ECONSTOR
Make Your Publications Visible.

A Service of

ZBW Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Lu, Di

Conference Paper

China's Selective Two-Child Policy and Its Impact on the Marriage Market

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2018: Digitale Wirtschaft - Session: Labor Markets I, No. D17-V3

Provided in Cooperation with:
Verein für Socialpolitik / German Economic Association

Suggested Citation: Lu, Di (2018) : China's Selective Two-Child Policy and Its Impact on the Marriage Market, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2018: Digitale Wirtschaft - Session: Labor Markets I, No. D17-V3, ZBW - Leibniz-Informationszentrum Wirtschaft, Kiel, Hamburg

This Version is available at:
https://hdl.handle.net/10419/181586

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

China's Selective Two-Child Policy and Its Impact on the Marriage Market

Author: Di Lu*

Goethe University

Supervisor: Prof. Dr. Thorsten Schank

Chair of Applied Statistics and Econometrics

Johannes Gutenberg-Universität Mainz

Abstract

This paper analyzes the effects of the earlier selective two-child policy (TCP) in the 1990s (both parents have to be only children) to explore the impacts of this relaxation on the marriage market as well as the fertility effect due to the marriage choice distortion. By using a difference in differences (DID) design in a subhazard model with competing risks, the results show that the subhazard ratio is 355.06% higher and this treatment effect is significant at a 1% level. The results suggest that the selective TCP increased the probability of the treatment group of choosing an only-child spouse rather than marrying a spouse with siblings or a spouse belonging to an ethnic minority. The marriage effect is stronger in urban areas where OCP was previously implemented more rigorously. The probability of giving birth to a second child is also positive and significant in a DID design, which implies that the fertility preference is binding under the OCP.

JEL: J12, J13, C41

Key words: China's two-child policy, marriage distortion, subhazard model, fertility effect

* I am particularly grateful to my supervisor, Prof. Dr. Thorsten Schank, for his guidance and support. This paper also benefited greatly from Jun. Prof. Jin-Young Choi, and seminar participants at Goethe University and Johannes Gutenberg-University Mainz for their invaluable and helpful comments on this paper.

1. Introduction

Since 1980, China has experienced a long family-planning-policy period. The One-Child Policy (OCP) was implemented rigorously and has far-reaching consequences, such as lower population size and family size, lower fertility rate, higher sex ratio (the ratio of males to females) and aging population. This period was also accompanied with a profound socio-economic development of the country, such as increasing GDP, life expectancy, literacy ratio and levels of employment. Although OCP was implemented very strictly with birth quotas and other punitive measures, it also varied across regions and ethnicities because of the different degrees of son preferences, economic development and other local features. It is worth pointing out that in rural areas, OCP was relaxed very soon after implementation due to a much stronger son preference and generally larger family size compared to urban areas. Moreover, most ethnic minorities are not included in OCP. In other words, Han Chinese[1], especially those living in urban areas are the main targets of OCP.

It was not until January 1st, 2016, that a nationwide two-child policy (TCP) was carried out, which announced the end of OCP. By that time, OCP existed for more than three decades. According to the quantity-quality trade-off theory (Becker and Lewis, 1973; Becker and Tomes, 1976) and many researches of pro-natal policies in other Asian countries (Straughan et al., 2008; Wong and Yeoh, 2003) such as Japan, Korea and Singapore, this general relaxation is expected to have a little effect on increasing the fertility rate. However, what about their neighbor China? Could such a relaxation have a positive effect on fertility rates or it is far from enough? Are pro-natal policies needed in China like in Singapore or Japan? As a large emerging market, whether the aging population and other undesired consequences of OCP could be partly addressed by this relaxation is a very important and meaningful question. On one hand, the hitherto short period of implementation makes the policy evaluation quite difficult, since the new policy takes time to have an effect on fertility rates, population structures and other aspects. Furthermore, the policy treats every family the same except for a few special cases[2]. One the other hand, the relaxation of OCP was not enacted in one step. Before the universal TCP in 2016, China carried out two locally restricted instances of TCP already. In other words, OCP was relaxed gradually well before 2016. The first policy relaxation

[1] Han is the ethnic majority in China, who constitutes approximately 92% of the population of China (2010 national census).

[2] For example, the first-born child or both children are disabled and some cases with remarried couples.

happened around 1990, specifying that if both parents are only children, the family is allowed to give birth to up to two children. At that time, it was only about one decade after the introduction of OCP. Hence, only a small proportion of people could benefit from this policy, since most people in the marriage market had siblings. The different treatment among different groups during this period makes it possible to investigate the policy effect. The second relaxation happened in 2014, which allows a family to give birth to two children if the mother or father is the only child. This occurred shortly before the universal TCP in 2016, and during that time a large proportion of people in the marriage market were only children. Therefore, the OCP was relaxed to a large extent already before 2016.

After considering the data availability and treatment variations by the policy, the earlier selective TCP (if both parents are only children, the family may give birth to two children) makes it possible to explore the impacts of this family-planning policy relaxation. The selective TCP implemented around 1990 can be considered as a unique natural experiment, which relaxed the birth quota of certain families from exact one child to two. Specifically, in this paper I will study the policy's effect on the marriage market since the selective TCP in 1990s is not a universal and indiscriminate policy for all groups. The treatment group are *Han Chinese only children*. The control group are *Han Chinese with siblings*. Because the ethnic minorities in general are not affected by TCP, they are not in either group. The four possible marriage choices of each individual include marrying someone who is Han and an only child (Type 1); marrying someone who is Han with siblings (Type 2+); marrying someone belonging to an ethnic minority (Type M) and staying unmarried. As a result, this policy might distort the individual's marriage choices because the potential utility of each marriage pattern could change due to different treatment of the policy on different groups (Becker 1973, 1974). One extra child could increase the unobserved marriage gains as long as the fertility preference is binding under the OCP. The hypotheses of this paper are the following:

H1a. The selective TCP would increase the relative probability of Han Chinese only child to marry a Type 1 spouse compared to Type 2+ and Type M.

The marriage utility of Type 1 and Type 2+ are assumed to be indifferent without the selective TCP after controlling the family background, demographic and geographic characteristics. Huang and

Zhou (2015) report more interethnic marriages (Type M) after OCP because of the children incentive. After the implementation of the selective TCP, Type 1 is more favorable than Type 2+ due to the relaxed birth quota. Type M also becomes less attractive because the preferential policy is similar to the selective TCP.

H1b. The treatment effect of the selective TCP is stronger in the urban areas than in rural areas.

In rural areas, a 1.5-child policy was implemented soon after the OCP because of stronger son preference and fierce resistance. The policy allows family to give birth to a second child if the first one is a girl. In addition, the proportion of the only children in rural areas is also lower than that in urban areas. Therefore, the selective TCP in rural areas is not so influential as in urban areas, where the OCP is carried out rigorously.

H1c. The treatment effect of the selective TCP is stronger for women than men.

The sex ratio keeps relatively high in China because of the long-acting family-planning policies. After the selective TCP, on one hand, the treated women enjoy an even higher bargaining power in the marriage market (Angrist, 2002) because of the increasing demand under the relaxation. On the other hand, men who are Type 1 in general have better family background and more parents' support[3]. Therefore, they are more favorable in the marriage market. These two factors contribute to a stronger treatment effect for women.

H2. The selective TCP has a fertility effect behind the marriage pattern changes.

Because the selective TCP targets only a small group of the population, the average fertility effect on the population is expected to be very little. It is more meaningful if we examine that whether people change their marriage pattern because of the children incentive. The fertility preference is

[3] Men who are Type 1 in general are better-off because the OCP was implemented stricter in urban areas and for parents who work in state sector. In addition, according to the quantity-quality trade-off (Becker and Lewis, 1973), the only-child is supposed to have more human capital investment and other support from parents.

assumed to be binding under the OCP. Therefore, people will change their marriage pattern after the policy due to the incentive of having one more child with more marriage gains. In addition, this effect is supposed to be also significant in rural areas because as long as people can be treated, they will use the relaxed birth quota owning to a larger family size preference.

To verify the hypotheses H1a, H1b and H1c, I use a subhazard model with competing risks to include all possible marriage choices in one model. By using a DID method, the regression results suggest that the selective TCP increased the probability of the treatment group of choosing a Type 1 marriage by 355.06% compared to Type 2+ and Type M and is significant at the 1% level. The results are consistent with the hypothesis H1a. The regressions of different subsamples confirm the hypotheses H1b and H1c that the treatment effect is stronger in urban areas and for women.

One concern arises from the varying timing of the selective TCP in different provinces. People in the neighboring provinces could change their anticipation and their behavior when they observe the policy change in a certain province. They can either expect a similar policy change in their province in the near future, or choose to migrate to the neighboring province. However, in 1990s, inter-province, especially rural-to-urban migration is still very difficult because of *Hukou* system[4]. Furthermore, a placebo test is conducted by falsifying the policy timing 1 to 3 years before the actual timing. The results imply that the anticipation changes and potential manipulation before the implementation of the policy are negligible. As to the children incentive proposed by H2, a similar DID method is used in the regressions. The results suggest a salient positive treatment effect of 94.18% in the full sample, which implies that the fertility effect induced by the selective TCP is very strong.

This paper contributes to the literature in two respects. First, this paper is related to a strand of literature exploring the marriage market effect of a relaxation of the family-planning policy. Many existing studies have investigated the effects of the OCP intensively regarding various aspects such as fertility rate (Li et al., 2005), sex ratio (Ebenstein, 2010), education attainment (Huang et al., 2015), parental labor supply and so on. However, only a few studies discuss the effect of the TCP

[4] *Hukou* is a household registration record system in China. Under this system, there are great, although diminishing in recent years, disparities between urban citizens and rural migrants in education, employment, health care and so on.

or a relaxation of the OCP such as Qian (2009) and Xu et al. (2016). To the best of my knowledge, this is the first paper to explore the marriage market effect of a relaxed family-planning policy in China. By using the selective TCP in 1990s, this paper identifies and documents the policy treatment effect on individual's marriage choices. The exogenous shock on the marriage market changes the marriage gains of different types. These exogenous variations are modeled in a subhazard function with competing risks, which makes the different marriage patterns comparable. Second, instead of estimating the average fertility effect on the population, my work targets the treated group and manages to estimate the treatment effect of children incentive behind the marriage decisions. In this way, this paper examines the fertility preference and suggests that the relaxation does have a positive fertility effect.

The rest of the paper is organized as follows. Section 2 introduces the institutional background of China's family-planning policies. Section 3 summarizes the previous related literature. Section 4 discusses the theoretical model, identification method and econometric methodology. Section 5 describes the CFPS dataset and descriptive statistics. Section 6 reports the main empirical results, robustness tests and the fertility incentive behind the marriage decisions. Sections 7 concludes.

2. Institutional background

According to the World Health Organization (WHO), family planning has many benefits. It can slow down the population growth, prevent pregnancy-related health risks in women, and reduce adolescent pregnancies and infant mortality, help to prevent HIV/AIDS, empower people and enhance education[5]. China experienced a dramatic fertility increase since 1962. From 1962 to 1970, its average annual birth population was 26.88 million[6]. To slow down the population growth, the One-Child Policy (OCP) was carried out nationwide in 1980 with policies varying across regions. The OCP was implemented rigorously and effectively. The central government established the National Family Planning Commission (NFPC) in 1981 to advocate and implement the OCP with biological methods, monetary penalties and subsidies[7] (Greenlaugh, 1986 and Gu et al. 2007). This

[5] http://www.who.int/mediacentre/factsheets/fs351/en/

[6] http://www.stats.gov.cn/ztjc/ztfx/qzxzgcl60zn/200909/t20090911_68637.html

[7] For example, a family which violated the OCP could be sued by the local NFPC and the fine could be collected compulsorily. The illegal born child cannot be registered to *Hukou* system if the fines were not paid. For those having

policy had a significant negative fertility effect and consequently markedly slowed down the population growth (Li et al., 2005). At the same time, in accordance with the "quantity-quality" theory (Becker and Lewis, 1973; Becker and Tomes, 1976), children could have more human capital investment from the family (Rosenzweig and Zhang, 2009) and the gender gap in education attainment is also narrowed down (Argys, 2015 and Qian, 2009).

Nevertheless, the implementation of the OCP also has many unexpected and undesired consequences. First, along with a decreasing fertility rate, the OCP also led to higher sex ratios, especially in rural areas, because of the stronger son preference and larger family size (Das Gupta, 2005; Ebenstein, 2010; Li et al., 2011). This sex ratio distortion comes from prenatal discrimination (Ebenstein, 2010) and a progress in gender-selection technology (Guilmoto, 2009). The prenatal discrimination also give rise to many other distortions such as fabricated twins by delaying birth registration (Huang, 2014), marriage distortion with more Han and ethnic minority marriages in preferential-policy provinces and the relevant welfare losses (Huang and Zhou, 2015). Most importantly, a long-term effect of the OCP is the aging problem. Although the OCP was implemented more strictly in urban areas, the internal migration reverses the regional aging trends (Wang et al., 2017). Nowadays in China, the rural and Midwest less-developed areas suffer a severe aging problem due to a massive emigration of young people. For all these reasons, after decades of the implementation of the OCP, a nationwide universal TCP was carried out in 2016.

