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RESEARCH PAPER

Child Gender and Subjective Well-Being of Older Parents in China

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Abstract
In many societies, parents prefer sons over daughters, but the well-being effects of child gender, especially in later life, are less studied. Using the latest two waves of the China Health and Retirement Longitudinal Study, this paper evaluates the impacts of having daughters on older parents' subjective well-being (SWB) in urban China, which has a rapidly aging population and the traditional preference for sons. Studying the cohort of parents whose child gender is as good as random, we find that having more daughters promotes older parents' SWB, especially overall life satisfaction, satisfaction with health, and satisfaction with children. Our results suggest that the increase in SWB is achieved through better health, more financial support from daughters and more spending on leisure. The positive SWB effects of daughters are found to be more salient among more vulnerable groups, including those who are older, less educated, and with fewer children.

Keywords Subjective well-being · Child gender · Older parents · China · Life satisfaction · Domain satisfaction

1 Introduction

There has been a growing number of studies examining the relationship between parenthood or the number of children and subjective well-being (SWB). Some have found that parenthood has negative effects on SWB (Alesina et al., 2004; Clark et al., 2008; Di Tella et al., 2001, 2003; Stanca, 2012), while others have found the effects to be positive (Aassve et al., 2012; Balbo & Arpino, 2016; Radó, 2020; Stutzer & Frey, 2006). However, there are relatively few studies investigating the role of the gender composition of children. Previous research focused primarily on its effects on conditions such as intergenerational support

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(Dykstra & Fokkema, 2011; Horowitz, 1985) and health (Li et al., 2021; Zeng et al., 2016) and mostly in the context of western countries. A few western studies find that younger parents derive greater benefits from the birth of sons than daughters because of greater paternal involvement in childbearing and a more stable marriage (Cox et al., 1989; Kabátek & Ribar, 2020; Lundberg, 2005).Other western studies of younger parents find no significant effects of child gender on outcomes including SWB (Aassve et al., 2012; Kohler et al., 2005; Kurdek, 1993). In western societies, however, it seems to be reasonable to observe that the sex of very young children is not that important to parents' behaviors, attitudes, or conditions since male and female infants are similar in their time-consuming requirements for physical care and nurturing. However, as parents become older and less functionally independent, the differential importance of sons and daughters becomes more profound: daughters are likely to be more communally oriented (Hall, 2010), have closer contact and emotional bonds with parents (Dykstra & Fokkema, 2011; Gans & Silverstein, 2006), and provide more caregiving (Stone et al., 1987).

In China, the study of child gender is of particular importance and interest due to its rapidly aging population and the traditional preference for sons. This preference is not only because of the Confucian culture but also because of the essential role of sons in traditional agricultural societies. In a society where there has been a long tradition of agricultural lifestyle and patriarchal culture, males are considered more capable of conducting production activities, providing financial support for their families, as well as taking care of their parents (Alesina et al., 2013; Ebenstein & Leung, 2010; Qian, 2008). However, as the market-oriented reforms started in the 1980s, the traditional importance of sons has been challenged. On the one hand, production activities have become more based on markets and enterprises, which emphasize individual rights and contracts, and less based on families or other community networks (Munshi, 2014). On the other hand, economic activities have become less dependent on physical strength, and, therefore, the relative value of sons has decreased (Xie & Zhu, 2009). There are a few other reasons why sons do not necessarily improve older parents' well-being, even in a society with traditional son preference. For instance, sons are more likely to co-reside with their older parents, and this might make parents worse off if it causes tension within a big family though it can bring financial and instrumental support to parents (Xu, 2019). Besides, to exchange for old-age support when co-residing with sons, older parents might need to take care of their sons' young children at the cost of enjoying leisure time (Cox & Rank, 1992; Wu & Li, 2014). Besides, parents might receive more and better care from daughters because women—due to the traditional gender norms—are often trained as caregivers within a family.

Recent studies on the impacts of child gender in China have found having daughters can significantly improve health (Li, 2021; Zeng et al., 2016) and increase the receipt of financial, emotional, and instrumental support (Lei, 2013; Xie & Zhu, 2009). Others have investigated the issue of the rising sex ratio imbalance in China, which has increased the pressure in the marriage markets for men. Wei and Zhang (2011) find that a higher local sex ratio increases the savings of households with a son while the savings of households with a daughter is not significantly influenced. Li et al. (2022) show that a higher sex ratio raises stock market participation for families with a son relative to those with a daughter. Tan et al. (2021) find that parents with sons in regions with a higher sex ratio spend more time working outside their hometowns and take more dangerous jobs but families with only daughters do not have the same tendency. So far, relevant Chinese studies have primarily focused on the effects of child gender on parents' objective living conditions, but few have studied their self-reported or subjective well-being. Li (2021) investigates the impacts of

sex ratio imbalance on the SWB of parents and shows that, facing a high sex ratio, parents with a son report lower SWB compared with those with a daughter.

SWB generally refers to a variety of individual self-reported quality of life (Helliwell et al., 2012). Over the past few decades, interest in studying SWB has increased remarkably among researchers and policy makers, especially because of its potential contribution to monitor overall living conditions as well as various domains of life of populations and its important role in informing relevant policy decisions (Layard, 2006). In general, there are three types of measures of SWB: cognitive life evaluations, emotional reports, and eudaimonia. The focus of this study is on cognitive life evaluations, represented by questions asking how happy or satisfied people are with their lives as a whole or with various domains of life. In this paper, SWB is measured as overall life satisfaction and three types of domain satisfaction—satisfaction with health, satisfaction with relationships with children, and satisfaction with marriage. Such measures are considered plausible measures of well-being since they are closely related to life circumstances, consistent over a short period of time, and strongly correlated with both objective and alternative subjective measures of well-being. The important determinants of life satisfaction include, but are not limited to, age, gender, employment, marriage, health, income, and expenditures (e.g. Blanchflower & Oswald, 2004; Clark & Oswald, 1996; Easterlin, 1995, 2001; Frey & Stutzer, 2010; Wu, 2022). For older adults, intergenerational support has been found to be particularly important (Chang, 2013; Wu, 2022). Several studies have also shown that various types of domain satisfaction are important determinants of overall individual well-being (Easterlin, 2006; van Praag & Ferrer-i-Carbonell, 2007).

It is challenging to estimate the causal effects of child gender on parents' SWB because parents can often manipulate the gender of their children. In Chinese culture, which has traditional son preference, this issue can be particularly important. In this paper, we adopt an empirical strategy that conditional on the total number of children, the child gender can be regarded as good as random. Using data from the last two waves of the China Health and Retirement Longitudinal Study (CHARLS), we find that having daughters significantly improves urban older parents' SWB, a finding that contradicts the traditional belief of raising boys for old-age support. Our results are robust to a series of robustness checks, including using alternative measures of gender composition of children, an alternative sample, and a different inference method. We also find the SWB effects of child gender vary across different groups of older people: the effects are more obvious for those who are older, less educated, with only one child, and in the regions with stronger son preference.

