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## Do children prevent their poor old parents from working?

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# Do children prevent their poor old parents from working? \*

Ziwei Rao<sup>†</sup>

February 28, 2021

## Abstract

This study provides the first empirical evidence of the causal impact of fertility outcomes on old-age labor supply, by innovatively employing population policies in the early 1970s and the sex of the eldest child within families as plausibly exogenous instruments of fertility. The results show strong impact of children on preventing old parents from strenuous works at senior age, e.g. having one more child significantly reduces post-retirement aged rural parents' probability of working by 12.8 percentage points. Such impact is especially strong among the more vulnerable elder parents with worse health and little pension benefits. Furthermore, the results suggest that population policies might jeopardize the elderly well being by reducing family sizes and compelling old parents in bad health to continue working.

**JEL Classification:** I14, I18, J13, J26

**Keywords:** *fertility, elderly labor supply, old-age support, health, pension*

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# 1 Introduction

Many Chinese elderly keep working until they are physically incapable (Pang, De Brauw, & Rozelle, 2004). Similar to the elderly in other developing countries, they receive little support from public social security systems. It is also often infeasible for them to accumulate sufficient savings or assets given their life-time poverty. Consequently, most elderly in developing countries have to rely on either own labor income or children's support to maintain their lives. According to the 2010 Chinese population census, 70 percent of the elderly who are 60+ chose either family support or own labor as the primary source of income. Working at post-retirement age is prevalent in China, where 53% of the elderly who are 60+ keep on working, and the figure only decreases to 34% among those who aged 70 and above.<sup>1</sup>

To examine if children can prevent potentially vulnerable old parents from working into senior age, this study investigates the impact of child quantity and child gender composition on parents' old-age labor supply decisions. This paper adopts a two-stage least square method to derive causal inferences and uses data from the China Health and Retirement Longitudinal Study (CHARLS). Family planning policies in the early 1970s and the sex of the first born child are explored as instruments for family fertility outcomes. Heterogeneity across differential health conditions and pension benefits of the parent are further explored to understand the importance of children in different parental statuses.

Children play an undoubtedly crucial role in providing old-age security to elder parents in China. Children, especially sons given the patrilineal tradition, have long been considered as responsible support providers from parents' perspective. It is well reflected by a Chinese survey, where more than 50% of respondents explicitly chose "for old age support" as one reason for having children.<sup>2</sup> Children's duty of supporting and caring one's parents is also written into Chinese constitution and law. Apart from economic reasons, filial piety, a well-accepted key virtue in the culture of many Asian countries, also requires children to provide material support and instrumental care to parents in a manner which conveys respect (Sung, 1998).

Although the elderly population rely heavily on transfers from descendants, the traditional family support pattern is experiencing adjustments under demographic challenges. Dramatic shrinkage in family sizes has been witnessed during the past decades starting from the early 1970s, when a series of population control policies were introduced. The total fertility rate dropped from 5.7 births per woman in 1970 to 1.7 in 2018. In the meantime, the population is aging rapidly. The share of population aged 60 and older is projected to rise to 34.6% in 2050. As a result of decreased birth rates and longer life expectancy, longer living parents have fewer children as potential caregivers.

Theoretically, parents would adopt self-insuring strategies to sustain a desired standard of living in older age when child support is potentially threatened. People could save more by themselves through the life time or postpone retirement entry age, if they have fewer children for the old-age support purpose. Abundant literature link fertility to savings (Caldwell, 1978; Boldrin & Jones, 2002; Tertilt, 2005), and one child policy has been argued to contribute to China's high saving rates although empirical results are mixed (Song, Coupé, & Reed, 2020; Ge, Yang, & Zhang, 2018; Modigliani & Cao, 2004; Huang, Lei, & Sun, 2016; Rosenzweig & Zhang, 2014; Banerjee, Meng, Porzio, & Qian,

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<sup>1</sup>Author's own calculation based on the data set this paper analyzes, i.e. CHARLS.

<sup>2</sup>Author's own calculation using data from the 2013 China Household Finance Survey.

2014).

However, research on the impact of family sizes on retirement decisions is scarce, despite the fact that old-age labor supply and child support are the two major pillars of support for many elderly. Most labor studies focus on the impact of fertility on labor supply decisions of young or middle-aged parents, especially mothers, instead of exploring old-age labor supply behaviors (Angrist & Evans, 1998; Agüero & Marks, 2011; He & Zhu, 2016; Guo, Li, Yi, & Zhang, 2018).<sup>3</sup> This paper thus aims to fill the gap by explaining the high elderly labor participation and providing the first thorough empirical analysis on the causal impact of decreased fertility on old-age labor supply decisions.

The endogeneity of fertility decisions poses a challenge for empirically examining the causal impact of fertility on old-age labor supply. For instance, parents with stronger precautionary motives may have more children and work into older age to better insure themselves. To address the endogeneity issue, family planning policies (FPP) are often used as they provide exogenous variations in fertility. Various variations related to one child policy (OCP) are most frequently exploited in the Chinese context, such as varying penalties for excess births across regions and time and differential regulations among ethnic minority groups, see Zhang (2017) for an excellent discussion.

This paper explores the less studied family planning policy "Later, longer and fewer" (LLF) implemented in the early 1970s, to instrument the number of children within families. Recent empirical evidence suggests that LLF, instead of OCP, has mainly contributed to the significant decrease in family sizes during the past decades (Wang, 2016; Y. Chen & Fang, 2019; Babiarz, Ma, Miller, & Song, 2019; Y. Chen & Huang, 2020). Together with the policy measure, the sex of the first born child and their interaction are adopted as instruments.

Results from the two-stage least squares regressions find that, having more children, especially sons, significantly reduces rural parents' incidence of participating in the labor market. The probability of being working is decreased by 12.8 percentage points (pp) if the total number of alive children increases by 1, among rural parents past retirement age. Having more sons relative to daughters also decreases rural parents' chance of working. For instance, in the extreme case where families change from having all daughters to having all sons (son ratio increases by one), the rural elderly are 16.7 pp more likely to drop out of the labor market.

The aforementioned pattern is found to be heterogeneous depending on parents' needs and stronger among parents aged between 65 and 74, with worse health conditions, and receive no or fewer pension benefits. For instance, having one more child decreases the probability of working by 22 pp among parents with 3+ (I)ADL limitations, which doubled from 11 pp among parents with one or two (I)ADL. The impact of child quantity has the largest magnitude and is only significant among parents with no pension at all, among whom the incidence of being working is decreased by 21.4 pp if there is one more child in the family.

The mechanism through child support is further explored to complement these findings. Results broadly confirm the hypothesized channel of child support through which children reduces parental labor supply. Parents with one more child are 7.5 pp more likely to receive any material transfer from children, and they receive 37.3 higher transfer conditional on receiving transfers, which amounts to 1026 yuan at the median level. Sur-

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<sup>3</sup>Oliveira (2016) is the only exception who examines the probability of working past retirement age as one of the measures of parental wellbeing, whereas old-age labor supply decisions are not investigated in detail.

prisingly, no gender difference is presented in the total help from children, as a greater ratio of sons does not reduce parental labor supply. The incidence of regular transfers is also found to be positively affected by child quantity, whereas with a stronger impact from the number of sons.

This study provides the first causal inference of the impact of fertility outcomes on old-age labor supply, by employing a 2SLS regression analysis. The less studied but influential population policy in the early 1970s, the sex of the eldest child within families and their interaction are innovatively adopted as plausibly exogenous instruments of fertility outcomes. The results show strong impact of children on preventing old parents, especially the vulnerable ones with worse health and little pension benefits, from strenuous works at senior age. Furthermore, the results suggests that population policies might jeopardize the elderly well being by reducing family sizes and compelling old parents in bad health to continue working.

The paper is organized as follows: Section 2 discusses the institutional background in China regarding the old-age support sources and the evolution of population policies. Section 3 provides a simple conceptual framework which guides following empirical analysis. Section 4 describes the data and variables used in the study, and presents stylized descriptive statistics. The empirical strategy, including fertility instruments and model specification, is introduced in Section 5. Section 6 presents the main results and explores heterogeneity. Section 7 discusses the mechanism and Section 8 concludes.

