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Grandparenting and well-being of the elderly in China



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Contents

| | |
|---|----|
| Abstract | 4 |
| 1 Introduction | 5 |
| 2 Literature review | 6 |
| 3 Data and methodology | 8 |
| 3.1 Data | 8 |
| 3.2 Empirical strategy..... | 12 |
| 4 Empirical results..... | 14 |
| 4.1 Grandparenting and quality of life | 14 |
| 4.2 Direct and mediating effect on life satisfaction..... | 17 |
| 4.3 Robustness check: The KHB analysis..... | 20 |
| 5 Discussions | 23 |
| References | 26 |

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Abstract

Grandparenting duties can affect the well-being of the elderly both positively and negatively. This paper disentangles the interactions between grandparenting, quality of life, and life satisfaction in China. Using a panel dataset of 3,205 respondents in three waves of the China Health and Retirement Longitudinal Study (CHARLS) in 2011, 2013, and 2015, we find that grandparents who look after grandchildren are less at risk of depression, receive more financial and in-kind transfers from their children, and report greater life satisfaction than grandparents who do not look after grandchildren. These benefits vary across gender and rural-urban status, however. The positive effect of grandparenting is driven mainly by the direct effect with negligible mediating effect attributable to better quality of life.

JEL Codes: D13; O18

Keywords: grandparenting; quality of life; life satisfaction; panel data analysis; CHARLS

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1 Introduction

Grandparental caregiving, or grandparenting, is an important aspect of family life in most societies. The provision of childcare by grandparents is widespread in Europe (Di Gessa et al., 2016a) with more than 50% of grandmothers providing grandchild care (Hank & Buber, 2009). In the United States, the number of grandparents playing a role in grandchild care has increased steadily since the 1990s (Pebley & Rudkin, 1999; Mutchler & Baker, 2004) with over 60% grandparents providing grandchild care for at least ten years and more than 70% for at least 2 years (Luo et al., 2012). In Asia, 58% of Chinese grandparents provide care to at least one grandchild, compared to only 6% in South Korea (Ko & Hank, 2014). Grandparenting can have important effects on the elderly people's quality of life and health. On one hand, it requires physical effort and can imply additional demands on the limited resources of grandparents. On the other hand, looking after grandchildren helps protect the elderly from loneliness and cements their ties with their (often non-resident) children. In this paper, we study how grandparenting affects the grandparents' quality of life and life satisfaction in China, a country where the phenomenon of grandparenting is highly prevalent.

The literature explicitly recognizes the beneficial effects of grandparental caregiving on the well-beings of the elderly. Grandparenting is shown to be positively related to both subjective and objective well-being (Di Gessa et al., 2016a; Di Gessa et al., 2016b; Xu et al., 2017), cognitive functioning (Aprino & Bordone, 2014; Ahn & Choi, 2019), reduced risk of depression (Grundy et al., 2012; Tang et al., 2016), lower mortality (Hilbrand et al, 2017a; Hilbrand et al, 2017b; Danielsbacka et al., 2019) and higher level of life satisfaction (Liu et al., 2019; Xu 2019; Danielsbacka et al., 2019). An emerging strand of studies, however, warns against neglecting the relationship between grandparenting and the financial condition of grandparents (Winefield & Air, 2010; Lee et al., 2016), especially in countries like China, where the elderly depend heavily on their children for financial support (Zimmer & Kwong, 2003; Gils & Mu, 2007; Cong & Silverstein, 2008; Cong & Silverstein, 2011). Indeed, most studies focus on the direct effect of grandparenting on life satisfaction without considering the indirect or mediating effect: looking after grandchildren affects the health and financial situation of grandparents which, in turn, have an impact on their wellbeing. In this paper, we seek to close this research gap by considering also the indirect (mediating) effect of grandparenting through health and household finances.

To disentangle the nexus of grandparenting, quality of life and life satisfaction, we conduct a panel data analysis on the basis of the China Health and Retirement Longitudinal Study (CHARLS). Existing studies investigating grandparenting in China are limited in generalizability because they are based on regional samples (e.g., Cong & Silverstein, 2008; Cong & Silverstein, 2011; Liu et al., 2019). Our empirical strategy is based on the nationally representative longitudinal

dataset that provides greater generalizability and replicability. In examining the mediating effect, we first measure the quality of life of caregivers in a broad sense, including their physical and mental health as well as the financial and in-kind transfer from their children. Unlike previous studies that only include a binary indicator to measure grandparenting, we also capture the intensity of grandparenting by taking into account the hours spent caring and the total number of grandchildren cared for. Additionally, we explore the potentially different effects of grandparenting in rural and urban areas and consider how its impact depends on caring grandparent's gender (i.e. we compare the effect of grandparenting in rural vs urban areas and between grandmothers and grandfathers). To preview the findings, we first show that grandparenting is positively related with quality of life in terms of lower incidence of symptoms of depression and more financial transfer and in-kind support received from children. Contrary to our expectations, we find no evidence of a mediating role of health and financial situation on well-being: the direct effect of grandparenting plays a predominant role.

The remaining part of this paper is organized as follows. Section 2 provides a literature review. Section 3 outlines the methodology including data description and empirical strategy introduction. Section 4 summarizes the empirical results. Section 5 discusses the results and concludes.

2 Literature review

A large body of literature focuses on the relationship between grandparenting and the health and well-being of grandparents. While a number of studies show grandparenting is associated with better well-being and health of grandparents (e.g. Aprino & Bordone, 2014; Di Gessa et al., 2016a; Di Gessa et al., 2016b; Ahn & Choi, 2019; Tang et al., 2016; Ku et al., 2013; Tsai et al., 2013), this is not always the case. The potential physical and psychological sacrifices of grandparenting are well known and fall well within role strain theory (Goode, 1960). Specifically, grandparenting can impair the health of grandparents when they are, involved in intense and custodial grandchild caregiving (Hayslip & Shore, 2000; Ku et al., 2013; Musil et al., 2017; Yalcina et al., 2018).

Early research on Chinese grandparenting focuses on the financial benefits as financial support from adult children is one of the most important sources of livelihood for the elderly in China, especially in rural area (Cai et al., 2012). Using longitudinal data set derived from a village in Anhui Province, Cong & Silverstein (2011) study the intergenerational exchange between elderly and their migrant and non-migrant sons in China. They find that grandparenting has a positive effect on the financial support the elderly receive from their sons. The financial support from migrant sons is higher as the intensity of care increases compared to non-migrant sons. The earlier study of Cong & Silverstein (2008) based on the same dataset notes that the financial support the elderly receive

from their children as a reward for grandchild care contributes significantly to reducing symptoms associated with depression. These studies comport with the assessment of Short et al (2001) that the high intensity of grandchild caregiving is not a culturally scripted responsibility of grandparents in China, but must be sustained instead through financial compensation.

There is also a substantial body of evidence for China on the interplay between grandparenting and grandparent health. Using data from the China Health and Nutrition Survey, Chen and Liu (2012) find that a low intensity of grandchild care is positively associated with self-rated health and a high intensity of grandchild care has a negative impact. Using data from China Health and Retirement Longitudinal Study, Xu (2019) investigates the impact of taking care of grandchildren on the mental and physical health of grandparents. Xu finds that grandparents who care for both grandchildren and great-grandparents tend to show fewer depressive symptoms, reduced hypertension, and greater life satisfaction compared to non-caregivers. While financial conditions and health are equally important for quality of life of the elderly, studies of grandparental caregiving tend to focus on the health or the financial standing of grandparents, but not both.

While much research has explored the impact on grandparents' quality of life when investigating grandparental caregiving, studies have only recently begun to look at life satisfaction. Using SHARE data for eleven European countries from 2004 to 2015 to investigate the within-individual effect of grandparenting, Danielsbacka et al. (2019) report a positive relationship between grandparenting and the life satisfaction of grandparents. Liu et al. (2019) conduct a city case study to explore the relationship between the grandparents' contributory behaviors and their life satisfaction based on a survey data set of 809 older adults in Jiangnan, a small town in Hubei province. They find that taking care of grandchildren frequently is positively related to grandparent's life satisfaction. Based on the 2005 wave of Chinese General Social Survey data, Chyi and Mao (2012) investigate the association between the living arrangements of grandparents and their level of happiness. They find that the elderly who live with their grandchildren report higher levels of happiness than their counterparts.

