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## Working Paper 'More Children, More Happiness?': New Evidence from Elderly Parents in China

GLO Discussion Paper, No. 366

**Provided in Cooperation with:** Global Labor Organization (GLO)

*Suggested Citation:* Gao, Yanyan; Qu, Zhaopeng (2019) : 'More Children, More Happiness?': New Evidence from Elderly Parents in China, GLO Discussion Paper, No. 366, Global Labor Organization (GLO), Essen

This Version is available at: https://hdl.handle.net/10419/200243

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## 'More Children, More Happiness?': New Evidence from Elderly Parents in China<sup>\*</sup>

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This version: July 2019

**Abstract:** In this paper, we test the conventional wisdom in developing countries of 'more children, more happiness' by exploiting the cohort and provincial variations of elderly parents exposed to the one-child policy in China. Using nationally representative survey data from the 2015 China Health and Retirement Longitude Survey, the results from both the ordinary least square and two-stage least square methods find that more children can enhance elderly parents' subjective well-being (SWB) measured with either life satisfaction or depression mood. The effect is channelled by raising their satisfaction with children and receiving in-kind transfers from children. The heterogeneity analysis also shows that the effect of children on parents' life satisfaction is heterogenous to sex composition, first-birth gender, and parents' age. Our study provides new causal evidence of the impact of fertility on elderly parents' SWB from a developing economy.

**Keywords:** children; happiness; life satisfaction; elderly parents; depression; China

JEL code: J13,J14,I18,I31

<sup>\*</sup> The authors are very grateful for the helpful comments from Xi Chen, Chao Ma, Guangchuan Zhao, Qin Zhou, Yi Chen, Rufei Guo, and other discussants at the 2018 International Symposium on Contemporary Labor Economics. In the early stage, Zeqian Lin provided excellent research assistant works. All remaining errors are those of the authors.

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#### 1. Introduction

As worldwide populations age, more and more research has explored the elderly's well-being, among which numerous studies have been devoted to examining the relationship between fertility and parents' subjective well-being (SWB) (Buber and Engelhardt 2008; Kruk and Reinhold 2014; Myrskylä and Margolis 2014; Balbo and Arpino 2016; Herbst and Ifcher 2016). Most studies, however, focus on developed countries, while few studies focus on the relationship in developing countries (Glass et al. 2016; Conzo et al. 2017).

Another knowledge gap comes from the methodology. Unlike the intensive studies regarding the effect on parents' physical health, most studies focusing on SWB or mental health reach their conclusions by a simple ordinary least square (OLS) regression, especially from disciplines such as public health, demography, and psychology(Hurt et al. 2006; Kruk and Reinhold 2014). Due to the inadequate attention to the potential endogeneity of the fertility decision of families, the literature hardly establishes a convincingly causal effect of additional children on parents' SWB for the complex mechanism underlying the fertility–SWB nexus.

In this paper, by taking advantage of the exogenous variation in fertility caused by the one-child policy (OCP), we empirically examine the conventional wisdom of connecting happiness to fertility in China, which we call the 'more children, more happiness' hypothesis, with national representative data, the China Health and Retirement Longitude Survey (CHARLS). We find that more children enhance elderly parents' SWB measured with either life satisfaction or depression mood, which is channelled by raising their satisfaction with children and receiving inkind transfers from children. Our study provides new causal evidence of the impact of fertility on elderly parents' SWB from a developing economy.

According to the classical quantity-quality (Q-Q) trade-off proposed by Becker and his associates (Becker 1960; Becker and Lewis 1973; Becker and Tomes 1986), given the resource constraints within a family, families with fewer children tend to have more resources for each child, thereby raising the quality of each child. Therefore, it is theoretically well known that the number of children may have a negative effect on children's outcomes. Nevertheless, it is not easy to reach a conclusion on how the number of children affects the well-being of their parents.<sup>1</sup> On the one hand, parenting children is probably a demanding job, which has to cost substantial financial resources and physical and mental energy. More children inevitably cost more family resources and make parents more stressed. Moreover, childbearing has an important inverse impact on maternal labour

<sup>&</sup>lt;sup>1</sup> If the Q–Q trade-off hypothesis held, there could be a negative effect of the number of children on elderly parents' SWB because parents might be better off with fewer but high-quality children. However, empirical evidence on the Q–Q trade-off is mixed. Some studies present evidence supporting it (Rosenzweig and Wolpin 1980; Hauser and Kuo 1998; Conley and Glauber 2006; Li et al. 2008; Booth and Kee 2009; Li and Zhang 2017; Qin et al. 2017), while others deny it (Black et al. 2005; Angrist et al. 2010; Liu 2014; Zhong 2014) or find it depends on sex compositions in children (Butcher and Case 1994; Conley 2000; Dahl and Moretti 2004; Deschênes 2007) or birth order (Black et al. 2005).

market decisions, especially for mothers, who put more risk on their career. While some may have a break and then return to work when their children grow up, others may ultimately drop out of the labour market. Thus, parents, especially for mother, face larger opportunity costs to have more children. Although the cost of bearing an additional child could be reduced limitedly by a scale effect, it inevitably lowers their life-cycle income and their career achievements, and ultimately their well-being in old age.

On the other hand, parents can treat birthing and parenting children as the savings for their consumption in the future. As returns, they may receive caring and protection from their children when they get old. Therefore, more children probably mean more 'savings' for the future, which can undoubtedly increase the parents' well-being, especially in their twilight years.

Therefore, the effect of the number of children on elderly parents' well-being depends on measuring and weighing both the positive and the negative sides of parenting children. This case is more pertinent in highly developed countries, where childbearing has become optional and financially expensive, and it is often associated with considerable trade-offs in terms of professional careers and pursuing other life goals.

The situation is somewhat different in developing countries. Although worldwide fertility has fallen dramatically since the 1960s, it is still relatively high in many developing countries. One reason is that people tend to hold a belief that more children can bring about more happiness, which is summarised in an old Chinese proverb: 'more children, more happiness (多子多福)'. In China, the traditional culture sees family units as the foundation of society, and prosperity within the family forms a crucial part of this, which often means having multiple children (with an emphasis on boys) to support parents when they are old. The conventional wisdom or philosophy has been passed on across generations for over 1,000 years and has affected some countries profoundly in the East Asia cultural sphere.<sup>2</sup>

From an economic perspective, this wisdom is a reflection of the fact that commercialised or public pension and medical systems are underdeveloped or unavailable in developing countries. It is also consistent with the support bank or old-age security hypothesis of having more children, which is confirmed by Chou (2009) with data from Hong Kong.<sup>3</sup> Besides, children can meet parents' emotional

<sup>&</sup>lt;sup>2</sup> Such values are embedded in some proverbs of Confucianism, such as, 'There are three ways to be unfilial; the worst is not to produce offspring (不孝有三,无后为大)'. Confucianism has affected the cultures profoundly in some countries and regions in eastern Asia, such as Japan, South Korea, Vietnam, Taiwan, and China.

<sup>&</sup>lt;sup>3</sup> Though Hong Kong is a developed economy, unlike many other developed ones, there is no public pension system. Chou (2009) summarises existing theories on the nexus between the number of children and transfers to their elderly parents into three hypotheses: support bank that elderly parents can withdraw savings from early life's investment in children's human capital; altruistic hypothesis that says that parents receive financial supports from children only for their needs; old age security hypothesis that perceives family as a source of capital when financial institutions are less developed.

needs that cannot be marketised, such as the feeling of being surrounded by offsprings. Lee and Xiao (1998) show that children financially support elderly parents when they need their support, which is consistent with the altruistic hypothesis of need-based transfer regarding more children. Since transfers and mental contacts usually contribute to elderly parents' SWB, children are expected to enhance parents' SWB in old age.

Modern economic development has manifested in an improved quality of life and a consumerist culture, and many believe that a lot of traditional family ideologies like 'more children, more happiness' have been fading for decades in China. In addition, since the end of the 1970s, along with the marketised-oriented reform, the Chinese government carried out the strictest birth control in the world, known as the 'one-child policy'. The policy, which was retained for nearly 40 years, not only reduced fertility greatly but also permanently altered the tradition of fertility to some extent.<sup>4</sup>

Taking account of these dramatic changes, it is reasonable to ponder the relationship between fertility and elderly parents' SWB and its change over time in China. More specifically, do Chinese people with more children feel happier than those with fewer children? Or formally, what is the effect of the number of children on their parents' SWB in China? What are the driving forces behind the relationship? We try to answer these open questions in this study.

The remainder of the paper is organised as follows. Section 2 introduces the background of our study, including a brief literature review, the institutional background of the OCP, and our potential contributions. In Section 3, we describe the data, the CHARLS, and our main variables. Section 4 presents our baseline OLS regression and instrumental variable (IV) strategy and their results. We check the robustness of our results in Section 5. Several potential channels and heterogeneity effects regarding the SWB impact of children are reported in Section 6 and Section 7, respectively. Finally, we conclude our paper in Section 8.

#### 2. Background

#### 2.1. Literature

The literature on public health, demography, sociology, and psychology indeed has investigated the association between the number of children and the physical and mental health status of the parents (Buber and Engelhardt 2008). While it seems conclusive that the number of children is adverse to mothers' physical health indicators (Cáceres-Delpiano and Simonsen 2012; Wu and Li 2012; Högnäs et al. 2017; Chen and Fang 2018; Gabel et al. 2018), the evidence of the impact on elderly

 $<sup>^4</sup>$  The data from the National Family Planning and Reproductive Health Survey for 2001 show that the percentage of women preferring to having zero, one, two, and no less than three children accounts for 1.1%, 35%, 57%, and 5.8%, respectively, with an average of preferring to have 1.71 children (Ding and Hesketh 2006).

parents' mental health, especially for the SWB, is far from a consensus (Kruk and Reinhold 2014).