## 2 Institutional Background

### 2.1 Old-age Support in China

Public pension schemes provide the broadest coverage compared to other annuity programs, and they are supposed to provide basic social security to residents. There were four different public pension schemes targeting different population and workforce groups, and their financing, contribution and benefit rules vary substantially. Apart from Public Employee Pension (PEP) for public sector employees and the Basic Old Age Insurance (BOAI) for urban private sector employees established in the 1950s, New Rural Resident Pension (NRP) and Urban Resident Pension (URP) were introduced in 2009 and 2011 as voluntary schemes for rural and urban residents without a formal non-agricultural job respectively. The former two were merged into one employee pension scheme BOAI in 2015, and the latter two were merged into a uniform Resident Pension Scheme (RPS) in 2014. In general, a participation history of 15 years or more is required to be entitled to pension benefits, and eligible beneficiaries start to receive pension benefits after reaching mandatory retirement ages, regardless of their work status.<sup>4</sup>

Despite recent expansion in public pension coverage, the inadequate benefits compel a large elderly population to remain relying mainly on their own labor income and the traditional family support. There is significant inequality in pension benefits across pension schemes and regions, where employee pension schemes (BOAI and PEP) are in overall much more generous than residents pension schemes (NRP, URP or RPS). For instance,

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<sup>4</sup>The BOAI and PEP retirement eligibility age is 60 for males, 55 for female white-collar workers and 50 for female blue-collar workers. The pension eligibility age for the NRP, URP and RPS is 60 for both males and females. The PEP does not require any contribution from public employees. Residents who were already 60 at the time the NRP and URP were introduced could receive flat-rate basic pension benefits without contribution if they opt to enroll.

the monthly average pension of BOAI is 2,870 RMB (1000 RMB yuan equals approx. 150USD) in 2017, which amounts to an average replacement ratio of 46%. However, most of the RPS participants receive a flat-rate benefit from the basic pension, whose monthly average is less than 5% of the BOAI pension level, and the benefit amounts to only 7-20% of income per capita, depending on the region (Fang & Feng, 2018). Although pension benefits supplement old-age income, the low level of pension benefits makes residents pension schemes inadequate in providing income security, especially for the vast rural elderly.

To overcome the lack of sources of support, Chinese elderly, especially rural ones, either work into senior age or rely on intergenerational child support. As shown in Table 1, at the national level, 29% of the elderly at post-retirement age primarily rely on own labor income for old-age support, and 41% rely on family support. Many urban elderly enjoy pension benefits, whereas much more rural counterparts obtain support through own labor income. It is also evident that, when labor supply decreases as they step into 70s, they turn to family support as the primary source. For instance, the proportion of rural elderly who primarily rely on own labor income decreases from 59.8% to 17.3%, and the proportion who primarily rely on family support increases from 31.0% to 69.3% correspondingly.

Table 1: **Primary source of support 60+**

Age	Labor income	Pension	Family support	Others
<i>Rural</i>				
60-69	59,8%	4,4%	31,0%	4,8%
70+	17,3%	4,8%	69,3%	8,7%
<i>Urban</i>				
60-69	19,6%	49,7%	25,8%	5,0%
70+	4,4%	50,7%	38,5%	6,3%
Total	29,1%	24,1%	40,7%	6,1%

*Source:* National Bureau of Statistics of China (NBSC) 2010 census. Respondents could choose one primary source from labor income, pension, family support, unemployment insurance, basic living allowance, property income and others. Latter categories are further merged into one.

Apart from economic reasons, Confucian filial piety and social norms embedded in the culture are believed to shape and help sustaining the inter-generational support. Filial piety (xiao) is considered a key virtue in Chinese and other Asian countries' cultures. Xiao, as an unconditional obligation of children, commands children to be obedient and respect, and it is demonstrated when children reciprocate parents' care (Ho, 1994; Kwan, 2000). In practice, it requires children to provide material support and instrumental care to parents in a manner which conveys respect (Sung, 1998). Children's duty of supporting and caring one's parents is also written into Chinese constitution and law. Intergenerational old-age support traditionally takes the form of co-residence (Zimmer & Korinek, 2010; Oliveira, 2016), which allows children to farm the household land and to provide instrumental help at a low cost. This is especially true for rural families when industries are less developed. Children, especially sons given the patriarchal social system and the patrilineal tradition, are also considered as responsible support providers

from parents' perspective. For instance, rural families without sons are more likely to participate in pension programs and to save more for old age support (Ebenstein & Leung, 2010).

## 2.2 Family Planning Policies in China

Before the introduction of OCP in 1979, family planning policies were already in place and had evolved for decades. The development of China's official party's family planning experienced back-and-forth between pro-natal and anti-natal phases. The debate in general shifts to consensus on population control during the middle 1950s to curb the high fertility rates in order to facilitate economic growth. Whereas political instability and major social events, including Great Famine between 1959 and 1961, Great Leap Forward during 1955 to 1960, and Cultural Revolution starting from 1966, jointly disrupted family planning movements. Only at the beginning of 1970s, anti-natal family planning movements were first formalized into a series of policies and expanded to rural areas at the national level.<sup>5</sup> This series of policies were later incorporated into one slogan – "Later, longer and fewer" (LLF), as they promoted later marriage, longer birth intervals and fewer births.<sup>6</sup> The family planning policy gradually intensified during the decade and eventually evolved into the one child policy by the end of the 1970s.

The most dramatic decline in total fertility rate (TFR) took place during the early 1970s, which coincides with the implementation period of LLF. As shown in Figure 1, during the period when LLF was being rolled out, the TFR decreased from around 6 children per woman in 1970 to below 3 children in 1978. After 1979, the TFR continued declining whereas at a lower rate. Growing literature attribute the fertility decline following OCP to socioeconomic development since the economic reform in 1978, and find limited impact of OCP on life-time fertility in the long term (Cai, 2010; Whyte, Feng, & Cai, 2015; Wang, 2016; Wang, Zhao, & Zhao, 2017). Instead, LLF policy is considered to be the main reason of the fertility drop during the 1970s, when economic development was almost stagnant by the time (Mauldin, 1982; Whyte et al., 2015; Zhang, 2017). Recent studies examining the causal impact of LLF on fertility also find many supporting evidences (Wang, 2016; Y. Chen & Fang, 2019; Babiarz et al., 2019; Y. Chen & Huang, 2020).

In practice, local governments set up Family Planning Leading Groups as a response to the state's calling for population control and took over the organization and implementation of LLF policies from the central level. Leading groups were established between 1970 and 1979 across provinces to facilitate local implementation of LLF, and the staggered roll-out created variation in the timing of the policy enforcement. To illustrate how differential policy enforcement time affects the decline of TFR, I categorize provinces into early, reference and late group based on their leading group establishment year.<sup>7</sup> The

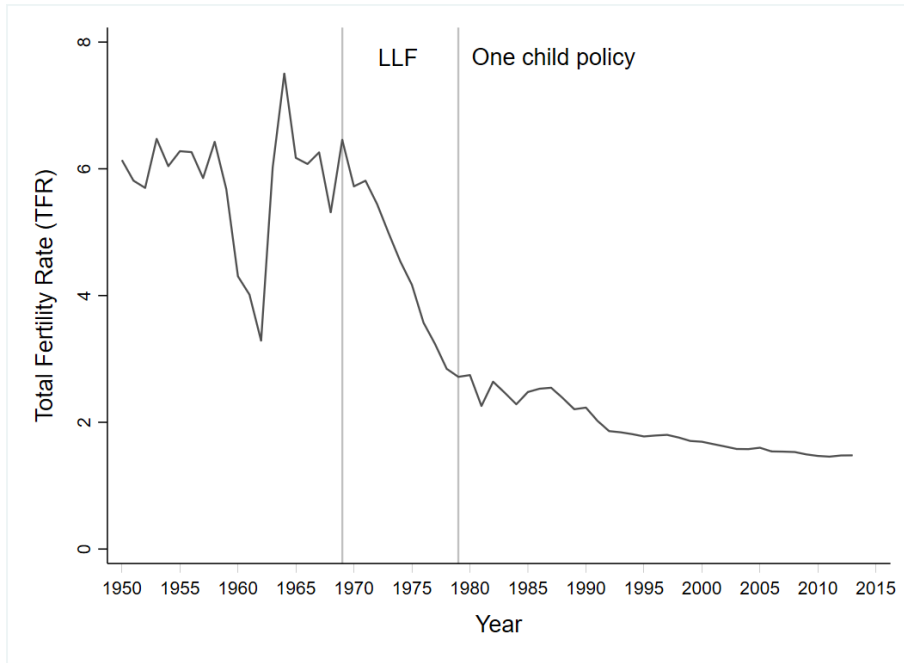
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<sup>5</sup>China's birth-planning campaigns date back to 1950s, while earlier campaigns were small and they targeted at urban residents with weaker restrictions and enforcement (White, 2009; Scharping, 2013; Wang, 2016).

<sup>6</sup>Later marriage denotes delaying marriage to age 23 for women and 25 for men; Longer birth intervals require intervals to be longer than 3 years between births; and fewer births urged urban couples to have no more than two children and rural couples no more than three (Greenhalgh, 2008; White, 2009).

