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The Long-Term Consequences of Family Planning in Old Age: Evidence from China's "Later, Longer, Fewer" Campaign

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Family planning plays a central role in contemporary population policies. However, little is known about its long-term consequences in old age. In this study, we examine how family planning policies implemented in China in the early 1970s affect the quality of life of the Chinese elderly forty years later. The direction of the effect is theoretically unclear. On the one hand, having fewer children allows parents to reallocate more resources to themselves, improving their well-being. On the other hand, having fewer children also leads to less care and companionship from children in old age. To empirically investigate the effect of family planning, we identify the causal impact by exploiting the provincial heterogeneity in implementing the "Later, Longer, Fewer" (LLF) policies in the early 1970s. We find that the LLF policies greatly reduced the number of children born to couples by 0.85. Parents also receive less support from children in terms of living arrangements, inter vivos transfers, and emotional support. Finally, we find that the impacts of the family planning policies on elderly parent's physical and mental well-being are drastically different: whereas parents who are more exposed to the family planning policies consume more and enjoy slightly better physical health status, they report more severe depression symptoms.

Keywords

family planning, "Later, Longer, Fewer", campaign, mental health, physical health

Disciplines

Demography, Population, and Ecology | Family, Life Course, and Society | Policy Design, Analysis, and Evaluation | Social and Behavioral Sciences | Sociology

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Keywords: Family Planning; "Later, Longer, Fewer" Campaign; Mental Health; Physical Health

JEL Classification Numbers: H31, I15, I18, J13

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1 Introduction

Family planning policies play a central role in contemporary population policies. According to the World Population Policies Datasets published by the United Nations, Population Division, the number of countries with direct government support for family planning reached 166 in 2015.[1] Some also claim that family planning played a fundamental role in the global fertility decline in recent decades (de Silva and Tenreyro 2017). Plenty of studies have been devoted to the immediate or short-term effects of family planning policies; however, there are surprisingly few studies on the long-term consequences of declining fertility as a result of family planning policies (Schultz 2008).[2] The dearth of such studies probably originates from two reasons. First, if family planning in a country came into effect only recently, the first affected cohorts have not yet grown old enough to see long-term impacts. The second reason is the identification challenge. Decades after the enforcement of the family planning policies, there were numerous simultaneous changes in other factors that reshaped people's fertility behavior, such as socioeconomic factors (Poston and Gu 1987; Zhang 1990; Schultz and Zeng 1995; Cai 2010), birth-control technology (Goldin and Katz 2002; Bailey 2006; Bailey 2010), abortion policies (Pop-Eleches 2006; Myers 2017), and women's empowerment (Upadhyay et al. 2014).

China provides an excellent opportunity to study the long-term consequences of family planning. They are among the earliest countries to implement family planning, and their policies have been recognized as the most stringent in the world (Cleland et al. 2006). Note that China initiated its stringent family planning policies in the early 1970s, which was ahead of the well-known one-child policy (OCP henceforth) that came into effect in 1979. The total fertility rate (TFR) declined drastically from 5.7 in 1969 to 2.7 in 1978 (Figure 1).[3] This drastic decline in fertility during the 1970s can be partially explained by a campaign named "Later, Long, Fewer" (or LLF) (Chen and Huang 2018; Babiarz et al. 2018). Forty years later, the first group of the affected cohorts is entering their sixties. Different from their predecessors, they will have fewer offspring who can take care of them; therefore, unveiling the long-term effects of family planning helps to understand the quality of life of this growing population.

[Figure 1 About Here]

It is theoretically unclear how family planning affects the quality of life in old age. There is no doubt that children play critical roles in providing old-age support, especially in developing countries (including China). However, the reduction in the number of children does not necessarily lead to a

[1] https://esa.un.org/poppolicy/wpp_datasets.aspx, accessed in April 2019.

[2] See Schultz (2008) for a comprehensive review of the effects of family planning (mostly short-term effects). He categorizes the effects into five categories: human capital formation (both mothers and children); family labor supply or time allocation; savings rate of parents; transfers of cash, goods, and time to and from household members; household living arrangements.

[3] Total fertility rate aggregates the fertility behavior of a group of people at a given time. Women of child-bearing age (15–49 years) are divided into several five-year age groups. Dividing the number of children born to women of a specific age group by the number of women in that group generates the age-specific fertility rate. Summing up the age-specific fertility rates and multiplying them by five gives us the total fertility rate. The total fertility rates represent the number of children a hypothetical woman would give birth to if she immediately went through her entire fertile history given the fertility pattern of the current population.

worsening situation for seniors for three reasons.[4] First, having fewer children spares resources that can be redirected to the parents. The reallocation of resources leads to an improved nutritional intake (Wu and Li 2012) and higher body mass index (Canning and Schultz 2012). Moreover, child-raising can be stressful for parents. Having fewer children also reduces parents' burden of childbearing, which may benefit their physical and mental health (Gove and Geerken 1977; Umberson and Gove 1989; Cáceres-Delpiano and Simonsen 2012). Secondly, parents can potentially turn to other measures of old-age support to substitute for having fewer children. For example, it has been well documented that Chinese households increased their savings in response to the family planning policies (Banerjee, Meng, and Qian 2010; Curtis, Lugauer, and Mark 2015; Choukhmane, Coeurdacier, and Jin 2016; Ge, Yang, and Zhang 2018). Finally, we should not simply interpret the effect of China's family planning policies as mechanically reducing households' welfare by imposing fertility restrictions. It also provides new technologies that allow households to better manage their childbirth. Access to birth-control technologies in countries without any restriction on fertility (e.g., the United States) also results in a reduced number of children (Goldin and Katz 2002; Bailey 2006; Bailey 2010). Interestingly, those studies find that the effect of contraceptive measures to be mostly positive. This indicates that people tend to have too many children if they have no access to birth-control technologies.

In this study, we examine the *long-term* consequences of China's LLF policies on the well-being of the elderly who are aged 60 and above. We examine a set of outcomes, including living arrangements, received support from children, consumption, and physical and mental health. Our identification relies on the provincial variation in the establishment year of the Family Planning Leading Group, a government institution that was mainly responsible for implementing the LLF policies, in the early 1970s. Previous studies largely refer to the 1979 one-child policy as an exogenous shock to the fertility rate.[5] However, recent studies point out that the one-child policy has a fairly limited impact on lifetime fertility (McElroy and Yang 2000; Wang 2016; García 2018). Instead, a majority of the fertility decline in China actually took place during the 1970s prior to the enforcement of the one-child policy. Figure 1 plots the time series of China's total fertility rate and sex ratio at birth (the number of male children per 100 female children). The fertility rate declined by three children from 5.7 in 1969 to 2.7 in 1978. During the succeeding decade, however, the rate dropped only marginally to 2.5 children in 1988. Additionally, the one-child policy resulted in a biased sex ratio (Hull 1990; Ding and Hesketh 2006; Ebenstein 2010; Bulte, Heerink, and Zhang 2011; Li, Yi, and Zhang 2011; Loh and Remick 2015). Figure 1 suggests that after 1979, the sex ratio at birth deteriorated rapidly and steadily exceeded 115 after 1990. The biased sex ratio can directly affect parents' well-being through their children's marriage (Rose 2000;

[4]It is possible that family planning can affect the well-being of the elderly through other channels, e.g., increased usage of intrauterine device and abortions. We discuss those alternative channels in Section 6 and conclude that childbirths play the dominant role.

[5]There are several ways to exploit the one-child policy as an exogenous shock. Some examples include comparing fertility behavior before and after 1979 (Ahn 1994; Ding and Hesketh 2006), using the year 1979 as the cut-off for a regression discontinuity design (Qin, Zhuang, and Yang 2017), analyzing fines imposed on above-quota births (McElroy and Yang 2000; Ebenstein 2010; Wei and Zhang 2011; Liu 2014; Huang, Lei, and Zhao 2016), examining the *ex-post* violations of the policy (Li and Zhang 2017; Zhang 2017), treating the minority as a control group (Li, Zhang, and Zhu 2005; Li, Yi, and Zhang 2011), and exploiting the rollout of family planning stations (Edlund et al. 2013; Jia and Persson 2017).

Wei and Zhang 2011). In contrast, the sex ratio during the early 1970s was relatively stable. Another advantage of utilizing earlier policy shocks is that it allows us to study the elderly that are "old enough." People aged 20 in 1979 would be only 52 in 2011. In contrast, people aged 20 in 1970 would be 61 in 2011—the age at which people are much more likely to be care-receivers rather than caregivers (to their grandchildren).

Using three waves (2011, 2013, 2015) of the panel data from the China Health and Retirement Longitudinal Study (CHARLS), our empirical analysis suggests that China's family planning policies have very different effects on parents' physical and mental well-being. Regarding their physical well-being, we find that parents with greater exposure to the family planning policies maintain a higher level of consumption. Their physical health is slightly better, and they spend less on medical services. We further investigate the source of such positive effects. First, their children become better educated and earn more as a result of the quantity-quality tradeoff. Children transfer more to parents even conditional on their "quality." Another source of financing is parents' accumulated wealth before they get old. Briefly speaking, there is no evidence suggesting that family planning makes the elderly's physical well-being worse off.

In contrast, the prospect of elderly parents' mental well-being is not so optimistic. We find that parents more exposed to the family planning policies are more likely to be depressed. The effect is even larger for women. Why are the effects of family planning on physical and mental well-being in old age so different? One explanation is that the two above-mentioned channels that may offset the negative effect of having fewer children on the parents' physical well-being do not necessarily apply to mental well-being. First, the elderly who are more affected by family planning not only have fewer children to accompany them but also receive fewer contacts and visits per child. What makes things worse is that children with a better education and higher income are even less attached to their parents. That is to say, the quantity-quality tradeoff is pushing children further away from parents in terms of geographic proximity. Second, whereas parents can save their earned income when they are young to prepare for old age, they can never "save up" children's company. Because of this, our study calls for greater attention to the elderly's mental health. Our findings may be related to China's high elderly suicide rates (ESR), which are found to be four to five times higher than the general Chinese population and more than twice the global average (Li, Xiao, and Xiao 2009; Zhou et al. 2019).

Our study contributes to the existing literature in two ways. First, it contributes to the understanding of the role of children on parents' well-being in old age. Whereas there is a large body of literature investigating the correlation between children and old-age well-being, few of them address the endogeneity of the fertility choice.[6] Studies that use arguably exogenous shocks to fertility mostly focus either on women's short-term performance or on the outcome of the second generation.[7] Studies on how

[6]See Hurt, Ronsmans, and Thomas (2006) for a review of the literature. More recent studies in this strand of literature include Buber and Engelhardt (2008); Spence (2008); Chen and Lei (2009); Hank (2010); Read, Grundy, and Wolf (2011); Kruk and Reinhold (2014); Islam and Smyth (2015).

[7]The fertility shocks used in the literature include family planning (Schultz 2008; Miller 2010; Canning and Schultz 2012; Joshi and Schultz 2013; Miller and Babiarz 2016), access to oral contraceptives (Goldin and Katz 2002; Bailey 2006; Bailey 2010; Ananat and Hungerman 2012; Bailey, Hershbein, and Miller 2012; Steingrimsdottir 2016), and abortion policies (Pop-Eleches 2006; Myers 2017).

having fewer children reshapes parents' old-age life are sparse. Second, our paper contributes to the understanding of the consequences of China's "Later, Longer, Fewer" campaign. There is a huge literature estimating the effect of China's family planning policies on various outcomes, including the savings rate (Banerjee, Meng, and Qian 2010; Wei and Zhang 2011; Curtis, Lugauer, and Mark 2015; Choukhmane, Coeurdacier, and Jin 2016; Ge, Yang, and Zhang 2018), marriage (Huang and Zhou 2015), labor supply (Huang 2016; Zhang 2017), children's outcomes (Li, Zhang, and Zhu 2008; Qian 2009; Liu 2014; Li and Zhang 2017; Qin, Zhuang, and Yang 2017), parental health (Chen and Lei 2009; Wu and Li 2012; Islam and Smyth 2015), rural-urban migration (Wang, Zhao, and Zhao 2017; Zhang 2017), and female empowerment (Huang 2016). However, the term "family planning policies" in those studies is almost identical to the "one-child policy." The effect of the "Later, Longer, Fewer" policies in the early 1970s, which arguably played a more important role in China's demographic transition than did the one-child policy (Figure 1), remains mostly unexplored.[8] Exploiting the provincial variation in the timing of the policy implementation, Chen and Huang (2018) and Babiarz et al. (2018) provide evidence that the LLF policies lead to reduced fertility, but they do not further investigate the long-term consequences when the affected parents get old because they used fertility surveys data collected in the 1980s.

The remainder of this paper is organized as follows. In Section 2, we provide the background information on China's family planning policies and old-age support system. In Section 3, we build a simple theoretical framework that guides our empirical analysis. We introduce the datasets used in this study and discuss our empirical strategy in Section 4, and in Section 5, we present our main results, that is, the effect of the family planning policies on the quality of life in old age. In Section 6, we discuss how family planning may affect elderly parents' well-being through channels other than fewer childbirths. Finally, we conclude in Section 7.

2 Institutional Background

2.1 China's Family Planning Policies during the 1970s

In this subsection, we briefly describe China's family planning policies during the 1970s, prior to the enforcement of the well-known one-child policy (see Zhang (2017) for a recent review of the one-child policy). However, China's family planning has a much longer history than that of the one-child policy; it dates back to December 1962 with the release of the No. [62]698 document "Instructions on Seriously Advocating Family Planning" (*guanyu renzhen tichang jihua shengyu de zhishi*). In 1964, the State Family Planning Commission was established after which commissions at the province, city, and county levels were gradually set up. However, the outbreak of the Cultural Revolution in 1966 severely interrupted the government's functioning including the family planning institutions, most of which ceased to work in 1966.

[8] Banerjee, Meng, and Qian (2010) is a notable exception who also explore the changes in the population policies in the early 1970s. They treat the year 1972 as the turning point at which "family planning policies shifted from a pro-fertility agenda to one that focused on curbing fertility" and define the treatment and control groups by whether the first child is born after 1972.

In early 1970, Premier Enlai Zhou emphasized that the implementation of family planning policies should not stop. In 1971, the State Council released document [71]51, "Report on Better Implementing Family Planning Policy" (*guanyu zuohao jihua shengyu gongzuo de baogao*), signaling the recovery of family planning from the Cultural Revolution. The document required provinces to set up a Family Planning Leading Group to organize and lead the implementation of family planning policies. A pilot run was initiated in 1970, and by 1975, all provinces had set up a leading group, an important and high-level provincial institution. In most cases, its leader was also the General Secretary of the provincial Communist Party Committee.

