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Abstract

Utilizing the 2015 wave of the China Health and Retirement Longitudinal Study (CHARLS) that covers 7045 households, we study the effect of grandparents looking after grandchildren on quality of life and life satisfaction of grandparents. We find evidence of important favorable effects of grandparents caregiving: when grandparents look after their grandchildren, they are 2.9% less likely to report symptoms of depression, the amount of support that they receive from their children approximately doubles, and are 2.7% (1.1%) more likely to report being very satisfied (completely satisfied). These favorable effects are proportionate to the amount of time spend caring for grandchildren and increase with the number of grandchildren looked after. The favorable effects on mental health seem limited to grandparents living in rural areas and apply especially to grandfathers. The favorable effect on life satisfaction is primarily directly attributable to caring for grandchildren rather than being incurred indirectly due to better health or financial situation of grandparents.

JEL-Codes: D130, O180.

Keywords: grandparenting, quality of life, life satisfaction.

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1. Introduction

The topic of grandparenting has attracted increasing attentions as a fuller understanding of grandparenting can offer a better explanation for household economics (for example, Møllegaard & Jæger, 2015; Bol & Kalmijn, 2016). Grandparental involvement in child care is common in many countries. For instance, Danish, Dutch, French and Swedish grandparents are mostly likely to provide care for their grandchildren while Spanish and Italian grandparents are least likely to do so (Hank & Buber, 2009). In the US, despite a steady proportion of grandparents and grandchildren co-residence, the number of grandparents taking a custodial role in grandchildren fostering has increased extensively from 1990s onwards (Pebley & Rudkin, 1999; Mutchler & Baker, 2004; Livingston & Parker, 2010). Over 60% grandparents provide grandchild care for at least one decade and more than 70% for at least 2 years (Luo et al., 2012). In China, traditional family values promote multigenerational co-residence as an ideal living arrangement that promotes filial piety, family solidarity and collective family interests over individual interests (Xu, 2018). Ko and Hank (2014) show that 58% of the Chinese grandparents are taking care of their grandchildren whereas this proportion is much lower in South Korea, only 6%. However, a major debate based on whether the grandparental caregiving for the grandchildren is a burden or a benefit still lasts and not yet reaches an indubitable consensus mainly due to the difference of cultures and societies.

On the one hand, taking care of grandchildren is believed to be beneficial not only to the whole family but also to the grandparents themselves. Working with a sample of Chinese Americans, Tang et al (2016) report a positive influence of grandparents' involvement in grandchild care on both grandparents' physical and mental conditions. The explanations focus on the culture aspect as they point out that the grandparent caregiving is generally expected in the Chinese culture. Likewise, in the case of Taiwan, self-rated physical health of grandparent caregivers is shown to be beneficially associated with providing care for grandchildren, especially in multigenerational families (Ku et al. 2013). In the case of Turkey, Yalcin et al (2018) find that grandparents who provide care to their grandchildren can indeed be better off in terms of both physical and mental condition compared to those who do not provide childcare. They argue that this is mainly due to the Mediterranean culture in which grandparents have highly positive perception and huge willingness for grandchild care. Similarly, Hayslip and Kaminski (2005) consider that providing grandchild care can mentally contribute to the grandparents because of the establishment of an especially affinitive grandparents-grandchildren relationship (Erhle & Day, 1994). The impact of grandparent caregiving on physical health of grandparents depends on the caring intensity in China (Chen & Liu, 2012). They argue that the high grandchild care intensity accelerates the grandparents' health decline while low intensity of care has a positive effect. Sampling a number of European countries, however, Di Gessa, et al. (2016) show that both intensive and non-intensive childcare have positive effects on grandparents' self-rated health over time. They believe that

looking after grandchildren brings the grandparents emotional gratification and a sense of usefulness and competence, which increases their life satisfaction.

On the other hand, some researches show that taking care of grandchildren has negative effect on grandparents. As grandparents carry greater grandchild care responsibility (Winefield & Air, 2010), grandparent caregivers suffer more stress (Lee, Clarkson & Lee, 2016). They argue that their stress originates mainly from financial constraints, grandchildren's misbehaviour, navigating service system and friction between the birth parents and themselves. In a similar vein, Komonpaisarn and Loichinger (2018) adopt socio-economic and demographic factors as well as female labour force participation rates as instruments in their empirical analysis. Their results report that the grandparents' health condition including both physical and psychological well-being is negatively affected by fostering their grandchildren as caregivers in Thailand.

It is surprising that in the literature there is limited evidence so far for China, a country where the grandparenting is hugely prevalent. Our goal is to fill this gap by investigating how grandparent caregiving affects the grandparents' quality of life and life satisfaction in the case of mainland China. The paper close to ours is Liu et al. (2018) that conducts a city-case study to explain the relationship between older adults' contributory behaviours and their life satisfaction based on 809 older adults in Jianghan, China. Xu (2018) provides another similar study recently, showing a positive relationship between grandparenting and physical and mental health of grandparents in China. Besides studying the impact of grandparenting on grandparents' quality of life in terms of physical health, mental health and financial condition and their life satisfaction from a broader dataset up to date, we use more specific measurements including "whether grandparents provide grandchildren care, how much time they spend on caring grandchildren and the number of grandchildren they take care" and further explore the role of quality of life changes through which the grandparenting affects the grandparents' life satisfaction indirectly.

Our results show that there is a positive relationship between grandparenting and grandparents' mental health and financial condition while the worsening physical health may not be blamed on grandparenting. Interestingly, when we take gender and region difference in to account, the positive effect of grandparenting on mental health is significant for grandparents who live in village areas and grandfathers. Grandparents living in urban areas get more financial support but are less likely to live with their adult children compared to those who live in village area. Also, the grandfathers get more financial support and more likely to live with their adult children than grandmothers. Equally importantly, the mediating effect of grandparenting through the life quality on life satisfaction is negligibly small. This suggests that the higher level of life satisfaction is ascribed to the grandparenting itself, which reflect the traditional attitude towards grandparenting in China, not as a burden but as an enjoyable task.

The remaining part of this paper is organized as follows. In the next section, we provide the background of providing care for grandchildren and its effect on grandparents' life satisfaction. Section

3 summarizes the data and methodology in use. Section 4 presents the estimation results. Section 5 discusses the results and concludes.

2. Theoretical framework

2.1 Background of taking care of grandchildren in China

The co-residence of grandparents and grandchildren has been common social phenomenon in China (He et al., 2018). China has the highest co-residence rate between grandparents and grandchildren among Asian countries, leading to a higher childcare involvement by the grandparents (Chen, 2011). The health of grandparents has an important effect on the family fertility decisions as grandmothers are expected to take the major childcare responsibility in Chinese society (Zhang & Luh, 2018). The health of the elderly has been improving in line with the recent economic development and the improvements of the standard of living. As a result, grandparents experience a longer life expectancy and are more capable of assisting their adult children in providing care to their grandchildren.

China has been undergoing an unprecedented demographic transition in line with the rising life expectancy (Ning et al., 2016) and decreasing total fertility since the 1970s (Hui et al., 2016). Hence, the structure of family is increasingly "4-2-1"[1]. Young couples have to work hard to financially support their child and their four elderly parents, which limits the time for looking after the next generation. The involvement of grandparents in grandchild care thus helps facilitate their participation in the labor market, especially for the women (Compton, 2015).

Grandparent can get more financial support (both money and in kind) from their children when taking care of grandchildren. In Western countries, the social security system and elderly welfare policy is relatively mature. Most of the grandparents do not necessarily rely on their adult children and other family members (Burnette et al., 2013). However, due to the lack of social security benefits and appropriate health care system, a high proportion of elderly people rely on their children for support in China (Silverstein & Cong, 2013; Arpino & Bordone, 2014). Some grandparents may therefore suffer from financial hardship. Taking care of grandchildren can help increase the financial support that the elderly receive from their children.

In Western countries, the elderly often value their independent living and social activities (Pruchno, 1999; Baker et al., 2008). In contrast, Chinese grandparents are expected to take full-time and custodial responsibility of care for grandchildren (Burnette et al., 2013). The extent of care, the prevalence of co-residence and the substantial involvement of both co-residential and non-coresidential grandparents in childcare all reveal a major aspect of Chinese culture, the importance of family solidarity in a Chinese way (Chen, 2011; Zhou, 2015; Xu et al., 2017). As such, providing grandchild

[1] "4-2-1" family structure is a family group consisting of four elders (paternal and maternal grandparents), two middle-aged (father and mother) and one child) (due to the birth-control policy adopted in the early 1970s and one-child policy adopted in the early 1980s).

care is taken for granted rather than considered as a burden for the grandparents (Tang et al., 2016).

2.2 Taking care of grandchildren and quality of life

The literature suggests several channels to explain the effect of taking care of grandchildren on quality of life. First, grandparent caregiving can change their physical health. For instance, grandparents provide care for their grandchildren as either full time or part time babysitters while the parents are working. Whatever the role of the grandparents in terms of taking care of grandchildren, it is a highly energy consuming activity. They can be faced with a more rapid health decline than the non-grandparent caregivers who experience normal age-related health decline (Jendrek, 1993). Also, the fatigues and pains caused by the caregiving can have negative effect on the physical health of caregivers (Winefield & Air, 2010; Hadfield, 2014). Moreover, taking care of grandchildren occupies grandparents' leisure time, raising the opportunity cost of participating in social activities. In this sense, grandparent caregiving can exacerbate the grandparents' burden and undermine their physical health and this negative effect is even significant on grandmothers who are expected to take the custodial role (Musil et al., 2017; Yalcina et al., 2018).