Figure 1 shows a timeline of China's family planning policies. Since the OCP in 1980, the family planning policies relaxed gradually. The first relaxation happened around 1990. Only when both parents are only children, the family is allowed to give birth to two children. The second relaxation happened in 2014, when either parent is the only child, the family is allowed to give birth to two children. By that time most people in the marriage market are only children, so a large number of families qualify the policy. Only two years later, at the beginning of 2016, a universal TCP was carried out national wide.

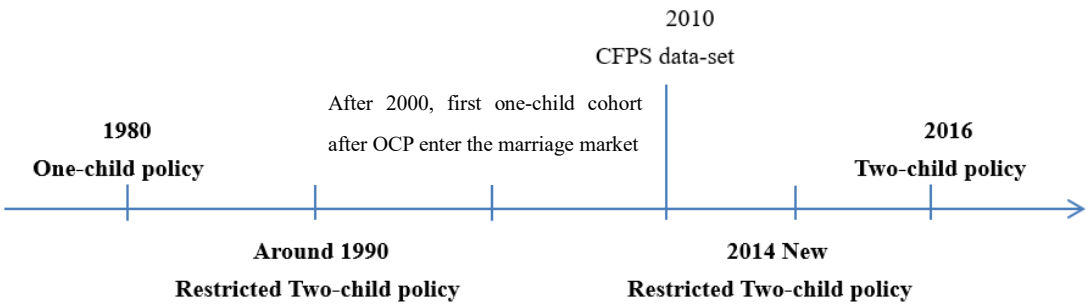
After a long time OCP implementation, the fertility nowadays in China is already quite low. According to the World Development Indicators (WDI) of World Bank, the fertility per woman in China in 2015 is 1.57, the corresponding value in the U.S. is 1.84 and 2.40 in India respectively.

only one child, they can obtain monetary bonuses.

Therefore, the government supplemented the TCP with a set of enforcement methods, which include decreasing the risk and cost of the second birth as well as cancelling the approval procedure of the birth of the second child[8]. In urban areas, nurseries and kindergartens (public services) are established to solve maternity leave problem for mothers. The local governments also provide special care and consults for the elderly parturient women (Wang et al., 2017).

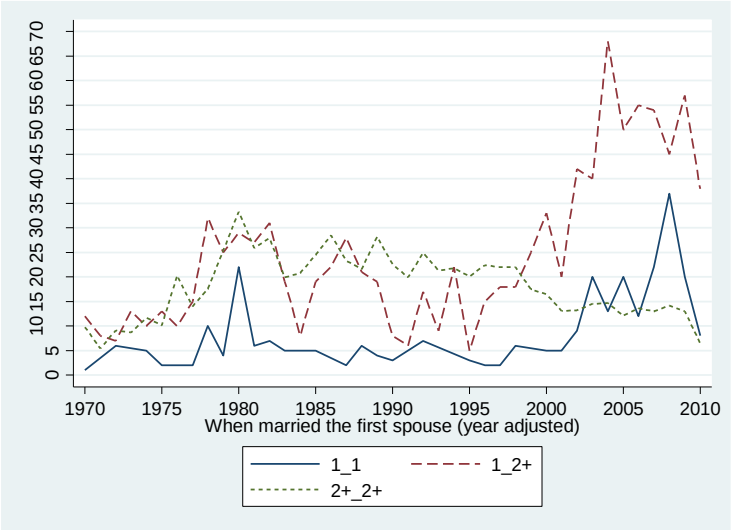
It is worth mentioning that since in China, the legal marriage age is 22 years old for male and 20 for female, together with the implementation year of the OCP, the fertility effect of earlier relaxation in 1990s (both parents are the only child) in the total population is quite limited. The first one-child cohort due to the OCP enters the marriage market around 2000, which is about a decade later than the earlier selective TCP. To show these changes in marriage market attributing to the OCP, Figure 2 presents the trends of different marriage patterns from 1970 to 2010. After 2000, the number of couples who at least one of them is the only-child increases a lot. In the meanwhile, the number of couples who both have siblings decreases. The sudden changes reflect an increase in supply of only-child since 2000, which is consistent with the implementation year of the OCP in 1980. The dataset used in this paper is the base-year 2010 data of a national family panel survey, which is long enough after the selective TCP in 1990s and thus is able to check the policy effect. By centering the data within five years before and after the local TCP implementation year, the long-run trends and other socioeconomic changes could be eliminated to certain extent.

Figure1. Timeline of China's family planning policies



[8] Measures include free consultance and healthcare for elderly pregnant women. Previously a family needs to apply first when they plan to give birth to the second child. Now such kind of application and approval is cancelled.

Figure2. Changes of marriage patterns in China, 1970-2010



Note: The results are calculated by the author with CFPS 2010 dataset. 1_1 represents both are the only children. 1_2+ represents either is the only child. 2+_2+ represents neither is the only child. To put three marriage patterns in the same graph, the unit of 2+_2+ type is adjusted (divided by 10). Year of the first marriage (year adjusted) is provided by the CFPS, who eliminated the errors and inconsistencies in the family relations dataset by referring to different information sources and keeping the most reasonable values.

Table 1 summarizes the basic birth quota rules of each family-planning policy since the OCP. From the table we can find that China's family planning policies mainly focus on Han Chinese and are more restricted in urban areas. In rural areas, the family-planning policies were relaxed not long after the OCP. Because of a much stronger son preference and larger family size preference compared with urban areas, which would lead to an unnatural high sex ratio under a very strict family-planning policy (Ebenstein, 2010), in practice a 1.5 child-policy was carried out in rural areas for a long time. Under this policy, the family in the rural area is allowed to have a second child when the first birth is a girl. The selective TCP in 1990s used in this paper enables those families with both parents who are only children to give birth to two children. The implementation year of the policies varies from 1984 to 2002 (except for two provinces Henan and Hubei with large populations, whose selective TCP year is 2011 and 2009 respectively) in different provinces. Figure 3 illustrates the timing of the selective TCP in urban areas in different provinces. The different colors in the graph represent the different implementation year interval. The graph shows that most provinces implemented the selective TCP between 1988 and 1992. In general, ethnic minority autonomous

regions[9] implemented the policy relatively later. However, as stated in Table 1, ethnic minorities are not restricted by the OCP. Besides, in the dataset of this paper, among five regions, only Guangxi Zhuang autonomous region not included. Zhuang Chinese, with the largest population (representing about 1.4% of the population) among ethnic minorities in China, does not enjoy the birth quota as other ethnic minorities[10].

Table 1. Basic Birth Quota Rules by *Hukou* and Ethnicity

A. National One-child policy (OCP) since 1980		
	Han	Ethnic Minorities
Urban	One-child policy.	Two-child policy. Some minorities have no restrictions.
Rural	1.5-child policy: the first birth is a girl; the implementation year varies across regions.	Three-child policy. Some minorities have no restrictions.
B. Selective Two-child policy (TCP): both parents are only children		
	Han	Ethnic Minorities
Urban	Selective TCP, the implementation year varies from 1984-2011 across regions.	Two-child policy.
Rural	1.5-child policy and selective TCP (varies from 1984-2011 across regions).	Three-child policy.
C. Selective Two-child policy (TCP): one parent is the only child		
	Han	Ethnic Minorities
Urban	Selective TCP in 2014.	Two-child policy.
Rural	1.5-child policy and selective TCP (varies from 1988-2014 across regions).	Three-child policy.
D. National Two-child policy (TCP) since 2016		

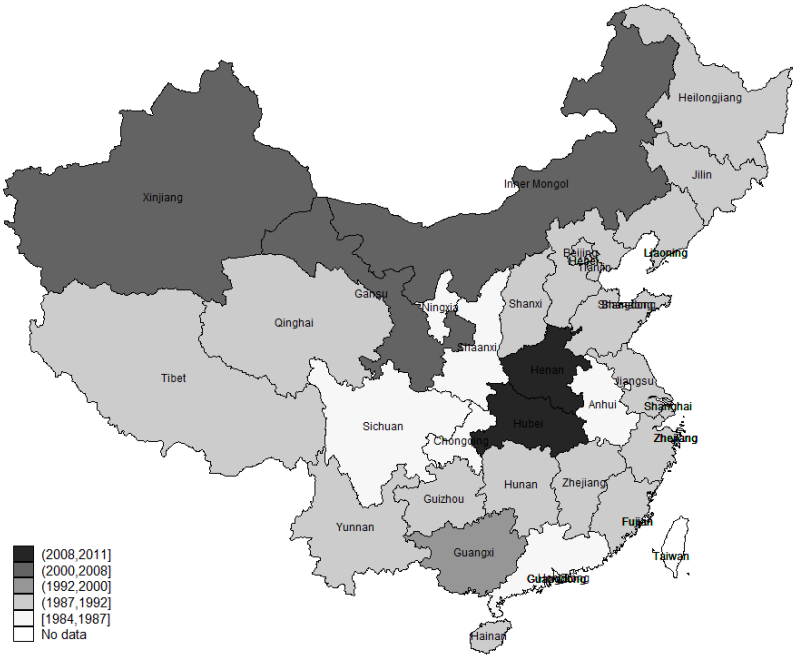
Source: Wang et al., 2017.

Note: Urban or rural can be defined by "*Hukou*", a household registration system that determines where the citizen is allowed to live. Other exceptions of OCP include the first-born child is disabled; parents with dangerous occupations; both parents are the only-child. In column "Han" the ethnic minority autonomous regions are not included. Ethnic minorities does not include Zhuang and Man Chinese, who has relative larger population.

[9] The ethnic minority autonomous regions include Inner Mongolia autonomous region, Guangxi Zhuang autonomous region, Tibet autonomous region, Xinjiang Uygur autonomous region and Ningxia Hui autonomous region.

[10] That is also the case for Man Chinese, who is another ethnic minority that makes up about 0.77% of the population and 9.28% of ethnic minorities (2010 national census). Two thirds of them now live in northeast China.

Figure 3. The selective TCP in urban areas in different provinces



Source: Wang et al., 2017.

3. Literature review

The effects of family planning policies have been studied for decades. Freedman (1997) gives a literature review of the fertility preference effect of family planning policies in different countries. In Asia, China, India and Indonesia implemented coercive family planning programs. However, even powerful and coercive measures cannot change fertility preferences easily and they often have serious ethnic problems. In China, soon after the OCP, the government had to relax the policy in rural areas because of the resistance resulting from "the overwhelming preference for at least one son".

For empirical studies on China's family planning policies, till now most researches focus on the fertility effect and some undesired consequences caused by the OCP (Li et al., 2005; Ebenstein, 2010; Das Gupta, 2010 and Li et al., 2011). The direct and intended result of the family planning program is a decrease in the birth rate and a change of the fertility behavior. Li et al. (2005) report a significant and negative fertility effect of the OCP, which implies the coerciveness and effectiveness of the policy. They use a simple difference-in-differences method to measure the fertility effect of the OCP. Because the main target of the OCP is Han Chinese, which is the ethnic majority in China, in their paper Han Chinse women are in the treatment group and women of ethnic

minorities are in the control group. In this way, they identify a causal effect of the OCP on fertility decline.

However, the contradiction between the strict policy and people's fertility preferences (especially in many rural areas) led to many unexpected and undesired results. For example, Ebenstein (2010) uses the annual provincial fine rates as the measurement of the OCP and shows a sex ratio imbalance due to the sex selection and son preference. Li el al. (2011) find a similar conclusion by using the 1% 1990-census data. Another example is Huang (2014), who shows that OCP resulted in more "man-made" twins because of the son and family size preference. He uses the birth gap and height difference to identify the fake twins. Due to the imbalanced sex ratio and gradually changed attitudes towards daughters, which are the indirect and long-run effects of the OCP, women in China gradually have more attainment of the education, more bargaining power in the marriage market and more participation in the labor market. Angrist (2002) uses the immigrant flows to examine the effect of sex ratio on marriage and labor markets. The empirical results imply that higher sex ratios will increase female bargaining power in the marriage market. The OCP also affects women's marriage age and their labor force participation. Zhao and Kohler (2016)'s research imply that in areas with less strict birth control policies, women tended to have their first birth earlier. Younger and higher-educated cohorts are more heterogeneous in fertility intentions. Huang (2015) uses the province-year panel data from 1979 to 2000 of China General Social Survey (CGSS) to explore the effect of the OCP on women's education attainment. His research indicates that the OCP increased the education attainment or investment of women because they have fewer children to take care of and they could delay the marriage age. As to the influences on children's education, Rosenzweig and Zhang (2009) use the Chinese child twin survey (CCTS) data and suggest a significant Q-Q trade-off effect of the OCP. Argys (2015) reports a similar result by using the Chinese migrants' data in American Community Survey.