One central responsibility of the leading group is to enforce the "Later, Longer, Fewer" (*wan, xi, shao*) policies. "Later" means marriage at a later age—23 years for women and 25 years for men. "Longer" means a birth planning rule of waiting for more than three years between births. "Fewer" means that one couple could have at most two children. China's family planning campaign in the 1970s was technically voluntary, although there is anecdotal evidence suggesting that the campaign had several coercive elements (Whyte, Wang, and Cai 2015). Overall, the policy enforcement was much more lenient during this period compared to that of the one-child policy period (Zhang 2017), when an above-quota birth could result in huge fines and even the loss of the parents' jobs.

The leading groups could not curb the fertility rate by simply "asking" people to have fewer children. They had to complement the LLF policies with concrete measures of birth control. Therefore, another responsibility of the leading groups was to provide technical support for birth control. This support included training technical staff to conduct research on contraception and sterilization measures, introducing technology and equipment for sterilization, and making contraceptive methods more widely available (e.g., distributing contraception pills) (Peng 1997). National Family Planning Commission of China (1983) records the number of family planning operations, including intrauterine device (IUD) insertions, sterilization, and abortions from 1971 to 1982, which is shown in Figure 2. IUD insertion experienced the most rapid increase in the early 1970s—almost tripled from 6.2 million in 1971 to 16.7 million in 1975 within mere five years. Interestingly, there was no rapid increase in abortions until the more stringent one-child policy came into play.

[Figure 2 About Here]

Figure 3 plots the geographic variation in the establishment years of the provincial Family Planning Leading Group. The data comes from the population chronicles in various provinces. The groups were first established in 1970 in Shandong and Guangdong provinces, and were last set up in Guizhou and Xinjiang in 1975. There might be concerns that the timing of the establishment is endogenously determined and may be related to local socioeconomic conditions. To test for such possibilities, we run a regression of establishment years on a set of initial provincial conditions in 1969, including the total fertility rate, sex ratio, GDP per capita, share of the non-agricultural population, share of primary industry in GDP, and share of the secondary industry in GDP. We find no evidence that these factors jointly predict the establishment year. The joint F-value is 1.39 with a p-value of 0.266. Additionally, both studies from Babiarz et al. (2018) (Figures 4 and 5) and Chen and Huang (2018) (Figure 6) find

no evidence of pre-existing trends in fertility behavior prior to the enforcement of the LLF policies (or the establishment of the Family Planning Leading Group).

[Figure 3 About Here]

Figure 4 sketches the effect of the provincial Family Planning Leading Group on the fertility decline. We take provincial total fertility rates from Coale and Li (1987) and separate provinces into different groups according to the establishment years of the leading groups. Figure 4 compares the total fertility rate of the provinces in which the leading groups were established between 1970 and 1971 (nine provinces) to those that established the leading group between 1973 and 1975 (also nine provinces). Before 1970 when no provinces established leading groups, or after 1975 when all provinces had established the leading groups, the difference in the total fertility rate between the two sets of provinces remained almost constant. Only during 1971–1974, when the family planning leading groups were established in the first set of provinces but not in the second, did the fertility rates drop more rapidly in the first set of provinces.

[Figure 4 About Here]

2.2 Old-Age Support in China

China is well known for its Confucian model and filial piety family system (Li and Tracy 1999; Whyte 2005). The Classic of Filial Piety (*xiaojing*) is listed among the Thirteen Classics of the Confucian tradition, giving people advice on filial piety since the 4th century BC. One famous quotation from the Classic of Filial Piety is "there is no greater actions than the filial piety" (*renzhixing, mo dayu xiao*). Such value persisted into modern China, and filial piety is even written into the constitution and the marriage law.[9] Traditions presume that children should respect and care for their elderly parents. Compared to western countries, where the social security system is more developed, China relies more heavily on families as the main providers of old-age support (Zimmer and Kwong 2003). In China, children's support for their parents mainly takes the form of co-residence (Logan and Bian 1999; Zhang 2004; Zimmer and Korinek 2010; Oliveira 2016), financial or in-kind support (Lee and Xiao 1998; Sun 2002; Cai, Giles, and Meng 2006; Lei et al. 2012; Oliveira 2016), and time transfer (or informal care) (Lee and Xiao 1998; Lu, Liu, and Piggott 2015).

It is true that filial piety may erode over time with economic development, and China is developing its public system of old-age support. The two most important systems of social support are the Basic Old Age Insurance (BOAI) for Urban Employees, the Resident Pension Scheme for non-employed residents.[10] In 2015, the former covered a population of 353.6 million and the latter covered a population of 504.7 million Ministry of Human Resources and Social Security (2016). Despite the wide coverage, the monthly

[9]Both Article 49 of the Constitution and Article 21 of the marriage law state: "Parents have the duty of raising and educating their minor children. Adult children have the duty of supporting and caring for their parents."

[10]In 2014, the Resident Pension Scheme was created by merging the Urban Resident Pension Scheme (established in 2011) and the New Rural Resident Pension Scheme (established in 2009), respectively for urban and rural residents without a formal non-agricultural job. See Fang and Feng (2018) for a detailed account of the Chinese pension system.

pension per capita was as low as 119 RMB (19.1 USD) in 2015. Moreover, there are increasing concerns over the financial sustainability of the system as China is aging rapidly (Cai, Giles, and Meng 2006).[11] At this stage, the basic pension system is more supplementary than a substitute of family support for the elderly. Nursing homes also fail to accommodate an important share of the elderly. Chu and Chi (2008) estimate that only 1.49% of the Chinese older population lived in nursing homes in 2006. The share is less than one-fifth of that in the United States.[12] The dearth of nursing homes in China can originate both from the supply side and the demand side. On the supply side, administrative approval procedures are complicated and lengthy, and the threshold for private elderly care agencies remains high.[13] On the demand side, there is still a social stigma for parents to live in a nursing home because it signals a lack of their children's filial piety.[14]

To further understand the role of children in providing old-age support, we take one question from CHARLS: "If you were too old to work in the future, who do you think you can rely on financially for old-age support?" Figure 5 presents the answers in different years for people aged 60 or above. The choices include: children, saving, pension, commercial insurance, and other. In urban areas, where the pension programs are more generous, the elderly report to rely financially more on a pension (67.0% in 2015). In contrast, children remain the dominant forces for old-age support in rural China (72.8%), despite an increasing share of reporting to rely on pensions because of the expansion of China's public pension system (from 8.2% to 20.0%). It is important to note that the question only asks about "financial" old-age support. We believe children are playing even more important roles in non-financial old-age support, such as caring and company, because these cannot be easily substituted with the public pension system. To conclude, neither the government nor the market can fully replace children's role for the provision of elderly care in China in the foreseeable future.

[Figure 5 About Here]

3 Theoretical Framework

In this section, we first build a simple three-period life-cycle model to guide our empirical analysis, but our later empirical analysis only focuses on the long-term consequences in old age. Therefore, to complement our model, in the second part of this section, we briefly review evidence from the existing literature on the short-term effects of family planning.

Note that we only model one specific mechanism (which we believe is the most important) of family planning—having fewer children. It is entirely possible that family planning takes effect through other

[11] The revenue of the Basic Pension Insurance for Urban and Rural Residents failed to cover the expenses on pensions in 23 out of 31 mainland provinces in 2015 Ministry of Human Resources and Social Security (2016). The gap is expected to become even larger in the future along with China's aging process.

[12] Using various sources of data (Census, American Community Survey, Health and Retirement Survey), Mommaerts (2018) find that about 8% of the U.S. elderly live in nursing homes. She also provides evidence that nursing homes are important substitutes for co-residence by exploiting arguable exogenous changes in Medicaid eligibility for long-term care benefits.

[13] http://www.chinadaily.com.cn/china/2017-03/29/content_28716504.htm, accessed in April 2019

[14] http://www.china.org.cn/english/2002/Mar/29603.htm, accessed in April 2019

channels (e.g., later marriage and longer birth intervals). It is beyond the scope of this paper to incorporate all possible mechanisms of family planning in a unified model. In Section 6, we will empirically evaluate the relative importance of those channels.

3.1 A Simple Model

Forward-looking households experience three periods: having children, young, and old. In the first period, a couple plan how many children they "want" to have. The final number can be affected by the availability of birth-control technologies and fertility restrictions. People do not derive direct utility in this period. In the second period (young), they earn labor income, raise children, and build up savings. In the third period (old), they retire from the labor market and receive financial transfers and care from their children. We do not model children's decisions for simplicity. In the latter two periods, the household derives utility from three sources: consumption, physical health, and mental health. Without loss of generality, we assume away discounting.

In the first period, a household plans to have an optimal number of N^* children based on their expectation about the future. We assume that people cannot fully control their fertility behavior and will have η ($\eta > 0$) more children in the end—the final number of children would be $N = N^* + \eta$. This assumption is justified by the effectiveness of contraceptive measures and human behavior. The introduction of family planning brings two effects. First, it helps households to better control their fertility ($\eta = 0$), and second, it imposes a fertility restriction ($N \leq \overline{N}$). Both effects reduce the number of children N, but the welfare implications of these effects are vastly different. The reduction in η makes the actual number closer to the optimal number, while the restriction of $\overline{N}$ may force households to have too few children.[15]

Given the number of children N, a representative household solves the following problem in the second period:

$$\begin{aligned} \max_{C_y} \; & U_y\left(C_y|N\right) = u\left(C_y\right) + \delta_1 h_{1,y} + \delta_2 h_{2,y} + U_o \\ s.t. \;\; & h_{1,y} = H_1\left(C_y\right), \; h_{2,y} = H_2\left(C_y\right), \\ & A_y = I - C_y - \tau\left(N\right). \end{aligned}$$

C_y is consumption when young. The function $u(.)$ is concave and strictly increasing with $u' > 0$ and $u'' < 0$. $h_{1,y}$ represents physical health and $h_{2,y}$ represents mental health when young with relative utility weights $\delta_1 > 0$ and $\delta_2 > 0$. Both types of health can be improved by more consumption. $H_j, \; j = 1, 2$, is the health production function with $H_j' > 0$ and $H_j'' < 0$. $\tau\left(N\right)$ represents the total resources devoted to raising children. For simplicity, we embed the quantity-quality tradeoff inside the function $\tau\left(.\right)$, and we assume $\tau' > 0$. This implies that when N becomes smaller, we expect total expenses on children to decrease despite the fact that per-child expenses might increase as a result of the quantity-quality

[15] In our model, we assume away the uncertainties in childbirth for simplicity, but the welfare implications naturally apply to the case with childbirth uncertainties in which η becomes a random number. Family planning reduces the randomness in η, which is welfare-improving if households are risk-averse.

tradeoff. Finally, I is the labor income, and A_y is the wealth that will be transferred to the next period.

In the third period, the household solves the following problem

$$\begin{aligned}\max_{C_o}\ & U_o\left(C_o|N,h_{1,y},h_{2,y}\right)=u\left(C_o\right)+\delta_1 h_{1,o}+\delta_2 h_{2,o}\\ s.t.\ \ & h_{1,o}=\lambda h_{1,y}+\left(1-\lambda\right)H_1\left(C_o\right)+F_1\left(S\left(N\right)\right),\\ & h_{2,o}=\lambda h_{2,y}+\left(1-\lambda\right)H_2\left(C_o\right)+F_2\left(S\left(N\right)\right),\\ & 0=A_y+T\left(N\right)-C_0.\end{aligned}$$

There are two notable differences from the second period. First, the health of the elderly is not only affected by current consumption. Health status when young partially persists into old age, with a persistence rate $0<\lambda<1$, and health in old age is further shaped by the care received from the elderly's children, denoted as $S\left(N\right)$. We assume $F_j'>0$. Second, the elderly do not earn income from the labor market. Instead, they rely on their accumulated wealth $\left(A_y\right)$ and the financial transfer from their children $\left(T\left(N\right)\right)$. We assume $T'>0$.

If the utility in the latter two periods is weighted equally, the first-order condition would be:

$$u'\left(C_y\right)+\left(1+\lambda\right)\left(\delta_1 H_1'\left(C_y\right)+\delta_2 H_2'\left(C_y\right)\right)=u'\left(C_o\right)+\left(1-\lambda\right)\left(\delta_1 H_1'\left(C_o\right)+\delta_2 H_2'\left(C_o\right)\right).$$

To let the model have a closed-form solution, we further assume functions $u\left(.\right)$, $H_1\left(.\right)$, and $H_2\left(.\right)$ to follow a quadratic form. More specifically,

$$\begin{aligned}u\left(C\right)&=C-\frac{a_c}{2}C^2,\\ H_1\left(C\right)=C-\frac{a_{h_1}}{2}C^2,&\text{and } H_2\left(C\right)=C-\frac{a_{h_2}}{2}C^2.\end{aligned}$$

With the above assumptions, we can solve for optimal consumption,

$$\begin{aligned}C_y^* &= \frac{I-[\tau(N)-T(N)]}{1+K},\\ C_o^* &= K\frac{I-[\tau(N)-T(N)]}{1+K},\\ A_y &= \frac{K}{1+K}\left[I-\tau(N)\right]-T\left(N\right),\end{aligned}$$

where

$$K=\frac{a_c+\left(1+\lambda\right)\left(\delta_1 a_{h_1}+\delta_2 a_{h_2}\right)}{a_c+\left(1-\lambda\right)\left(\delta_1 a_{h_1}+\delta_2 a_{h_2}\right)}>0.$$

With the above simple model, we can describe how consumption, savings, and physical and mental health respond to an exogenous decrease in N as a result of family planning policies.

Proposition 1 *If we assume* $\frac{\partial(\tau(N)-T(N))}{\partial N}>0$*, that implies fewer children free up a household's lifetime budget, savings* (A_y) *and consumption in both period* (C_y *and* C_o*) increases as* N *decreases.*

Proof.

$$\begin{aligned}
\frac{\partial A_y}{\partial N} &= -\frac{K}{1+K}\frac{\partial \tau(N)}{\partial N} - \frac{\partial T(N)}{\partial N} < 0, \\
\frac{\partial C_y^*}{\partial N} &= -\frac{1}{1+K}\frac{\partial \left(\tau(N) - T(N)\right)}{\partial N} < 0, \\
\frac{\partial C_o^*}{\partial N} &= -\frac{K}{1+K}\frac{\partial \left(\tau(N) - T(N)\right)}{\partial N} < 0.
\end{aligned}$$

Therefore, all three variables will increase when N decreases. ■

The intuition behind this proposition is as follows. If lower N increases a household's lifetime resources, households would increase their consumption in both periods because they wish to smooth their consumption. Moreover, a reduction in N effectively reallocates the household's disposable income from the third period to the second.[16] Households need to increase savings at the end of the second period to achieve the goal of consumption smoothing.