Some find that there is a negative association between the number of children and parents' SWB, especially in parenthood when there is a negative side effect of bearing a child. (Evenson and Simon 2005; Spence 2008; Glass et al. 2016). Others provide evidence that having a child or more children may produce happiness. Specifically, more children are found to be positively related to the mental health of elderly parents (Buber and Engelhardt 2008), the chance of parents receiving necessary and financial support from children (Zimmer and Kwong 2003), and positive moods like perceived happiness or life satisfaction (Myrskylä and Margolis 2014). The effect is more significant for elderly parents whose children appear to protect them against social and economic forces (Herbst and Ifcher 2016).

Some studies also find heterogeneity effects related to children's gender, parents' marital status, and age stage (Shi 2016). Using World Value Survey data for 86 countries, Myrskylä and Margolis (2014) also suggest that the association differs for population subgroups, at different stages of the life cycle, and in different regimes that often provide different social welfares. Glass et al. (2016) confirm that there is considerable variation in the parenthood gap in happiness across 22 OECD countries. These studies may explain why the evidence is so ambiguous that researchers cannot yet reach a consistent conclusion. It indicates that the context is very crucial to the examination of the relationship, and the association between the number of children and elderly parents' SWB in the developing world can be very different from that in developed countries.

However, few studies test the relationship with the data from developing countries. To the best of our knowledge, the only exception is Conzo et al. (2017). They investigate the empirical relationship between fertility and life satisfaction in rural Ethiopia, which is still one of the most deprived areas with very high population growth in the world. Compared with rural Ethiopia, China, with a higher per-capita income and much lower aggregate fertility, could be a good representative of middle-income countries. Therefore, in this study, we use nationally representative data, the CHARLS, to explore the relationship between fertility and elderly parents' SWB in China and provide new evidence of the relationship under the context of a wealthier and lower-fertility developing economy.

The major challenge of identifying the causal effect of the number of children on parents' SWB is that fertility is endogenous to parents' self-selection, which is well recognised in the literature on the economic analysis of families (Becker 1960; Becker and Lewis 1973; Becker and Tomes 1986). While the endogeneity of the number of children is unlikely caused by reversed causality or measurement errors, because elderly parents' SWB cannot determine their fertility several decades ago and they usually know the accurate number of children they have, it is very likely caused by omitting unobservable variables determining both the family size and elderly parents' outcomes. Thus, if the determinants of the number of children are unobservable and correlated with both the number of children and elderly parents' SWB, the OLS estimation without controlling for those unobservable factors will be biased.

However, most of the aforementioned related empirical studies overlook the inherent endogeneity of fertility. As a consequence, they are unable to establish a convincing causal relationship. Only a few try to use quasi-experimental methods to overcome the drawback. Conducting a study with twins from Denmark, Kohler et al. (2005) find that becoming a parent has a substantial positive effect on happiness. Using multiple births and the sex composition of the first two children as two natural experiments to construct IVs, Kruk and Reinhold (2014) estimate the causal effect of children on their elderly parents' depression for Europeans. They find that having one additional child will increase the probability of poor mental health by 10–20 percentage points for women, while there is no evidence for a similar effect for men. Using the firstborn's sex as an IV of fertility to address the endogeneity of fertility, Conzo et al. (2017) investigate the empirical relationship between fertility and life satisfaction in rural Ethiopia. Their results suggest that older men benefit the most in terms of life satisfaction from having a large number of children.

However, it is also argued that IVs at the family level may fail to meet the exclusion restriction. Girls can directly affect their siblings' educational outcomes other than only through the number of children, and they play different roles from boys in fulfilling parents' needs. Twins may have other effects on family size, and children with the same gender are more comfortable sharing their resources, like clothes and toys, and reduce the costs of childbearing, which also determine how many resources are enjoyed by each child and thus the quality of children (Conley and Glauber 2006). Some groups of people are more likely to have multiple births than others, indicating that twins are also not very exogenous (Angrist et al. 2010; Angrist and Pischke 2014). The son preference, which is more likely to occur in developing countries but also exists in developed countries (Dahl and Moretti 2004), may make the effect on family size when the first two children are sons different from that when the first two children are daughters. Moreover, a large number of empirical studies (Parish and Willis 1993; Butcher and Case 1994; Garg and Morduch 1998; Conley 2000; Dahl and Moretti 2004; Deschênes 2007) have shown that the sex composition directly affects children's outcomes, including educational attainment.

Due to these limitations in exploring family-level exogenous shocks as an IV of family size, a burgeoning strand of literature uses more exogenous variations of the fertility caused by natural experiments, such as the arrival of new birth control technologies or the implementation of birth control policies by governments, to identify the causal effect of fertility on outcomes of children or parents (Clarke 2018). Among them, China's birth control policy, especially the OCP, which could be the largest and strictest in modern human history, has be seen as an excellent natural experiment(Zhang 2017).

While it has been used to identify the causal effect of fertility on children's or parents' outcomes in terms of education, labour market performance, and health, ,

it is still not used to identify the causal effect of fertility on parents' SWB (Zhang 2017).

## 2.2. One-Child Policy and Empirical Strategies

The OCP introduced at the end of the 1970s, along with the marketised-oriented reform. Under this policy, which later became a law in China, a married couple was generally entitled to have, at most, one child. The policy, which was retained for over 40 years, not only reduced the fertility rate sharply but also affected Chinese society profoundly in many aspects.

Although the OCP was formally implemented in 1980 by the central government and applied throughout China, birth control policies varied significantly over time, between rural and urban areas, and across regions, provinces, ethnicities, and even entities (Scharping 2003; Wang et al.2017; Zhang 2017). The variations provide exogenous shocks on fertility behaviours and are used to identify the causal relationship between fertility and children's or parents' outcomes in many studies.<sup>5</sup>

While extant literature has broadly used the OCP as a natural experiment to identify the effect of fertility on many maternal or child's outcomes, it has not been used to test the 'children-happiness' hypothesis. To the best of our knowledge, the only exception was made by Chen and Fang (2018). They tried to evaluate the long-term consequences of China's family planning policy on the elderly's well-being measured with family consumption and life-satisfaction.

Our study has one crucial difference from Chen and Fang (2018) in that the policy they tried to evaluate is not the OCP since the end of the 1970s, but the 'Later, Longer, and Fewer' Campaign in the early 1970s carried out by the Chinese central government. It is noted that while the birth control campaign started in the 1970s, it was technically voluntary and significantly less coercive than the OCP, which was enacted throughout China. Another study also found that fertility reduction in the 1970s was not mainly caused by that campaign, which explains only 28% of the reduction and contributed more to sex selection (Babiarz et al. 2018). So our identification strategy with OCP may create more exogenous elements and produce larger variants in the fertility of each cohort than Chen and Fang (2018).

The literature uses several empirical methods to measure the variations of fertility, which are summarised as follows.<sup>6</sup> The first compares the birth behaviour of Chinese women before and after 1979 (or 1980), when the OCP was formally implemented. Zhong (2014) and Qin et al. (2017) further upgrade the method to conduct a fuzzy regression discontinuity design and identify the effects of fertility

 $<sup>^5</sup>$  Please refer to Wang et al. (2017) and Zhang (2017) for their brilliant literature reviews on this topic.

 $<sup>^{6}</sup>$  The following text in the subsection heavily borrows from Zhang (2017), who discusses in detail four methodological approaches used in the literature of the OCP and its consequences. We update and adjust the content by covering more recent studies.

on children's human capital and health, respectively. Specifically, they used the change of the ratio of families with a single child to all families around this starting point as the jump in the regression discontinuity design.

The second approach exploits the cross-sectional and temporal variations on fines or the eligibility for a second birth. Using both variables and their interactions as IVs for fertility, Liu (2014) examine the effect of an additional child in a family on child height and education outcomes. Huang et al. (2016) and Liang and Gibson (2018) also use a similar approach to studies that misreported twins' and children's nutritional intake, respectively.

The third approach explores variation by the differential length of exposure of different birth cohorts to the OCP and the intensity of the implementation across different regions or ethnic groups. The first logic of the variations is that the older the mother was at the time of the policy implementation, the more likely she was to have completed her fertility, and thus the less likely she was affected by the policy. The second logic comes from the variation of the implementation of the OCP between rural and urban areas, across regions and provinces, and between Han and ethnic minorities. Wu and Li (2012) construct the intensity of each cohort exposed to the OCP and used its interactions with dummies of Han ethnic and urban hukou as IVs of the number of children to identify the effect of family size on maternal health. Li and Zhang (2017) also calculate the excess fertility rate (EFR) at the prefectural level to measure local OCP enforcement intensity. They separate prefectures with the intensities into two categories — 'strict' and 'nonstrict' regions and 1982 and 1990 Chinese census data - and constructed a simple difference-in-differences framework to test the Q–Q theory in terms of children's education.

In this paper, we propose a new method to explore the variation of the OCP, a combination of the differential length of exposure of different birth cohorts to the OCP and the fine or eligible differences in excess births across provinces. Specifically, we introduce three sources of exogenous shocks on the fertility of mothers, the intensity of different cohorts exposed to the OCP, the tightness of different provinces in enforcing the birth limit of the OCP, and the change of that tightness over time.