The most related work to this paper is Huang and Zhou (2015). By using the 2000 and 2005 China's census data and a reduced-form testable formula of transferable utility model by Choo and Siow (2006), they document a marriage distortion because of the OCP. The OCP led to an exogenous variation in marriage gain, which is supposed to result in higher Han's unmarried rate, more interethnic marriages (H-M marriage) particularly in the preferential-policy regions and an increase in utility transfer within H-M marriage. The results conclude that the OCP distorts the individual's

marriage incentives and leads to more interethnic marriage pattern and a significant higher unmarried rate. They also find a welfare loss resulting from the marriage distortion.

Until now, only a few empirical studies explore the effects of a relaxation of the OCP. Qian (2009) analyzes the 1.5-child policy in China's rural areas. She used a triple interaction of first birth is a girl or not, girl's age and region of birth as an IV for family size to analyze the effect on children school enrollment due to the fertility change from one to two. His analyses indicate that an additional child can increase the school enrollment of first-born child attributing to a scale effect. Instead of using a policy as an exogenous shock, Yi (2015) uses the twining at the first birth as an IV to explore the effects of an increase in fertility on parental labor supply. The results show that the fertility has no significant effect on parental labor supply because the co-residence of grandparents or other adult relatives mitigate the childcare needs. He and Zhu (2015) also document an insignificant effect on female labor force participation by using the twin information in 2000 census data. Xu et al. (2016) surveyed 2,345 women in five provinces. They conclude that women with higher education level are more likely to be influenced by the selective two-child policy. Xu and Pak (2015) build a theoretical model of parental decision-making, in which they find that the fear of second daughter might lead gender imbalance to worsen under the TCP.

However, to the best of my knowledge, this paper is the first study discusses the marriage market effect in China of a family-planning policy relaxation. By using the selective TCP in 1990s as an exogenous shock to people's marriage pattern choices, I can check the policy effect on the marriage market through a difference-in-differences design. Furthermore, I also use a subhazard model with competing risks (Fine and Gray, 1999) to include all possible marriage pattern choices properly in an econometric model.

4. Theoretical model and identification method

4.1 Transferable utility model for the marriage market

The theoretical work of marriage decision include Becker (1973, 1974) and Keely (1977). The former one builds a transferable utility model for the marriage market. In this model a person will choose to marry someone only when she is better off after the marriage, otherwise she will remain single. In the meantime, there exists a competitive marriage market and the positive assortative mating is generally optimal. The division of total household output between husband and wife is

derived from the nature of marriage market equilibrium and could be affected by sex ratios and some other variables. The marriage gains are the production of household commodities such as companionship and children. The later one models the opportunity cost of the marriage for female. Choo and Siow (2006) derive a static reduced-form testable formula that links the unobserved marriage gains to the observable marriage outcomes. Huang and Zhou (2015) use this reduced-form model to analyze the marriage market under OCP. They derive empirical examinable implications of both marriage distortion and welfare loss, which are in accordance with the empirical results using the Chinese census data. The model I use in this paper is mainly based on Huang and Zhou's (2015) model.

A man who is type *i* tries to maximize the marriage gains by marrying a woman who is type *j*. The marriage gains include a children utility $u(n_{ij})$, a function of the number of children n_{ij}. The optimizing problem is as below:

$$\text{Max } u_{ij} = u(n_{ij}) + y_{ij} - n_{ij}C - (n_{ij} - \overline{n_{ij}})f,$$

where $\overline{n_{ij}}$ is the birth quota, which equals to one under OCP for Han Chinese in urban areas. n_{ij} is the realized number of children. The couple will choose a n_{ij} to optimize the utility. *y* is the exogenously given household income. *C* is the fixed cost of raising up a child. *f* is the penalty rate for an additional illegal birth when n_{ij} is larger than $\overline{n_{ij}}$, which measures the strictness of OCP[11].

The utility of type *i* man *g* is:

$$V_{ijg} = \widetilde{\alpha_{ij}} - \tau_{ij} + \epsilon_{ijg}, \qquad \widetilde{\alpha_{ij}} = \frac{1}{2}u_{ij} + \widetilde{a_{ij}}$$

The utility of children is assumed to be equally shared by the couple. $\widetilde{\alpha_{ij}}$ denotes the gross marriage gains including gains from expected number of children(u_{ij}) and other returns ($\widetilde{a_{ij}}$). τ_{ij} is the marriage transfer[12] from type *i* man to type *j* woman. Type *i* man *g* has four choices altogether: single (Type 0), marry a one-child Han woman (Type 1), marry a Han woman with siblings (Type 2+) and marry an ethnic minority woman (Type M). He will choose one of them to maximize his utility:

$$V_{ijg} = max_j\{V_{i0g}, V_{i1g}, V_{i2+g}, V_{iMg}\}$$

[11] Usually the fine rate is based and measured on the yearly household income (Ebenstein, 2010).

[12] Direct marriage transfer includes dowries (from woman to man) and bride-prices (from man to woman), which are widespread in China and other Asian countries (Anderson, 2007).

Symmetrically we can also write down the utility of type j woman g.

The assumption in this paper is that the fertility preference is binding under OCP and thus an extra child allowed by policy means an increase in the marriage gains. Therefore under the selective TCP, V_{i1g} and V_{i2+g} become different for the targeted groups, while under OCP these two utilities are supposed to be similar after controlling for individual's characteristics. Hence, an individual who is treated by the selective TCP has an incentive to seek for a marriage pattern that allows him or her to have two children i.e. more marriage gains. Moreover, it could be accompanied by a longer duration of unmarried status because now both the searching and preferred marriage pattern is costlier.

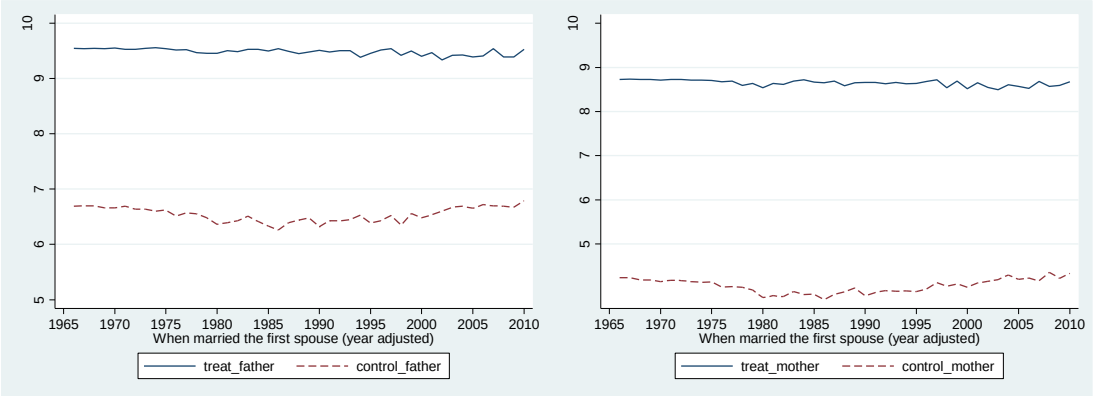
4.2 Difference in differences (DID) design

Because the selective TCP directly affects only certain groups, it allows me to use a difference in differences (DID) method to estimate the policy effects on marriage outcomes as well as the existence of children incentives.

DID estimator is one of the most popular tools and is widely used to evaluate treatment effects in absence of truly experimental data. It is an extension of before-after analysis with including treatment and control groups and it overcomes the endogenous problem caused by time-invariant unobservable factors. The assumption of DID is that in absence of treatment, the average outcomes for treated and controls would have followed parallel paths (the level values of two groups does not necessarily be the same) over time (Abadie, 2005). However, this assumption usually is difficult to verify. One main concern in this paper is that the family background could be systemically different between two groups. For example, parents' education levels can affect their children's education level and therefore affect their competitiveness in the marriage market. Figure 4 shows the systematic differences in parents' years of education between the treatment group and control group. On average, father's years of education in the treatment group is almost three years more than those in the control group over time, and this difference is even bigger in mother's years of education and in urban areas. This reflects that the family background could be systematically different between two groups, which is possible to affect the final marriage choice outcomes and the influences are not necessarily linear. More explanations could be found in section 6.2. The results are very similar to the main results. In robustness tests, I also use propensity score matching to balance the data of

the treatment group and control group. Furthermore, based on the matched sample I run the multinomial choice model to check whether the treatment effect is still significant.

Figure 4. Parents' education level of treatment group and control group



Note: The results are calculated by the author with CFPS 2010 dataset.

In this DID design, the treatment group is Han Chinese who is the only child (1). The control group is Han Chinese with siblings (2+). For both treatment group and control group, I only consider the individuals with first marriage or who are never married[13]. However, their spouses are allowed to be remarried. In addition, I drop those individuals who got married before OCP.

I also use the subsample according to the rural and urban areas, and we can expect the degree of the effect may differ because in China's rural areas there is another relaxation that the couple can give birth to two children if the first one is a girl. In addition, in some provinces the relaxation is even further (either one parent is the only child can give birth to two children) compared with other provinces.

The basic DID model setting is as follows.

$$Y_{ijg} = \alpha_0 + \alpha_1 Year_{TCP} + \alpha_2 Treat + \alpha_3 Year_{TCP} * Treat + X'\beta + \varepsilon$$

Where je{type 0, type 1, type 2+, type M}.

The dependent variable is the marriage choice (woman of type j) an individual g of type i makes. As is stated above, she has four choices to choose from: remain single (type 0); marry an only child

[13] If the individual's current marriage status is not the first marriage, the information of his or her first marriage is incomplete. In addition, these individuals' marriage incentive and children incentive can be different from those with first marriage. Therefore, I only keep those with first marriage or have never married until the survey year.

(type 1); marry someone with siblings (type 2+) or marry an ethnic minority (type M). However, the family planning policies for remarried couples in China are different from the first married couples. The details of these policies are reported in Appendix 1. According to them, the three marriage choices can be further divided into more sub-categories. Table 2 listed the detailed qualification criteria of three types.

Table 2. Three marriage pattern choices

Type 1	Spouse is Han ethnicity, the only child and first marriage
	Spouse is Han ethnicity, the only child, remarried but with no child
Type 2+	Spouse is Han ethnicity with siblings, first marriage or remarried
	Spouse is Han ethnicity, the only child, remarried and has one child
Type M	Spouse is ethnic minority

$Year_{TCP}$ represents the local implementation year of the selective TCP in a provincial level and it also distinguishes the different implementation time between urban and rural areas. It equals one if the individual got married after the local TCP year, and otherwise it equals zero. For those who never get married until the latest survey year 2010, $Year_{TCP}$ equals one because so long as they get married, they are treated. The information is from Wang et al. (2017) and they collect the TCP year information from various local legal and administrative documents. $Treat$ is a dummy variable which equals one if individual i is a Han Chinese who is the only child, with first marriage or never married. This dummy variable equals zero if the individual is in the control group, who is a Han Chinese and has siblings, also with first marriage or never married.

Table 3. DID estimators

	Pre-TCP	Post-TCP	Difference
Treatment group	$\alpha_0 + \alpha_2$	$\alpha_0 + \alpha_1 + \alpha_2 + \alpha_3$	$\alpha_1 + \alpha_3$
Control group	α_0	$\alpha_0 + \alpha_1$	α_1
Difference	α_2	$\alpha_2 + \alpha_3$	α_3

Table 3 lists the main estimators in a DID regression, where $\alpha_0 = (y|Year_{TCP} = 0, Treat = 0)$, $\alpha_1 = (y|Year_{TCP} = 1, Treat = 0) - (y|Year_{TCP} = 0, Treat = 0)$,

$$\alpha_2 = (y|Year_{TCP} = 0, Treat = 1) - (y|Year_{TCP} = 0, Treat = 0),$$

$$\alpha_3 = [(y|Year_{TCP} = 1, Treat = 1) - (y|Year_{TCP} = 0, Treat = 1)]$$
$$- [(y|Year_{TCP} = 1, Treat = 0) - (y|Year_{TCP} = 0, Treat = 0)].$$

Therefore, α_3 is the DID estimator, which is the coefficient of the interaction term $Year_{TCP} * Treat$ and measures the treatment effect of the treatment group. X represents a set of control variables including age, gender, living in urban or rural areas, local income level, education level and migration experience[14]. I also include the province dummy variables based on *Hukou* to control for local features such as different degree of son preferences and attitudes toward family size, female work participation and so on. In the next subsection, I will describe the econometric methodology used in this paper to include four marriage pattern choices in a single model.

As to the children incentive, which is an augmented analysis of the marriage effect of the selective TCP, the dependent variable is the probability of a woman to have a second child. In this part, I use a probit regression with DID method to check the fertility effect behind the marriage distortion. Except for the control variables used in the main regressions above, local sex ratio (in provincial urban-rural level) and spouse's education level are also included in that part.

