Expected Fertility and Educational Investment: Evidence from the One-Child-Policy in China *

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Abstract

This paper addresses the question how future expected fertility affects current schooling investment decisions. Using diverse eligibility criteria for second child permits issued at the province level during the One-Child-Policy in China, I investigate the effect of not having to pay fines for the second child on educational investment decisions. First, I show that second child permits increase the likelihood of having a second child by around 11 percentage points. I then find that officially being allowed to have more than one child at the age of 16 increases basic educational investment significantly for both men and women. Furthermore, I argue that the effect is driven by individuals that are unlikely to have a second child absent of second child permits but are likely to do so once eligible for the permit. This suggests that within the Chinese setting, higher expected fertility actually increases education investment. This positive effect is in line with theoretical prediction when the number of children does not have a strong negative effect on the returns to education in the labour market and when children are generally regarded as costly.

Keywords: Fertility, Schooling Investment, Family Planning, China

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1 Introduction

Educational investment decisions are closely intertwined with other major live decisions such as if to have children and how many. However, while the question how education and fertility outcome are related has been well researched, the question how fertility expectations - the number of children one expects to have in the future - affect schooling investment decisions, lacks theoretical and empirical evidence. This paper tries to fill this gap. First, a simple theoretical model motivates two economic channels how expected fertility can influence schooling investment. Then, policy data from the One-Child-Policy in China is used to investigate empirically how individual variation in the cost of having a second child due to permits allowing a second child affects fertility outcomes and educational levels.

This question is of interest for countries where fertility outcomes is an important public policy topic. Most empirical literature states a negative relation between educational level and number of children particularly for women. However, one might question where causality lies: Do women want fewer children when they get educated? Or do women that expect to have less children in the future choose to educate more? In this paper, I address the second question: How does expected fertility influence educational investment decisions? The answer to this question is of importance for policy makers who wonder how reforms affecting fertility potentially influence educational investment. It also has implications for labour market and family policies such as parental leave, child care and child allowance.

Basic educational decisions usually concern individuals and parents that do not have children or grand-children yet, but who might take into account how many they expect to have in the future. A simple 2-period model is used to motivate the empirical analysis and illustrate two channels through which fertility expectations can affect educational investment: When raising children is costly, children decrease future consumption and thereby increase the incentives to use educational investment to transfer consumption to the future. Children

can also affect the time their parents can spend working in the labour market and in this way impact the overall returns to education. I show that 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 of the One-Child-Policy in China that varies the number of children an individual is allowed to have based on observable characteristics. During the One-Child-Policy in China, monetary fines, monetary bonuses as well as disciplinary measures and penalties were employed to discourage having more than one child. However, some couples had the possibility to apply for a permit allowing them to have second child under specific circumstances. Falling into one of those exemption can increase the expected fertility from having one to having two children. It can, however, also relief an individual that was planning on having two children in the future in any case from having to pay income-dependent fines and endure social penalties.

Utilizing the provincial and time variation in the eligibility criteria for second child permits, I calculate the number of children an individuals is allowed to have at age 16 where individuals finish secondary school and the decision to continue schooling at 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 that do not get affected. Provinces that do not change their policies during that time help to control for the effect of eligibility characteristics as well as annual trends.

First, using an older cohort that has finished their main reproductive stage in 2010, I verify that being allowed to have two children increases the likelihood of having a second child, which it does on average by 11 percentage points. In the following, I looks at individuals that turn 16 during the 1990s and subsequently have not finished their reproductive stage in 2010 but have finished their educational stage. I find that being

allowed to have two children instead of one at the age of 16 increases significantly the level of education measured in years of education for men and women. Eligibility for a second child permit increases the likelihood to finish junior and senior high school significantly. While primary and secondary education is completed before the reproductive stage in this context (marriage is only allowed after 21), tertiary education overlaps with the reproductive stage, making analysis theoretically different. It is not the focus of this paper.

Furthermore, I want to determine who gets 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. Those always planning with two children are affected by second child permits since they benefit from not having to pay the income-dependent monetary and social fines. 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 absent of the reforms. I find that those that react to the reforms are those with 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 that increase their fertility expectations from one child to two children as a response to being eligible for a second child permit.