The explanations for such positive effects of grandparenting on grandparents' life satisfaction can be examined from two perspectives. First, evolutionary theories such as the grandmother hypothesis have been extended to the beneficial effects of grandparenting on the elderly (Hawkes et al., 1998; Hilbrand et al., 2017b). Under this view, grandparenting is a behavior of evolutionary nature that contributes to human longevity (Hawkes, 2004; Hilbrand et al., 2017a; Tanskanen & Danielsbacka, 2019; Danielsbacka et al., 2019). Alternatively, the positive effects of grandparenting on caregiver life satisfaction can be seen as an intrinsic reflection of the caregiving system (Brown et al., 2011). Drawing upon psychological theories such as role enhancement theory (Sieber, 1974) and studies in that vein (Di Gessa et al., 2016b; Liu et al., 2019; Yalcin et al., 2018), the role of

grandchild caregivers can strengthen the grandparents' relationship with the family. It provides grandparents with emotional gratification but, a sense of personal enrichment and life competence, thereby leading to greater life satisfaction. On the contrary, these theories may not hold in the case when grandparents take primary role in providing grandchild care (Goode, 1960). In a recent research, for example, Wen et al. (2019) use cross-sectional data and find that grandparents living in skipped-generation households are less happy than those living with their spouse or those living in three-generation households. Taking the surrogate role of parents, grandparents living in skipped-generation households are overwhelmed by caring for their grandchildren and report lower levels of happiness.

Most of the previous work focuses on grandparenting and its direct effects on health, financial position, and life satisfaction. However, health and financial condition can arguably mediate the effect of grandparenting on life satisfaction. Building on the happiness theory of Layard (2005), a number of studies find that health and financial condition are among the factors determining the happiness of Chinese senior citizens (Appleton & Song, 2008; Knight et al., 2009). However, it remains unclear in the literature whether changes in the life satisfaction of grandparents are directly associated with the behavior outcomes of grandparenting or the amounts of financial transfer they receive as a reward for their effort in caring for the newest generation. With these concerns in mind, this study seeks to clarify the relationship of grandparenting, quality of life, and life satisfaction. In doing so, we first examine the relationship between grandparenting and quality of life. We treat life satisfaction separately before taking quality of life indicators (health and financial situation) as mediators linking grandparenting and life satisfaction. We take the heterogeneity of grandparent roles into account by distinguishing grandparent gender (grandmother or grandfather) and residence (rural or urban context).

3 Data and methodology

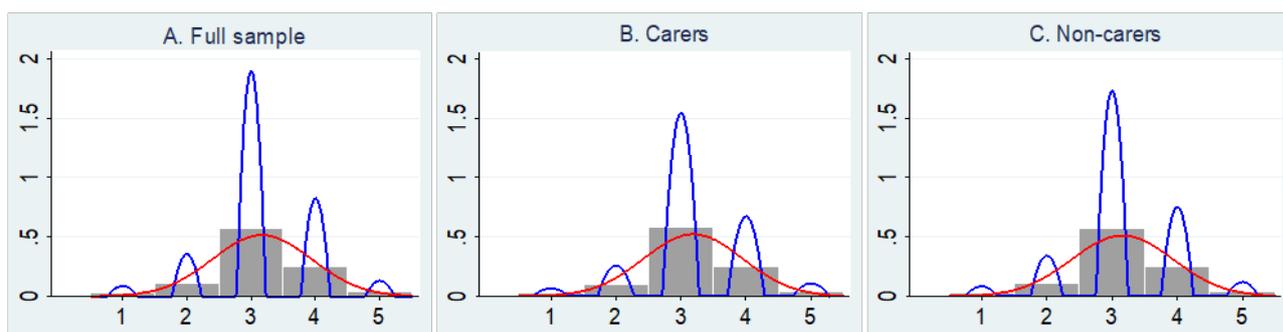
3.1 Data

Our empirical analysis is based on the China Health and Retirement Longitudinal Study (CHARLS), a biennial survey conducted by Peking University that seeks to record and examine the health and socio-economic outcomes of China's rapidly aging population in China. CHARLS was designed as the Chinese counterpart of Western surveys on population aging such as the Health and Retirement Study (HRS), the English Longitudinal Study of Ageing (ELSA), and the Survey of Health, Ageing

and Retirement in Europe (SHARE).¹ Utilizing a panel dataset allows us to tease out the true nature of the relationship between grandparenting and well-being of the elderly. Studies employing cross-sectional analyses can only shed light on between-individual differences; they do not but cannot examine whether an increase or decrease in childcare causes changes in the well-being of grandparents over time (Danielsbacka et al., 2019). Thus, unlike research using cross-sectional data, we construct a panel dataset by merging three recent CHARLS waves (2011, 2013 and 2015). This enables us to control for unobserved heterogeneity at the level of individuals. After cleaning the data,² we obtain a sample of 3,205 respondents whom we can observe for all three waves during a five-year period. This yields a total of 9,615 observations.

The primary dependent variable is life satisfaction, measured as the responses to the survey 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?” Answers range from 1 to 5, with 1 corresponding to “not at all satisfied”, and 5 assigned to “completely satisfied”. Figure 1 outlines the distribution of life satisfaction. For comparison, we report figures for the full sample, the elderly carers providing grandparental care (3,765 observations) and the non-carers (5,850 observations). The two groups display similar distribution of life satisfaction, with the intermediate assessment (3 on our 1 to 5 scale) being the most common, followed by the generally positive assessment of 4. Figure 2 depicts the relationship between life satisfaction and age. Notably, there are more respondents over 90 year of age in the group of non-carers than in the carer group.

Figure 1 Distribution of life satisfaction

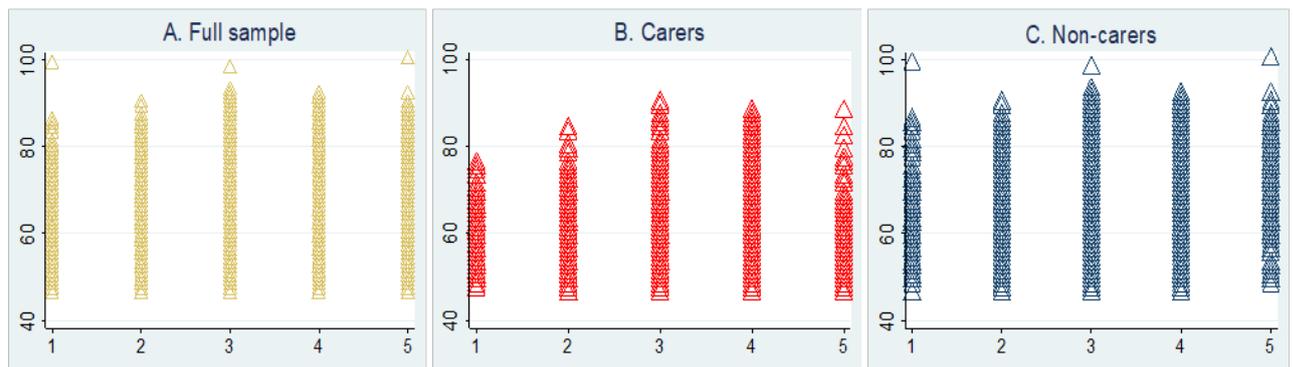


Notes: 1. Horizontal axis represents life satisfaction and vertical axis represents the density.
2. Kernel density plot in blue and normal density plot in red.

¹ For more details on the CHARLS survey, see charls.pku.edu.cn/.

² For instance, some respondents only report their financial support from children in the 2011 wave, and thereby fail to give such information for the 2013 and 2015 waves. In constructing our panel, we only include respondents reporting their financial support information in all three waves of the survey.

Figure 2 Life satisfaction in different age groups



Note: Horizontal axis represents life satisfaction and vertical axis represents the age.

Grandparenting, our main explanatory variable, is customarily captured with a binary indicator of whether or not the grandparents provide care for their grandchildren. We go further and account for the intensity of grandparental caregiving by taking into account hours of caring for grandchildren, and the number of grandchildren cared for in a year.³ Our grandparenting variables measure caring for grandchildren in the preceding year, not during the year of the survey. Specifically, the respondents were asked whether they had provided care for any grandchild or grandchildren during the preceding year, and if so, how many hours they have provided care to each grandchild and how many grandchildren they provided care for. This granular focus helps mitigate the potential problem of reverse causality between well-being and grandparenting (Ku et al., 2013).