Second, caregiving can also affect psychological health. The impact of taking care of grandchildren can either be positive or negative. Research has shown that the size of support network and frequency of social contacts decline with age. As social isolation is often an issue for elderly adults, the quality of the relationship between parents and children is of great importance (Denise, 2011). Taking care of grandchildren can be beneficial to grandparents since they are more likely to maintain close contact with their offspring through visiting, phone calls or messages, which creates a tighter relationship. The grandparents then have more social contacts, which potentially has a positive impact on their psychological health. However, grandparents can suffer from the psychological strain due to grandchildren caregiving and the associated stress and loss of freedom (Kolomer & McCallion, 2005; Letiecq et al., 2008). Also, intergenerational conflicts between grandparents and parents may arise while taking care of grandchildren because of different expectations about the role of grandparent in caregiving. This can havew a negative impact on the relationship between grandparents and their children and raises the risk of depression, which in turn leads to a decline of elders' life satisfaction (Leung & Fung, 2014).

Third, financial condition of grandparents can as well be affected by the caregiving to their grandchildren. Financial support from adult children is one of the most important sources for the elderly in China to maintain their livelihood in old age, especially for elderly people in rural area (Cai et al., 2012). A noticeable portion of Chinese people have no social security in rural areas where the poverty rate remains high and this situation also applies for low income people in urban areas. At the end of 2017, the coverage rate of pension insurance was 65.85%[2]. As the probability of being employed

[2] Data sources: Ministry of Human Resources and Social Security of the People's Republic of China

decreases, financial support from children is particularly important for ageing grandparents. Taking care of grandchildren can increase their children's "support behavior" by about 7% (Li &Yang, 2017). Grandparent caregiving is considered as a way of reciprocal exchanges of money or material support (Fingerman et al., 2010; Cong & Silverstein, 2011). It has also been pointed out that the caring time for grandchild provided by grandparents is positively related to the amount of remittance received from their children, which in turn not only improves their nutrition and physical health by allowing them to purchase food so as to maintain and improve health care, but also reduces depressive symptoms and eventually increases life satisfaction. (Cong & Silverstein, 2012; Xu, 2018).

2.3 The mediators

The previous discussion on the literature implies that grandparenting can affect grandparents' life satisfaction directly and indirectly. The indirect effect refers to the mediating effect that captures the positive relationship between grandparent caregiving and quality of life of the grandparents, which in turn raises their life satisfaction. As Fig. 1 shows, first, proving care for grandchildren can place a negative effect on grandparents' physical health which in turn decreases their life satisfaction. Second, grandparents obtain better social contacts because of more intense and deeper connection with their offspring due to taking care of their grandchildren, which has a positive effect on their psychological health and helps increase their life satisfaction. However, a negative effect on the grandparents' psychological health can be caused by the intergenerational conflicts that can ensue because of different views on how to raise the grandchildren. It can therefore be argued that the effect of providing care for grandchildren on life satisfaction as mediated by psychological health is either positive or negative. Third, grandparents can get more financial support from their children by taking care of grandchildren, which has a positive effect on their financial conditions, thereby increasing their life satisfaction. As a result, proving care for grandchildren can affect grandparents' life satisfaction though the mediating effect of grandparents' physical health, psychological health and the financial conditions.

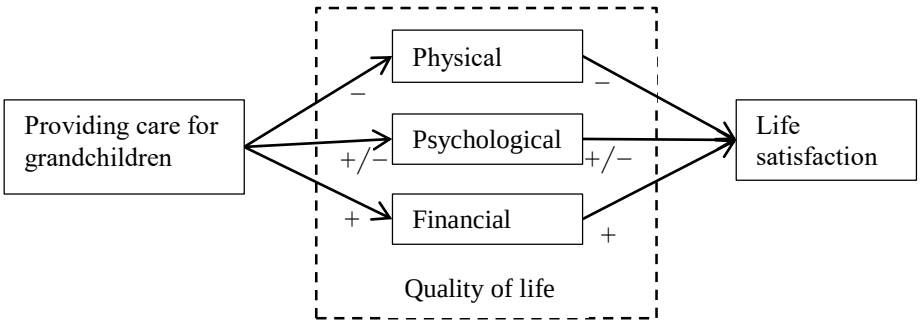

Fig. 1. Grandparenting, quality of life and life satisfaction.

3. Data Methodology

The empirical strategy takes two steps. The first step we investigate how grandparenting affects the life quality, the mediators. In the second step, we compare how grandparenting affects the life

satisfaction directly without considering life quality, the mediators and how grandparenting affects the life satisfaction indirectly via life quality, the mediators that affected by grandparenting in the first step. Specifically, grandparenting is measured by "providing care for grandchildren (yes/no)", "caring hours in the last year" and "number of grandchildren cared". We use "health", "health change", "suffering body pains", "depression", "supports from children" and "living with children" as mediator variables to measure grandparents' quality of life.

3.1 Data

The data is from nationally representative China Health and Retirement Longitudinal Study (CHARLS), which is a biennial survey conducted by Peking University that aims to record and examine the main health and economic outcomes caused by the rapidly ageing population in China. It has been designed on the basis of a series of prior surveys on population ageing, namely the Health and Retirement Study (HRS), the English Longitudinal Study of Ageing (ELSA), and the Survey of Health, Ageing and Retirement in Europe (SHARE).[3] The analysis uses CHARLS data in the year of 2015 including 12,235 households. After excluding observations with missing answers to the questions required for our analysis, the final sample comprises 7045 households.

Table 1 shows the descriptive statistics of the dependent variable, older people's life satisfaction. The question is "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?" The answers are assigned numerical values from 1 to 5, with 1 corresponding to Not at all satisfied, and 5 assigned to Completely satisfied.

The explanatory variables of interesting, capturing grandparenting, are shown in Table 2. We construct three different variables: a binary indicator of taking care for grandchildren, aggregate hours of grandchild care,[4] and number of grandchildren in grandparents' care.

Table 1
Definition and descriptive statistics of life satisfaction, the dependent variable (N=7045).

Dependent variable	Value	Obs.	Prop. (%)	Mean	Std.Dev.
Life satisfaction	Not at all satisfied=1	175	2.52	3.3441	0.8178
	Not very satisfied=2	543	7.83		
	Somewhat satisfied=3	3409	49.13		
	Very satisfied=4	2343	33.77		
	Completely satisfied=5	469	6.76		

Table 2
Definition and descriptive statistics of independent variables (N=7045).

Independent Variables	Obs.	Min	Max	Mean	Std.Dev.
Providing care for grandchildren	7045	0	1	0.3043	0.4602
Caring hours in the last year	7045	0	34,944	1063.951	2668.131
Number of grandchildren cared	7045	0	9	0.3726	0.6411

Note: Caring hours are calculated as the sum of hours for taking care of each grandchild.

[3] For more details of the CHARLS survey, see charls.pku.edu.cn/.

[4] For example, if grandparents report to have provided care for grandchild 1, 2 and 3 for 8760 hours (whole year) and grandchild 4 for 4380 hours (half year), the total caring hours are 3,0660.

As for the mediators, we use "health", "health change" and "suffering body pains" to measure grandparents' physical health; "depression" to measure their psychological health, and "supports from children" and "living with children" to measure their financial situation after providing care for grandchildren. The descriptions and values of each variable are shown in Table 3. Fig. 2 compares the quality of life and life satisfaction of carers and non carers as age proceeds. The assessment of depression is based on 10-item list from the Center for Epidemiologic Studies Depression Scale (CES-D), which is a widely used method to measure depressive symptoms. It has been shown that CES-D has shown good validity and reliability in the Chinese population (Cheng & Chan, 2005; Cheng et al., 2016). Since each item is rated on a 4-point Likert scale, we assign them values 0 to 3, with higher values corresponding to greater likelihood of depression. By adding up those 10 items we obtain the depression degree, which ranges from 0 to 30. For simplicity, the bigger the numbers, the higher is the depression degree. The descriptive of statistics of CES-D in our analysis are shown in Table 4. We follow the study of Kilbourne et al. (2002) and Othieno et al. (2014) and use a cut-off point of 10. Those with scores equivalent to or higher than 11 in the survey are considered to suffer from depression. We thus create a binary depressive symptom variable, with a value of 1 assigned to those with score of 11 or higher, and 0 otherwise.

Table 3
Definition and descriptive statistics of life quality, the mediator variables (N=7045).

Mediator variables	Value	Obs.	Prop. (%)	Mean	Std.Dev.
Health	Bad=0	2047	29.06		
	Fair=1	3388	48.09	0.9380	0.7179
	Good=2	1610	22.85		
Health change compared with last interview	Worse=0	3218	45.68		
	About the same=1	3126	44.37	0.6427	0.6547
	Better=2	701	9.95		
Suffering body pains	None=0	4783	67.89	0.3211	0.4669
	Yes=1	2262	32.11		
Depression	no=0	4344	61.66	0.3204	0.4667
	yes=1	2048	29.07		
Economic supports from children (yuan)		7045	100	13488.46	834002.20
Live with children	No=0	4096	58.14	0.4186	0.4934
	Yes=1	2949	41.86		

As shown in Table 5, the control variables are the grandparents' socio-economic characteristics including gender, marriage, age, address, retirement statues, whether they can take care of themselves, and whether they are in the insurance scheme. Also, we control the household structure of grandparents such as the number of children, the number of grandchildren over 16, the number of grandchildren under 16 and the number of siblings.

