Does the Family's Investments in the First child Affects the Decision to Give Birth to a second child?

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Abstract

While the one-child policy had achieved great success in controlling the population growth in China, the low fertility rate followed by the family planning policy had been widely concerned by academics and the Chinese government. Trying to boost China's fertility rate, the Chinese central government formally abolished the one-child policy and replaced it with the universal two-child policy in 2015. Under the background, a core question is what factors affect the family's fertility decision to have a second child without the policy control. This paper follows Gary Becker's children's quantity-quality theory, exploring this question in the family scope. The paper proposes that the more the family invests in the first child, the less likely they will give birth to a second child. This article uses a sample data called China Family Panel Studies (CFPS), and multilevel logistic regression is applied. The analysis includes the family's characteristics and the province's traits to examine the impact from different levels. The result finds that the quantity-quality trade-off has little impact on the family's fertility decision. Compared with educational investment and education expectations, the time is a more significant factor that affect a family's fertility decision. The study also finds a moderate variation of the probability of having a second birth among the provinces, indicating that the local variables should be noticed.

Keywords: second child, family planning policy, quantity-quality substitute, provincial effect, multilevel regression

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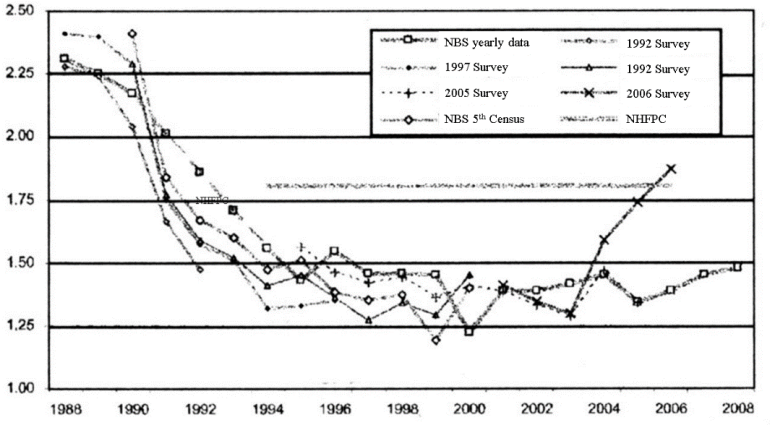
The Quantity-Quality Trade-off Effect in Chinese Family's Fertility Decision on the Second Child

The total fertility rate (TFR) is one of the most widely used indexes to estimate fertility, yet the exact number of the TFR in China for the recent 20 years is still in debate. Figure 1 shows the estimated TFR from multiple sources, includes the fifth National Census, survey data from many years, the National Bureau of Statistics (NBS), and the National Health and Family Planning Commission (NHFPC). Many scholars believe that the data released by National Health and Family Planning Commission, which keeps 1.8 and lasts for many years, are misleading (Guo, 2008, 2010; Morgan et al., 2009). They claim that the real value is nearly 1.5 (Cai, 2008; Guo, 2008, p. 200, 2010; Morgan et al., 2009; Retherford et al., 2005) and even close to 1.3 (Guo, 2008, 2010).

Figure 1

Multiple Sources for the TFR in China Between 1988 and 2008[1]



[1] *Source:* Guo, Z. (2010). *Low level of TFR in China and related population research problem*. Xue Hai. (Guo, 2010) The caption is translated.

Contrary to these studies, some scholars disagree that China's fertility has dropped to the lowest-low fertility rate[2]. They argue that the TFR seems too low because of the under-reporting. The actual number should be close to 1.7 or 1.8 after adjusting the original data (Chen & Duan, 2019). However, academics have achieved a consensus that China had completed the demographic transition since the early 1990s as its total fertility rate dropped to below replacement level and showed no signs of recovery (Cai, 2010; Morgan et al., 2009; Retherford et al., 2005; Wang, 2008; Wang et al., 2013). Studies point out that the nation's family planning policy and rapid socio-economic development are the two key factors that caused the fertility transition (Cai, 2010; Chen et al., 2009). In the early stage of the family planning policy in the 1970s and 1980s, the policy played a crucial role in reducing the TFR. When China achieved marvelous development in the late 1990s, socio-economic development then became a more critical factor.

The decreasing TFR is a threat to prolonged economic and social development. Facing the low fertility challenge, the Chinese government intends to use policy as an effective tool to motivate China's fertility once again. Family planning policy is one of the most important forces that shaped China's TFR, as it was once a reliable tool to regulate the population. The government hopes to use it to reverse or at least slow down the fertility decline. In recent years, the Chinese government changed the one-child policy to increase the fertility rate. After the pilot program in some districts, in 2013, the Chinese central government carried out the "selective two-child" policy. It allowed families to have a second

[2] Based on the 5th National Census (2000), the TFR was 1.22 (see NBS 2002), and the result of the 6th National Census (2010) showed the TFR was 1.18(see NBS 2011).

child if either of the parents was an only child regardless of their *Hukou* status[3]. In 2015, the government formally abolished the One Child Policy and allowed all couples to have two children without any condition.

The policy change draws broad concern with its possible impact on fertility and may even reshape the future of China's population. It provides a context change that no study should ignore. There are three main research directions related to it. The first one is to evaluate how much the policy can alter the TFR and change the population. Many researchers claimed that the policy change had increased the TFR (Chen & Duan 2019; He et al., 2018; Shi et al., 2019; Wang & Ge 2016). According to 2017 China Fertility Survey data, the TFR was risen from 1.41 in 2015 to 1.77 in 2016. The primary rising happened in the second child fertility rate; it increased from 0.943 to 1.013 (Chen & Duan, 2019; He et al., 2018). However, its effect is limited. It will not reverse the trend but only delay when the population shrinks (Wang & Ge, 2016; J. Wang& G. Wang, 2016). Without the policy change, China's population will start decreasing in 2027, the natural rate of growth will be -0.8% per year in 2050. The decrease will happen in 2030 with the universal two-child policy, and the natural growth rate will be increased to -0.5% per year in 2050 (Wang & Ge, 2016). This research direction concerns how to calculate the direct influence the policy caused at the macro level.

The second and third directions concern the more indirect influence of the policy change at the family level to explore the micro-level factors that influence women's and family's fertility intentions and behavior. The second direction is to study how policy change

[3] *Hukou* is a household registration system. It has two main categories: Agriculture for rural residents and Non-agriculture for urban citizens. A person's welfare can have related to their Hukou status, including the right for children to enter public school, the medical insurance, the qualification to purchase a house, and many other kinds of social welfares. Hukou status can also decide if a family is allowed to have a second child. See the discussion below.

may affect people's fertility intentions. Because the surveys of fertility intentions were mainly conducted after the family planning policy, the policy effect has already influenced most of the collected fertility intentions (Qiao, 1999). The practice of family planning policy has inevitably shaped people's fertility intentions (Zheng, 2004). Most of the work neglected the policy's influence because the fertility intentions are typically estimated by asking the respondents, "regardless of the policy, how many children do you want?" Many scholars had realized this problem and explored the different factors that can influence fertility intentions (Hong & Zhu, 2017; Qing & Ding, 2015; Wang et al., 2019; Zhang et al., 2016; Zhao, 2019). Their work covered a lot of socio-economic factors and policy factors as well.

The last research direction studies how policy change can affect people's fertility behavior. Many studies have explored the determinants of second-child fertility behavior. First, economic factors have a significant influence on giving birth to the second child.

Family income is an essential factor. People whose family income is higher will be more likely to give birth to a second child (Jin et al., 2018). Besides household incomes, childcare is a critical factor. Raising children needs a solid financial foundation and requires parents to spend a large part of their time on the children. Taking care of the children can be very time-consuming, especially when people need to work longer to earn more salary to support more children. Even when parents can afford a second child, they may not have enough time to do so. The grandparents' support is proved to be essential. Grandparents can provide economic support (Jin et al., 2018) and help them take care of the child (Ni et al., 2018). They will significantly relieve the parents' pressure on childcare when they take the parents' place to care for the child. Ni et al. (2018) state that since fathers spend more time

working and mothers also widely attend the workforce, childcare is a massive problem because parents lack time and energy to take proper care. Grandparents' participation in childcare is almost inevitable. Li's work (Li, 2018) also supports the conclusion. She found that childcare brings tremendous pressure on professional women. For those who already gave birth to one child, the pressure will significantly lower their intentions to have a second child.

According to the studies mentioned above, economic condition and time are the two main micro-level factors that would affect people's fertility decisions. However, some gaps need to be filled.

First, few studies combine the individual and family to study fertility. Although these articles emphasized the importance of the cost of raising a child, few of them consider the decision-making process from a family view. Raising the children depends on family income and is also a matter of family resources allocation. Either economic condition or time are family resources allocated according to the parents' will (Basu, 2002). The family variables are as important as individual variables and need to be further studied.

Another research gap is that few works relate the provincial variables to the family's fertility decision. The fact that the environment where the family lives can influence the family's fertility decision too. Although some papers have demonstrated that the differences in economic development and policy among the provinces caused considerable geographic disparity in TFR (Chen et al., 2009; Deng et al., 2015; Evans & Gray, 2017), few studies took the provinces' characteristics as determinants that affect the family's fertility decision. Many studies suffer from a lack of cross-province comparison as they use the data from a single

province (Jiang et al., 2016; Luo & Mao, 2014; Shi et al., 2019). Since the cost of child-rearing and education can significantly vary among the provinces, the province's characteristics are very likely to affect people's fertility behavior. It is worth trying to link the macro-level and micro-level factors and further the understanding.

At last, most of the studies were conducted before the population policy change. For literature published after the policy change, only a few of them concentrate on fertility behavior. Since the policy change happened just several years ago, it is still hard to tell its effect on fertility. It may influence fertility behavior directly or indirectly. It is helpful to consider the policy as a factor to analyze the family's fertility. More updated data should also be used to capture the recent changes. It can bring new insight by using the latest data, especially the data after the policy change.

Research question

This paper will explore the relationship between the family's investment in their first child and the fertility behavior of the second child. The main research question is: Does the family's investment in the first child affect their decision to have a second child?