The mediators between grandparenting and life satisfaction are physical health captured by self-rated health and self-rated health change, mental health captured by self-reported signs of depression, and financial and in-kind transfers from children. The assessment of self-rated symptoms of depression is based on the 10-item Center for Epidemiologic Studies Depression Scale (CES-D), which has been widely used to measure levels of depression. Each item is rated on a 4-point Likert scale, from 1 to 4, with higher values corresponding to higher risk of depression. By adding up these ten items, we obtain a depression indicator that ranges from 10 to 40. The larger the number, the higher the risk of depression. Kilbourne et al. (2002) and Othieno et al. (2014) use a cut-off point of 20. Those with scores equal to or higher than 21 are considered to be at risk for depression.

We control the grandparents' socio-economic characteristics including gender, marriage, age, education, *hukou* domicile⁴ and financial conditions. We also account for the household structure of grandparents such as the number of children and the number of grandchildren under 16.

³ For example, if a set of grandparents report having provided care all year for grandchild number 1, grandchild number 2, and grandchild number 3 (8,760 hours), and grandchild number 4 for half of the year (4,380 hours), their total for the year would be 30,660 caring hours.

⁴ *Hukou* is China's household registration system. It identifies each person's place of residence and classes that person as either a rural or urban resident. While the law no longer requires a person to remain in the locality of their *hukou* domicile, moving to another locality still typically comes with constraints on formal employment and limited access to

Table 1 summarizes the descriptive statistics of the variables used in our analysis, both for the full sample, and separately for carers and non-carers. The two groups differ only slightly in terms of life satisfaction. A few more non-carers report high values (4 or 5) and slightly fewer of them report intermediate and low values (2 or 3). This finding suggests that non-carers are marginally more satisfied with their lives. Non-carers are more prone to assess their health as “good” or “bad,” rather than the intermediate assessment of “fair.” Non-carers are also more likely to say that their health improved over the past year and appear to be less at risk of depression, albeit only slightly. Thus, it appears that non-carers enjoy slightly better health, despite being six years older on average than their carer counterparts. Somewhat surprisingly, grandparenting is roughly equally prevalent among urban and rural residents. It is not substantially more common among rural dwellers whose children may have migrated to towns and cities for work. Instead, what matters most is the need for care. Although carers and non-carers have similar numbers of children (two, on average), carers average three grandchildren compared to two for non-carers. Finally, carers are wealthier. They are more likely to own a house and/or land and their houses are more expensive than those of non-carers.

Table 1 Definition of variables and descriptive statistics. (N=9615)

| Variable | Definition | Full sample (N=9615) | Carers (N=3765) | Non-carers (N=5850) |
|--|------------------------|-------------------------|--------------------|------------------------|
| Dependent variable | | | | |
| Life satisfaction | Not at all satisfied=1 | 224 (2.33%) | 86 (2.28%) | 138 (2.36%) |
| | Not very satisfied=2 | 885 (9.20%) | 351 (9.32%) | 534 (9.13%) |
| | Somewhat satisfied=3 | 5694 (59.23%) | 2242 (59.55%) | 3452 (59.00%) |
| | Very satisfied=4 | 2428 (25.25%) | 942 (25.01%) | 1486 (25.40%) |
| | Completely satisfied=5 | 384 (3.99%) | 144 (3.82%) | 240 (4.10%) |
| Mediators/1st step dependent variables | | | | |
| Self-rated health | Bad=0 | 2960 (30.79%) | 1115 (29.61%) | 1845 (31.53%) |
| | Fair=1 | 4574 (47.57%) | 1858 (49.34%) | 2716 (46.43%) |
| | Good=2 | 2081 (21.64%) | 792 (21.09%) | 1289 (22.03%) |
| Self-rated health change | Worse=0 | 3032 (31.53%) | 1216 (32.30%) | 1816 (31.04%) |
| | Same=1 | 5927 (61.64%) | 2320 (61.62%) | 3607 (61.66%) |
| | Better=2 | 656 (6.82%) | 229 (6.08%) | 427 (7.30%) |
| Self-rated depression CES-D | From 10 to 40 | 18.72 (6.15) | 18.71 (6.27) | 18.73 (6.06) |
| Financial transfers from children (1,000 yuan) | Actual value | 4.19 (3.90) | 4.29 (3.99) | 4.13 (3.85) |
| In-kind transfers from children (1,000 yuan) | Actual value | 3.44 (3.50) | 3.43 (3.52) | 3.45 (3.48) |
| Independent variables | | | | |
| Provide grandchild care last year | No = 0 | 5850 (60.84%) | 3765 (100%) | 0 |
| | Yes = 1 | 3765 (39.16%) | 0 | 5850 (100%) |
| Caring time in the last year (hours) | Actual value | 1298.78 (2634.57) | 2997.78 (3305.85) | 0 |
| Number of grandchildren cared last year | Actual value | 0.49 (0.66) | 1.12 (0.57) | 0 |

public services. In theory, all Chinese should have a *hukou*. However, some CHARLS respondents (3.5% of the sample) report not to have one; most likely because they were born in violation of China’s One Child Policy.

| Variable | Definition | Full sample (N=9615) | Carers (N=3765) | Non-carers (N=5850) |
|--|-----------------------|-------------------------|--------------------|------------------------|
| Control variables | | | | |
| Gender | Female=0 | 4881 (50.76%) | 2005 (53.25%) | 2876 (49.16%) |
| | Male=1 | 4734 (49.24%) | 1760 (46.75%) | 2974 (50.84%) |
| Married | No = 0 | 3339 (34.73%) | 1004 (26.67%) | 2335 (39.91%) |
| | Yes = 1 | 6276 (65.27%) | 2761 (73.33%) | 3515 (60.09%) |
| Age | Actual value | 64.92 (9.31) | 61.23 (7.74) | 67.28 (9.57) |
| Education | No formal education=0 | 2837 (29.51%) | 930 (24.70%) | 1907 (32.60%) |
| | Elementary school=1 | 4353 (45.27%) | 1723 (45.76%) | 2630 (44.96%) |
| | High school=2 | 2,073 (21.56%) | 981 (26.06%) | 1092 (18.67%) |
| | Vocational school=3 | 352 (3.66%) | 131 (3.48%) | 221 (3.78%) |
| Hukou | Rural Hukou=0 | 7552 (78.54%) | 2978 (79.10%) | 4574 (78.19%) |
| | Urban Hukou=1 | 1724 (17.93%) | 669 (17.77%) | 1055 (18.03%) |
| | Does not have Hukou=2 | 339 (3.53%) | 118 (3.13%) | 221 (3.78%) |
| Saving (1,000 yuan) | Actual value | 10.32 (40.34) | 9.97 (37.01) | 10.56 (42.43) |
| Loan (1,000 yuan) | Actual value | 2.34 (26.99) | 2.65 (24.91) | 2.14 (28.26) |
| House owner | No=0 | 1361 (14.15%) | 439 (11.66%) | 922 (15.76%) |
| | Yes=1 | 8254 (85.85%) | 3326 (88.34%) | 4928 (84.24%) |
| House values (1,000 yuan) | Actual value | 1.57 (32.68) | 1.83 (38.05) | 1.39 (28.59) |
| Land owner | No=0 | 3204 (33.32%) | 1138 (30.23%) | 2066 (35.32%) |
| | Yes=1 | 6411 (66.68%) | 2627 (69.77%) | 3784 (64.68%) |
| Number of children | Actual number | 2.08 (1.92) | 1.93 (1.72) | 2.17 (2.02) |
| Number of grandchildren under 16 years old | Actual number | 2.47 (2.05) | 3.01 (2.01) | 2.12 (1.99) |

Notes: For categorical variable, observations are reported with proportions in parentheses. For variables with actual values, the mean is reported with standard error in parentheses. Caring time is calculated as the sum of hours devoted to taking care of each grandchild.