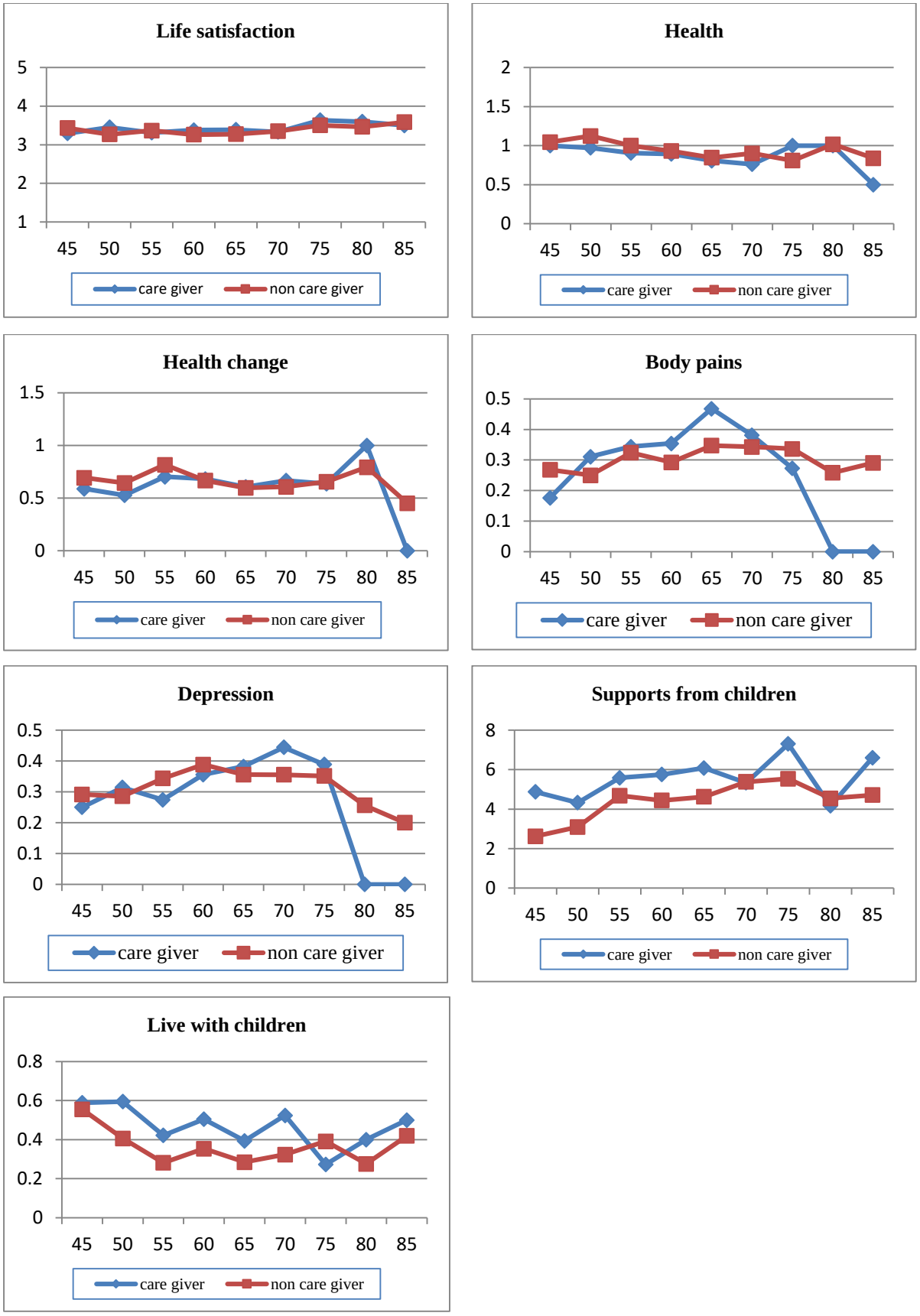

Fig. 2. Quality of life and life satisfaction with age.

Table 4
The descriptive statistics of CES-D.

	Rarely or none of the time (<1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of the time (3-4 days)	Most or all of the time (5-7 days)	Total
I was bothered by things that don't usually bother me	3736 (53.03)	1063 (15.09)	1094 (15.53)	1016 (14.42)	6909 (98.07)
I had trouble keeping my mind on what I was doing	3826 (54.31)	1006 (14.28)	1048 (14.88)	943 (13.39)	6823 (96.85)
I felt depressed	3667 (52.05)	1183 (16.79)	1124 (15.95)	925 (13.13)	6899 (97.93)
I felt everything I did was an effort	3942 (55.95)	925 (13.13)	864 (12.26)	1174 (16.66)	6905 (98.01)
I felt hopeful about the future	2344 (33.27)	815 (11.57)	962 (13.66)	2566 (36.42)	6687 (94.92)
I felt fearful	5767 (81.86)	440 (6.25)	373 (5.29)	392 (5.56)	6972 (98.96)
My sleep was restless	3446 (48.91)	1000 (14.19)	984 (13.97)	1544 (21.92)	6974 (98.99)
I was happy	1668 (23.68)	836 (11.87)	1288 (18.28)	3124 (44.34)	6916 (98.17)
I felt lonely	4778 (67.82)	620 (8.8)	647 (9.18)	885 (12.56)	6930 (98.37)
I could not get "going"	5590 (79.35)	418 (5.93)	412 (5.85)	469 (6.66)	6889 (97.79)

Note: The percentages of full sample are in parentheses. The scale for 'I felt hopeful about future' and 'I was happy' was reversed so that higher values indicate qualitatively worse outcomes.

3.2 Empirical model

Based on the channel shown in Fig. 1, we use "health", "health change", "body pains", "depression", "supports from children" and "living with children" as mediators to measure grandparents' quality of life after taking care of grandchildren.

We estimate the following equations:

$$health = \alpha_0 + \alpha_1 care + \alpha_2 X + \mu_1 \quad (1)$$

$$health\ \ change = \beta_0 + \beta_1 care + \beta_2 X + \mu_2 \quad (2)$$

$$body\ \ pains = \gamma_0 + \gamma_1 care + \gamma_2 X + \mu_3 \quad (3)$$

$$depression = \delta_0 + \delta_1 care + \delta_2 X + \mu_4 \quad (4)$$

$$support = \rho_0 + \rho_1 care + \rho_2 control\ \ var + \mu_5 \quad (5)$$

$$living = \sigma_0 + \sigma_1 care + \sigma_2 X + \mu_6 \quad (6)$$

$$life\ \ satisfaction = \tau_0 + \tau_1 care + \tau_2 X + \mu_7 \quad (7)$$

and

$$life\ \ satisfaction = \theta_0 + \theta_1 care + \theta_2 health + \theta_3 health\ \ change + \theta_4 body\ \ pains + \theta_5 depression + \theta_6 support + \theta_7 living + \theta_8 X + \mu_8 \quad (8)$$

where X is a vector of control variable including the economic and socio characteristics of the grandparents. The dependent variables of equation from (1) to (6) are grandparents' health, health change, body pains, depression, supports from children and living with children respectively. The

dependent variable of equation (7) and (8) is life satisfaction. We use "providing care", "caring time" and "number of grandchildren cared" to capture caring for grandchildren in the above equations. Providing care is a binary variable; caring time is grandparents' total caring hour in the last year; number of grandchildren cared is grandparents' total caring number of grandchildren in the last year; control variables included grandparents' characteristics, household structure of grandparents, social supports and previous financial condition. τ_1 in equation (7) represents the total effect of caring for grandchildren's on grandparents' life satisfaction. In equation (8), θ_1 is the direct marginal effect after adding mediator variables into the model.

Table 5
Definition and descriptive statistics of additional control variables (N=7045).

Additional control variables		Value	Obs.	Prop. (%)	Mean	Std.Dev.
Characteristics	Gender	Female=0	3732	52.97	0.4703	0.4992
		Male=1	3313	47.03		
	Married	No=0	2232	31.68	0.6832	0.4653
		Yes=1	4813	68.32		
	Age		7045	100	60.2091	11.1012
	Living place	Village=0	4989	71.11	0.4370	0.7364
		County/town=1	988	14.08		
		City=2	1039	14.81		
	Retired	No=0	6328	89.82	0.1018	0.3024
		Yes=1	717	10.18		
Household structure	Number of children		7045	100	2.6091	1.5597
	Number of grandchildren over 16		7045	100	1.7412	3.0732
	Number of grandchildren under 16		7045	100	1.7449	1.9573
	Number of sibling		7045	100	0.3093	1.0587
	Parents of grandparents can take care of themselves	No=0	6724	95.44	0.0456	0.2086
		Yes=1	321	4.56		
Social supports	Enrolled in pension program	No=0	6143	87.20	0.1280	0.3342
		Yes=1	902	12.80		
	Enrolled in health insurance (policy&primary)	No=0	711	10.09	0.8991	0.3012
		Yes=1	6334	89.91		
	Have social activities in the last mouth	None=0	3026	42.95	0.5705	0.4950
		Yes=1	4019	57.05		
	Contact with non-coresident children monthly (or more often)	No=0	2671	37.91	0.6209	0.4852
		Yes=1	4374	62.09		
	See non-coresident children monthly (or more often)	No=0	2738	38.86	0.6114	0.4875
		Yes=1	4307	61.14		
Previous financial condition	Saving (yuan)		7045	100	13455.09	109574.8
	Loan (yuan)		7045	100	5395.25	57578.44
	Own a house	No=0	1189	16.88	0.8312	0.3746
		Yes=1	5856	83.12		
	Value of the houses (yuan)		7045	100	2288.83	98804.12
	Own land	No=0	3043	43.19	0.5681	0.4954
		Yes=1	4002	56.81		

4. Empirical results

4.1 Grandparenting and quality of life

Table 6, Table 7 and Table 8 report the results of providing care, caring time and number of grandchildren cared, respectively, on grandparents' quality of life. These tables report coefficients. For the sake of conserving space, the marginal effects are reported in Tables A1, A2 and A3 in the Appendix. Providing care for grandchildren has a favorable effect on the grandparents' mental health. Grandparents who look after their grandchildren are 2.9% less likely to report symptoms associated with depression (Tables 6 and A1). This effect is proportional to the number of grandchildren in care (each grandchild cared for decreases the incidence of depression by 2%, see Tables 8 and A3) and the time spent looking after them (Tables 7 and A2). The financial situation is also positively affected: looking after grandchildren approximately doubles the amount of support that grandparents receive from their children (with every additional grandchild increasing the amount of support by approximately 60%).[5] Granparents looking after grandchildren are also significantly more likely to live in the same household with their children, although in this case it is not clear whether the direction of causality goes from caregiving to co-residence or the other way around. Finally, providing care also has a favorable effect on grandparents' physical health: those caring for grandchildren are 1.8% less likely to report poor health and 1.5% more likely to be in good health (Table A1), Each additional grandchild in care increases the probability of good health (decreases the probability of poor health) by 1.3% (1.6%). However, no effects are observed for change in physical health or for experiencing pain.