The family's investment consists of three parts. The first one is the education expectation towards the first child. Educational attainment is a crucial indicator measuring the quality of the person. Parents with higher education expectations on the first child may be more likely to invest more in this child. It is an evaluation of the parent's intentions to spend more money and time on the child. The second part is how much money the family spend on the first child's education. It is an objective measurement of funds used in improving the child's quality. Children in China have nine years of compulsory education in China, which means families do not need to spend any money on school education. Most educational expenditure comes from tutorial classes after school. Parents will spend a lot of money sending their children to these classes if they pin their hope on the child. In this way, education expenditure is an excellent way to measure the family investment in the child. The last part is the time, and energy parents spend on the child. According to the studies mentioned above, time is a crucial factor affecting parents' fertility intentions. If they spend more time on the first child, they may be less likely to give birth to the second child.

It is also necessary to consider the macro-level factors such as the province's characteristics, which can influence fertility decisions. The development of the provinces and their population policy may affect the families' fertility decisions. For example, those

provinces where strictly executed the one-child policy may see a rebound in fertility rate after abolishing the policy. In contrast, the areas where the policy was relatively loose may be less affected. The cost of child education varies among the provinces and may have a different impact on giving birth to a second child. The traditions related to the family are quite different among the provinces as well. The boy preference can be much serious in some provinces than in others, and the reasons to have offspring may also be vastly divergent. In conclusion, the provincial difference may play an important role in deciding the family's fertility.

The family and province variables are used in the analysis to accommodate both the micro and macro effects. The primary concern is the family's investment in the first child, while the other variables are control variables. It combines the micro-level and macro-level factors using multilevel logistic regression, which will be more precise than logistic regression. This paper can test if the family's investment can influence the family's fertility decision on the second child. The effects of family-level variables and province-level variables are jointly estimated too. Thus, the paper can provide experiential evidence for the determinants of the second child's fertility behavior. It can fill the gap in previous studies and lead to some meaningful findings.

Literature Review

According to the background part, the policy change is a reaction to the TFR decreasing. Its purpose is to increase the fertility rate, and it does have some outcomes as expected. However, releasing the policy restrain does not mean the families will simultaneously give birth to a second child. Fertility decision is a very complex process, and it relates to multiple levels of variables, including individual, household, and more contextual variables. This part presents a more detailed literature review about the determinants of fertility decisions.

Individual factors that affect fertility

Individual and household are the two central research units used in studies about fertility. Scholars using them emphasize different research directions. The individual is commonly used to analyze the determinants of the fertility intentions, such as women's education and women's labor participation. When researchers using the household as the research unit, on the other side, they tend to concentrate on the decision-making process and the relationship within the family, such as the power structure and resource distribution.

For individual studies, most studies concentrate on the effect of mothers' characteristics on their fertility behavior. Women's education is the most established and widely studied socioeconomic determinant of fertility in developing countries (Bongaarts, 2003). The relationship between education and fertility is quite complex. Among many theories, the demand and supply theory (Axinn & Barber, 2001) explained how education affects people's fertility decisions. They highlighted why higher educated people are less

likely to give birth from both the demand-side and supply-side. The theory focuses on individual-level factors for the demand-side through which education affects people's desire for children. With higher educational attainment, people are more likely to acquire knowledge or social status that influences their attitudes or behavior to limit giving birth. The theory focuses on how the availability of schooling at the macro-level impacts lowering fertility levels for the supply side. Wider availability of education could affect fertility decisions in two ways. On the one hand, as schools become more pervasive and more people attend them, they caused the compositional change of potential parents. On the other hand, more widespread schooling can trigger various demand-side mechanisms, concentrating births among relatively less educated people.

Education can lower fertility through exposure to mass media in developing countries (Ramesh et al., 1996; Westoff & Rodriguez, 1995). Mass media spreads a "modern" lifestyle, including individualism, accepting consumerism, and a smaller but more efficient family. Women with higher educational attainment are more likely to embrace the "modern" lifestyle; thus, they need to reallocate their resources among foster children and satisfy their desire (Basu, 2002). Having higher education expectations shows that people pursue children's quality and investing more in children. Since the household's resources are limited, investing more in the first child's education would lower the probability of giving birth to the second child.

The education-fertility relation also varies among provinces and parities in China (Niu & Qi, 2020). Niu and Qi's work pointed out that regional socioeconomic development can significantly moderate the education-fertility association. In more economically

developed provinces, the mothers' educational gap is smaller in the first parity but more prominent in the second parity. One possible explanation is that in more economically developed provinces, higher educated women may value their independence more and face higher opportunity costs of childbearing.

Another vital variable is women's labor participation. Some researchers explain the low fertility rate from women's work-family relationships. McDonald (2000) distinguished between gender equity in the family- and individual-oriented institutions. This distinction is crucial to understand the low fertility rate. He argued that the increased rate of gender equity is different in the two sections. Increases in the individual-oriented institutions, such as the education and labor market, are much faster than in family-oriented institutions. As a result, although women's labor participation rate had increased, the traditional family role had not changed, thus caused intense work-family conflict and reduced women's fertility.

Brewster and Rindfuss (2000) emphasized the relationship between the institutional arrangement and the family traditions. Countries that have public policies that enhance the traditional family role would reduce the fertility rate. In contrast, those countries' policies that encourage women's rights can maintain the fertility rate at a relatively high level. The institutional arrangement can affect women's fertility by influencing work-family relationships (Rindfuss & Brewster, 1996). With the increase of technology, women have more chances to join the labor market (Charles, 2011). Although women's labor participation rate has dramatically increased, they still need to face the expectation of traditional gender roles, which asks women to take care of the family. However, women in the workforce need

to spend a lot of time and energy to compete with men or hardly succeed in their careers. The limited time and energy force women to choose between career and family.

Some studies concern with the work-family conflict in China too. Ji and Zheng (2018) reported that the work-family conflict was one of the most critical factors that led to low fertility in China. One study directly examined the relationship between women's work participant and fertility intentions (Li et al., 2020). The result shows that labor participation significantly reduces women's fertility intentions. The effect is more substantial among married women and women who already have a child, indicating that childcare is an important mechanism. Giving birth to a child also means a great loss in income for working women. Liu (2020) calculated the cost for women who have a job giving birth to a child. For women living in the urban area, the labor participation rate would decrease by 10%, with the birth of one child would reduce by 10% and by 22% if they have two children. It would cause her 6.6 years and 12.8 years of work-life. According to the average income in 2016, it would be 290,000 yuan and 570,000 yuan for the whole life, respectively. Women with higher educational attainment would experience more loss. Those living in Beijing and Shanghai would lose around 600 thousand yuan to born one child and over 1,000,000 yuan for two children. The vast cost greatly reduces the probability for women to give birth.

Fertility as a family decision

On the other hand, fertility decision is not merely an individual choice but also involves other family members. It is essential to take the family factors into the discussion.

Becker (1973) provided a framework to study fertility in the family scope. He claims a relationship between the number of children ever born to a family and the children's quality. They are closely related as the marginal cost to increase the children's quality would be higher with more children in the family. Similarly, with heavier investment in each child's quality, the cost to have more children would be more significant. As a result, a substitution effect emerges. Their later paper (Becker & Tomes, 1976) introduced the social interactions between quantity and quality. The parents' preferences regarding their consumption relate to their children. In other words, parents would choose to spend their money among many options; raising children is only one of the options, and there are competitions among the choices. In this case, the parents' intentions to spend money on children are critical. The household expenditures on children partly influence the quality of the children, and the children's endowment partially decides them in turn. Parents may compensate more to less-endowed children, or they can reinforce better-endowed children. If parents have desired quality toward the children, they are likely to invest more.

Many studies have examined the quantity-quality substitute theory, but their conclusions are controversial. One study reported that for American families with multiple children, later-born children would reduce the probability of going to school for the senior children (Cáceres-Delpiano, 2006). Similarly, Lee (2008) found that the number of siblings has a significant negative effect on each children's educational expenditure in Korea. The effect also exists in China. Rosenzweig and Zhang (2009) pointed out that the one-child policy increased by 4% the rate of school participation. It also increases 9% of the university's enrollment rate. There are also contrary findings. Black et al. (2005) found that family size

has a relatively small effect on children's educational attainment. However, the birth order is the main reason to influence educational attainment. Qian (2009) illustrated that giving birth to the second child will significantly increase the probability of going to school for the first child. The effect will be more substantial if their gender is the same.

Becker's quantity-quality substitute theory is very instructive. It implies that the existed children can affect the family's future fertility decisions. Under China's background, although most families only have one child, the substitute effect can happen among the first child's quality and the probability of giving second birth. If the parents have more expectations toward the first child, they may spend more money on the first child and be less likely to have a second child.

There are several studies focused on the influence of the existing number of children. Some studies found that the number of children women already have has a positive relationship with their fertility intentions (Li & Zhai, 2014; Xu & Li, 2010; You & Zheng, 2002). However, other studies report no connection between the number of children and fertility intentions (Feng, 2010; Lv et al., 2013). They argue that the positive relationship between the existing number of children and fertility intentions might reverse the cause-and-effect relation. Having higher fertility intentions might make these women have more children (Lv et al., 2013).

The parity order also matters. Giving birth to a second child is quite different from the first one under Chinese background. The long practice of the one-child policy makes it become an essential factor in shaping people's fertility intentions (Basten & Gu, 2013). The young generation has widely accepted the idea that each family should only give birth to one

child. Most people would have one child, but it is a massive decision for a second child. One approach is to treat the second birth as an emotional view. Parents have different expectations and demands toward different parities (Bulatao, 1981). People might have the first child for emotional reasons, such as having someone to love or carrying on the family name. The second and later births can be a more rationalized choice, such as providing a sibling for the first child. Studies also found that socioeconomic factors can affect higher parities easier than first parity (Morgan 2003, 2; Morgan et al., 2009). The demand for the second child is long being suppressed in China. The recent historical reduction in births in China was mainly concentrated among second-and-third- births, while firstborn remained largely unaffected (Feeney & Feng, 1993; Morgan et al., 2009).

Besides the number of children and the birth order, the first child's gender also draws wide attention. Studies report that if the first child is a boy, the family's intention to give birth to a second child will be lower than the family that the first child is a girl(Chen & Liu, 2020; Qian et al., 2020; Zhou & Guo, 2020). Feng and Li (2016) reported that the first child's gender would affect the family's fertility decision. Parents would be more likely to give birth to a second child if the first child is a girl. The first child's gender is related to the execution of the one-child policy, which will be discussed later. It also relates to gender preference and other family values that may affect people's fertility.

Provincial factors

The social context should not be omitted when considering the factors affecting fertility—the district’s characteristics where the family lives can affect fertility behavior.