To shed light on how child gender affects older parents' SWB, we investigate three dimensions of mechanisms. We find that having daughters improves parents' mental health, increases their financial transfer from children and raises their spending on leisure. Using child-parent pairs data, we find that older parents are less likely to live with daughters or take care of their daughters' young children.

At a general level, this study contributes to the scarce literature on the effects of child gender on SWB among older parents. An investigation into this relationship is more important but far less studied in developing countries with strong son preference. One contribution is to investigate the causal impacts of having daughters on SWB by focusing on the cohort of urban parents who can hardly manipulate the gender of children. Another contribution is to study not only overall life satisfaction but also domain satisfactions in order to provide a more comprehensive picture of older parents' SWB. Besides, we explore potential underlying reasons, first, by examining three dimensions of mechanisms, including health, intergenerational support, and employment and living conditions, and, second,

by a heterogeneity analysis investigating subsamples by gender, age, education, the number of children, and regional level of son preference. Since we focus on the cohort of parents whose children enjoy a balanced sex ratio, the gender difference in children's marriage market perspectives is ruled out as a potential mechanism.

The remainder of the paper is organized as follows. Section 2 and 3 introduce the conceptual framework and the empirical strategy adopted for this research, respectively. Section 4 describes the data and variables. Section 5 presents the results, including main results, robustness checks, mechanisms, and heterogeneity analysis, followed by conclusions and discussions in Sect. 6.

2 Conceptual Framework

Child gender may affect parents' later-life SWB through multiple pathways. First, health is considered one of the most important determinants of SWB, and having more daughters may make parents healthier, by reducing parents' burden on housework and childcare. It is common that in many developing countries parents ask girls to do more household chores and take care of young siblings starting from a young age (Edmonds, 2006; Hannum et al., 2009; Levison & Moe, 1998). As a result, parents may enjoy more leisure time and have less pressure, which helps them maintain better mental and physical health in later life. Daughters may also benefit older parents' health by providing more and better care (Li et al., 2021; Zeng et al., 2016).

Second, daughters and sons may exchange different types of intergenerational support with their older parents, which can be another key determinant of older people's SWB (Chang, 2013; Wu, 2022). Daughters tend to provide more emotional support and better care, but sons are more likely to provide support by co-residing with their older parents (Lei, 2013; Lei et al., 2015). However, co-residence might make it difficult to protect privacy and, therefore, could cause family conflicts (Hill, 2006; Rook, 1984). Besides, sons and daughters may also differ in the exchanges of financial support with their parents. Sons earn more in general, but daughters will give more if they are altruistic or obligated to filial norms (Brasher, 2022; Xie & Zhu, 2009). Except for the above-mentioned types of intergenerational support, older parents usually provide childcare to their grandchildren. Interactions with young kids affects SWB (Choi & Zhang, 2021; Dunifon et al., 2020; Shen & Yang, 2022), and the decision on grandchild-care provision may depend on the gender of adult children (Chu et al., 2011).

Third, older parents' employment and living conditions are also important contributors to their SWB, and these might depend on the gender composition of children. Parents may spend more on their children when raising sons compared to daughters, either due to the existing son preference or the higher expected return for males in the labor market (Hannum & Xie, 1994; Lei et al., 2017; Lu & Treiman, 2008).[1] If so, compared with having more sons, parents with more daughters may have higher savings in their old age. Consequently, they would consume more. On the other hand, if parents expect to receive constant and sufficient old-age support from sons as opposed to daughters, their consumption may increase with the number of sons. Studies have found that even though total consumption expenditures generally have a positive effect on SWB, the impacts of various types of

[1] For instance, parents may spend more on sons' than daughters' education and housing, in expecting higher returns in later life (e.g., Kornrich & Furstenberg, 2013).

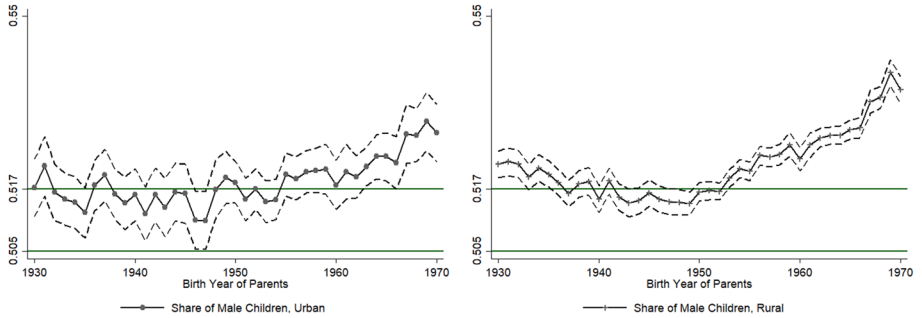

Fig. 1 Children's sex ratio by parents' cohort. *Note*: This figure shows the sex ratio of children for parents born between 1930 and 1970, in urban (left panel) and rural (right panel) China. The dashed lines represent the 95% confidence intervals. The data come from China population census of 1990 and 2000, which contains information on the total number of sons and daughters a couple ever gives birth to

expenditures may differ (Headey et al., 2008; Perez-Truglia, 2013; Wu, 2020). An increase in certain types of expenditures, such as those on food, clothing, and leisure can significantly increase individuals' SWB while an increase in other types of expenditures, such as those on healthcare and housing, can significantly decrease it (DeLeire & Kalil, 2010; Noll & Weick, 2015). Besides, if parents have more savings in later life, they are more likely to work less. Studies have also shown that working in later life could significantly decrease older adults' health and SWB (Carrino et al., 2020; Giusta & Longhi, 2021).

In summary, child gender may influence older parents' SWB through its impacts on parents' health status, intergenerational support, as well as employment and living conditions. These impacts might be either positive or negative, and it is not clear a priori which mechanisms dominate.

3 Empirical Strategy

3.1 Identification Assumption

Without interventions, nature determines the gender of each birth while people determine the number of children. Our empirical strategy is based on this randomness assumption—conditional on the number of births, the gender of each birth within a family is random. This strategy has been adopted in a number of studies on child gender in both developed countries (Oswald & Powdthavee, 2010; Washington, 2008) and developing countries (Heath & Tan, 2018; Zhou, 2014). We decided to focus on urban parents for two main reasons. First, urban mothers usually gave birth in hospitals, where infanticide is too risky to commit (Zhou, 2014). Second, stronger preference for sons in rural China would encourage more selective abortions and infanticides.

