced by a dummy variable indicating if the individual has finished junior high school or senior high school. We do not look at university degrees for two reasons: First, they are quite rare in the predominantly rural sample. Second, while basic education is completed before the reproductive stage, university education overlaps with the reproductive stage, making analysis theoretically

[15]Selective abortion is said to be relatively wide-spread and the sex of the first child could be correlated with the number of children the couple is allowed to have. If they are only allowed one child, they might be more likely to use selective abortion to make sure the only child they have is a boy. Indeed, in the cohort that I look at, 54% of the first born children are boys and only 46% are girls.

different[16].

Similar to in the previous exercise, the explanatory variable of interest is the individual's eligibility status for a second child permit, that is to say the number of children officially allowed at age 16 ($nb\ children\ allowed_{ip\ age(16)}$). I control for all characteristics that can make someone eligible for an exemption ($characteristics_i$). Again, province fixed effects ($provinceFE_p$) and birth year fixed effects ($yearFE_t$) are included. Due to the triple-differences-approach province-level year fixed effect can be included to control for province-specific trends ($ProvinceFE_p * YearFE_t$).

$$\begin{aligned} years\ education_{ip\ in\ 2010} = \beta_1 nb\ children\ allowed_{ip\ age(16)} + \beta_2 characteristics_i \\ + \beta_3 yearFE_t + \beta_4 provinceFE_p + \epsilon_{ipt} \end{aligned} \tag{12}$$

Again, identification comes from the geographical and time variation of the introduction and scope of exemptions from the one child policy. Thanks to the triple difference approach, I can also control for province-specific time trends, thus relaxing the common trend assumption.

The exclusion restriction is that, conditioned on province trends, the sub-groups that become eligible have the same educational trend as the sub-groups in other provinces that do not change eligibility status. In order to support this identifying assumption, I run a pre-OCP placebo test. Identification also implies that provincial family planning policies targeting a specific sub-population are independent of educational measures that target the same group. For instance, if provinces that allow second child permits for ethnic minorities during the 1990s couple these measures with an increase in the educational budget for ethnic minorities areas, the policy measure captures both. So far, I have not encountered evidence in the literature for such behaviour. Additional robustness checks aim to strengthen the results, such as verifying that the overall results are not driven by a specific easily targeted group.

One might be concerned about potential spill-over through migration. However, the Chinese household registration system restricts the possibility to migrate, particularly between provinces.

[16]The number of children allowed at age 16 does not have a significant effect on the likelihood to obtain a university degree.

Applications for the second child permit can only be submitted at the place of registration and moving the place of registration is restricted[17].

5.3 Separating out the effect on *increasers*

Until now, only the overall effect of the policy, the intention-to-treat effect, is measured. As argued in the theoretical section, those that are eligible for a second child policy but do not react to it because they prefer to only have one child (*Unaffected*) should only lower the overall effect. However, one would like to know if the overall effect is driven by those that increase their expected fertility as a response to eligibility (*Increasers*) or those that wanted to have two children in any case (*Benefiters*) since policy implications are very different. As a first step, I verify that eligibility has a real effect on fertility outcome.

In the second step, I use proxies for individual and regional fertility preferences (α in the model) in order to predict the likelihood of having a second child absent of second child exemptions. As such, I expect the treatment effect to vary according to observable characteristics that I show are correlated with fertility outcome. Since individual fertility behaviour is difficult to predict, I use a broad categorization, only differentiating between those with low initial likelihood of having a second child, those with medium likelihood and those with high likelihood.

For this, the older cohort for which fertility outcome is observed is used to estimate the effect of fertility proxies and to verify the intuition that those with a medium likelihood of having a second child react most to second child permits. As proxies, I use the regional fertility rate calculated as the average number of children that individuals have between the age of 31 and 35 within the same county, the educational level of the father and the number of siblings. Instead of year fixed effects a linear trend variable is included.