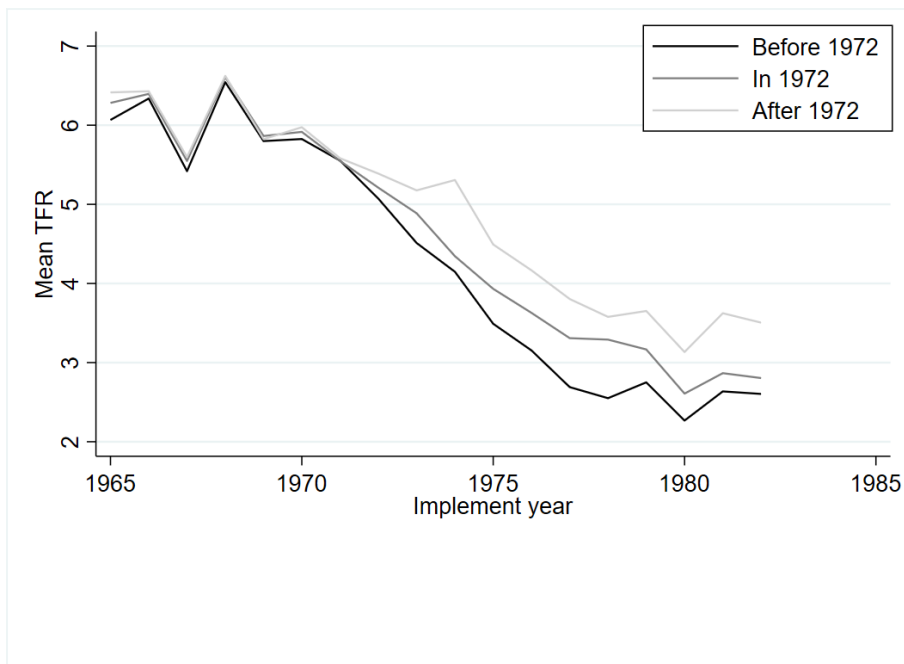
<sup>7</sup>The early group consists of 8 provinces who established leading groups in 1970 or 1971, the reference group contains 9 provinces who established leading groups in 1972, and the late group has 8 provinces who established leading groups from 1973 onward. See Table A1 in the appendix for an overview of FPLG establishment years across provinces .

Figure 1: TFR trend



TFR trend of the early and late groups is displayed in Figure 2, where the decline of TFR follows the establishment of leading groups. Provinces who established the leading groups in 1970 or 1971 – the early group– witnessed an immediate decrease in the average TFR starting from around 1970. Whereas the average TFR of provinces in the late group started to drop rapidly with a similar slope as the early group did only after 1974. It suggests that the differential timing of LLF implementation plausibly explains the cross-province difference in fertility drop.

Figure 2: Differential TFR changes with Leading Group establishment



Two sources of variation of the LLF policy are exploited in this paper, including the



varying timing and the differential intensity of enforcement across provinces. Aforementioned varying timing implies that, at the micro level, women of the same age who live in provinces with earlier enforcement exposed longer to the LLF policy, thus their fertility decisions were more affected. Additionally, pre-existing fertility trends contribute to the differential enforcement intensity of the policy. Before the LLF policy being implemented, there was large heterogeneity in fertility rates across regions. In 1969, national TFR was 5.67, while the TFR in Beijing was 3.57 in contrast to a TFR of 6.71 in Jiangxi province. Since the LLF policy advocated no more than two (three) children for urban (rural) families homogeneously to the whole country, families in provinces with higher levels of pre-existing fertility rates exposed heavier to the policy.

### 3 Conceptual Framework

To be added.

## 4 Data

### 4.1 Data

We use data from China Health and Retirement Longitudinal Study (CHARLS), an ongoing micro-longitudinal survey which is nationally representative of Chinese older population aged 45 and above. CHARLS is the sister data set of Health and Retirement Study (HRS), Survey of Health, Aging and Retirement in Europe (SHARE), etc. CHARLS contains rich information on individual demographic characteristics, work status, retirement and pensions, as well as on the family structure and interpersonal transfers. The main surveys start from 2011, and I employ data from all available waves, including the 2011, 2013, 2015 and 2018 wave. Details of the survey design, sampling procedure and samples are described in Zhao et al. (2013) and X. Chen, Smith, Strauss, Wang, and Zhao (2017).

The main respondent and its spouse (if present) are interviewed as respondents of the household. The respondents are treated as the parents who make fertility and old-age labor supply decisions. Therefore, this study exploits individual fertility and old-age labor supply decisions of at most two respondents per household.

The sample is selected by focusing on only respondents who were born after 1925 and before 1952. The later restriction ensures that respondents are in their old age, in the sense that they have passed the normal retirement age (60) in all waves. Since the main interest is the impact of fertility on elderly labor supply, the selection also limits the channel through which family planning policies influence mothers' education as female respondents in the selected sample should have completed education by the time of LLF enforcement.<sup>8</sup> Due to the fact that there are only few oldest old in the survey and that it is reasonable to study the labor supply of individuals under 90, the sample is restricted to be born after 1925.

Never married and never worked individuals are excluded, given that the main research question is how fertility affects old-age labor supply. Couples with either spouse being

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<sup>8</sup>The average year of leading team establishment is 1972, thus the average age of the youngest female respondents after selection is 20. Given the very low educational level of the cohort who were born before 1952, among whom 37% are illiterate and 93% attained no higher than middle school, it is likely that women who were 20 years old had completed their education already before LLF was implemented.

an ethnic minority are dropped as well, since family planning policies either exclude minorities at large or pose less strict restrictions on them (H. Li & Zhang, 2007; H. Li, Yi, & Zhang, 2011; Scharping, 2013). Finally, direct-administered municipalities, including Beijing, Tianjin and Shanghai, are not included in the analysis as big cities could be essentially different from other provinces. They are much smaller in sizes, wealthier in economics, and more populated with higher educated residents. These cities might have experienced earlier exposure to small-scale family planning movements before LRF, which are difficult to measure and control. The final sample consists of 3,883 households, 6,292 respondents, and 18,453 respondent-year observations.

## 4.2 Variables and Descriptive Statistics

**Labor Supply** Both the extensive margin and the intensive margin of labor supply are investigated. *Whether currently working* is used to measure the retirement decision of the elderly. I define retirement as a cessation of work, since the conventional definition of retirement – the reception of pensions – is not appropriate in the developing context, and whether continuing working in old age better reflects the elderly’s need to work due to the lack of support. In order to take gradual retirement into consideration, the intensive margins – (the natural logarithms of) *Hours worked per week* and *Whether more than 20 hours per week* – are studied as well.<sup>9</sup>

There are a considerable number of elderly, especially rural elderly, who work into their late 70s. Both rural and urban elderly in the sample gradually leave the labor market as aging, whereas urban residents stop working much earlier, as plotted in Figure 3. Rural elderly are shown to be more likely to be working at all ages, which reflects their lack of pension support compared to urban counterparts. Between age 70 - 74, around 35% of urban elderly keep working, and the proportion amounts to 60% in rural area. Even at age 80, almost 40% of rural residents have not yet retired, contrast to the life expectancy at birth of 76 years in 2015 according to the World Bank. The high labor force participation in old age corresponds to earlier description of the retirement pattern of Chinese elderly as "ceaseless toil" – the elderly had to work their entire lives due to lacking sufficient means of support (Davis, 1991).

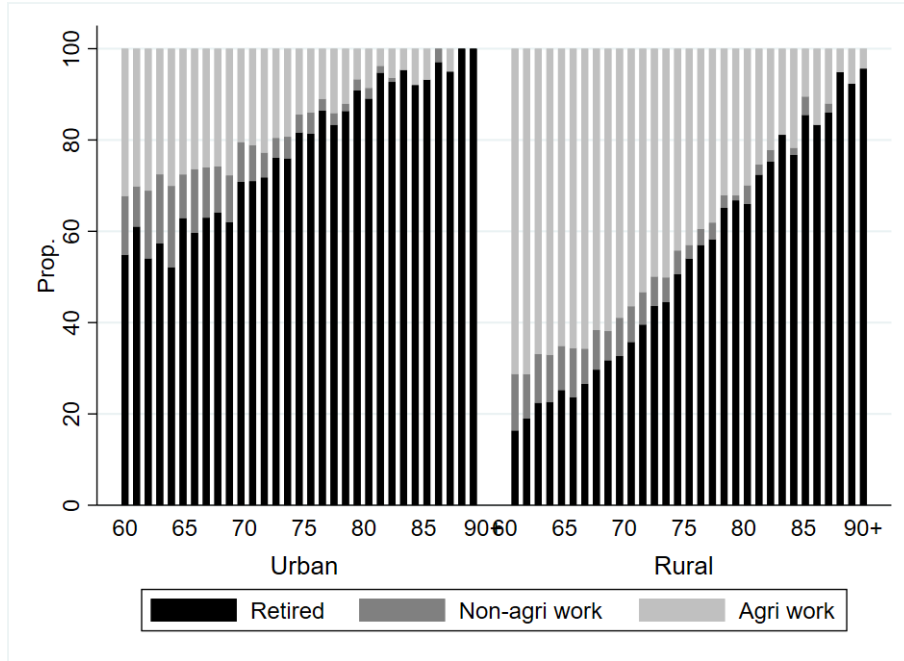
The working sample is rather homogeneous as its vast majority are constituted of agricultural workers, as shown in Figure 3. It not only reflects the population distribution of the sample data, but also suggests a physically strenuous and challenging nature of the working elderly’s job. Farmers tend to keep working at older ages compared to individuals with non-agricultural jobs, since they receive little or no pension benefits and have less accumulated wealth through their life time. Apart from the rural sample, who primarily work in the agriculture sector, urban residents could participate in agriculture work as well. Many urban residents who migrated from villages to live in nearby counties or towns, which are geographically close to farm land whereas classified as urban areas, maintain the access to agricultural land. When it is difficult for these elderly to return to the job market and find a formal job after retirement, farming could be one of the few alternatives they have.

Turning to the intensive margin of labor supply, an evident decreasing trend is present as well, where working hours reduce with age among those who are currently working.

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<sup>9</sup>The unemployed are classified into the retired group, as the proportion of unemployed is extremely small (0.08%), and there are no information at the intensive margin of labor supply among the unemployed.