We further restrict the sample to the cohort born between 1930 and 1960, who hardly had access to ultrasound technology. We check the balance in sex ratio by plotting the shares of male children for rural and urban parents born between 1930 and 1970 in Fig. 1 based on population census data in 1990 and 2000. As expected, the children's sex ratios of urban parents born between 1930 and 1960 are close to the natural ratio, 51.7%, while younger urban parents who were born after started to have male-biased sex ratios. This is

probably because of the implementation of the strict one-child policy and the introduction of ultrasound technology. For rural parents, the balanced cohorts appear to be those born between 1940 and 1950. Not surprisingly, the issue of sex ratio imbalance appeared earlier and was more serious in rural areas probably due to rural parents' stronger preference for sons, which encouraged more selective abortion and infanticides especially in the 1980s when family planning policies became more intense. Consequently, based on our expectation and the empirical test, we choose the urban parents born between 1930 and 1960 as our main study sample since this is a cohort that can hardly manipulate the gender of their children and their children's sex ratios are proven to be relatively balanced.

3.2 Regression Equation

The general specification of the regression analysis is as follows:

$$Satisfaction_{ipt} = \beta_0 + \beta_1 Daughters_{ip} + \beta_2 X_{ipt} + \tau_t + \pi_p + \epsilon_{ipt} \quad (1)$$

where $Satisfaction_{ipt}$ represents a satisfaction measure of individual i, in province p and in survey year t. We use both overall life satisfaction and three domain satisfactions—satisfaction with health, marriage, and relationships with children. $Daughters_{ip}$, in our main analysis, represents the number of daughters. Our main parameter of interest is β_1, which captures the effect of having an additional daughter on parents' SWB. We also use the gender of the first child (firstborn daughter) and gender composition of all children as robustness checks. X_{ipt} represents a vector of individual demographic characteristics. The most important control variable in X_{ipt} is the number of children since it is the key variable making the conditional independence assumption hold. Please keep in mind that adding the number of children as a control variable means β_1 captures the relative effect of having a daughter instead of a son on parents' SWB. Please also note that we use the total number of ever-born children (and daughters) instead of living children (and daughters) to avoid any survival bias.[2] Other control variables in X_{ipt} include respondents' gender, education level, widowhood status,[3] birth year dummies, and dummies for the year of having the first child. τ_t and π_p denote survey year fixed effects and province fixed effects, respectively. ϵ_{ipt} is an error term. The standard errors are clustered at the community level to allow the correlation of error terms for individuals who live in the same community.[4]

4 Data and Measures

4.1 Data and Sample

This study uses data from the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative survey of mid-aged and older adults of ages 45 or over and their

[2] Using the number of living children to study older parents' SWB can be confounded by early life family conditions, such as family income and socioeconomic status, and this is what we refer to as survival bias.

[3] In our analysis sample, 85% of the urban individuals are married with spouse present, and 13% are widowed. Only 1% are divorced and the remaining 1% are those separated or never married. The variable widowhood is defined as 1 if the individual is widowed, and 0 otherwise.

[4] Clustering the standard errors at the community level also allows any possible correlations for individuals across time.

spouse of any age in China. It covers 28 provinces and 150 counties/districts in China. The study has been conducted for four waves in 2011, 2013, 2015, and 2018, respectively. Each wave contains about 10,000 households and 17,500 individuals. The CHARLS contains rich information on older people's demographics, physical and mental health, living arrangement, and household expenditures. Besides, it also collects detailed information about each child of the interviewed older parents, including his or her demographic characteristics, and the exchanges of emotional and financial support with older parents.

Our outcome variables of interest, including life satisfaction and three domain satisfactions, were collected in the last two waves of the CHARLS in 2015 and 2018. These two waves include 37,337 individual-level observations, of which 21% are urban residents (i.e., those holding a non-agricultural household registration status). Using two waves of CHARLS increases the sample size and power, and this allows us to detect small effect sizes. We select the sample of analysis in the following steps: first, we select urban residents as our primary sample, which excluded 30,408 rural residents[5]; second, we restrict our urban sample to those born between 1930 and 1960 since the gender of their children is arguably random, conditional on the number of children. The final sample consists of 4822 observations and sample sizes for estimation are no greater than 4822, due to the missing values in the control variables.

4.2 Main Variables

The main variables in the empirical analysis include SWB measures as the outcome variables, variables on child gender as the regressors of interest, and a set of mechanism variables on health conditions, child-parent intergenerational support, and older parents' employment and living conditions. The rest of the section illustrates them accordingly.

4.2.1 Subjective Well-Being

We study four measures of SWB, an overall life satisfaction and three types of domain satisfaction. The measure of overall life satisfaction relies on the question "*Please think about your life-as-a-whole. How satisfied are you with it? Are you completely satisfied, very satisfied, somewhat satisfied, not very satisfied, or not at all satisfied?*". This measure takes value 5 if an individual chooses "completely satisfied" and takes value 1 if an individual chooses "not at all satisfied". The three domains of satisfaction include satisfaction with health, satisfaction with marriage and satisfaction with relationships with children, all of which are measured on the same scale.[6]

4.2.2 Child Gender

Using the information on family structure, we construct three explanatory variables of interest: the number of born daughters (i.e., a variable of primary interest); an indicator variable on whether the firstborn is a daughter; and dummies on gender composition of

[5] The ideal sample consists of individuals who gave all births in urban areas, but it is not possible to identify the birth place of each child in the data. Our sample of analysis should be as good as the ideal sample as the older adults born between 1930 and 1960 are very unlikely to change their Hukou statuses: Hukou policies only started to be gradually relaxed at the end of the 1990s (Chan & Zhang, 1999).

[6] People did not need to answer the marriage (children) question if they did not have any spouse (children) at the time of the interview.

children [having daughters and sons, having daughters only, and having sons only (the reference group)].

4.2.3 Mechanism Variables

Based on the existing literature, we consider three dimensions of mechanisms: health, intergenerational support, and employment and living conditions. Our health-related variables include self-assessed health, the number of chronic diseases, the Center for Epidemiological Studies Depression 10-item scale (CESD-10), and cognition. *Self-assessed health* is a 5-point Likert scale such that a higher value implies better health. *Number of chronic diseases* counts the number of chronic diseases an older adult has in the following 14 items: hypertension, dyslipidemia, diabetes, cancer, chronic lung diseases, liver disease, heart-related disease, stroke, kidney disease, digestive disease, mental problems, memory-related disease, arthritis, and asthma. *CESD-10*[7] is constructed from 10 standard questions on mental health and depressive symptoms, ranging from 0 to 30, and a higher value indicates worse mental health. *Cognition* is the sum of two measures: episodic memory and mental intactness (Lei et al., 2012, 2014). Episodic memory is constructed as the average of the scores of immediate recall and delayed recall of ten Chinese nouns read to the respondents. The intactness of mental status is created based on tasks of serial 7 subtraction from 100 (up to five times), naming today's date (month, day, year, and season) and the day of the week, and the ability to redraw a picture. Correct responses in these tasks are aggregated into a single mental intactness score that ranges from 0 to 11. We standardize the score of cognition in the empirical analysis.