3.2 Empirical strategy

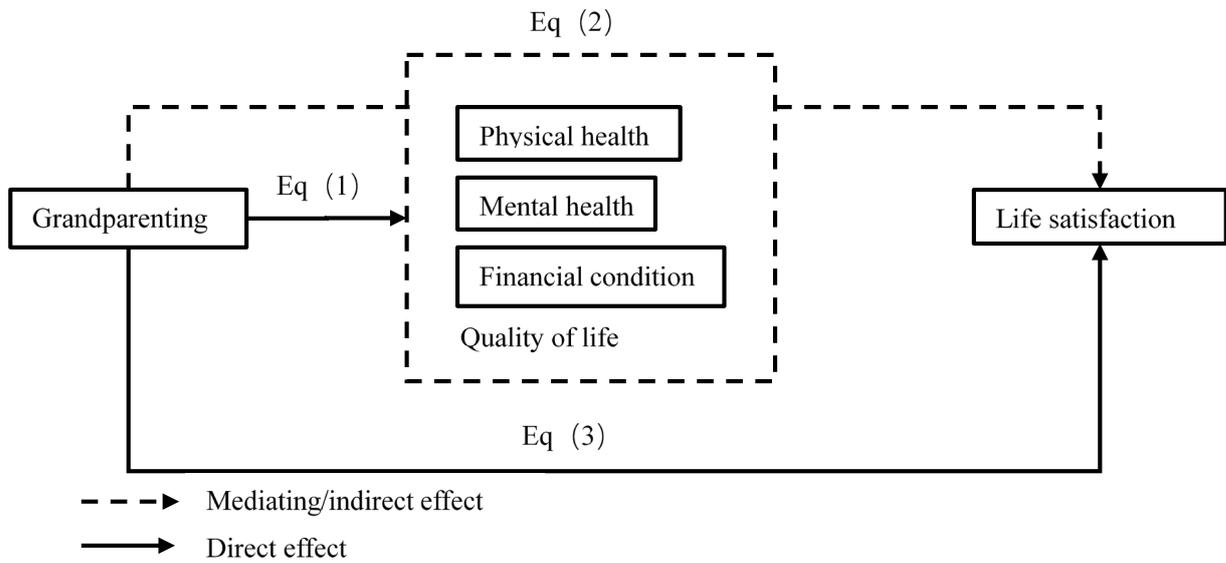
To study the direct and indirect effects of grandparenting on life satisfaction, our empirical strategy consists of two steps as presented in Figure 3. In the first step, we investigate the effect of grandparenting on the mediators, the quality of life indicators, as specified in equation (1) below. In the second step, equation (2) examines the mediating effect of quality of life on life satisfaction. In addition, we also examine the direct effect of grandparenting on life satisfaction, as captured by equation (3).

$$QL_{it} = \alpha_0 + \alpha_1 GP_{it} + \alpha_2 X_{it} + \eta_t + \mu_i + \nu_{it} \quad (1)$$

$$LS_{it} = \beta_0 + \beta_1 GP_{it} + \beta_2 QL_{it} + \beta_3 X_{it} + \eta_t + \mu_i + \nu_{it} \quad (2)$$

$$LS_{it} = \gamma_0 + \gamma_1 GP_{it} + \gamma_2 X_{it} + \eta_t + \mu_i + \nu_{it} \quad (3)$$

Figure 3 Grandparenting, quality of life and life satisfaction



In equation (1), QL_{it} is a vector of quality of life mediators for individual i in year t that includes physical health, mental health, and financial and in-kind transfers from children; GP_{it} is an indicator of grandparenting; and X_{it} is a vector of socio-economic characteristics. We use three alternative indicators of grandparenting: a binary indicator, amount of time spent looking after grandchildren, and the number of grandchildren looked after. In equation (2), we relate life satisfaction of the elderly, LS_{it} , to quality of life, QL_{it} , and socio-economic characteristics, X_{it} . Finally, in equation (3), we consider how grandparenting shapes life satisfaction directly. All equations include η_t and μ_i to capture unobserved individual-specific and time-specific effects. A downside to including fixed effects is that time-invariant variables are omitted. This is the case for gender, education and hukou, which do not change for any of the respondents during the three waves that we consider.⁵ Finally, v_{it} is the usual error term.

We use three alternative indicators of grandparenting: a binary indicator, amount of time spent looking after grandchildren, and the number of grandchildren looked after. Therefore, we estimate three different versions of equation (1). In equations (2–3), γ_1 reflects the direct effect of grandparenting on grandparents' life satisfaction, while β_1 is the marginal effect after controlling for quality of life. β_2 measures the mediating (indirect) effect. If the mediating effect is present, β_1 should be smaller than γ_1 . As a robustness test, we then adopt a Karlson-Holm-Breen (KHB) decomposition analysis to isolate the indirect effect from total effect.

⁵ We also estimate equations (1–3) with random effects. The results do not vary significantly from those presented here and are available on request.

4 Empirical results

4.1 Grandparenting and quality of life

Tables 2–4 report the results for providing grandchild care, time spent caring, and number of grandchildren cared for, on grandparents' quality of life with fixed effect. Note that all regressions control for individual socio-economic characteristics (in addition to fixed effects for individuals and time). As the coefficients of the socio-economic characteristics are quite similar across regressions, we only report them in Table 2. Columns 1 and 2 consider the relationship between grandparenting and physical health (i.e., self-rated health and self-rated health change). We find no significant relationship between grandparenting and physical health, suggesting that physical health is unrelated with grandparenting regardless time, effort or the number of grandchildren cared for. Column 3 reports the coefficients for the relationship between grandparenting and mental health). The results suggest that taking care of grandchildren, the number of hours of care and the number of grandchildren cared for are all negatively associated with risk of depression. This suggests that the mental health of grandparents is favorably affected by providing care for their grandchildren. The results in column 4 and 5 show that the relationship between grandparenting and financial transfers from children is positive and statistically significant, suggesting that grandparents receive more financial support from their children when providing grandchild care. This effect is also significantly related to the caring time and the number of grandchildren care for. In a similar vein, grandparenting also has a significant impact on in-kind transfers from children.

A number of observations can be made about the individual controls. Married individuals are less likely to be at risk of depression and receive more in-kind transfers from their children. Somewhat surprisingly, married individuals are less inclined to report an improvement in their physical health. Having more savings and a more expensive house is also correlates with better physical and mental health. Elderly Chinese with more children and grandchildren have poorer physical health, but receive more financial and in-kind transfers. Age displays a hump-shaped relationship for financial and in-kind transfers from children. The peak of this effect is reached at 91 for financial transfers and 96 for in-kind transfers, i.e. it is effectively positive throughout.

Table 2 Effect of providing grandchild care on quality of life: full sample. FE

| Mediators | (1) Self-rated health | (2) Self-rated health change | (3) Self-rated depression | (4) Financial transfer | (5) In-kind transfer |
|----------------------------------|-----------------------------|------------------------------------|---------------------------------|------------------------------|----------------------------|
| Providing grandchild care | -0.008 (-0.45) | 0.007 (0.40) | -0.288* (-1.95) | 0.448*** (4.60) | 0.335*** (3.88) |
| Marriage | 0.051 (-0.57) | -0.013 (-0.35) | -0.795** (-2.37) | 0.171 (0.77) | 0.197 (0.94) |
| Age | -0.066 (-1.53) | -0.249*** (-5.25) | 0.042 (1.11) | 3.256*** (11.40) | 2.938*** (4.61) |
| Age-squared | 0.000 (1.43) | 0.001* (1.71) | -0.000 (-1.30) | -0.018*** (-8.08) | -0.008*** (-3.84) |
| Saving | 0.006** (2.50) | 0.001 (0.34) | -0.067*** (-3.84) | 0.026** (2.25) | 0.049*** (4.56) |
| Loan | -0.004 (-1.01) | -0.004 (-1.32) | 0.038 (1.30) | -0.035* (-1.85) | -0.014 (-0.78) |
| House owner | -0.011 (-0.47) | 0.003 (0.13) | 0.005 (0.02) | -0.066 (-0.51) | -0.038 (-0.31) |
| House value | 0.001 (0.31) | -0.002 (-0.63) | -0.109*** (-3.45) | 0.051** (2.41) | -0.038 (1.37) |
| Land owner | -0.016 (-0.73) | 0.018 (0.90) | -0.141 (-0.81) | 0.170 (0.115) | 0.163 (1.50) |
| Number of children | -0.009 (-1.27) | -0.015** (-2.12) | -0.144*** (-3.15) | 0.197*** (4.70) | 0.094** (2.39) |
| Number of grandchildren under 16 | 0.000 (-0.02) | -0.003 (-0.48) | 0.048 (0.97) | 0.056* (1.70) | 0.038 (1.23) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| R ² -within | 0.008 | 0.154 | 0.014 | 0.196 | 0.368 |
| R ² -between | 0.008 | 0.001 | 0.021 | 0.035 | 0.016 |
| R ² -overall | 0.008 | 0.001 | 0.017 | 0.003 | 0.016 |
| Observations | 9,615 | 9,615 | 9,615 | 9,615 | 9,615 |

Notes: t-values given in parentheses. *p<0.1 **p<0.05 ***p<0.01. FE = Fixed Effect.