The estimated significant coefficients of the variables that are already realized at the age of 16 [18] are then used to predict the likelihood of someone in the main cohort of having a second child

[17] Within the main cohort, only 1.2% indicated a different provincial code as place of residence at the age of 12 than at the age of 3 while 5.4% indicated a different county or district code (within-province migration).

[18] The educational level and the sex of the first child are not realized yet.

absent of second child exemptions:

$$Pr(2nd\_child)\_pred = \frac{exp(\hat{\beta}_2 charact._i + \hat{\gamma} proxies_{ipt} + \hat{\beta}_3 trend_t + \hat{\beta}_4 provFE_p)}{1 + exp(\hat{\beta}_2 charact._i + \hat{\gamma} proxies_{ipt} + \hat{\beta}_3 trend_t + \hat{\beta}_4 provFE_p)} \tag{13}$$

This exercise relies on the strong assumption that the effect of the fertility proxies stays constant over time. It also depends on the first stage explaining a significant part of the overall variation in the likelihood of having a second child.

Based on the predicted likelihood of having a second child, the sample is divided into three sub-samples of equal size: Those with a low likelihood of having a second child absent of second child policies, those with a medium likelihood and those with a high likelihood. The main regression is then run on the three sub-samples to see which category drives the main results. The motivation for using three groups is derived from the three groups behaving differently in the theoretical model. Sub-sample analysis is chosen as it makes sure that similar individuals (those with similar likelihood of having a second child) are in the control and treatment groups. It also accounts directly for the possibility of control variables having different effects in the different subgroups.

6 Empirical results

6.1 Effectiveness of second child permits

First, I estimate the effect of second child permits on the likelihood of having a second child. The results for the number of children allowed at age 16 and at age 30 are displayed in table 3. I find that the number of children allowed at age 16 not adjusted for the sex of the first child does not have a significant effect; however once the variable is adjusted for the sex of the first child it is significantly positive with an average marginal effect of 5.7 percentage points. The effect comes from the sub-sample of women. This is probably due to women on average being younger when they have their first child and therefore the correlation between the eligibility status at age 16 and at the age when the individual wants to have a second child being stronger.

The unadjusted number of children allowed at age 30 has a weakly significant positive effect on the likelihood of having a second child while the adjusted number of children allowed at age 30 has a highly significant effect for both men and women. On average, being allowed a second child increases the likelihood to have a second child by 10.6 percentage points. The marginal effect is slightly higher for women, with an increase of 11 percentage points.

I thus find that the official number of children allowed influences real fertility decisions. However, an increase of approximately 11 percentage points implies that there is a significant share of the population that does not significantly change their fertility outcomes due to the policy, potentially because they want only one child anyway, or potentially because they were planning to have two children and to pay the fine. On the other hand, the existence of criteria for second child permits that I cannot observe and that are not necessarily foreseeable also introduce some noise and suggest that the estimate is rather a lower bound.

6.2 Effect of second child permits on schooling investment

The results for the effect of second child permits on schooling investment estimated based on equation 12 are displayed in table 4. I control for province and year fixed effects and also include province specific year fixed effects in column 2 as described in the empirical approach section. Other than the characteristics that allow individuals to be eligible for a second child permit, I control for the sex of the individual and whether one lives in an urban area according to the 2010 census definition.

The estimation results show that being allowed to have two children instead of one increases the years of education by around 0.7 years on average. The coefficient does not change significantly when province specific fixed effects are included. This mitigates the concern that the effect is driven by provinces that introduce second child permits for a large part of their population and simultaneously implement some measure to increase the educational attainment of their population. Furthermore, the effect is higher for men but not significantly so. This empirical result is evidence that men and women that are allowed to have one more child without having to pay any fines react by increasing educational investment.

Next, I check at which stage of the educational career the number of children has an effect on by looking at indicator variables of finishing junior and senior high school. Results are displayed in table 5. I find that being allowed to have another child without paying a fine significantly increases the likelihood to graduate from junior high school by between 5.8 and 8 percentage points on average and the likelihood of graduating from senior high school by around 6 percentage points on average.