Figure 3: Work status across age by residence type



The average total work hours falls from around 45 hours per week at age 60 to around 20 hours per week at age 80 among the working sample. The pattern is noisier among the oldest old due to its small sample size. Although the elderly could have a second job to supplement income, only 1 percent of the still working sample have a side job. I employ the total working hours in the empirical analysis to take this into account.

**Fertility** Family fertility outcomes are measured by a) *The number of living children* and *Son ratio*, or alternatively, b) *The number of living daughters* and *The number of living sons*. The number of living children better captures the potential old-age support from children than the number of children ever born does, thus it is considered as more relevant in determining elderly parents' labor supply. Sex ratio among living children within families provides additional information on the composition of children, which might affect family wealth and parental expectation about elderly support (Ebenstein & Leung, 2010; L. Li & Wu, 2017). Sex selection through either a male-biased fertility stopping rule or postnatal selection is possibly a side effect of the LLF policy, given the prevailing son preference in China (Yamaguchi, 1989; Arnold & Zhaoxiang, 1992; Clark, 2000; Babiarz et al., 2019).<sup>10</sup> Without differentiating the approaches and estimating the impact size of sex selection, I focus on the son ratio among living children (number of living son/total number of living children) within families in parents' old age. A different set of fertility outcomes composed of the numbers of sons and daughters provide an alternative way to interpret the impact of fertility.

As total fertility rate in Chinese families has dropped substantially during the past decades as a pronounced demographic trend, family size is also decreasing rapidly among younger households. Table 2 displays the trend of family size and within family sex ratio across birth cohorts of the mother. From the cohort born between 1932 and 1936 onward,

<sup>10</sup>Prenatal selection, i.e. abortion, is not a concern during the study period, as ultrasound technology was not widely available until the mid-1980s (H. Li & Zheng, 2009; Y. Chen, Li, & Meng, 2013).

the total number of children keeps decreasing whereas the ratio of sons is relatively stable. It implies that the number of sons and the number of daughters are reducing at a similar rate. The statistics confirm that families did not reduce family sizes by curbing only the number of daughters. It is also noticeable that the positive rural-urban difference in family sizes presents in every cohort. Rural families always have more children, potentially for risk-sharing and old-age support purposes.

Table 2: **Fertility outcomes across mother’s birth cohort**

Birth cohort	1926-1931	1932-1936	1937-1941	1942-1946	1947-1951	Total
<i>Total Nr. Children</i>						
Rural	4.51	4.87	4.43	3.74	3.25	3.76
Urban	3.98	4.29	3.56	3.23	2.78	3.22
<i>Son Ratio</i>						
Rural	0.55	0.54	0.56	0.54	0.55	0.55
Urban	0.56	0.51	0.52	0.53	0.55	0.53
OBS	724	1,648	3,061	4,902	8,118	18,453

**Old-age support** To visualize the lack of pension benefits, among both rural and urban residents, Figure 4 displays the proportion of residents with different types of public pension. I categorize main public pension schemes into employee pension, including BOAI and PEP, and non-employed resident pension, including NRP, URP and RPS, where pension benefits of the former (average replacement ratio of 50%) is much generous than that of the latter (average replacement ratio lower than 20%) as discussed above. 32.8% of rural individuals and 26.8% of urban elderly do not participate in or receive any kind of public pension. Thus not only rural elderly, but also many urban ones have to rely on own labor income or family support.<sup>11</sup> In addition, few rural elderly have access to employee pension (5.7%) compared to urban elderly (37.6%), which indicates that the majority of rural pension recipients potentially receive a very low and inadequate level of pension benefits.

The pension inequality between rural and urban is evident when comparing the amount of pension and subsidy benefits received during the previous year of the interview, as shown in Table 3. The mean and median, conditional on receiving any pension or subsidy benefits, are 3,284 yuan and 840 yuan respectively among rural residents, in contrast to the official national poverty line of 2,300 yuan per person per year. However, the mean is 4 times and the median is 14 times higher among urban elderly than the numbers of rural residents.

There seems to be a substitution effect among the old-age support sources. Consistent with the huge disparity in pension benefits, there are a higher labor participation rate and stronger reliance on inter-generational support among rural elderly. Table 3 shows that more rural elderly receive inter-generational material transfers (81% versus 72%) and remain staying in the labor market (58.4% versus 28.8%). Although the amount of inter-generational transfer received is higher among urban parents, it is likely due to

<sup>11</sup>Note that although some urban residents participate in private pension programs such as annuity programs and commercial pension, the size is small.

urban children’s higher income and urban parents’ higher expenditure. There is not much rural-urban difference at the intensive margin of labor supply if the elderly keep working. Overall, own labor supply and inter-generational support substitute pension when there is a lack of pension benefits.

The importance of larger family sizes in preventing elder parents, especially parents with worse health and no pension, from working into senior age is strongly supported by the differential labor participation rates in Table 4. Instead of age and rural-urban differentiation, I use (instrumental) activities of daily living ((I)ADL) limitations and the reception of pension benefits to more accurately reflect the restriction of working capability led by aging and the access to social support, respectively. Parents with larger family sizes are less likely to be working conditional on health status and pension benefits. For instance, among parents with 3+ ADL limitations and no pension, those who have more than 3 children are 10.3 pp (37.3% versus 27.0%) more likely to retire. Furthermore, parents are more likely to retire as health deteriorates if they have more children. Among elderly parents with pension, those who develop 3 and more ADL limitations are 19.1 pp (49.2% versus 30.1%) more likely to retire if they have at most 3 children, whereas the number is as high as 26.7 (49.6% versus 22.9%) if they have more than 3 children.

Figure 4: **Type of public pension by residence type**

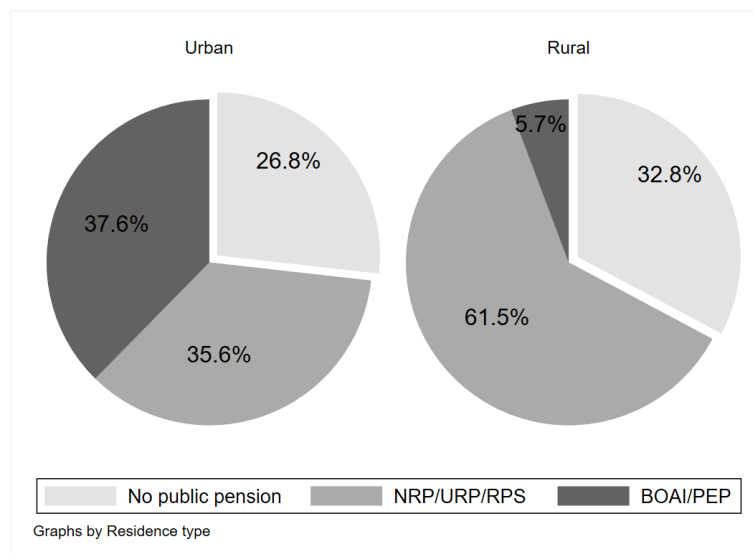


Table 3: **Old-age support sources**

	Rural	Urban
<i>Pension and subsidy</i>		
Prop.	70.7%	79.2%
Mean (if >0)	3,284	16,567
Median (if >0)	840	12,840
<i>Intergenerational transfer</i>		
Prop.	81.0%	72.2%
Mean (if >0)	4,720	6,980
Median (if >0)	2,500	3,100
<i>Labor supply</i>		
Prop.	58.4%	28.8%
Hours/week (if >0)	36.9	35.7
More than part time (if >0)	0.71	0.65
OBS	11,407	7,046

Table 4: **Family sizes and labor supply**

Family size	ADL	No Pension	Have Pension
No more than 3 Children	< 3	62.8%	49.2%
	3+	37.3%	30.1%
More than 3 Children	< 3	54.1%	49.6%
	3+	27.0%	22.9%

*Note:* Proportion of working individuals is reported in the table for each group.

**Control variables** Variables possibly influence elderly labor supply, including gender, hukou, residence type (rural or urban areas), educational attainment, age and age gap, whether widowed, health, wealth, pension, region and survey year, are controlled. Hukou denotes whether the individual is classified into a rural or an urban status in the household registration system, and it determines one’s social welfare (Wu & Treiman, 2004). I control for both the first hukou and the current hukou, as the former might be more relevant to family planning policy enforcement in early lives whereas the latter determines the current social welfare. Age fixed effects are controlled by a group of age dummies. Age gap refers to the age gap between the oldest and the youngest among couples. Health status restricts the ability to work, while wealth and pension benefits determine the necessity to work. Thus these three are crucial factors to consider when making old-age labor supply decisions. Health is objectively measured by the number of chronic diseases and the number of (I)ADL. Wealth is measured by the value of household assets, including the housing value, durable assets, fixed capital assets, irrigable land, and agricultural asset – livestock and fisheries. Pension measures the amount of annual pension benefits received during the past year. Based on mother’s birth year, 5 cohort interval dummies (1926-1931, 1932-1936, 1937-1941, 1942-1946, and 1947-1951) are created and included to capture cohort fixed effects. Province and wave fixed effects are applied everywhere.

## 5 Empirical Strategy

**Fertility Instruments** To address the endogeneity of fertility outcomes in OLS, instruments for fertility are needed for a causal inference. Exposure to the “Later, long, and fewer” family planning policy, the sex of the first born child, and their interaction are adopted as appropriate instruments for family fertility outcomes.