Proposition 2 *A reduction in N will unambiguously improve the parents' health status when young ($h_{j,y}$), but its effect on the parents' health status in old age ($h_{j,o}$) is ambiguous.*

Proof. For $j = 1, 2$,

$$\begin{aligned}
\frac{\partial h_{j,y}}{\partial N} &= \frac{\partial H_j}{\partial C_y}\frac{\partial C_y}{\partial N} < 0, \\
\frac{\partial h_{j,o}}{\partial N} &= \lambda\frac{\partial H_j}{\partial C_y}\frac{\partial C_y}{\partial N} + (1-\lambda)\frac{\partial H_j}{\partial C_o}\frac{\partial C_o}{\partial N} + \frac{\partial F_j(S)}{\partial S}\frac{\partial S}{\partial N}.
\end{aligned}$$

The first two terms of $\frac{\partial h_{j,o}}{\partial N}$ are negative while the third term is positive; therefore, the sign of the aggregate effect remains ambiguous. ■

$\frac{\partial h_{j,y}}{\partial N} < 0$ captures the quantity-quality tradeoff between children and parents. The extra resources spared from having fewer children can be used not only to increase the quality of the remaining children but also to increase parent's consumption, further improving their health status. We call it the "nutrition effect." The third term in the expression ($\frac{\partial F_j(S)}{\partial S}\frac{\partial S}{\partial N}$) represents the negative consequences of a smaller N that there are fewer children to take care of the elderly, which we call the "caring effect." If children's care positively affects their elderly parents, the relationship between $h_{j,o}$ and N is less clear.

Proposition 3 *If we assume that mental health is less sensitive to consumption compared with physical health, i.e. $\left|\frac{\partial H_1(C)}{\partial C}\right| > \left|\frac{\partial H_2(C)}{\partial C}\right|$, but more sensitive to children's company, i.e. $\left|\frac{\partial F_1(S)}{\partial S}\right| < \left|\frac{\partial F_2(S)}{\partial S}\right|$, a lower N has a more negative effect on the elderly's mental health.*

Proof. Given the expression of $\frac{\partial h_{j,o}}{\partial N}$, we can see that for mental health, the first two terms are less

[16] In the second period, $\frac{\partial(I-\tau(N))}{\partial N} < 0$ because the couple have fewer children to rear. In the third period, $\frac{\partial T(N)}{\partial N} > 0$ as what we assume in the model.

negative while the third term is more positive:

$$\frac{\partial h_{1,o}}{\partial N} = \lambda \frac{\partial H_1}{\partial C_y}\frac{\partial C_y}{\partial N} + (1-\lambda)\frac{\partial H_1}{\partial C_o}\frac{\partial C_o}{\partial N} + \frac{\partial F_1(S)}{\partial S}\frac{\partial S}{\partial N}$$
$$< \lambda \frac{\partial H_2}{\partial C_y}\frac{\partial C_y}{\partial N} + (1-\lambda)\frac{\partial H_2}{\partial C_o}\frac{\partial C_o}{\partial N} + \frac{\partial F_2(S)}{\partial S}\frac{\partial S}{\partial N} = \frac{\partial h_{2,o}}{\partial N}.$$

■

Lower fertility affects the elderly's health status through a nutrition effect and a caring effect. If we believe physical health is more affected by consumption and mental health is more affected by children's care and company, family planning policies are expected to exert a more negative effect on mental health than on physical health. Table 1 summarizes the predictions of our theoretical framework.

[Table 1 About Here]

3.2 Supporting Evidence from the Existing Literature

Our theoretical framework involves both the young and the old. Although our empirical analysis will focus on the effect of family planning in old age, there are abundant existing studies that support our framework when households are young. This subsection briefly reviews this strand of literature.

Health When Young

Medical literature has long been interested in the biological influence of childbearing on maternal health. Because giving birth to a child is a risky event in developing countries, having fewer children mechanically lowers mothers' mortality rate (Chen et al. 1974; Boerma 1987; Menken, Duffy, and Kuhn 2003). Other biological consequences of childbirth include: breast cancer (Kelsey, Gammon, and John 1993), heart disease (Ness et al. 1994), obesity (Weng et al. 2004), and stroke (Zhang et al. 2009). Economic literature puts a greater emphasis on the channel of the budget constraint, which we also highlight in our theoretical framework. Canning and Schultz (2012) find an anthropometric gain of 1 kg/m^2 in the body-mass index for reproductive-age women in treatment areas in the Matlab experiment.[17] Wu and Li (2012) further discuss the source of the BMI gain, finding that it originates from more nutrition intake and that the father's health is also improved as a consequence of the one-child policy.

Savings When Young

With fewer children to rear, households would realize that they can spare more resources when young but will receive fewer inter vivos transfers when old. In response to such expectation, households should increase their savings according to a standard life-cycle model. In the context of China, it has

[17]The Matlab experiment was a randomized experiment designed to document the efficiency of family planning. It was initiated in 149 villages in a relatively remote rural district of Matlab, Bangladesh. 70 villages became the treatment village, with government community clinics offering a range of methods and instructions on fertility control.

been argued that family planning is an important candidate explanation for China's high household savings rate. Curtis, Lugauer, and Mark (2015) propose two channels through which having fewer children increases the savings rate: a "dependent children effect" and an "intergenerational family transfer effect." The dependent children effect means that "a household with relatively few children devotes a smaller share of household income to support dependents and, therefore, has more to save." The intergenerational family transfer effect states that "the current working-age population should save more aggressively because they will be supported in retirement by relatively few working people." Those two effects are similar in spirit to our theoretical framework. Exploiting the plausibly exogenous decline in fertility in China caused by family planning programs that began in the early 1970s, Banerjee, Meng, and Qian (2010) find that having one less child increases the savings by over 14,000 RMB (or 2258 USD). Choukhmane, Coeurdacier, and Jin (2016) also argue that the one-child policy contributes to the rise in China's household savings rate because the lower expected support from children induces parents to increase saving.

4 Data and Empirical Strategy

4.1 Data and Variables

The main data used in this study is the China Health and Retirement Study (CHARLS), which is a nationally representative sample of Chinese residents aged 45 and older and is the sister study of the U.S. Health and Retirement Study (HRS) (Zhao et al. 2013). The survey covers 150 counties/districts in 28 provinces in mainland China. Each wave includes about 10,000 households and 17,500 individuals. The individuals are followed up every two years. We use three waves of the panel data from CHARLS: 2011, 2013, and 2015.

Because we wish to understand the effect of China's family planning policies on a wide range of outcomes, we construct three levels of data accordingly: individual, household, and child. For this reason, the number of observations in our later analysis can vary based on the dependent variable. Some variables are naturally defined at the individual level such as health status, but others are more suitable to be defined at the household level such as consumption. We exclude samples from Inner Mongolia because we fail to find information about its family planning leading group. We also drop households with either spouse being an ethnic minority, as ethnic minority households are subject to less stringent policies compared with their *Han* counterparts (Peng 1997; Li, Zhang, and Zhu 2005; Li, Yi, and Zhang 2011). We further restrict our analysis to those who were ever married and aged 60 and above in the year 2011. The age restriction serves two purposes. First, we wish to alleviate the concern that elderly parents remain the caregivers instead of care-receivers. There is increasing evidence suggesting elderly parents in China are still helping their adult children through providing residence and taking care of the grandchildren (Chen, Liu, and Mair 2011; Lee and Bauer 2013; Zeng and Xie 2014; Lumsdaine and Vermeer 2015). Second, we wish to exclude the effect of family planning on parents' human capital accumulation and focus on the channel of having fewer children. Those who were aged 60 in 2011 would be at age 20 in 1971, by which time most of them had already completed

their education.[18,19]

Individual-level data covers demographics (e.g., age, gender), socioeconomic status (e.g., *Hukou* status,[20] education), and health status, both physical and mental health. More specifically, we include the following ten measures to proxy the elderly parents' physical and mental well-being:

1. Self-rated life satisfaction: CHARLS asks the interviewee how satisfied they are with their life as a whole. The variable ranges from 1 (completely satisfied) to 5 (not at all satisfied).

2. Self-rated health: Ranges from 1 (Excellent) to 5 (Poor).

3. Self-perceived probabilities of living for another 11–15 years: CHARLS interviews the elderly at age a about their self-perceived chances of reaching age $a + x$, where x ranges between 11 and 15.[21] There are five options: 1 (almost impossible); 2 (not very likely); 3 (maybe); 4 (very likely); 5 (almost certain). For ease of interpretation, we convert those values to probabilities 0.1, 0.3, 0.5, 0.7, and 0.9, respectively.

4. Body mass index (BMI): One important feature of CHARLS is that it provides a physical examination of the interviewees; as a result, we have access to measured numbers instead of self-reported numbers on anthropometric data (height and weight) and blood pressure. Body mass index is calculated by dividing one's weight in kilograms by the square of one's height in meters.

5. Underweight: This is a dummy variable indicating that a person's BMI is lower than 18.5.

6. Limitations in Activities of Daily Living (ADL): Our definition of ADL measures people's difficulty in doing the following daily activities: dressing, bathing and showering, self-feeding, getting into or out of bed, toilet hygiene, controlling urination and defecation. The original questions have four choices: no difficulty, have difficulty but can still do it, have difficulty and need help, cannot do it. We define the latter two choices as having ADL limitations.

7. Limitations in Instrumental Activities of Daily Living (IADL): These include doing household chores, preparing meals, shopping for groceries, making phone calls, and taking medications. The definition of IADL limitation is the same as that of ADL limitation.

8. Hypertension: Defined by either systolic pressure exceeding 140 mmHg or diastolic pressure exceeding 90 mmHg.

[18] According to a 1 percent sample of China's 1990 population census, only 2.2% of cohorts born between 1941 and 1950 received some post-secondary education. If an individual receives at most senior high education, he should have left school by the age of 19.

[19] See Miller (2010) and Huang, Lei, and Sun (2016) for a discussion on how the expectation of having fewer children influences young women's educational outcomes.

[20] *Hukou* system is a household registration system in China that categorizes people into urban or rural status based on their parents' place of origin. An individual's *hukou* status is directly tied to his/her eligible social welfare. It has been well documented that urban *hukou* holders enjoyed significantly better social welfare (Bian 2002; Wu and Treiman 2004).

[21] More specifically, CHARLS asks people aged 65–69 about their perceived probabilities of reaching age 80, and asks people aged 70–74 about their perceived probabilities of reaching age 85, etc.

9. Center for Epidemiologic Studies Depression Scale (CES-D scale): CES-D is a brief self-report questionnaire to measure the severity of depressive symptoms. CHARLS asks ten questions related to depression, eight of which are about negative behaviors and two of which are about positive behaviors.[22] For the eight negative behaviors, we assign 0 points to "rarely or none of the time"; 1 point to "some or a little of the time (1–2 days a week)"; 2 points to "occasionally or a moderate amount of the time (3–4 days a week)"; 3 points to "most or all of the time (5–7 days a week)." Points are assigned in the opposite order (from 3 to 0 points) for the two positive behaviors. Summing up the points from ten questions gives us the CES-D scale. Following the standard procedure (Andresen et al. 1994), we will code the scale to missing if two or more items are missing.

10. Depressed: This is a dummy variable indicating that a person's CES-D is equal to or above 10 (Andresen et al. 1994).

The left panel of Table 2 reports the summary statistics at the individual level. Note that there are variations in the number of observations. Such variations mainly originate from two reasons aside from "don't know" or "refuse to answer". First, respondents need to participate the physical examination provided by CHARLS to obtain the biomarker information (e.g., height, weight, blood pressure). Second, if the main respondent is absent, CHARLS allows the proxy to answer some questions (e.g., functional limitations such as ADL and IADL), but not others (e.g., depression).

[Table 2 About Here]

The household level data covers age structure, net transfers (including in-kind transfers) from children, living arrangements, and household expenditures. Whereas the definition of age is straightforward at the individual level, defining the age at the household level is more complicated. Both the husband's and wife's age are important in household decision making. Moreover, we also need to take into account the possibility that one of the couple is deceased. We, therefore, use three variables to control for the age structure of the couple: widow or not, age of the oldest, and the age gap between the couple.[23] Living arrangement is defined as whether there is at least one child living within a locality (household, village/community, district/county). CHARLS also contains detailed information on household expenditures, the categories of which are generally consistent with the definition used by the National Bureau of Statistics in China.[24,25] We highlight three categories that may be especially important for the elderly: food expenditures, living expenditures (e.g., communication, transportation, utilities, household

[22]The eight negative behaviors include: was bothered by things that don't usually bother me; had trouble keeping my mind on what I was doing; felt depressed; felt everything I did was an effort; felt fearful; sleep was restless; felt lonely; could not get "going." The two positive behaviors are "felt hopeful about the future" and "was happy."

[23]Because CHARLS surveys information regarding the deceased spouse, this variable can be constructed for all those who ever get married.

[24]CHARLS asks some categories of expenditures on a weekly basis (e.g., food), some on a monthly basis (e.g., utilities), and others on a yearly basis (e.g., health). We transform all expenditures to annual expenditures.

[25]Total expenditures involve adding 23–24 variables (depending on the survey year). We code the total expenditures as missing if five or more items are not reported.

items), and health expenditures. The three categories together account for about 70.0% of the total household expenditures. The right panel of Table 2 reports the summary statistics at the household level.

CHARLS uses a loop structure to ask information about each child, allowing us to construct child-level data regardless of whether he/she co-reside with the parents. Our child level data covers children's demographics (e.g., age, gender), socioeconomic status (e.g., education and income),[26] net transfer to parents, and monthly frequency of contacting and visiting parents.[27] Table 3 reports the summary statistics at the child level.

[Table 3 About Here]

4.2 Empirical Strategy

To evaluate the effects of "Later, Longer, Fewer" policies, we first need to develop a measure of policy exposure. We define the exposure according to the province and mothers' birth cohort, regardless of whether mothers are currently alive or not. Such approach alleviates the concern of endogenous timing of childbirth that would arise if we defined the exposure according to children's year of birth. More specifically, we define the exposure to the "Later, Longer, Fewer" policies as follows:

$$\text{FPP}_{p,c} = \sum_{a=15}^{49} \text{AFR}_p\left(a\right) I\left[c + a \geq T_p\right]. \tag{1}$$

$\text{FPP}_{p,c}$ defines the exposure to the family planning policies for cohorts born in year c in province p. In equation (1), $I\left[\cdot\right]$ is an indicator function that takes a value of 1 if the argument is true and 0 otherwise; a is age. $\text{AFR}_p\left(a\right)$ is the age-specific fertility rate of province p in 1969, *prior to* the enforcement of any effective family planning policy in any province. This measurement can be interpreted as the number of children a woman would have given birth to under the influence of the policy with the province's fertility profile in 1969. The data source for the age-specific fertility rate is Coale and Li (1987), who computed the provincial fertility rate from 1940 to 1982 using China's 1982 One-per-thousand Sample Fertility Survey. T_p is the year of the family planning policy enforcement, which can vary by province. For the "Later, Longer, Fewer" policies in the early 1970s, T_p is defined by the establishment year of the provincial Family Planning Leading Group. The provincial variation within each cohort then comes from: (1) different years of establishment of the Family Planning Leading Group (T_p); and (2) different initial fertility profiles (AFR_p). Figure 6 illustrates how exposure to the policy is computed, using the examples of Shandong and Beijing. The solid and dashed curves in Figure 6 are, respectively,

[26] Because it is difficult for parents to know children's income precisely, CHARLS asks the parents whether their children's annual income (in RMB) falls into one of the following ranges: none, under 2,000, 2,000–5,000, 5,000–10,000, 10,000–20,000, 20,000–50,000, 50,000–100,000, 100,000–150,000, 150,000–200,000, 200,000–300,000, above 300,000. We are aware that this measurement is quite coarse, but there are no better alternatives.