Table 3 Effect of caring time for grandchildren on quality of life: full sample. FE

| Mediators | (1) Self-rated health | (2) Self-rated health change | (3) Self-rated depression | (4) Financial transfer | (5) In-kind transfer |
|--------------------------|-----------------------------|------------------------------------|---------------------------------|------------------------------|----------------------------|
| Caring time | -0.001 (-0.22) | 0.001 (0.05) | -0.039* (-1.94) | 0.056*** (4.23) | 0.056** (4.32) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| R ² -within | 0.008 | 0.154 | 0.014 | 0.196 | 0.368 |
| R ² -between | 0.008 | 0.001 | 0.022 | 0.035 | 0.016 |
| R ² -overall | 0.008 | 0.001 | 0.017 | 0.033 | 0.016 |
| Observations | 9,615 | 9,615 | 9,615 | 9,615 | 9,615 |

Notes: t-values given in parentheses. *p<0.1 **p<0.05 ***p<0.01. Control variables are included but not reported. Caring time is given in log form.

Table 4 Effect of number of grandchildren cared on quality of life: full sample. FE

| Mediators | (1) Self-rated health | (2) Self-rated health change | (3) Self-rated depression | (4) Financial transfer | (5) In-kind transfer |
|--------------------------------|-----------------------------|------------------------------------|---------------------------------|------------------------------|----------------------------|
| No, of grandchildren cared for | 0.001 (0.08) | 0.011 (0.91) | -0.170* (-1.66) | 0.223*** (3.21) | 0.261*** (4.00) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| R ² -within | 0.008 | 0.154 | 0.013 | 0.195 | 0.368 |
| R ² -between | 0.008 | 0.001 | 0.022 | 0.035 | 0.016 |
| R ² -overall | 0.008 | 0.001 | 0.017 | 0.033 | 0.016 |
| Observations | 9,615 | 9,615 | 9,615 | 9,615 | 9,615 |

Notes: t-values given in parentheses. *p<0.1 **p<0.05 ***p<0.01. Control variables are included but not reported.

Table 5 presents a comparison of the effects of grandparenting on the quality of life of grandparents in rural settings (village) and urban areas (town or city). There are 2,458 grandparents in rural areas and 747 grandparents in urban areas, with 7,374 observations and 2,241 rural and urban observations in the three years, respectively. Panel A reports the effect in rural areas and panel B reports the effect in urban areas. As for the effect on physical health shown in column 1 and 2, there is no significant relationship between grandparenting and physical health in either rural or urban areas. In column 3, which presents the effect on mental health, depression is significantly and negatively associated with all the indicators of grandparenting in urban areas but insignificantly related with grandparenting in rural areas. This suggests that the favorable effect of grandparenting on mental health only exists in urban areas. Regarding financial transfers in column 4, the results show that the effect of grandparenting on financial support received from children is slightly stronger in urban areas, although this may simply reflect the greater earning power of urban residents and higher cost of living in towns or cities. In column 5, we see the positive relationship between in-kind transfers and grandparenting is significant in rural areas but insignificant in urban areas.

Table 5 Effect of grandparenting on quality of life: rural vs urban. FE

| Mediators | (1) Self-rated health | (2) Self-rated health change | (3) Self-rated depression | (4) Financial transfer | (5) In-kind transfer |
|--------------------------------|-----------------------------|------------------------------------|---------------------------------|------------------------------|----------------------------|
| Panel A: Rural | | | | | |
| Provide grandchild care | -0.042 (-0.62) | -0.007 (-0.12) | -0.067 (-1.16) | 0.373*** (2.98) | 0.309*** (2.60) |
| Caring time | -0.001 (-0.35) | 0.000 (0.15) | -0.039 (-1.50) | 0.043*** (2.48) | 0.041** (2.54) |
| No, of grandchildren cared for | -0.011 (-0.23) | 0.014 (0.32) | -0.037 (-0.88) | 0.270*** (4.11) | 0.213** (2.48) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 7,374 | 7,374 | 7,374 | 7,374 | 7,374 |
| Panel B: Urban | | | | | |
| Provide grandchild care | 0.090 (0.71) | -0.109 (-0.98) | -0.207* (-1.87) | 0.428** (2.40) | 0.106 (0.70) |
| Caring time | 0.019 (1.10) | -0.013 (-0.88) | -0.022 (-1.44) | 0.053** (2.23) | 0.013 (0.64) |
| No, of grandchildren cared for | 0.061 (0.66) | -0.080 (-0.97) | -0.132* (-1.65) | 0.092 (0.71) | 0.113 (1.00) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 2,241 | 2,241 | 2,241 | 2,241 | 2,241 |

Notes: 1. t-values are in parentheses; 2. *p<0.1 **p<0.05 ***p<0.01. 3. Control variables are included but not reported.

Table 6 investigates the effect of grandparenting on quality of life by grandparents' gender. There are 1,578 grandfathers and 1,627 grandmothers, with 4,734 observations and 4,881 male and female observations, respectively, in the three years. Panel A reports the effect for grandfathers and panel B reports the effect for grandmothers. Columns 1 and 2 show that the effect of grandparenting on physical health is mostly statistically insignificant for both grandfathers and grandmothers. This is consistent with our full sample estimate (with the possible exception of grandmother physical health,

which seems positively affected by grandparenting in two out three of our indicators). As shown in column 3, grandparenting is negatively associated with depression for grandfathers whereas this relationship is insignificant for grandmothers, which suggests that grandmothers do not benefit from providing grandchild care in terms of mental health. The results in columns 4 and 5 suggest that financial and in-kind transfers from children are significantly and positively related to grandparenting for both grandmothers and grandfathers. The financial gain associated with grandparenting is, however, larger for grandmothers, while the effect on in-kind transfers seems to depend little on gender of the grandparent.

Table 6 Effect of grandparenting on quality of life: grandmother vs grandfather

| Mediators | (1) Self-rated health | (2) Self-rated health change | (3) Self-rated depression | (4) Financial transfers | (5) In-kind transfers |
|--------------------------------|-----------------------------|------------------------------------|---------------------------------|-------------------------------|-----------------------------|
| Panel A: Grandfather | | | | | |
| Provide grandchild care | -0.039 (-1.55) | 0.001 (0.06) | -0.607* (-3.19) | 0.298** (2.15) | 0.359*** (2.73) |
| Caring time | -0.004 (-1.20) | -0.001 (-0.01) | -0.057** (-2.15) | 0.024* (1.76) | 0.038** (2.08) |
| No, of grandchildren cared for | -0.022 (-1.23) | 0.009 (0.56) | -0.247* (-1.80) | 0.070* (1.76) | 0.272*** (2.88) |
| Individual fixed | Yes | Yes | Yes | Yes | Yes |
| Year fixed | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,734 | 4,734 | 4,734 | 4,734 | 4,734 |
| Panel B: Grandmother | | | | | |
| Provide grandchild care | 0.019 (0.74) | 0.013 (0.52) | 0.038 (0.17) | 0.585*** (4.26) | 0.363*** (2.83) |
| Caring time | 0.002 (0.68) | 0.001 (0.07) | -0.022 (-0.74) | 0.086*** (4.66) | 0.058*** (3.37) |
| No, of grandchildren cared for | 0.020 (1.10) | 0.012 (0.71) | -0.095 (-0.60) | 0.367*** (3.80) | 0.246*** (2.73) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,881 | 4,881 | 4,881 | 4,881 | 4,881 |

Notes: 1. t-values are in parentheses; 2. *p<0.1 **p<0.05 ***p<0.01. 3. Control variables are included but not reported.