When discussing fertility in China, the most notable factor is the family planning policy(Cai, 2010).

Based on the demographic transition theory (Bryant, 2007), one country's TFR would decrease eventually with economic and social development. Economic development improves living conditions, brings enhanced medication, thus reducing the mortality rate. The mortality decrease will lead to the fertility rate decline, and the fertility rate would approach the replacement level at the end of the transition. In the classic demographic transition theory, economic development is the main force to shape the population.

However, this theory cannot fully explain the fertility decline that happened in China. China's total fertility rate experienced a rapid increase in the 1950s and peaked in the 1960s. In the 1970s, the Chinese Government decided to use a family planning policy to control the population. The TFR rapidly decreased in the 1970s and dropped under the replacement level in the early 1990s. Cai (2010) compared over 200 countries' TFR and GDP per capita in 1975 and 2005. In 1975, China was an outlier. Its TFR was significantly lower than the countries which had similar GDP per capita. They proposed that China's demographic transition was ahead of its economic development, which means the economic growth was not the main force to drive the evolution (Cai, 2010).

Instead, the family planning policy pushed the transition. It made China's case unique (Feeney & Feng, 1993; Hesketh et al., 2005). By using strong regulations, China achieved the demographic transition in about 20 years. However, the policy's role is not constant across periods. At the early stage (the 1970s-1980s), the policy was the main reason TFR dropped so fast. However, empirical study studies found that the decrease is not entirely attributable to

the regulation. With China's continuous growth, economic and social factors became the main factors reducing the TFR (Cai, 2010; Chen et al., 2009, p. 20; Feng, 2011; Zhao, 2015). However, this does not mean that policy has lost its strength. Especially after abolishing the one-child policy, how policy influences future population growth is still a question.

The family planning policy is not simply equal to the one-child policy. It had several significant changes in the past. When the Government started the regulation initially, it was called the "Wan, Xi, Shao" policy. It aimed to reduce the number of children and postpone the women's childbearing age. In this stage, it was more moderate(Short & Fengying, 1998). However, the Government pushed a much more restrictive policy called the one-child policy in 1980. This policy limited people to give birth to only one child and a second child under particular conditions. People who violated the regulation can face different punishments, including penalties, job loss, and jail.

The strict one-child policy was too radical and only survived four years before the Government replacing it with a more relaxed one (Short & Fengying, 1998). The adjusted version of the one-child policy has four main types accord to the areas where it was executed (Niu & Qi, 2020). It did not force people to have only one child universally. Instead, it allowed provincial governments to apply it base on their statement. Table 1 displays the four main types of the one-child policy. The first type was the strictest as it forbade people to give birth to a second child under any circumstance. The four municipalities directly under the central Government and two other provinces applied this type. The second type, which was carried out in most provinces where Han Chinese mainly populated, allowed rural residents to have a second child if the first-born was a female. The

third type applies to minority autonomous regions and Hainan, a remote province. Rural residents can have two children without restriction in these regions, while the one-child policy holds in urban areas. At last, there was no forced birth control in Tibet. In general, the policy is relatively loose in remote provinces and rural regions.

Table 1

The Variation of the One-child Policy Among Provinces

Type	One	Two	Three	Four
Provinces	Beijing, Tianjin, Shanghai, Chongqing, Sichuan, Jiangsu	19 provinces	Hainan, Ningxia, Qinghai, Yunnan, Xinjiang	Tibet
Policy	The strict one-child policy in both rural and urban areas	The one-child policy in urban areas and a one-and-a-half child policy[4] in rural areas	The one-child policy in urban areas and a universal two-child policy in rural areas	No forced birth control

The difference of policy at the province level partly caused the significant variation for TFR among the provinces. The policy caused differences were calculated by Guo et al. (2003), the provincial TFR ranged between 1.06 and 2.37 in 1990, with the first group of provinces falling below 1.3, the second in the range of 1.3-2.0, and the last two groups no less than 2.0.

One child policy lasted around 30 years until 2013, when the Chinese Government released the restriction. If both the husband and wife were single children, they could have a second child regardless of their hukou type. In 2015, the Hukou restriction was also abolished. Every couple can have two children now.

Although the one-child policy no longer exists, its impact on fertility still lasts. Abolishing the one-child policy may induce a rebound effect, especially in areas where the

[4] One-and-a-half child policy means for people who has agriculture Hukou type, they could have a second child if their first born was a girl.

gap between the fertility intentions and the policy restrain was larger (Yin et al., 2013). Yin et al. (2013) argued that the policy change might lead to policy change caused rebound and non-policy change caused rebound in the TFR. There were discussions concerned about the potential rebound in fertility rate before the policy change. Zhai et al. (2014) proposed that If the one-child policy were rescinded in 2012, there would be a significant rebound effect with a peak value of up to nearly 50 million newborns and a total fertility rate of about 4.5. In response to the study, Qiao (2014) claimed that Zhai et al. exaggerated the number they claimed. Based on her calculation, the highest number of births would be from 22 to 27 million, and the peak of TFR would be from 2.17 to 2.68. After the policy change, a study declared policy-caused rebounds in TFR in Hunan and Hubei provinces after 2014 (Chen, 2019). However, there is no comparison between the provinces for the rebound effect.

The province's characteristics can also affect people's fertility decisions. House price is one of the most critical factors that can affect fertility decisions. Many studies have found that increasing house prices will reduce the fertility rate (Jin & Liu, 2019; Li, 2019; Li et al., 2012; Liu et al., 2016). The house price itself, along with the house price's increased rate (Li, 2019; Li et al., 2012), and the income-price ratio (Jin & Liu, 2019), can suppress the people's fertility intentions and fertility decisions. Li et al. (2012) claimed that the house price is the primary factor that affects people's fertility behavior. Usually, owning a house is a precondition for young males to get married. It also relates to the qualification for their offspring to attend school. A better public school requires the family owns a house in the school district. Higher house prices will reduce the probability of having a first and second child; it will also postpone females' age to give birth to the first child (Ge & Zhang, 2019).

The province's age structure is another essential variable. Many researchers have pointed out the importance of the age structure on economic development and society. Although no literature has proved the age structure directly impacts a family's fertility decision, it can influence fertility through economic growth and consumption. Population aging has been proved to be a great threat to economic development and relates to many problems. A larger total dependency ratio will pose more pressure on the working-age population, thus impair social consumption.

On the other hand, economy and consumption are closely related to fertility. Thus, age structure provides a contextual effect for fertility. Li and Liu (2020) emphasized the difference in the age structure among the provinces. They stated that there are four waves of the timing when the provinces start population decline. The difference in the age structure among the provinces can also make their fertility more divergent.

The province's fiscal expenditure on education is an important factor. Becker and Lewis proposed that if the education cost were relatively lowered, people would be more likely to have fewer children and increase their quality (Becker & Lewis, 1973). Later studies found that the Government's fiscal expenditure on education can affect the cost of giving birth to the child and educate the child, thus promoting the child's quantity-quality substitution and lowering the fertility rate (Li et al., 2008; Rosenzweig & Zhang, 2009). Yang et al. (2013) reported that the fiscal expenditure on education negatively impacts the fertility rate. However, other studies found that fiscal expenditure can increase the fertility rate (Baudin, 2011; He et al., 2016; Omori, 2009). Yang (2020) provided an experience study by analyzing provincial panel data from 2006 to 2017. He found that education's fiscal

expenditure can come into the family decision as a subsidy to fertility. Alongside the cost of fertility and the increase of quality, the expenditure can improve the family's and society's fertility rate.

Summary

As the literature mentioned above, a family's fertility decision is a complex process that involves variables from different dimensions. It can be affected by the characteristics of the family and the district where the family lives. Women's education and labor participation are the major factors influencing their fertility behavior at the individual level. With many theories that explain fertility at the family level, this paper will follow Becker's theory and concentrate on the family's investment in the first child. The first child's age and gender are also important variables to influence the family's fertility intentions. At the provincial level, the policy change may cause a rebound effect and boost fertility. The province's house price, population structure, and the government's fiscal expenditure on education are important factors. It is necessary to take micro-level and macro-level factors into the discussion.

Hypotheses

The literature mentioned above emphasized the importance of both micro-level and macro-level variables. Three hypotheses are proposed based on the literature review.

Hypothesis 1: Parents who have higher educational expectations for their first child will be less likely to give birth to a second child.

The parents' expectation of the first child's education impacts the probability of birth to a second child. The parents intend to invest in the child. Higher education expectations mean parents want to spend more money and time on the child, which would reduce the probability of having a second child.

Hypothesis 2: A family that spends a more considerable amount of money on the first child's education will be more unlikely to give birth to a second child.

This hypothesis directly follows the quantity-quality substitute theory. The expenditure on the child's education is an investment to improve the child's quality, which will reduce the probability of having more children.

Hypothesis 3: Having other people to help the parents with childcare will increase the probability of giving a second birth.

Other people mean anyone except the parents themselves, include grandparents, the child themselves, paid people such as a nanny. Previous studies have found that time is one of the major limitations for women to have more children (Li, 2018; Ni et al., 2018). The burden will be relieved when other people help the parents to have more time for the second child. As a result, the probability of giving second birth will be higher if other people help parents

take care of the child. The grandparents' help, on the other side, is also a form of family resource that needs to be relocated. In this way, *Hypothesis 3* can test the time restrain on the family's fertility decisions.

In the following chapters, the hypotheses will be tested through data analysis.

Methodology

Data

The data used in this paper are China Family Panel Studies (CFPS) 2016 and 2018. It is a tracking survey mainly conducted by the Institute of Social Science Survey, Peking University (ISSS), which aims to provide panel data covering various social aspects for policymakers and academics. The CFPS is a nationwide survey covering all the provinces/municipalities directly under the central government[5]/autonomous regions except Hongkong, Macao, and Taiwan[6]. After two trial surveys in 2008 and 2009, the research center started the formal survey in 2010. All the individuals who belong to the survived families will permanently be tracked even if they leave the original family. The data is collected every two years with new respondents added in new waves and the questionnaires modified. There are five waves of surveys: CFPS2010, 2012, 2014, 2016, and 2018. Table 2 shows the timeline of the survey data.