Apart from the LLF policy, which associates with decreased family sizes as discussed above, sex of the first born predicts both the total number of children and the sex ratio within families. Families with son-biased preferences usually discontinue childbearing after achieving a desired number of sons, thus they are more likely to give fewer births and comply with birth control policies when the eldest child is male.<sup>12</sup> The interaction term accounts for the additional policy impact on reducing family sizes among families with first-born sons. First-born son also raises the ratio of sons within families given no daughter-preference at higher disparities. The sex of the first born is plausibly exogenous due to the fact that ultrasound technology for prenatal selection was in general unavailable at the time (H. Li & Zheng, 2009; Y. Chen et al., 2013), and that couples had little incentive to select the sex of the first birth as they were able to have more than one child.

I follow the policy exposure measure from Y. Chen and Fang (2019), which combines the age-specific exposure with the heterogeneous intensity across provinces. Similar age-specific exposure measures to family planning policies can be found in Miller (2010) and Wang (2016). The policy exposure for families with mothers born in year  $c$  in province  $p$

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<sup>12</sup>Evidence supporting son preference is abundant, for instance, 94% families in the sample have at least one son, females on average have more siblings than males do, son-biased sex ratios is greater at high disparities, especially the last-born, and various male-biased stopping rules have been adopted (i.e. Babiarz et al., 2019).

is measured as following

$$Exp_{pc} = \sum_{a=15}^{49} AFR_p(a)I[c + a \geq T_p] \quad (1)$$

where  $AFR_p(a)$  is the provincial age-specific fertility rate in 1969 when the LLF policy has not yet been introduced anywhere,  $a$  is age and  $T_p$  denotes the establishment year of Family Leading Group in province  $p$ .<sup>13</sup>  $I[.]$  is an indicator function which equals 1 when the statement is true. The policy exposure adds up the provincial age-specific fertility rate (AFR) at all remaining fertile ages of the mother.<sup>14</sup> Therefore, the variation of policy exposure comes from: a) differential leading group establishment year across provinces, b) varying initial fertility profiles across provinces, and c) birth cohort of the mother.

Based on the definition in Equ. 1, younger cohorts were more exposed, and women's mean exposure is higher in provinces with higher initial fertility rates and earlier policy enforcement conditional on birth cohort. Figure 5 illustrates the cohort and provincial differences. Age-specific exposure hypothesizes that, women's fertility outcomes are more affected by family planning policies in a non-linear fashion among those who were younger at the enforcement time, as they spent more fertile years under the policy. The staggered roll-out of LLF thus implies that, women of the same birth cohort who reside in provinces with earlier enforcement were younger when the policy was implemented, and consequently they were exposed stronger to the policy. The age-specific exposure can be captured by the sum of age-specific fertility rates (AFR) at all upcoming fertile ages, which accounts for both the length of exposure and the heterogeneous age-profile of fertility. By using provincial AFR in the calculation, the variation of intensity across provinces is exploited as well. Women in provinces with higher initial fertility rates are more exposed to the LLF policy as LLF applied the same birth quota restrictions homogeneously to the entire country.

Among the 24 out of 28 provinces which are left in the final sample with complete information, 2 provinces established the Family Planning Leading Groups the earliest in 1970 and 1 province formed their leading group the latest in 1979. Except the last province, all provinces had family planning groups set up no later than 1975. Table A1 in the appendix summarizes the leading team establishment years across provinces.

The cohorts of the sample are also reasonably affected by the LLF policy. Women would be impacted only if they were in their child-bearing years when the policy was in place. After the birth year selection, the minimum age is 19 and the maximum age is 53 at the time of policy enforcement. Table 5 presents that 84.7% of the sample were under 35 years old when the policy was implemented in their respective provinces, which implies that the majority of the sample spent their most productive child-bearing years under the policy.

**Model specification** In a context where elderly parents rely on own labor income and support from children, fertility decline might lead to later retirement and longer work

<sup>13</sup>The age-specific fertility rate measures the annual number of births to women of a specified age or age group per 1,000 women in that age group. Provincial AFR data is retrieved from (Coale & Chen, 1987) who compute the data based on 1982 One-per-thousand Sample Fertility Survey.

<sup>14</sup>Child-bearing years range from age 15 to age 49, and women who were younger than 15 at the enforcement time are considered as full exposed, whereas women who were already 49 and above are considered to be not affected as their fertility decisions had completed by the time of policy enforcement.



Figure 5: Exposure measure by initial TFR and enforcement time

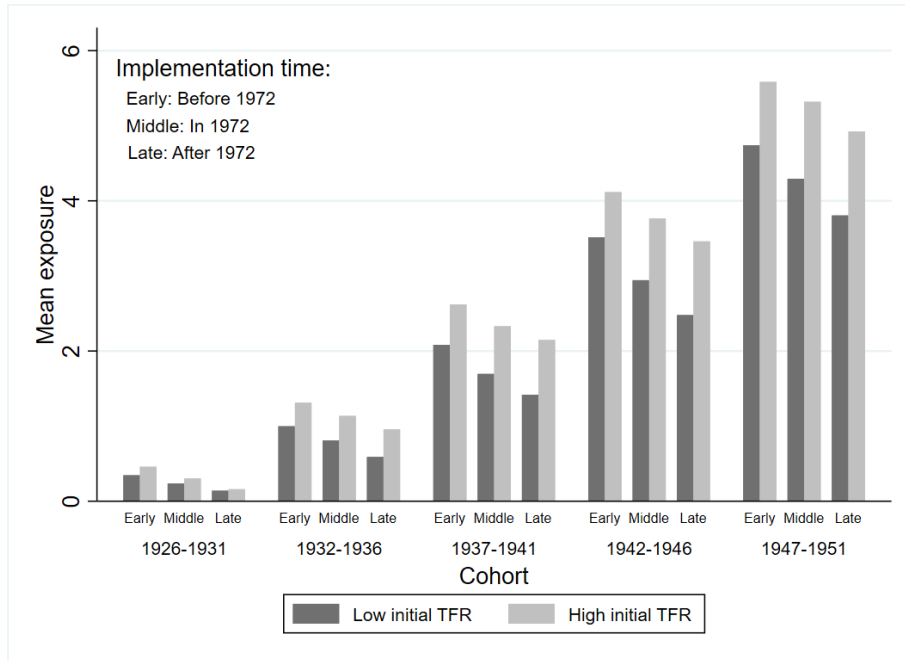


Table 5: Distribution of Age at Enforcement

Age at Enforcement	Percentage
-24	39.38%
25-29	28.76%
30-34	17.61%
35-39	9.50%
40-44	4.19%
45+	0.56%
Total	100%

hours in old age. To examine the sign and the magnitude empirically, the following equation is estimated.

$$LaborSupply_{ijcpt} = \alpha_0^{LS} + \beta_1 NrChild_{jcpt} + \beta_2 SonRatio_{jcpt} + \gamma z_{jcpt} + \tilde{\gamma} \mathbf{x}_{ijcpt} + \delta_c + \zeta_p + \theta_t + \epsilon_{ijcpt}. \quad (2)$$

Labor supply mainly includes the extensive margin *Whether currently working* and the intensive margin *Hours worked per week*. The labor supply of individual  $i$  from family  $j$  with a mother born in year  $c$  living in province  $p$  in survey year  $t$  is a function of: the total number of alive children,  $NrChild_{jcpt}$ ; the ratio of sons among living children,  $SonRatio_{jcpt}$ ; a vector of family characteristics including age gap, whether widowed, highest educational attainment within the couple, wealth, and rural/urban residence,  $z_{jcpt}$ ; a vector of individual level controls that includes gender, age dummies, first hukou, current hukou, educational attainment, health status, annual pension benefits,  $\mathbf{x}_{ijcpt}$ ; cohort group fixed effects,  $\delta_c$ ; region fixed effects,  $\zeta_p$ ; year fixed effects,  $\theta_t$ ; and an error term,  $\epsilon_{ijcpt}$ .<sup>15</sup>

Two-stage least squares (2SLS) regression analysis is employed in this study, where two endogenous explanatory variables representing fertility outcomes – a) the total number of children and the sex composition of children or b) the number of sons and the number of daughters – are instrumented by the exposure to LLF policy ( $Exp_{pc}$ ), the sex of the first born ( $1stSon_{jcpt}$ ), and their interaction ( $Exp_{pc} \times 1stSon_{jcpt}$ ). The following first stage regressions are estimated:

$$NrChild_{jcpt} = \alpha_0^{NC} + \hat{\beta}_1 Exp_{pc} + \hat{\beta}_2 1stSon_{jcpt} + \hat{\beta}_3 Exp_{pc} \times 1stSon_{jcpt} + \hat{\gamma} z_{jcpt} + \hat{\gamma} \mathbf{x}_{ijcpt} + \delta_c + \zeta_p + \theta_t + \eta_{jcpt}. \quad (3)$$

and

$$SonRatio_{jcpt} = \alpha_0^{SR} + \hat{\beta}_1 Exp_{pc} + \hat{\beta}_2 1stSon_{jcpt} + \hat{\beta}_3 Exp_{pc} \times 1stSon_{jcpt} + \hat{\gamma} z_{jcpt} + \hat{\gamma} \mathbf{x}_{ijcpt} + \delta_c + \zeta_p + \theta_t + \eta_{jcpt}. \quad (4)$$

## 6 Main Results

### 6.1 First stage: Fertility Outcomes

First stage results in Table 6 panel A show that exposure to LLF policy significantly decreases the total number of living children. Given the rural (urban) sample mean of policy exposure is 3.61 (3.51), the policy on average reduces family size by  $0.304 \times 3.61 = 1.10$  ( $0.277 \times 3.51 = 0.97$ ) children among rural (urban) families with first-born daughters. The impact size is comparable to findings in Babiarz et al. (2019), who estimate that LLF policy reduces lifetime births by 0.88 through a parity progression estimation. The positive rural-urban difference in the policy impact is also found by Y. Chen and Fang (2019).