Our IV has the advantage that it has more variations than those using only one or two sources of those exogenous shocks and thus captures the intensity of these exposures better, thereby reducing the likelihood of suffering a weak instrument while maintaining the exogeneity of our IV to omitted variables.<sup>7</sup>

<sup>&</sup>lt;sup>7</sup> Although Li et al. (2011) and Zhang (2017) argue that the spatial and temporal variation of the OCP may be endogenous, the instruments may not suffer serious endogeneity under the settings of our paper. We will discuss the detail of our IV strategy in Section 4.

### 2.3. Our Potential Contributions

We potentially contribute to the literature on the knowledge of the childrenhappiness nexus in the following aspects. First, our study provides new causal evidence of the relationship under the context of a middle-income and lowerfertility developing economy rather than developed or low-income countries. Our empirical results from both the OLS and two-stage least square (2SLS) methods show that more children increase elderly parents' life satisfaction and reduce their likelihood of reporting depression moods. The finding is consistent with Chen and Fang (2018) in that the 'Later, Longer, and Fewer' Campaign, the family planning policies implemented before the OCP in China slightly promote elderly parents' physical health and lead to more severe depression symptoms.

Second, we propose a new IV for fertility that combines the differential length of exposure of different birth cohorts to the OCP and the fine or eligible differences in excess births across provinces. The IV captures more exogenous elements and produces more significant variants in the fertility of each cohort, but suffers fewer endogeneity threats from family levels.

Third, we also examine several channels by which children improve the SWB of elderly parents. Specifically, we find that elderly parents with more children are more satisfied with their children and receive more net transfers from their children. The positive effect of the number of children on elderly parents' life satisfaction is highly consistent under various robustness checks. While both sons and daughters enhance elderly parents' life satisfaction, sons decrease the likelihood of their elderly parents' depression mood.

Last but not least, our results also can be used to evaluate China's birth control policies, which have lasted for over four decades, through the lens of the elderly's SWB. Although it is agreed that the social protections for the elderly have been greatly improved during the past decades in China, beliefs among elderly Chinese preferring more offsprings persist over time. Instead, they seem to play essential roles in shaping their personal and social values regarding happiness. While financial supports are still important factors in bridging the children–happiness nexus and could be replaced by pensions, the affections created by mental interactions behind them and across generations would never be marketised. Thus, our empirical results support the compelling need to abolish China's family planning policy to enhance older people's life satisfaction.

### 3. Data and Variables

### 3.1. Data

The data are taken from the CHARLS, which is targeted to investigate the health, social security, and family information of adults older than 45 and aims to provide high-quality survey data for an interdisciplinary study on ageing issues of China. The survey was first conducted in 2011, covering 150 counties, 450 villages, and

over 10,000 households.<sup>8</sup> The questionnaire consists of detailed contents on demographic backgrounds, family information, health status and functioning, health care and insurance, work, retirement and pension, household income, expenditures and assets, and housing characteristics. For our purpose, we used the data from the 2015 survey by matching the respondents' information with their children's averages or constructed characteristics.

Specifically, we collected the following information on the respondents: year of birth, gender, education levels, *hukou* status, ethnicity status, and rural or city birthplaces from respondents' demographic background information; their received income from their individual income information; and life satisfaction, health satisfaction, satisfaction with children and marriage, and mental health such as the feeling of depression, hope, happiness, loneliness, and desperation, from the health status and functioning section.

We also collected their children's information regarding their average levels of income and education; the number of children, sons, and daughters; gender structure; health status; marriages; housing; living with children; and within-household transfers from the family section.

Since this paper tests the impact of children on elderly parents' SWB, we dropped observations from respondents younger than 60, <sup>9</sup>and further matched the missing values of respondents' education level and *hukou* status in the 2015 survey with the survey data from 2013 and life history survey conducted in 2014. Moreover, since ethnic minorities are free from the OCP, we also dropped observations from minorities. As a result, we constructed cross-sectional data with 8,890 respondents from 5,670 households. However, the observations vary across variables due to missing values in some variables (see also Appendix A1 for details on data cleaning).

### 3.2. Variables

The dependent variable is the happiness of parents aged 60 and above. The literature has used both objective and subjective measures of well-being, while it has been emphasised that SWB is more essential than objective well-being (Diener et al. 1998; Ng 2008). It is not hard to conceive that people with the same physical conditions differ significantly in SWB in terms of mental health, life satisfaction, and perceived happiness. Hence, we use indicators regarding SWB to measure parents' happiness. Specifically, we mainly use two variables to measure parents' happiness: life satisfaction and depression mood, two opposite indicators of SWB.

The perceived life satisfaction is a five-scale variable ranging from 1 (completely satisfied) to 5 (not at all satisfied). To make a larger value indicating a higher level of life satisfaction, we revised the original variable in the survey into a new one, with 1 representing the lowest level of life satisfaction and 5 denoting the highest

<sup>&</sup>lt;sup>8</sup> For detailed information about the CHARLS, please refer to http://charls.pku.edu.cn/en.

<sup>&</sup>lt;sup>9</sup> In the section of robustness check, we extended the analysis to the people aged over 55.

level of life satisfaction. Following Conzo et al. (2017), we treat the scale as cardinal in order to use a simple linear model and IV method and avoid using ordered latent response models, which can be unnecessarily complex to estimate, especially under the IV settings in our studies.

The depression mood of parents is constructed with 10 questions regarding the perceived days with positive and negative moods during the last week. These questions include 'I was bothered by things that don't usually bother me'; 'I had trouble keeping my mind on what I was doing'; 'I felt depressed'; 'I felt everything I did was an effort'; 'I felt hopeful about the future'; 'I felt fearful'; 'My sleep was restless'; 'I felt happy'; 'I felt lonely'; and 'I could not get "going". The respondent is asked to choose among four perceived frequencies: 'rarely or none of the time (less than one day)'; 'some or a little of the time (1–2 days)'; 'occasionally or a moderate amount of the time (3–4 days)';and 'most or all of the time (5–7 days)'. For negative moods, the frequencies are assigned respectively with values of 0, 1, 2, and 3, while for positive moods such as 'I felt happy', they are assigned with values of 3, 2, 1, and 0.

For each respondent, we calculate the sum of the 10 indicators and thus construct a variable regarding a depression scale, which ranges from 30, the severest depression scale, to 0, the lowest depression scale, in our case. Such method of measuring and evaluating depression is developed by the Centre of Epidemiological Survey as Depression Scale (CES-D) (Radloff 1977) and is used and simplified in the CHARLS, according to Andresen et al. (1994), as a measure of SWB. Respondents are usually treated as 'suffering from depression' if their scale is larger than 9. Thus, we construct a dummy variable on whether the respondent suffers from depression as an additional measure of her or his SWB.

The explanatory variable of our interest, the number of children, is first measured with the total number of children reported by the respondent, including sons and daughters who are alive. It is also measured by the number of sons and daughters, respectively, through which we can observe the heterogeneity effects of the number of sons and daughters on parents' happiness. Additionally, the sex composition of children is also constructed as three-category dummy variables — only having a son(s), only having a daughter(s), and having both a son(s) and a daughter(s) — and a dummy variable on whether the first birth is a girl, which can be used to observe the effects of sex composition of children on parents' happiness. Moreover, the intensity of mothers exposed to the OCP, which explores both the cohort and provincial variations in fertility controls, is constructed as an IV of the number of children and is used to identify the causal effect with 2SLS estimation (see Section 5 for details on this variable).

Control variables include two categories: parental controls and children controls. The parental controls include the parents' gender, age, marital status, *hukou* status, China Communist Party (CCP) membership, individual income, education levels, alcoholic beverage consumption, and living place. The children controls include the averages of children's income and education years; dummies on whether having one child or more is reported as 'poor health', 'never married', or 'do not own a house'; and a dummy on whether the parents had children who passed away.

The descriptive statistics of the variables mentioned above are reported in Table 1(see Appendix A2 for details on these variables). The observations range from 8,890 to 8,046, indicating missing values in some variables. The respondents have an average life satisfaction of 3.4 and an average depression mood of 0.35, indicating that 35% of them are diagnosed as having a depression mood. Meanwhile, they have, on average, about three children, fewer than two sons, and 1.5 daughters. About 77% of respondents have both sons and daughters, and about half of respondents have a first-birth girl. The intensity of mothers exposed to the OCP ranges from 0 to 3.53, with a mean of 0.736. We also see that half of the respondents are mothers. The respondents are, on average, 68.6 years old, mostly have a spouse who is alive, and have a low education level of primary school. Respondents who have a rural *hukou*, have a CPC identity, drink, and live in rural areas account for about 80%, 12%, 32%, and 72%, respectively. In terms of their children, the summary statistics show that they, on average, received about nine years of education, with an average income level of about five. Less than half of them have their parents living with them, and they are in poor health, unmarried, and do not own a house or passed away, taking, respectively, about 18%, 12%, 50%, and 18%.

#### < Insert Table 1 here.>

In Table 2, we further report the summary statistics of parental SWB by the number of children that elderly parents have. It shows that while elderly parents with more children on average, have a higher level of life satisfaction, they, except for those without a child, have a lower likelihood of depression. However, we cannot infer the impact of fertility on parental SWB, since elderly parents with different numbers of children always differ from each other in other parental or children-level covariates.