[27] Visiting is clearly a closer form of interaction with parents. Additionally, CHARLS only asks for the frequency of contacting if the child visit the parent less than once per week. Therefore, we choose the higher frequency of "visiting" and "contacting" in CHARLS to define the frequency "contacting" in our study.

the AFRs by age in Shandong province and Beijing in 1969. Shandong formed its Family Planning Leading Group in 1970, while Beijing did it in 1973. Women born in 1945 would start being exposed to LLF in Shandong and in Beijing, respectively, when they were aged at 26 and 29 (counting 9 months of pregnancy). Figure 6 shows that women born in 1945 are more exposed to the policies in Shandong than in Beijing because, first, Shandong formed its Family Planning Leading Group earlier than Beijing, and second, it had higher initial age-specific fertility rates. Note that such a definition naturally applies to the one-child policy by defining T_p as 1979 for all provinces.

[Figure 6 About Here]

The mean exposure to the LLF policies in our household level data is 3.47 with a standard deviation of 1.88. The policy exposure ranges from 0 to 6.73. A household would remain unaffected if the wife already passed the age of 49 prior to the enforcement of the family planning policies. On the contrary, a household would be fully exposed if the wife was younger than age 15 at the time of enforcement. The exposure equals the provincial total fertility rate in 1969 in this scenario. Guizhou had the highest TFR (6.73) at that time.

After defining the exposure to family planning policies, we run the following regressions:

$$y_{i,p,c,t} = \beta_0 + \beta_1 \text{FPP}_{p,c} + \boldsymbol{\beta}_2 \mathbf{X}_{i,p,c,t} + f\left(\text{Age}_{i,c,t}\right) + \text{Prov}_p + \text{Year}_t + \varepsilon_{i,p,c,t}. \tag{2}$$

Note that the age effects, $f\left(\text{Age}_{i,c,t}\right)$, and the year fixed effects, Year_t, effectively capture the cohort effects. $\mathbf{X}_{i,p,c,t}$ represent a list of control variables. To avoid bad-control issues (Angrist and Pischke 2008), we carefully choose our control variables to only include those that are pre-determined before households make their fertility decision. $y_{i,p,c,t}$, the dependent variable of interest, varies according the context.[28] Because our study exploited the establishment of the provincial Family Planning Leading Group, we cluster the standard errors at the province level. Moreover, since our number of clusters ($\approx$30) is relatively small, we compute the clustered standard errors using the wild bootstrap method with 999 replications, as proposed by Cameron, Gelbach, and Miller (2008). Sample weight is applied in all regressions.

Parameter β_1 is of primary interest in equation (2). With cohort effects and province fixed effects both controlled for, the identification of β_1 relies on the remaining variations in $\text{FPP}_{p,c}$, which results from the *interaction* between differential timing in the establishment of the Family Planning Groups and the initial fertility profiles prior to the groups' establishment.

Following Miller (2010), we rely exclusively on a reduced-form approach because family planning may affect socioeconomic outcomes through pathways other than completed lifetime fertility, despite our best effort to rule out other channels. For example, we arguably rule out the channel of parental human capital accumulation through, first, controlling for parents' completed education, and second,

[28]For ease of interpretation, we adopt a linear regression for all possible $y_{i,p,c,t}$. We also tried Probit models and computed the marginal effects if the dependent variables are binary. The results are both qualitatively and quantitatively similar, and they are available upon request from the authors.

restricting to cohorts who were most likely to have completed their education prior to the enforcement of the "Later, Longer, Fewer" policies. We will discuss other channels in Section 6.

5 Empirical Results

We present our main results in three steps. In the first step, we provide evidence that the "Later, Longer, Fewer" campaign had powerful effects in reducing fertility. In the second step, we investigate the effect of the policy on parents' aggregate support from children as well as the per-child support. We are also interested in whether the quantity-quality tradeoff of children alleviates or exaggerates the effect of family planning. Thirdly, we look into a set of outcomes that can proxy parents' well-being in old age, including consumption, subjective well-being, physical health, and mental health.

5.1 Effect on Completed Fertility

[Table 4 About Here]

Table 4 presents how households' exposure to family planning affects their number of children. Panel A reports the effect on the number of currently living children. Column (1) suggests that a one unit exposure to the "Later, Longer, Fewer" policies reduce the number of currently living children by 0.251. Because the national average exposure to the policies is 3.47 in our sample, the LLF policies reduce the number of living children by 0.87, which explains about one-third of the decline in fertility from 5.7 in 1969 to 2.7 in 1978. The magnitude of our estimated impact of LLF on fertility decline is almost identical to Babiarz et al. (2018), which used fertility survey data and implemented a parity progression estimation framework to estimate a 0.9-birth reduction per woman. Note that our identification rests on the provincial variation in policy implementation. Therefore, if there is any national-level progress in the "Later, Longer, Fewer" campaign, we will not be able to capture the effect. The national-level campaign may partially account for the remaining two-thirds of the unexplained fertility drop. Socioeconomic factors, including improvement in health (for both women and children) and education, also played important roles in this drastic fertility decline prior to the one-child policy (Poston and Gu 1987; Wang 1988; Lavely and Freedman 1990).[29]

Columns (2) and (3) estimate the additional effect of the one-child policy.[30] If we only include the exposure to the OCP in the regression, its coefficient would be strongly negative, which seemingly suggests the one-child policy also has a strong effect in reducing fertility. However, once we control for the exposure to LLF policies in Column (3), the additional effect of OCP becomes small and insignificant. This is not a surprising finding if we look back to Figure 1, which reveals that the majority of China's historical fertility decline took place prior to the enforcement of the one-child policy.

[29] In Appendix A, we discuss the robustness of our results against a range of contemporaneous events that took place around the period of the "Later, Longer, Fewer" campaign, including the Cultural Revolution, the Sent-Down Movement, rural education expansion, and economic development.

[30] The coefficient of the exposure to the one-child policy should be interpreted as the additional effect of OCP conditional on pre-existing "Later, Longer, Fewer" policies.

Columns (4) and (5) lend support to the accuracy of our measurement of policy exposure. A couple's ability to have children is more affected by the mother than by the father. In Column (4), we define a household's exposure according to the father's birth cohort instead of the mother's. The coefficient remains statistically significant but smaller than that in Column (1). This is not surprising because the couple's ages are generally close to each other. However, once the mother's exposure is controlled for, the father's exposure no longer shows any sign of significance. Columns (6) and (7) look into the policy's heterogeneous effects. LLF affects rural residents more than urban residents. This is probably because rural households had a much higher fertility rate before 1970 (6.2 in rural China versus 3.3 in urban China), they needed to reduce child births more after the government recommended a maximum quota of two children.

Panel B of Table 4 uses the number of children ever born as the dependent variable. The general implications derived from Panel B are consistent with those from Panel A, but the coefficients in Panel B are larger, suggesting that the policy effect is larger on the number of births. This is because the family planning policies directly target child births. The number of living children is further influenced by adoption and children's premature death. In principle, the number of birth children and that of living children should affect parents' well-being differently. While the former affects more the resources that can be allocated to parents when they are young, the latter is a more important determinant for the amount of care that parents can receive in old age (Chen and Lei 2009). However, separately identifying the effects of the two numbers is a demanding task. The challenge not only comes from the high correlation between the two numbers (0.92 in our sample) but also from the fact that the gap between the two numbers generates a third effect—the early death of a child is undoubtedly a catastrophic shock to parents and therefore has a huge impact on them, both physically and emotionally. In the remainder of this paper, we will loosely use the term "number of children" to represent that of living children, without distinguishing the number of living children from that of birth children. We leave the identification of the two separate effects for future research.

5.2 Effect on Support from Children

Living Arrangements

Co-residence is an important form of old-age support (Logan and Bian 1999; Zhang 2004; Zimmer and Korinek 2010; Oliveira 2016)—it enables children to provide care for elderly parents if necessary; however, only looking at co-residence (or living in the same dwelling) is not enough. Zimmer and Korinek (2008) show that a large fraction of Chinese elderly who do not live with their adult children have children living within the same neighborhood. Lei et al. (2015) show that the recent decline in the co-residence rate in China is fully compensated by the increasing share of adult children living nearby. Such living arrangement serves both the needs of privacy and that of family support; therefore, we explore three outcomes: whether parents have at least one child living in the same dwelling, have at least one child living in the same village/community, have at least one child living in the same county/district.

[Table 5 About Here]

In Table 5, we estimate the effect of LLF policies on the elderly parents' living arrangements. Panel A shows that there is no evidence that family planning affects households' decision of co-residency; however, Panels B and C suggest that family planning reduced the probabilities of having at least one child living nearby. LLF policies reduce the probabilities of having children in the same village/community by 10.7 percentage points (0.0307×3.47) and those of having children in the same county/district by 9.1 percentage points (0.0263×3.47). Our findings are consistent with those of Holmlund, Rainer, and Siedler (2013), who use multiple births as the instruments for family sizes and also find that having fewer children reduces the likelihood of having at least one child close-by in old age. Columns (2) and (3) suggest that both rural and urban parents suffer from not having children in the same county/district, and that rural parents experience a greater decline in the probability of having children in the same village.

Intergenerational Transfers

Whereas some recent studies question the importance of children's financial support as a form of old-age support for the current generation of urban families in China (Rosenzweig and Zhang 2014) in which the pension payments are more generous, other studies claim that children's financial support still plays an important role, especially in rural China (Lee and Xiao 1998; Sun 2002; Cai, Giles, and Meng 2006; Lei et al. 2012; Oliveira 2016). For example, Cai, Giles, and Meng (2006) find evidence that the transfers help to insure against parents' risk of falling below the poverty line.

[Table 6 About Here]

In Table 6, we estimate the effect of LLF policies on inter vivos transfers. Panel A presents the parents' perspective and explores aggregate net transfers from children. Column (1) of Panel A suggests that the magnitude of the effect is sizable despite its statistical insignificance. Such discrepancy might originate from the large volatility of inter vivos transfers. The LLF policies reduce elderly parents' net annual transfers from children by 326.4 RMB, about 15.2% of the sample average.

Elderly parents' aggregate transfers received can be decomposed into the number of children and net transfers per child. Panel B of Table 6 looks into how children's transfers to parents change in response to the policies from the children's perspective. The results suggest that per child transfers slightly increase and therefore partially offset the effect of fewer children. Two reasons can potentially explain the increase in per-child transfers. The first is children's quantity-quality tradeoffs.[31] Family planning can improve the quality of children by reducing the family size. Children of higher quality can earn more and therefore can better support their parents. The second possibility is children's behavioral adjustments. For example, children born under the LLF policies realize they have fewer siblings, and they need to take greater responsibilities in taking care of their parents. Panel C probes

[31]For evidence of quantity-quality tradeoffs in China, see Li, Zhang, and Zhu (2008); Rosenzweig and Zhang (2009); Li and Zhang (2017); Qin, Zhuang, and Yang (2017)

the two possibilities by additionally controlling for children's characteristics, including education and income. The difference between the two panels reflects the quantity-quality tradeoff, and the remaining effect in Panel C reflects the behavioral adjustment. The coefficient estimate in Column (1) of Panel C is about two-third of that in Panel B, suggesting that both channels are at play. If we compare the coefficient estimates between those of Columns (2) and (3) in Panels B and C, we find that the quantity-quality tradeoff seems to play a more important role for rural families. This finding is in line with the study of Li, Zhang, and Zhu (2008), who use a twin strategy and also find that the effect of family size on children's education is larger in rural China.

Visits and Contacts from Children

Whereas the existing literature has paid great attention to children's financial transfers to parents, few studies have focused on the role of children's company. In the model section, we highlight two potential risks in old age when parents have fewer children: lower transfers, $T(N)$, and less company from children, $S(N)$. Note that parents can self-insure the former risk by increasing savings (A_y), but there is no way to insure against the latter risk. Moreover, children's company can be a more important determinant of parents' mental health status, such as depression. Children play vital roles in parents' social network and in preventing loneliness in old age (Bures, Koropeckyj-Cox, and Loree 2009).

[Table 7 About Here]

In Table 7, we show how the exposure to the "Later, Longer, Fewer" policies affects children's frequency of contacting and visiting parents. We find that family planning policies reduce children's monthly contacts with parents by 2.96 times per month and monthly visits to parents by 2.90 times per month. Note that from parents' perspectives, the effect is further exaggerated by fewer children.

The decline in frequencies of contacting and visiting parents can be further decomposed into a quantity-quality effect and a behavioral adjustment effect. In Columns (4)–(6), we additionally control for children's characteristics. Similar to our findings about financial transfers, the quantity-quality tradeoff is more important for rural families. After controlling for children's characteristics, the coefficients of LLF fall almost by half from Column (2) to Column (5). In contrast, the coefficients in Column (3) are close to those in Column (6). This suggests that children with more advanced education and higher income are even less attached to their parents. Two reasons can potentially explain the negative correlation between children's achievements and their attention to their parents. First, better education raises children's accessibility to migration (Zhao 1997). As a result, better-educated children can live further away from their parents, thereby increasing the costs of visiting. This echoes our previous finding that the LLF policies reduce parents' chances of having children live nearby. Second, children of higher quality earn a higher wage rate in the labor market, so their opportunity costs of visiting their parents are higher.

What explains the remaining effects in Columns (4)–(6) of Table 7 after controlling for children's observable characteristics? On the one hand, our controls of children's quality are not complete, and the remaining effects may simply capture the residuals. "Quality" is a very complex measure that

covers a much broader scope than human capital and labor market performance. On the other hand, having fewer siblings can directly reshape people's personalities. One concrete example is the "Little Emperor" syndrome. Blake (1981) and Cameron et al. (2013) document that an only child tends to be more self-centered, less cooperative, and less conscientious; therefore, children born under the family planning policies may be more selfish and less altruistic toward their parents.