Table 2

Timeline of data and policy change

Policy	One-child Policy (Before 2013)			Selective Two-child Policy(2013-2015)			Universal Two-child Policy (2016-)			
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Survey Year	CFPS 2010		CFPS 2012		CFPS 2014		CFPS 2016		CFPS 2018	

[5] Beijing (11), Shanghai (31), Tianjin (12), and Chongqing (50) are four municipalities directly under the central government of China.
[6] The survey range only covered 25 provinces in 2010 originally. Xinjiang (65), Tibet (54), Qinghai (63), Inner Mongolia (15), Ningxia (64), and Hainan (46) were added in later waves.

CFPS has five main questionnaires containing variables about three different research units: individual, household, and community. There are two questionnaires per household. The family roster questionnaire mainly concerns the relationship between family members, and the family questionnaire involves the family's income, expenditure, and assets. For individuals, there is an adult questionnaire to collect data of adults[7]. The children questionnaire is for children under 16. It has two parts; if the child is under 10, their parents will answer the first part and leave the second part blank. If the children ages between 10 and 15, they will answer the second part, and their parents still fill the second part[8]. There is also an adult proxy questionnaire for those who are not there when the survey happens. Data collected from the five questionnaires are stored separately. As a result, there are five datasets for every wave. Each respondent will be given a unique personal id, "PID," which is identical in every dataset for the same wave and the other waves. In this way, data users can connect data from the same respondent across the questionnaires and study waves through the "PID" variable. There is also a family id "FID" for each respondent, which has the same function as "PID."[9]

The sample design[10] used the implicit stratification method to produce a multistage probability sample. The designers wanted to emphasize China's geographic representation since Chinese economic development shows a significant geographic difference. They stated

[7] The definition of the adult here is people aged over 15. For those adolescents aged between 16 to 18, although they have not legally been an adult, they still need to answer this questionnaire.
[8] Who answers the questionnaire is decided by the respondents themselves.
[9] However, family the respondents belong may change, for example, divorce, or marriage, can change their family id.
[10] The sample design introduced here was for the axis survey, CFPS 2010. There are some adjustments for later surveys, but the principle remained unchanged. For technical specification, see http://www.isss.pku.edu.cn/cfps/docs/20180928161838082277.pdf?CSRFT=YQVK-N7F7-RWST-S8GV-BU02-Y4MD-A2XO-9XCH for user's manual.

that using the implicit stratification method can ensure good representativeness of the sample. The first step of sampling was to choose counties within each province randomly. Five provinces were designated as “Large Provinces,” including Shanghai, Liaoning, Henan, Gansu, and Guangdong. These provinces were representative of the regional level. The sample size in these provinces was larger than in other provinces, as 16 counties for each province. Other provinces were “Small Provinces,” eighty counties were randomly selected with the 20 provinces. They did not have representativeness at the province level. The sum of the sample can be weighted to achieve national representative. The next step was to select village committees and neighborhood committees[11] in the chosen counties. The final step was to choose an individual from these committees.

In CFPS2016, the final sample size was 14,763 households and 45,319 individuals. Based on the data of 2014, CFPS2016 managed to track 89% of families and 82% of individuals. According to the data of 2010, after six years, CPFS successfully tracked 69% of the sample. Around 20% of interviews were performed by telephone; the rest were conducted by face-to-face interview. The survey used a Computer-Assisted Personal Interviewing (CAPI) system to improve the working efficiency and the data’s quality. After the interview is finished, the research center validated the interview through a record check, telephone revisits, and data analysis. The CFPS data have become a major data that is widely used in Chinses studies[12].

[11] The village committee is the primary government organization institute in rural areas, and the neighborhood committee is the urban areas' primary government organization.

[12] For the list of papers that have used this data, see http://www.isss.pku.edu.cn/cfps/xzyj/wxlb/index.htm?CSRFT=YQVK-N7F7-RWST-S8GV-BU02-Y4MD-A2XO-9XCH

There are several reasons to use this survey in this paper. The first reason is that it contains variables both from household and individual. In this case, the variables reflect individuals' characteristics and can be treated as household variables and integrated with other household variables. The second reason is that it includes comprehensive variables covering economic factors, personal aspects, and educational factors required for the study. It is also representative of the population nationwide. At last, it is one of the most well-established surveys in China. Hundreds of published papers use the CFPS, and it has a good reputation for data quality.

The variables used in this paper are divided into two levels. Level-1 variables, which are individual and household characteristics, come from multiple datasets of CFPS 2016. Only the dependent variable comes from CFPS 2018 to see the outcome. Family characteristics, such as the respondents' location, urban or rural, family income, and family expense, come from the Family dataset. Variables related to the child include the child's current education, education expenditure, education expectation, and who takes care of the child comes from the Child dataset. Parents' characteristics come from the Adult dataset. Since the variables are contained in several separate datasets, they need to be integrated into the same respondents' records through the variables "PID" and "FID." The matching works are based on the family roster dataset since it contains the entire family relationship. The level-2 variables are the province's attributes. The data comes from the 2017 Chinese Statistical Yearbook produced by the National Bureau of Statistics.

Variables

Dependent variable

The dependent variable is "*Give birth."* It is whether give birth or not to a second child between 2016 and 2018. It is a solid outcome that is the result of family decisions rather than intentions. It is a binary variable that values 0 and 1. 0 means not giving birth to a second child, and 1 means have given birth to a second child in 2018.

Although there is a variable called "cfps_childn" in the Adult dataset to show the number of the respondent's children, it has many contradictions compared with the Family roster dataset record. Every family member will be given an identical personal id in another dataset in the family roster dataset. If a person has any offspring, there will be a record for their child in the Family roster dataset. However, many people claim they do not have children but have children's id in their records. Also, some people report having children without any record in family data. As for the difference in the number of children, there are more mistakes. To match the variables in the Child dataset requires people's child's id, which means if a person claims they have a child, there must be an individual id for their child in the Family roster dataset. As a result, the number of one person's child is computed based on the record in Family roster data since it is more reasonable.

Independent variables include Level-1 variables, which are family-level variables, and level-2 variables, which are province-level variables.

Level-1 variables

Level-1 variables include *Education Expectation of the First Child*, *Expenditure on the Child's Education*, and *Who Takes Care of the Child in the Morning* as predictor variables. It also includes control variables such as *First Child's Gender, Mother's age, First Child's age, Urban or Rural*, *Mother's job*, *Mother's Educational Attainment,* and *Family Income Status*.

Education Expectation of the First Child has three values. Suppose the expected educational attainment is high school or less; it is coded as 1. 0 for the university since it is the most common Chinese parent's aim. It is also the most common value in original data. Considering this, it makes more sense to set university as the reference value. 2 is higher than Bachelor's degree, including master's degree and Ph.D.

Expenditure on the Child's Education is calculated by taking the logarithm form of the original spent amount plus one because many families did not have any educational expenditure.

Who Takes Care of the Child in the Morning has three values. If the parents take care of the child, its value is 0 as the reference value. If the grandparents take care of the child, the value is 1. 2 for the other way of taking care, like babysitter or self-care. The meaning of this variable is to measure the energy parents spent on the child. 0 means parents need to take care of the child by themselves. 1 means the child's grandparents can help parents in childcare. 2 represents parents hardly need to take the child.

First Child's Gender is a binary variable. 0 is for females, and 1 is for males.

Mother's age has an upper limit of 49, follow the standard approach in fertility studies.

First Child's age ranges from 0 to 15, and it is based on the condition set by the Child questionnaire as it is only for children under 16.

Urban or Rural is estimated by residence rather than Hukou type. 0 for rural areas and 1 for urban areas.

Mother's job's value ranges from 0 to 4. 0 includes unemployed, stay in the home, or left the labor market, 1 is agriculture, 2 is self-employed or employer, 3 is employee in the state-owned company or government employee, 4 is employed in a private company. There are two questions in the Adult questionnaire structure of this variable. The first question is the employment status to tell if they are agriculture workers, self-employed, employee, or unemployed. The second question classifies employees according to the nature of their employers into three kinds. Unemployed is set to be the reference value.

Mother's Educational Attainment has three values, 0 for those who finished junior high school or lower education, 1 for finished senior high school or three-year college, and 2 for finished university and above.

Family Income Status is calculated by the province where the family is. It evaluates the rank of the family income13 within the province. Based on the clustered family income quartile, the family income lower than 75% is 0, between 75% and 50% is 1, 50% to 25% is 2, higher than 25% is 3. Transferring the income variable from a consistent variable to a

[13] Family incomes include all source of income, not just wage.

discrete variable emphasizes the comparison among the social class rather than concentrating on the income.

Level-2 variables

Level-2 variables include six variables, *Pre Policy, GDP per capita, TDR, Pfamilysize, Eduexpense, and Phouseprice.*

Pre Policy shows which type of family planning policy the province used, and it works as an indicator to estimate policy effect. It ranges from 0 to 2. 0 means the family planning policy was moderate in these provinces, allowing rural residents to have a second child if their firstborn was a girl. 1 means the policy was loose. 2 means the policy was strict that everyone can only have one child.

GDP per capita is used to estimate the economic development of the province. Its unit is one thousand yuan per person.

TDR is the total dependency ratio of the province. It is calculated by the sum of the number of children aged between 0 to 14 and the people aged over 65 divided by the sum of the people aged 15 to 64. The TDR is used to measure the age structure. It can also represent the pressure on the productive population.

Pfamilysize is the average family size in the province. Family size is important in measuring family structure. A province that has a larger average family size is more traditional in the family structure.

Eduexpense is the government spending on education. It is calculated using the sum of the education spending divided by the number of people living in the province. Its unit is one hundred yuan per person.

Phouseprice is the average price of a house in the province. The house here means new commodity housing, which does not include second-hand houses and other kinds of houses. Its unit is one hundred yuan per square meter.

The group variable is *Province*, which indicates the province the family lives. There are 31 provinces initially, but two have no household, and four have only one household in the sample. After they are removed, there are 25 provinces remain. The sample size will be presented below in Table 3.

Sample

The research object is the families with only one child under 15 in 2016 and can still be tracked in 2018. The reason to select these families is to find out if they did give birth to a second child or not. If they cannot be tracked, there is no way to identify the outcome.