4.3 Subhazard model with competing risks

Survival analysis is usually used by medical statisticians to analyze the survival time, which is the expected duration of time from a starting point until some event or failure happens. Standard statistical techniques cannot usually be applied because the underlying distribution is rarely Normal and the data are often right-censored. Kaplan and Meier (1958) use a non-parametric statistic to estimate the survival function from lifetime data. Based on their results, Cox (1972) extends the method and augments the analysis with the regression part. This proportional hazard model is used not only in medical research but also in labor economics such as measuring the duration of unemployment.

In this paper, I use this survival analysis to model the individual's unmarried status duration. The

[14] I didn't use cohort variables in the final regressions because the age variable here is the individual's age in the survey year 2010. However, the main results do not change much if I put cohort variables in the regression (see Appendix 2). For instance, in the full sample the coefficient of the interaction term 1.475 and 1.515, with and without cohort variables, respectively, both of with are significant at 1% level.

starting point is the legal marriage age in China, since when an individual enters the marriage market. However, because there are more than one marriage pattern choices or failure types, an extended form of hazard model with competing-risks is needed. The competing risks could be either overlapping (experiencing multiple events) or mutually exclusive. In the latter case, the occurrence of one of them will prevent any other event from ever happening (Gichangi and Vach, 2005). In the final regressions, only the individuals with first marriage or who is never married are considered in both treatment group and control group, because otherwise they could experience more than one type of marriage pattern and the marriage incentives could also be systematically different. Under this setting, all the marriage patterns are competing with each other hence satisfying the "mutually exclusive" assumption of the model.

The basic cause-specific proportional hazard model is developed by Cox, 1972. A cause-specific hazard is the instantaneous risk of failure from a specified cause given that no failure from any cause has yet occurred. When there is more than one type of events, the types of event can be defined as $\mathrm{J} \in \{1,2,\dots,\mathrm{m}\}$, which is unknown if the observation is censored at last time period T. The hazard rate of individual *i* for cause *j* can be rewritten as:

$$h_{ij}\left(t\middle|x_{ij}\right) = h_{0j}(t)\exp\left\{x_{ij}'\beta\right\}, j = 1,\dots,m \qquad (1)$$

A total hazard is the sum of any event will occur: $\mathrm{h(t|x)} = \sum_1^m h_j(t|x)$. Event time is from the starting time point until the first cause occurs: $\mathrm{T} = \min(J_1,\dots,J_m)$. $h_{0j}(t)$ is the baseline subhazard function. The DID design enters into the exponential part of this function, $x_{ij}'\beta$. If we still want to use the cause-specific hazard model, the events should be independent with each other by assumption, which however cannot be tested. Furthermore, the cumulative incidence function (CIF) for cause *j* is a function of all cause-specific hazards. The estimated failure function by Kaplan-Meier method is biased because it does not consider this fact. Therefore, the cause-specific hazard function does not have a direct interpretation in terms of survival probabilities for the particular failure type when facing competing risks.

Fine and Gray (1999) solve this problem by developing an alternative semi-parametric model that directly link the CIF to covariates. In this specific model, failure type j's sub-distribution hazard ratio can be represented as

$$\bar{h}_j(t) = \lim_{\delta\to 0}\left\{\frac{P(t<T\leq t+\delta \text{ and } J=j)|\, T>t \text{ or } (T\leq t \text{ and } J\neq j)}{\delta}\right\} \qquad (2)$$

, which is the instantaneous risk of failing from a particular cause *j* at time t given that the subject at time t has either not failed before t or failed from other causes except for *j* before t. The difference between cause-specific and sub-distribution hazards is the risk set, i.e. the conditional part in the probability. With the sub-distribution hazard, subjects that fail from another cause remain in the risk set and are given a censoring time that is larger than all event times.

There is a direct link between subhazards and CIF:

$$CIF_j = 1 - \exp\{-\overline{H_j(t)}\} \qquad (3)$$

, where $\overline{H_j(t)} = \int_0^1 \overline{h_j(t)}\, dt$ is the cumulative subhazard. In a proportional subhazard model, the subhazard function is

$$\overline{h_j}(t|x) = \overline{h_{j,0}}(t)\exp(x\beta) \qquad (4)$$

, where $\hat{\beta}$ are the estimated subhazard ratios.

Combining (3) and (4)[15] we can have:

$$CIF_j(t) = 1 - \{1 - CIF_{j0}(t)\}^{\exp(x\beta)} \qquad (5)$$

, where $CIF_{j0}(t)$ is the baseline CIF function for cause j with all covariates X set to zero. In this way, the covariates are directly linked to CIF.

In Section 6 Fine and Grey (1999) subhazard model is used, which will produce estimates of β, or subhazard ratios. This model has no constant term, which is not directly estimated and absorbed as part of the baseline subhazard. The relationship between raw coefficient and subhazard ratio (SHR) is $\exp(\beta_k) = SHR$. A positive (negative) coefficient means that the effect of increasing that covariate is to increase (decrease) the subhazard and thus increase (decrease) the CIF across the board.

5. Data and descriptive statistics

5.1 CFPS dataset

In this paper, I use the 2010 survey dataset provided by China Family Panel Studies (CFPS)[16]. This dataset contains the information on the number of parents' siblings, which makes it possible to identify whether the parent is an only child or not, which is necessary to identify treatment group

[15] An exponential algorithm $e^{xy} = (e^x)^y$ is needed here.

[16] http://www.isss.edu.cn/cfps/EN/

and control group[17]. Unlike CHIP dataset, CFPS also contains the marriage year information. These two variables allow me to use a DID design. In this paper a cross-sectional dataset is enough to evaluate the policy effect. Hence, I only use the 2010 baseline dataset.

CFPS is a nationally representative, annual longitudinal survey of Chinese communities, families, and individuals launched in 2010 by the Institute of Social Science Survey (ISSS) of Peking University, China. The CFPS is designed to collect individual-, family-, and community-level longitudinal data in contemporary China. In the 2010 baseline survey, the CFPS successfully interviewed almost 15,000 families and almost 30,000 individuals within these families, for an approximately response rate of 79%[18]. The CFPS respondents are tracked through annual follow-up surveys.

The original dataset covers 25 provinces and regions in mainland China. Four ethnic minority autonomous regions are not included in the original dataset except for Guangxi. Individuals with no marital information, inconsistent age or marital information[19] are dropped. The number of children excludes those with no biological relationship. I only keep the individuals with first marriage or who is never married, otherwise their marriage incentives can be different. However, their spouses are allowed to be remarried. In addition, I also drop individuals those who got married before OCP (year 1980) and those whose first marriage age was more than 50 for both men and women, in which case I suppose they have no children incentives[20].

The data of local TCP timing comes from Wang et al. (2017). The local policy year varies across provinces and differs between urban and rural areas. It is reasonable to quest that people can

[17] Although the official census data or urban household survey by the national bureau of statistics (NBS) contains a much bigger sample size, it only has the relationship of a household member to the household head. Therefore, I cannot use these two dataset to investigate the policy effect. There is another dataset China Household Income Project (CHIP), which contains the information of the individual's number of siblings. The dataset covers 31 provinces and regions in mainland China, which has 6 more regions than CFPS dataset including Hainan Province and 5 ethnic minority autonomous regions. However, the CHIP dataset does not have the information of the individual's marriage year, which makes it impossible to identify whether an individual got married pre- or post-treatment.

[18] In this 2010 dataset, 32,918 observations were surveyed in 2010 and 682 were surveyed in 2011.

[19] The CFPS dataset provides a set of questions on age and marital information, so that I can cross-verify the correctness and consistency by comparing these variables.

[20] I also limit the first marriage age 50 for women and 60 for men. The results show that the treatment effect is still positive and significant.

anticipate the policy and manipulate their behaviors by changing their marriage type before the local TCP year or migrant to the neighbor provinces whose relaxation of the OCP was earlier. The migration was easier after 1978's "opening up" policy, but migrants did not have the same welfare and other opportunities as the local people due to the restrictions by *Hukou* system. In addition, I implement the placebo tests by falsifying the timing of the local selective TCP. The results report insignificant treatment effects when moving the timing 1 to 3 years before the real policy year. Therefore, the potential anticipation changes and the consequent manipulation behaviors caused by the different timing of the selective TCP in different regions can be regarded as negligible.

5.2 Summary statistics

Table 4 report the descriptive statistics of the full sample and the data centered by 5 years before and after local TCP year, which is used in the final regression analysis. The initial sample size is 23,003 observations surveyed in 2010. After centering, the centered sample size is 8,736. In both samples, the treatment group accounts only a small proportion (8.65% in the full sample and 10.24% in the centered sample) compared with the large control group. The reason is that in 1990s most Chinese people at marriage age still have siblings, because the OCP implemented in 1980, which means the generation of single-child can enter into the marriage market only after 2000.

In the centered sample, the treatment group on average got married a bit latter than the control group among the married individuals. In addition, the age structure in the treatment group is concentrated in the younger cohorts, those born in 1980s occupy the biggest proportion. In the centered sample, individuals born in 1980s account to 59.4% in the treatment group, while in the control group this number is only 19.0%. The age structure of the control group is almost inversed when compared with the treatment group. The different age structures of two groups explain why the marriage rate of the treatment group is 40% lower than that of the control group. Observations in treatment group also have a relatively higher proportion to live in the urban areas and higher education levels. In the centered data, treatment group has an especially higher proportion of higher education levels than control group. "Income index" is a self-report local income level index, which can partly reflect the individual's family's local income level and social status[21]. On average, this index is similar in both

[21] The survey also has a "local social status" index, which is highly correlated with "local income" index. I also ran

samples. “Non-migrants” is a dummy that equals to one when the individual still lives in the birth place at age 12. Thus, it reflects whether individuals migrate with their parents when they are young (before age 12). This variable could affect the local networking and other resources a person might have.

In short, the demographic and other features between treatment and control group are not exactly the same. The differences of education level and cohort structure are bigger in the centered data. In subsection 6.2, to deal with these differences, I will use the matched sample after propensity score matching in a multinomial choice model and the conclusion is similar to the main results.

the regression with this social status index as one of the control variables instead of income level index, and the results are similar to the main results. Therefore, I only use local income level index in the final regression.

Table 4. Summary Statistics

Panel A summarizes characteristics of the individuals surveyed in CFPS 2010 dataset. "Age" is the age of an individual in the survey year. "Marriage age" is the age when an individual got married and it is the current marriage. "Male" is a dummy variable equal to one when an individual is male. "Urban" is a dummy variable equal to one when an individual currently lives in urban areas. "Income index" is an index varies from 1 to 4. Bigger number means a relatively higher income level in the local area. "Non-migrants" is a dummy that equals to one when the individual still lives in the birth place at age 12. In education-level dummy variables, "illiterate or semi-illiterate" group is omitted. In cohort variables, for example, "Forties" is a dummy variable equal to one when an individual born in 1940s. Panel B summarizes characteristics of the individuals who got married within five years before or after the local TCP year, or those never get married.

Panel A: full sample

Group	**Treatment group**			**Control group**			**Full sample**		
Variable	**Obs**	**Mean**	**Std.Dev.**	**Obs**	**Mean**	**Std.Dev.**	**Obs**	**Mean**	**Std.Dev.**
A. Demographics									
Age	1,990	37.26	14.46	18,248	44.03	12.44	23,003	43.37	12.81
Marriage age	1,247	24.59	3.279	15,091	24.10	3.205	18,267	24.13	3.213
Male	1,990	0.528	0.499	18,248	0.446	0.497	23,003	0.452	0.498
Urban	1,990	0.720	0.449	18,248	0.488	0.500	23,003	0.495	0.500
Income index	1,990	2.265	0.987	18,248	2.155	0.974	23,003	2.167	0.979
Non-migrants	1,988	0.911	0.284	18,243	0.944	0.230	22,993	0.942	0.234
B. Education levels									
Primary	1,990	0.123	0.328	18,248	0.229	0.420	23,003	0.217	0.412
Junior	1,990	0.233	0.423	18,248	0.310	0.462	23,003	0.297	0.457
Senior	1,990	0.221	0.415	18,248	0.148	0.355	23,003	0.149	0.356
College	1,990	0.276	0.447	18,248	0.076	0.266	23,003	0.092	0.289
C. Cohorts									
Forties	1,990	0.079	0.270	18,248	0.094	0.292	23,003	0.094	0.291
Fifties	1,990	0.147	0.354	18,248	0.214	0.410	23,003	0.206	0.405
Sixties	1,990	0.115	0.319	18,248	0.282	0.450	23,003	0.265	0.441
Seventies	1,990	0.172	0.378	18,248	0.239	0.426	23,003	0.236	0.424
Eighties	1,990	0.453	0.498	18,248	0.151	0.358	23,003	0.178	0.383

Panel B: five-year centered sample (continued)