4.2 Direct and mediating effect on life satisfaction

In this subsection, we investigate the direct effect of grandparenting on life satisfaction and its mediating effect. Table 7 reports the effect of grandparenting on life satisfaction. Columns 1, 3 and 5 show the direct effect of grandparenting without the mediators while columns 2, 4 and 6 include the mediators. As physical health has been shown to be insignificantly related with grandparenting, it is excluded from the analysis of mediating effects.⁶ The direct effect of grandparenting measured with a dummy variable is positive and statistically significant (column 1). The effects of caring time and grandchildren in care are also positive but only marginally significant (column 3) or insignificant (column 5). After including the mediators (column 2), the effect of grandparenting remains

⁶ The results, which are similar when we include physical health, are available upon request.

positive and is only slightly reduced. The effects of caring time and number of grandchildren in care become insignificant when accounting for the mediating effects. The limited change in the coefficients indicates that the improvements in mediators (mental health and financial condition) attributable to grandparenting play at most a limited role in increasing life satisfaction.

Few of the additional individual control variables are significant, especially when we control for quality of life indicators. Finally, having more savings and more expensive house translates into higher satisfaction with life, whereas owing money, not surprisingly, has a negative effect.

Table 8 examines the effect of grandparenting on life satisfaction with Panel A presenting the results for rural areas and Panel B for urban areas. The positive effect of grandparenting on life satisfaction is insignificant in both rural and urban areas, which suggests that providing grandchild care does not lead to a higher life satisfaction for the elderly and that there are no significant mediating effects.

Table 7 Effect of grandparenting on life satisfaction: full sample. FE

| Dependent variable: Life satisfac- | (1) | (2) | (3) | (4) | (5) | (6) |
|------------------------------------|--------------------|-----------------------|--------------------|-----------------------|--------------------|--------------------|
| Provide grandchild care | 0.049** (2.42) | 0.039** (1.96) | | | | |
| Caring time | | | 0.005* (1.69) | 0.003 (1.23) | | |
| No. of grandchildren cared for | | | | | 0.020 (1.40) | 0.014 (1.01) |
| Self-rated depression | | -0.022*** (-12.56) | | -0.022*** (-12.58) | | -0.022 (-12.59) |
| Financial transfers from children | | 0.006** (2.29) | | 0.006** (2.33) | | 0.006** (2.35) |
| In-kind transfers from children | | 0.003 (0.95) | | 0.003 (0.98) | | 0.003 (0.98) |
| Married | 0.080 (1.08) | -0.031 (-0.66) | -0.012 (-0.26) | -0.031 (-0.67) | -0.011 (-0.25) | -0.030 (-0.66) |
| Age | 0.174*** (2.90) | 0.165*** (2.73) | 0.171*** (2.85) | 0.162*** (2.69) | 0.173*** (2.88) | 0.163*** (2.70) |
| Age-squared | -0.001 (-0.73) | -0.000 (-0.82) | -0.000 (-0.70) | -0.000 (-0.79) | -0.000 (-0.72) | -0.000 (-0.80) |
| Saving | 0.002 (1.04) | 0.001 (0.39) | 0.003 (1.04) | 0.001 (0.39) | 0.002 (1.04) | 0.001 (0.39) |
| Loan | -0.007* (-1.84) | -0.006 (-1.59) | -0.007* (-1.85) | -0.006 (-1.60) | -0.007* (-1.87) | -0.006 (-1.61) |
| House owner | 0.028 (1.01) | 0.029 (1.06) | 0.027 (0.99) | 0.028 (1.03) | 0.027 (0.99) | 0.028 (1.04) |
| House value | 0.011** (2.47) | 0.008 (1.06) | 0.011** (2.49) | 0.008* (1.88) | 0.011** (2.48) | 0.008* (1.87) |
| Land owner | 0.004 (0.17) | -0.001 (-0.03) | 0.004 (0.16) | -0.001 (-0.03) | 0.004 (0.18) | -0.001 (-0.02) |
| Number of children | 0.005 (0.58) | 0.005 (0.52) | 0.006 (0.63) | 0.005 (0.56) | 0.005 (0.63) | 0.005 (0.56) |
| Number of grandchildren under 16 | 0.005 (0.74) | 0.005 (0.52) | 0.006 (0.81) | 0.006 (0.91) | 0.006 (0.83) | 0.006 (0.92) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| R ² -within | 0.059 | 0.084 | 0.059 | 0.083 | 0.059 | 0.083 |
| R ² -between | 0.013 | 0.026 | 0.013 | 0.026 | 0.013 | 0.025 |
| R ² -overall | 0.011 | 0.021 | 0.011 | 0.021 | 0.010 | 0.021 |
| Observations | 9,615 | 9,615 | 9,615 | 9,615 | 9,615 | 9,615 |

Notes: t-values given in parentheses. *p<0.1 **p<0.05 ***p<0.01.

Table 8 Effect of grandparenting on life satisfaction: rural vs urban, FE

| Dependent variable: Life satisfaction | (1) | (2) | (3) | (4) | (5) | (6) |
|---------------------------------------|-----------------|----------------------|-----------------|----------------------|-----------------|----------------------|
| Panel A: Rural | | | | | | |
| Provide grandchild care | 0.026 (0.99) | 0.019 (0.74) | | | | |
| Caring time | | | 0.004 (1.14) | 0.003 (0.88) | | |
| No, of grandchildren cared for | | | | | 0.015 (0.76) | 0.012 (0.063) |
| Self-rated depression | | -0.019*** (-8.89) | | -0.019*** (-8.89) | | -0.019*** (-8.90) |
| Financial transfer | | 0.004 (1.21) | | 0.004 (1.22) | | 0.004 (1.23) |
| In-kind transfer | | 0.005 (1.40) | | 0.005 (1.39) | | 0.005 (1.40) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| R ² -within | 0.021 | 0.044 | 0.021 | 0.044 | 0.021 | 0.044 |
| R ² -between | 0.017 | 0.028 | 0.017 | 0.028 | 0.017 | 0.028 |
| R ² -overall | 0.013 | 0.021 | 0.013 | 0.021 | 0.013 | 0.021 |
| Observations | 7,374 | 7,374 | 7,374 | 7,374 | 7,374 | 7,374 |
| Panel B: Urban | | | | | | |
| Provide grandchild care (yes=1) | 0.037 (0.30) | -0.062 (-0.51) | | | | |
| Caring time | | | 0.002 (0.12) | -0.009 (-0.53) | | |
| No, of grandchildren cared for | | | | | 0.053 (0.57) | -0.002 (-0.02) |
| Self-rated depression | | -0.163*** (-9.62) | | -0.163*** (-9.62) | | -0.163*** (-9.60) |
| Financial transfer | | 0.011 (0.75) | | 0.011 (0.75) | | 0.011 (0.73) |
| In-kind transfer | | 0.042** (2.42) | | 0.042** (2.42) | | 0.042** (2.41) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| R ² -within | 0.035 | 0.043 | 0.035 | 0.043 | 0.035 | 0.043 |
| R ² -between | 0.028 | 0.036 | 0.029 | 0.038 | 0.028 | 0.035 |
| R ² -overall | 0.097 | 0.125 | 0.097 | 0.125 | 0.099 | 0.127 |
| Observations | 2,241 | 2,241 | 2,241 | 2,241 | 2,241 | 2,241 |

Notes: t-values given in parentheses. *p<0.1 **p<0.05 ***p<0.01. Control variables are included but not reported

Table 9 reports the effect of grandparenting and quality of life on the grandparents' life satisfaction by gender. Panel A presents the results of grandparenting effect on life satisfaction for grandfathers and Panel B present the results for grandmothers. Again, grandparenting raises the life satisfaction of grandparents but has little impact on grandmothers. As before, we find little evidence of a mediating effect when accounting for the role of gender in caring for grandchildren.