The sample experienced multiple stages of treatment. Table 3 shows the process. The first step is to choose people with only one child in 2016 in the Family roster dataset[14]. There are 17,765 men and women who have only one child. The next step is to choose those whose child is still in Children's dataset; this step needs to match the child's PID with PID in Children's dataset. There are 5,155 people left after the match. Other respondents whose first child was older than 15 were removed from the sample. The third step is to choose the people

[14] The family roster questionnaire is answered by individual and stored in the same way, which means one row in this dataset is an individual's record. There will be multiple records for the same family if the family has more than one member.

still in marriage since there is little chance for divorced people to give birth. After that, only 4,366 people left. The next step is to transfer records from individual to household. In this process, the people are divided into father and mother based on gender and then match their spouse's PID. There are 1,822 records successfully matched. However, some FIDs still have multiple records, indicating that these households consist of more than one couple. After removing these households, there are 1,784 families left. Then, match these families' FID with CFPS 2018's record, and 1,531 families remain. The last step is to remove the missing values[15]. At last, the final sample size is 1,405 households in 25 provinces[16].

Table 3

Sample Treatment Process

	Start	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
process		Has only one child	The child still in the Child dataset	Still in marriage	Transfer individual records into household	Can be tracked in 2018	Remove missing data
Sample size	58,179 individuals	17,765 individuals	5,155 individuals	4,366 individuals	1,784 households	1,531 households	1,405 households

The number of families in each province is shown in Table 4. Gansu, Henan, Liaoning, and Hebei have the largest sample size (163, 162, 142, and 100 respectively), while some provinces only have a minimal sample size (7 for Chongqing, 13 for Tianjin, 13 for Fujian, 18 for Beijing, 19 for Guangxi, and 27 for Jiangxi)

[15] Before removing the missing values, the variables were cross checked with other datasets. For example, if a person's educational attainment was missing in Adult dataset, there is a variable called 'spouse's educational attainment'. Then I go to the person's spouse and fill the value of 'spouse's education' into this person's educational attainment. Only those sample with variables which value cannot be found anywhere and only take up a very small proportion of the sample size are removed.

[16] There are only one household in province 15,46,64,65, and they are removed.

Table 4

Sample Size

	Original Data (CFPS2016)[17]	Sample
Province Name With Code	Household	Household
Beijing (11)	151	18
Tianjin (12)	112	13
Hebei (13)	779	100
Shanxi (14)	614	58
Inner Mongolia (15)	9	1(removed)
Liaoning (21)	1405	142
Jilin (22)	284	33
Heilongjiang (23)	428	55
Shanghai (31)	978	87
Jiangsu (32)	328	32
Zhejiang (33)	331	47
Anhui (34)	315	43
Fujian (35)	188	13
Jiangxi (36)	283	27
Shandong (37)	728	75
Henan (41)	1575	162
Hubei (42)	244	31
Hunan (43)	450	34
Guangdong (44)	1483	79
Guangxi (45)	323	19
Hainan (46)	10	1(removed)
Chongqing (50)	169	7
Sichuan (51)	753	61
Guizhou (52)	454	39
Yunnan (53)	390	46
Tibet (54)	2	0
Shaanxi (61)	346	30
Gansu (62)	1595	163
Qinghai (63)	4	0
Ningxia (64)	5	1(removed)
Xinjiang (65)	27	1(removed)
Total	14763	1405

[17] This sample size is based on the Family roster dataset.

Model

Generalized Linear Mixed Effects Models (GLMM) are used to analyze the data. Theoretical and technical concerns are the main reasons to apply this model. As the literature mentioned above has proved, the province variables can impact the family's fertility decision as well as individual and household characteristics. It is essential to include province variables in the model. On the other hand, CFPS 2016 is a dataset collected by using the multistage stratification method. The data has hierarchical structures (households are clustered in provinces). When dealing with hierarchical data, GLMM can work better than the logistic regression model. Logistic regression assumes the independent observations in the estimating of standard errors. However, hierarchical data violates the assumption since the standard errors for observations in the same group can be correlated. Ignoring the hierarchical structures in the model will underestimate the standard errors of regression coefficients, leading to an overstatement of statistical significance. GLMM can avoid the problem by allowing any categorical variable that might represent a level in the data to vary. It can also identify the group effects and meet the research interest in group effects. Moreover, it can estimate group effects simultaneously with the effects of group-level predictors. In this way, GLMM is a better choice in the paper.

The household is the level-1 unit, and the province is the level-2 unit. GLMM can better reflect micro and macro factors affecting the household's fertility decision as household variables are micro factors and province variables are macro factors. The province's previous one-child policy can reflect the policy factor; its GDP per capita can represent its development level for the macro factors. Total dependent ratio, average family

size, education spending, and average house prices are other variables that may affect people's fertility decisions.

The first model used here is logistic regression. This model uses level-1 variables to predict the probability that a family gives birth to a second child in two years. Its meaning is to provide a preliminary result. The model can be described as

Eq.1

$$\Pr(y_{i,t+2} = 1) = \text{logit}^{-1}(\beta_{0t} + x_{it}\beta)$$

Where y_{it+2} is the observed value of the outcome variable for household i, t = 2016, which means the outcome is for 2018, two years later than the main predictors. It is a binary variable. 0 represents the household that did not give birth to a second child between 2016 and 2018, and 1 means having a second child during the period. x_{it} is the observed value of the level-1 variables of household i in 2016. β is the matrix of estimated coefficients of the predictor variables describing the relationship between x_{it} and y_{it+2}.

After fitting the logistic regression model, a one-way ANOVA model with random effects is fitted as the first step of multilevel logistic regression to capture the within-group variability and between-group variability. Then the intra-class correlation coefficient $\hat{\rho}$(ICC) is produced to identify the proportion of the between-group variability in the total variability. In other words, it shows the impact of the provincial effect. This model presents how much of the variation can be attributed to the provinces. The group variable is *Province*. The model can be described as

Eq.2

Level-1 model

$$\Pr(y_{ijt+2} = 1) = \text{logit}^{-1}(\beta_{0jt})$$

Level-2 model

$$\beta_{0jt} = \gamma_{00t} + u_{0jt}$$

Full model

$$\Pr(y_{ijt+2} = 1) = \text{logit}^{-1}(\gamma_{00t} + u_{0jt})$$

Where y_{ijt+2} is the observed value of the outcome variable for a household i in province j in 2018. β_{0jt} is the matrix of estimated coefficients of the predictor variables describing the relationship between x_{it} and y_{ijt+2}. However, in Model 2, there are no independent variables. The β_{0jt} is explained by intercept γ_{00t} , and u_{0jt} , which is the random error between groups, in this case, province j. In this way, Model 2 can capture the provincial effect in affecting people's fertility decisions.

The next step is adding six level-2 variables in Model 3 to explain the provincial effect. The model can be described as

Eq.3

Level-1 model

$$\Pr(y_{ijt+2} = 1) = \text{logit}^{-1}(\beta_{0jt})$$

Level-2 model

$$\beta_{0jt} = \gamma_{00t} + \gamma_{01t}W_{1jt} + \gamma_{02t}W_{2jt} + \gamma_{03t}W_{3jt} + \gamma_{04t}W_{4jt} + \gamma_{05t}W_{5jt} + \gamma_{06t}W_{6jt} + u_{0jt}$$

Full model

$$\Pr(y_{ijt+2} = 1) = \text{logit}^{-1}(\gamma_{00t} + \gamma_{01t}W_{1jt} + \gamma_{02t}W_{2jt} + \gamma_{03t}W_{3jt} + \gamma_{04t}W_{4jt} + \gamma_{05t}W_{5jt} + \gamma_{06t}W_{6jt} + u0jt)$$

Model 3 is a regression model with means-as-outcomes. W_{1jt} represents *Pre Policy*, W_{2jt} represents *GDP per capita*, W_{3jt} represents *TDR* , W_{4jt} represents *Pfamilysize*, W_{5jt} represents *Eduexpense*, and W_{6jt} represents *Phouseprice*. The β_{0jt} is explained by the six level-2 variables. It can get a reduction in $\hat{\rho}$ compared to model 2. The proportion of the

reduction in total $\hat{\rho}$ means how much of the intraclass correlation can be explained by level-2 variables. In other words, it examines the effectiveness of the level-2 variables in explaining the provincial effects on the family's fertility decision.W_{1jt} It can also provide the influence of the level-2 variables on the outcome variable.

Model 4 is the random-coefficients regression model with intercepts-as-outcomes. The coefficients of the predictor variables are set to be random.

Eq.4

Level-1 model

$$\Pr(y_{ijt+2} = 1) = \text{logit}^{-1}(\beta_{0jt} + x_{it}\beta)$$

Level-2 model

$$\beta_{0jt} = \gamma_{00t} + \gamma_{01t}W_{1jt} + \gamma_{02t}W_{2jt} + \gamma_{03t}W_{3jt} + \gamma_{04t}W_{4jt} + \gamma_{05t}W_{5jt} + \gamma_{06t}W_{6jt} + u_{0jt}$$

$$\beta_{1jt} = \gamma_{10t} + u_{1jt}$$

$$\beta_{2jt} = \gamma_{20t} + u_{2jt}$$

$$\beta_{3jt} = \gamma_{30t} + u_{3jt}$$

Full model

$$\Pr(y_{ijt+2} = 1) = \text{logit}^{-1}(\gamma_{00t} + (\gamma_{10t} + u_{1jt})x_1 + (\gamma_{20t} + u_{2jt})x_2 + (\gamma_{30t} + u_{3jt})x_3 + \beta_4 x_4 + \cdots + \beta_{12}x_{12} + \gamma_{01t}W_{1jt} + \cdots + \gamma_{06t}W_{6jt} + u_{0jt})$$

In this model, $x_1$represents *Education Expectation of the First Child*, x_2 represents *Expenditure on the Child's Education*, and x_3 represents *Who Takes Care of the Child in the Morning.* These predictor variables' coefficients are set to vary randomly and be explained by the intercept(γ_{10t}, γ_{20t}, and γ_{30t}) and random error of the group(u_{1jt}, u_{2jt}, and u_{3jt}). It means the province randomly influences the effect of the predictor variables. While the control variables, from x_4 to x_{12}, are also added in the model.

This model contains level-1 and level-2 variables to make a full analysis. It allows the slope of the independent variables to vary among the provinces. Since there are 12 level-1 variables, it would be too complicated and unnecessary if their slopes are all set to be random. Only three predictor variables' slopes are allowed to vary randomly. This model means the outcome variable is the outcome of a fixed regression model with two random effects: the random effect on the group random error u_{0jt} and the random effects on the slopes $u_{1jt}, u_{2jt}, \text{and } u_{3jt}$. It assumes the effects of the control variables are constant among the provinces, while the predictor variables' effect varies among the provinces.