The intergenerational support variables include the types of support not only from but also to children. *Co-residing with children* is an indicator variable taking value 1 if parents currently live with any adult children. To construct the variable *Days visiting per month*, we first collect days per month each child visits the parents[8] and then aggregate them at the household level.[9] *Care for grandchildren* is an indicator variable taking value 1 if older parents report they spent time taking care of their grandchildren last year. *Annual transfer to children* is the amount of transfer from parents to children, measured in RMB. *Annual transfer from children* is the amount of transfer from children to parents. It is worth noting that the CHARLS collects each child's information—even if a child does not live in the same household as his or her parents—on whether older parents provide grandchild-care and the exchanges of emotional and financial support between an adult child and his or her older parents. This allows us to perform sibling fixed-effects regressions when we examine the effects of child gender on intergenerational supports.

Variables on employment and living conditions include one's work status, household expenditures, and household wealth. *Work currently* is an indicator variable taking value 1 if older parents reported they engaged in any agricultural work for at least 10 days in the past year or in off-farm paid work for at least 1 h last week, or are on leave but can get back to the job in the future. We measure a household's material living conditions using

[7] There are two positive questions and eight negative questions. For each question, there are four possible choices: 0 means "rarely or none of the time", 1 means "some or a little of the time", 2 means "occasionally or a moderate amount of the time", and 3 means "most or all of the time". The response scale was reversed for the two positive questions.

[8] We assign a value of 30 for an adult child living together with parents.

[9] The frequency of visits by children can be considered a measure of emotional support between parents and children.

total household expenditures,[10] four specific expenditure categories, and total wealth. The four expenditure categories, including *food expenditures*, *leisure expenditures* (on entertainment and vacations), *living expenditures* (on, for instance, utilities, fuels, transportation, and daily necessities), and *medical expenditures*, account for 90% of the urban older households' total consumption. *Total wealth* represents parents' lifetime wealth accumulation. Both the expenditure variables and total wealth are measured in RMB (1 USD≈7 RMB). In the empirical analysis, we use the natural logarithm of transfer (from/to children), expenditures and wealth instead of their actual levels.[11] Like many other money-related variables (e.g., income, wage, and assets), they tend to have outliers in the right tail of the distributions. Taking the natural logarithm transformation is a common way to deal with the skewed distributions.

4.3 Summary Statistics

In this section, we briefly describe our final sample by showing the mean and standard deviation of the variables used in Eq. (1). Table 1 shows that respondents in our study sample were, on average, born in 1949, 55% are male, and 13% are widowed. Their median education level is middle school. On average, the birth year of the first child is 1974.

The overall life satisfaction has a mean of 3.37 out of a 5-point Likert scale, slightly above somewhat satisfied. Regarding the three domains of satisfaction, our sample of older parents is relatively less satisfied with their health (scored at 2.94) than with children (scored at 3.58) or with marriage (scored at 3.49). On average, they have more than two children (2.54) and the average number of daughters is 1.21. The proportion of having a firstborn daughter is 0.5, which suggests birth gender is as good as random in our study sample. In addition, we conduct a balance test[12] to verify the conditional exogeneity assumption of child gender: after controlling for the total number of children, the number of daughters should have no prediction power on parental characteristics. To this end, we regress a sequence of parental characteristics, including, for example, birth year, year of firstborn child and education, on the number of daughters and the number of children. If the conditional independence (randomness) of child gender holds, we expect the coefficients on the number of daughters to be statistically insignificant, after controlling for the number of children.Table 2 reports all the 14 coefficients on the correlates of the number of daughters and parental characteristics. Each coefficient is estimated from a separate regression. Only one of the 14 estimates is statistically significant at the 10% level, and this is in line with what one would expect under no gender selection.

Older parents' average self-assessed health is at the upper-middle position of the 5-point Likert scale. Their average number of chronic diseases is 1.27. In terms of mental health, the average CESD-10 score is 7.08. 23% of our sample scored above 10, a commonly used cut-off threshold of being depressed. As expected, the exchanges of intergenerational support are common among our sample of older parents. 36% of them are co-residing with their children, and 64% are taking care of their grandchildren. In general, the average frequency of visits

[10] Consumption expenditures provide a better measure of long-term resources than income (Smith et al., 2012).

[11] We use the transformation $\log(X+1)$ to deal with the 0 s in the level values. For the variable net transfer from children, which contains negative values, we apply $-\log(-X+1)$ for the negative part and $\log(X+1)$ for the non-negative part.

[12] Balance tests on pre-determined individual characteristics are often reported in the randomized controlled trail (RCT) papers, such as Chetty et al. (2016).

Table 1 Descriptive statistics

	(1)	(2)	(3)
	Mean	SD	N
Subjective well-being			
Life satisfaction	3.37	0.73	4822
Health satisfaction	2.94	0.82	4813
Marriage satisfaction	3.49	0.79	4183
Children satisfaction	3.58	0.75	4790
Children gender			
N of children	2.54	1.46	4822
N of daughters	1.21	1.08	4822
N of sons	1.33	1.06	4822
Firstborn daughter	0.50	0.50	4822
Health			
Self-assessed health	3.09	0.93	4815
N of chronic diseases	1.27	1.43	4630
CESD-10 score	7.08	6.99	4680
Standardized cognition	−0.00	1.00	4084
Intergenerational support			
Co-residing with children	0.36	0.48	4813
Days visiting per month	27.47	24.8	4813
Care for grandchildren	0.64	0.72	4229
Annual transfer to children	3579.43	7751.29	4813
Annual transfer from children	4106.94	5938.45	4813
Employment and living conditions			
Work currently	0.29	0.45	4819
Total household expenditures	46,557.36	58,512.29	4657
Food expenditures	24,143.55	35,480.26	4427
Leisure expenditures	2061.94	9772.19	4765
Living expenditures	12,485.55	15,884.93	4682
Medical expenditures	7658.11	19,340.95	4616
Total wealth	455,345.52	2,404,393.87	4807
Demographic characteristics			
Year of birth	1949.25	7.26	4822
Gender	0.55	0.50	4821
No education	0.22	0.41	4817
Primary school	0.22	0.41	4817
Middle school	0.27	0.44	4817
High school	0.23	0.42	4817
Above high school (base group)	0.06	0.25	4817
Widowed	0.13	0.34	4821
Birth year of the first child	1974.13	10.00	4822

The sample contains urban cohorts born in 1930–1960 from CHARLS 2015 and 2018

from all children per month is about 27 days. The average annual transfer from children to older parents is 4100 RMB, and older parents, on average, transfer 700 RMB less to their