Following, I run a placebo test to argue that the exclusion restriction is not violated (table 6). I map the eligibility status of those in my main cohort to those that turned 16 before the introduction of any second child exemptions. I find that the placebo variable does not have any effect on the educational level of those that turned 16 between 1972 and 1982[19].

Furthermore, I verify that the overall result is not driven by one specific, easily targeted sub-group. I find that the effect is mainly driven by the rural population: both by those that are allowed two children and those with an expected fertility limit of 1.5 (see table 7 column 1 and 3). The result is also robust to only using the Han sample, indicating that it is not driven by members of ethnic minorities (table 7 column 2). I also vary the cut off of 16 but the effect for the number of children allowed stays the same. This is not surprising since the policies do not vary much over a period of three years and educational decisions are usually not made on one specific date. It shows that the results are not an effect of picking the right threshold.

Finally, I verify that the results do not change if the amount of monetary fines that one has to pay for an unauthorized second birth is included. The data for the fines is taken from Ebenstein [2010] and matched with the year the individual turns 16. I find that the coefficient is unchanged and the effect of monetary fines on schooling investment is not significant (see table 8). The coefficient is also unchanged when I include the change of the fines over the last three years. In any case, once including province-specific time fixed effects, monetary fines cannot be used because they are fixed on the province level.

[19]Results do not change significantly if one year earlier or later is chosen for the mapping.

There are several variables that might have an effect on the impact of the policy. For one, in provinces that have higher monetary fines, the effect of being eligible for a second child permit could be higher. However, I do not find evidence for this. I also check if individuals with a highly educated father have a different intensity of the effect, with the idea that the father's education is a proxy for household income. However, I do not find any significant difference. This might be due to the fact that though individuals with a highly educated father are more likely to have the means to pay the fines, they are also more likely to have lower fertility preferences. Indeed, as I will show in the next section, this relationship seems to be inversely U-shaped.

As an interesting addition, I find that individuals whose father is a member of the Communist party are not significantly affected by the second child permit reforms. It is very plausible that those have already internalized the party rule of one child per family and thus their fertility expectations are not affected by a change in eligibility rules[20].

6.3 Separating out the effect on *increasers*

The previous results indicate that second child permits have a significant effect on fertility outcome and on schooling investment. Therefore, I continue to investigate which sub-group drives the results. First, fertility proxies are included in the regression that predicts having a second child for the cohort of 1982 to 1990 (see table 9, column 1). The local fertility rate, the educational level of the father and the number of siblings have a significant effect on the likelihood of having a second child. Also, having an agricultural household status and living in an urban in 2010 are important factors. The first child being a girl and the educational level in 2010 are significant as well but cannot be used to predict fertility for the main cohort because they are not realized at the age of 16. Overall, all variables explain approximately 35% of the overall variation in having a second child, which is relatively high for such an individual choice variable.

Based on the significant variables that are already realized at the age of 16, I predict the

[20]Empirically, it could also be the case that they were always planning with two children due to their family's rank and thus do not get affected. However, this explanation does not seem plausible in the context.

individual likelihood of having a second child absent of second child permit. Figure 3 displays the distribution of the predicted likelihood. An important share of individuals are bunched at the lower and upper end of the distribution. Those with a low likelihood are suspected to be *unaffected*, and those with a high likelihood *benefiters* of the reforms.

In my rough approach to distinguish between *unaffected*, *benefiters* and *increasers*, I divide the sample into three subgroups according to their a priori likelihood of having a second child. The idea is that individuals with a low likelihood of having a second child (less than 23%) would not change their view even when becoming eligible. Those with a medium likelihood of having a second child (between 23% and 72%) are those that are likely to change their fertility expectations, thus can be considered as *increasers*. The ones with a high likelihood (over 72%) probably have two children in any case.

In order to confirm this intuition, I run the same analysis with the older cohort: I predict the likelihood of having a second child absent of second child permits and based on the results divide the sample into three groups of equal size. As displayed in table 9 (column 2-4), the group with the medium likelihood of having a second child reacts most to second child permits[21].