Summary

In this subsection, we estimate the effect of the LLF policies on children's provision of old-age support to their parents. We use three measures of support: co-residence, financial transfer, and visits (or contacts). LLF policies have negative impacts on all three measures. These findings confirm our assumption in the theoretical framework that financial transfers and psychological support are increasing functions of the number of children ($\frac{\partial T(N)}{\partial N} > 0$ and $\frac{\partial S(N)}{\partial N} > 0$).

Another important finding is that the quantity-quality tradeoffs of children play different roles in financial support and in psychological support. In terms of financial support, better-educated children earn more in the labor market and also transfer more income to their parents. This alleviates the financial consequences of family planning on the elderly. However, the opposite is true for the psychological support. Children of higher "quality" contact/visit their parents less often, either because of higher opportunity costs, more selfish personalities, or both.

5.3 Effect on Parental Well-being in Old Age

Our theoretical framework generates three testable implications when the number of children declines as a result of the family planning policies (see Table 1): (1) the elderly parents consume more; (2) the effect on physical health in old age is less positive than that in young age; (3) the effect on old-age mental health is less positive than that on old-age physical health. In this subsection, we discuss the causal impacts of family planning policies on a set of indirect welfare measures and tests the three implications.

Consumption

[Table 8 About Here]

In Table 8, we report the influence of LLF policies on household expenditures in old age. We restrict our sample to the elderly parents who are not co-residing with their children. In the case of co-residency, we will not be able to distinguish the expenditures of the parents from those of their children. Table 5 suggests that the LLF policies do not affect the decisions of co-residing, despite the finding that the policies lead children to live further away from parents conditional on non-coresidence.

Although Panel A of Table 8 seemingly suggests there is no overall policy effect on expenditures, some interesting patterns emerge when we further decompose total expenditures into more detailed categories. Strictly speaking, what our theoretical model predicts is about consumption, not expenditures. The life-cycle hypothesis also predicts "consumption smoothing," not "expenditure smoothing." There exists

a gap between expenditure and consumption—people do not derive utility from all types of expenditures (e.g., health expenditures). Panels B and C suggest that households who are more exposed to the LLF policies spend more on food and living expenses. Columns (2) and (3) suggest that rural parents enjoy greater increase in food and living expenses, which can be explained by a larger reduction in number of children (Table 4). Previous literature finds that the one-child policy induces more food consumption for parents when they are young (Wu and Li 2012). The persistently positive effect on old age simply echoes the wisdom of consumption smoothing and is consistent with the first testable implication of our model.

Our findings of the negative policy effect on health expenditures also call for attention. So far, our empirical evidence has not yet pinned down the specific reasons of this decline: is it because elderly parents become healthier or because they are less likely to seek treatment in case of illness (e.g., no children are taking them to hospitals)? Note that the two scenarios yield vastly different welfare implications. In the subsequent analysis (Table 9 below), we find some evidence that family planning positively affects parents' (especially mothers') physical health status; however, we still cannot rule out the possibility of the second, more unfortunate, scenario.

Physical Health

[Table 9 About Here]

In Table 9, we report the effect of LLF policies on a set of health outcomes. Column (1) finds no effect on self-rated life satisfaction. Columns (2) and (3) look at two other subjective health measures: self-rated health and self-perceived life expectancy. The estimation results suggest that exposure to family planning prolongs mother's perceived life expectancy.[32] Previous studies highlight the immediate or short-term effects of family planning on reducing maternal mortality (Chen et al. 1974; Boerma 1987; Menken, Duffy, and Kuhn 2003). Our results suggest that such an effect persists into old age. No similar effect is observed among fathers. Columns (4)–(8) of Table 9 use more objective health measures as the dependent variables: BMI, underweight, limitations in ADL, limitations in IADL, and hypertension. We find some weak evidence of health improvement for women—they are less likely to be underweight and to suffer from hypertension.

Despite less support from children, we find no evidence that parents' physical health suffered. Our theoretical framework offers a possible explanation. On the one hand, the positive gain in health when parents are young, as documented in Canning and Schultz (2012) and Wu and Li (2012), partially persists into old age; on the hand, the elderly parents can self-insure themselves and maintaining their living standard, as shown in Table 8.

Mental Health

[Table 10 About Here]

[32] Despite the statistical insignificance, the magnitude is large—exposure to LLF increased mother's self-perceived chances of living another 11–15 years by 13 percentage point (0.0376×3.47), which is about 28% of the sample mean.

The most surprising finding from Table 9 is that family planning greatly worsens parents' symptoms of depression measured with the CES-D scale (Column (9)) and they are more likely to exceed the threshold of self-diagnosed depression (Column (10)). The effect is especially strong for mothers (Panel B). In Table 10, we further break the CES-D scale into the scores of ten sub-items. Interestingly, if we list the top four contributors to the increased degree of depression for mothers and fathers separately, three out of four top contributors are common: "felt everything they are doing is an effort;" "felt lonely;" and "felt unhappy." Mothers are also more likely to directly report "felt depressed." Our previous analysis suggests that the elderly parents suffer from neither reduced consumption nor worse physical health; therefore, a lower amount of children's company becomes a candidate explanation.

Our theoretical framework shows that if mental health is more sensitive to children's support than physical health, family planning would have more negative effects on parents' mental well-being. Sociologists stress the importance of children within a social network of elderly parents (Bures, Koropeckyj-Cox, and Loree 2009) and identify social isolation as an important risk factor for depression (Cappeliez and Flynn 1993). One additional piece of evidence further support this conjecture: in Columns (9) and (10) of Table 9, we find that the effect on women is much larger than that on men. Psychological literature shows that women are more likely to feel negative emotions (Fischer et al. 2004; Else-Quest et al. 2012) and react more negatively to unpleasant experiences (Grossman and Wood 1993; Bradley et al. 2001; Chentsova-Dutton and Tsai 2007). Therefore, if we view China's coercive family planning as an unpleasant experience that restricts households' ability to have their desired number of children, women can react more negatively to the policies.

[Table 11 About Here]

In Table 11, we evaluate the effect of LLF policies on urban and rural parents separately. We find that urban fathers enjoy more improvement in BMI and are less likely to report depressive symptoms (Panel A), while rural fathers are slightly more depressed because of the policy change (Panel B). Both urban and rural mothers' physical health become better, but in different perspectives (Panels C and D)—urban mothers self-report better health, which is shown to be an independent predictor of future mortality (Idler and Benyamini 1997), and higher chances of living longer; rural mothers are less likely to be underweight and have fewer limitations in instrumental activities of daily living. Both urban and rural mothers report more depressive symptoms.

6 Mechanisms Other Than Fewer Births

So far, we interpret the effect of LLF policies as the effect of having fewer children. We first build a model that tries to understand the potential consequences, both positive and negative, of having fewer children in old age from a life-cycle perspective. Our empirical analysis is also in line with the hypothesis that family planning mainly exerts an effect through fewer births. However, the LLF policies are a policy bundle that may directly affect households through channels other than childbirths. For example, as the name of the policy indicated, "Later" (marriage) caused people to get married at an

older age, and "Longer" (birth interval) prolonged the spacing between the births. In this section, we propose several potential channels of LLF other than the number of children that may impact the parents' well-being in old age. For each channel, we first discuss why it may, or may not, affect parents' well-being and then provide empirical evidence—either from existing studies or our own analysis.

Rigorously separating the contributions of different mechanisms is challenging because of endogeneity issues; thus, our discussion here is more suggestive rather than conclusive. To the best of our knowledge, none of the existing empirical strategies that exploit exogenous variations in the number of births can *separately* identify the roles of marriage age, birth interval, and total births. For example, studies using twin births as the source of variation for the number of children mechanically imply no spacing of the two births. Even family planning policies without explicit requirements on marriage age and birth interval can affect those two variables. The reason is simple—once knowing their lifetime births are rationed, people will reschedule their entire life-course, including the age of marriage and fertility (Huang 2016).

Before proceeding, we would like to argue that "Fewer" (births) was the most important policy target among the "Later, Longer, Fewer" bundle. "Later" and "Longer" are two practical methods to achieve the goal of "Fewer." Two pieces of anecdotal evidence support this claim. First, population control was the main target of the family planning policies in the early 1970s. The instruction from the central government (Document [71]51, "Report on Better Implementing Family Planning Policy") set a target to slow down the natural population growth in the fourth Five-Year Plan (1971–1975)—by 1975, the population growth rate should not exceed 1% in urban areas and not exceed 1.5% in rural areas. There was no such goal for marriage age or birth spacing. Second, in 1979, when China initiated the more-stringent version of family planning—the one-child policy, the requirement of "Later" and "Longer" was abolished. One interesting fact is that the age of first marriage experienced a sharp reduction after 1980 when the "Later" part of the LLF campaign was no longer emphasized with the enforcement of the one-child policy (Whyte, Wang, and Cai 2015).

"Later" (Marriage) and "Longer" (Birth Interval)

Medical research has explored the relationship between the timing of first marriage/birth and late-life physical health. Hanson, Smith, and Zimmer (2015) find that an early age at first birth is associated with increased risks of comorbidity. In a recent review, Rosendaal and Pirkle (2017) conclude that early age at first birth is "possibly" related to cardiovascular disease. Dupre, Beck, and Meadows (2009) find that the association between teenage marriages and mortality was greatly reduced when socioeconomic factors are introduced. A longer birth interval is also believed to be beneficial to women, and the World Health Organization (WHO) recommends mothers wait at least 24 months before attempting to conceive again. Birth intervals shorter than 18 months (or twin births) are shown to be associated with poor self-rated health and higher mortality risks among elderly women (Read, Grundy, and Wolf 2011; Grundy and Kravdal 2014).

Whether marriage timing and birth interval have strong impacts on old-age well-being remains a question. Note that none of the above studies has a causal interpretation, and socioeconomic factors are driving a big part of the association (Dupre, Beck, and Meadows 2009). From a different perspective,

Barclay and Kolk (2018) examine the long-term effects of birth spacing on children's adulthood outcomes. They find that once the family background is controlled for, the previously observed association between too-short (or too-long) birth intervals with a variety of physical health measures (e.g., BMI, mortality) disappears. From a theoretical point of view, "Later" and "Longer" affect old-age well-being indirectly at best—through parental health when young, through the parent-child age gap, or through the age gap between children. In contrast, children play direct and vital roles throughout the entire life-cycle, which has been widely discussed in the literature. Therefore, we believe that the importance of the three components of the "Later, Longer, Fewer" policy is not equal, with the "Fewer" component playing the dominant role from a life-cycle perspective.

We statistically evaluate the influence of "Later" and "Longer" with the following approach. First, we estimate Equation (2) with the number of children as the dependent variable and generate the policy-predicted number of children $\widehat{N}_{i,p,c,t}\left(\mathrm{FPP}_{p,c}\right)$. Next, we run a second-stage-style regression as follows,

$$y_{i,p,c,t} = \gamma_0^{(1)} + \gamma_1^{(1)}\widehat{N}_{i,p,c,t} + \boldsymbol{\gamma}_2^{(1)}\mathbf{X}_{i,p,c,t} + f\left(\mathrm{Age}_{i,c,t}\right) + \mathrm{Prov}_p + \mathrm{Year}_t + \varepsilon_{i,p,c,t}. \tag{3}$$

Finally, we add proxies for other potential mechanisms W ("Later" and "Longer" here) into the above equation:

$$y_{i,p,c,t} = \gamma_0^{(2)} + \gamma_1^{(2)}\widehat{N}_{i,p,c,t} + \delta W_{i,p,c,t} + \boldsymbol{\gamma}_2^{(2)}\mathbf{X}_{i,p,c,t} + f\left(\mathrm{Age}_{i,c,t}\right) + \mathrm{Prov}_p + \mathrm{Year}_t + \varepsilon_{i,p,c,t}. \tag{4}$$

To be an important mechanism of family planning, the variable W needs to satisfy two conditions. First, W should be powerful in explaining the variation in the outcome variable. This condition can be tested with the statistical significance of δ and the increase in R^2 from equation (3) to equation (4). Second, exposure to family planning ($\mathrm{FPP}_{p,c}$) should be related to W. If family planning policies affect the outcome variables through important channels other than number of children, adding the new variable W should change the estimated coefficient $\widehat{\gamma}_1^1$. For space consideration, we focus on three outcomes that are most worrisome: children living further away, children visiting parents less frequently, and mothers' self-reported depression.

[Table 12 About Here]

Table 12 adopts this approach with Columns (2), (6), and (10), additionally controlling for mother's age at first birth and children's average age gap. Note that we have to restrict the sample to households with at least two children in order to define the birth interval. Despite a sharp decline in the number of children, a majority (91.46%) of the households in our sample still have at least two children, and we confirmed that this restriction does not change our results. Because of the endogeneity in fertility history, the coefficients of age at first birth and birth intervals should be interpreted with caution. Column (2) suggests the "Later" and "Longer" parts of the policy can be powerful in explaining children's residence decision—their coefficients are statistically significant, and the R^2 increases from 0.036 to 0.050. However, their power in explaining children's visits to parents and mothers' depression is much weaker, with R^2 barely being affected. Moreover, with those two variables controlled for, the effect

through the number of children ($\widehat{\gamma}_1$) actually becomes slightly larger.

Direct Impact of Birth Control Methods

The decline in childbirths as a consequence of family planning is usually accompanied by more frequent usage of birth control methods, e.g., abortion. Recent medical research generally concludes that abortions are not associated with depressive symptoms (Steinberg, McCulloch, and Adler 2014; Steinberg et al. 2018). Interestingly, women who were denied an abortion report more anxiety symptoms (Biggs et al. 2017)—suggesting that it is not abortion, but not having the ideal number of births, that plays a more critical role. Therefore, in China's context, it is important to distinguish two types of abortion: unwanted births or those forced by the policy.

In 2014, CHARLS carried out a life history survey, including pregnancy history. There are 1,871 women who report being pregnant at least once from 1965 to 1990. Figure 7 plots how each pregnancy is ended. The rate of induced abortion rose from 6% in 1970 to 11% in 1975, but it was still significantly lower than the rate of 20% after the 1979 implementation of the one-child policy. If a pregnancy was ended in induced abortion, CHARLS further asked the reason. Figure 7 suggests that prior to the year 1975, unwanted birth remains the dominant reason for induced abortion. After 1979, as the family planning policies became more stringent, policy-related abortions accounted for over two-thirds of total abortions.