[5] The coefficient capturing the effect of providing care on financial support is 0.753, Given that the financial support is in logs, the effect of providing care corresponds is exp (0.753) = 2.12. Grandparents looking after their grandchildren thus receive slightly more than double the amount of financial support from their children than grandparents who do not look after grandchildren. The effect of additional grandchildren in care is computed analogously.

Table 6
Estimation of providing care for grandchildren on the grandparents' quality of life: full sample.

Variables	Physical			Psychological	Financial	
	Health	Health change	Body pains	Depression	*Ln* Support from children	Living with children
	(1)	(2)	(3)	(4)	(5)	(6)
Providing care	0.089*	-0.003	-0.004	-0.148**	0.753***	0.521***
	(0.053)	(0.054)	(0.062)	(0.065)	(0.103)	(0.062)
Male	0.197***	0.086*	-0.682***	-0.635***	-0.655***	-0.171***
	(0.048)	(0.048)	(0.057)	(0.060)	(0.092)	(0.056)
Married	0.015	-0.042	-0.082	-0.364***	-0.167	-0.252***
	(0.056)	(0.057)	(0.064)	(0.068)	(0.108)	(0.066)
Age	-0.137***	-0.051**	0.114***	0.154***	0.459***	-0.230***
	(0.023)	(0.024)	(0.027)	(0.031)	(0.045)	(0.027)
Age squared	0.001***	0.000*	-0.001***	-0.001***	-0.003***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Live in village	-0.086	-0.112	0.221***	0.326***	0.186	-0.141*
	(0.070)	(0.071)	(0.083)	(0.090)	(0.135)	(0.082)
Live in city	0.181**	-0.030	-0.212*	-0.019	-0.032	0.206**
	(0.088)	(0.089)	(0.112)	(0.119)	(0.172)	(0.104)
Retired	-0.062	0.071	-0.069	-0.159	-0.619***	-0.087
	(0.091)	(0.092)	(0.118)	(0.127)	(0.178)	(0.109)
Number of children	-0.023	-0.016	0.045*	-0.024	0.493***	0.314***
	(0.023)	(0.024)	(0.027)	(0.029)	(0.045)	(0.028)
Number of grandchildren over 16	-0.023*	0.010	0.007	0.034**	0.039	-0.038**
	(0.013)	(0.013)	(0.014)	(0.016)	(0.025)	(0.015)
Number of grandchildren under 16	-0.021	-0.007	0.013	0.045**	0.098***	0.020
	(0.015)	(0.016)	(0.017)	(0.018)	(0.029)	(0.018)
Number of sibling	-0.023	-0.006	0.035	-0.015	0.092**	-0.011
	(0.021)	(0.022)	(0.025)	(0.027)	(0.042)	(0.025)
Parents can take care of themselves	-0.201*	-0.436***	0.245**	0.104	-0.340	0.122
	(0.109)	(0.114)	(0.123)	(0.129)	(0.211)	(0.125)
Enrolled in pension program	0.298***	0.120	-0.360***	-0.436***	-0.485***	-0.047
	(0.084)	(0.085)	(0.113)	(0.121)	(0.165)	(0.100)
Enrolled in health insurance (policy & primary)	-0.023	-0.086	-0.026	-0.257***	0.195	-0.028
	(0.077)	(0.079)	(0.088)	(0.094)	(0.148)	(0.089)
Have social activities in the last mouth	0.154***	0.078	-0.060	-0.133**	0.313***	-0.027
	(0.047)	(0.048)	(0.054)	(0.057)	(0.091)	(0.055)
Contact with non-coresident children monthly	-0.025	0.004	0.001	0.078	1.300***	-1.259***
	(0.049)	(0.050)	(0.058)	(0.062)	(0.095)	(0.058)
See non-coresident children monthly	0.182***	0.091*	-0.110*	-0.161***	-0.001	-0.636***
	(0.050)	(0.051)	(0.059)	(0.062)	(0.097)	(0.059)
Saving (logarithm)	0.036***	0.014***	-0.034***	-0.050***	0.003	-0.014**
	(0.005)	(0.005)	(0.007)	(0.007)	(0.010)	(0.006)
Loan (logarithm)	-0.016*	-0.029***	0.019*	0.026**	-0.014	0.007
	(0.009)	(0.009)	(0.011)	(0.011)	(0.018)	(0.011)
Own a house	-0.001	-0.046	-0.134*	-0.033	-0.174	0.595***
	(0.066)	(0.068)	(0.075)	(0.081)	(0.128)	(0.082)
Value of the houses (logarithm)	0.065***	0.049***	-0.057***	-0.083***	0.147***	0.149***
	(0.014)	(0.014)	(0.016)	(0.017)	(0.026)	(0.016)
Own land	-0.048	-0.079	0.063	0.024	0.275***	0.098
	(0.053)	(0.054)	(0.061)	(0.065)	(0.103)	(0.063)
Observations	7,045	7,045	7,045	6,392	7,045	7,045

Notes: 1. Robust standard errors are in parentheses; *p<0.1 **p<0.05 ***p<0.01; 3. (1), (2) and (3) are ordered logistic regressions, (4) and (6) are logistic regressions, (5) is OLS; 4. Marginal effects are reported in appendix Table A1.

Table 7
Estimation of caring time for grandchildren on the grandparents' quality of life: full sample.

Variables	Physical			Psychological	Financial	
	Health	Health change	Body pains	Depression	*Ln* Support from children	Living with children
	(1)	(2)	(3)	(4)	(5)	(6)
Caring time (logarithm)	0.008	-0.004	0.001	-0.018**	0.103***	0.069***
	(0.007)	(0.007)	(0.008)	(0.009)	(0.014)	(0.008)
Male	0.195***	0.083*	-0.681***	-0.636***	-0.644***	-0.165***
	(0.048)	(0.049)	(0.057)	(0.060)	(0.093)	(0.056)
Married	0.016	-0.040	-0.082	-0.363***	-0.176	-0.256***
	(0.056)	(0.057)	(0.064)	(0.068)	(0.108)	(0.066)
Age	-0.135***	-0.050**	0.113***	0.152***	0.460***	-0.227***
	(0.023)	(0.024)	(0.027)	(0.031)	(0.045)	(0.027)
Age squared	0.001***	0.000	-0.001***	-0.001***	-0.003***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Live in village	-0.086	-0.113	0.222***	0.325***	0.189	-0.140*
	(0.070)	(0.071)	(0.083)	(0.090)	(0.135)	(0.082)
Live in city	0.180**	-0.031	-0.212*	-0.019	-0.033	0.206**
	(0.088)	(0.089)	(0.112)	(0.119)	(0.172)	(0.104)
Retired	-0.061	0.072	-0.070	-0.158	-0.623***	-0.090
	(0.091)	(0.092)	(0.118)	(0.127)	(0.177)	(0.109)
Number of children	-0.024	-0.016	0.045*	-0.023	0.493***	0.314***
	(0.023)	(0.024)	(0.027)	(0.029)	(0.045)	(0.028)
Number of grandchildren over 16	-0.023*	0.010	0.007	0.034**	0.038	-0.039***
	(0.013)	(0.013)	(0.014)	(0.016)	(0.025)	(0.015)
Number of grandchildren under 16	-0.019	-0.005	0.012	0.044**	0.094***	0.019
	(0.015)	(0.016)	(0.017)	(0.018)	(0.030)	(0.018)
Number of sibling	-0.023	-0.006	0.035	-0.015	0.091**	-0.012
	(0.021)	(0.022)	(0.025)	(0.027)	(0.042)	(0.025)
Parents can take care of themselves	-0.200*	-0.436***	0.245**	0.103	-0.341	0.123
	(0.109)	(0.114)	(0.123)	(0.129)	(0.211)	(0.125)
Enrolled in pension program	0.296***	0.118	-0.360***	-0.435***	-0.485***	-0.049
	(0.084)	(0.085)	(0.113)	(0.121)	(0.165)	(0.100)
Enrolled in health insurance (policy & primary)	-0.024	-0.087	-0.026	-0.257***	0.195	-0.028
	(0.077)	(0.079)	(0.088)	(0.094)	(0.148)	(0.089)
Have social activities in the last mouth	0.155***	0.079*	-0.061	-0.134**	0.313***	-0.027
	(0.047)	(0.048)	(0.054)	(0.057)	(0.091)	(0.055)
Contact with non-coresident children monthly	-0.025	0.003	0.002	0.078	1.304***	-1.256***
	(0.049)	(0.050)	(0.058)	(0.062)	(0.095)	(0.058)
See non-coresident children monthly	0.184***	0.092*	-0.110*	-0.163***	0.011	-0.627***
	(0.050)	(0.051)	(0.059)	(0.062)	(0.097)	(0.059)
Saving (logarithm)	0.036***	0.014***	-0.034***	-0.050***	0.003	-0.014**
	(0.005)	(0.005)	(0.007)	(0.007)	(0.010)	(0.006)
Loan (logarithm)	-0.016*	-0.029***	0.019*	0.026**	-0.013	0.007
	(0.009)	(0.009)	(0.011)	(0.011)	(0.018)	(0.011)
Own a house	-0.000	-0.046	-0.134*	-0.033	-0.174	0.595***
	(0.066)	(0.068)	(0.075)	(0.081)	(0.128)	(0.082)
Value of the houses (logarithm)	0.065***	0.049***	-0.058***	-0.083***	0.147***	0.148***
	(0.014)	(0.014)	(0.016)	(0.017)	(0.026)	(0.016)
Own land	-0.048	-0.079	0.062	0.023	0.274***	0.098
	(0.053)	(0.054)	(0.061)	(0.065)	(0.103)	(0.063)
Observations	7,045	7,045	7,045	6,392	7,045	7,045

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. (1), (2) and (3) are ordered logistic regressions, (4) and (6) are logistic regressions, (5) is OLS; 4. Marginal effects are reported in appendix Table A2.