However, one possible result is the predictor variables' effects do not significantly vary randomly among the provinces. In this case, setting their slope as random effects may make the model more complicated and less accurate. Model 5 is an alternative option by adding level-1 variables into Model 3. The model can be described as

Eq.5

Level-1 model

$$\Pr(y_{ijt+2} = 1) = \text{logit}^{-1}(\beta_{0jt} + x_{it}\beta)$$

Level-2 model

$$\beta_{0jt} = \gamma_{00t} + \gamma_{01t}W_{1jt} + \gamma_{02t}W_{2jt} + \gamma_{03t}W_{3jt} + \gamma_{04t}W_{4jt} + \gamma_{05t}W_{5jt} + \gamma_{06t}W_{6jt} + u_{0jt}$$

Full model

$$\Pr(y_{ijt+2} = 1) = \text{logit}^{-1}(\gamma_{00t} + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \cdots + \beta_{12} x_{12} + \gamma_{01t}W_{1jt} + \cdots + \gamma_{06t}W_{6jt} + u_{0jt})$$

It means all the level-1 variables are fixed. Their effects are constant across the provinces, while the province effect is examined as in Model 3. Compare to Model 1, Model 5 can overcome the problem of overstatement of statistical significance by considering the

hierarchical data structure. Compare to Model 4, it is more concise and accurate if the coefficients of the predictor variables should not be set as a random effect.

Result

Descriptive Result

Table 5 shows the descriptive results. The sample (N = 1405) represents the households living in the 25 provinces. 21.7% of the family gave birth to a second child between 2016 and 2018. 40.9% of the family's firstborn is female, and 59.1% is male. 58.3% lived in an urban area, and 41.7% lived in a rural area. The mother's mean age in 2016 was 31.5, and the mean age of the child was 6.3. The private-owned employer is the major type of the mother's job, which accounts for 30.2% of the sample. Unemployed was the second largest group, took up 24.1%. Other job types were under 20% (17.2% for agriculture, 17.0% for the state-owned employer, and 11.5% for self-employed). More than half of the mother's educational attainment was junior high or below (55.1%), and only 10.7% of them finished university or higher education. For family income status, 23.3% of families were in the lowest quantile within the province, while 32.5% were in the highest quantile. Only 11.1% of the families were in the second quantile (25%-50%). University is the primarily expected education attainment (73%), as 15% of the parents wanted their child to achieve educational attainment higher than Bachelor's degree, and 12% of the parents did not expect their child to attend university. Parents took care of the child was still the most common arrangement (38%), yet the percentage of the other two options were quite close to it (30.2% for grandparents take care of and 31.8% for others take care of).

For 25 provinces in the sample, 13 of them executed a moderate one-child policy, while six provinces used strict policy and the other six provinces used loose policy. The GDP

per capita also had a huge difference. The lowest income province had only 27,640 yuan, while the GDP per capita in the highest income province was more than fourfold of it as 118,200 yuan. The mean GDP per capita was 53,690 yuan, and the standard deviation was 24,870 yuan. The mean total dependency ratio was 37.0%, and the standard deviation was 5.6%. The mean average family size was 3.11, and its value ranges from 2.47 to 3.64. The standard deviation was 0.33. On average, the governments of the provinces spent 1,917 yuan on education per person in 2016. The standard deviation was 574 yuan, the smallest amount was 1,400 yuan, and the largest was 4,100 yuan.

At last, the average house price had great difference too. The lowest average house price was 1,109 yuan per square meter, and the most expensive was 27,497 yuan per square meter. The mean average house price was 7,105 yuan, with the standard deviation was 5,464 yuan.

Table 5
Descriptive Statistics for Household and Province-level Variables

Variables	Measurement	Number	Percentage	
Give birth	0 = no	1100	78.3	
	1 = yes	305	21.7	
Predictor variables				
Child's expected education	0 = university	1025	73.0	
	1 = high school or less	169	12.0	
	2 = above university degree	211	15.0	
Who takes care of the child in the daytime	0 = parents	534	38.0	
	1 = grandparents	425	30.2	
	2 = others	446	31.7	
Control variables				
First child's gender	0 = female	574	40.9	
	1 = male	831	59.1	
Urban	0 = rural	586	41.7	
	1 = urban	819	58.3	
Mother's job	0 = unemployed	387	27.5	
	1 = agriculture	242	17.2	
	2 = self-employed	162	11.5	
	3 = state-owned employer	239	17.0	
	4 = private-owned employer	375	26.7	
Mother's education	0 = junior high or below	774	55.1	
	1 = senior high and college	480	34.2	
	2 = university and above	151	10.7	
Family income status	0 = lower than 75%	328	23.3	
	1 = between 75% and 50%	464	33.0	
	2 = between 50% and 25%	156	11.1	
	3 = higher than 25%	457	32.5	
Pre policy	0 = moderate	13	52	
	1 = loose	6	24	
	2 = strict	6	24	
Variables	Mean	S.D.	Min	Max
Predictor variables				
Expenditure on child's education(log)	4.16	4.03	0	11.11
Control variables				
Mother's age	31.5	5.65	16	47
Child's age	6.3	4.35	0	15
Variables	Mean	S.D.	Min	Max
GDP per capita (1000 yuan/person)	53.69	24.87	27.64	118.20
Total Dependency ratio	37.01	5.57	28.19	46.83
Average family size in the province	3.11	0.33	2.47	3.64
Government spending on education (100 yuan/person)	19.17	5.74	14.00	41.00
Average house price (100 yuan/square meter)	71.05	54.64	11.09	274.97

Logistic Regression

Table 6 shows the result of logistic regression. In Model 1, the coefficient of *Child's expected education* is insignificant, which means there is no significant difference in the probability of giving birth to a second child among the parents who have different education

expectations towards their child. The coefficient of the *Money expenditure on Child's education(log)*money expenditure is insignificant, indicating that spending money on the first child's education has no significant impact. However, compared with the parents who take care of the child independently, those whose child is cared for by their grandparents may be more unlikely to give birth to a second child (OR = 0.58). The probability is also lower for families that the child is cared for by the others (OR = 0.64).

The family will be less likely to have a second child if the first child is a boy since the coefficient is negatively significant. The Square of *Mother's age* coefficient is negatively significant, indicating that the probability of giving birth to a second child first rises with the *Mother's age* and then declines. The *Child's age* and *Square of Child's age* show the same pattern. What is unexpected is that the coefficient of *Urban*, *Mother's education*, and *Family income status* are all insignificant, indicate that these variables will not affect the family's fertility decision. For the *Mother's job*, compared with an unemployed woman, a woman who works in the agriculture sector has a higher probability of giving birth to a second child, as its coefficient is positively significant. If the mother has other kinds of jobs, there will be no difference in the probability of giving birth to a second child.

Table 7 shows the multicollinear test of Model 1. . All variables' VIF is smaller than 10, which means there are no severe multicollinear problems. The major multicollinear happens in the mother's and the child's age and their quadratic terms, which is acceptable.

Table 6

The Result of Logistic Regression Model 1

Variable	Category	Estimate	Std. Error	Odds ratio
(Intercept)		-7.0121**	2.3475	0.001
Predictor variables				
Child's expected educational attainment (ref: university)	High school or less	0.1801	0.2023	1.198
	Higher than Bachelor's degree	-0.0092	0.1974	0.991
Expenditure on education		-0.0047	0.0216	0.996
Who takes care of the child in the morning (ref: parents)	Grandparents	-0.5458**	0.1689	0.580
	Others	-0.4459*	0.1813	0.641
Control variables				
Child's gender (ref: female)	Male	-0.365**	0.1372	0.701
Mother's age		0.444**	0.1572	1.552
Square of Mother's age		-0.0083**	0.0035	0.992
Child's age		0.3032***	0.0816	1.354
Square of child's age		-0.0211***	0.0061	0.979
Urban (ref: rural)	Urban	-0.2067	0.1512	0.814
Mother's job (ref: unemployed)	Agriculture	0.4434*	0.2134	1.557
	Self-employed	0.2275	0.2338	1.255
	State-owned employer	0.1931	0.2387	1.213
	Private-owned employer	0.1619	0.1909	1.174
Mother's education (ref: junior high or below)	Senior high	-0.0223	0.1698	0.979
	University and above	-0.3285	0.2934	0.720
Family's income status (ref: lowest quantile)	Low	-0.2673	0.1843	0.766
	Middle	-0.1097	0.2512	0.897
	Highest	0.0201	0.1856	1.020

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 7

Multicollinear Test for Model 1

Variable	GVIF	Df	GVIF^(1/(2*Df))
Child's expected educational attainment	1.07	2.00	1.02
Expenditure on education	1.57	1.00	1.25
Who takes care of the child in the morning	1.33	2.00	1.07
Child's gender	1.02	1.00	1.01
Mother's age	113.43	1.00	10.65
Square of Mother's age	113.48	1.00	10.65
Child's age	18.72	1.00	4.33
Square of child's age	16.62	1.00	4.08
Urban	1.24	1.00	1.11
Mother's job	1.52	4.00	1.05
Mother's education	1.59	2.00	1.12
Family's income status	1.13	3.00	1.02

Multilevel logistic regression

Table 8 shows the result of Model2, Model 3, and Model4. Model 2's ICC is 0.116, which means around 11.6% of the ICC can be explained by the variation between groups. It

indicates that for variations in the probability of giving birth to a second child, around 11.6% is explained by the province difference. The province-level variables are added in Model 3 to explain the province difference.

After adding six province-level variables in Model 3, ICC declines from 0.116 to 0.004. The result suggests that the chosen level-2 variables can explain over 95% of the variation caused by provinces. Among the six province-level variables, the coefficients of *Previous Policy* and *GDP per capita* are insignificant. They have no significant impact on the family's fertility decision. The coefficient of the *Total Dependency ratio* is positively significant, which means families living in the province with higher TDR are more likely to have a second child. It is the same as the coefficient of the *Average Family Size.* It is positively significant at the 0.1 level, indicating that families living in the province with a larger average family size are more likely to give birth to a second child. The province government's spending on education is positively related to the second child's fertility decision. If the local government spends more on education, the family's probability of having a second child will be higher. The *Average house price*'s coefficient is negatively significant, which means if the province's house price is higher, the family's probability of giving birth to a second child will be lower.