In the theoretical section I highlight one reason why fertility expectations can have a positive impact on schooling investment: when children are costly incentives to invest in future income are higher. However, there are other possible channel that could create this effect such as wanting to help children with their schooling, higher pay-offs from a higher quality spouse or an overall more positive attitude.

This paper adds to the vast literature on schooling investment and fertility[1]. Theoretical growth models and country level empirical work usually connect low fertility rates and

[1]Among many other by Bulatao et al. [1983], Basu [2002], Osili and Long [2008].

high human capital investment (Becker et al. [1990], Rosenzweig [1990], Kalemli-Ozcan [2003]). On an individual level, particularly female education 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 for an educated woman the opportunity costs of having a child 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 in case of childbearing. Amongst other explanations, education also 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 focus on high fertility countries (like Duflo et al. [2015], Osili and Long [2008], Duflo et al. [2017]). Developed countries often face low fertility rates below the replacement rate and aim at raising their fertility levels. At the same time, governments want high educational investments and might wonder if this contradict their fertility goal. This paper looks at the effect of expected fertility on schooling investment in a low fertility setting and advocates that wanting a family in the future does not necessarily hold one back from education. However, labour market conditions are important. If parents are well integrated into the labour market 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. One explanation why this might be true in China is the important role of grandparents in raising children (Chen et al. [2011]).

A distinct but connected strand of literature looks at the effect of contraception on educational investment choice of women (Goldin and Katz [2002], Ananat and Hungerman [2012], Miller [2010]). The idea is that contraceptive methods give women certainty over pregnancy consequences of sex and thus decrease the risk of tertiary schooling investment.

This paper on the contrary looks at planned pregnancies; it indeed assumes that individuals can plan their fertility outcome as well as the timing of pregnancy, an assumption that is appropriate in 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 implication about the effect of the current changes in the fertility policies allowing two children. There is still an ongoing discussion how effective fines and propaganda was during the OCP in decreasing fertility rates (McElroy and Yang [2000], Li [1995]). 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 one (Qin et al. [2016], Li and Zhang [2016], Rosenzweig and Zhang [2009]). To my best knowledge, the only paper discussing a similar idea and using variation in the enforcement in the OCP as an identification mechanisms is Huang et al. [2015]. However, they only use regional variation in monetary fines that in the data set I use has no effect neither on schooling investment nor on fertility choice. 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 [2015]).

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 times, regulations for second child permits that were issued at the province level and were changed over time. This provides the necessary variation needed for the empirical analysis. It is important to understand the setting of the policy and of second child permits in order to understand how permits and fines affect expected fertility.

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 ambitious family planning policies including the "Later, Longer, Fewer" campaign from 1971-1979, the one-child policy (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 government to set out rules that would decrease fertility rates substantially. 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 area where the one-child limit met significant resistance (Baochang et al. [2007]). Between 1982 and 1984, provincial government started to issue more or less formal guidelines under which married or remarried couples could apply for a permit to have a second child, thereby relaxing the one child per family limit significantly mainly in rural areas (Scharping [2013]). Between 1986 and 1991, the provincial government 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

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

goal. Fines and bonuses were set out 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 being restricted.

Eligibility criteria for second child permits varied on the province 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 which conditions a married couple was able apply for a permit. Most exemptions from the strict one child policy also postulated that the applying couple has to respect late child-birth (after 24 year for women) and an acceptable birth interval (between 4 and 7 years). While officially couples have to obtain the second child permit before having the second child, this posed a significant financial burden to local governmental units particularly in rural areas such that presumably second child permits were given out after birth if the couple falls 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 s well and that permits were not given to unmarried individuals or couples.

The most used exemption is likely the one allowing couples in rural areas whose first born is 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 often were 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 population of the ethnic minority. Specifically autonomous regions[4] were more lenient with fertility constraints on minority couples.

[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]).

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

Most provinces introduced the criterion 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 and not be a long-term policy.

There were also some specific exemptions targeted at certain occupational groups such as fishermen, mine worker or 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 which makes it impossible to evaluate without having governmental application and acceptance data.

The exemptions I use for the empirical analysis are:

1. In five provinces, couples in rural areas can 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 have 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 can have two children.

Empirical identification of the effect or the reform changes relies on geographical and temporal variation in the introduction of second child eligibility criteria. Figure 1 illustrates

[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 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.

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 which is the time many provinces revised their family planning regulations.