Table 8
Estimation of number of grandchildren cared on the grandparents' quality of life: full sample.

Variables	Physical			Psychological	Financial	
	Health	Health change	Body pains	Depression	*Ln* Support from children	Living with children
	(1)	(2)	(3)	(4)	(5)	(6)
Number of grandchildren cared	0.078**	0.020	-0.023	-0.102**	0.481***	0.346***
	(0.038)	(0.039)	(0.043)	(0.046)	(0.074)	(0.045)
Male	0.197***	0.088*	-0.684***	-0.633***	-0.669***	-0.180***
	(0.048)	(0.048)	(0.057)	(0.059)	(0.092)	(0.056)
Married	0.016	-0.044	-0.081	-0.366***	-0.155	-0.243***
	(0.056)	(0.057)	(0.064)	(0.068)	(0.108)	(0.066)
Age	-0.137***	-0.053**	0.115***	0.152***	0.470***	-0.222***
	(0.023)	(0.024)	(0.027)	(0.031)	(0.045)	(0.027)
Age squared	0.001***	0.000*	-0.001***	-0.001***	-0.003***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Live in village	-0.086	-0.112	0.221***	0.327***	0.185	-0.142*
	(0.070)	(0.071)	(0.083)	(0.090)	(0.135)	(0.082)
Live in city	0.180**	-0.030	-0.212*	-0.018	-0.037	0.202*
	(0.088)	(0.089)	(0.112)	(0.119)	(0.172)	(0.104)
Retired	-0.060	0.070	-0.069	-0.162	-0.602***	-0.075
	(0.091)	(0.092)	(0.118)	(0.127)	(0.178)	(0.109)
Number of children	-0.024	-0.015	0.045*	-0.022	0.483***	0.307***
	(0.023)	(0.024)	(0.027)	(0.029)	(0.045)	(0.028)
Number of grandchildren over 16	-0.023*	0.010	0.007	0.035**	0.037	-0.040***
	(0.013)	(0.013)	(0.014)	(0.016)	(0.025)	(0.015)
Number of grandchildren under 16	-0.023	-0.009	0.015	0.044**	0.103***	0.022
	(0.015)	(0.016)	(0.017)	(0.018)	(0.030)	(0.018)
Number of sibling	-0.023	-0.006	0.035	-0.015	0.090**	-0.013
	(0.021)	(0.022)	(0.025)	(0.027)	(0.042)	(0.025)
Parents can take care of themselves	-0.201*	-0.437***	0.246**	0.103	-0.336	0.123
	(0.109)	(0.114)	(0.123)	(0.129)	(0.212)	(0.124)
Enrolled in pension program	0.298***	0.121	-0.361***	-0.434***	-0.492***	-0.050
	(0.084)	(0.085)	(0.113)	(0.121)	(0.165)	(0.100)
Enrolled in health insurance (policy & primary)	-0.024	-0.086	-0.027	-0.257***	0.194	-0.028
	(0.077)	(0.079)	(0.088)	(0.094)	(0.148)	(0.089)
Have social activities in the last mouth	0.153***	0.077	-0.060	-0.134**	0.315***	-0.027
	(0.047)	(0.048)	(0.054)	(0.057)	(0.091)	(0.055)
Contact with non-coresident children monthly	-0.024	0.005	0.000	0.077	1.301***	-1.255***
	(0.049)	(0.050)	(0.058)	(0.062)	(0.096)	(0.058)
See non-coresident children monthly	0.182***	0.090*	-0.110*	-0.161***	0.002	-0.633***
	(0.050)	(0.051)	(0.059)	(0.062)	(0.097)	(0.059)
Saving (logarithm)	0.036***	0.014***	-0.034***	-0.050***	0.003	-0.014**
	(0.005)	(0.005)	(0.007)	(0.007)	(0.010)	(0.006)
Loan (logarithm)	-0.016*	-0.029***	0.019*	0.026**	-0.013	0.007
	(0.009)	(0.009)	(0.011)	(0.011)	(0.018)	(0.011)
Own a house	-0.000	-0.046	-0.134*	-0.034	-0.166	0.601***
	(0.066)	(0.068)	(0.075)	(0.081)	(0.128)	(0.082)
Value of the houses (logarithm)	0.065***	0.049***	-0.057***	-0.083***	0.148***	0.148***
	(0.014)	(0.014)	(0.016)	(0.017)	(0.026)	(0.016)
Own land	-0.048	-0.080	0.063	0.024	0.278***	0.099
	(0.053)	(0.054)	(0.061)	(0.065)	(0.103)	(0.063)
Observations	7,045	7,045	7,045	6,392	7,045	7,045

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. (1), (2) and (3) are ordered logistic regressions, (4) and (6) are logistic regressions, (5) is OLS; 4. Marginal effects are reported in appendix Table A3.

4.1.1 Village vs non village

The life style varies between rural and urban areas in China. For example, the fast development of urbanization accounts for an increasing rural to urban labor transfer (Wang et al., 2018). Most of the young workers have left their children and parents in rural area, thereby increasing the co-resident rate especially in rural areas.

In this section, we compare the effect of grandparent caregiving on the grandparents' quality of life in village area and non-village (town or city) areas as shown in Table 9, Table 10 and Table 11. The results suggest that the favorable effect on psychological health is only observed in the village area. This observation does not depend on whether we measure grandparent caregiving with providing care, caring time or number of children in grandparent care. The favorable effect of grandparent caregiving is imprecisely estimated when we split the sample into village and non-village areas, except for the effect of looking after more grandchildren, which is marginally significant. Finally, the effect of grandparent caregiving on financial support received from children is somewhat stronger in the non-village area (although this may simply reflect the greater earning power of urban residents and higher cost of living in towns and cities).

Table 9
Estimations of providing care for grandchildren on the grandparents' quality of life: Village vs non-village.

Variables		Physical			Psychological	Financial	
		Health	Health change	Body pains	Depression	*Ln* Support from children	Living with children
Village	Providing care	0.078	0.040	-0.025	-0.154**	0.683***	0.568***
		(0.062)	(0.064)	(0.070)	(0.075)	(0.119)	(0.072)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	4,989	4,989	4,989	4,484	4,989	4,989
Non village	Providing care	0.151	-0.124	0.060	-0.174	0.899***	0.449***
		(0.104)	(0.107)	(0.129)	(0.136)	(0.208)	(0.124)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	2,056	2,056	2,056	1,908	2,056	2,056

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. The results of the control variables are similar with Table 6 and can be reported upon request.; 4. Marginal effects can also be reported upon request.

Table 10
Estimations of caring time for grandchildren on the grandparents' quality of life: Village vs non-village.

Variables		Physical			Psychological	Financial	
		Health	Health change	Body pains	Depression	*Ln* Support from children	Living with children
Village	Caring time	0.005	-0.000	-0.002	-0.019*	0.092***	0.073***
	(logarithm)	(0.008)	(0.008)	(0.009)	(0.010)	(0.016)	(0.010)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	4,989	4,989	4,989	4,484	4,989	4,989
Non village	Caring time	0.021	-0.016	0.011	-0.021	0.128***	0.064***
	(logarithm)	(0.014)	(0.014)	(0.017)	(0.018)	(0.027)	(0.016)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	2,056	2,056	2,056	1,908	2,056	2,056

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. The results of the control variables are similar with Table 7 and can be reported upon request.; 4. Marginal effects can also be reported upon request.

Table 11
Estimations of number of grandchildren cared on the grandparents' quality of life: Village vs non-village.

Variables		Physical			Psychological	Financial	
		Health	Health change	Body pains	Depression	*Ln* Support from children	Living with children
Village	Number of grandchildren cared	0.073*	0.043	-0.016	-0.108**	0.459***	0.355***
		(0.044)	(0.044)	(0.049)	(0.052)	(0.083)	(0.052)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	4,989	4,989	4,989	4,484	4,989	4,989
Non village	Number of grandchildren cared	0.116	-0.056	-0.054	-0.117	0.527***	0.360***
		(0.080)	(0.081)	(0.096)	(0.105)	(0.157)	(0.094)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	2,056	2,056	2,056	1,908	2,056	2,056

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. The results of the control variables are similar with Table 8 and can be reported upon request; 4. Marginal effects can also be reported upon request.

4.1.2 Grandmother vs grandfather

The role of gender matters in grandparenting: grandmothers are more likely to play the primary or custodial role in taking care of grandchildren in many different cultures. This is also the case in China.

Therefore, this section investigates how grandparent caregiving may affect grandparents' quality of life in regard to their gender. Providing care for grandchildren does not have any impacts on physical health of grandmothers or grandfathers as presented in Table 12-14. It has a favorable effect on the psychological health of grandfathers only. Grandfathers' caregiving also elicits slightly higher support from children than grandmothers' care.

Table 12
Estimations of providing care for grandchildren on the grandparents' quality of life: grandmother vs grandfather.

Variables		Physical			Psychological	Financial	
		Health	Health change	Body pains	Depression	*Ln* Support from children	Living with children
Male	Providing care	0.057	-0.010	-0.021	-0.234**	0.842***	0.639***
		(0.73)	(-0.12)	(-0.22)	(-2.26)	(5.47)	(6.96)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	3,313	3,313	3,313	3,079	3,313	3,313
Female	Providing care	0.106	0.001	0.016	-0.104	0.658***	0.388***
		(0.072)	(0.074)	(0.080)	(0.086)	(0.140)	(0.085)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	3,732	3,732	3,732	3,313	3,732	3,732

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. The results of the control variables are similar with Table 6 and can be reported upon request.; 4. Marginal effects can also be reported upon request.