Columns (3), (7), and (11) of Table 12 additionally control for the numbers of two types of abortion that the mother experienced. One interesting observation is that both types of abortion are positively associated with depression, with the magnitude of family-planning-induced abortions being much larger than that of unwanted births (Column (11)). Nevertheless, $\widehat{\gamma}_1$ remains quite stable after controlling for abortions. This can probably be explained by the fact that there was not a significant increase in abortions during the LLF period, as shown in Figures 2 and 7. Unsurprisingly, Columns (3) and (7) suggest that the abortion experience is not associated with having children living nearby and children's visiting frequency.

Aside from abortion, they are other birth control measures, such as condoms, an oral pill, sterilization, and an intrauterine device (IUD), which CHARLS does not cover. Those are more lenient methods and have arguably smaller direct effects on health. Among those methods, IUDs require further attention because their use rapidly expanded during the LLF period (Figure 2). Worly, Gur, and Schaffir (2018) reviewed 26 studies to look for an association between progestin-only contraception (IUD included) and depression and concluded that the evidence does not yet support an association. When discussing the effect of an IUD, they argue in an *ex ante* way that "because the hormone in this device acts locally rather than systemically, it might also be expected to have fewer systemic effects, including depression."

Children's Gender Composition

Sons and daughters may provide support to their parents differently (Xie and Zhu 2009; Lei 2013). If the family planning policies distorted the sex ratio at birth, which has been shown to be the case for the one-child policy (Ebenstein 2010; Li, Yi, and Zhang 2011), it may affect children's support to parents and parents' well-being through children's gender composition. However, one advantage of using the LLF campaign in the early 1970s as policy shocks is that it had limited impacts on the sex ratio because the gender selection technology (mainly Ultrasound B) did not become prevalent in China until the late 1980s (Li and Zheng 2009; Chen, Li, and Meng 2013).[33]

Columns (4), (8), and (12) of Table 12 report the results with the additional controls of children's gender composition. Given the patriarchal society in China, we add a dummy variable indicating whether the parents have at least one living son. Columns (4) and (8) show that gender composition is an important factor for children's support to parents, suggesting children of different gender do play different roles in supporting their parents. The R^2 increases from 0.036 to 0.044 when we use having children in the same county as the dependent variable, and increases from 0.021 to 0.033 when we use children's visiting frequency as the dependent variable. Despite the association between children's gender composition and support to parents, the main coefficient of interest ($\widehat{\gamma}_1$) remains almost unchanged. This can be explained by the limited impacts of LLF policies on the sex ratio. Children's gender composition is not associated with mothers' depression, however.

To summarize, although it is hard to completely rule out three above-mentioned channels because of the endogeneity issue, their relative importance is unlikely to match that of having fewer children. Moreover, none of those channels on their own can predict the entire empirical patterns presented in Section 5. For example, although it may be intuitive to think that abortions have long-term effects on women's physical and mental health (Column (11)), understanding why mothers' abortion history affects children's residence is more challenging (Column (3)). Later marriage, longer birth spacing, and children's gender composition may be important factors for children's support to parents, but their association with parents' depression is less clear. To conclude, we believe having fewer births is the dominant channel through which LLF policies affect parents' well-being in old age.

7 Conclusions

What are the long-term consequences of family planning policies? Understanding this question is crucial in designing population policies as an increasing number of countries start to adopt some kind of family planning policy. China is among the earliest countries to initiate family planning, and its policies were considered the most stringent in the world. China's experience provides valuable lessons for other countries that are contemplating their own family planning policies. By exploiting the provincial

[33]Note that this conclusion does not contradict with the findings of Babiarz et al. (2018), who concluded the "Later, Longer, Fewer" policies coincided with increased sex selection in China. It is because the vast majority of "sex selection" in their study is using male-child biased stopping rules, which should not affect the sex ratio at birth.

heterogeneity in the implementation of the "Later, Longer, Fewer" policies in the 1970s in China, we evaluate how exposure to the family planning policies changes people's life in old age. Previous studies generally find positive effects of family planning policies on parents' consumption and health status when young, either because the policies reduce a mother's risk during childbirth or because they free up family resources as a result of having fewer children to rear. However, the negative side gradually emerges as parents turn older—there are fewer children that can take care of and provide company to the elderly parents. This will negatively affect the elderly's physical and mental well-being.

Our empirical analysis brings good and bad news. The good news is that the physical well-being of the elderly becomes slightly better as a consequence of family planning. We find that elderly parents spend more on food and living expenditures. Mothers expect themselves to live longer and are less likely to suffer from underweight and hypertension. Household medical expenditures also become smaller. Why does a smaller number of children not necessarily threaten elderly parents' material well-being? Because there are two channels that can neutralize the effect of having fewer children. The first channel is the quantity-quality tradeoff. The financial support from each child actually increases because children become better educated and earn a higher income. The second channel is parents' self-insurance through higher savings. Anticipating that they will receive fewer transfers from children, parents can save more when young to prevent the downfall of consumption in old age.

The bad news is that the mental well-being of the elderly parents becomes more worrisome. Under the influence of the family planning policies, together with the rapid economic growth, children live further away from and interact less frequently with their parents. Despite the better material conditions, elderly parents feel more depressed. What makes things worse is that children with higher "quality" provide even less psychological support to their parents, probably because of their higher opportunity costs. To conclude, our study calls for greater attention on elderly people's social network and mental health status.

Our research has its own limitations. The empirical analysis mainly provides reduced-form estimations without a comprehensive analysis of the mechanisms. Our study involves many variables, whose mechanisms can vary tremendously from each other. Future studies need to solve two challenges to better understand how family planning affects people's well-being in old age. First, many outcomes in old age are cumulative ones (e.g., health). Strictly speaking, any event that takes place when a person is still young can have persistent effects into his or her old age. Second, it is not sufficient to study only the elderly people themselves if we wish to understand fully their well-being status. We also need to unveil the complex parent-child interactions. Ideally, we not only need to know parents' responses to the policy changes, but we also need to know how children respond to their parents' responses, parents' higher-order responses to their children's responses, etc.

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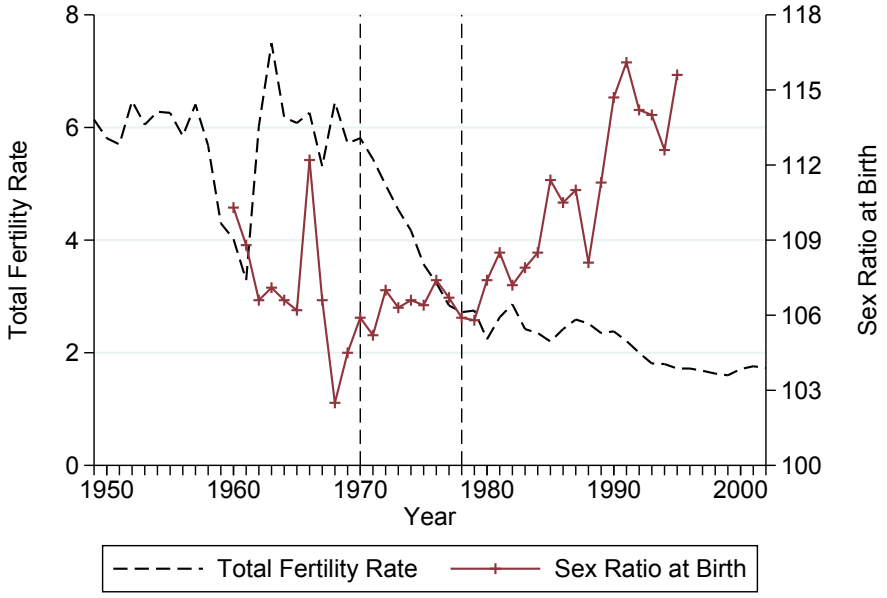
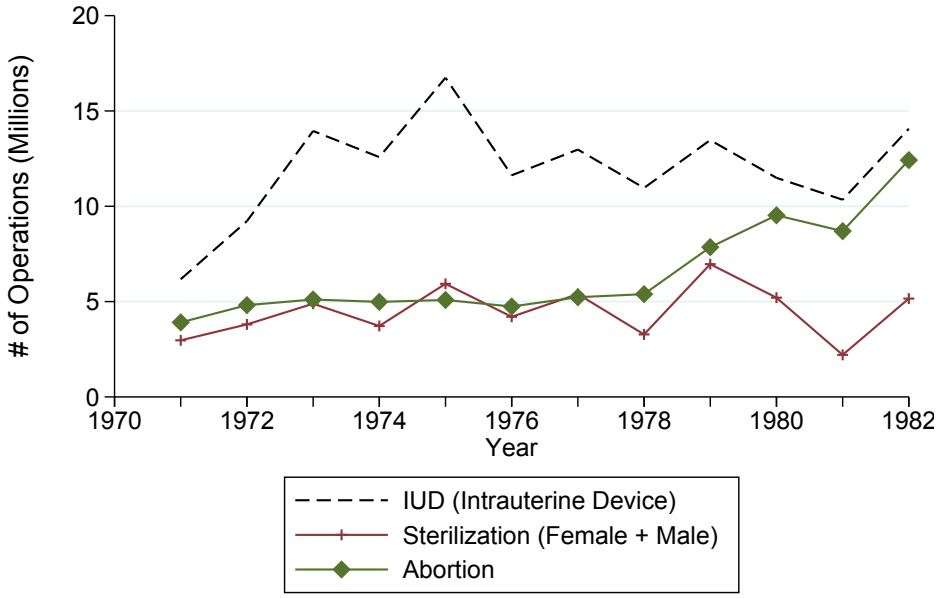
Figures

Figure 1: National Total Fertility Rate and Sex Ratio at Birth, 1949–2002



Data source:
Total fertility rate 1949–2002: Lu and Zhai (2009) "Sixty Years of New China Population."
Sex ratio at birth 1960–1988: Liang and Chen (1993).
Sex ratio at birth 1989–2000: China Population Statistics Yearbook.

Figure 2: Different Methods of Birth Control



Note: Data from the National Family Planning Commission of China (1983)

Figure 3: Years of Establishment of Provincial Family Planning Leading Group

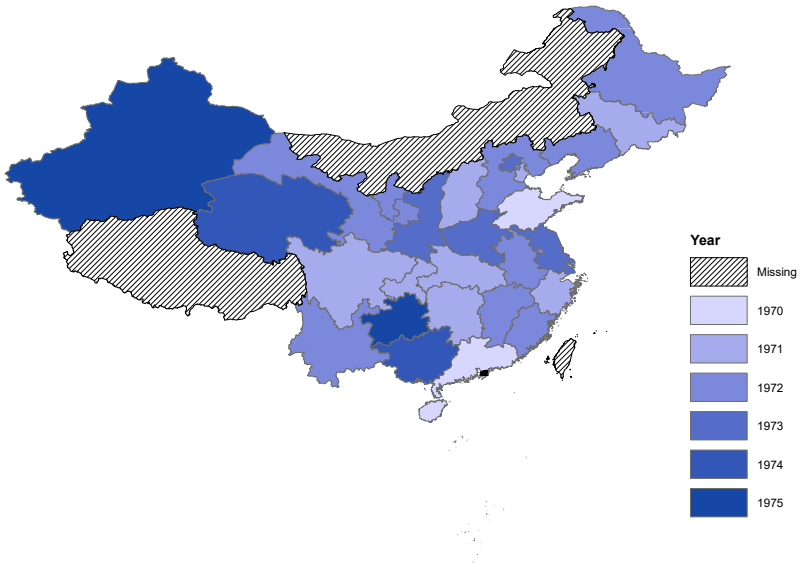


Figure 4: Trends of Total Fertility Rate, Early Establishment Provinces versus Late Establishment Provinces

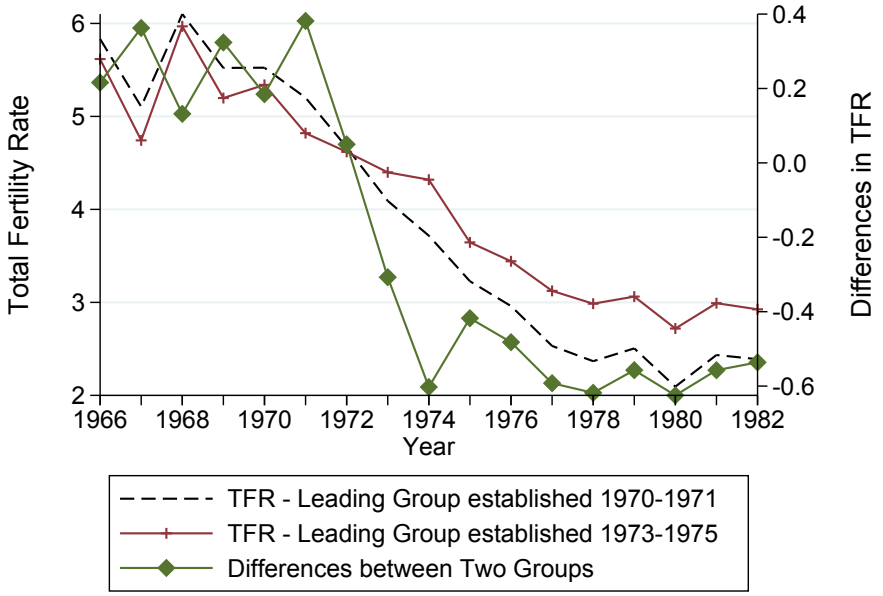
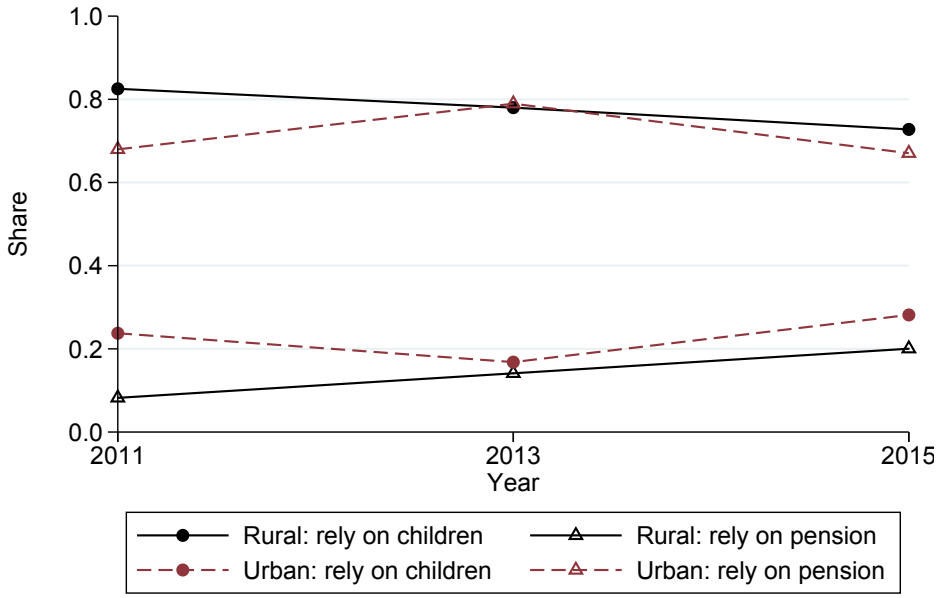


Figure 5: Answers to "Who do you think you can rely on financially for old-age support?"