The policy effect on reducing family sizes is greater among rural families with first-born sons, meaning that families are more likely to reduce fertility and comply with the family planning policy, if their eldest child is a boy. It is in line with the hypothesis that families are more willing to stop childbearing if they have at least one son or reach a desirable number of sons due to their son preference.

The population policy, however, keeps sex ratio within households relatively constant, regardless of the sex of the first born. When the first born is a boy, the sum of the

<sup>15</sup>In an alternative specification,  $NrDaughter_{jcpt}$  and  $NrSon_{jcpt}$  are used to measure children composition instead of the total number and the sex ratio.

Table 6: **First stage: Fertility Outcomes**

	A		B	
	Nr. Children	Son Ratio	Nr. Daughters	Nr. Sons
<b><i>Rural</i></b>				
Exposure	-0.304*** (-3.88)	0.011 (0.79)	-0.213** (-2.78)	-0.098* (-1.88)
Exposure*1stSon	-0.058* (-1.94)	0.014** (2.36)	-0.010 (-0.40)	-0.049** (-2.17)
1stSon	-0.107 (-0.73)	0.227*** (9.45)	-0.998*** (-9.46)	0.898*** (9.22)
Observations	11,407	11,407	11,407	11,407
R-squared	0.251	0.298	0.253	0.233
<b><i>Urban</i></b>				
Exposure	-0.277*** (-4.25)	-0.018 (-1.16)	-0.129** (-2.32)	-0.151** (-2.31)
Exposure*1stSon	-0.010 (-0.35)	0.022*** (3.21)	0.010 (0.34)	-0.018 (-0.80)
1stSon	-0.305** (-2.46)	0.281*** (11.14)	-1.155*** (-12.06)	0.844*** (8.01)
Observations	7,046	7,046	7,046	7,046
R-squared	0.308	0.391	0.341	0.282

*Notes:* \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust t-statistics in parentheses. Standard errors are clustered at the provincial level. Other controls, Age FE, Cohort group FE, Year FE, Province FE are included everywhere. Mean exposure is 3.61 and 3.51 in the rural and the urban subsample, respectively. Rural and urban sample means of 1stSon are 0.53 and 0.51 respectively.

coefficients of the policy exposure and the interaction term reflects the policy impact, which is insignificant when son ratio is the outcome. Although there was increase in stopping rule use under LLF (Babiarz et al., 2019), such sex selection does not result in a biased within-family sex ratio.

Having a first-born son exogenously decreases the total number of living children and increases the son ratio. Since ultrasound technology was not widely available during the study period, sex of the first-born child is reasonably exogenous and balanced. Having a first-born son should not impact the total number of children if there is no gender preference present, however, it reduces the family size by 0.32 ( $-0.058 \times 3.61 - 0.107$ ) and 0.34 ( $-0.010 \times 3.51 - 0.305$ ) among rural and urban respondents, respectively. This provides additional evidence for the existence of son preference.

Results in panel B implies that both the number of daughters and the number of sons are reduced by the LLF policy, and that families do not control family sizes by curbing only the number of daughters. The decline in the number of daughters is homogeneous among families with different sexes of the first-born. However, the quantity of sons would be more significantly reduced if the eldest child is male. The often statistically significant interaction term is consistent with the prevalent son preference in China, suggesting that the effectiveness of family planning policies would vary across families.

## 6.2 Labor Supply Decisions

Results of the 2SLS regression analysis show that having more children could significantly reduce old parents' labor supply in old age. As shown in the first column of Table 7, rural parents who are 60+ are 12.8 pp less likely to be working if they have one more living children. The magnitude of the impact is relatively large, compared to the average working incidence of 58.4% among the rural sample.

The higher ratio of sons a respondent has, the less likely the elder respondent is working. Parents' elderly labor supply may depend on the expectation of future support from children, thus parents with a better faith in sons would retire earlier if they have more male descendants. Similar results can be found in panel B. Having more daughters and having more sons both reduce parents' probability of working, whereas the impact of sons is greater than that of daughters ( $-0.134$  versus  $-0.089$ ).

Aforementioned pattern is stronger and only significant among rural households. The rural-urban heterogeneity suggests that parents living in rural regions have to rely more on children for support as they in general have less accessible resources. The more evident gender difference among rural sample is potentially the result of a more traditional gender role of sons as support providers.

The intensive margin is examined in addition to the retirement decision, given the possibility of gradual retirement. Column two and five in Table 7 report the impact of children on working hours, conditional on working. The total working hours on all jobs is employed to account for potential side jobs. According to both panels, neither having more children nor having a higher ratio of sons significantly influences the total working hours per week in either sample.

However, the probability of working more than part time is found to be significantly reduced by the son ratio and the number of sons, among urban respondents. For instance, urban old parents who are currently working, are 10.3 pp less likely to work more than 20 hours per week, if they have one more son.

Results suggest that, fertility outcomes impact rural parents' labor supply mainly

through reducing the incidence of working at all, whereas it decreases urban parents' labor supply mainly by lowering the incidence of working more than part time.

Table 7: **Labor Supply Decisions**

	Rural			Urban		
	Working Hours/week		> 20 hours/week	Working Hours/week		> 20 hours/week
<i>Panel A</i>						
Nr. Children	-0.128*** (0.043)	0.057 (0.094)	-0.018 (0.044)	-0.032 (0.082)	-0.213 (0.146)	-0.072 (0.048)
Son Ratio	-0.167*** (0.065)	0.111 (0.137)	-0.062 (0.069)	-0.008 (0.075)	-0.298 (0.220)	-0.151** (0.067)
R-squared	-0.017	0.042	0.033	0.108	0.015	0.020
Hansen J test p-value	0.586	0.679	0.677	0.353	0.924	0.466
F-stat 1st stage: Nr. Children	10.87	9.662	9.662	14.64	10.18	10.18
F-stat 1st stage: Ratio sons	210.1	251.6	251.6	192.1	143	143
<i>Panel B</i>						
Nr. Daughters	-0.089*** (0.032)	0.032 (0.072)	-0.006 (0.033)	-0.042 (0.069)	-0.155 (0.124)	-0.044 (0.043)
Nr. Sons	-0.134*** (0.045)	0.066 (0.107)	-0.028 (0.051)	-0.050 (0.094)	-0.270 (0.182)	-0.103* (0.059)
R-squared	0.011	0.043	0.034	0.097	0.012	0.015
Hansen J test p-value	0.316	0.631	0.739	0.385	0.718	0.659
F-stat 1st stage: Nr. dau	218.4	127.9	127.9	185.6	73.38	73.38
F-stat 1st stage: Nr. son	71.13	43.58	43.58	94.31	51.34	51.34
Observations	11,407	5,985	5,985	7,046	1,801	1,801

*Notes:* \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses. Standard errors are clustered at the provincial level. Other controls, Age FE, Cohort group FE, Year FE, Province FE are included everywhere. STATA command *ivreg2* and the partial option are adopted in above analyses.

## 6.3 Heterogeneous impact of children

### 6.3.1 Age group

To investigate the elderly from which age group is the most affected by children, similar analyses are conducted separately for age groups 60-64, 65-69, 70-74, and 75+, respectively. Theoretically, elder parents would be more in need of child support due to aging, thus stronger impact of children is expected among the elder parents or the oldest old. However, aforementioned pattern is found to be stronger among relatively younger post-retirement age respondents, as shown in Table 8.

An overall decreasing gradient in coefficients is observed across age groups, where the child quantity impact is stronger among younger respondents and the most significant among elder parents who age between 65 and 74. Nevertheless, old parents who are 70+ still work significantly less if they have more children, both statistically and quantitatively. For instance, parents who are between 70-74 are 12.4 and 13.7 pp less likely to be working if they have one more daughter and son, respectively.

Sons also play a more important role among younger elderly, who are below 70. The coefficients of son ratio are large (above 0.25) and significant among groups 60-64 and 65-69. It implies that, in the extreme case where families change from having no son to having no daughter (the ratio of sons to all children increases by one), old respondents in these age groups are more than 25 pp more likely to retire.

To more accurately account for parental needs and the aging process, differentiation of elder parents with different health statuses and different levels of pension benefits are further made in the following analysis.