### 4. The Number of Children and Parental Happiness

#### 4.1. Baseline Results

To test the children-happiness hypothesis, that is, the effect of the number of children on elderly parents' SWB, we first construct the following empirical model that will be estimated by a simple OLS method:

$$SWB_{ihm} = \alpha_0 + \alpha_1 No\_chd_{ihm} + \beta X_{ihm} + \gamma_m + \varepsilon_{ihm}(1)$$

Where *SWB* is the measure of parents' happiness. *No\_chd* is the number of children. *X* is a vector of control variables at both the parent level and the children level, which is the same for their parents.  $\gamma_m$  is the community fixed effects, which

we use to control for unobservable factors that are the same within a community but vary across communities. Subscriptions *i*, *h*, and *m* denote parents, household, and community, respectively.  $\varepsilon$  is the error term. Because elderly parents from the same household usually have the same number of children, we cluster the standard errors at the household level to conduct robust estimation.  $\alpha_0$ ,  $\alpha_1$ , and  $\beta$ are parameters to be estimated, among which  $\alpha_1$  is of our interest, which indicates how an additional child will affect parents' SWB. If it is statistically significant and positive, we would like to say that the children-happiness hypothesis is verified.

The baseline results from OLS estimation are reported in Table 3. In columns (1)– (4), we control nothing, parental characteristics, child-level covariates, and both parental and children's characteristics, step by step. The results in these columns show that the number of children is positively associated with the life satisfaction of parents. The positive effect tends to increase as either parental covariates or child-level covariates are controlled for (see columns (1)–(4)). While controlling for parental characteristics changes the estimate little, controlling for child-level covariates substantially increases it, indicating that child-level covariates are more likely to bias the effect of children on their elderly parents' life satisfaction. This might be because the quality of children is an important determinant of elderly parents' life satisfaction, which is also associated with the number of children, as proposed by the Q-Q trade-off hypothesis. Omitting child-level variables would bias down the real effect of children on elderly parents' life satisfaction (see columns (2)-(4)), but omitting parental characteristics and community fixed effects only change the estimate a little (see columns (1) and (2)). The OLS results show that one more child is associated with about an 0.02 to 0.04 level of increase in elderly parents' life satisfaction.

The rest of the columns (columns (5)-(7)) in Table 3 report the results when the dependent variable changes into whether the parents have a depression mood. In contrast with that in Table 2, we find that the number of children is negatively associated with that likelihood, which is statistically significant after controlling for child-level covariates (see columns (6) and (7)). One more child is associated with one percent lower likelihood of having depression. These results also indicate that omitting child-level covariates biases down the role of children in reducing parents' depression mood.

Among other covariates, we find that their impacts on elderly parents' SWB are mostly consistent with our intuitions. For example, mothers have a lower level of life satisfaction but a higher likelihood of suffering from depression than fathers. Parents' age, marital status, and income are positively associated with their life satisfaction and negatively associated with their depression mood. However, elderly parents with rural *hukou* and living in a rural area have a larger likelihood of getting depression but have no difference in life satisfaction, compared with those with urban *hukou* or living in an urban area. Another surprising result is that parents with higher education levels tend to be less satisfied with their life. Children's characteristics are also related to elderly parents' life satisfaction and depression mood. Children's average education years and income levels are enhancing factors of parents' SWB, while having at least one child with poor health is detrimental to their SWB. Having an unmarried child or a child without a house also contributes to a lower level of life satisfaction. Finally, parents having a child who died have about a 6% higher likelihood of getting depression than those without a child who died.

<Insert Table 3 here.>

#### 4.2. The Number of Children and Parental Happiness: IV Estimation

#### 4.2.1 IV Strategy

Among the three causes of endogeneity: reversed causality, measurement errors, and omitted unobservable variables, our study is more likely subject to the third cause of endogeneity. The reversed causality does not happen because the present happiness cannot affect the number of children that parents determined to have several decades ago. Besides, parents are less likely to report the number of children with systematical errors, and thus, measurement errors are also less concerning. However, the number of children may be endogenous due to some omitted variables, which determine the past fertility and parents' present happiness simultaneously. Then the estimated effect would be biased. Given the Q–Q trade-off, the quality of children is related to the number of children. However, it is also related to the SWB of elderly parents because high-quality children can provide better caring and protections for their parents. Therefore, as displayed in Table 3, failure to control for child-level covariates has down-biased the effect of children on their elderly parents' SWB. While child-level covariates can control the bias from child quality, that caused by other unobservable variables cannot.

To further address such endogeneity, we use the instrumental variable method. The candidates of IVs for family size used by the literature include twin births (Rosenzweig and Wolpin 1980; Li et al. 2008), the sex composition of children (Angrist and Evans 1998; Angrist et al. 2010; Angrist and Pischke 2014; Kruk and Reinhold 2014; Conzo et al. 2017; Gabel et al. 2018), and the variation in the intensity of various cohorts or population groups exposed to the OCP (Wu and Li 2012; Liu 2014; Li and Zhang 2017) or family planning policies (Chen and Fang 2018). We also exploit the variations of different cohorts in the intensity of exposure to the OCP to instrument for the number of children. Although twin births and the sex composition of children are somewhat exogenous and positively correlated with the number of children, they may have direct effects on elderly parents' happiness, thereby violating the exclusion restriction of a valid IV, as argued or shown by empirical studies (Conley and Glauber 2006).

Specifically, we explore the cohort and provincial variations of mothers in exposure to the OCP as an exogenous shock to the family size of elderly parents. Due to the implementation of the OCP in 1979, Chinese families entered into an era of strict family planning. The permitted number of children for each parent differs according to their *hukou* status, ethnicity, or the province they live in. A

one-child limit is strictly enforced for urban residents; a 1.5 child limit is mandated to rural residents, which permits rural parents to have a second child if the first birth is a girl; a limit of two or three children is enforced for remote provinces; and there is no limit for Chinese ethnic minorities and those employed in dangerous occupations (Ebenstein 2010). Parents who determine to have an excess child and do have one have to pay a large amount of money to get an identity for this child. The monetary punishment, which is also known as the fine of excess birth, varies across provinces and over time, ranging from an amount of only 5% of the annual household income in Anhui province in 1979 to five times the annual household income in Beijing, Liaoning, and Guizhou in the years after 1991, 1997, and 1998, respectively (Scharping 2003). The variation in the fines measures the cost of having an excess birth and thus the tightness of enforcing the birth limit of the OCP.

Meanwhile, parents from different age cohorts also differ remarkably in terms of exposure to the OCP, which is used by Wu and Li (2012) to construct an IV for family size. They calculated the intensity of exposure to the OCP as the ratio of the years of mothers from each cohort exposed to the OCP in the total fertility period, that is, (55-age\_at\_1979)/(55-18). We also explore such variations of exposure regarding age cohorts but follow the reproductive age defined by the Chinese National Family Planning Commission (Ding and Hesketh 2006) to confine the reproductive age of females to within 16 to 49.<sup>10</sup> Females below 16 in 1979 were exposed fully to the OCP with the variant intensity measured by the fine of excess birth across provinces, while those above 49 are free from the birth limits of the OCP. Thus, to explore the variations of different cohorts from different provinces in exposure to the OCP, we calculate the following variable:

$$Expo\_OCP_{cp} = \begin{cases} 0, if \ age_{c,1979} > 49; \\ \sum_{y=1979}^{y(age_{c}=49)} fine_{py}I(c \in p)/35, if \ age_{c,1979} \in [16,49]; \\ \sum_{y=1979}^{2014} fine_{py}I(c \in p)/35, if \ age_{c,1979} < 16. \end{cases}$$
(2)

Where  $Expo_OCP_{cp}$  denotes the intensity of a mother exposed to the OCP for cohort c in province p.  $age_{c,1979}$  is the age of cohort c in 1979, the first year implementing the OCP. y denotes the year, and  $fine_{py}$  is the fine that parents have to pay for an excess birth in province p in the year y.  $I(c \in p)$  is an indicator function that takes the value of 1 if cohort c is from province p and 0 otherwise. A larger value of  $Expo_OCP$  indicates that the OCP exerted more restrictions on elderly mothers' fertility. Thus, the fertility of females aged over 49 in 1979, would not be affected by the OCP; for females aged between 16 and 49 in 1979, their fertility was partially affected by the OCP, depending on both the number of years that their fertility period was covered by the OCP and the tightness of implementing that policy in the province in which they resided; and for females younger than 16 in 1979, they were exposed fully to the OCP, and the variation of

<sup>&</sup>lt;sup>10</sup> Females in those days with poor socioeconomic conditions were more likely to complete their fertility at 50 years old, although some females might be able to conceive at an even older age. It should be noted that such minor changes in the definition of age groups that are entirely or entirely not subject to the OCP do not undermine our empirical results.

the intensity of exposure to the OCP is determined only by provincial differences in the fine for each excess birth. We assign mothers' intensity of exposure to the OCP to their respective husband according to the household ID.

The provincial and temporal variations in the fine of each excess birth are taken from Ebenstein (2010), who constructed them with the data from Scharping (2003) and used them to measure the intensity of each province in implementing the OCP from 1979 to 2000 and test the 'missing girls' hypothesis, that is, the role of the OCP in the increasing sex ratio of births in Chinese families. The fine is calculated as the number of years of household income that parents have to pay for an excess birth, which changes across provinces and over some years. Since the OCP seldom changed since 2000, we extend the fines for an excess birth in 2000 to the rest of the years before the survey used in our paper.