3 Model

3.1 Setup

To give an intuition 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 educate and to have children. In the model, a representative family consisting of two parents and one focus child decides how much to invest in 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 being made by the family. One can argue that the educational decision is made by parents and the fertility decision by the focus child. However, there are important interaction that make this simplifying assumption realistic. 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 per-

suasive in China where the family is still the most important social unit for many individuals.

Parents draw important benefit 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 less resources to be allocated to the parents when they are retired and have financial and care needs.

It should also be noted that educational investment stage and 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 age limit for marriage is 21 for women and 23 for men and individuals are strongly discouraged from having children without being married. If one wanted to analyse tertiary education, an intermediary period that can be either used 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 is exogenously. I ignore the possibility to borrow or save[6] and in such 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

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

In period 2, the focus child is grown up and married. The income he/she earns is consumed by the 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 is dependent on the educational level of the focus child I, reflecting the fact that monetary fines are dependent on the household income which is a function of the individual's educational level ad 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.

[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.

[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.

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 and if one is able to find a partner and have a child at the moment one wants to. However, to illustrate the basic mechanisms, this basic 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:

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

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:

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

On the left hand side we have the marginal (opportunity) cost of having n^* (grand-)children which consists in 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 which increases 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:

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

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

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

Falling into the exemption has two opposing effects: On the one hand, it decreases the marginal utility of consumption ($u'(.)$) by benefiting from a decrease in the cost of having (grand-)children by $\mu p(I)$ (positive income effect). This has the effect of decreasing

[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.

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:

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

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

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

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 total 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 gets easier 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 *increasers* and those with a high α *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 level does not change $\underline{\alpha}$ (equation 6). Thus, at a certain α and μ, families are unaffected independent of the fine level. Intuitively, if families see one (grand-)child as optimal, penalties for the second (grand-)child are irrelevant. The fine level only

[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.

changes the threshold between those that are *increasers* or *benefiters*: The higher the penalties, the more families are *increasers*.

An empirical challenge is to disentangle the overall effect of the second child permit reforms on schooling investment, differentiating between the effect it has on individuals that are *increasers* or *benefiters*. We know that the policy 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 that are *increasers*, or both of them. Indeed, in both cases, a positive effect of the removal of fines can explain a positive impact on schooling investment. The conditions for a positive effect are summarized in the following proposition.

Proposition 1 *The effect of the exemption on schooling investment is positive*

- *on families wanting two (grand-)children being or not being eligible for a second child permit (**benefiters**) when the decrease in cost for the second (grand-)child due to the removal of fines is small relative to the increase in the returns to education.*
- *on families increasing fertility expectations due to eligibility for a second child permit (**increasers**) when the decrease of the returns to education due to the second (grand-)child is small relative to the increase in total cost for raising (grand-)children.*

4 Data

4.1 Individual Data

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

For the main cohort, I include individuals that turn 16 between 1990 and 2000. This leaves me with 5 405 observation for the main empirical investigation of which 53% are female. 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. 89% of the sample indicate that they are of Han ethnicity. The other main minorities present in the sample are Miao (2.1%), Yi(2.3%) and Man (1.5%)[11].

Table 1 displays the summary statistics. On average, individuals have stayed 7.6 years in school. Women stayed on average 7.1 year at school and men stayed 8.18 years. At the same time, man and women with non-agricultural household status spend nearly double as many years at school at men and women with agricultural household status (11.4 compared to 6.1).

One issue is that those in the main cohort, those that turn 16 after 1989 but before 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. I therefore need an older cohort that has already finished the reproductive stage at the time of the survey. For this, I use individuals that turn 16 between 1982 and 1990. The assumptions is that while their educational investment has not necessarily been affected by the second child policies, the number of children they have should have 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 outcome.

The summary statistics for the older cohort are also displayed in table 1. As expected,

[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%).

educational levels are lower but other characteristics are the same (sex, ethnicity). There are only more individuals with an agricultural household registration status.

4.2 Policy exemptions

Data about the 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 chosen since at that time the decision to continue with high school after compulsory secondary schooling has to be taken. The official exemption policy within the province should influence this decision.

The main variable of interest is calculated for individuals that turn 16 after 1980, however, for the main result only use those turning 16 after 1989 until 2000 are included. This has two reasons: For one, 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 the 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 tertiary level is finished[13].