### 6.3.2 Ceaseless toil – health status

To directly examine if working in old age is as Davis (1991) described as *ceaseless toil* – parents in bad health still need to rely on own labor income, respondents are further categorized based on their health status instead of age. The number of (I)ADL limitations is a good indicator of physical working ability, as the proportion of respondents being working decreases from 52.6% among individuals with no ADL to 27.5% among those with 3+ ADL limitations. Its correlation with age (corr. 0.23) suggests that age might be less accurate in measuring the elderly's ability to work.

Table 9 shows that the impact of children on reducing parental labor supply is increasing with parents' health limitations. Parents with 3+ (I)ADL limitations are 22 pp more likely to retire when having one more child, compared to parents with no ADL limitation whose labor supply is not significantly reduced by having more children.

Both the number of daughters and the number of sons exhibit such negative impact on parental labor supply among parents with any ADL limitation, as shown in panel B. In the mean time, sons are more influential than daughters in preventing parents from working in bad health, given the significantly negative coefficients of son ratio. If the within son ratio increases by one (from no son to all sons), parents' probability of working would decrease by 22.5 pp, if they have more than 2 ADL limitations.

In addition, old parents are stratified based on their self-rated health (SRH). Self perception of own health status might be a more crucial determinant of happiness, in the sense that parents would feel worse if they have to work when they consider themselves as very unhealthy. SRH reported as very good, good and fair are classified as good health, and SRH of poor and very poor are classified into poor health.

Results are reported in the last two columns of Table 9. Similar findings are presented: parents with poor health tend to substitute more work with children (-0.067 versus -0.129). The substitution effect between children and own labor is significant in both good and poor SRH groups, whereas it is greater in magnitude in the latter. Such pattern can be found among both daughters and sons. Having one more daughter decreases the probability of working by 10.1 pp among parents with poor SRH, and the number almost doubled from 5.3 pp among parents with good SRH.

Results imply that parents in worse health conditions rely more on children, and that children play a more important role in providing old-age security when parents are more in need. Since LLF significantly reduces family sizes as shown in Table 6, population policies are likely to threaten vulnerable elderly's well being by compelling them to work into bad health. Having more children, especially sons, can potentially improve sick elderly's life satisfaction by reducing their needs to work.

### 6.3.3 Pension

Another crucial determinant of retirement decision is pension benefits, which constitutes the post-retirement income. According to the hypothesized role of children as old-age assets, the retirement decision of those with high pension benefits would be less sensitive to the availability of children. In the sample, around 25% received no pension and subsidy benefit during the past year, and among those who have pension, 50% received more than approximately 1,000 yuan. I thus define three groups based on whether received any pension benefit and the median of positive benefits.

As shown in Table 10, the impact is most evident among parents with no pension. The incidence of being working is decreased by 21.4 pp if there is one more child in the family, among those who have no pension at all. Both daughters and sons reduce parental needs of own labor income. However, having more sons relative to daughters significantly reduces parents' probability of working, which suggests the gender difference in child's impact on parental labor supply.

To account for regional and cohort differences in pension benefits and pension eligibility rules, the community-age group specific median is defined as the local median and compared with individual respondents' pension benefits. The last three columns in Table 10 demonstrate the heterogeneity across relative levels of pension benefits.

Having more children, either daughters or sons, significantly decreases parents' incidence of working, when parents' pension benefits is not higher than peers. Such child impact on labor supply is stronger when parents' pension is lower compared with elder parents with similar age living in the same neighborhood. The heterogeneity is most evident among daughters. Having one more daughter reduces the incidence of parents being working by 8.8 pp when parents receive median level pension benefits, whereas the magnitude of the impact is 37.5% (from 8.8 pp to 12.1 pp) greater among parents with below-median pension.

Parents with no pension have to rely on either labor or child support, thus the substitution effect is most drastic. In addition, when compared with similar-aged elderly in the same community, parents whose pension benefits is not higher than the median are significantly less likely to work if they have more children. The heterogeneous impact presented here provides powerful support to the life-cycle hypothesis that parents work longer to compensate the consequence of having fewer children, especially sons.

The heterogeneity analysis of health and pension provides explanation for the stronger

impact of child quantity on the incidence of parental old-age labor supply among rural residents. Since rural residents have worse health (corr. (rural (I)ADL) = 0.08) and receive lower pension benefits (corr. (rural pension) = -0.38), they are more vulnerable and more in need of child support. Therefore, rural parents with more children successfully prevent themselves from working in old age.

Table 8: Labor Supply Decision by Age Group

	Total	Age			
		60-64	65-69	70-74	75+
<i>Panel A</i>					
Nr. Children	-0.089*** (0.034)	-0.190 (0.126)	-0.205*** (0.071)	-0.128*** (0.035)	-0.074 (0.066)
Son Ratio	-0.091** (0.038)	-0.289** (0.130)	-0.256*** (0.086)	-0.033 (0.066)	-0.110 (0.086)
R-squared	0.116	0.079	-0.019	0.077	0.039
Hansen J test p-value	0.674	0.457	0.803	0.189	0.335
F-stat 1st stage: Nr. Children	22.4	13.2	22.3	16.8	5.5
F-stat 1st stage: Ratio sons	254.6	151.0	306.3	193.3	165.5
<i>Panel B</i>					
Nr. Daughters	-0.068** (0.027)	-0.133 (0.105)	-0.155*** (0.057)	-0.124*** (0.030)	-0.067 (0.059)
Nr. Sons	-0.097*** (0.036)	-0.254 (0.162)	-0.248*** (0.086)	-0.137*** (0.044)	-0.100 (0.079)
R-squared	0.124	0.070	-0.012	0.072	0.016
Hansen J test p-value	0.970	0.330	0.837	0.176	0.462
F-stat 1st stage: Nr. dau	326.2	99.1	162.9	132.8	141.0
F-stat 1st stage: Nr. son	186.0	59.5	83.6	133.8	147.2
Observations	18,453	3,153	5,406	4,689	5,205

*Notes:* \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses. Standard errors are clustered at the provincial level. Other controls, Age FE, Cohort group FE, Year FE, Province FE are included everywhere. STATA command *ivreg2* and the partial option are adopted in above analyses.



Table 9: **Heterogeneous impact across health status**

	Nr. (I)ADL			Self-rated Health	
	No (I)ADL	1-2 (I)ADL	3+ (I)ADL	Good	Poor
<i>Panel A</i>					
Nr. Children	-0.060 (0.046)	-0.110** (0.045)	-0.220** (0.098)	-0.067* (0.035)	-0.129** (0.055)
Son Ratio	-0.047 (0.045)	-0.126* (0.074)	-0.225* (0.123)	-0.072* (0.042)	-0.122 (0.079)
R-squared	0.191	0.025	-0.480	0.174	-0.025
Hansen J test p-value	0.472	0.276	0.724	0.896	0.834
F-stat 1st stage: Nr. Children	18.4	11.4	8.0	27.5	11.3
F-stat 1st stage: Ratio sons	214.2	262.9	202.8	223.8	335.0
<i>Panel B</i>					
Nr. Daughters	-0.047 (0.039)	-0.090** (0.036)	-0.158** (0.063)	-0.053* (0.030)	-0.101** (0.041)
Nr. Sons	-0.061 (0.053)	-0.136** (0.056)	-0.217** (0.087)	-0.078* (0.042)	-0.138** (0.059)
R-squared	0.194	0.019	-0.330	0.176	-0.008
Hansen J test p-value	0.379	0.488	0.542	0.677	0.968
F-stat 1st stage: Nr. dau	226.0	258.0	122.1	284.8	127.1
F-stat 1st stage: Nr. sons	111.2	96.1	114.3	143.2	148.7
Observations	10,273	4,660	3,520	12,054	5,480

*Notes:* The dependent variable is labor support decision at the extensive margin – whether currently working. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses. Standard errors are clustered at the provincial level. Other controls, Age FE, Cohort group FE, Year FE, Province FE are included everywhere. STATA command *ivreg2* and the partial option are adopted in above analyses.

Table 10: **Heterogeneous impact across pension benefits**

	Pension			Local pension		
	Top 50%	Bottom 50%	None	Above median	Equal median	Below median
<i>Panel A</i>						
Nr. Children	0.015 (0.056)	-0.055 (0.052)	-0.214*** (0.074)	0.001 (0.037)	-0.122*** (0.041)	-0.157** (0.064)
Son Ratio	-0.035 (0.052)	0.033 (0.083)	-0.319*** (0.122)	-0.029 (0.047)	-0.192** (0.075)	-0.128* (0.071)
R-squared	0.187	0.087	-0.211	0.177	0.062	0.003
Hansen J test p-value	0.252	0.439	0.400	0.284	0.398	0.685
F-stat 1st stage: Nr. Children	11.6	17.9	13.2	17.3	20.1	12.6
F-stat 1st stage: Ratio sons	147.0	200.4	176.8	170.9	222.5	243.2
<i>Panel B</i>						
Nr. Daughters	0.010 (0.052)	-0.056 (0.035)	-0.134*** (0.051)	0.000 (0.033)	-0.088** (0.035)	-0.121** (0.049)
Nr. Sons	-0.009 (0.067)	-0.043 (0.054)	-0.219*** (0.079)	-0.013 (0.044)	-0.148*** (0.053)	-0.159** (0.064)
R-squared	0.186	0.090	-0.100	0.176	0.066	0.037
Hansen J test p-value	0.341	0.491	0.132	0.322	0.185	0.470
F-stat 1st stage: Nr. dau	139.5	155.5	142.0	230.5	126.6	250.8
F-stat 1st stage: Nr. sons	140.4	131.4	78.6	97.0	137.1	133.0
Observations	6,579	7,069	4,805	7,301	4,484	6,668

*Notes:* The dependent variable is labor support decision at the extensive margin – whether currently working. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses. Standard errors are clustered at the provincial level. Other controls, Age FE, Cohort group FE, Year FE, Province FE are included everywhere. STATA command *ivreg2* and the partial option are adopted in above analyses.