The results from the sub-sample analysis are displayed in table 10. The positive overall result that was found before seems to be driven by individuals with a medium likelihood of having a second child, supposed *increasers*: Being allowed to have another child increases education significantly by on average around 2 years. For those with low likelihood, supposed *unaffected*, the coefficient is positive but insignificant. For those with high likelihood, supposed *benefiters*, the coefficient is close to zero and insignificant. The latter points to the hypothesis that monetary fines were not very effective on those that really wanted to have two children. Indeed, I do not find any effect of monetary fines on fertility outcomes. These results suggest that those for whom the permit constraint is binding and who increase their fertility expectations increase schooling investment.

[21] The regression can also be run with an OLS ensuring that the sample size in all three sub samples stays the same. The results do not change: The group with the medium likelihood of having a second child has the largest coefficient, is strongly significant and significantly different to the coefficient of the group with high likelihood of having a second child.

7 Discussion and Conclusion

In this paper, I use a novel empirical approach to address the question of how expected fertility - the number of children one expects to have in the future - affects educational decisions. For this, I use the One-Child-Policy in China and the existence of second child permits for a subset of individuals. The empirical results show that individuals who are allowed to have a second child without having to pay a fine invest more in education. This perhaps surprising result is likely a result of the specific Chinese social and economic environment; however, it can still be a positive sign for policy makers who want to promote fertility and education. Replicating this result in other countries will be difficult since identification relies on a setting in which fertility constraints are set exogenously; however, it is important to verify the external validity of the results.

In my model, I sketch one channel of how fertility expectations can positively influence educational investment: Because children are expensive one might want to ensure to earn sufficient money in the future in order to be able to provide for children. The overall positive effect depends on the relationship between lifetime returns to education and fertility. In so far, the policy implication is nothing novel as it stresses the importance of providing the opportunity for men and women to stay in or re-enter the labour market without loss of their skills.

However, there are other channels how fertility expectations can affect education that one can think of. For one, individuals who plan to have more than one child in the future might also plan to take over important childcare tasks and want to be well prepared for it. It can also increase the incentive to find a productive spouse to share the cost of raising a child and therefore affect marriage market returns to education. Also, one parent might want to increase her/his bargaining power when he/she counts on having to secure sufficient resources for more than one child. Since bargaining power within the household and education are often said to be positively correlated, increasing education can be seen as a way to increase bargaining power. In the Chinese context, one can also add that obtaining a second child permit might come with difficult bureaucratic hurdles for which the individual prepares by getting more educated. One could also point out a psychological effect: being allowed to have two children in a society where children are seen as

essential can imply a more positive attitude towards the future and thus more motivation at school.

China is one specific social and economic environment that has been perturbed by strict policies. Comparing individuals who plan to have two children instead of one (intensive margin) is not the same as comparing individuals who do not plan to have any children with those that do (extensive margin). However, this is one of the first empirical papers that addresses the identification issue of the relationship between fertility expectations and educational investment and will hopefully lead to a discussion where case studies of different countries can be compared.

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8 Appendix

[22] Truncated at 7

[23] Taking into account the sex of the first child.

[24] Only if husband does not have a brother.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
Main Cohort (turning 16 between 1990 and 2000)				
Years of education completed (in 2010)	8.262	4.721	0	22
Female	0.531	0.499	0	1
Han ethnicity	0.89	0.312	0	1
Rural/agricultural household registration status	0.673	0.469	0	1
Year born	1978.702	3.179	1974	1984
Nb children allowed: 2 (at age 16)	0.258	0.438	0	1
Nb children allowed: 1.5 (at age 16)	0.344	0.475	0	1
N		5405		
Older cohort: (turning 16 between 1982 and 1990)				
Years of education completed (in 2010	6.202	4.674	0	22
Female	0.527	0.499	0	1
Han ethnicity	0.915	0.279	0	1
Rural/agricultural household registration status	0.745	0.436	0	1
Year born	1969.43	2.251	1966	1973
Nb children allowed: 2 (at age 16)	0.144	0.351	0	1
Nb children allowed: 1.5 (at age 16)	0.116	0.321	0	1
Number of children[22]	1.673	0.821	0	7
Allowed to have 2nd child[23]	0.35	0.477	0	1
N		6142		