Source: authors' calculations based on CHARLS.

Figure 6: Example of Constructing the Exposure to Policy (for cohort born in 1945)

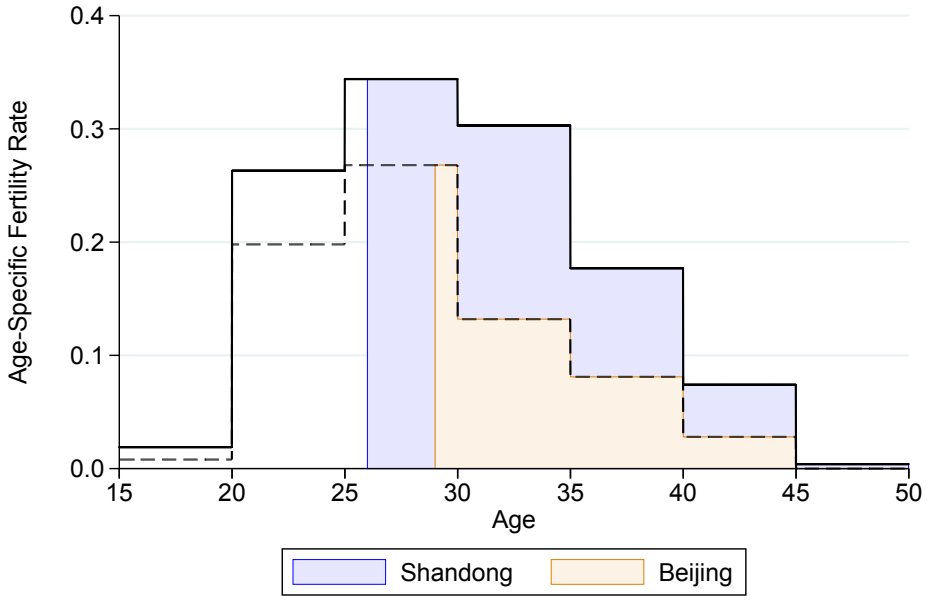
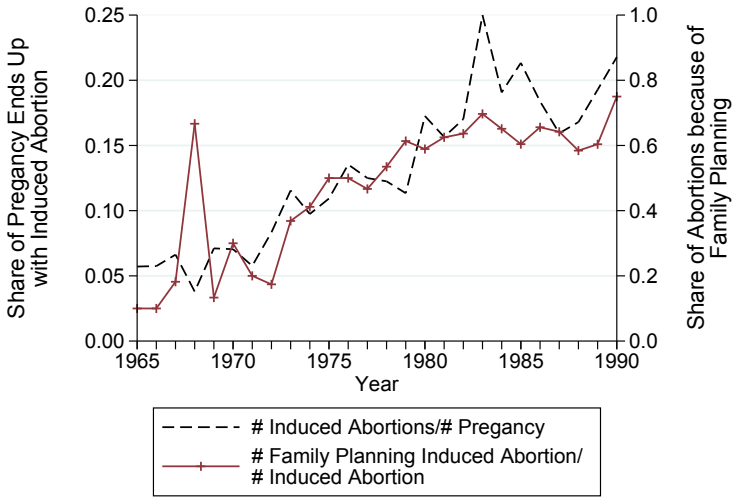


Figure 7: Women's History of Abortion



Note: Authors' calculation based on the China Health and Retirement Longitudinal Study 2014.

Tables

Table 1: Predictions of the Theoretical Framework

	Period	Variable	Effect of Lower N
(1)	Young	Consumption (C_y)	Positive
(2)		Physical Health ($h_{1,y}$)	Positive
(3)		Mental Health ($h_{2,y}$)	Positive
(4)		Savings (A_y)	Positive
(5)	Old	Consumption (C_o)	Positive
(6)		Physical Health ($h_{1,o}$)	More negative than (2)
(7)		Mental Health ($h_{2,o}$)	More negative than (6)

Table 2: Summary Statistics of Parents

Level	Individual			Level	Household		
Variables	Mean	S.D.	Obs.	Variables	Mean	S.D.	Obs.
Age	70.209	7.081	17077	Widow	0.305	0.46	11551
Male	0.462	0.499	17118	Couple's Age Gap	3.053	4.234	11551
Education				Hukou	1.276	0.447	11551
Illiterate	0.358	0.480	17119	Number of Children Ever Born	3.57	1.669	11551
Some Elementary School	0.181	0.385	17119	Number of Living Children	3.545	1.735	11551
Elementary School	0.234	0.423	17119	Annual Net Transfer from Children (RMB)	1976.9	3576.0	11341
Middle School	0.108	0.310	17119	***Living Arrangement***			
High School and Above	0.063	0.242	17119	Children in Home	0.457	0.498	11551
Self-rated Satisfaction				Children in Village/Community	0.736	0.441	11551
Completely satisfied	0.038	0.192	14828	Children in County/District	0.899	0.302	11551
Very satisfied	0.277	0.448	14828	***Annual Household Expenditure***			
Somewhat satisfied	0.575	0.494	14828	Total Expenditure (RMB)	22877.7	24419.4	8119
Not very satisfied	0.087	0.282	14828	Food Expenditure (RMB)	9216.5	10819.4	8119
Not at all satisfied	0.022	0.148	14828	Living Expenditure (RMB)	4031.0	9774.6	8119
Self-rated Health				Health Expenditure (RMB)	2736.8	8739.9	8119
Excellent	0.033	0.179	16692				
Very good	0.101	0.301	16692				
Good	0.300	0.458	16692				
Fair	0.370	0.483	16692				
Poor	0.197	0.398	16692				
Measures of Health							
Changes of Living 10–15 More Years	0.485	0.256	13023				
BMI	23.075	3.471	13122				
Underweight	0.085	0.278	13122				
ADL	0.234	0.850	17119				
IADL	0.530	1.192	17119				
Hypertension	0.324	0.468	13567				
CES-D scale	8.544	6.279	15034				
Depressed	0.368	0.482	15034				

Table 3: Summary Statistics of Children

Level	Children		
Variables	Mean	S.D.	Obs.
Age	42.361	9.383	36334
Male	0.526	0.499	37694
Annual Net Transfer to Parents (RMB)	603.7	1233.1	31068
Annual Income of Child and Child-in-law	33321.83	37090.845	24016
Education			
Illiterate	0.08	0.271	37245
Did Not Finish the Elementary School	0.137	0.343	37245
Elementary School	0.26	0.439	37245
Middle School	0.315	0.465	37245
High School and Above	0.209	0.406	37245
Frequency of Visiting Parents			
30 times a month	0.221	0.415	30640
10–15 times a month	0.072	0.258	30640
4 times a month	0.082	0.275	30640
Twice a month	0.083	0.276	30640
Once a month	0.117	0.321	30640
Less than once amonth	0.386	0.487	30640
Almost never	0.039	0.194	30640
Frequency of Contacting Parents			
30 times a month	0.244	0.43	31572
10–15 times a month	0.13	0.336	31572
4 times a month	0.174	0.379	31572
Twice a month	0.129	0.335	31572
Once a month	0.15	0.357	31572
Less than once amonth	0.146	0.353	31572
Almost never	0.026	0.16	31572

Table 4: Effect of Family Planning on Fertility, Household-level Analysis

Sample	All					Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Number of Living Children							
M's Exposure to LLF	-0.251***		-0.237**		-0.349***	-0.287***	-0.167**
	(0.0479)		(0.0887)		(0.0709)	(0.0592)	(0.0680)
M's Exposure to OCP		-0.191***	-0.0189				
		(0.0656)	(0.108)				
F's Exposure to LLF				-0.163**	0.108		
				(0.0650)	(0.0930)		
Observations	5,174	5,174	5,174	4,922	4,922	3,781	1,393
Sample Mean	3.308	3.308	3.308	3.282	3.282	3.504	2.777
Panel B: Number of Children Ever Born							
M's Exposure to LLF	-0.337***		-0.340***		-0.441***	-0.375***	-0.219***
	(0.0498)		(0.0787)		(0.0641)	(0.0653)	(0.0603)
M's Exposure to OCP		-0.242***	0.00403				
		(0.0662)	(0.0964)				
F's Exposure to LLF				-0.204***	0.138		
				(0.0702)	(0.0859)		
Observations	5,174	5,174	5,174	4,922	4,922	3,781	1,393
Sample Mean	3.449	3.449	3.449	3.415	3.415	3.689	2.798
Other Controls	Y	Y	Y	Y	Y	Y	Y
Age FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the provincial level using the wild cluster bootstrap method (Cameron, Gelbach, and Miller 2008). Other control variables include widow, couple's age gap, *hukou*, and education.

Table 5: Effect of Family Planning on Living Arrangements (conditional on having at least one living child), Household-level Analysis

Sample	All	Rural	Urban
	(1)	(2)	(3)
Panel A: Children in Home			
M's Exposure to LLF	-0.00749	3.40e-05	-0.0296
	(0.0182)	(0.0173)	(0.0261)
Observations	11,069	8,160	2,909
Sample Mean	0.458	0.477	0.404
Panel B: Children in Village/Community			
M's Exposure to LLF	-0.0307**	-0.0355***	-0.0267
	(0.0128)	(0.0103)	(0.0274)
Observations	11,069	8,160	2,909
Sample Mean	0.737	0.771	0.643
Panel C: Children in County/District			
M's Exposure to LLF	-0.0263***	-0.0271**	-0.0276**
	(0.00871)	(0.0108)	(0.0130)
Observations	11,069	8,160	2,909
Sample Mean	0.902	0.904	0.897
Other Controls	Y	Y	Y
Age FE	Y	Y	Y
Year FE	Y	Y	Y
Province FE	Y	Y	Y

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the provincial level using the wild cluster bootstrap method (Cameron, Gelbach, and Miller 2008). Other control variables include widow, couple's age gap, *hukou*, and education.

Table 6: Effect of Family Planning on Inter Vivos Transfers (conditional on having at least one child outside the household), Household-level (Panel A) and Child-level (Panel B & C) Analysis

Sample	All	Rural	Urban
	(1)	(2)	(3)
Panel A: (Parents' Perspective) Net Transfer from Children			
M's Exposure to LLF	-94.07	27.72	-383.6
	(137.2)	(166.8)	(230.4)
Observations	10,288	7,651	2,637
Sample Mean	2151	2239	1893
Panel B: (Children' Perspective) Net Transfer to Parents			
M's Exposure to LLF	32.08	25.49	87.33
	(22.61)	(23.33)	(53.50)
Observations	29,941	23,420	6,521
Sample Mean	600	589.4	638.1
Panel C: (Children' Perspective) Net Transfer to Parents Conditional on Children's Characteristics			
M's Exposure to LLF	22.25	4.037	95.94
	(20.19)	(17.05)	(60.03)
Observations	28,529	22,210	6,319
Sample Mean	608.1	599.1	639.8
Other Controls	Y	Y	Y
Age FE	Y	Y	Y
Year FE	Y	Y	Y
Province FE	Y	Y	Y

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the provincial level using the wild cluster bootstrap method (Cameron, Gelbach, and Miller 2008). Other control variables include widow, parents' age gap, *hukou*, and education. Children's characteristics include age, gender, education, and income.

Table 7: Effect of Family Planning on Children's Attachment to Parents (conditional on not co-residing with parents), Child-level Analysis

Sample	All	Rural	Urban	All	Rural	Urban
	Children's Characteristics Not Controlled			Children's Characteristics Controlled		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Monthly Contacts with Parents						
M's Exposure to LLF	-0.853***	-0.858***	-0.617	-0.548*	-0.467*	-0.633
	(0.304)	(0.288)	(0.604)	(0.310)	(0.264)	(0.710)
Observations	30,403	23,542	6,861	29,051	22,385	6,666
Sample Mean	9.753	9.316	11.25	9.825	9.382	11.31
Panel B: Monthly Visits to Parents						
M's Exposure to LLF	-0.835***	-0.843***	-0.932	-0.528*	-0.433	-0.855
	(0.278)	(0.279)	(0.588)	(0.308)	(0.278)	(0.702)
Observations	29,496	22,833	6,663	28,194	21,721	6,473
Sample Mean	8.032	7.796	8.840	8.073	7.834	8.875
Children's Characteristics				Y	Y	Y
Other Controls	Y	Y	Y	Y	Y	Y
Age FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the provincial level using the wild cluster bootstrap method (Cameron, Gelbach, and Miller 2008). Other control variables include widow, parents' age gap, *hukou*, and education. Children's characteristics include age, gender, education, and income.

Table 8: Effect of Family Planning on Household Expenditures (conditional on not co-residing with children), Household-level Analysis

Sample	All	Rural	Urban
	(1)	(2)	(3)
Panel A: log(Annual Total Expenditure)			
M's Exposure to LLF	0.0412	0.0474	0.00590
	(0.0345)	(0.0444)	(0.0566)
Observations	4,542	3,176	1,366
Sample Mean	18828	15370	26866
Panel B: log(Food Expenditure)			
M's Exposure to LLF	0.118**	0.139*	0.0732
	(0.0520)	(0.0680)	(0.0646)
Observations	4,542	3,176	1,366
Sample Mean	7979	6126	12286
Panel C: log(Living Expenditure)			
M's Exposure to LLF	0.0908*	0.0865	0.0803
	(0.0477)	(0.0573)	(0.0743)
Observations	4,542	3,176	1,366
Sample Mean	3139	2701	4157
Panel D: log(Health Expenditure)			
M's Exposure to LLF	-0.103	-0.123	0.0239
	(0.0720)	(0.0772)	(0.159)
Observations	4,542	3,176	1,366
Sample Mean	2795	2421	3663
Other Controls	Y	Y	Y
Age FE	Y	Y	Y
Year FE	Y	Y	Y
Province FE	Y	Y	Y

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the provincial level using the wild cluster bootstrap method (Cameron, Gelbach, and Miller 2008). Other control variables include widow, couple's age gap, *hukou*, and education.