Thus, similarly to Chen and Fang (2018), we also employ the variation of exposure to the birth control policies at both the cohort level and the provincial level to explore the exogenous shocks to the fertility of elderly parents several decades ago. However, we use the exogenous shocks from the OCP and the punishments of each province rather than those from family planning policies in the earlier 1970s and fertility rates of provinces in 1969. Moreover, our IV strategy also differs from Li and Zhang (2017), Liu (2014), and Wu and Li (2012) in that ours combines age cohort, provincial, and temporal variations in exposure to the OCP, while theirs capture only one or two aspects of such variations.

We first graph the changes in the intensity of average exposure to the OCP across prefectures in Figure 1.<sup>11</sup> Elderly respondents in Liaoning, Guangdong, and Guangxi provinces have, on average, an intensity of exposure to the OCP that is larger than 1, followed by those in Hebei, Jiangsu, Hubei, Fujian, and Yunnan provinces with a mean ranging from 0.8 to 1. The mean of the intensity of exposure in most provinces falls in the interval from 0.6 to 0.8, and the six provinces of Jilin, Tianjin, Shandong, Anhui, Shaanxi, and Sichuan have the lowest class of means in that intensity.

### < Insert Figure 1 here.>

Figure 2 further graphs the differences of each age cohort exposed to the OCP and the number of children they have and their life satisfaction. We find that the number of children raised by each cohort, which is scaled in the left axis, decreases with the intensity of the exposure to the OCP, which is scaled in the right axis. In other words, the younger the parents were in 1979, the lower the number of children they have and the more intensely they were exposed to the OCP. Thus, the intensity of exposure to the OCP for each cohort is highly but negatively correlated with the number of children.

< Insert Figure 2 here.>

<sup>&</sup>lt;sup>11</sup> Since the CHARLS covers only 28 provinces, there are three provinces in China that do not have data on that intensity, namely Ningxia, Hainan, and Tibet.

Figure 3 further exemplifies the differences in two provinces, Jiangxi and Anhui, which are spatially connected but have a sharp difference in the monetary punishment for excess birth. According to Ebenstein (2010), the monetary punishment of excess fertility in Jiangxi province before and after 1997 is respectively 1.23 times and three times the annual household income, while that in Anhui province is only 0.65 times the annual household income. Thus, since cohorts in Jiangxi province suffer more from the OCP than those in Anhui province, we expect that elderly parents in Jiangxi have fewer children than those in Anhui, especially those who were younger in 1979. Figure 2 is consistent with such expectation that there is a sharp gap in the intensity of exposure to the OCP between the cohorts in the two provinces, and females in Jiangxi in 1979 on average had fewer children than those in Anhui. Parents older than 32 do not show any apparent differences in the number of children they have, because most parents aged over 32 at that time had finished their fertility and thus suffered little from the OCP.

< Insert Figure 3 here.>

While the intensity of exposure to the OCP is negatively associated with the number of children of the elderly parents, it is mostly exogenous to the omitted variables at the parental and household levels. The OCP and the fine for excess birth are determined by governments mostly at the provincial level and above, producing exogenous shocks to the fertility of each parent.

To exploit the exogenous shocks from variations in exposure to the OCP and to identify the causal effect of the number of children on elderly parents' SWB, we conduct the following 2SLS estimation:

$$SWB_{imcp} = \alpha_{10} + \alpha_{11}No\_chd_{imcp} + \beta_1 X_{imcp} + \gamma_{1m} + \varepsilon_{1imcp}(3-1)$$
$$No\_chd_{imcp} = \alpha_{20} + \alpha_{21}Exp\_OCP_{cp} + \beta_2 X_{imcp} + \gamma_{2m} + \nu_{2imcp}(3-2)$$

where equation (3-1) is the second stage estimation, equation (3-2) is the first stage estimation, and the variables here are the same as those in equations (1) and (2). Since the intensity of exposure to the OCP, that is, *Exp\_OCP*, is the same for the same cohort in the same province, we cluster the standard errors at the provincial level.

Moreover, since our identification strategy, which includes age cohort variations in exposure to the OCP, also means that the OCP takes effect through the age of residents — that is, it exerts a larger fertility reduction effect on the younger the intensity of exposure is thus highly correlated with the age of elders. We remove the age of parents from the list of control variables to avoid bad control.<sup>12</sup>

<sup>&</sup>lt;sup>12</sup> The variation of different cohorts exposed to the OCP constructed with the method proposed by Wu and Li (2012) leads to a correlation coefficient of it with the age of elderly parents by 0.99, while adding further provincial variations regarding the fine for excess birth results in a correlation coefficient of over 0.6. It can also be shown that once the age is controlled for in the right side of our estimation, the positive effect of the intensity of exposure to the OCP on the

Since ethnic minorities are not subject to the OCP, we drop observations from minority parents.

### 4.2.2 IV results

Table 4 reports some regression results related to the IV method, among which column (1) is the first-stage estimation. As expected, the number of children is indeed negatively associated with the intensity of exposure to the OCP, and the estimate is significant at the 1% significance level, which justifies the relevance of our IV, the intensity of exposure. Further, the F-statistic in the first stage is as large as 58, which indicates that the IV cannot be weak.

As noted by Angrist and Pischke (2008), the reduced-form estimation is more likely unbiased than 2SLS and is proportional to the real effect of interest. To further test the validity of our IV, we also report the reduced-form results in columns (2) and (3). The results show that parents exposed more to the OCP have a lower level of life satisfaction and a higher likelihood of feeling depressed, and both are significant at the 5% level of significance. This coincides with the result from 2SLS estimation and confirms that our IV, the intensity of exposure to the OCP, is relevant enough to be a valid instrument of fertility.

Finally, the two-stage estimate, which is the ratio of the reduced-form estimate to the first-stage estimate, is presented in columns (4) and (5), from which we find that more children contribute to enhancing elderly parents' SWB. Specifically, having one additional child increases the life satisfaction of elderly parents by about 0.1 (see column (4)) and reduces their likelihood of being depressed by about 3% (see column (5)). Thus, the effect of the number of children on life satisfaction from the 2SLS method is estimated at about 3.8 times that of the OLS method. Meanwhile, the effect on depression mood from the 2SLS method is also more substantial, about three times that of the OLS method. These results indicate that omitting unobservable factors will bias down the estimate of the number of children.

< Insert Table 4 here.>

### 5. Robustness Checks

### 5.1. Alternative Measures of SWB

We first check the robustness of our previous results using alternative measures of SWB. We use the life satisfaction of elderly parents from the 2013 CHARLS and expect to attain a consistent result that children contribute to elderly parents' life satisfaction. As shown in columns (1) and (2) of Table 5, which respectively use OLS estimation and 2SLS estimation with the intensity of mothers exposed to the

number is statistically insignificant, as a result of multicollinearity.

OCP as the IV, we again find a positive effect of children on the life satisfaction of elderly parents. However, now the estimate with OLS and 2SLS estimations is 0.0446 and 0.147, respectively, both larger than that in 2015.

Since the 2013 CHARLS does not contain questions on the moods of respondents that can be used to construct a CES-D measure of the depression, we use CES-D scores rather than a dummy variable on depression mood as the measure of mental health. The result is reported in column (3) of Table 5. We again find with 2SLS estimation, where the intensity of exposure to the OCP is used to instrument for the number of children, that the number of children tends to reduce depression, although the effect is not statistically significant. Finally, we also use an indicator of physical health, that is, whether or not the respondent has lost all her/his teeth, as the dependent variable and also the intensity of exposure to the OCP as the IV, to see the effect of children on the physical health of elderly parents. The result in column (4) of Table 5 shows that more children increase the likelihood of elderly parents losing all their teeth, which is consistent with the finding of Gabel et al. (2018), although they use twin births and the sex composition to construct an IV for family size. The opposite effect of children on SWB and physical health seems misleading, while it is arguable considering that the latter is not a measure of SWB.

<Insert Table 5 here.>

#### 5.2. Subsamples

We further check the robustness of the previous result using some subsamples. One may also wonder how the previous result would change if respondents who are not so old are included, since China is still a developing country and the life expectancy of elderly parents is far shorter than that of newborns. Thus, 55 rather than 60 might be a better threshold age to define older people. The results from 2SLS estimation, also using the intensity of exposure to the OCP as an IV of the number of children, are reported in the first two columns of Table 6. Again, we find evidence that more children are associated with a higher level of life satisfaction, and the estimate is comparable to that with the data from parents aged over 59. However, the impact of children on depression mood is statistically insignificant, although it is still negative. These results suggest that children contribute more to parents' mental health as they get much older, while their role in forming parents' perceived life satisfaction changes little.

The second concern is that the OCP is usually strictly implemented to urban residents, permitting them to have only one child, while rural residents enjoy less strict birth control policies and prefer to have more children, and they indeed have more children. Thus, the number of children varies more in rural households than in urban households. Columns (3) and (4) report the impact of the number of children on life satisfaction and the depression mood of elderly parents, respectively, using the data from rural parents. We find consistent evidence from 2SLS estimation that children contribute significantly and positively to the life satisfaction by 0.0923 (see column (3)) and improve rural parents' mental health by reducing their likelihood of getting depressed by 4.5% (see column (4)).