	Hebei	Chongqing	Hubei	Zhejiang	Jiangsu
Family only has girl (rural area)	1989	1997	1987	1995	2002[24]
Ethnic minorities	1982	2002	2002	1990	-
Spouses are only child	1982	1997	2002	1989	1990

Note: Provinces have several other eligibility criteria such as for couples who had their first child outside of China, remarried couples, couples with a disabled first child etc. that I do not regard. Based on Scharping [2013] and family planning documents.

Table 2: Example of when provinces formalized eligibility criteria.

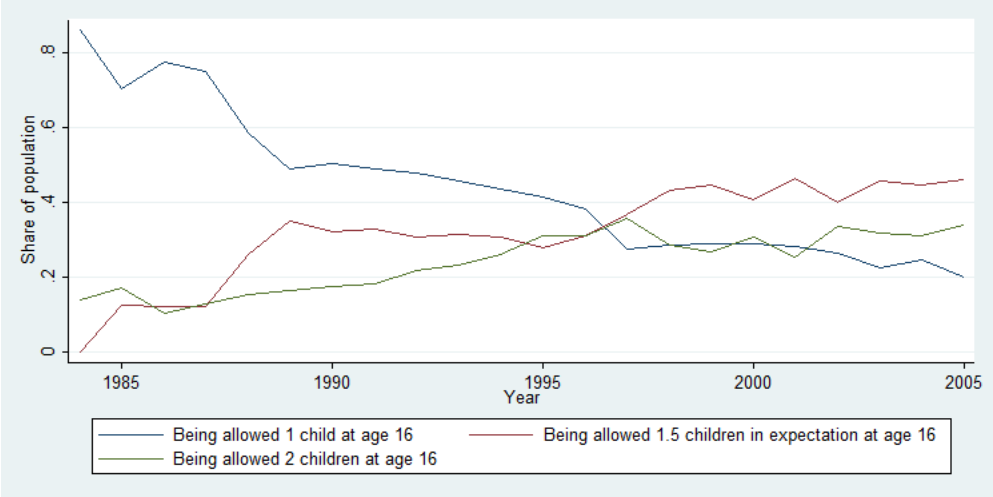

Figure 1: Evolution of the share of population falling into an exemption category according to the year they turn 16. Data Source: CFPS 2010.

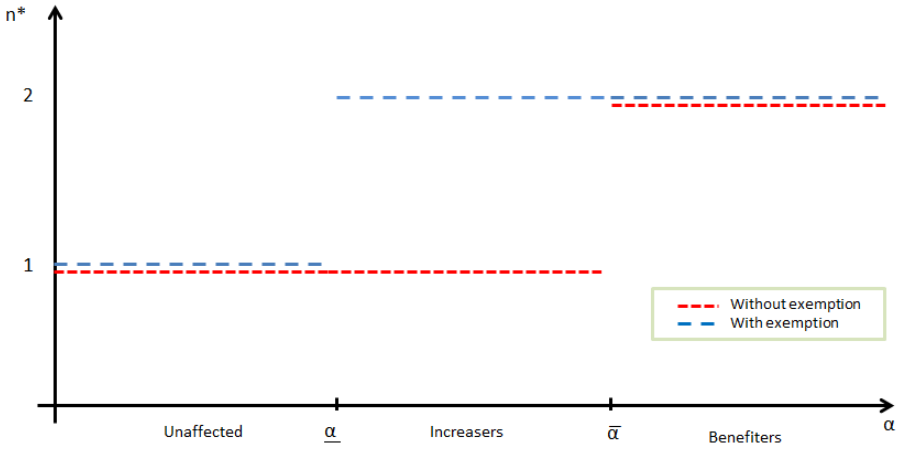

Figure 2: The effect of ferility preferences on the number of children.