Level-1 variables are added in Model 4 to analyze the outcome variable. For the three main level-1 predictor variables that the slopes set to be random, the *Child's Expected Education* and *Expenditure on Education*'s coefficients are insignificant. In contrast, the coefficients of *Who Takes Care of the Child in the Morning* are negatively significant.

The average slope (from fixed effect) for the *Child's Expected Education* is 0.0179 for the "high school or less" group and -0.2381 for the "higher than Bachelor's degree" group, which means the average odds ratio is 1.01 for the "high school or less" group and 0.79 for the "higher than Bachelor's degree" group. The standard deviation is 0.5100 and 0.6285, respectively. For the "high school or less" group, the slope varies between -0.98 and 1.02; the OR ranges from 0.38 to 2.7. For the "higher than Bachelor" group, the slope varies between -1.47 and 0.99; the OR ranges from 0.22 to 2.8. The result means, compared to the child expected to go to university, the average odds ratio for the families in the "high school or less" group is 1.01 on average, and 0.79 for the "higher than Bachelor's degree" group on average among the provinces, nevertheless its variation is great. In the province where the OR is the lowest, the families in the "high school or less" group only have 38% of the probability of giving birth to a second child compared to the families in the 'university' group. The families in the "higher than Bachelor's degree" group have 22% of the probability. But in the province where the OR is the highest, the probability is 277% for the 'high school or less' group and 269% for the "higher than Bachelor's degree" group, respectively. The result indicates that the variation of the *Child's Expected Education* effect is great among the provinces. However, its impact on the family's probability of giving birth to a second child is insignificant.

The average slope for the *Expenditure on Education* is -0.0049, which means the average odds ratio is 0.995 among the provinces. 1% increase in the *Expenditure on Education* accompanies a 0.5% decrease in the probability of giving birth on average among the provinces. The standard deviation is pretty small (0.0002), which means the variation of

the effect of the *Expenditure on Education* among the provinces can cause less than 0.1% of the probability of giving birth to a second child. It is a tiny variation, which means the effect of the *Expenditure on Education* is stable across the provinces.

For *Who Takes Care of the Child in the Morning*, the "grandparents" group's average slope is -0.5658 (OR = 0.57) and -0.3597 for the "other" group (OR = 0.70). The standard deviations are 0.0006 and 0.0009, which are very small too. Compared with the families that the parents take care of the child, the families in the "grandparents" group have 57% of the probability of giving birth to a second child, while families in the 'others' group have 70%. The result shows that although the *Who Takes Care of the Child in the Morning* is significant in statistics, the variation is relatively slight among the provinces.

The random-effects suggest that although there are variations for the three predictor variables' effect on the outcome variable among the provinces, the variations are too small for *Expenditure on Education* and *Who Takes Care of the Child in the Morning*. The variation of the effect of *Child's Expected Education* is great, but its coefficient is insignificant. The ICC decreases from 0.004 in Model 3 to less than 0.001 in Model 4, indicating that although setting three variables' slopes as a random effect can better explain the provincial variation, their explanatory power is weak. It is better just to set the intercept as a random effect.

Table 8

The Result of Multilevel Logistic Regression Model 2, Model 3, and Model 4

Random effect		Model 2	Model 3	Model 4
Groups	Name	Std.Dev.	Std.Dev.	Std.Dev.
Province	(Intercept)	0.6573	0.1215	0.0009
Province	(Intercept)			0.0754
	(High school or less)			0.5100
	(Higher than Bachelor)			0.6285
Province	(Intercept)			0.0003
	Expenditure on education			0.0002
Province	(Intercept)			0.0001
	(Grandparents)			0.0006
	(Others)			0.0009
Fixed effect		Estimate	Estimate	Estimate
(Intercept)		-1.4248***(0.1577)	-8.587***(1.391)	-15.54***(3.267)
Level-2 variables				
Pre policy (ref: Moderate)	Loose		0.1634(0.3809)	0.1076(0.4619)
	Strict		-0.3876(0.3018)	-0.5810·(0.3319)
GDP per capita			0.0093(0.0061)	0.0172*(0.0068)
TDR			0.0747***(0.0218)	0.0841***(0.0242)
Family Size			0.9719·(0.5024)	0.9686·(0.5561)
Education Spending			0.0713*(0.0281)	0.0683* 0.0312)
House Price			-0.0061*(0.0030)	-0.0063·(0.0032)
Level-1 predictor variables				
Expected Education (ref: University)	High school or less			0.0179(0.2466)
	Higher than Bachelor			-0.2381(0.2657)
Expenditure on Education				-0.0049(0.0227)
Takes Care of the Child in the Morning (ref: Parents)	Grandparents			-0.5653**(0.1749)
	Others			-0.3597·(0.1927)
Level-1 control variables				
Child's gender (ref: female)	Male			-0.3572*(0.1431)
Mother's age				0.4996**(0.1651)
Square of Mother's age				-0.0093***(0.0027)
Child's age				0.3343***(0.0840)
Square of child's age				-0.0216***(0.0057)
Urban (ref: Rural)	Urban			-0.1228(0.1599)
Mother's job (ref: Unemployed)	Agriculture			0.5171*(0.2305)
	Self-employed			0.1855(0.2427)
	State-owned employer			0.1686(0.2500)
	Private-owned employer			0.1322(0.1993)
Mother's Education (ref: Junior high or below)	Senior high			-0.0619(0.1760)
	University and above			-0.2692(0.3082)
Family's income status (ref: Lowest quantile)	Low			-0.2132(0.1920)
	Middle			-0.1596(0.2639)
	Highest			0.0018(0.1938)
Adjusted ICC		0.116	0.004	0.000
AIC		1417.5	1400.2	1358.5
Log-likelihood		-706.8	-691.1	-635.2
Observations		1405	1405	1405
Clusters		25	25	25

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 9

ANOVA Test for Model 2, Model 3, and Model 4

	npar	AIC	BIC	LogLik	Deviance	Chisq	Df	Pr(>Chisq)
M2	2	1417.5	1428	-706.77	1413.5			
M3	9.00	1400.20	1447.50	-691.12	1382.2	31.294	7	5.49E-05***
M4	44.00	1358.50	1589.40	-635.23	1270.5	111.787	35	5.92E-10***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 9 shows the ANOVA test result for Model 2, Model 3, and Model 4. It is significant for Model 3 and Model 4. In this case, Model 4 is likely to be significant because of the introduction of level-1 variables instead of setting the three random effect variables. To simplify the model, Model 5 is fit by setting the predictor variables as a fixed effect. The result is presented in Table 10.

In Model 5, all the level-2 variables' coefficients are significant except the *Pre Policy*. After controlling the other variables, the previous policy's coefficients are insignificant. Compared with the family lives in provinces that executed a moderate one-child policy, families in other provinces have no significant difference in the probability of having a second child. The result illustrates that the previous policy factor may not be an essential factor that affects people's fertility decisions. Per 1000 yuan increase in the province's GDP per capita will increase 1.6% of the probability of giving birth to a second child. The total dependency ratio has a positive impact, with a 1% increase accompany a 7% increase. The families that live in a province with a larger average family size have a higher probability of giving birth to a second child. The province government spending more money on education will also lead to a higher probability of having a second child. Finally, the increase of house price for 100 yuan per square meter will decrease the probability of having a second child by 1%.

Table 10

The result of multilevel logistic regression Model 5

Random effect				
Groups	Name	Variance	Std.Dev.	
Province	(Intercept)	0.0001	0.0289	
Fixed effect		Estimate	Std. Error	Odds ratio
(Intercept)		-16.3613**	5.3088	1.124**
Child's Expected Educational Attainment (ref: University)	High school or less	0.1170	0.2105	0.952
	Higher than Bachelor's degree	-0.0487	0.2048	0.995
Expenditure on Education		-0.0053	0.0224	0.565
Who Takes Care of the Child in the Morning (ref: Parents)	Grandparents	-0.5716**	0.1766	0.691**
	Others	-0.3690·	0.1926	0.758·
Pre policy (ref: Moderate)	Loose	-0.2775	0.3867	0.635
	Strict	-0.4545	0.3022	1.016
GDP per capita		0.0157*	0.0066	3.204*
TDR		0.0712***	0.0216	1.069***
Family size		1.1643*	0.5208	0.994*
Education spending		0.0663*	0.0304	0.758*
House price		-0.0064*	0.0032	0.709*
Child's gender (ref: Female)	Male	-0.3437*	0.1454	1.686*
Mother's age		0.5225**	0.3780	0.990**
Square of Mother's age		-0.0096**	0.0061	1.382**
Child's age		0.3234**	0.1022	0.979**
Square of child's age		-0.0212**	0.0073	0.884**
Urban (ref: Rural)	Urban	-0.1229	0.1591	1.722
Mother's job (ref: Unemployed)	Agriculture	0.5435*	0.2361	1.200*
	Self-employed	0.1820	0.2415	1.197
	state-owned employer	0.1796	0.2483	1.180
	private-owned employer	0.1653	0.2028	0.935
Mother's education (ref: Junior high or below)	Senior high	-0.0668	0.1765	0.740
	University	-0.3011	0.3095	0.802
Family's income status (ref: Lowest quantile)	Low	-0.2209	0.1921	0.858
	Middle	-0.1534	0.2619	1.013
	Highest	0.0127	0.1931	1.124
Adjusted ICC		0.001		
AIC		1332.5		
Log- likelihood		-633.2		
Observations		1405		
Clusters		25		

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

If the family's firstborn is a boy, the probability of having a second child is 7% of the family that the first child is a girl. The coefficients of the mother's age and the square of the mother's age show that with age rising, the probability of having a second child also rising at first and then decline. At the same time, the child's age is positively related to the family's fertility decision. A family that has an older first child is more likely to have a second child. While the coefficient of urban is insignificant, it indicates that living in the urban or rural area

has no significant impact on the family's fertility decision. Compare with a mother who has no job, a mother working in agriculture is significantly more likely to give birth to a second child (OR = 1.71).

In contrast, the differences for the other jobs are all insignificant. The discrepancies between mothers who have different educational attainment are also insignificant. At last, the family's income status has no significant impact on the family's fertility decision.

Compare Model 4 with Model 5, the ICC increases no more than 0.001, which indicates they can both explain the provincial differences well. The ANOVA result showed in Table 11 indicates that Model 5 is significant. Model 5's AIC and BIC are lower than Model 4's, and it also uses less degree of freedom than Model 4. The result suggests that Model 5 is better than Model 4.