The last robustness check with a subsample uses only the observations from mothers. Since the OCP is more comfortable to target the female than the male and our intensity of exposure to the OCP is constructed according to mothers' age, using the observations from mothers may identify the causality better. The 2SLS results using observations of elderly mothers are shown in columns (5) and (6) of Table 6, from which, respectively, we find that children increase mothers' life satisfaction by 0.0958 and also reduce their depression mood by about 3.2%, both at the significance level of 1%.

< Insert Table 6 here.>

#### 5.3. An Alternative IV

To test the robustness of our empirical results, we finally use an alternative IV strategy by exploiting the variations of exposure to the OCP resulting from age cohorts and the average number of children in each province that is permitted. This IV is constructed by interacting two variables, the extent of different cohorts exposed to the OCP, which is calculated with the method proposed by Wu and Li (2012), but we constrain the cohorts that are fully and fully not subject to the OCP at the age of 16 and 49, respectively, and the average number of children in each province that is permitted by the OCP between 1979 and 2014, which is taken from Ebenstein (2010).

We can also see that the interaction variable is also negatively correlated with the number of children (see column (1) of Table 7) and has a significant effect on the life satisfaction and the likelihood of depression of elderly parents in the reduced-form estimation (see columns (2) and (3)). As a consequence, we find again that more children increase elderly parents' life satisfaction by 0.0944 (see column (4)), with a size slightly smaller than that in Table 4. Meanwhile, it is also found that children contribute to reducing their parents' likelihood of getting depressed by 3.7% (see column (5)), but now the effect is a bit larger than that in Table 4.

< Insert Table 7 here.>

Thus, we find consistent evidence that children contribute to improving elderly parents' SWB, where the increase in parents' life satisfaction is about 0.1 and the increase in mental health measured with the likelihood of getting depressed ranges from -3% to -4.5%, depending on the subsamples used.<sup>13</sup>

<sup>&</sup>lt;sup>13</sup> As noted by Imbens and Angrist (1994), estimates based on IV lead to a local average treatment effect (LATE), not to an average treatment effect for the population in general.

#### 6. Potential Channels

In this section, we further examine several channels in which children enhance the SWB of elderly parents. We first see if some specific type of life satisfaction channels the children-happiness hypothesis. In addition to an aggregate evaluation of life satisfaction, the respondents in the CHARLS are also asked three types of satisfaction: satisfaction with their children, their health status, and their marriage(see Appendix A2 for variables used in this section).We estimate the impacts of children on each of the three types of satisfaction, which are presented in Panel A of Table 8. We find that the number of children only has a statistically significant effect on elderly parents' satisfaction with their children (see columns (1)-(3)). The second-stage result with the intensity of exposure to the OCP as the IV of the number of children shows that one more child increases elderly parents' satisfaction with their children by about 0.071 (see column (1)). This result indicates that more children are more likely to meet the support requirements of their elderly parents, thereby shaping a satisfying relationship of parents with their children.

The hypotheses of both support bank and old-age security (Chou 2009) highlight the role of children's support, financially or mentally, in fulfilling the needs of elderly parents (Lee and Xiao 1998). These supports are critical to the SWB of older people in traditional or transitional societies when socialised or marketised pension and old-age caring services are less available. We test this channel by examining whether the net transfers from children increase with the number of children, also using the 2SLS method. The net transfers received by elderly parents are calculated as the transfers received from children minus those given to children. The second-stage results are reported in Panel B of Table 8. It is found that more children contribute to increasing the net in-kind transfer to parents (see columns (3) and (4)).

Although children are shown providing protections for their elderly parents, one may also wonder if the protections decrease with the number of children because children may shirk or take a free ride in taking care of elderly parents. To test this, we estimate the effect of the number of children on the average net transfers per child. If the shirking or free ride would happen, we expect to observe a negative effect on the average transfers, indicating the average transfers received from children decrease with the number of children. However, the results reported in Panel C of Table 8 show that the averages of regular money and in-kind transfer do not decrease with the number of children. Instead, the averages of regular net transfers increase with that number (see columns (2) and (4)), thereby failing to support shirking or free-ride effects.

Different results from different IVs may just reflect the different complier group into the estimate. However, our second IV in nature is just an alternative measure to the intensity of the exposure to the OCP.

Thus, exploration into the channels of the children-happiness hypothesis shows that more children increase parents' satisfaction with their children and net inkind transfers from children, both consistent with the theories on the economic and emotional roles of children in parents' old age.

< Insert Table 8 here.>

#### 7. Heterogeneity Effects

In this section, we further examine the potential heterogeneity effects of the number of children on parents' happiness. Accurately, we test the gender heterogeneity in terms of children, due to the inherent differences of gender and its role in social division and interactions. The gender heterogeneity regarding children includes the number of sons and the number of daughters, the three categories of the sex composition of children (i.e., only having sons, only having daughters, and having both a son(s) and a daughter(s)), and the gender of the first child.

The Chinese people still hold the tradition that sons have the responsibility of taking care of their elderly parents, which is the origin of the saying 'raising sons to protect old life'. A daughter is usually treated as an 'outsider' once she is married and is not permitted to inherit the property of her parents unless the elderly parents only have a daughter, which is more likely in rural society. Sons also play the role of succession. Not bearing a son is considered the primary filial impiety. These conventional beliefs lead to a culture of preference for sons, which also is embedded in the daily blessings. For example, people present their blessing for newlyweds as 'to have a precious son early'.

While preferring a son, Chinese parents also prefer to have both sons and daughters. A national survey on reproductive women in 2001 shows that among 39,344 female respondents, only 6.3% of respondents prefer girls, while 45.36% prefer to have both a girl and a boy (Ding and Hesketh 2006). Girls are found to be more caring and helpful for household work, playing different roles in elder care that cannot be replaced by sons. When the female gender of the first child is used as an IV of family size, it is broadly argued that the first-birth girl has direct effects on family outcomes, including elderly parents' care (Parish and Willis 1993; Butcher and Case 1994; Kaestner 1996; Garg and Morduch 1998; Conley 2000; Dahl and Moretti 2004; Deschênes 2007).

Besides heterogeneity effects in terms of sex composition in children, we also test in terms of parental age, because parents need more support from their children as they get older.

To investigate these heterogeneity effects, we use the following four empirical models:

 $SWB_{ihm} = \alpha_{30} + \alpha_{31}No\_son_{ihm} + \alpha_{32}No\_daut_{ihm} + \beta_3X_{ihm} + \gamma_{3m} + \varepsilon_{3ihm}(4-1)$ 

 $SWB_{ihm} = \alpha_{40} + \alpha_{41}D_{all}daut_{ihm} + \alpha_{42}D_{all}son_{ihm} + \beta_4X_{ihm} + \gamma_{4m} + \varepsilon_{4ihm}(4-2)$ 

 $\begin{aligned} SWB_{ihm} &= \alpha_{50} + \alpha_{51} No\_chd_{ihm} + \alpha_{52} No\_chd_{ihm} \times D\_first\_girl_{ihm} + \\ \alpha_{53} D\_first\_girl_{ihm} + \beta_5 X_{ihm} + \gamma_{5m} + \varepsilon_{5ihm} (4-3) \end{aligned}$ 

 $SWB_{ihm} = \alpha_{60} + \alpha_{61}No\_chd_{ihm} + \alpha_{62}No\_chd_{ihm} \times Page_{ihm} + \beta_6X_{ihm} + \gamma_{6m} + \varepsilon_{6ihm}(4-4)$ 

where No\_son and No\_daut denote the number of sons and the number of daughters, respectively.  $D_all_daut$  and  $D_all_son$  refer to a dummy variable of parents having both daughters and sons, and only having daughters, respectively.  $D_first_girl$  is also a dummy variable indicating a first-birth girl. Page refers to parents' age. Again, we cluster the standard errors at the household level because the variables of interest are the same within the household. If the estimates of the coefficient of these variables or its interaction with the number of children are statistically significant, we would like to say that the children-happiness hypothesis is heterogeneous to the sex composition of the children or parents' age.

The results from OLS estimation are reported in Table 9. We first find that both sons and daughters contribute significantly to the life satisfaction of elderly parents, while only sons contribute to their likelihood of getting depressed, with a marginal significance level (see columns (1) and (2)). Columns (3) and (4) report the effect of sex composition on elderly parents' SWB. It is found that, compared with parents who have both a son(s) and a daughter(s), those who have only sons reported a significantly lower level of life satisfaction (see column (3)), but no such heterogeneity is found for depression mood (see column (4)).

This finding is consistent with other studies focusing on the relationship between the gender structure of the children and life satisfaction. Smith et al. (2018) find that despite a strong apparent preference for sons that is exhibited in fertility behaviours, Chinese parents with girls report higher levels of life satisfaction. This could be explained by the fact that a daughter has an inherent advantage over a son in taking care of elderly parents, which has been found by many studies, such as that of Zeng et al. (2016).

Columns (5) and (6) of Table 9 report the heterogeneity effect of the number of children on the SWB of elderly parents in terms of the gender of the firstborn. We find that although both the number of children and a first-birth girl contribute positively to the life satisfaction of elderly parents, their interaction produces a negative effect. We explain this with the son preference. Given birth control policies, a first-birth girl increases the number of children only with a son preference, which is larger than the ideal one, and thus they interact to worsen the life satisfaction of elderly parents. Similarly, we fail to observe such a heterogeneity effect on depression mood.