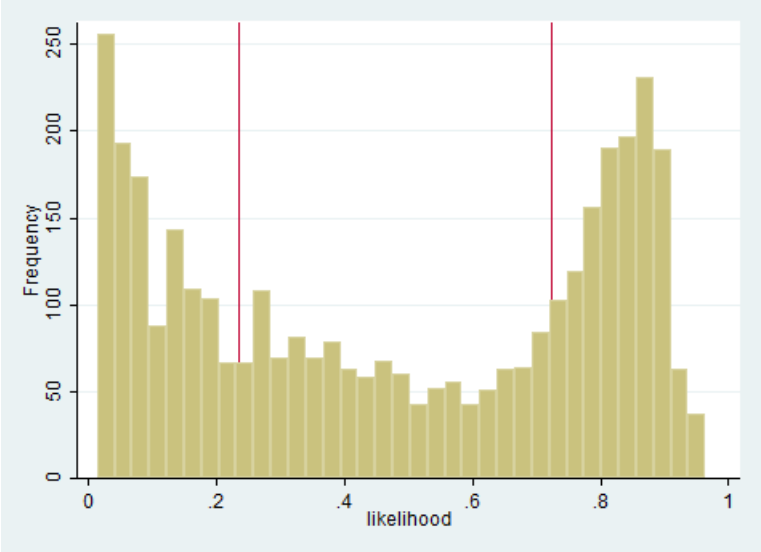

Figure 3: Frequency table of predicted likelihood of having a second child for 1990/2000 cohort

	Dependent variable: Indicator: Having a second child					
	(1) All	(2) All	(3) All	(4) All	(5) Women	(6) Men
Nb children allowed at 16*	0.0569***					
	(0.0206)					
Nb children allowed(16)		0.0268				
		(0.0242)				
Nb children allowed at 30*			0.106***		0.113***	0.0967***
			(0.0192)		(0.0260)	(0.0284)
Nb children allowed at 30				0.0617*		
				(0.0360)		
Controls for Eligibility	Yes	Yes	Yes	Yes	Yes	Yes
Additional Indiv. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5241	5241	5241	5241	2858	2376

* Adjusted for the sex of the first child.

Note: Sample includes individuals that turned 16 between 1982 and 1990, that had their first child before 2003 and have no more than two children. Logit regressions; robust standard errors in parenthesis. Dependent variable = 1 if the individual had a second child. Coefficients are average marginal effects. Eligibility controls: Household status, only child status, minority status. Additional controls: sex, sex of first child, education, living in urban area in 2010. Data source: China Family Panel Survey 2010.

Table 3: Predicting the likelihood of having a second child using the number of children allowed at the age of 16 adjusted and not adjusted for the sex of the first child.

	Dependent variable: Years of education			
	(1) All	(2) All	(3) Women	(4) Men
Nb children allowed(16)	0.702***	0.701***	0.675*	0.883**
	(0.222)	(0.244)	(0.357)	(0.356)
female	-0.735***	-0.718***		
	(0.0963)	(0.0984)		
Agri. household status	-4.193***	-4.182***	-4.340***	-3.983***
	(0.149)	(0.156)	(0.229)	(0.226)
Han ethnicity	1.343***	1.330***	1.573***	1.083***
	(0.204)	(0.207)	(0.270)	(0.337)
Only Child	-0.258	-0.197	-0.0196	-0.280
	(0.227)	(0.248)	(0.375)	(0.346)
Urban Area	1.867***	1.851***	2.145***	1.560***
	(0.123)	(0.127)	(0.177)	(0.189)
Time FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Time FE x Province FE	No	Yes	Yes	Yes
Observations	5368	5368	2846	2522
R^2	0.454	0.478	0.532	0.467

Note: Sample includes individuals that turned 16 between 1990 and 2000. Dependent variable is the years of education the individual completed. Standard OLS regression with robust standard errors in parenthesis. Significance levels: * 0.10; ** 0.05; *** 0.01. Data source: China Family Panel Survey 2010.