Table 12 presents the result of the multicollinear test for Model 5. It suggests that there are no serious multicollinear problems among the selected variables. The result is the same to what in Table 8, all variables' VIF is smaller than 10, except the mother's and the child's age and their quadratic terms.

Table 11

ANOVA Test for Model 2, Model 3 and Model 5

	Npar	AIC	BIC	LogLik	Deviance	Chisq	Df	Pr(>Chisq)
M2	2	1417.5	1428	-706.77	1413.5			
M3	10	1401.5	1454.0	-690.76	1381.5	32.017	8	9.25E-05***
M5	33	1332.5	1505.6	-633.23	1266.5	115.069	23	3.18E-14***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 12

Multicollinear Test for Model 5

Variable	GVIF	Df	GVIF^(1/(2*Df))
Child's expected educational attainment	1.10	2.00	1.02
Expenditure on education	1.65	1.00	1.28
Who takes care of the child in the morning	1.42	2.00	1.09
Child's gender	1.07	1.00	1.03
Mother's age	628.50	1.00	25.07
Square of Mother's age	633.55	1.00	25.17
Child's age	28.47	1.00	5.34
Square of child's age	27.74	1.00	5.27
Urban	1.30	1.00	1.14
Mother's job	1.93	4.00	1.09
Mother's education	1.69	2.00	1.14
Family's income status	1.20	3.00	1.03
Pre policy (ref: Moderate)	2.41	2.00	1.25
GDP per capita	4.61	1.00	2.15
TDR	2.43	1.00	1.56
Family size	4.92	1.00	2.22
Education spending	4.27	1.00	2.07
House price	3.85	1.00	1.96

Conclusion and discussion

In this paper, a 2-level multilevel logistic regression model is used to test the hypotheses. Based on the result, *Hypothesis 1* is not supported since there is no significant difference in the probability of giving birth to a second child among families with different education expectations towards their first child. *Hypothesis 2* is not supported as the coefficient of the money expenditure on the child's education is insignificant. More money expenditure on the first child's education will not significantly reduce the family's probability of having a second child. For *Hypothesis 3*, although the coefficients of who takes care of the child are significant for both groups, the directions are negative instead of positive as expected. *Hypothesis 3* assumes that grandparents or others take care of the child would relieve the parents' pressure to have time for the second child. However, the result suggests otherwise. Having grandparents or others take care of the child will not increase but reduce the parents' probability of giving birth to a second child.

The result suggests that the quantity-quality trade-off has little impact on the family's fertility decision. The family's education expectation of the first child and their education expense will not significantly influence fertility decisions. However, it appears that time, rather than the family's economic condition, is the major factor that affects fertility decisions. However, the coefficients of *Who Takes Care of the Child in the Morning* contradict *Hypothesis 3* and previous findings (Jin et al., 2018; Ni et al., 2018; Ji & Zheng, 2018). Compared with parents who take care of the child on their own, grandparents' help will reduce, rather than increase, the probability of giving second birth.

There are two ways to explain the finding. First, the result may reflect the reverse of the cause and effect. There is a possibility that grandparents take care of the child due to parents' lack of time. Those who take care of their child by themselves may have more time to spend on the child than those who already need to seek the grandparents' help. As a result, this variable may function as the measurement of "if the parents have time to take care of their first child." Another possible explanation is that having grandparents can increase the probability of parents giving birth to a second child. The effect is mixed with the first effect, so there is no way to tell it from Model 5. More control variables can be added to the model to further the analysis, such as the family's average house space per person, the parents' leisure time, hours spent with the child, etc.[18]

Although the results do not support the quantity-quality trade-off theory, it does not necessarily mean the theory can not be applied to China's background. Several reasons can explain why the hypotheses are not supported.

For *Hypothesis 1*, the parents' expectations towards their child lack precise measurement. The major difference happens within the university group rather than among the different education attainment groups in China. Most of the children are expected to attend university. However, although the respondents report their education expectations towards their child are "University," their real expectations can differ. There is a pyramid of the university, which has many layers. For some children living in a relatively disadvantaged situation, their parents may expect them to get admission to any university regardless of its rank. However, the parents with more resources may be more likely to expect their children

[18] Due to the data limit and the model design, they are not added in Model 5.

to attend university abroad or go to the top-class university in China. Although their expectations are labeled the same as “university,” the actual meaning can substantially differ. Also, the discipline (medicine, law, information technology, etc.) might make a difference in future investment. However, these situations are not reflected in the original data. And that probably is the reason why the coefficient of the education expectation is insignificant.

For *Hypothesis 2*, the coefficient of *Expenditure on Education* is insignificant because more than half of the families spend zero on a child’s education. During the test, when all families with no educational expenses are excluded from the sample in Model 5, the coefficient of money expenditure is significantly negatively related to the probability of giving birth to a second child as hypothesized. The result suggests that the education expenditure’s impact on fertility exists among the families that have spent money on the child’s education. However, due to many families do not spend any money, the result is distorted. Given that the sample size is not large enough and makes no sense to exclude them, they are kept in Model 5.

Many families spend no money on their child’s education can be explained by three reasons. The first reason is the child was too young to attend any education, so the family does not need to spend any money on the child’s education. The second reason is the primary school and junior high school education is compulsory in China. The family with a child in this stage does not need to spend money on school education. The main educational expense, however, is caused by after-school tutoring and a child’s early-stage education. These after-school tutoring aim to enhance the child’s competitiveness in many ways, and they can be costly. The result suggests the difference among the families that their child only goes to

school without any extra education, and the families spend additional money on after-school tutoring should be noticed. The last possibility is that the respondents didn't consider the extra fees related to the child's education (for example, the rent for a closer house to the school, payments for the books or other materials, etc.) when they answered the question.

In conclusion, this paper does not find evidence to support the idea that the quantity-quality trade-off will impact the family's fertility decisions. However, some reasons may cause this result, and more work can be done in the future to make a more in-depth study.

The result also provides other meaningful findings. It appears that the different types of practice of the one-child policy do not make a significant difference in a family's fertility decisions. In other words, the previous one-child policy is not an essential determinant for the family's fertility decision. *Urban*'s coefficient is insignificant, which means living in rural or urban areas makes no significant difference after control the other variables. The urban-rural differences may be more due to other factors, and itself is less important now. The province's average family size has a positive impact on the family's fertility decision. Provinces that have larger family size is more traditional in family structure. Traditional family structure is linked with traditional family ideas, and these ideas influence families. The result suggests that we should notice the impact of culture and traditions in deciding a family's fertility decisions.

If the provincial government spends more money on education, the probability of giving birth to a second child will be higher. If the house price is higher, the fertility will be lower. The result is consistent with previous studies (Jin & Liu, 2019; Li, 2019; Li et al., 2012; Liu et al., 2016). What is confusing is that the GDP per capita coefficient is positively

related to the probability of giving birth to a second child. The higher provincial GDP per capita may reflect better institutional arrangements and services that favor women's fertility, such as parental leave, complete nursing facilities, etc.

It seems that the personal characteristics (mother's age, child's age) are accountable for the fertility decisions. As many studies have shown (Qian et al., 2020; Zhou & Guo, 2020), the first child's gender is important in deciding to have a second child or not. If the firstborn is a boy, the family is less likely to have a second child. Among all the mother's jobs, only those working in the agricultural sector have a higher probability of having a second child, while others have no significant difference.

What is surprising is that the mother's education and family's income status are all insignificant. The result suggests that the fertility decision has become more homogeneous among people with different characteristics. Mothers who have different jobs and educational attainments have become more similar in fertility decisions. It also happens on the family's income status. Families in different quantile of the income status show no significant difference in the probability of giving birth to a second child. It indicates that the gap among the income groups may be narrowed. However, if the family income is analyzed as a consistent variable to emphasize the difference in income, the result may show more divergence.

In summary, the result shows that personal characteristics (mother's age, child's age, child's gender) are significant variables affecting a family's fertility decisions. While other level-1 control variables, such as mother's job, mother's education, and family's income status, are irrelevant. The provincial factors, on the other hand, are also important. The

previous policy makes no significant difference that suggests that during the decades of the practice of the one-child policy, the idea has already deep in the people's minds and reshapes their fertility decisions. If the family lives in a rural or urban area is also irrelevant to the second child's fertility. The rural residents' fertility becomes more similar to the urban citizens. The province's family tradition, educational expenditure, and house price are also significant factors worth notice.

Based on the findings, there are several policy suggestions.

First, the government should endeavor to relieve the parents' pressure on childrearing, not just financial burden, but also time burden. It requires the government to construct a complete system that favors fertility and family life. It includes implementing labor law to prevent parents from working overtime, guarantee parental leave, and any other policies that may prolong parents' time with their child. If the parents have more time to take care of the first child, they are more likely to have a second child.

Next, the government can play an important role in many ways. Local governments can provide financial aid to children's education and restrain the house price from increasing too quickly. It can also provide more effective public services for childcare to relieve the parents' pressure. The government should also invest more in education, increase public school quality, and avoid the intense competition in after-school tutoring.

At last, it is crucial to notice the similarity between urban and rural areas. The difference in fertility decisions between residents in urban and rural areas is quite small. What needs to be done in an urban area should be done in the rural area as well. It is

important to increase the facility and services rather than neglect the existing problem in rural areas.

There are some deficiencies in this paper. First, the sample size is not enough. It will be much better to use the city instead of the province as the level-2 group. The characteristics of the city that the family lives in are more closely related to the family's fertility decision. For example, the city's house price and the number of schools can directly impact the family's fertility behavior. However, the sample size in this paper cannot support such an analysis. As a result, the findings may be unprecise. Next, the time scope is two years, which is too short. It takes years for a family to decide to give birth and prepare for it. The outcome in this paper is an immediate response of the couples to the change in the policy, and it can only reflect the result in two years. The result may be quite different if the period is longer.

Last but not least, this paper concentrates on the first child and neglects many dimensions that may impact fertility. For example, the second demographic transition theory proposed by Lesthaeghe and van de Kaa (Lesthaeghe, 2010; Surkyn & Lesthaeghe, 2004; van de Kaa, 2004) is a useful framework to discuss fertility under low fertility rate. The ideational factors, such as self-fulfillment, self-autonomy, and other variables, can be added to the fertility decision analysis. It is also very important to take the average fertility intentions of the province into consideration. Migration is also not discussed. Due to the data and model limit, these important variables are omitted in the models. It is the direction for the work in the future.

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