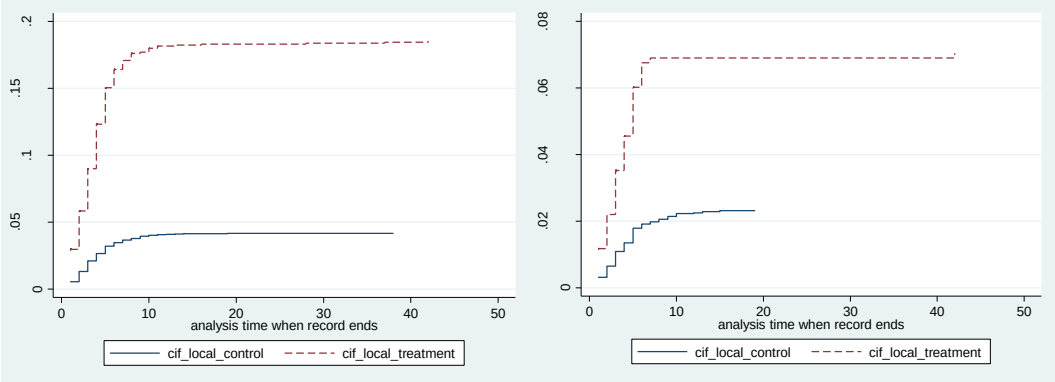
Group	**Treatment group**			**Control group**			**Full sample**		
Variable	**Obs**	**Mean**	**Std.Dev.**	**Obs**	**Mean**	**Std.Dev.**	**Obs**	**Mean**	**Std.Dev.**
D. Demographics									
Age	895	32.56	12.71	6,718	40.88	10.85	8,736	40.21	11.42
Marriage age	235	24.76	4.069	4,517	23.97	3.230	5,304	24.00	3.278
Male	895	0.537	0.499	6,718	0.461	0.499	8,736	0.469	0.499
Urban	895	0.751	0.433	6,718	0.460	0.498	8,736	0.473	0.499
Income index	895	2.173	1.005	6,718	2.152	0.974	8,736	2.154	0.983
Non-migrants	895	0.895	0.307	6,717	0.951	0.216	8,732	0.946	0.226

E. Education levels									
Primary	895	0.094	0.292	6,718	0.226	0.419	8,736	0.210	0.407
Junior	895	0.164	0.371	6,718	0.328	0.470	8,736	0.300	0.458
Senior	895	0.260	0.439	6,718	0.165	0.371	8,736	0.167	0.373
College	895	0.365	0.482	6,718	0.082	0.275	8,736	0.109	0.311
F. Cohorts									
Forties	895	0.037	0.189	6,718	0.022	0.146	8,736	0.028	0.165
Fifties	895	0.073	0.260	6,718	0.126	0.332	8,736	0.120	0.325
Sixties	895	0.171	0.377	6,718	0.461	0.499	8,736	0.427	0.495
Seventies	895	0.076	0.265	6,718	0.175	0.380	8,736	0.170	0.375
Eighties	895	0.594	0.491	6,718	0.190	0.392	8,736	0.227	0.419

6. Empirical results

Before running the regression, Figure 5 reports the non-parametric CIF graphs of two groups by setting type 1 as the main interest and the other two types as the competing risks. The two graphs below show the local CIF of two groups in full sample and centered sample. The analysis time begins at the legal marriage age, which is 20 for women and 22 for men. In both cases, the treatment group (the dashed curve) has a higher local CIF than the control group, which means the treatment group has a higher probability of a type 1 marriage pattern than the control group. Both groups converge quickly in around 10 years after entering the marriage market.

Figure 5. CIF of control group and treatment group



Note: These are the nonparametric CIF graphs of the control group and the treatment group based on type 1 (considering competing risks of type 2+ and type M by using command "**stcompet**" in Stata, which needs to know all competing events). Full sample is on the left side and 5-year-centered sample is on the right side.

6.1 Main results

In the final regression, the treatment group are Han Chinese and only child. The control group are Han Chinese with siblings. All samples the time interval is centered within five years before and after the local selective TCP year. The provincial effects are included in all regressions. The subhazard regression results are reported in Table 5.

The DID estimators are significant at 1% level in the full sample and all the subsamples except for the urban male subsample. In the full sample, when the DID covariates equals to one, the subhazard ratio (SHR) is 355.06% higher than when the interaction term equals to zero. The value of raw coefficient is 1.515, whose relationship with SHR is SHR=exp(1.515)=4.5506. Moreover, this

treatment effect of the treatment group is significant at 1% level. This implies that the selective TCP substantially increased the probability among treated people of choosing a type 1 marriage by more than three times compared with other two competing types of marriage patterns. The results of the subsamples from column (2) to (6) suggested a relatively stronger treatment effect in female group and in urban areas. One reason might be the high sex ratio in China, which means the competition in the marriage market is more intensive for men. Furthermore, men who are the only child usually have a better family background, for example, parents with higher education level or higher income level, as well as more support from parents. These two factors together make women prefer to marrying Type 1 men. The improving bargaining power in the marriage market with an unbalanced sex ratio also makes it possible for them to find such a type. People live in the urban areas also have a positive significant treatment effect of choosing Type 1 marriage pattern because the family-planning policies are in general carried out much stricter in urban areas than in rural areas. Therefore, they have a stronger incentive to choose this pattern as long as their fertility preference is binding under the OCP[22].

The covariate "Age" here is the individual's age in the survey year, which actually reflects different cohorts. Therefore, the results reported in the table imply that the older generation has a higher probability of getting married with Type 1 marriage but in a slowing-down increasing rate. This implies a changing social attitude toward marriage in China. For example, in the full sample more than 50% of the only children were born after 1980, who are more likely to stay unmarried or to choose Type 2 or Type 3 marriage compared with the older generations. Being male has a negative but insignificant effect in the full sample. The "Local income" is an index, which reflects the individual's relative income level in the local area. The higher the index is, the richer or better off the person will be. In addition, he is more likely to have a Type 1 marriage, which is in accordance with the positive assortative matching theory. The income effect in the full sample increases the person's SHR on average by 25.1% with one level increasing in the status. This effect is stronger in urban areas and especially for men. This is because in urban areas the OCP was stricter. To obtain the marriage gains from the selective TCP, men need to compete and pay more marriage transfer in

[22] The results of rural subsample are not reported here because the variance matrix is non-symmetric or highly singular.

the marriage market, which is partly reflected in this local income index.

The individual's education level in general does not have a significant effect in marriage pattern choice. For urban males, attending a college has a positive but insignificant effect on marriage type 1; while for urban females, such an effect is negative and insignificant. When a person migrates with his or her parents before age 12 overall has an insignificant effect but have different signs for male and female.

The CIFs of full sample and subsamples calculated by Fine and Gray's method are reported in Figure 6. In four graphs, the red curves are the CIFs when the interaction term (TCP*Treat) equals to one and the blue curves are the CIFs when interaction term equals to zero. All the results show a gap between two groups, which means that the DID estimator is positive. This is an complementation of the results in Table 5, which also implies the treatment effect based on a DID design is positive and the selective TCP does increase the possibility of choosing Type 1 marriage with the two other competing types (Type 2+ and Type M). The graphs also show that the treatment group in general need more time to converge after entering the marriage market, which means on average they stay in unmarried status longer than the control group.

In sum, the results in Table 5 verify the hypotheses H1a to H1c. The selective TCP increased the relative probability of Han Chinese who is the only-child to marry a spouse who is also the only child compared with who has siblings and who is an ethnic minority. The treatment effect of the selective TCP is stronger in the urban areas because the OCP was implemented stricter in urban areas and there was a 1.5 child relaxation in rural areas.

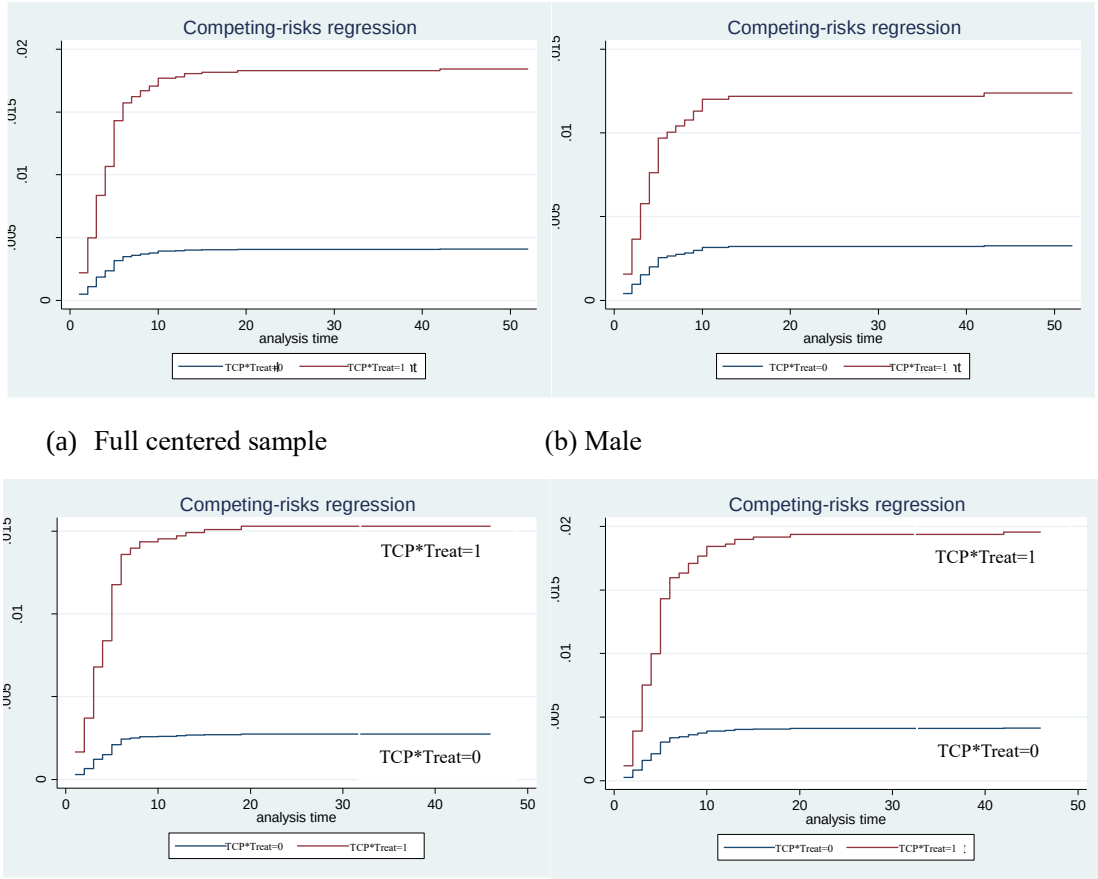
Table 5. Estimation results of subhazard model

The event of interest is marrying Type1. The competing events are marrying Type 2+ and marrying Type M. "TCP" is a dummy variable equal to one if the individual got married after the local TCP year or never gets married. "Treat" is a dummy variable equal to one if the individual is Han Chinese and only child, equal to zero if the individual is Han Chinese with siblings. "TCP*Treat" is the DID covariate. "Age" is the individual's age in the survey year. "Age^2" is age squared and divided by 100. Constant is absorbed as part of the baseline subhazard. All samples are five-year centered to eliminate the socioeconomic effect and other effects in the long term. The variance matrix of rural subsample is non-symmetric or highly singular.

	(1) Full	(2) Male	(3) Female	(4) Urban	(5) Urban Male	(6) Urban Female
TCP*Treat	1.515***	1.339***	1.726***	1.559***	1.483**	1.912***
	(0.367)	(0.517)	(0.559)	(0.456)	(0.632)	(0.658)
TCP	-0.707***	-0.710**	-0.604**	-0.757***	-0.716*	-0.797**
	(0.209)	(0.316)	(0.307)	(0.282)	(0.432)	(0.375)
Treat	1.047***	1.091***	1.182***	0.814***	1.033**	0.860**
	(0.250)	(0.400)	(0.336)	(0.286)	(0.461)	(0.381)
Age	0.238***	0.322***	0.195**	0.216***	0.361***	0.176
	(0.062)	(0.098)	(0.097)	(0.076)	(0.130)	(0.122)
Age^2	-0.215***	-0.300***	-0.164	-0.191**	-0.332**	-0.161
	(0.072)	(0.110)	(0.121)	(0.0887)	(0.141)	(0.159)
Urban	0.454**	0.486*	0.481*			
	(0.195)	(0.270)	(0.292)			
Male	-0.239			-0.225		
	(0.170)			(0.201)		
Income index	0.224***	0.299**	0.206**	0.281***	0.362*	0.269**
	(0.080)	(0.142)	(0.102)	(0.104)	(0.196)	(0.132)
Primary	0.006	0.407	-0.244	0.097	0.028	-0.012
	(0.271)	(0.406)	(0.373)	(0.421)	(0.650)	(0.542)
Junior	-0.651**	-0.547	-0.758**	-0.556	-0.415	-0.852
	(0.260)	(0.434)	(0.338)	(0.384)	(0.539)	(0.519)
Senior	-0.262	0.126	-0.672**	-0.103	0.121	-0.522
	(0.256)	(0.420)	(0.339)	(0.371)	(0.537)	(0.485)
College	-0.074	0.299	-0.472	0.012	0.369	-0.510
	(0.304)	(0.476)	(0.426)	(0.407)	(0.555)	(0.561)
Non-migrant	0.299	0.840	-0.066	0.222	0.947	-0.238
	(0.358)	(0.620)	(0.452)	(0.385)	(0.665)	(0.489)
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,478	2,664	2,849	3,001	1,422	1,579

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Figure 6. Fine and Gray's (1999) CIFs of full sample and subsamples



(a) Full centered sample (b) Male

(c) Female (d) Urban

Note: All results are calculated by the author using Fine and Gray's (1999) method with CFPS 2010 dataset. The red curves are the CIFs when the DID covariate equals one and the blue curves are the CIFs when the DID covariate equals zero.