Table 4: Effect of the number of children allowed at age 16 on the years of education.

	Dependent variable: Indicator for finishing			
	Junior High School		Senior High School	
	(1)	(2)	(3)	(4)
Nb children allowed(16)	0.0578**	0.0801**	0.0629***	0.0637***
	(0.0264)	(0.0324)	(0.0215)	(0.0244)
Female	-0.0793***	-0.0822***	-0.0337***	-0.0329***
	(0.0107)	(0.0111)	(0.00974)	(0.01000)
Agri. household status	-0.338***	-0.359***	-0.313***	-0.325***
	(0.0195)	(0.0222)	(0.0112)	(0.0127)
Han ethnicity	0.102***	0.108***	0.0449**	0.0450**
	(0.0202)	(0.0214)	(0.0215)	(0.0219)
Only Child	-0.0252	-0.0311	-0.00599	0.00229
	(0.0266)	(0.0296)	(0.0216)	(0.0241)
Urban Area	0.152***	0.152***	0.131***	0.137***
	(0.0120)	(0.0128)	(0.0117)	(0.0121)
Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Province FE x Year FE	No	Yes	No	Yes
Observations	5405	5165	5405	5182

Note: Sample includes individuals that turned 16 between 1990 and 2000. Dependent variable is the likelihood of completing junior high school (columns 1 and 2) and senior high school (columns 3 and 4). Logit regression; average marginal effects displayed with robust standard errors in parenthesis. Significance levels: * 0.10; ** 0.05; *** 0.01. Data source: China Family Panel Survey 2010.

Table 5: The effect of the number of children allowed on the likelihood of completing a degree.

	Dependent variable: Years of Education	
	(1) Yrs of Education	(2) Yrs of Education
Placebo: Nb children allowed (16)	0.100	0.172
	(0.278)	(0.306)
female	-1.878***	-1.898***
	(0.0958)	(0.0971)
Agri. household status	-3.815***	-3.824***
	(0.179)	(0.188)
Han ethnicity	0.634***	0.708***
	(0.228)	(0.234)
Only Child	-0.905***	-0.933***
	(0.300)	(0.312)
Urban Area	0.924***	0.920***
	(0.126)	(0.128)
Year FE	Yes	Yes
Province FE	Yes	Yes
Year FE x Province FE	No	Yes
Observations	6903	6903
R^2	0.280	0.307

Note: Sample includes individuals that turned 16 between 1972 and 1982. Dependent variable is the years of education the individual completed. Standard OLS regression with robust standard errors in parenthesis. Significance levels: * 0.10; ** 0.05; *** 0.01 Data source: China Family Panel Survey 2010.

Table 6: Placebo test.

	Dependent variable: Years of Education		
	(1) All	(2) Only Han	(3) All
Nb children allowed(16)		0.653**	0.299
		(0.282)	(0.291)
Agri. household status	-4.136***	-4.136***	-4.472***
	(0.173)	(0.164)	(0.195)
Agri. hh status X Nb children allowed(16)			0.797**
			(0.326)
Indicator: Nb of children allowed(16)=1.5	0.244		
	(0.207)		
Indicator: Nb of children allowed(16)=2	0.737***		
	(0.254)		
female	-0.717***	-0.661***	-0.716***
	(0.0984)	(0.104)	(0.0984)
Han ethnicity	1.366***		1.369***
	(0.218)		(0.206)
Only Child	-0.244	-0.225	-0.108
	(0.263)	(0.277)	(0.253)
Urban Area	1.844***	1.849***	1.836***
	(0.128)	(0.132)	(0.127)
Province FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Province FE X Year FE	Yes	Yes	Yes
Observations	5405	4813	5405
R^2	0.478	0.456	0.478

Note: Sample includes individuals that turned 16 between 1990 and 2000. Dependent variable is the years of education the individual completed. Standard OLS regression with robust standard errors in parenthesis. Significance levels: * 0.10; ** 0.05; *** 0.01 Data source: China Family Panel Survey 2010.

Table 7: Effect of the number of children allowed at age 16 on the years of education - Robustness Checks.