Table 13
Estimations of caring time for grandchildren on the grandparents' quality of life: grandmother vs grandfather

Variables		Physical			Psychological	Financial	
		Health	Health change	Body pains	Depression	*Ln* Support from children	Living with children
Male	Caring time	0.001	-0.006	-0.001	-0.029**	0.108***	0.087***
	(logarithm)	(0.011)	(0.011)	(0.013)	(0.014)	(0.021)	(0.012)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	3,313	3,313	3,313	3,079	3,313	3,313
Female	Caring time	0.012	-0.004	0.004	-0.014	0.097***	0.049***
	(logarithm)	(0.009)	(0.010)	(0.010)	(0.011)	(0.018)	(0.011)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	3,732	3,732	3,732	3,313	3,732	3,732

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. The results of the control variables are similar with Table 7 and can be reported upon request.; 4. Marginal effects can also be reported upon request.

Table 14
Estimations of number of grandchildren cared on the grandparents' quality of life: grandmother vs grandfather

Variables		Physical			Psychological	Financial	
		Health	Health change	Body pains	Depression	*Ln* Support from children	Living with children
Male	Number of	0.068	0.014	-0.033	-0.154**	0.538***	0.399***
	grandchildren cared	(0.059)	(0.060)	(0.072)	(0.077)	(0.114)	(0.068)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	4,989	4,989	4,989	4,484	4,989	4,989
Female	Number of	0.080	0.024	-0.016	-0.083	0.432***	0.290***
	grandchildren cared	(0.051)	(0.051)	(0.055)	(0.059)	(0.097)	(0.060)
	Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	2,056	2,056	2,056	1,908	2,056	2,056

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. The results of the control variables are similar with Table 8 and can be reported upon request.; 4. Marginal effects can also be reported upon request.

4.2 Grandparenting and life satisfaction: the direct effect and indirect effect (mediating effect)

Results shown in Table 15 show that caring for grandchildrenhas a positive effect on the grandparents' life satisfaction (columns 1-2). As before, the positive effect of grandparenting is proportional to caring time (columns 2-3). Column (5) and (6) show that life satisfaction is positively related to number of grandchildren cared but negatively related to its square term, which displays an inverse U shape suggesting the life satisfaction initially increases with the number of grandchildren cared but decreases as the number of grandchildren grows, with the optimal nmber being between 2 and 3 (life satisfaction peaks at 2.4 in column 5 and 2.6 in column 6).

As previously discussed, grandparent caregiving can not only affect grandparents' life satisfaction directly but also indirectly through quality of life as the mediating effect. Quality of life can be a major channel connecting providing care for grandchildren with grandparents' life satisfaction. Yet, the results in full sample suggest that the mediating effect is negligibly small: the coefficient of grandparent care is essentially the same when it is included on its own (column 1) and alongside the potential mediators (column 2). Considering the marginal efffects (Table A4), the full effect of grandparenting is an increase

in the probability of being very satisfied with life by 3.2% and 1.1% increase in the probability of being completely satisfied. When controlling for quality of life mediators, the corresponding effects are 2.7% and 1.1%, respectively. The patterns obtained with caring time and the number of grandchildren is very similar: adding the quality of life mediators changes the effect of grandparent care little.

4.2.1 Village vs non village

Table 16 examines the effect of grandparent caregiving and quality of life on the grandparents' life satisfaction in village and non-village area. Results show that providing grandchild care, caring time and number of grandchildren cared all have a positive effect on the grandparents' life satisfaction for the grandparents living in the village areas but not for those living in towns and cities.

4.2.2 Grandmother vs grandfather

The effect of grandparent caregiving and quality of life on the grandparents' life satisfaction in regards to genders is shown in Table 17. The effects of grandparent care and caring time are significant for both genders but somewhat stronger for males. In contrast, the inverted U-shaped effect of the number of grandchildren is only significant for females; grandmothers life satisfaction peaks when caring for 2 grandchildren. As before, the effect of grandparenting changes little when we add the mediators.

Table 15
Ordered logistic regressions: Care, quality of life and satisfaction: full sample.

Variables	Life satisfaction					
	(1)	(2)	(3)	(4)	(5)	(6)
Providing care for grandchildren (yes)	0.183***	0.179***				
	(0.053)	(0.057)				
Caring time (logarithm)			0.023***	0.023***		
			(0.007)	(0.008)		
Number of grandchildren cared					0.215***	0.211***
					(0.062)	(0.065)
Squared number of grandchildren cared					-0.044**	-0.041*
					(0.021)	(0.022)
Health (poor)		-0.217***		-0.219***		-0.215***
		(0.065)		(0.065)		(0.065)
Health (good)		0.633***		0.634***		0.633***
		(0.062)		(0.062)		(0.062)
Health change (worse)		-0.120*		-0.120*		-0.118*
		(0.062)		(0.062)		(0.062)
Health change (better)		-0.283***		-0.283***		-0.284***
		(0.057)		(0.057)		(0.057)
Body pains (yes)		0.156*		0.158*		0.155*
		(0.085)		(0.085)		(0.085)
Depression		-0.941***		-0.941***		-0.942***
		(0.062)		(0.062)		(0.062)
Supports from children (logarithm)		0.017***		0.017***		0.017***
		(0.007)		(0.007)		(0.007)
live with children (yes)		0.048		0.048		0.048
		(0.054)		(0.054)		(0.054)
Male	0.049	-0.104**	0.050	-0.102**	0.048	-0.104**
	(0.048)	(0.052)	(0.048)	(0.052)	(0.048)	(0.052)
Married	0.218***	0.199***	0.217***	0.197***	0.217***	0.198***
	(0.057)	(0.061)	(0.057)	(0.061)	(0.057)	(0.061)
Age	-0.089***	-0.046*	-0.088***	-0.044*	-0.089***	-0.046*
	(0.023)	(0.026)	(0.023)	(0.026)	(0.023)	(0.026)
Age squared	0.001***	0.000**	0.001***	0.000**	0.001***	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Live in village	-0.113	-0.024	-0.113	-0.024	-0.113	-0.025
	(0.070)	(0.074)	(0.070)	(0.074)	(0.070)	(0.074)
Live in city	-0.046	-0.085	-0.046	-0.085	-0.045	-0.084
	(0.089)	(0.093)	(0.089)	(0.093)	(0.089)	(0.093)
Retired	-0.143	-0.130	-0.144	-0.130	-0.141	-0.128
	(0.090)	(0.095)	(0.090)	(0.095)	(0.090)	(0.095)
Number of children	0.017	0.014	0.017	0.014	0.016	0.013
	(0.024)	(0.026)	(0.024)	(0.026)	(0.024)	(0.026)
Number of grandchildren over 16	0.005	0.007	0.004	0.007	0.005	0.008
	(0.013)	(0.015)	(0.013)	(0.015)	(0.013)	(0.015)
Number of grandchildren under 16	-0.007	-0.001	-0.007	-0.001	-0.008	-0.002
	(0.016)	(0.017)	(0.016)	(0.017)	(0.016)	(0.017)
Number of sibling	-0.036*	-0.043*	-0.036*	-0.043*	-0.036*	-0.043*
	(0.022)	(0.023)	(0.022)	(0.023)	(0.022)	(0.023)
Parents can take care of themselves	0.004	0.146	0.004	0.146	0.003	0.145
	(0.111)	(0.116)	(0.111)	(0.116)	(0.111)	(0.116)
Enrolled in pension program	-0.014	-0.107	-0.015	-0.108	-0.013	-0.106
	(0.084)	(0.088)	(0.084)	(0.088)	(0.084)	(0.088)
Enrolled in health insurance (policy & primary)	0.136*	0.119	0.136*	0.119	0.136*	0.119
	(0.080)	(0.085)	(0.079)	(0.085)	(0.080)	(0.085)
Have social activities in the last mouth	-0.036	-0.094*	-0.036	-0.093*	-0.036	-0.093*
	(0.047)	(0.050)	(0.047)	(0.050)	(0.047)	(0.050)
Contact with non-coresident children monthly	0.043	0.055	0.044	0.056	0.045	0.057
	(0.050)	(0.056)	(0.050)	(0.056)	(0.050)	(0.056)

See non-coresident children monthly	0.094*	0.020	0.097*	0.022	0.093*	0.019
	(0.051)	(0.054)	(0.051)	(0.054)	(0.051)	(0.054)
Saving (logarithm)	0.006	-0.008	0.006	-0.008	0.006	-0.008
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
Loan (logarithm)	-0.017*	-0.008	-0.017*	-0.008	-0.017*	-0.008
	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)
Own a house	-0.009	0.007	-0.009	0.006	-0.007	0.009
	(0.068)	(0.073)	(0.068)	(0.073)	(0.068)	(0.073)
Value of the houses (logarithm)	0.074***	0.039***	0.074***	0.039***	0.074***	0.039***
	(0.013)	(0.015)	(0.013)	(0.015)	(0.013)	(0.015)
Own land	0.014	0.035	0.014	0.036	0.014	0.036
	(0.054)	(0.057)	(0.054)	(0.057)	(0.054)	(0.057)
Observations	6,939	6,361	6,939	6,361	6,939	6,361

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. Marginal effects are reported in appendix Table A4, Table A5 and Table A6.

Table 16
Care, quality of life and satisfaction: Ordered logistic regressions, village vs non-village.