6.2 Robustness test

6.2.1 Parents' education level

Figure 4 shows the systematic differences in parents' years of education between treatment group and control group. This reflects that the family background could be systematically different between two groups thus affect the final marriage choice outcomes. Although the CFPS dataset provides the variables of father and mother's education level, too many values are missing. To deal with this problem, I create a category for those whose information of parents' education is missing. I also assume that both their parents and they themselves have a significant lower education level than those with information. The two-sample t-tests results with equal variance shown in Table 6.1 and 6.2 verified this assumption. In both cases (father's and mother's years of education), the

differences of the individuals' education between two groups are big and significant at 1% level. The difference is bigger in mother's education case. The group with relevant information on average has 5.5 year more education than those who does not provide the information. The results show that the observations are self-selected to report their parents' education level. It is more likely in mother's case because in China, especially in rural areas, there exists a relatively big gender education gap.

Table 6.1 Years of education difference between two groups (father's education)

Group	obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
No information	4,326	5.705	0.073	4.780	5.56	5.848
With information	2,876	10.090	0.081	4.322	9.932	10.248
Combined	7,202	7.456	0.060	5.088	7.339	7.574
diff		-4.385	0.111		-4.603	-4.168

diff = mean(0) - mean(1) t = -39.519

Ho: diff = 0 degrees of freedom = 7200

Table 6.2 Years of education difference between two groups (mother's education)

Group	obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
No information	3,294	5.405	0.085	4.859	5.239	5.571
With information	2,225	10.949	0.083	3.899	10.79	11.111
Combined	5,519	7.640	0.071	5.255	7.501	7.779
diff		-5.543	0.123		-5.785	-5.302

diff = mean(0) - mean(1) t = -44.925

Ho: diff = 0 degrees of freedom = 5517

Note: These two tables show the parents' education status of the surveyed individuals. For those without information of their parents' education, their own education level is significantly lower than those with information.

I create different indicators of parents' level of education, and an additional indicator for those whose information of parents' education is massing as control variables in the regressions. The results are in Panel A and Panel B of Table 7[23]. In the full 5-year centered sample in column (1), the subhazard regression results are similar to the main results in Table 5. In the main results, the SHR

[23] These two variables are highly correlated. The regression results with both variables are similar to the main results. Both the coefficients are insignificant in this case and are not reported in the paper.

355.06% higher than when the interaction term equals to zero and significant at 1% level in the full sample. The corresponding value is 305.93% and 319.96% with mother and father's years of education categories as control variables, respectively. Both of them are significant at 1% level. In the results in column (2) to (4), the treatment effect is all positive and significant in male, urban and urban male subsamples. In Panel A, the category with missing information of mother's education has a small negative and significant effect on male (decreasing the probability of marriage Type 1 spouse by 16.63%, significant at 10% level) and especially urban male's (decreasing the probability of marriage Type 1 spouse by 12.10%, significant at 5% level) marriage choice. In the contrary, the category with missing information of father's education in Panel B has no significant effect in either full sample or other subsamples.

I also replace the missing values with zero in parent's years of education. The regression results are reported in Appendix 3. The main results are still similar to the main results. The effects of parent's education are stronger for males. In general, higher parent's education has a negative and significant effect on male of choosing type 1 marriage, and mother's education has a stronger effect than father's education. In urban subsample, the effect of father's education is no longer significant, but the effect of mother's education is still significant and negative.

Table 7. Estimation results of subhazard model with parent's education dummies

The event of interest is marrying Type1. The competing events are marrying Type 2+ and marrying Type M. Mother's education is categorized into six dummy variables, 1) information is missing (Medu_missing); 2) illiterate (years of education equal zero, omitted in the regression); 3) years of education ranging from 1 to 6 years (Medu_primary); 4) years of education ranging from 7 to 9 years (Medu_junior); 5) years of education ranging from 10 to 12 years (Medu_senior) and 6) years of education greater than 12 years (Medu_college). The dummy variables are defined in the same way in fathers' education. Constant is absorbed as part of the baseline subhazard. All the samples are five-year centered to eliminate the socioeconomic effect and other effects in the long term. The variance matrices of female, rural and urban female subsamples are non-symmetric or highly singular.

Panel A: Mother's years of education				
Variable	(1)	(2)	(3)	(4)
	Full	Male	Urban	Urban Male
TCP*Treat	1.401***	1.164**	1.473***	1.466**
	(0.367)	(0.501)	(0.452)	(0.609)
TCP	-0.659***	-0.652**	-0.753***	-0.647
	(0.211)	(0.325)	(0.285)	(0.434)
Treat	1.104***	1.202***	0.855***	1.113**
	(0.250)	(0.380)	(0.292)	(0.443)
Mother's education dummies	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Provincial dummies	Yes	Yes	Yes	Yes
Observations	5,518	2,678	2,991	1,415
Panel B: Father's years of education				
Variable	(1)	(2)	(3)	(4)
	Full	Male	Urban	Urban Male
TCP*Treat	1.435***	1.240**	1.494***	1.524**
	(0.379)	(0.537)	(0.480)	(0.624)
TCP	-0.653***	-0.697**	-0.746***	-0.764*
	(0.211)	(0.318)	(0.285)	(0.429)
Treat	1.097***	1.253***	0.834***	1.171**
	(0.255)	(0.399)	(0.300)	(0.462)
Father's education dummies	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Provincial dummies	Yes	Yes	Yes	Yes
Observations	5,518	2,678	2,991	1,415

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

6.2.2 Placebo tests

One concerning about the causality of the policy effect is that whether the individuals could anticipate and manipulate their behaviors before the implementation of the local selective TCP. It is worthy of attention because the policy year varied across provinces. Although during the 1990s changing "*Hukou*" status was very difficult and restricted, the different implementation years in the neighboring provinces might also change people's anticipation and therefore change their marriage behavior before the local policy year. For example, Tianjin municipality and Hebei province are close neighbors. The selective TCP year in urban areas in Tianjin is 1988, which is only one year earlier than that in Hebei. Hence it is possible that people in Hebei would have an anticipation of the policy change in the near future, and they will change their marriage type preference in 1988 instead of the real policy year 1989. Changes in anticipation like this could attenuate the treatment effect of the selective TCP.

To examine this potential manipulation and to check whether it has attenuated the effect of the selective TCP, in this part I use the placebo tests by falsifying the timing of the policy year one year, two years and three years before the real local policy year. Table 8 shows the results of placebo tests. Column (1) to (3) are the results by falsifying the timing one year before the real local policy year. Similarly, column (4) to (6) and column (7) to (9) are the results by shifting the timing two years and three years before, respectively. No coefficients of the DID estimators are significant in placebo tests. In other words, the treatment effect are insignificant in all these samples if the real policy year is shifted to earlier years. The effects of living in urban areas, mother's years of education and local income index do not change much compared with the main results. The placebo tests imply that the potential concerning that people might manipulate their behavior before the local policy year is trivial.

Table 8. Placebo tests

The event of interest is marrying Type1. The competing events are marrying Type 2+ and marrying Type M. In column (1) to (3), the local TCP year is falsified one year before the real timing. Similarly, column (4) to (6) is set two years before the real timing and (7) to (9) is three years before the real timing. Constant is absorbed as part of the baseline subhazard. All the samples are five-year centered to eliminate the socioeconomic effect and other effects in the long term. The variance matrices of rural and urban female subsamples are non-symmetric or highly singular.

	1 year			**2 years**			**3 years**		
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Full	Urban	Male	Full	Urban	Male	Full	Urban	Male
TCP*Treat	-0.894	-1.282	-1.019	-0.889	-1.309	-0.890	-0.870	-1.343	-0.991
	(1.010)	(1.039)	(1.662)	(1.004)	(1.021)	(1.635)	(0.999)	(1.013)	(1.629)
TCP	-2.420***	-1.611**	-2.445**	-2.480***	-1.910***	-2.480**	-2.574***	-1.950***	-2.837***
	(0.702)	(0.697)	(0.997)	(0.705)	(0.733)	(0.975)	(0.710)	(0.733)	(1.006)
Treat	1.867***	1.651***	1.987***	1.866***	1.574***	1.992***	1.741***	1.563***	1.807***
	(0.195)	(0.231)	(0.304)	(0.187)	(0.223)	(0.275)	(0.177)	(0.203)	(0.265)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,234	2,822	2,531	5,234	2,854	2,538	5,158	2,820	2,507

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

6.2.3 Data balancing

As we can see in the summary statistics (Table 4), treatment group and control group are different in many features. One way to deal with this problem is using a propensity score matching method with replacement to balance the data, and run the regression with the matched sample.

Table 9.1 shows the matched sample based on the treatment group. After matching. Table 9.2 and Figure 7 show that after matching, the standardized differences between the treatment group and the control are much smaller than the raw sample. Only the local income index and non-migrant stays significant different between two groups after matching.

Table 9.1 Covariate balance summary

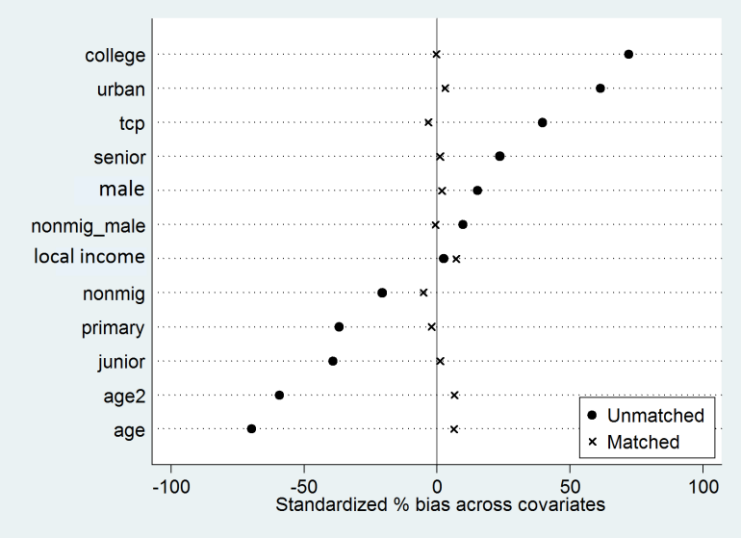
	Raw	Matched
Number of obs	7,524	1,784
Treated obs	892	892
Control obs	6,632	892

Table 9.2 Propensity score matching results

	Standardized differences		Variance ratio	
	Raw	Matched	Raw	Matched
TCP	0.396***	0.015	0.806	0.985
Age	-0.697***	0.015	1.373	0.981
Age2	-0.592***	0.009	1.382	0.979
Urban	0.614***	0.031	0.752	0.966
Male	0.151***	-0.011	1.001	1.002
Income index	0.025	0.078	1.067	1.121
Primary	-0.369***	0.031	0.486	1.094
Junior	-0.391***	0.009	0.621	1.017
Senior	0.237***	-0.025	1.403	0.974
College	0.722***	0.021	3.051	1.012
Non-migrant	-0.206***	-0.081	1.983	1.259
Nonmig*Male	0.097***	-0.027	1.017	0.999

Note: The results are calculated with command **teffects psmatch** in Stata, which can get the correct standard error in the second stage when running regression with the matched sample.

Figure 7. Propensity score matching results



Note: The results are calculated and graphed with command **pstest** in Stata.

With the balanced data, I run the multinomial choice (MNC) model with the same three marriage types as in main results.

A general model of multinomial choice model is:

$$s_{ij} = x'_{ij}\delta + z'_{ij}\eta_j + u_{ij}$$

Where *j* is the unordered alternatives individual *i* can choose from the J alternatives (here J=3), which include one-child spouse and Han (Type 1) or Han spouse with siblings (Type 2+) or minority spouse (Type M); s_{ij} is the utility of individual *i* when she chooses alternative *j*. If person *i* chooses alternative *j,* it means $s_{ij} > s_{im}$ for any m is different from *j*. x'_{ij} are the case-specific regression coefficients and z'_{ij} are the alternative-specific regression coefficients. When $\eta_j = 0$, an alternative-specific conditional logit (McFadden's choice) model reduces to a simple multinomial logit model. Compare with the subhazard model used in the main regressions, multinomial choice model does not take the period of unmarried status into account. However, it can compare the probability of choosing which marriage pattern in a more detailed way.