Table 2 Balance test

	(1) Correlates	(2) SD	(3) N
Father birth year	0.156	(0.211)	1715
Mother birth year	0.194	(0.217)	1666
Birth year of the first child	0.493	(0.310)	1810
Widowed	0.002	(0.009)	1810
Father no education	−0.012	(0.012)	1810
Father primary school	−0.003	(0.013)	1810
Father middle school	0.009	(0.014)	1810
Father high school	−0.000	(0.013)	1810
Father college	0.007	(0.009)	1810
Mother no education	−0.001	(0.013)	1937
Mother primary school	−0.018	(0.012)	1937
Mother middle school	−0.001	(0.011)	1937
Mother high school	0.019*	(0.011)	1937
Mother college	0.001	(0.004)	1937

This table tests whether the individual characteristics are orthogonal to our main regressor of interest—the number of daughters. Each row is from a separate regression. The regressors are the number of daughters and the number of children, and the dependent variable is the parental characteristic listed. The coefficient reported in each row is the one on the number of daughters from each regression. Because the parental characteristics and number of daughters are both time-invariant, we keep one observation for each household in this test

Clustered standard errors at the community level are reported in parentheses

*$p<0.1$; **$p<0.05$; ***$p<0.01$

children. Regarding employment and living conditions, about one-third of our sample of parents are still working. On average, they spend around 24,000 RMB per year on food, 2000 RMB on leisure, 12,000 RMB on living, and 8000 RMB on healthcare. Their average total wealth is around 455,000 RMB.

5 Results

5.1 Main Results

Table 3 shows the SWB effects of having daughters by estimating Eq. (1) using the 1930–1960 urban cohort.[13] Panel A reports the main findings using the number of

[13] We also perform the same analysis for rural older parents following the same identification strategy. Since the estimates from the rural sample may be biased due to the higher possibility of infanticides in rural areas, making the estimation not plausible, we do not discuss the results here and they will be available on request.

Table 3 The effects of having daughters on old-age SWB in urban China

	Overall		Subdomains	
	(1)	(2)	(3)	(4)
	Life satisfaction	Health satisfaction	Marriage satisfaction	Children satisfaction
Panel A: Number of daughters				
N of daughters	0.040**	0.030*	0.018	0.054***
	(0.016)	(0.018)	(0.019)	(0.015)
Adjusted R-squared	0.036	0.024	0.054	0.051
Panel B: Firstborn daughter				
Firstborn daughter	0.062**	0.093***	0.041	0.073***
	(0.025)	(0.027)	(0.031)	(0.027)
Adjusted R-squared	0.036	0.026	0.054	0.050
Panel C: Child gender composition				
Daughters and sons	0.023	0.053	0.037	0.061*
	(0.039)	(0.040)	(0.045)	(0.036)
All daughters	0.103***	0.086**	0.044	0.140***
	(0.039)	(0.041)	(0.048)	(0.038)
Adjusted R-squared	0.036	0.024	0.053	0.051
Mean	3.369	2.941	3.488	3.575
N	4815	4806	4176	4783

This table shows the OLS results of the effect of having daughters on old-age SWB, using urban cohorts born in 1930–1960 from CHARLS 2015 and 2018. Control variables in each regression cover individual characteristics including the number of children dummies, gender, respondent's birth year dummies, education level dummies, year dummies for having the first child and widowhood status. We also control for survey year and province fixed effects

Clustered standard errors at the community level are reported in parentheses

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

daughters as the main regressor. Column (1) suggests that having an additional daughter (relative to a son) leads to a 0.04 increase in older parents' life satisfaction, which is around 5.5% of the standard deviation (0.73). Columns (2) to (4) suggest that having an additional daughter also leads to increases in older parents' satisfaction with two domains of life. Specifically, the effects of number of daughters on the older parents' health satisfaction and their satisfaction with children[14] are statistically significant (at the 10 and 1 percent level respectively) with the effect sizes equal to 0.03 and 0.05 respectively. The effect on older parents' satisfaction with marriage is positive but statistically insignificant.

To complement the main results, we repeat the estimation using a dummy indicating whether the firstborn is a daughter in Panel B. The results are consistent with the main findings. The estimated coefficients on having a daughter as the first child are larger than the coefficients on the number of daughters. One possible explanation is that firstborn daughters, compared to later-born daughters, play a more important role in parents' life in old age. In other words, the effects of having firstborn daughters may contain not only the

[14] The marriage satisfaction question in CHARLS data excluded those who are widowed or divorced. This leads to a drop of about 600 observations.

effects of having daughters but also the birth order effects. Compared with sons and later-born daughters, firstborn daughters are more likely to be responsible for taking care of their families, such as assisting with household chores. Two behavioral theories can support this argument. First, as suggested by the role modelling theory, firstborn daughters often follow their mothers as role models to take care of their families (Hu, 2015). Second, according to the labor substitution theory, firstborn daughters frequently take on the role of substituting their working mothers' household chores (McHale et al., 2003).

Panel C further examines the effects of child gender composition. Taking those who only have sons as the reference group, we test whether having both sons and daughters or daughters only make parents better off in their old age. Similar to the results in Panels A and B, compared to having sons only, parents with daughters only are significantly more satisfied both with life as a whole and with health and children. However, having both daughters and sons only has a marginally significant and positive influence on older parents' satisfaction with children.

In general, our findings complement existing literature on the relationships between child gender and older parents' SWB, especially in the Chinese context. Lu et al. (2017) suggest that having firstborn daughters is positively correlated with parents' happiness over their life cycle, especially during children's adulthood. Our study establishes causal links and finds having daughters promotes not only older parents' life satisfaction but also their satisfaction with health or relationships with their children, thus offering a more comprehensive story.

5.2 Robustness Checks

We conduct two robustness checks. First, we further restrict the sample to those whose children's sex ratios are closer to the natural ratio 0.517. Although it is common to use the 1930–1960 urban cohort in the literature, we use a more restricted cohort as a robustness check since our identification strategy relies on no selection in birth gender. As shown in Fig. 1, the share of male children among some urban cohorts (i.e., those born in the early 1930s and late 1950s) is slightly above 0.517. Online Appendix Table 1 replicates the regression analysis in Table 3 but restricts the sample to the cohorts born between 1935 and 1955. Column (1) shows that the estimates for overall life satisfaction are quite similar to those in column (1) of Table 3. Except for the statistically insignificant coefficient on the number of daughters for health satisfaction, the estimates for health satisfaction and children satisfaction are consistent with the baseline results and are slightly greater in magnitude. The effect of having daughters only on marriage satisfaction becomes marginally significant at the 10 percent level. Overall, our results are robust if a more restricted and conservative sample is used.