The number of children one is allowed to have is a results of the province one lives in, the household registration status (agricultural or non-agricultural), if one has siblings, and

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

[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).

if one belongs to an ethnic minority. Overall, for those turning 16 after 1990, 32% in my 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 can have a second child when the first one is a girl such that I denote the number of children allowed with 1.5. 23% fall into the category that they are allowed have 2 children.

5 Empirical Approach

5.1 Estimating the effect of second child permits

The first question one might ask is if second child permits have an effect on fertility outcome. If second child permits had no effect on real fertility outcome, it should not change fertility expectations either. In this case, any effect that the policy on education levels would be driven by *benefiters*, those that do not change their expected fertility, but benefit from the reform because they benefit from not having to pay fines for the second child. We would merely learn that income-dependent fines have a negative effect on educational investment of those that plan on paying them. If the effect was driven by *increaser*, those that increase their expected fertility as a response to the policy change, the policy implications would be more general as it shows 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 1983 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 have 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 thus are excluded.

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

Between 1983 and 1990, some provinces already introduced exemptions such that the number of children allowed at 16 can be used. However, since this is the adjustment period, the policies that were introduced 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 with 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 might decide to have a second child when 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.

$$\begin{aligned} 2nd\_child_{i\ in\ 2010} = \beta_1 nb\ children\ allowed_{ip\ age(16/30)} + \beta_2 characteristics_i \\ + \beta_3 yearFE_t + \beta_4 provinceFE_p + \epsilon_{ipt} \end{aligned} \tag{6}$$

In one specification the number of children allowed is adjusted to 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 born is a son are changed to being allowed to 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 second child policy, and the sex of the individual. 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, the sex of the first child is controlled for[15].

[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

Identification comes from the assumptions 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 sub-group 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 a 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 Reduced form regression to estimate the overall effect of exemptions on education

The overall effect of being eligible for a second child permit on educational investment is mainly 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 different.

Similar to in the previous exercise, the variable of interest is the number of children the individuals is officially allowed to have at age 16 ($nb\ children\ allowed_{ip\ age(16)}$). I control for

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.

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 ($ProvinceFE_p * YearFE_t$).

$$\begin{aligned} years\ education_{ip\ in\ 2010} = \beta_1 nb\ children\ allowed_{ip\ age(16)} + \beta_2 characteristics_i \\ +\beta_3 yearFE_t + \beta_4 provinceFE_p + \epsilon_{ipt} \end{aligned} \tag{7}$$

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 pre-OCP trend regressions and do a 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 of the educational budget for ethnic minorities areas, the policy measure captures both. So far, I have not encountered evidence for such behaviour and robustness checks such as verifying that the overall results are not driven by a specific easily targeted group aim at strengthening the results.

One might be concerned about potential spill-over through migration. However, the Chinese household registration system restricts the possibility to migrate, particularly between provinces. Applications for the second child permit can only be submitted at the place of

registration and moving the place of registration is restricted. 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).

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 (*Increasers*) or those that merely benefit from not having to pay the fine but wanted to have two children in any case (*Benefiters*) since policy implications are very different. Verifying that second child permits have a real effect on fertility outcome was the first step.

In the second step, I use proxies for individual and regional fertility preferences 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 are shown to be correlated with fertility outcome. Since individual fertility behaviour is difficult to predict, I use a very rough 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 some fertility proxies and to verify the intuition that those with medium likelihood of having a second child should react most to second child permits. As proxies, I use the regional fertility rate calculated as the average number of children individuals between the age of 31 and 35 have within the same county, the educational level of the father and the number of siblings which are added to regression 6. Instead of year fixed effect a linear

trend variable is included.

The estimated significant coefficients of those variables that are already realized at the age of 16 [16] are then used to predict the likelihood of having a second child for the younger generation absent of the effect of second child exemptions:

$$Pr(2nd\_child)\_pred = \frac{exp(\hat{\beta}_2 charact._i + \hat{\gamma} proxies_{ipt} + \hat{\beta}_3 trend_t + \hat{\beta}_4 provFE_p)}{1 + exp(\hat{\beta}_2 charact._i + \hat{\gamma} proxies_{ipt} + \hat{\beta}_3 trend_t + \hat{\beta}_4 provFE_p)} \quad (8)$$

This exercise relies on the strong assumption that the effect of those 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, otherwise the predicted likelihood would be close to random.