	Dependent variable: Years of Education		
	(1)	(2)	(3)
Nb children allowed(16)	0.700***	0.701***	0.704***
	(0.222)	(0.244)	(0.222)
female	-0.737***	-0.718***	-0.736***
	(0.0963)	(0.0984)	(0.0963)
Agri. household status	-4.194***	-4.182***	-4.195***
	(0.149)	(0.156)	(0.149)
Han ethnicity	1.342***	1.330***	1.344***
	(0.204)	(0.207)	(0.204)
Only Child	-0.250	-0.197	-0.240
	(0.227)	(0.248)	(0.227)
Urban Area	1.869***	1.851***	1.869***
	(0.123)	(0.127)	(0.123)
Fine in years of income	-0.0861	-0.182	-0.138
	(0.0763)	(0.356)	(0.0877)
Change in fine (3 yrs)			0.0726
			(0.0674)
Year FE	Yes	Yes	Yes
Province FE	Yes	Yes	Yes
Year FE x Province FE	No	Yes	No
Observations	5405	5405	5405
R^2	0.454	0.478	0.454

Note: Sample includes individuals that turned 16 between 1990 and 2000. Dependent variable is the years of education the individual completed. Standard OLS regression with robust standard errors in parenthesis. Significance levels: * 0.10; ** 0.05; *** 0.01 Data source: China Family Panel Survey 2010.

Table 8: Effect of the number of children allowed at age 16 on the years of education including monetary fines documented at the age of 16 as well as the change in monetary fines over the past three years.

	Dependent variable: Indicator: Having a second child			
	(1) All	(2) Low likelihood	(3) Medium Likelihood	(4) High likelihood
Nb children allowed at 30*	0.128***	0.0700*	0.195***	0.0628
	(0.0272)	(0.0414)	(0.0518)	(0.0616)
Fertility Proxies:				
Father's education (yrs)	-0.00336*			
	(0.00188)			
Number of siblings	0.0141**			
	(0.00563)			
Local Fertility Rate	0.0936***			
	(0.0194)			
Trend	-0.00263			
	(0.00326)			
Controls for Eligibility	Yes	Yes	Yes	Yes
Additional Indiv. Controls	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Observations	2618	911	920	830

Note: Sample includes married individuals that turned 16 between 1982 and 1990, had their first child before 2003 and have no more than two children. Logit regressions; robust standard errors in parenthesis. Dependent variable = 1 if the individual had a second child. Coefficients are average marginal effects. Eligibility controls: Household status, only child status, minority status. Additional controls: sex, sex of first child, education, living in urban area in 2010. Data source: China Family Panel Survey 2010.

Table 9: Effect of the second child policy based on the predicted likelihood of having a second child.

	Dependent variable: Years of education		
	Low likelihood	Medium likelihood	High likelihood
	(1)	(2)	(3)
	Yrs of Education	Yrs of Education	Yrs of Education
Nb children allowed(16)	0.728	1.998**	0.122
	(0.545)	(0.879)	(0.997)
female	0.134	-0.212	-1.536***
	(0.190)	(0.223)	(0.228)
Agri. household status	-3.278***	-4.538***	-4.610***
	(0.255)	(0.547)	(1.698)
Han ethnicity	-0.888*	1.376**	0.728
	(0.503)	(0.547)	(0.505)
Only Child	-0.0367	-2.678***	0.504
	(0.514)	(0.761)	(1.704)
Urban Area	1.052***	0.835**	0.785**
	(0.320)	(0.373)	(0.382)
Province FE	Yes	Yes	Yes
Province FE X Year FE	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	1199	1199	1199
R^2	0.422	0.503	0.316

Note: Sample includes individuals that turned 16 between 1990 and 2000. OLS regression with robust standard errors in parenthesis. Sample divided in three sub samples based on the three percentiles of the predicted likelihood for having a second child. Data source: China Family Panel Survey 2010.

Table 10: Effect of the second child policy based on the predicted likelihood of having a second child.