Second, we use an alternative inference method—the randomization inference (Rosenbaum, 2007). Randomization inference produces exact p value, which is more conservative and does not rely on asymptotic approximation.[15] In practice, we randomly assign the child gender within a group of respondents who have the same birth year and fertility size. Then, we estimate the simulated coefficients of daughter numbers by using the same specification in Eq. (1). In Online Appendix Figure 1, we show the distribution of simulated coefficients

[15] This method is usually considered an alternative way of inference to check whether empirical results keep robust. For instance, Calder-Wang and Gompers (2021) also report the p value from the randomization inference as a robustness check.

of 1000 replications. The p values based on the randomization inference are calculated as the proportion of simulated coefficients that are larger than the true coefficients, in absolute values. The p values are all less than 0.1 except in the case of marriage satisfaction, a finding that again confirms our main results.

5.3 Mechanisms

Child gender could affect older parents' SWB through three dimensions of mechanisms as suggested earlier in our conceptual framework. In this section, we examine the mechanisms in two steps: first, we empirically test these by estimating Eq. (1) for various intermediate outcomes; second, we conduct the Sobel test to investigate whether these intermediate outcomes can explain the total effects of having daughters on life satisfaction. In Table 4, we explore health status in Panel A, intergenerational support in Panel B, and employment and living conditions in Panel C. We report the results using the number of daughters as the regressor in column (1), followed by the parallel results using firstborn daughters as the regressor in column (2), and the mean of the outcome variables in column (3).

Panel A reports the effects of having daughters on parents' physical health, mental health, and cognitive function. All health mechanisms are more statistically significant when we use the dummy for a firstborn daughter as our main regressor. Specifically, having a firstborn daughter leads to better physical health as shown by a 0.146 decrease in the number of chronic diseases. It also leads to better mental health as shown by a statistically significant decrease in the CES-D score by around 0.853 units. Its effect on cognition is also positive and marginally significant at the 10 percent level. Regarding self-assessed health, which includes an individual's self-evaluation of both physical and mental health, having a firstborn daughter has a positive and significant effect. The results are mostly statistically insignificant (except for the CES-D score) but consistent if we use the number of daughters as the main regressor. Overall, it seems that the influence of child gender on mental health is the strongest and most robust among all the health outcomes.

Panel B reports the results on intergenerational support. Having more daughters does not affect parents' co-residence status with children and childcare provision to their grandchildren as well as children's frequency of visits. On the other hand, parents do receive more transfer from children if they have more daughters. The results are consistent when we use the dummy indicating the firstborn is a daughter as an alternative measure.[16] Since our regression analysis from parents' perspective may not provide comprehensive information on the exchanges of support between parents and each child, we conduct a complementary exercise from children's perspective. We leverage the survey design that the CHARLS contains information on how parents exchange family support with each child. Each observation represents a child-parent pair in one survey year. We use a dummy for being a female child as the main regressor and estimate the effect of child gender on a series of intergenerational support measures. The control variables are the same as in our baseline specification with one exception: we control for family fixed effects instead of regional dummies.[17] Online Appendix Table 2 suggests that a daughter is less likely to live with her parents though the results in Table 4 indicate that having daughters do not change parents' likelihood of co-residing with

[16] The main difference is in the case of transfer from children: the negative coefficient on firstborn daughter appears to be statistically significant at the 1 percent level while that on the number of daughters is statistically insignificant.

[17] We can utilize the family fixed effects model because there are variations in child gender within a household if we use all pairs of child-parent observations.

Table 4 Mechanisms: the effects of having daughters on intermediate outcomes in urban China

	(1) N of daughters	(2) Firstborn daughter	(3) Mean	(4) N
Panel A: Health				
Self-assessed health	0.029	0.096***	3.094	4808
	(0.021)	(0.031)		
N of chronic diseases	−0.021	−0.146***	1.271	4627
	(0.028)	(0.042)		
CESD-10 score	−0.366**	−0.853***	7.073	4672
	(0.161)	−0.234		
Standardized cognition	0.024	0.059*	0.002	4075
	(0.023)	(0.035)		
Panel B: Intergenerational support				
Co-residing with children	−0.015	0.000	0.359	4806
	(0.013)	(0.019)		
Days visiting per month	0.276	−0.052	27.494	4806
	(0.726)	(1.015)		
Care for grandchildren	−0.020	0.014	0.637	4218
	(0.014)	(0.026)		
Log annual transfer to children	−0.153	−0.424***	3.953	4806
	(0.095)	(0.153)		
Log annual transfer from children	0.261***	0.404***	5.850	4806
	(0.087)	(0.145)		
Panel C: Employment and living conditions				
Log total HH expenditures	0.048	0.044	10.168	4649
	(0.036)	(0.050)		
Log food expenditures	0.044	0.112*	9.521	4418
	(0.041)	(0.057)		
Log leisure expenditures	0.203**	0.534***	2.491	4758
	(0.082)	(0.143)		
Log living expenditures	0.009	0.031	8.944	4674
	(0.026)	(0.041)		
Log medical expenditures	−0.004	−0.272**	6.761	4609
	(0.074)	(0.122)		
Log total wealth	−0.153	−0.131	8.161	4800
	(0.122)	(0.211)		
Work currently	−0.017*	−0.048***	0.286	4812
	(0.009)	(0.015)		

This table explores the mechanisms of the SWB effects of having daughters by estimating the effects on three sets of intermediate outcomes, using urban cohorts born in 1930–1960 from CHARLS 2015 and 2018. Each estimate in columns (1) and (2) is drawn from a separate regression. All the regressions contain the same set of regressors as mentioned in Table 3

Clustered standard errors at the community level are reported in parentheses

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

children. In other words, although parents are less likely to live with a child if this child is a daughter, they can still find another child to co-reside with. The results also show that older parents receive fewer visits from daughters and are less likely to take care of grandchildren for daughters. They receive more financial transfers from a daughter and provide less to her. The results persist even if we control for the child's household income and education level. Therefore, the gender difference in intergenerational support is not caused by the differences in the levels of education or household income between genders.

Finally, Panel C reports the effects on employment and living conditions. The effect of daughters on total household expenditures is insignificant, either using the number of daughters or a dummy indicating if the firstborn is a daughter as the main regressor. Despite no effect on total expenditures, child gender may have various effects on different expenditure categories. Interestingly, we find, in general, the effects of having daughters to be positive and significant on expenditures on leisure, either using the number of daughters or firstborn daughter as the main regressor. For a few other expenditure categories, the effects are only significant when the dummy for a firstborn daughter is used as the main regressor. Specifically, having a firstborn daughter has a marginally significant and positive influence on food expenditures and a significant negative effect on medical spending.[18] We also find that older parents are less likely to work if they have more daughters.

Overall, we find having daughters affects intermediate outcomes across all three dimensions of mechanisms. Older parents have better health conditions, especially mental health, if they have more daughters. Although they are less likely to live together with their daughters, they receive more financial support from daughters. Besides, they are less likely to take care of their daughter's young children, which may allow them to enjoy more leisure time. Regarding employment and living conditions, older parents with more daughters are less likely to work, and they spend more on leisure.