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 three groups is derived from the three groups reacting 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 group. It also accounts directly for the possibility of control variables having different effects in the different subgroups.

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

6 Empirical results

6.1 Effectiveness of second child permits

In this part, 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 probably due to women on average being younger when they have their first child and therefore the correlation between the exemption status at age 16 and the exemption status 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. 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 to have only one child in any case, or potentially because they were planning with two children and paying 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 Overall effect of second child permits on schooling investment

The results for the overall effect of second child permits on schooling investment estimated based on equation 7 are displayed in table 4. I control for province fixed effects 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 if the person lives in an urban area according to the 2010 census definition.

I find that being allowed to have two children instead of one child increases the years of education on average around 0.7 years. The coefficient does not change significantly when I include province specific fixed effects. This mitigates the concern that the effect might be driven by provinces that introduce second child permits for a great part of the population and simultaneously increase their effort in educational attainment of their population. Furthermore, the effect is higher for men but not significantly so. This empirical result is evidence that within this environment, men and women that are allowed to have one more child without having to pay any fines react by increasing educational investment.

Following, I check at which stage of the education career the number of children has an effect 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 one more child without having to pay a fine significantly increases the likelihood to graduate from junior high school by on average between 5.8 and 8 percentage points and the likelihood of graduating from senior high school by around 6 percentage points.

In order to check the robustness of the results and to argue that the exclusion restriction is not violated, I run a placebo test and several robustness checks. For the standard placebo test, I map the eligibility status of those in my main cohort to those that turned 16 before

the introduction of any second child exemptions. As a result, those that turn 16 between 1972 and 1982[17] have a placebo variable as the number of children allowed at age 16 which does not have any effect on the educational level.

Concerning the robustness of the results, I check that the overall result is not driven by one specific sub-group that is easy to target by an educational policy or could have a specific trend in some provinces. I find that the effect is mainly driven by the rural population by both those that are allowed to have two children and those that have an expected fertility limit of 1.5 (see table 6 column 1 and 3). The results is also robust to only using the Han sample, indicating that the result is not driven by minority people (table 6 column2). Different provinces have different approaches to how they handle minority issues and targeting minorities with special population and educational policies might have been plausible. 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 a lot over a period of three years and educational decisions are usually not made on one specific date. It shows that the results is not an effect of picking the right threshold.

Furthermore, I check if results change if the amount of monetary fines that someone has to pay for an unauthorized second birth documented when the individual is 16 years old 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 7). The coefficient is also unchanged when I include the change of the fines over the last three year.

There are several variables that one might suggest have an effect on the impact of the policy. For one, one might suggest that in provinces that have higher monetary fines, the

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

effect of being eligible for a second child permit should be higher. However, this is not the case. I also check if individuals with a high educated father have a different intensity of the effect, the idea being that education of the father is a proxy for income. However, I do not find any significant difference. This might be due to the fact that though individuals with an high educated father are more likely to have the means to pay the fines, but 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 do not get affected by the policy. 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[18].

6.3 Separating out the effect on *increasers*

Since a real effect of second child permits on fertility outcome and an overall effect on schooling investment was found, I continue to investigate which sub-group drives these results. As the first step, fertility proxies are included in the regression that predicts having a second child for the cohort of 1982 to 1990 (see table 8). 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 are 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 the likelihood for my 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.

[18]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.

Based on the significant variables that are already realized at the age of 16, I predict the individual likelihood of having a second child absent of second child permit. Figure 3 displays the distribution of the predicted likelihood. We see that there are many individuals being bunched at the lower and upper end of the distribution. Those with a very low likelihood are suspected to be *unaffected* and those with a high likelihood *benefiters* of the reforms.

In my naive 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. They are thus most likely to be *unaffected*. 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 the *increasers*. The ones with a high likelihood (over 72%) will probably have 2 children in any case, thus are *benefiters*.

In order to confirm this intuition, I do the same analysis with the older cohort: I predict the likelihood of having a second child absent of second child permits and divide them into three groups of equal size according to the predicted likelihood of having a second child. As can be seen in table 8, the group with the medium likelihood of having a second child is indeed the one that reacts most to the number of children allowed[19].