The last two columns of Table 9, columns (7) and (8), report the heterogeneity effect in terms of parents' age. The results show that age interacts with the number of children to increase elderly parents' life satisfaction (see column (7)), but no such heterogeneity on depression mood is found (see column (8)). The finding that children interact with parents' age to improve life satisfaction implies that more children enable parents to fulfil their increasing needs for care and support as they get older.

Thus, our estimation on heterogeneity effects provides evidence supporting the gender difference of children in taking care of elderly parents, which is consistent with the previously mentioned literature, and the importance of children in the SWB of parents at the end of their life when lacking a sound pension system.

<Insert Table 9 here.>

#### 8. Conclusion

This paper tests the conventional wisdom in developing countries of 'more children, more elderly happiness' by exploring the exogenous shocks on fertility caused by the OCP in China. Using national survey data from the CHARLS, we first used the OLS method to test the impact of the number of children on elderly parents' SWB and then used the 2SLS method to identify the causal effect by constructing the intensity of mothers' exposure to the OCP and using it to instrument the number of children. The empirical results show that children contribute significantly to elderly parents' life satisfaction, while the size of the effect is mild. One additional child is found to increase elderly parents' life satisfaction level by about 0.1, which is robust under various specifications. Meanwhile, children also contribute to enhancing parents' mental health by reducing their likelihood of depression by more than 3%. Further studies show that the effect of children on elderly parents' SWB is channelled by raising their satisfaction with children and receiving financial support from children. Heterogeneity effects are observed only on life satisfaction, which shows that both sons and daughters contribute to elderly parents' life satisfaction. Parents only having sons have a lower level of life satisfaction. A first-birth girl tends to increase parents' life satisfaction but interacts with the number of children to reduce parents' life satisfaction. The age of the parents enhances the role of children in improving elderly parents' life satisfaction.

Our results have substantial policy implications, given the rapid ageing of China's population after about four decades of the OCP. While the OCP indeed reduces fertility, enhances maternal physical health, and may also reduce the stress from bearing more children, it also reduces parents' life satisfaction, which is one of the most critical indicators of SWB regarding how older people evaluate their life and perceived happiness. Childbearing is indeed stressful work, leading to negative moods like depression, but it can be significantly improved by family-supporting policies, as argued by Glass et al. (2016). Meanwhile, the social value of cherishing more children, though fading among the Chinese, remains essential in shaping

their evaluations of their life.<sup>14</sup> Aside from the substantial welfare loss in the elderly's SWB, the social costs of strict birth control have also emerged as China speeds up its population's ageing process. It was estimated that by 2050, more than a quarter of China's population — almost 500 million people — will be aged over 65. Since happiness should be used as the ultimate objective of public policy and the ultimate motivation of human action, and it is one of the most critical aspects of SWB or can be used interchangeably with SWB (Diener 1984; Diener et al. 1998; Ng and Ho 2006; NG 2008), our study has significant implications for enhancing future elderly people's SWB through revising current fertility policies to ones encouraging fertility.

Letting parents self-determine their fertility would significantly improve their SWB, since children can enhance their perceived life satisfaction and reduce depression later in life. Given the *de facto* ageing population and decreasing fertility rate in China, this paper has a twofold suggestion in terms of further reforming China's current family planning policies. First, the Chinese government should invest more in the social security system to provide decent care for older people who have sacrificed heavily due to those birth control policies. As shown by our paper, this system would increase elderly parents' SWB. Second, birth control policies should be completely abandoned, and family support policies aiming to reduce child-bearing costs should be introduced to encourage fertility. The recent relaxation in birth control — the two-child policy — is far from maintaining the current population size, since the opportunity costs of childbearing seem insurmountable for Chinese households, thereby making women who are willing to reproduce far below the actual reproductive population. Thus, switching from birth control to birth supports is expected to improve the happiness of current and future elderly generations and would also benefit the whole society by maintaining a sustainable population.

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<sup>&</sup>lt;sup>14</sup> The data from the National Family Planning and Reproductive Health Survey for 2001 show that the percentage of women preferring to have zero, one, two, and no fewer than three children accounts for 1.1%, 35%, 57%, and 5.8%, respectively, with an average of preferring to have 1.71 children (Ding and Hesketh 2006).

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# **Figures**



Fig. 1. The intensity of exposure to the OCP by provinces in mainland China

Notes: The values are the means of the intensity of exposure to the OCP by respondents in each province in mainland China.

Data Source: The authors' own calculation.



Fig.2. The number of children and the intensity of exposure to the OCP by the age cohort

Note: Both variables are in mean. Source: The authors with the data from CHARLS.



Fig.3. The intensity of Exposure to the OCP and the number of children in Jiangxi and Anhui provinces

Note: All values are in mean.

Source: The authors with the data from CHARLS.

# Tables

Table 1. Descri	Table 1. Descriptive statistics of main variables								
Variable	Obs	Mean	Std. Dev.	Min	Max				
Life satisfaction	8250	3.4004	.7716	1	5				
Depressive mood	8046	.3523	.4777	0	1				
No. of children	8890	3.1668	1.5393	0	10				
No. of sons	8783	1.8869	1.2598	0	9				
No. of daughters	8783	1.54	1.1837	0	9				
Only having sons	8783	.1439	.351	0	1				
Only having daughters	8783	.0815	.2736	0	1				
Having both son and daughter	8783	.7704	.4206	0	1				
First birth a girl	8783	.4892	.4999	0	1				
The intensity of exposing to the OCP	8890	.7356	.5151	0	3.5267				
Parental level covariates									
Mother	8890	.5011	.5	0	1				
Parents' age	8890	68.5928	7.0569	60	105				
Parents' marriage status	8890	.789	.4081	0	1				
Educational levels	8742	1.5276	1.491	0	7				
Wage income	8294	1.1311	2.9675	0	11.9576				
Rural hukou	8752	.7877	.409	0	1				
CPC member	8727	.1242	.3298	0	1				
Drink	8883	.323	.4676	0	1				
Living place	8890	.7179	.4501	0	1				
Children level covariates									
Average education years	8783	8.8567	3.2488	0	22				
Live with a child	8783	.4401	.4964	0	1				
Average income	8783	5.102	2.7375	0	12				
Having a poor health child	8783	.183	.3867	0	1				
Having an unmarried child	8783	.1219	.3272	0	1				
Having a child without a house	8783	.498	.5	0	1				
Having a child died	8890	.1781	.3826	0	1				

Table 1. Descriptive statistics of main variables

Notes: The wage income is in natural logarithm.

Number of children	Life satisfaction			Depression	Depression mood		
	Mean	Std.Dev.	Freg.	Mean	Std.Dev.	Freg.	
0	3.2086	0.8637	139	0.4468	0.5025	47	
1	3.3757	0.7560	708	0.2776	0.4481	706	
2	3.3799	0.7409	2,261	0.3233	0.4678	2,258	
3	3.4102	0.7761	2,233	0.3580	0.4795	2,190	
4	3.4187	0.7696	1,538	0.3778	0.4850	1,514	
5	3.3958	0.7943	854	0.3843	0.4867	830	
>5	3.4855	0.8343	517	0.4251	0.4949	501	

Table 2. Life satisfaction and depression mood by the number of children

Table 3	. The num	ber of child	ren on pare	ents' SWB:	OLS
(1)	(2)	(3)	(4)	(5)	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Life satisfact	ion			Depression		
Number of children	0.0184***	0.0211***	0.0373***	$0.0264^{***}$	-0.0046	-0.0109**	-0.0103**
	(0.0062)	(0.0081)	(0.0072)	(0.0086)	(0.0051)	(0.0044)	(0.0052)
Parental							
characteristics							
Mothers		-0.0332		-0.0402*	$0.1112^{***}$		$0.1123^{***}$
		(0.0205)		(0.0206)	(0.0127)		(0.0127)
Age		0.0061***		0.0079***	-0.0011		-
							0.0031***
		(0.0018)		(0.0019)	(0.0011)		(0.0011)
Marriage		0.1270 ***		$0.1058^{***}$	-0.0678***		-
							$0.0535^{***}$
		(0.0256)		(0.0261)	(0.0154)		(0.0154)
Income		0.0072 **		0.0071**	-0.0053***		-
							0.0055***
		(0.0030)		(0.0030)	(0.0018)		(0.0018)
Drink		0.0142		0.0085	-0.0340***		-0.0311**
		(0.0212)		(0.0211)	(0.0124)		(0.0123)
Primary school		-0.0114		-0.0232	0.0080		0.0137
unfinished							
		(0.0275)		(0.0273)	(0.0166)		(0.0164)
Primary school		-0.0195		-0.0355	-0.0304*		-0.0172
		(0.0262)		(0.0262)	(0.0164)		(0.0163)
Middle school		-0.0100		-0.0414	-0.0535***		-0.0310
		(0.0315)		(0.0317)	(0.0195)		(0.0196)
High school		0.0036		-0.0132	-0.0691**		-0.0457
0		(0.0493)		(0.0490)	(0.0290)		(0.0291)
Vocational school		-0.0605		-0.1046**	-0.0639*		-0.0312
		(0.0518)		(0.0514)	(0.0326)		(0.0327)
College		-0.1229		-0.1727**	-0.0137		0.0277
8-		(0.0786)		(0.0794)	(0.0463)		(0.0465)
Undergraduate and		-0.2174**		-0.2570**	-0.0180		0.0146
above							
		(0.1089)		(0.1099)	(0.0581)		(0.0570)
Rural hukou		-0.0246		-0.0061	0.0571***		0.0424**
iter ar interioù		(0.0298)		(0.0300)	(0.0184)		(0.0184)
CPC member		-0.0040		-0.0229	-0.0136		-0.0016
		(0.0262)		(0.0261)	(0.0162)		(0.0162)
Living in rural		-0.0288		-0.0147	0.0526**		0.0446**
		(0.0359)		(0.0359)	(0.0232)		(0.0227)
Child level		(3.0000)		(0.0000)	(0.0202)		(
characteristics							
Average education			0.0051	0.0078*		-0.0110***	-
years							0.0084***