To complete our mechanism analysis, we employ the Sobel test to examine whether the abovementioned mechanisms can significantly explain the total SWB effects of having daughters. To be concise, we only focus on the overall life satisfaction in this part, and we only report the mediation analysis for those mechanisms that having daughters has a significant impact on, as shown in Table 4.

Table 5 reports the mediation analysis using the number of daughters as the main regressor. Column (1) reports its effect on each mediator, column (2) reports its total effect on overall life satisfaction, and column (3) accounts for both the number of daughters and the mediator to predict parents' overall life satisfaction. The indirect effect of the number of daughters (reported in column 3) working through the mediator is measured by how much the estimated coefficients of daughters shrink from column (2) to column (3).

Panel A of Table 5 shows that the inclusion of the CESD-10 score as an additional covariate decreases the magnitude of the estimated coefficient of the number of daughters from 0.038 to 0.025. The CESD-10 score attenuates the effect of the number of daughters by about 31.6% (0.012/0.038). In other words, CESD-10 score can explain 31.6% of the total life satisfaction effect of having daughters. Panel B shows that the log annual transfer from children reduces the impact of having daughters by about 7.7% (0.003/0.039). Panel C shows the log leisure expenditures reduces the effect of having daughters by about 7.5%. Panel D shows that working currently does not help explain the total impact of having daughters on older parents' life satisfaction though having an additional daughter (instead of a son) reduces older parents' tendency to work. Therefore, mental health (measured by

[18] The drop in medical spending resonates with our finding that parents with more daughters enjoy better health conditions.

Table 5 The mediation analysis, the SWB effect of the number of daughters

	(1) Mediator	(2) Life satisfaction	(3) Life satisfaction
Panel A: CESD-10 score as a mediator			
N of daughters	−0.366**	0.038**	0.025*
	(0.161)	(0.017)	(0.015)
CESD-10 score			−0.034***
			(0.002)
Observations	4672	4672	4672
Indirect effect			0.012** (0.005)
Panel B: Log annual transfer from children as a mediator			
N of daughters	0.261***	0.039**	0.036**
	(0.087)	(0.016)	(0.016)
Log annual transfer from children			0.013***
			(0.003)
Observations	4806	4806	4806
Indirect effect			0.003*** (0.001)
Panel C: Log leisure expenditures as a mediator			
N of daughters	0.192**	0.040**	0.037**
	(0.082)	(0.016)	(0.016)
Log leisure expenditures			0.014***
			(0.003)
Observations	4758	4758	4758
Indirect effect			0.003** (0.001)
Panel D: Work currently as a mediator			
N of daughters	−0.017*	0.040**	0.040**
	(0.009)	(0.016)	(0.016)
Work currently			0.002
			(0.025)
Observations	4812	4812	4812
Indirect effect			−0.000 (0.000)

This table reports the mediation analysis by adopting the Sobel test, using urban cohorts born in 1930–1960 from CHARLS 2015 and 2018. All the regressions contain the same set of regressors as mentioned in Table 3. Column (1) reports the effect of number of daughters on four mediators: CESD-10 score, log annual transfer from children, log leisure expenditures, and work currently. Column (2) reports the effect of number of daughters on parents' overall life satisfaction. Column (3) reports the effect of number of daughters on parents' overall life satisfaction with each mediator as an additional regressor. The indirect effect of each mediator is reported at the bottom of each panel

Clustered standard errors at the community level are reported in parentheses

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

the CESD-10 score) is the most important mediator in explaining daughters' effects on older parents' life satisfaction.

We also conduct the mediation analysis using the dummy indicating if the firstborn child is a daughter as the main regressor and report the results in the Online Appendix

Tables 3, 4 and 5. Again, we find that mental health, measured by the CESD-10 score, is the most important mediator: it explains 46.0% (0.029/0.063) of the total effect of firstborn daughters on older parents' life satisfaction. The second important mediator is self-assessed health, which attenuates the effect of firstborn daughters on older parents' life satisfaction by 29% (0.018/0.062).[19] Other mediators, such as intergenerational support (Online Appendix Table 4) and work and living conditions (Online Appendix Table 5), also significantly attenuate the life satisfaction effect of firstborn daughters, but with smaller magnitudes.

In general, the mechanisms we have examined are more comprehensive than those from previous studies about China, which find that the child gender enhances some intermediate outcomes such as health (Li, 2021; Zeng et al., 2016) and family support (Lei, 2013; Xie & Zhu, 2009). Consistent with the existing literature, we find that the effects on mental health and receiving financial support are positive and statistically significant. Although Zhang and Harper (2022a, 2022b) find that sons as caregivers (compared to daughters) are more likely to improve Chinese older parents' physical and mental health, their study restricts the sample to parents who need instrumental support and conducts a correlational analysis. In contrast, our study builds causal links between the number of daughters and the mechanisms using a nationally representative sample of older parents. The other dimension of mechanisms, employment and living conditions, is less discussed in the literature, but we find that having more daughters can also enhance living conditions of older parents, such as spending more on leisure, which is important for older parents' health and SWB (Carrino et al., 2020; DeLeire & Kalil, 2010; Giusta & Longhi, 2021; Noll & Weick, 2015). Our mediation analysis also offers valuable insights into the existing literature that connects intermediate outcomes with the SWB of older parents (Huang & Fu, 2021; Peng et al., 2018; Wang et al., 2020).

5.4 Heterogeneity

We explore the relationship heterogeneity across a variety of dimensions and present the coefficients (with 95-percent confidence interval) on the number of daughters from subgroup regressions in Fig. 2. Panel (a) reports the heterogeneous effects for overall life satisfaction, panel (b) for satisfaction with health, panel (c) for satisfaction with marriage, and panel (d) for satisfaction with children.

First, we investigate effect heterogeneity with respect to gender. As shown in the top two lines in each panel, the effects of the number of daughters on each of the four measures of SWB between genders are similar. Next, we turn to the age dimension by splitting the sample into two groups: those aged above the sample median of 63 and those aged below it. We find that the daughter effects are mainly concentrated among the older sample. Compared with those who are older, having more daughters does not affect satisfaction with marriage or children of parents aged 63 or below.

Regarding education levels, we compare people with lower education levels and those with higher education levels, using middle school education as a cutoff. Both groups benefit from having more daughters in terms of overall life satisfaction. However, for the three satisfaction domains, those who are less educated are more significantly influenced by the number of daughters. We then examine whether the effects differ by the number of

[19] We are aware that self-assessed health may overlap with mental health so these two mechanisms may overlap with each other.