The regression results are reported in Table 10. Column (1) and (2) show the results of MNC regression with unweighted full sample. When based on the choice Type 2 marriage, i.e. choosing to marriage someone who has siblings, the DID estimator of Type 1 compared with the base Type 2+ is positive and significant, which is consistent with the main results. The relative-risk ratio $\Pr(\frac{Failtype=Type1|TCP*Treat=1}{Failtype=Type2+|TCP*Treat=1})$ of DID estimator in Type 1 is 2.509 and significant at 1% level, which means the relative risk of choosing Type 1 over Type 2+ (for DID estimator) is 2.509.[24] In contrary, the treatment effect of Type M compared with Type 2+ is negative and significant. Column (3) and (4) report the multinomial logistic regression results with the matched sample. The main results remain similar to the unmatched regression, but the significance of the treatment effect is weaker. Column (5) reports the results of the subhazard model with competing risks by using the matched full sample. After matching, the positive treatment effect of the TCP becomes much stronger and stays significant.

The regression results of multinomial choice model with the matched subsamples can be found in Appendix 4. Based on Type 2+, after matching, the treatment effect of marrying Type 1 keeps positive and significant in urban and urban female subsamples.

[24] The calculation of the relative-risk ratio is given in the output under the heading "RRR" by stata.

Table 10. Multinomial choice model results with matched sample

The results are calculated based on the matched full sample after propensity-score matching with caliper value of 0.1. All the samples are five-year centered to eliminate the socioeconomic effect and other effects in the long term. The control variables used here are the same with those listed in Table 9.2. In column (5), constant is absorbed as part of the baseline subhazard. The event of interest is marrying Type1. The competing events are marrying Type 2+ and marrying Type M.

	Multinomial logistic regression				Subhazard
	full unmatched (base 2)		full matched (base 2)		full matched
	(1)	(2)	(3)	(4)	(5)
Failtype	1	3	1	3	Competing 2 and 3
TCP*Treat	0.916***	-2.163***	0.920*	-3.409***	2.429***
	(0.341)	(0.350)	(0.524)	(0.402)	(0.600)
TCP	-0.717***	0.464***	-0.851*	1.879***	-1.634***
	(0.193)	(0.0723)	(0.461)	(0.226)	(0.581)
Treat	1.795***	1.159***	0.956***	1.165***	-0.021
	(0.196)	(0.132)	(0.294)	(0.202)	(0.319)
Constant	-0.476	11.89***	-14.49	11.93***	
	(1.650)	(0.605)	(2,274)	(1.694)	
Controls	Yes	Yes	Yes	Yes	Yes
Provincial dummies	Yes	Yes	Yes	Yes	Yes
Observations	7,524	7,524	1,784	1,784	1,326

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

6.3 Fertility incentive behind the marriage decision

In the previous part, the placebo tests and the regressions with the matched samples show the robustness of the main results. In this part, I use a simple probit regression with a similar DID method used in the main results to analyze the incentive to have more children behind the marriage pattern choice.

The selection of the treated and controlled is a bit different from the analysis of the marriage pattern choice. Table 11 describes the criteria of the treatment group and the control group, as well as the pre-treatment and post-treatment groups. The identification of whether getting treated is based on the results and method of Li et al. 2005. Their research identifies that the cohorts after 1943 are treated by the OCP, and they use the cutoff of age 37 as whether already gave birth to two children. In this paper, I use their conclusions and limit the cohort 1943 as the upper bound of the pre-treatment group. Similarly, age 37 is a threshold of two groups in consideration of the probability of giving birth to two children is quite low after that. For the post-treatment group, I limit the lower

bound of policy-age from 17 to 20 respectively. One to three years before the legal female marriage age in China are also considered here, because the policy could have an influence on their marriage and fertility decisions before they enter the marriage market.

Table 11. DID method in fertility incentive analysis

Treatment group	Han, female, no siblings, first marriage and the spouse also has no siblings. Han, female, no siblings, never married.
Control group	Han, female, with siblings, first marriage. Han, female, with siblings, never married.
Pre-treatment	Age in the local TCP-year is older than 37, get married before the local TCP-year and in the cohort after 1943.
Post-treatment	Age in the local TCP-year is between 17 (this lower bound varies from 17 to 20) and 37, get married after the local TCP-year.

The dependent variable is a binary variable "Two_child", which equals to one when the individual has two children and equals to zero when she has one or no child. The independent variable "Child1_male" is an indicator to imply whether the first child is a son or daughter. Table 12 reports the probit regression results of the full (centered) sample, urban subsample and rural subsample.

In all samples, the DID estimator is positive and significant at 1% level. In a basic nonlinear (probit) DID model $\mathrm{E}(Y^1|\mathrm{Treat}, \mathrm{Policy}, \mathrm{X}) = \Phi(\alpha_1 \mathrm{Treat} + \alpha_2 \mathrm{Policy} + \alpha_{12} \mathrm{Treat} * \mathrm{Policy} + \mathrm{X}\theta)$, the treatment effect is $[\Phi(\alpha_1 + \alpha_2 + \alpha_{12} + X\theta) - \Phi(\alpha_1 + \alpha_2 + X\theta)]$, which is the incremental effect of the coefficient of the interaction term (Puhani, 2012). Therefore, the results reported in Table 12 imply a positive treatment effect in the full sample, urban and rural subsamples, which means the TCP does have a positive fertility effect[25]. By calculations according to the formula above, the treatment effect in the full sample is 94.18% and significant at 1% level. The treatment group in general has a lower probability of giving birth to two children compared with the control group. The reasons might be that the treatment group put more emphasis on the quality of children instead of the quantity of children, and they also have a weaker son preference. Due to similar reasons, people in urban areas in general have a lower probability to give birth to two children. The average marginal

[25] The results of post-treatment group with different lower bounds are similar to those in Table 12 and are not reported in this paper.

effect (AME) is -0.099 and significant at 1% level, which means that on average, the probability of giving birth to two children for an urban individual is 9.94% lower than one in rural area.

Column (2) and (3) report the results in urban and rural subsamples. The treatment effect is 87.44% in urban subsample, which is positive and significant at 1% level. In rural subsample, this fertility effect is even stronger with the value of 91.39%, in spite of the long-lasting 1.5-child policy in rural areas in China. Under this policy, when the first birth is a girl, the family in the rural area is allowed to have a second child. This result reflects that no matter in urban or rural areas, the fertility preference in general is binding under the OCP, which is in accordance with the hypothesis H2.

The son preference is reflected in covariate "child1_male". The probability of giving birth to two children is significantly reduced when the first child is a son. In the full sample, the AME is -0.084 and significant at 1% level, which means that on average, the probability of giving birth to two children when the first child is a son is 8.42% lower than that is a daughter. This effect is stronger in rural areas with the average marginal effect of -0.093, where in general is dominated by stronger son preferences and larger family size. Higher education level has a negative fertility effect in full and urban samples. In the full sample, attending the college on average decrease the probability of having two children by 47.18% in the full sample, and 51.01% in urban subsample. However, the education effect is insignificant in the rural subsample. In both full sample and urban subsample, people who are non-migrants have a higher probability (AMEs of 17.7% and 18.5%, respectively) to give birth to two children. These people relatively have a better networking, more resources and they are more likely to get help from their grandparents and other relatives for childcare. All these reasons contribute to a positive fertility effect.

Table 12. The fertility effects of the TCP

The dependent variable is "Two_child", a dummy variable equal one if a Han Chinese woman has two children and equal zero when a Han Chinese woman has one or no child. "Child1_male" is a dummy variable equal one if the first birth is a son. The DID estimates with a full sample for post-treatment group with lower bound varies from age 18 to 20 are 4.739, 4.106 and 4.170. They are all significant at 1% level. All the samples are five-year centered to eliminate the socioeconomic effect and other effects in the long term.

	(1)	(2)	(3)
Variable	Full	Urban	Rural
TCP*Treat	4.706***	4.736***	4.533***
	(0.498)	(0.677)	(0.701)
TCP	-0.042	0.473	0.005
	(0.215)	(0.365)	(0.328)
Treat	-4.990***	-5.116***	-4.646***
	(0.201)	(0.187)	(0.267)
Age	0.104*	0.0497	0.124
	(0.0544)	(0.107)	(0.0892)
Age^2	-0.118**	-0.0304	-0.190*
	(0.0598)	(0.119)	(0.0968)
Urban	-0.307***		
	(0.0713)		
Mother's educ	0.00806	-0.00720	0.0313*
	(0.0116)	(0.0163)	(0.0190)
Local income	-0.0163	-0.00638	-0.0410
	(0.0322)	(0.0535)	(0.0423)
Child1_male	-0.260***	-0.236**	-0.260***
	(0.0630)	(0.0979)	(0.0867)
Primary	0.0210	-0.153	0.0641
	(0.0874)	(0.153)	(0.109)
Junior	-0.105	-0.456***	0.122
	(0.0869)	(0.141)	(0.116)
Senior	-0.560***	-0.932***	-0.189
	(0.122)	(0.168)	(0.206)
College	-1.457***	-1.889***	-0.103
	(0.236)	(0.312)	(0.545)
Non-migrant	0.545***	0.684***	0.0656
	(0.192)	(0.253)	(0.357)
Constant	-3.251**	-3.054	-2.316
	(1.383)	(2.390)	(2.053)
Provincial dummies	Yes	Yes	Yes
Observations	1,908	937	942

Note: 1. robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

7. Conclusion

With a coercive and well-known OCP and long implementation period, the profits and drawbacks of family planning policies in China have been studied for decades. The general and national TCP in 2016 also attracted attention by many researchers. According to the previous researches on Asian countries, such kind of general relaxation is expected to have a negligible effect on increasing the fertility rate. As a big economy, whether the aging problem and other undesired consequences of OCP could be partly addressed by this TCP relaxation in China is very important and meaningful. However, the period hitherto is too short to evaluate the policy effects. In this paper, I use a relaxation in 1990s (the selective TCP) to measure the policy effect on marriage market. The relaxation allows families with both parents are only children to give birth to two children. The transferable utility theory by Becker (1973) indicates that people will choose marriage patterns to maximize their marriage gains. In the meantime, children are a main source of marriage gains. The selective TCP will distort the marriage gains of different patterns by the assumption that the optimal fertility is binding under OCP. By using the individual survey data of CFPS 2010, which provides the number of siblings, I can hence identify the treatment group. I also use a subhazard model with competing risks and include a DID design in the exponential part. The regression results document a significant positive treatment effect with the subhazard ratio of 4.55 and significant at 1% level in full sample. It implies that the selective TCP substantially increased the probability among treated people of choosing a type 1 marriage by more than three times compared with other two competing types of marriage patterns. This effect is stronger in urban areas where OCP was implemented stricter. The treatment effect is also stronger among women group because the unbalanced sex ratio as well as the policy-induced marriage preference changes improving the bargaining power of the treatment group in the marriage market.

In robustness test, first I use the placebo tests by falsifying the policy timing 1 year, 2 years and 3 years before the real timing. The results show an insignificant treatment effects in all samples, which indicate that the concern on manipulation or expectation changes because of the timing variations could be negligible. Second, because of the concerning of the differences between treatment group and control group, I use the propensity score matching to balance the covariates of two groups. In the second step, I run the multinomial choice model with the balanced sample. The regression result

is consistent with the main regressions and therefore support the conclusion that the selective TCP has a positive treatment effect in increasing the preference of one-child spouse.

Finally, instead of only estimating a fertility effect of the population, I evaluate the fertility effect of the selective TCP with a similar DID design. The results show that the treatment effect is positive and significant. This means that behind the change of marriage patterns, people do have a fertility incentive. This effect is stronger in urban areas but also significant in rural areas, although in rural areas there was a 1.5-child relaxation soon after OCP.

Some further analyses could be done in the future, which are beyond the scope of this paper. First, whether men who are the only children and chose the type 1 marriage should pay more marriage transfer for their children incentive. Second, the selective TCP analyzed in this paper only affected a small amount of population. Therefore, the extrapolation of the conclusions in this paper is not plausible. By analyzing the relaxation of OCP in 2014, which had a widespread influence, we might have richer and more general results.

Appendix 1

Family planning policies of remarried couples

Type	Enforcement scope	individual's number of children before current marriage	spouse's number of children before current marriage	Total number of children before current marriage	number of children allowed in the new family
1	28 provinces	0	1	1	1
2	12 provinces	0	2 and widowed before marriage	2	1
3		0	2+	2+	0
4	4 provinces	1 but not in the new family	1 but not in the new family	0	1
5		0	0	0	1-2
6		0	1	1	0-1
7		1+	1+	2+	0

Note: These policies are relaxed after around 2014 (only one parent is the only child can give birth to two children). But before and during the selective TCP in the context, remarried couples with children (either has 1 or more children) are regarded separately no matter whether parents are the only-child or not. 2+ means equal or bigger than 2.