Table 9: Effect of Family Planning on Parents' Health Status, Individual-level Analysis

Dependent Variables	Self-Rated Satisfaction	Self-Rated Health	Chances of Living 11–15 More Years	BMI	Underweight	ADL	IADL	Hypetension	CES-D Scale	Depressed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					Panel A: Father					
M's Exposure to LLF	0.0168	0.0307	0.00720	-0.0576	-0.00907	-0.0229	-0.0101	-0.00734	0.186	0.0101
	(0.0314)	(0.0311)	(0.0126)	(0.250)	(0.0147)	(0.0311)	(0.0401)	(0.0223)	(0.265)	(0.0186)
Observations	6,921	7,554	6,246	6,054	6,054	7,682	7,682	6,239	7,041	7041
Sample Mean	2.777	3.526	0.502	22.62	0.0882	0.178	0.387	0.289	7.504	0.297
					Panel B: Mother					
M's Exposure to LLF	-0.00235	-0.00376	0.0376	0.0266	-0.0339*	0.00642	-0.108	-0.0477*	0.456	0.0696**
	(0.0368)	(0.0492)	(0.0237)	(0.274)	(0.0171)	(0.0556)	(0.0639)	(0.0267)	(0.395)	(0.0316)
Observations	7,426	8,297	6,374	6,576	6,576	8,546	8,546	6,823	7,530	7530
Sample Mean	2.789	3.663	0.464	23.49	0.0768	0.209	0.527	0.346	9.654	0.442
Other Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Age FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the provincial level using the wild cluster bootstrap method (Cameron, Gelbach, and Miller 2008). Other control variables include widow, couple's age gap, *hukou*, and education. Please refer to Section 4 for detailed definitions of the listed dependent variables.

Table 10: Effect of Family Planning on Parents' Depression Symptoms, Individual-level Analysis

Dependent Variables	Bothered by Trifles	Difficulty in Concentration	Felt Depressed	Difficulty in doing Everything	Felt Fearful	Insomnia	Felt Lonely	Could not Continue Life	Felt Unhappy	Felt Hopeless
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Father										
M's Exposure to LLF	0.00140	-0.00288	-0.00405	0.0796*	0.0164	-0.00657	0.0444	0.0388	0.0667	-0.0247
	(0.0444)	(0.0470)	(0.0328)	(0.0409)	(0.0228)	(0.0485)	(0.0319)	(0.0248)	(0.0691)	(0.0389)
Observations	7,151	7,079	7,142	7,140	7,197	7,194	7,153	7,142	7,166	6,994
Sample Mean	0.746	0.753	0.752	0.892	0.214	0.860	0.419	0.290	1.162	1.504
Panel B: Mother										
M's Exposure to LLF	0.0576	0.00977	0.0978**	0.139**	-0.0134	-0.150*	0.0727	0.0444	0.0622	0.0756
	(0.0648)	(0.0621)	(0.0473)	(0.0535)	(0.0580)	(0.0858)	(0.0611)	(0.0451)	(0.0673)	(0.0478)
Observations	7,720	7,592	7,688	7,709	7,819	7,844	7,757	7,717	7,789	7,479
Sample Mean	1.019	0.976	1.018	1.104	0.416	1.310	0.666	0.448	1.269	1.554
Other Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Age FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the provincial level using the wild cluster bootstrap method (Cameron, Gelbach, and Miller 2008). Other control variables include widow, couple's age gap, *hukou*, and education.
The ten symptoms are: was bothered by things that don't usually bother me; had trouble keeping my mind on what I was doing; felt depressed; felt everything I did was an effort; felt fearful; sleep was restless; felt lonely; could not get "going"; was unhappy; felt hopeless about the future.

Table 11: Effect of Family Planning on Parents' Health Status, Individual-level Analysis (Cont.)

Dependent Variables	Self-Rated Satisfaction	Self-Rated Health	Chances of Living 11–15 More Years	BMI	Underweight	ADL	IADL	Hypetension	CES-D Scale	Depressed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Father, Rural										
M's Exposure to LLF	0.0476	0.0690	0.00806	-0.422	0.00328	-0.00977	0.0402	-0.0212	0.528	0.0424*
	(0.0405)	(0.0439)	(0.0139)	(0.370)	(0.0190)	(0.0264)	(0.0339)	(0.0219)	(0.345)	(0.0228)
Observations	5,074	5,584	4,521	4,625	4,625	5,680	5,680	4,764	5,176	5176
Sample Mean	2.784	3.568	0.479	22.22	0.103	0.182	0.408	0.283	8.095	0.331
Panel B: Father, Urban										
M's Exposure to LLF	-0.0705	-0.106	0.00394	0.945***	-0.0367**	-0.0181	-0.137	0.0301	-0.752	-0.0745**
	(0.0448)	(0.0883)	(0.0247)	(0.209)	(0.0148)	(0.0766)	(0.114)	(0.0348)	(0.490)	(0.0354)
Observations	1,847	1,970	1,725	1,429	1,429	2,002	2,002	1,475	1,865	1865
Sample Mean	2.760	3.406	0.563	23.93	0.0406	0.167	0.328	0.308	5.862	0.204
Panel C: Mother, Rural										
M's Exposure to LLF	0.0144	0.0681	0.0257	-0.146	-0.0343*	-0.0185	-0.193**	-0.0502	0.193	0.0624
	(0.0535)	(0.0630)	(0.0254)	(0.363)	(0.0193)	(0.0623)	(0.0924)	(0.0348)	(0.509)	(0.0373)
Observations	5,809	6,541	4,930	5,312	5,312	6,733	6,733	5,533	5,877	5877
Sample Mean	2.800	3.703	0.443	23.29	0.0825	0.217	0.564	0.348	10.19	0.476
Panel D: Mother, Urban										
M's Exposure to LLF	-0.0541	-0.146**	0.0732**	0.201	-0.0180	0.0510	0.0565	-0.0490	1.044**	0.0792
	(0.0694)	(0.0566)	(0.0295)	(0.559)	(0.0373)	(0.103)	(0.119)	(0.0506)	(0.458)	(0.0475)
Observations	1,617	1,756	1,444	1,264	1,264	1,813	1,813	1,290	1,653	1653
Sample Mean	2.751	3.515	0.538	24.33	0.0530	0.180	0.387	0.338	7.756	0.318
Other Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Age FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the provincial level using the wild cluster bootstrap method (Cameron, Gelbach, and Miller 2008). Other control variables include age, gender, widow, *hukou*, and education. See Section 4 for detailed definitions of the listed dependent variables.

Table 12: Examine Possible Channels of Family Planning other than Number of Children

Dependent Variables	Children in County/District, Household Level (mean = 0.901)				Visits to Parents, Child Level (mean = 0.444)				(Mother) Depressed, Individual Level (mean = 0.444)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Predicted Number of Children	0.0793***	0.0897***	0.0804***	0.0829***	2.569***	2.737***	2.566***	2.359**	-0.131**	-0.112*	-0.126**	-0.135**
	(0.0265)	(0.0309)	(0.0259)	(0.0273)	(0.854)	(0.867)	(0.858)	(0.888)	(0.0594)	(0.0597)	(0.0586)	(0.0587)
M's Age at First Child-birth		-0.00324***				-0.0879*				0.000760		
		(0.000777)				(0.0481)				(0.00246)		
Children's Mean Age Gap		-0.00847***				-0.139**				0.00704		
		(0.00212)				(0.0625)				(0.00436)		
M's Abortions due to			-0.0551				0.444				0.125*	
*Family Planning			(0.0463)				(0.461)				(0.0672)	
M's Abortions due to			-0.0116*				0.0764				0.0213*	
*Unwanted Birth			(0.00598)				(0.145)				(0.0111)	
Have Son				0.0604***				-2.521***				-0.0379
				(0.0116)				(0.763)				(0.0315)
Share of Children being Son				-0.0528**				5.935***				-0.00273
				(0.0193)				(0.676)				(0.0267)
Observations	11,139	10,133	11,139	11,069	29,496	28,537	29,496	29,496	7,530	7,000	7,530	7,479
R-squared	0.036	0.050	0.040	0.044	0.021	0.021	0.021	0.033	0.072	0.074	0.076	0.073
Other Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Age FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the provincial level using the wild cluster bootstrap method (Cameron, Gelbach, and Miller 2008). Other control variables include age, gender, widow, *hukou*, and education.

Appendix A: Robustness against other Contemporaneous Events

This appendix discusses the robustness of our estimated effects of family planning policies against other contemporary events, including: the Cultural Revolution, the Sent-Down Movement, rural education expansion, and economic development.

Cultural Revolution

The key variation we use in our empirical analysis is the establishment years of provincial Family Planning Leading Group, who was responsible for enforcing the "Later, Longer, Fewer" policies. As introduced in the background section, China's family planning can trace back to the early 1960s but its course was interrupted by the outbreak of the Cultural Revolution in 1966. The Cultural Revolution from 1966 to 1976 was a catastrophic political event for large sections of the population, with the number of victims (fatalities plus those imprisoned or persecuted) estimated to be close to 30 million (Walder and Su 2003). The establishment of the Family Planning Leading Group is a symbol of recovery from this turmoil. On the one hand, the Cultural Revolution can be related to the establishment of the leading group because it negatively impacted the government functioning including family planning. On the other hand, the violence and uncertainty brought by the Cultural Revolution could suppress the desire to have children.

To evaluate the impact of the Cultural Revolution, we proceed as follows. First, we construct the exposure to the Cultural Revolution (1966–1976) in a similar way as we construct the exposure to the "Later, Longer, Fewer" policies. More specifically, we define

$$\text{EXPO CulturalRevolution}_{pc} = \sum_{a=15}^{49} \text{AFR}_p(a)\, I\left[1966 \leq c + a \leq 1976\right].$$

This number can be interpreted as the number of children a woman would have given birth to during 1966–1976 with the fertility profile in 1969. In the second step, we take into account the fact that provinces can be shocked differently. We proxy the provincial intensity of the Cultural Revolution with the provincial aggregate fatalities during the revolution, which are taken from Walder (2017), as a share of the 1965 population. Table A1 Columns (2) and (7) do indicate that families who were more intensively exposed to the Cultural Revolution would end up having fewer children. However, the coefficients of family planning are barely affected, suggesting the event is unlikely to bias our estimated effects of the LLF policies.

Sent-down Movement

The sent-down movement was partially a direct consequence of the Cultural Revolution. It attempted to end the urban unrest with the outbreak of the Cultural Revolution and was, in part, to discharge the Red Guards (Bernstein 1977).[34] From 1967 until 1978, an estimated 17.7 million urban youths were sent down to rural areas (Gu 2009). Those young people were at the peak of their fertility but were sent to an unfamiliar place away from their hometown. It is possible that the sent-down movement directly affected people's fertility behavior (Zhou and Hou 1999).

[34]The Red Guards were formed by teenagers, most of whom were junior or senior high school students. They were used as a political weapon to fight those opposed to Mao's policies during the first few years of the Cultural Revolution. However, the revolution spiraled out of control and turned into "red terror." To resolve the violence, Chairman Mao issued instructions to send millions of urban youth down to the countryside for "re-education."

Using the same procedure, we define the exposure to the movement as

$$\text{EXPO SentDown}_{pc} = \sum_{a=15}^{49} \text{AFR}_p(a)\, I\left[1968 \leq c+a \leq 1978\right],$$

and proxy the provincial intensity of the Sent-Down Movement by the total number of people who were sent down to the countryside during the movement, which is taken from Gu (2009), as a share of the provincial population who were born between 1945 and 1960 (calculated based on census 1982). Table A1 Columns (3), (4), (8) and (9) suggest that our estimated effects of LLF policies are robust to the inclusion of the sent-down movement.

Rural Education Expansion

From the late 1960s to the middle 1970s, the Chinese government implemented a rural school expansion (mainly at the junior-high level[35]) program (Han 2001; Andreas 2004), whose goal was to achieve universal education through junior high school and to increase rates of progression to senior high school for rural children (Pepper 1990). In a case study of Jimo county, Han (2001) reported that the number of middle schools grew from 8 in 1965 to 269 in 1976, a 32-fold increase.

Whereas there is no doubt that such an expansion would improve teenagers' education, which is an important socioeconomic factor for fertility level, the program is unlikely to affect our main results because our empirical approach purposefully excluded the channel of education. First, our study focuses on the cohorts who are old enough (60 or above in 2011)—they mostly had completed their education by the time the LLF came into play. Second, we consistently control for a list of education dummies throughout our study.

Economic Development

Aside from education, economic development is another decisive socioeconomic factor for fertility. However, it is well-known that the Chinese economy started to boom in 1978, following its Reform and Open-up Policy. The Chinese economy somewhat staggered in the early 1970s partially due to the Cultural Revolution. Nevertheless, we try to control the impact of economic development with the following measure:

$$\text{Life Time GDP}_{pc} = \frac{\sum_{a=15}^{49} \text{AFR}_p(a) \times Y_{p,c+a}}{\sum_{a=15}^{49} \text{AFR}_p(a)},$$

where $Y_{p,c+a}$ represents the real GDP per capita of province p in year $c+a$. This measure can be interpreted as the average GDP during a woman's fertile period weighted by the age-specific fertility rate. Table A1, Columns (5) and (10) estimate the impact of LLF on the number of children with the lifetime average GDP as the additional control variable. The effect of LLF remains almost unchanged, which is not surprising because the shock of LLF took place ahead of China's rapid economic growth.

[35]The expansion at the primary level started earlier. During the 1950s and 1960s, the central government had been trying to put a school in every village (Hannum 1999).

Table A1: Robustness to the Cultural Revolution and the Sent-Down Movement, Household-level Analysis

Dependent Variables	Number of Living Children (mean = 3.285)					Number of Children Ever Born (mean = 3.427)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
M's Exposure to LLF	-0.239***	-0.235***	-0.250***	-0.254***	-0.248***	-0.335***	-0.331***	-0.337***	-0.343***	-0.332***
	(0.0504)	(0.0503)	(0.0481)	(0.0490)	(0.0467)	(0.0497)	(0.0501)	(0.0493)	(0.0498)	(0.0481)
M's Exposure to the CR	0.0464	0.0999				0.00499	0.0646			
	(0.0720)	(0.0658)				(0.0667)	(0.0610)			
M's Exposure to the CR		-0.0131***					-0.0146***			
*Provincial CR Intensity		(0.00175)					(0.00201)			
M's Exposure to the SDY			0.0342	0.0377				0.000971	0.00674	
			(0.0718)	(0.0717)				(0.0659)	(0.0657)	
M's Exposure to the SDY				-0.0156					-0.0260	
*Provincial SDY				(0.0186)					(0.0182)	
Life-time Weighted GDP					-0.459					-0.500
per capita (thousand RMB)					(0.461)					(0.501)
Observations	5,174	5,174	5,174	5,174	5,174	5,174	5,174	5,174	5,174	5,174
Other Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Age FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the provincial level using the wild cluster bootstrap method (Cameron, Gelbach, and Miller 2008). Other control variables include widow, *hukou*, and education. "Provincial Cultural Revolution Intensity" is approximated by the provincial aggregate fatalities during the Cultural Revolution, which are taken from Walder and Su (2003). "Provincial Sent-Down Movement Intensity" is approximated by the total number of people who were sent outside the province during the movement, which is taken from Gu (2009).