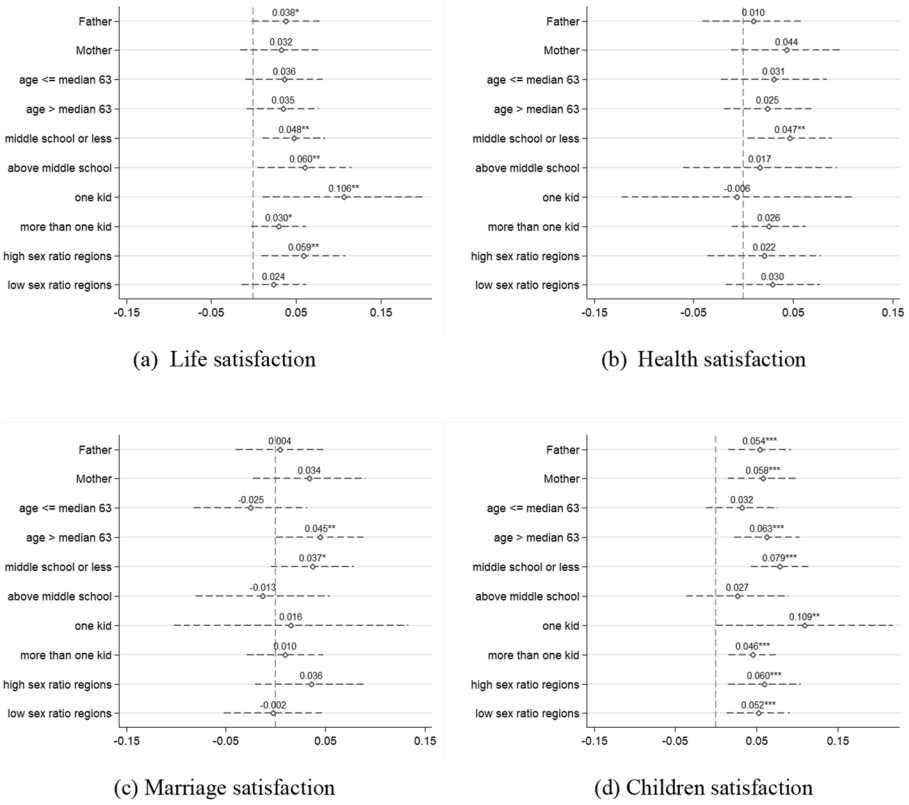

Fig. 2 Heterogeneity analysis. *Notes*: This figure shows the heterogeneous effects of the total number of daughters on older parents' SWB across different groups. The y-axis lists the corresponding groups. In particular, we divide parents based on gender (father vs mother), age (those below the sample median age 63 vs those above 63), education level (those obtained a middle school degree or below vs those whose education degree is above middle school), number of children (those with only one child vs those with multiple children), and son preference [those who live in regions with stronger son preference vs those living in regions with weaker son preference (Regions with stronger son preference are defined as those with sex ratios at birth above the national median in 2000. The other regions are defined as those with weaker son preference.)]. The x-axis shows the value of the estimated coefficients on the total number of daughters. The dashed lines surrounding the point estimates represent the 95-percent confidence intervals. The outcome variable in **a** life satisfaction, **b** health satisfaction, **c** marriage satisfaction, and **d** satisfaction with children

children. The effect of the number of daughters on overall life satisfaction and satisfaction with children is much larger for the older parents who have only one child.

Finally, we try to investigate whether the effects differ by attitudes toward child gender. In regions with stronger son preference, it is possible that the positive effect of daughters on SWB would be attenuated by the disappointment of not having sons. From the mid-1980s, because of the stringent birth control policies and the prevalence of ultrasound technology, parents who prefer boys usually abort a female fetus (Ebenstein, 2011). This has led to imbalanced sex ratios at birth since then. Therefore, we use county-level sex ratio at birth in 2000 as a proxy for the local culture of son preference and assume that counties with higher sex ratios (i.e., higher male-biased sex ratios) at birth tend to have a culture of

stronger son preference. We split the sample into those living in regions above and below the national median sex ratio at birth. According to the results at the bottom of each panel in Fig. 2, the effects of the number of daughters are quite similar in these two types of regions except that the daughter effect on overall life satisfaction tends to be a little more salient in regions with higher male-biased sex ratios at birth. Surprisingly, the results suggest that the SWB effects of having daughters for older parents can be even stronger in regions with stronger son preference. One possible explanation is that sons are so spoiled in the regions with stronger son preference that the incentive for them to provide care to their older parents in exchange of transfer and inheritance is much lower, compared to sons in regions with weaker son preference.

In sum, the heterogeneity analysis suggests that the positive effects of having daughters on older parents' SWB are more salient in more vulnerable groups, including those who are older, less educated, with fewer children. The effects are also more obvious in the regions with stronger son preference.

6 Conclusion

The relationship between child gender and the well-being of parents has been widely studied in the literature, but most of the studies have focused on younger parents, their objective living conditions and in the context of developed countries. Recent studies have begun to investigate the impacts of child gender on SWB in developing countries mainly because of rising efforts in data collection.

Using a national representative sample of Chinese older parents, this paper studies the effects of child gender on parents' SWB in China, where there is a traditional preference for sons. Exploiting the randomness of child gender among urban older parents born between 1930 and 1960, we find that having daughters significantly improves their SWB, especially overall life satisfaction, satisfaction with health, and satisfaction with children. The increase in SWB is achieved through better health, more financial support from daughters and more spending on leisure.

Our findings suggest that, despite traditional son preference, having more daughters (relative to sons) can lead to better well-being of parents in their old age. Although it is widely stated that one of the reasons for son preference is the possible old-age support provided by sons (Alesina et al., 2013; Ebenstein & Leung, 2010; Qian, 2008), our results suggest that, at least in urban China, daughters (compared to sons) play a more important role in older parents' SWB. It seems that daughters should be valued more because of their potential benefits for parents in later life. Cultural norms which exacerbate favoritism towards sons are common in developing countries, leading to higher degrees of gender inequality in several dimensions, such as education, employment, and personal autonomy (Jayachandran, 2015). Our findings kind of support that parents should invest more equally in sons and daughters even in societies with cultural norms of strong son preference.

The analysis presented here is subject to certain limitations. For instance, the present study only investigates the SWB effects of having daughters in old age. However, there might be life-cycle heterogeneity in the relationship. As family structures and financial burdens change over the life course, the benefits of daughters can also change. Therefore, it should be not surprising to find relationship heterogeneity over the life cycle. Future research can conduct life-cycle analysis if data permit. Another interesting finding that needs further investigation is the reasons underlying the stronger positive SWB effects

of daughters in regions with stronger son preference. This result is kind of counterintuitive but interesting. Sons (and their wives) are expected to provide old-age support to their parents in a society with the tradition of patriarchal culture. However, our result suggests that the well-being effects of daughters may be stronger for older parents in a family with stronger son preference.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Informed Consent This study uses secondary data without individual identifiers.

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