Table 9 Effect of grandparenting on life satisfaction grandfather vs grandmother, FE

| Dependent variable: Life satisfaction | (1) | (2) | (3) | (4) | (5) | (6) |
|---------------------------------------|--------------------|-----------------------|-------------------|-----------------------|-------------------|-----------------------|
| Panel A: Grandfather | | | | | | |
| Provide grandchild care (yes=1) | 0.094*** (3.46) | 0.082** (3.05) | | | | |
| Caring time | | | 0.009** (2.25) | 0.007** (1.98) | | |
| Number of grandchildren cared | | | | | 0.053** (2.67) | 0.048** (2.48) |
| Self-rated depression | | -0.015*** (-6.05) | | -0.016*** (-6.15) | | -0.016*** (-6.15) |
| Financial transfers | | 0.012*** (3.29) | | 0.012*** (3.35) | | 0.012*** (3.38) |
| In-kind transfers | | -0.002 (-0.64) | | -0.002 (-0.58) | | -0.002 (-0.64) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| R ² -within | 0.072 | 0.085 | 0.070 | 0.084 | 0.070 | 0.085 |
| R ² -between | 0.007 | 0.013 | 0.007 | 0.013 | 0.008 | 0.014 |
| R ² -overall | 0.006 | 0.012 | 0.007 | 0.012 | 0.007 | 0.012 |
| Observations | 4,734 | 4,734 | 4,734 | 4,734 | 4,734 | 4,734 |
| Panel B: Grandmother | | | | | | |
| Provide grandchild care (yes=1) | 0.004 (0.15) | 0.002 (0.08) | | | | |
| Caring time | | | 0.001 (0.21) | 0.001 (0.03) | | |
| Number of grandchildren cared | | | | | 0.012 (0.55) | 0.011 (0.46) |
| Self-rated depression | | -0.026*** (-10.99) | | -0.026*** (-10.99) | | -0.026*** (-11.00) |
| Financial transfers | | 0.001 (0.21) | | 0.001 (0.21) | | 0.001 (0.25) |
| In-kind transfers | | 0.007* (1.77) | | 0.007* (1.78) | | 0.007* (1.80) |
| Individual fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| R ² -within | 0.057 | 0.092 | 0.057 | 0.093 | 0.057 | 0.093 |
| R ² -between | 0.015 | 0.033 | 0.015 | 0.033 | 0.016 | 0.033 |
| R ² -overall | 0.013 | 0.028 | 0.013 | 0.029 | 0.013 | 0.029 |
| Observations | 4,881 | 4,881 | 4,881 | 4,881 | 4,881 | 4,881 |

Notes: t-values given in parentheses. *p<0.1 **p<0.05 ***p<0.01. Control variables are included but not reported.

4.3 Robustness check: The KHB analysis

To test for robustness of our results in the final step in our analysis, we adopt the Karlson-Holm-Breen (KHB) decomposition analysis, which decomposes the total effect into direct and indirect effects. Developed by Karlson, Holm and Breen (2012), the KHB methods allow the researchers to assess the influence of confounding relative to the influence of rescaling. The mediated effect is only considered significant when the total and indirect effects are significant (Karlson & Holm, 2011; Santini et al., 2016). The results of the KHB test are shown in Tables 10–12. The total effect of all mediators is statistically significant and positive, indicating that taking care of grandchildren has a generally positive effect on life satisfaction. The results of full sample alongside subsample estimates regarding the residence and gender indicates little in a way of a mediating effect of grandparenting. This is consistent with our previous results. It confirms that the mediating effect is economically negligible.

Table 10 The KHB decomposition analysis, full sample

| Variables | Provide grandchild care (yes=1) | | | Caring time | | | Number of grandchildren cared | | |
|-----------------------------------|---------------------------------|--------------------|------------------|--------------------|--------------------|------------------|-------------------------------|--------------------|------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| | Total effect | Direct effect | Indirect effect | Total effect | Direct effect | Indirect effect | Total effect | Direct effect | Indirect effect |
| Self-rated depression | 0.1373** (2.50) | 0.1243** (2.26) | 0.0130 (0.14) | 0.0175** (2.34) | 0.0148** (1.98) | 0.0027 (0.03) | 0.1010** (2.51) | 0.0894** (2.22) | 0.0116 (0.13) |
| Financial transfers from children | 0.0979** (2.18) | 0.0872* (1.94) | 0.0107 (0.84) | 0.0137** (2.25) | 0.0121** (1.99) | 0.0016 (0.13) | 0.0844** (2.55) | 0.0773** (2.34) | 0.0071 (0.56) |
| In-kind transfers from children | 0.0986** (2.19) | 0.0980** (2.18) | 0.0006 (0.04) | 0.0138** (2.26) | 0.0137** (2.24) | 0.0001 (0.01) | 0.0854** (2.58) | 0.0829** (2.51) | 0.0025 (0.15) |
| Mediators group | 0.1109** (2.44) | 0.0903** (1.98) | 0.0206 (0.23) | 0.0156** (2.52) | 0.0117* (1.90) | 0.0038 (0.04) | 0.0961*** (2.87) | 0.0781** (2.33) | 0.0180 (0.20) |

Notes: z-values are in parentheses; *p<0.1 **p<0.05 ***p<0.01; Mediators group contains Self-rated depression, Financial transfers and In-kind transfers from children.

Table 11 The KHB decomposition analysis: rural vs urban

| Variables | Provide grandchild care (yes=1) | | | Caring time | | | Number of grandchildren cared | | |
|-----------------------------------|---------------------------------|--------------------|--------------------|--------------------|--------------------|------------------|-------------------------------|--------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| | Total effect | Direct effect | Indirect effect | Total effect | Direct effect | Indirect effect | Total effect | Direct effect | Indirect effect |
| Panel A: Rural | | | | | | | | | |
| Self-rated depression | 0.1592** (2.58) | 0.1649** (2.67) | -0.0057 (-0.05) | 0.0202** (2.39) | 0.0198** (2.34) | 0.0004 (0.00) | 0.1060** (2.36) | 0.1065** (2.37) | -0.0005 (-0.00) |
| Financial transfers from children | 0.1204** (2.36) | 0.1098** (2.15) | 0.0106 (0.59) | 0.0161** (2.32) | 0.0145** (2.08) | 0.0016 (0.09) | 0.0915** (2.45) | 0.0831** (2.23) | 0.0084 (0.47) |
| In-kind transfers from children | 0.1211** (2.37) | 0.1210** (2.37) | 0.0000 (0.00) | 0.0162** (2.32) | 0.0162** (2.32) | 0.0000 (0.00) | 0.0921** (2.47) | 0.0901** (2.42) | 0.0020 (0.09) |
| Mediators group | 0.1363*** (2.64) | 0.1335** (2.59) | 0.0029 (0.02) | 0.0184 (2.61) | 0.0167 (2.37) | 0.0017 (0.01) | 0.1040*** (2.75) | 0.0966** (2.55) | 0.0075 (0.06) |
| Panel B: Urban | | | | | | | | | |
| Self-rated depression | 0.0357 (0.29) | -0.0518 (-0.42) | 0.0875 (0.42) | 0.0040 (0.24) | -0.0075 (-0.46) | 0.0115 (0.06) | 0.0638 (0.71) | 0.0037 (0.04) | 0.0601 (0.29) |
| Financial transfers from children | 0.0013 (0.01) | -0.0092 (-0.09) | 0.0104 (0.47) | 0.0017 (0.13) | 0.0003 (0.02) | 0.0013 (0.06) | 0.0374 (0.52) | 0.0345 (0.48) | 0.0030 (0.14) |
| In-kind transfers from children | 0.0023 (0.02) | -0.0005 (-0.01) | 0.0028 (0.07) | 0.0017 (0.13) | 0.0013 (0.10) | 0.0005 (0.01) | 0.0408 (0.56) | 0.0364 (0.50) | 0.0044 (0.12) |
| Mediators group | 0.0084 (0.09) | -0.0790 (-0.80) | 0.0875 (0.44) | 0.0026 (0.20) | -0.0089 (-0.68) | 0.0115 (0.06) | 0.0510 (0.69) | -0.0093 (-0.13) | 0.0603 (0.31) |

Notes: z-values given in parentheses. *p<0.1 **p<0.05 ***p<0.01. Mediators group contains Self-rated depression, Financial transfers and In-kind transfers from children.