Variables	Life satisfaction											
	(1) Village		(2) Non village		(3) Village		(4) Non village		(5) Village		(6) Non village	
Providing care (yes)	0.226***	0.227***	0.069	0.015								
	(0.062)	(0.067)	(0.105)	(0.111)								
Caring time (logarithm)					0.026***	0.028***	0.013	0.005				
					(0.008)	(0.009)	(0.014)	(0.015)				
Number of grandchildren cared									0.263***	0.265***	0.034	-0.049
									(0.069)	(0.073)	(0.152)	(0.154)
Squared number of grandchildren cared									-0.054**	-0.054**	0.009	0.039
									(0.022)	(0.023)	(0.068)	(0.066)
Health (poor)		-0.189**		-0.315**		-0.193**		-0.314**		-0.185**		-0.323**
		(0.075)		(0.133)		(0.075)		(0.133)		(0.075)		(0.133)
Health (good)		0.591***		0.733***		0.591***		0.733***		0.592***		0.739***
		(0.076)		(0.108)		(0.076)		(0.108)		(0.076)		(0.109)
Health change (worse)		-0.102		-0.173		-0.101		-0.173		-0.099		-0.171
		(0.071)		(0.126)		(0.071)		(0.126)		(0.071)		(0.126)
Health change (better)		-0.315***		-0.199*		-0.315***		-0.200*		-0.317***		-0.195*
		(0.067)		(0.106)		(0.067)		(0.106)		(0.067)		(0.106)
Body pains (yes)		0.087		0.292**		0.089		0.292**		0.085		0.292**
		(0.105)		(0.147)		(0.105)		(0.147)		(0.105)		(0.147)
Depression		-0.916***		-1.040***		-0.917***		-1.039***		-0.918***		-1.039***
		(0.071)		(0.128)		(0.071)		(0.128)		(0.071)		(0.128)
Supports from children		0.017**		0.022*		0.017**		0.022*		0.017**		0.022*
		(0.008)		(0.012)		(0.008)		(0.012)		(0.008)		(0.012)
live with children (yes)		0.073		-0.041		0.076		-0.043		0.075		-0.039
		(0.064)		(0.101)		(0.064)		(0.102)		(0.064)		(0.102)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,911	4,461	2,028	1,900	4,911	4,461	2,028	1,900	4,911	4,461	2,028	1,900

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. The results of the control variables are similar with Table 15 and can be reported upon request.; 4. Marginal effects can be reported upon request.

Table 17
Care, quality of life and satisfaction: Ordered logistic regressions, marginal effect, grandmothers vs grandfathers.

Variables	Life satisfaction											
	(1) Male		(2) Female		(3) Male		(4) Female		(5) Male		(6) Female	
Providing care (yes)	0.198**	0.170**	0.165**	0.179**								
	(0.079)	(0.083)	(0.073)	(0.079)								
Caring time (logarithm)					0.026**	0.023**	0.020**	0.021**				
					(0.011)	(0.011)	(0.009)	(0.010)				
Number of grandchildren cared									0.080	0.060	0.214***	0.229***
									(0.122)	(0.122)	(0.079)	(0.084)
Squared number of grandchildren cared									0.046	0.046	-0.055**	-0.056**
									(0.058)	(0.055)	(0.023)	(0.024)
Health (poor)		-0.138		-0.275***		-0.140		-0.276***		-0.139		-0.269***
		(0.097)		(0.088)		(0.097)		(0.088)		(0.097)		(0.088)
Health (good)		0.696***		0.567***		0.697***		0.566***		0.693***		0.567***
		(0.088)		(0.088)		(0.088)		(0.088)		(0.088)		(0.088)
Health change (worse)		-0.253***		-0.045		-0.253***		-0.045		-0.251***		-0.041
		(0.097)		(0.080)		(0.097)		(0.080)		(0.097)		(0.080)
Health change (better)		-0.315***		-0.266***		-0.315***		-0.266***		-0.318***		-0.270***
		(0.083)		(0.078)		(0.083)		(0.078)		(0.083)		(0.078)
Body pains (yes)		0.151		0.173		0.152		0.175		0.146		0.170
		(0.129)		(0.114)		(0.129)		(0.114)		(0.129)		(0.114)
Depression		-0.898***		-0.976***		-0.898***		-0.976***		-0.902***		-0.980***
		(0.097)		(0.081)		(0.097)		(0.081)		(0.097)		(0.081)
Supports from children		0.014		0.019**		0.014		0.019**		0.015		0.019**
		(0.009)		(0.009)		(0.009)		(0.009)		(0.009)		(0.009)
live with children (yes)		0.071		0.013		0.070		0.014		0.073		0.017
		(0.078)		(0.075)		(0.078)		(0.075)		(0.078)		(0.075)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,276	3,068	3,663	3,293	3,276	3,068	3,663	3,293	3,276	3,068	3,663	3,293

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. The results of the control variables are similar with Table 15 and can be reported upon request.; 4. Marginal effects can also be reported upon request.

Table 18
The KHB decomposition analysis.

Variables	Providing care for grandchildren			Caring time			Number of grandchildren cared		
	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Health	0.1959***	0.1780***	0.0179	0.0244***	0.0231***	0.0014	0.1244***	0.1079***	0.0164*
	(3.63)	(3.30)	(1.35)	(3.43)	(3.24)	(0.79)	(3.25)	(2.82)	(1.75)
Health change	0.1939***	0.1960***	-0.0020	0.0240***	0.0250***	-0.0010	0.1230***	0.1206***	0.0025
	(3.61)	(3.65)	(-0.23)	(3.39)	(3.53)	(-0.84)	(3.20)	(3.13)	(0.39)
Body pains	0.1889***	0.1866***	0.0022	0.0235***	0.0235***	-0.0000	0.1192***	0.1148***	0.0044
	(3.52)	(3.48)	(0.25)	(3.32)	(3.31)	(-0.01)	(3.11)	(2.99)	(0.69)
Depression	0.2116***	0.1748***	0.0368**	0.0260***	0.0214***	0.0045**	0.1415***	0.1162***	0.0253**
	(3.78)	(3.12)	(2.32)	(3.51)	(2.90)	(2.16)	(3.52)	(2.89)	(2.23)
Supports from children	0.1842***	0.1717***	0.0125**	0.0229***	0.0211***	0.0017**	0.1150***	0.1069***	0.0081**
	(3.44)	(3.20)	(2.52)	(3.24)	(2.98)	(2.53)	(3.00)	(2.78)	(2.53)
Live with children	0.1833***	0.1754***	0.0079	0.0228***	0.0217***	0.0011	0.1144***	0.1089***	0.0055
	(3.43)	(3.26)	(1.45)	(3.22)	(3.06)	(1.47)	(2.98)	(2.83)	(1.51)
Mediators group 1	0.2250***	0.1710***	0.0540**	0.0276***	0.0218***	0.0058**	0.1508***	0.1103***	0.0405***
	(3.99)	(3.01)	(2.55)	(3.72)	(2.91)	(2.06)	(3.76)	(2.73)	(2.73)
Mediators group 2	0.2121***	0.1622***	0.0500***	0.0261***	0.0197***	0.0064***	0.1418***	0.1081***	0.0337***
	(3.79)	(2.88)	(2.97)	(3.52)	(2.65)	(2.84)	(3.53)	(2.68)	(2.84)
Observations	7045	7045	7045	7045	7045	7045	7045	7045	7045

Notes: 1. z-values are in parentheses; 2. Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. Mediators group 1 contains Health, Health change, Depression, Supports from children and Live with children; 4. Mediators group 2 contains Depression and Supports from children.

4.3 The mediating role of quality of life

Further, we adopt the Karlson-Holm-Breen (KHB) decomposition analysis for the mediator effect. This method decomposes the total effect of a variable into direct and indirect effects. It also allows for the calculation of the mediated percentage, which is interpreted as the percentage of the main association that can be explained by the mediator. The mediated percentage is only considered significant when the total and indirect effects are significant (Karlson & Holm, 2011; Santini et al., 2016). This method has been proved to be one of the most suitable methodologies to deal with the multiple mediator variables and indirect effect based on a cross-sectional survey data set (Breen et al., 2013; Grollman, 2018; Shahriar, 2018; Bosick & Fomby, 2018). The result of KHB test is shown in Table 18. The total effect of all mediators is statistically significant and positive, which indicates that taking care of grandchildren has a positive effect on life satisfaction as a whole. As for the indirect effect, only depression and supports from children are significant among all mediator variables. This indicates that the effect of taking care of grandchildren on life satisfaction is partially mediated by depression and supports from children. The mediating effect of providing grandchild care via life quality in terms of depression and financial supports from children accounts for 3.68% and 1.25%, respectively; the mediating effect of caring time via depression and financial supports from children accounts for 0.45% and 0.17%, respectively and the mediating effect of number of grandchildren cared accounts for 2.53% and 0.81%, respectively.

5. Discussion

Based on information on 7405 households from the CHARLS data set, this paper studies the effect of grandparent caregiving on life quality and life satisfaction of grandparents. There are two main findings from the analysis. First, grandparent caregiving has a positive effect on grandparents' quality of life in terms of better mental health and financial condition. We do not find any evidence that the grandparents' physical health is negatively affected by grandparenting as suggested by the literature. Second, grandparents' satisfaction is also positively affected by grandparenting. Third, although grandparent caregiving can affect the grandparents' life satisfaction both directly and indirectly, we find that the positive relationship between grandparenting and life satisfaction is mainly driven by the direct effect. That is, although grandparent caregiving affects their life quality significantly, the mediating effect of quality of life measures on life satisfaction is small and mostly insignificant.

Somewhat surprisingly, our results show that there is no significant relationship between grandparenting and physical health of grandparents. That is, grandparenting does not accelerate the physical health decline experienced by the elderlyOur findings thus stand in contrast to those of Chen and Liu (2012) who argue that the high frequency of grandchild caregiving is harmful for the grandparents' health. One possible explanation is that while providing grandchild care accelerates the health decline as Chen and Liu (2012) argue, it can also have a positive effect. Ahn and Choi (2018),

for example, show that the grandparent caregiving improves the cognitive functioning, orientation and delayed recall. Therefore, the net effect can be neutral. Yet, another explanation is that this neutral relationship only holds in the short term whereas in the long run, the negative impact of grandparenting on grandparents' physical condition can be more salient (Ku et al., 2013; Liu, et al. 2018).