The results from the sub-sample analysis is displayed in table 9. We can see that the results are driven by individuals with a medium likelihood of having a second child, supposed *increasers*. For those with low likelihood (supposed *unaffected*), the coefficient is positive but clearly insignificant. For those with high likelihood (supposed *benefiters*) the coefficient

[19]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.

is very close to zero and insignificant. The latter points to the hypothesis that the 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. That the group with the medium likelihood drives the overall result suggests that it is those that increase their fertility expectations that increase schooling investment.

7 Discussion and Conclusion

In this paper I use a novel empirical approach to address the question how fertility expectations - the number of children one thinks she/he will 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 that are allowed to have a second child without having to pay a fine invest more in education. This perhaps surprising result is most likely a result of the specific Chinese social and economic environment; however, it can still be a positive sign for policy makers that want to promote fertility and education. Replicating this result in other countries will be difficult since identification is a crucial point and it is difficult to find 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 how fertility expectations can influence educational investment: Because children are expensive one might want to ensure to gain more money in the future once one has to provide for children. The overall positive effect depends on the relationship between returns to education and fertility. In so far, the policy implication is nothing novel as that it stressed the importance of providing the opportunity for men and women to stay or re-enter the labour market without much loss of their skills.

However, there are other channels how fertility expectations can affect education that one can think of. For one, individuals that are planning to have more than one child in the future might also plan to take over important child care 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 the marriage market returns to education. Possibly, one parent might want to increase her/his bargaining power when he/she counts with 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 also 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 that are panning to have two children instead of one child is not the same as comparing individuals that do not plan to have any children with those that do. However, this one of the first empirical papers that addresses the identification issue of the relationship between fertility expectations and educational investment and hopefully will lead to a discussion in which case studies of different countries can be compared.

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8 Appendix

[20]Truncated at 7
[21]Taking into account the sex of the first child.
[22]Only if husband does not have a brother.

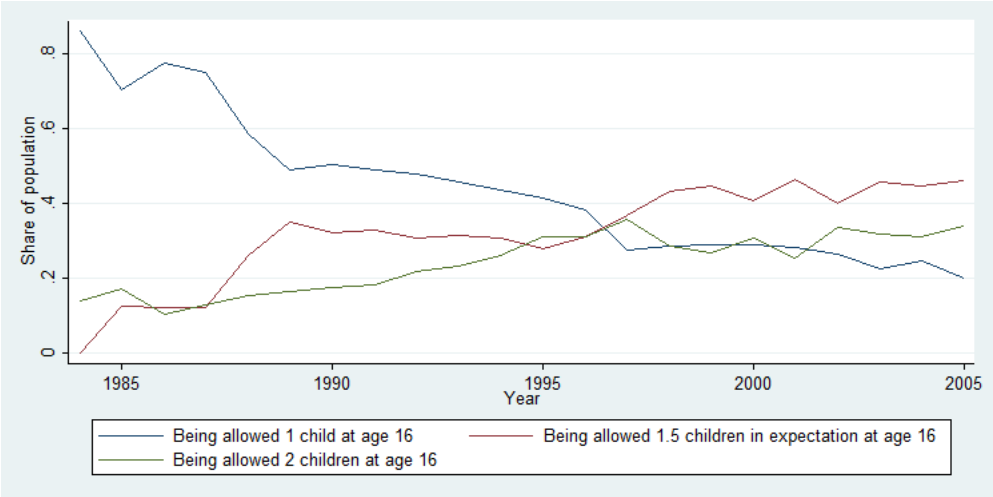

Figure 1: Evolution of the share of population falling into an exemption category according to the year they turn 16

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[20]	1.673	0.821	0	7
Allowed to have 2nd child[21]	0.35	0.477	0	1
N		6142		