Table 12 The KHB decomposition analysis: grandfather vs grandmother

| Variables | Provide grandchild care (yes=1) | | | Caring time | | | Number of grandchildren cared | | |
|-----------------------------------|---------------------------------|----------------------|------------------------|---------------------|----------------------|------------------------|-------------------------------|----------------------|------------------------|
| | (1) Total effect | (2) Direct effect | (3) Indirect effect | (4) Total effect | (5) Direct effect | (6) Indirect effect | (7) Total effect | (8) Direct effect | (9) Indirect effect |
| Panel A: Grandfather | | | | | | | | | |
| Self-rated depression | 0.2408*** (2.94) | 0.1971** (2.41) | 0.0437 (0.36) | 0.0233** (2.05) | 0.0183 (1.61) | 0.0050 (0.04) | 0.1473** (2.46) | 0.1278** (2.13) | 0.0195 (0.16) |
| Financial transfers from children | 0.1510** (2.32) | 0.1415** (0.17) | 0.0095 (0.55) | 0.0155* (1.71) | 0.0141 (1.56) | 0.0013 (0.08) | 0.1006** (2.08) | 0.0944* (1.95) | 0.0062 (0.36) |
| In-kind transfers from children | 0.1514** (2.33) | 0.1505** (2.31) | 0.0009 (0.08) | 0.0155* (1.71) | 0.0153* (1.69) | 0.0002 (0.02) | 0.1011** (2.09) | 0.0992** (2.05) | 0.0020 (0.17) |
| Mediators group | 0.1629** (2.47) | 0.1115* (1.69) | 0.0514 (0.43) | 0.0166* (1.81) | 0.0104 (1.14) | 0.0061 (0.05) | 0.1067** (2.18) | 0.0821* (1.68) | 0.0247 (0.21) |
| Panel B: Grandmother | | | | | | | | | |
| Self-rated depression | 0.0399 (0.53) | 0.0589 (0.78) | -0.0190 (-0.14) | 0.0120 (1.20) | 0.0115 (1.14) | 0.0005 (0.00) | 0.0528 (0.96) | 0.0497 (0.91) | 0.0032 (0.02) |
| Financial transfers from children | 0.0387 (0.62) | 0.0285 (0.45) | 0.0102 (0.55) | 0.0112 (1.35) | 0.0097 (1.16) | 0.0016 (0.09) | 0.0613 (1.35) | 0.0544 (1.19) | 0.0069 (0.38) |
| In-kind transfers from children | 0.0392 (0.62) | 0.0403 (0.64) | -0.0011 (-0.03) | 0.0113 (1.36) | 0.0116 (1.39) | -0.0003 (-0.01) | 0.0632 (1.39) | 0.0620 (1.36) | 0.0012 (0.03) |
| Mediators group | 0.0521 (0.82) | 0.0648 (1.02) | -0.0127 (-0.09) | 0.0136 (1.61) | 0.0123 (1.46) | 0.0013 (0.01) | 0.0758 (1.64) | 0.0675 (1.46) | 0.0083 (0.06) |

Notes: z-values given in parentheses. *p<0.1 **p<0.05 ***p<0.01. Mediators group contains Self-rated depression, Financial transfers and In-kind transfers from children.

5 Discussions

We have conducted a panel data analysis to study how grandparenting affects the quality of life and life satisfaction in China in order to understand whether grandparents achieve better life satisfaction directly due to looking after and spending time with their grandchildren, or indirectly via improved quality of life. Our results, based on CHARLS data from the 2011, 2013 and 2015 waves, show that grandparenting has an overall significant and positive effect on grandparents' quality of life by improving their mental health and financial condition. We do not find any evidence that physical health is significantly affected by grandparenting either in a positive or negative way. Contrary to our expectation that both direct and indirect effects of grandparenting can affect life satisfaction, we find that the positive relationship between grandparenting and life satisfaction is mainly driven by the direct effect. Somewhat surprisingly, the mediating (indirect) effect on life satisfaction is negligible.

Thus, we find no significant relationship between grandparenting and the physical health of grandparents. In contrast to previous literature asserting that grandparenting, especially intensive grandparenting, has an adverse effect on physical health of the elderly (Jendrek, 1993; Hayslip & Shore, 2000; Chen & Liu, 2012; Musil et al., 2017; Yalcin et al., 2018), our findings do not suggest that grandparenting accelerates physical health decline. Similar to Ku et al. (2013) and Liu et al. (2019), our interpretation is that the net effect of grandparenting on physical health is neutral in the short-run, while the negative impact of grandparenting on physical health is more salient over the long run. In line with previous findings of Grundy et al. (2012), Tang et al. (2016), and Tsai et al. (2013), our results show that the incidence of depression, as measured by the score of CES-D, is negatively associated with grandparenting. Elderly grandchild caregivers are less likely to report being lonely and less likely to suffer symptoms of depression. Moreover, when distinguishing rural and urban grandparents, we find that this positive relationship between grandparenting and mental health is only significant for grandparents in rural areas, which is in line with the findings of Tsai et al. (2013) and Burnett et al. (2013). This result is intuitive. A large number of rural workers have migrated to urban areas in recent decades, leaving their children with the grandparents in rural areas. The grandchildren, in turn, constitute an important emotional connection between the grandparents and their adult children. This effect is significant for grandfathers and insignificant for grandmothers as the grandfather role in grandparenting tends to be complementary rather than primary or custodial (Di Gessa et al., 2016a). By the same token, grandmother involvement in grandchild care is psychologically demanding and can lead to mental strain (Blustein et al., 2004; Xu, 2019).

This study also relates to the intergenerational exchange literature. We find that the financial condition of grandparents is significantly and positively associated with grandparenting. The

grandchild caregivers who live in rural areas receive less financial support from their children than those who live in urban areas, which contrasts with Cong and Silverstein (2011) who show that financial returns to grandparents from providing grandchild care and financial assistance are greater from migrant sons than from non-migrant sons in rural China. Our interpretation is straightforward – the cost of raising children is lower for grandparents in rural areas than in urban areas. We also find that grandfathers receive more financial and in-kind transfer than grandmothers from their children when they provide grandchild care. This reflects the ingrained patriarchalism of Chinese society. The grandmother takes responsibility for taking care of grandchildren as a duty, while the grandfather provides care as a favor, obtaining financial and in-kind transfers in return.

The positive effect of grandparenting is significant in rural but not in urban areas. Intuitively, grandparents in rural areas are more likely to take custodial role in grandchild care, especially if their children move for work elsewhere. Looking after grandchildren helps them bolster relationships with their non-resident children. Grandparenting may also be more rewarding in rural areas because the traditional norms and cultural values are better preserved in rural contexts than in urban areas.

Finally, we extend the literature by examining whether quality of life mediates the impact of grandparenting on life satisfaction. The direct effect of grandparenting on life satisfaction is statistically significant and positive, broadly consistent with the life satisfaction literature (Danielsbacka et al., 2019; Liu et al., 2019; Xu, 2019; Chyi & Mao, 2012). We find, however, that the mediating effect of grandparenting via quality of life accounts only for a tiny portion of the total effect on the life satisfaction of grandparents. Although health and financial situation play significant roles in determining the level of happiness of the elderly (Appleton & Song, 2008; Knight et al., 2009; Chyi & Mao, 2012), the positive effect of grandparenting on life satisfaction is mainly driven by the direct effect. This finding comports with role enhancement theory with an emphasis on the role performance and family solidarity (Sieber, 1974; Chen et al., 2011; Di Gessa et al., 2016a; Yaelcin et al., 2018; Liu et al., 2019), which is intensively embedded in the Chinese culture. According to the grandmother hypothesis, the greater life satisfaction of grandchild caregivers is an inherent reflection of a caregiving system that encourages investments in grandchildren (Brown et al., 2011; Hilbrand et al., 2017a; Hilbrand et al., 2017b; Danielsbacka et al., 2019). Lending credence to these studies, we provide empirical evidence that the happiness triggered by grandparenting is an intrinsic rather than extrinsic mediating quality-of-life outcome.

As a social phenomenon of increasing importance, especially in less developed countries, one would have expected the subject of grandparenting to have attracted more research attention. There are several implications offered by our study. Our findings suggest that only rural grandparents derive benefits in terms of their mental health and life satisfaction from looking after their

grandchildren. Rural grandparents often see their children moving to urban areas for work. Looking after grandchildren presumably helps compensate the elderly for the adverse impact of their children living far away. The observed differences between the effects of rural and urban grandparenting thus may be attributable to different outcomes of intergenerational transfer between grandparents, their children, and grandchildren.

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