Appendix 2

Estimation results of subhazard model with cohort variables

The event of interest is marrying Type1. The competing events are marrying Type 2+ and marrying Type M. Cohort variables include “1950s”, “1960s”, “1970s”, “1980s” and “1990s”, which are binary variables indicating that whether an individual was born in that decade or not. The remaining control variables are the same with the main regression. Constant is absorbed as part of the baseline subhazard. All the samples are five-year centered to eliminate the socioeconomic effect and other effects in the long term. The variance matrices of rural and urban female subsamples are non-symmetric or highly singular.

Variable	(1) Full	(2) Urban	(3) Male	(4) Urban Male
TCP*Treat	1.475***	1.581***	1.298**	1.321**
	(0.370)	(0.456)	(0.507)	(0.579)
TCP	-0.679***	-0.807***	-0.717**	-0.590
	(0.214)	(0.283)	(0.335)	(0.428)
Treat	1.069***	0.805***	1.117***	1.128***
	(0.252)	(0.291)	(0.391)	(0.415)
Cohorts	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Provincial dummies	Yes	Yes	Yes	Yes
Observations	5,478	3,001	2,696	1,418

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Appendix 3

Estimation results of subhazard model with parent's education

The event of interest is marrying Type1. The competing events are marrying Type 2+ and marrying Type M. "Mother's educ" is mother's years of education of the individual. "Father's educ" is father's years of education of the individual. For those without information of these two variables, the value is replaced by zero. Constant is absorbed as part of the baseline subhazard. All the samples are five-year centered to eliminate the socioeconomic effect and other effects in the long term. The variance matrices of rural and urban female subsamples are non-symmetric or highly singular.

Panel A: Mother's years of education					
Variable	(1)	(2)	(3)	(4)	(5)
	Full	Male	Female	Urban	Urban Male
TCP*Treat	1.488***	1.238**	1.727***	1.517***	1.436**
	(0.371)	(0.494)	(0.559)	(0.460)	(0.595)
TCP	-0.683***	-0.640**	-0.605**	-0.731***	-0.659
	(0.209)	(0.326)	(0.306)	(0.282)	(0.447)
Treat	1.086***	1.214***	1.181***	0.860***	1.138***
	(0.246)	(0.370)	(0.337)	(0.281)	(0.428)
Mother's educ	-0.060**	-0.148***	0.002	-0.065**	-0.164***
	(0.029)	(0.053)	(0.036)	(0.032)	(0.057)
Controls	Yes	Yes	Yes	Yes	Yes
Provincial dummies	Yes	Yes	Yes	Yes	Yes
Observations	5,478	2,696	2,849	3,001	1,422
Panel B: Father's years of education					
Variable	(1)	(2)	(3)	(4)	(5)
	Full	Male	Female	Urban	Urban Male
TCP*Treat	1.527***	1.319***	1.727***	1.554***	1.541**
	(0.371)	(0.511)	(0.557)	(0.458)	(0.609)
TCP	-0.690***	-0.680**	-0.610**	-0.742***	-0.713*
	(0.210)	(0.320)	(0.305)	(0.283)	(0.432)
Treat	1.054***	1.194***	1.186***	0.824***	1.107**
	(0.248)	(0.383)	(0.337)	(0.284)	(0.445)
Father's educ	-0.048**	-0.117***	0.007	-0.040	-0.099**
	(0.024)	(0.039)	(0.031)	(0.027)	(0.040)
Controls	Yes	Yes	Yes	Yes	Yes
Provincial dummies	Yes	Yes	Yes	Yes	Yes
Observations	5,478	2,696	2,849	3,001	1,422

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Appendix 4

Multinomial choice model with matched subsamples

The results are calculated based on the matched sample after propensity-score matching with caliper value of 0.1. All the samples are five-year centered to eliminated the socioeconomic effect and other effects in the long term.

Panel A: Urban and rural subsamples								
	Rural matched		Rural unmatched		Urban matched		Urban unmatched	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1	3	1	3	1	3	1	3
TCP*Treat	-0.677	-3.201***	0.468	-2.081***	1.973***	-3.120***	1.206**	-1.923***
	(0.907)	(0.666)	(0.516)	(0.552)	(0.743)	(0.553)	(0.480)	(0.464)
TCP	1.083	1.483***	-0.310	0.456***	-1.302**	2.129***	-1.053***	0.487***
	(0.844)	(0.374)	(0.287)	(0.0971)	(0.638)	(0.328)	(0.265)	(0.112)
Treat	1.277**	0.589*	2.131***	0.761***	1.110***	1.533***	1.312***	1.235***
	(0.627)	(0.329)	(0.314)	(0.224)	(0.424)	(0.292)	(0.257)	(0.175)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-27.57	2.584	-19.46	8.427***	-4.800	16.90***	3.923**	14.00***
	(8,737)	(3.094)	(2,558)	(0.951)	(1,530)	(2.152)	(1.909)	(0.854)
Observations	444	444	3,774	3,774	1,340	1,340	3,750	3,750
Panel B: Male and female subsamples								
	Male matched		Male unmatched		Female matched		Female unmatched	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1	3	1	3	1	3	1	3
TCP*Treat	1.045	-3.331***	0.839	-2.168***	0.527	-3.643***	1.036**	-1.960***
	(0.830)	(0.576)	(0.511)	(0.514)	(0.688)	(0.622)	(0.474)	(0.480)
TCP	-0.579	2.351***	-0.530*	0.827***	-0.693	1.597***	-0.822***	0.128
	(0.717)	(0.326)	(0.289)	(0.110)	(0.587)	(0.355)	(0.263)	(0.0984)
Treat	1.074**	1.196***	1.867***	1.222***	1.213***	1.478***	1.893***	1.088***
	(0.492)	(0.288)	(0.302)	(0.186)	(0.397)	(0.304)	(0.269)	(0.197)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-13.10	30.56	-0.743	14.17***	-14.64	9.742***	-13.43	10.40***
	(6,001)	(2,083)	(2.337)	(0.901)	(2,734)	(2.347)	(852.4)	(0.831)
Observations	958	958	3,540	3,540	826	826	3,984	3,984

Panel C: Urban male and urban female subsamples (continued)

Variables	Urban male matched		Urban male unmatched		Urban female matched		Urban female unmatched	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1	3	1	3	1	3	1	3
TCP*Treat	1.096	-3.580***	0.948	-2.516***	3.047***	-3.339***	1.708**	-1.514**
	(1.099)	(0.879)	(0.702)	(0.749)	(1.140)	(0.830)	(0.699)	(0.612)
TCP	-0.245	2.611***	-0.860**	0.679***	-2.550***	1.967***	-1.151***	0.335**
	(0.966)	(0.489)	(0.400)	(0.171)	(0.943)	(0.530)	(0.355)	(0.151)
Treat	1.383**	1.490***	1.431***	1.054***	1.061*	2.001***	1.380***	1.333***
	(0.700)	(0.428)	(0.390)	(0.252)	(0.568)	(0.446)	(0.358)	(0.253)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-11.76	34.40	1.477	16.98***	-4.441	11.59***	-7.932	11.97***
	(7,633)	(2,706)	(3.018)	(1.331)	(4,181)	(2.771)	(629.9)	(1.145)
Observations	704	704	1,773	1,773	636	636	1,977	1,977

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

References

Abadie, A. (2005). Semiparametric difference-in-differences estimators. *The Review of Economic Studies*, *72*(1), 1-19.

Angrist, J. (2002). How do sex ratios affect marriage and labor markets? Evidence from America's second generation. *The Quarterly Journal of Economics*, *117*(3), 997-1038.

Argys, L. M., & Averett, S. L. (2015). The Effect of Family Size on Education: New Evidence from China's One Child Policy, *IZA Discussion Papers*, No. 9196

Becker, G. S. (1973). A theory of marriage: Part I. *Journal of Political economy*, *81*(4), 813-846.

Becker, G. S. (1974). A theory of marriage: Part II. *Journal of Political Economy*, *82*(2, Part 2), S11-S26.

Becker, G. S., & Lewis, H. G. (1973). On the Interaction between the Quantity and Quality of Children. *Journal of Political Economy*, *81*(2, Part 2), S279-S288.

Becker, G. S., & Tomes, N. (1976). Child endowments and the quantity and quality of children. *Journal of Political Economy*, *84*(4, Part 2), S143-S162.

Choo, E., & Siow, A. (2006). Who marries whom and why. *Journal of Political Economy*, *114*(1), 175-201.

Cleves, M., Gould, W. W., Gutierrez, R. G., & Marchenko, Y. (2010). An Introduction to Survival Analysis Using Stata. *Stata Press books*.

COX, D. (1972). Regression Models and Life-Tables. *Journal of the Royal Statistical Society. Series B (Methodological)*, *34*(2), 87-22.

Das Gupta, M., Ebenstein, A. Y., & Sharygin, E. J. (2010). China's marriage market and upcoming challenges for elderly men. *Policy Research Working Paper, 5351.*

Decker, C., Lieb, E. H., McCann, R. J., & Stephens, B. K. (2013). Unique equilibria and substitution effects in a stochastic model of the marriage market. *Journal of Economic Theory*, *148*(2), 778-792.

Ebenstein, A. (2010). The “missing girls” of China and the unintended consequences of the one child policy. *Journal of Human Resources*, *45*(1), 87-115.

Fine, J. P., & Gray, R. J. (1999). A proportional hazards model for the subdistribution of a competing risk. *Journal of the American Statistical Association*, *94*(446), 496-509.

Freedman, R. (1997). Do family planning programs affect fertility preferences? A literature review. *Studies in Family Planning*, 1-13.

Gichangi, A., & Vach, W. (2005). The analysis of competing risks data: A guided tour. *Statistics in Medicine*, *132*(4), 1-41.

Greenhalgh, S. (1986). Shifts in China's population policy, 1984-86: Views from the central, provincial, and local levels. *Population and Development Review*, 491-515.

Gu, B., Wang, F., Guo, Z., & Zhang, E. (2007). China's local and national fertility policies at the end of the twentieth century. *Population and Development Review*, *33*(1), 129-148.

Guilmoto, C. Z. (2009). The sex ratio transition in Asia. *Population and Development Review*, *35*(3), 519-549.

Huang, W., Lei, X., & Sun, A. (2015). The Great Expectations: Impact of One-Child Policy on Education of Girls, *IZA Discussion Papers*, No. 9301

Huang, W., & Zhou, Y. (2015). One-Child Policy, Marriage Distortion, and Welfare Loss, *IZA Discussion*

Papers, No. 9532

Huang, W., Lei, X., & Zhao, Y. (2016). One-child policy and the rise of man-made twins. *Review of Economics and Statistics*, *98*(3), 467-476.

Kaplan, E. L., & Meier, P. (1958). Nonparametric estimation from incomplete observations. *Journal of the American Statistical Association*, *53*(282), 457-481.

Keeley, M. C. (1977). The economics of family formation. *Economic Inquiry*, *15*(2), 238-250.

Li, H., Yi, J., & Zhang, J. (2011). Estimating the effect of the one-child policy on the sex ratio imbalance in China: identification based on the difference-in-differences. *Demography*, *48*(4), 1535-1557.

Li, H., Zhang, J., & Zhu, Y. (2005). The effect of the One-Child policy on fertility in China: identification based on the differences-in-differences. *Department of Economics, The Chinese University of Hong Kong, Discussion Papers*, (19).

Puhani, P. A. (2012). The treatment effect, the cross difference, and the interaction term in nonlinear "difference-in-differences" models. *Economics Letters*, *115*(1), 85-87.

Qian, N. (2009). Quantity-Quality and the One Child Policy: The Only-Child Disadvantage in School Enrollment in Rural China. NBER Working Paper No. 14973. *National Bureau of Economic Research*.

Rosenzweig, M. R., & Zhang, J. (2009). Do population control policies induce more human capital investment? Twins, birth weight and China's "one-child" policy. *The Review of Economic Studies*, *76*(3), 1149-1174.

Straughan, P., Chan, A., & Jones, G. (Eds.). (2008). Ultra-low fertility in Pacific Asia: trends, causes and policy issues. *Routledge*.

Wang, F., Zhao, L., & Zhao, Z. (2017). China's family planning policies and their labor market consequences. *Journal of Population Economics*, *30*(1), 31-68.

Xu, B., & Pak, M. (2015). Gender ratio under China's two-child policy. *Journal of Economic Behavior & Organization*, *119*, 289-307.

Xu, X., Zuo, H., Rao, Y., Zhang, L., Wang, L. L., & Zhao, Y. (2016). Intention to have a second child among Chinese women one year after the implementation of selective two-child policy: a cross-sectional survey. *The Lancet*, *388*, S96.

Zhao, M., & Kohler, H. P. (2016). Effects of Birth Control Policies on Women's Age at First Birth in China. *University of Pennsylvania Population Center Working Paper (PSC/PARC)* WP2016-1. http://repository.upenn.edu/psc_publications/1.