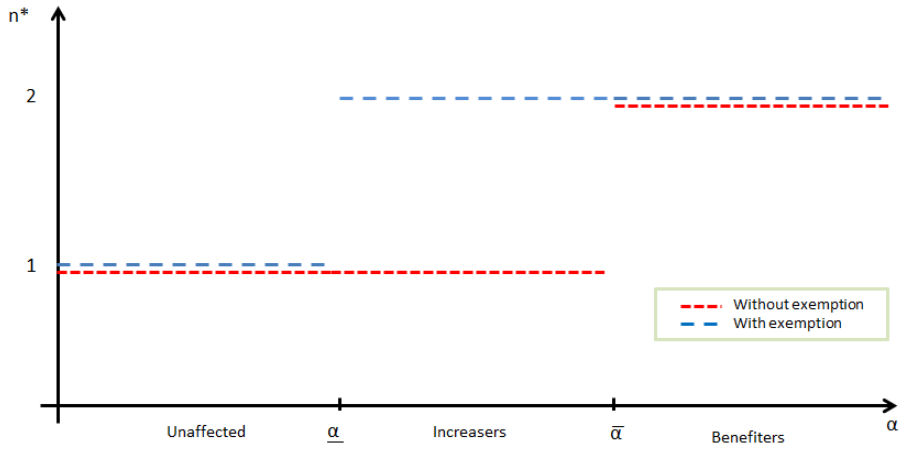

Figure 2: The effect of ferility preferences on the number of children.

	Hebei	Chongqing	Hubei	Zhejiang	Jiangsu
Family only has girl (rural area)	1989	1997	1987	1995	2002[22]
Ethnic minorities	1982	2002	2002	1990	-
Spouses are only child	1982	1997	2002	1989	1990

Table 2: Examples of when provinces formalized eligibility criteria.
Provinces have several other eligibility criteria such as couples moving from outside China, remarried couples, couples with a disabled child etc. that I do not regard. Based on Scharping [2013] and family planning documents.

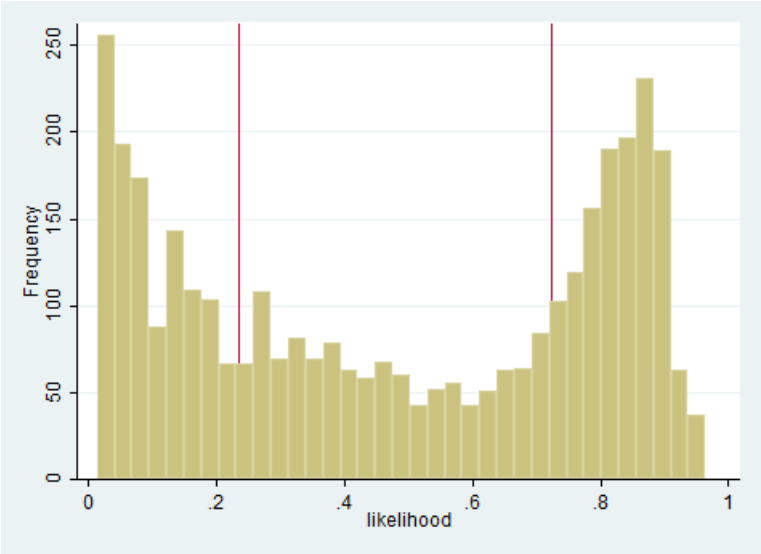

Figure 3: Frequency table of predicted likelihood of having a second child for 1990/2000 cohort

	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) 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 6: 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)	(4)
Nb children allowed(16)	0.700***	0.701***	0.704***	0.701***
	(0.222)	(0.244)	(0.222)	(0.244)
female	-0.737***	-0.718***	-0.736***	-0.718***
	(0.0963)	(0.0984)	(0.0963)	(0.0984)
Agri. household status	-4.194***	-4.182***	-4.195***	-4.182***
	(0.149)	(0.156)	(0.149)	(0.156)
Han ethnicity	1.342***	1.330***	1.344***	1.330***
	(0.204)	(0.207)	(0.204)	(0.207)
Only Child	-0.250	-0.197	-0.240	-0.197
	(0.227)	(0.248)	(0.227)	(0.248)
Urban Area	1.869***	1.851***	1.869***	1.851***
	(0.123)	(0.127)	(0.123)	(0.127)
Fine in years of income	-0.0861	-0.182	-0.138	-0.327
	(0.0763)	(0.356)	(0.0877)	(0.407)
Change in fine (3 yrs)			0.0726	0.606*
			(0.0674)	(0.352)
Year FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Year FE x Province FE	No	Yes	No	Yes
Observations	5405	5405	5405	5405
R^2	0.454	0.478	0.454	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 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 8: 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 9: Effect of the second child policy based on the predicted likelihood of having a second child.