			(0.0038)	(0.0041)		(0.0022)	(0.0024)
Live with children			0.0343*	0.0373*		0.0081	0.0041
			(0.0200)	(0.0205)		(0.0120)	(0.0122)
Average income			$0.0152^{***}$	0.0166***		-0.0090***	-
							0.0074***
			(0.0033)	(0.0035)		(0.0021)	(0.0021)
Poor health child			-0.1464***	-0.1463***		0.1300***	0.1188***
			(0.0276)	(0.0281)		(0.0161)	(0.0162)
Unmarried child			-0.1032***	-0.0942***		0.0149	0.0191
			(0.0313)	(0.0326)		(0.0182)	(0.0185)
Child without a			-0.0617***	-0.0459**		0.0060	0.0033
house							
			(0.0194)	(0.0199)		(0.0121)	(0.0123)
Died child			-0.0439*	-0.0615**		0.0579 * * *	0.0557***
			(0.0256)	(0.0263)		(0.0156)	(0.0159)
Community fixed	No	Yes	Yes	Yes	Yes	Yes	Yes
effects							
Constant	3.3427***	2.2593***	$2.6176^{***}$	$2.0586^{***}$	0.5031***	$0.5442^{***}$	0.6778***
	(0.0210)	(0.2468)	(0.2053)	(0.2471)	(0.1535)	(0.1290)	(0.1575)
Observations	8,250	7,964	8,160	7,877	7,762	8,046	7,762
R-squared	0.0013	0.1024	0.1058	0.1146	0.1556	0.1389	0.1698

Notes: Robust standard errors clustered at the household level are in parentheses; \*, \*\* and \*\*\* denote the significance level of 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)
	First Stage	Reduced	Form	2SL	S
VARIABLES	No of	Life	Depression	Life	Depression
	children	satisfaction		satisfaction	
Intensity of exposure to the	-0.9670***	-0.0961***	0.0292**		
OCP					
	(0.1267)	(0.0267)	(0.0117)		
Number of Children				0.0994***	-0.0304***
				(0.0308)	(0.0113)
F-Statistic	58.3175				
Observations	7,877	7,877	7,762	7,877	7,762
R-squared	0.4033	0.1100	0.1676	0.1047	0.1677

#### Table 4. The Number of Children on Parents' SWB: 2SLS estimation

Notes: Robust standard errors clustered at the province level are in parentheses; \*, \*\* and \*\*\* denote the significance level of 10%, 5%, and 1%, respectively; All columns control for both parental-level and child-level covariates except for the age and ethnicity of parents, and prefectural fixed effects.

<b>M 11 M D 1</b>			1	. 1	1 .
Table 5 Robustness	check	with	alternative	narental	hanniness
Table 0. Hobabiliosb	OHOOK	AA TOTT	anoniani	paronual	mappmoss

	(1)	(2)	(3)	(4)
	OLS		2SLS	
VARIABLES	Life satisfact	Life satisfaction 2013		Loss all
				teeth
Number of Children	0.0446***	0.1470***	-0.2961	0.1284***
	(0.0083)	(0.0330)	(0.1834)	(0.0122)
Observations	5,548	5,547	6,920	7,335
R-squared	0.1402	0.1116	0.2086	0.0577

Notes: Robust standard errors clustered at the province level are in parentheses; \*, \*\* and \*\*\* denote the significance level of 10%, 5%, and 1%, respectively; All columns control for both parent-level and child-level covariates except for the age of parents, and community fixed effects.

	(1)	(2)	(3)	(4)	(5)	(6)
	Respondents	aged over 59	Rural reside:	nts	Mothers	
VARIABLES	Life	Depression	Life	Depression	Life	Depression
	satisfaction		satisfaction		satisfaction	
Number of children	0.0930***	-0.0163	0.0923***	-0.0450***	0.0958***	-0.0322***
	(0.0176)	(0.0103)	(0.0298)	(0.0133)	(0.0205)	(0.0099)
Observations	10,220	10,094	6,210	6,107	3,949	3,872
R-squared	0.0966	0.1594	0.1170	0.1714	0.1598	0.2128

Notes: Robust standard errors clustered at the province level are in parentheses; \*, \*\* and \*\*\* denote the significance level of 10%, 5%, and 1%, respectively; All columns are estimated with 2SLS with the intensity of exposing to OCP as IV and control for both parent-level and child-level covariates except for the age of parents, and cmmunity fixed effects.

Table 7. Robustness check with alternative IV strategy									
	(1)	(2)	(3)	(4)	(5)				
	First Stage	Reduce	d Form	2S	LS				
VARIABLES	No of	Life	Depressio	Life	Depression				
	children	satisfaction	n	satisfaction					
Cohorts exposure to the OCP × average number of children permitted in each province	-2.5299***	-0.2387***	0.0941***						
Number of Children	(0.1587)	(0.0573)	(0.0208)	0.0944*** (0.0204)	-0.0372*** (0.0081)				
F-Statistics	254.357								
Observations	0.4845	7,877	7,762	7,877	7,762				
R-squared	7,877	0.1124	0.1689	0.1060	0.1663				

Notes: Robust standard errors clustered at the province level are in parentheses; \*, \*\* and \*\*\* denote the significance level of 10%, 5%, and 1%, respectively; All columns control for both parent-level and child-level covariates except for the age of parents, and community fixed effects.

	(1)	(2)	(3)	(4)
Panel A: Subindicators of life				
satisfaction				
VARIABLES	Satisfaction	Satisfaction	Satisfaction	
	with children	with health	with marriage	
Number of children	0.0709***	0.0347	0.0057	
	(0.0239)	(0.0241)	(0.0211)	
Observations	7,831	7,847	6,378	
R-squared	0.1111	0.1009	0.1417	
Panel B: Aggregate net transfers				
VARIABLES	Net money	Regular net	Net in-kind	Regular net in-
	from children	money from	from children	kind from
		children		children
Number of children	0.2721	0.2492	0.6133***	0.1998**
	(0.1932)	(0.1538)	(0.1747)	(0.1012)
Observations	7,961	7,961	7,961	7,961
R-squared	0.2539	0.1853	0.1688	0.1440
Panel C: Average net transfers				
VARIABLES	Net money	Regular net	Net in-kind	Regular net in-
	from children	money from	from children	kind from
		children		children
Number of children	-0.0586	0.2079**	0.0201	0.1265*
	(0.1145)	(0.1048)	(0.1022)	(0.0669)
Observations	6,802	7,503	7,380	7,734
R-squared	0.2299	0.1905	0.1881	0.1591

Table 8. Channels of the effect on elderly parents	' SWB
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Notes: Robust standard errors clustered at the province level are in parentheses; \*, \*\* and \*\*\* denote the significance level of 10%, 5%, and 1%, respectively; All columns control for both parent-level and child-level covariates except for the age of parents, and community fixed effects; All results are estimated by 2SLS method with the intensity of exposing to the OCP as the IV of the number of children; The transfers are all in natural logarithm; Average transfer is calculated as the net transfer divided by the number of children.

	<u>e neterogener</u>	ty chects. ci	muten s gen	iuci allu gei	iuci stiuciu	10		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Life	Depression	Life	Depression	Life	Depression	Life	Depression
	satisfaction		satisfaction		satisfaction		satisfaction	
Number of sons	0.0228**	-0.0143**						
	(0.0107)	(0.0064)						
Number of daughters	0.0313***	-0.0041						
	(0.0092)	(0.0057)						
Age	0.0078***	-0.0032***	0.0104***	-0.0043***	0.0078***	-0.0032***	0.0006	-0.0001
	(0.0019)	(0.0011)	(0.0017)	(0.0010)	(0.0019)	(0.0011)	(0.0036)	(0.0021)
All daughters			0.0264	-0.0036				
			(0.0346)	(0.0214)				
All sons			-0.0632**	-0.0007				
			(0.0281)	(0.0170)				
Number of children					0.0388***	-0.0094	-0.1246*	0.0528
					(0.0110)	(0.0068)	(0.0666)	(0.0395)
First birth a girl×number of					-0.0242*	-0.0016		
children					(0.0100)			
					(0.0129)	(0.0078)		
First birth a girl					$0.0827^{*}$	0.0043		
					(0.0438)	(0.0267)	0 0001**	0.0000
Age×number of children							0.0021**	-0.0009
Ohannationa		<b>F F C O</b>		<b>F F C O</b>		<b>F F C O</b>	(0.0009)	(0.0006)
Ubservations Descriptions	1,811	1,162	1,811	1,162	1,811	1,162	1,811	1,162
κ-squareα	0.1100	0.1699	0.1142	0.1693	0.1101	0.1698	0.1193	0.1701

#### Table 9. The heterogeneity effects: children's gender and gender structure

Notes: Robust standard errors clustered at the household level are in parentheses; \*, \*\* and \*\*\* denote the significance level of 10%, 5%, and 1%, respectively; All columns control for both parent-level and child-level covariates and community fixed effects.