## 7 Discussion

### 7.1 Child support

According to findings above, labor supply seems to be a substitute for children. To test if the impact of having more children, or more sons, works through more child support, I next examine the influence of child quantity and within-family son ratio on parents' received material support from children.

Theoretically, if there is child quantity-quality trade off, the total material support from children is not necessarily higher among larger families. There are evidences showing that, along with the decrease in child quantity is the improvement of child quality (H. Li, Zhang, & Zhu, 2008; Liu, 2014; Oliveira, 2016; B. Li & Zhang, 2017). Children with fewer siblings might be able to receive better human capital investment, and consequently earn more and transfer more to parents in their adulthood. The higher quality of children attenuates the negative impact of having fewer children on parental old-age security. As health, wealth and pension are controlled in all analyses, potential channels through which child quantity affects other family outcomes are largely ruled out.

The first two columns of Table 11 show that having more children (daughter/son) significantly increases the probability and the amount of transfers they received from children. Parents with one more child are 7.5 pp more likely to receive any material transfer from children, and they receive 37.3 higher transfer conditional on receiving transfers, which amounts to 1026 yuan at the median level.<sup>16</sup>

Surprisingly, no gender difference is presented in the total help from children. It suggests that daughters are equivalently important as their male siblings are in providing material support, although greater impact on parental labor supply have been found among sons. There might be a discrepancy between parental perception and the actual transfer, in the sense that parents may consider sons as more reliable although daughters provide similar support.

Regular transfer results presented in the last two columns show slightly different patterns. First, only the incidence of regular transfer is increased significantly by the number of children. Second, the ratio of sons within families has positive impacts on the incidence, which suggests gender differences in terms of regular transfer. The gender difference can also be found in panel B, where the coefficient of the number of sons is much greater than the coefficient of daughters (0.076 versus 0.044). Therefore, although sons do not provide more material transfers in total, they do be more likely to transfer regularly.<sup>17</sup>

### 7.2 Robustness check

To be added.

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<sup>16</sup>The amount value is calculated based on the percentage change and the conditional median of material transfers. i.e.,  $(exp(0.317) - 1) \times 2750 = 1026$ .

<sup>17</sup>I also experimented with net transfer from children, which is the transfers received minus downward transfers to children. This yielded quantitatively and qualitatively very similar results, see Table A5.

Table 11: Material support from children

	Total		Regular	
	Incidence	Amt	Incidence	Amt
<i>Panel A</i>				
Nr. Children	0.075** (0.032)	0.317** (0.162)	0.075** (0.030)	0.112 (0.231)
Son Ratio	0.001 (0.031)	0.066 (0.212)	0.121** (0.048)	0.009 (0.310)
R-squared	0.125	0.058	0.046	0.030
Hansen J test p-value	0.0461	0.353	0.201	0.258
F-stat 1st stage: Nr. Children	22.4	11.6	22.4	16.5
F-stat 1st stage: Ratio sons	254.6	262.9	254.6	186.0
<i>Panel B</i>				
Nr. Daughters	0.068*** (0.026)	0.316*** (0.116)	0.044* (0.023)	0.140 (0.184)
Nr. Sons	0.063* (0.034)	0.343** (0.170)	0.076** (0.036)	0.165 (0.241)
R-squared	0.131	0.055	0.056	0.027
Hansen J test p-value	0.0471	0.395	0.0996	0.274
F-stat 1st stage: Nr. dau	326.2	221.4	326.2	333.6
F-stat 1st stage: Nr. son	186.0	194.4	186.0	135.6
Observations	18,453	14,330	18,453	4,913

*Notes:* \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses. Standard errors are clustered at the provincial level. Other controls, Age FE, Cohort group FE, Year FE, Province FE are included everywhere. STATA command *ivreg2* and the partial option are adopted in above analyses. The amounts of material transfers are natural logarithmic transformed to correct for the right skewed distribution.

## 8 Conclusion

This study investigates the impact of child quantity and child gender composition on parents' old-age labor supply decisions, and examines if children can prevent potentially vulnerable old parents from working into senior age. This paper uses micro data from the China Health and Retirement Longitudinal Study (CHARLS), and adopt a two-stage least square method, by using differential exposure to family planning policies in the early 1970s and the sex of the first born child as instruments, to account for the endogenous fertility decisions. Heterogeneity across differential health conditions and pension benefits of the parent are further explored to test if children are more important when parents are more in needs.

Overall, the results provide strong evidence for children's substitution effect of old parents' own labor supply – having more children significantly reduces parents' probability of working at post retirement age. The impact is stronger among more vulnerable groups, for instance, rural residents, parents with worse health and parents with no pension. Although there might be quality-quantity trade off in children, a larger family size still results in more material transfers received by parents, which provides an explanation for the estimated child impact.

Findings in this paper suggest that population policies potentially threaten the elderly well being by compelling old parents to rely on own labor even if they are in bad health. When social security is not improved sufficiently corresponding to the reduction in fertility led by such policies, parents would lack sources of support in old age and have to work till physically incapable.

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Table A1: Family Planning Leading Group Establishment Year

Leading group	Provinces	Percentage
1969	Guangdong	4.17%
1970	Shandong	4.17%
1971	Gansu, Hubei, Hunan, Shaanxi, Shanxi, Sichuan, Zhejiang	29.17%
1972	Anhui, Fujian, Hebei, Heilongjiang, Inner Mongolia, Jiangxi, Jilin, Liaoning, Yunnan	37.50%
1973	Henan, Jiangsu	8.33%
1974	Guangxi, Qinghai	8.33%
1975	Guizhou, Xinjiang	8.33%
Total		100%

Table A2: Labor supply

Variables	Mean	S.D.	OBS
<i>Currently working</i>			
60-64	0.65	0.48	3,153
65-69	0.58	0.49	5,406
70-74	0.46	0.50	4,689
75+	0.25	0.43	5,205
Total	0.47	0.50	18,453
<i>Condi. on currently working</i>			
Main job			
Weeks/year	32.95	17.80	7,994
Hours/week	36.49	23.68	7,791
All jobs			
Second job	0.10	0.29	7,791
Hours/week	39.45	27.73	7,791

*Notes:* Weeks and hours are logarithmic transformed in regression analyses.

Table A3: Fertility outcomes

Variables	Mean	S.D.	OBS
Number of children	3.55	1.49	18,453
Rural	3.76	1.50	11,407
Urban	3.22	1.42	7,046
Number of daughters	1.68	1.23	18,453
Number of sons	1.87	1.12	18,453
Ratio of sons	0.54	0.28	18,453

Table A4: Annual transfer from children

Variables	Mean	S.D.	OBS
Transfer, total			
Prop.	0.78	0.42	18,453
Amount (Trimmed top 1%)	5,522	15,391	14,330
Transfer, regular			
Prop.	0.27	0.44	18,453
Amount (Trimmed top 1%)	3,992	19,970	4,913

*Notes:* Monetary values are measured in RMB yuan (1000 yuan equals approx. 150USD). Transfers are transformed by natural logarithmic in regression analyses due to the highly skewed distribution. The material transfer includes transfers from grandchildren as well.

Table A5: Net material support from children

	Total		Regular	
	Incidence	Amt	Incidence	Amt
<i>Panel A</i>				
Nr. Children	0.069*	0.337**	0.069**	0.014
	(0.038)	(0.162)	(0.027)	(0.256)
Son Ratio	-0.039	0.146	0.112***	-0.019
	(0.039)	(0.222)	(0.043)	(0.328)
R-squared	0.133	0.029	0.048	0.019
Hansen J test p-value	0.117	0.263	0.471	0.460
F-stat 1st stage: Nr. Children	22.4	12.1	22.4	14.4
F-stat 1st stage: Ratio sons	254.6	241.0	254.6	171.3
<i>Panel B</i>				
Nr. Daughters	0.069**	0.321***	0.043**	0.043
	(0.031)	(0.118)	(0.020)	(0.207)
Nr. Sons	0.051	0.373**	0.076**	0.054
	(0.042)	(0.173)	(0.031)	(0.270)
R-squared	0.134	0.026	0.054	0.022
Hansen J test p-value	0.165	0.332	0.260	0.463
F-stat 1st stage: Nr. dau	326.2	209.7	326.2	236.2
F-stat 1st stage: Nr. son	186.0	160.2	186.0	114.3
Observations	18,453	13,000	18,453	4,631

*Notes:* \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses. Standard errors are clustered at the provincial level. Other controls, Age FE, Cohort group FE, Year FE, Province FE are included everywhere. STATA command *ivreg2* and the partial option are adopted in above analyses. The amounts of material transfers are natural logarithmic transformed to correct for the right skewed distribution.