In addition, our findings relate to the grandparenting-mental health literature. For instance, the results of our baseline estimations show that depression measured by the score of CES-D is negatively associated with the grandpareting, which is line with Tsai et al. (2013). They show that those caring for their grandchildren are at a lower risk of feeling lonely and a lower risk of having depressive symptoms when taking care of grandchildren. Furthermore, when differentiating between rural and urban grandparents, we find with that this positive grandparenting-mental health relationship is only significant for the grandparents in village (rural) areas (see also Tsai et al. 2013). Similar to Burnett et al. (2013), our understanding for this is straight forward. There is a large amount of rural-urban migrant workers in China (Wang et al., 2018). The migrant parents leave their children with the grandparents in the rural area. The grandchildren serve as an important emotional connection for the grandparents and their adult children. Interestingly, this effect is significant for grandfathers rather than for grandmothers. The likely reasons are twofold. First, it is less common for grandfathers to take care of their grandchildren: those that do may experience sizeable benefits with respect to their mental health. Second, the care provided by grandfathers is more likely to be complementary instead of primary or custodial (Di Gessa et al., 2016). Therefore, providing grandchild care does not majorly occupy their lives but serve as a routine "condiment".

Our findings also contribute to the grandparenting-financial support literature. We find that among all the life quality variables, the financial condition of grandparents is the most significantly and positively affected by grandparent caregiving. The grandparents who live in village (rural) area receive less financial support from their children but become more likely to live with their children, which collaborates with the findings of Cong and Silvestein (2011). They show that financial returns to grandparents of providing grandchild care and financial assistance are greater from migrant sons than from non-migrant sons in rural China. In turn, we extend Cong and Silvestein (2011) by comparing the village (rural) and non-village (urban) area as in Xu (2018)[1]. We interpret the results from the grandparents' living cost and the adult children's financial ability. Let $i = r, u$; $j = r, u$ denote that the adult children and grandparents living in either rural or urban areas, respectively and S_{ij} denote that the financial support (from children to grandparents). We have $S_{uu} > S_{ur} > S_{rr} ? S_{ru}$ in general. The first case is that the living cost and financial ability are both high if both grandparents and adult children live in urban area providing grandchild care, the financial support from children is the highest. When the children's financial ability is high as they live in urban areas while the grandparents' living and grandprenting cost is low as they live in rural areas, the financial support is neither the highest nor

[1] Xu (2018) conducts a rural-urban comparative studies for physical and mental health only.

the lowest. Yet, both grandpareting cost and the financial ability for the family is low if they all live in rural areas, the financial support is the lowest. One unknown level of financial support is from the situation when children live in rural areas while grandparents live in urban areas, which is the least common in Chinese society.

Grandparenting in terms of providing care to grandchildren, total time of caring children and the number of grandchildren cared is also shown to have a significant positive effect on grandparents' life satisfaction, which is broadly consistent with the life satisfaction literature such as Chen et al. (2011), Ku et al. (2013) and Liu et al. (2018) that studies Chinese grandparenting. Specifically, we detect an inverse U shaped relationship between grandparents' life satisfaction and number of grandchildren cared for. That is, the life satisfaction increases as the number of grandchildren cared increases but decreases after a certain number, which is between 2 and 3. Further, we elaborate their study by showing that this effect is significant only for the grandchild carers in village area, which can be similarly explained by the rural urban cultural difference discussed above.

We complement the literature by further examining the mediating effect of grandparenting in terms of its effect on grandparents' physical health, mental health and financial condition. We find, however, that the mediating effect of grandparenting accounts for only a tiny portion of the total effect on grandparents' life satisfaction. The interpretation of these results is straightforward: grandparenting does not rely on improving life quality to contribute to higher level of life satisfaction as it can bring more happiness to carers directly. which reflects the Chinese traditional family values.

It is noteworthy that our research is less likely to suffer from endogeneity and reverse causality (Di Gessa et al., 2016; Komonpaisarn and Loichinger, 2018) as the variables capturing grandpareting are lagged so that they precede the variables measuring quality of life and life satisfaction of the grandparents.[2]

As a social phenomenon of growing importance in a country suffering population aging, grandparenting should attract more attention in China. Our findings have an intriguing implication. On the one hand, our analysis suggests that only rural grandparents derive benefits in terms of their mental health and life satisfaction stemming from looking after their grandchildren. However, rural elderly often see their children moving to urban areas for work. Grandparents looking after grandchildren in such situations would imply that the grandchildren spend considerable time separated from their parents. We do not measure the quality of life or life satisfaction of parents and grandchildren, but such separation is unlikely to be good for either of them. In contrast, if the grandparents move to the urban areas to live with their children and grandchildren, the positive effects of grandparenting vanish, possibly because they are counterbalanced by the stress of moving to a new location and/or of living in an urban area. The decision between rural vs urban grandparenting thus may involve intergenerational transfers between grandparents, their children and grandchildren.

[2] Find similar arguments in Ku et al. (2013)

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Appendix

Table A1
Estimation of providing care for grandchildren on the grandparents' quality of life: full sample.

Variables	Physical						Psychological		Financial	
	(1) Health			(2) Health change			(3) Body pains	(4) Depression	(5) *Ln* Support from children	(6) Living with children
	Bad	Fair	Good	Worse	About the same	Better				
Providing care	-0.018*	0.003*	0.015*	0.001	-0.000	-0.000	-0.001	-0.029**	0.753***	0.106***
	(0.011)	(0.002)	(0.009)	(0.013)	(0.008)	(0.005)	(0.013)	(0.013)	(0.103)	(0.012)
Male	-0.039***	0.006***	0.033***	-0.021*	0.013*	0.008*	-0.139***	-0.127***	-0.655***	-0.035***
	(0.009)	(0.002)	(0.008)	(0.012)	(0.008)	(0.004)	(0.011)	(0.012)	(0.092)	(0.011)
Married	-0.003	0.000	0.003	0.010	-0.007	-0.004	-0.017	-0.073***	-0.167	-0.051***
	(0.011)	(0.002)	(0.009)	(0.014)	(0.009)	(0.005)	(0.013)	(0.013)	(0.108)	(0.013)
Age	0.027***	-0.004***	-0.023***	0.013**	-0.008**	-0.005**	0.023***	0.031***	0.459***	-0.047***
	(0.005)	(0.001)	(0.004)	(0.006)	(0.004)	(0.002)	(0.006)	(0.006)	(0.045)	(0.005)
Age squared	-0.000***	0.000***	0.000***	-0.000*	0.000*	0.000*	-0.000***	-0.000***	-0.003***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Live in village	0.017	-0.003	-0.014	0.027	-0.017	-0.010	0.045***	0.065***	0.186	-0.029*
	(0.014)	(0.002)	(0.012)	(0.017)	(0.011)	(0.006)	(0.017)	(0.018)	(0.135)	(0.017)
Live in city	-0.036**	0.006**	0.030**	0.007	-0.005	-0.003	-0.043*	-0.004	-0.032	0.042**
	(0.018)	(0.003)	(0.015)	(0.022)	(0.014)	(0.008)	(0.023)	(0.024)	(0.172)	(0.021)
Retired	0.012	-0.002	-0.010	-0.017	0.011	0.006	-0.014	-0.032	-0.619***	-0.018
	(0.018)	(0.003)	(0.015)	(0.023)	(0.014)	(0.008)	(0.024)	(0.025)	(0.178)	(0.022)
Number of children	0.005	-0.001	-0.004	0.004	-0.002	-0.001	0.009*	-0.005	0.493***	0.064***
	(0.005)	(0.001)	(0.004)	(0.006)	(0.004)	(0.002)	(0.005)	(0.006)	(0.045)	(0.006)
Number of grandchildren over 16	0.005*	-0.001*	-0.004*	-0.003	0.002	0.001	0.001	0.007**	0.039	-0.008**
	(0.003)	(0.000)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.003)	(0.025)	(0.003)
Number of grandchildren under 16	0.004	-0.001	-0.004	0.002	-0.001	-0.001	0.003	0.009**	0.098***	0.004
	(0.003)	(0.000)	(0.003)	(0.004)	(0.002)	(0.001)	(0.004)	(0.004)	(0.029)	(0.004)
Number of sibling	0.005	-0.001	-0.004	0.001	-0.001	-0.001	0.007	-0.003	0.092**	-0.002
	(0.004)	(0.001)	(0.004)	(0.005)	(0.003)	(0.002)	(0.005)	(0.005)	(0.042)	(0.005)
Parents can take care of themselves	0.040*	-0.006*	-0.034*	0.107***	-0.068***	-0.039***	0.050**	0.021	-0.340	0.025
	(0.022)	(0.003)	(0.018)	(0.028)	(0.018)	(0.010)	(0.025)	(0.026)	(0.211)	(0.025)
Enrolled in pension program	-0.059***	0.009***	0.050***	-0.029	0.019	0.011	-0.074***	-0.087***	-0.485***	-0.009
	(0.017)	(0.003)	(0.014)	(0.021)	(0.013)	(0.008)	(0.023)	(0.024)	(0.165)	(0.020)
Enrolled in health insurance (policy & primary)	0.005	-0.001	-0.004	0.021	-0.013	-0.008	-0.005	-0.051***	0.195	-0.006
	(0.015)	(0.002)	(0.013)	(0.019)	(0.012)	(0.007)	(0.018)	(0.019)	(0.148)	(0.018)
Have social activities in the last mouth	-0.031***	0.005***	0.026***	-0.019	0.012	0.007	-0.012	-0.027**	0.313***	-0.005
	(0.009)	(0.002)	(0.008)	(0.012)	(0.007)	(0.004)	(0.011)	(0.011)	(0.091)	(0.011)
Contact with non-coresident children monthly	0.005	-0.001	-0.004	-0.001	0.001	0.000	0.000	0.016	1.300***	-0.256***
	(0.010)	(0.002)	(0.008)	(0.012)	(0.008)	(0.004)	(0.012)	(0.012)	(0.095)	(0.010)

See non-coresident children monthly	-0.036***	0.006***	0.031***	-0.022*	0.014*	0.008*	-0.022*	-0.032***	-0.001	-0.130***
	(0.010)	(0.002)	(0.008)	(0.012)	(0.008)	(0.005)	(0.012)	(0.012)	(0.097)	(0.012)
Saving (logarithm)	-0.007***	0.001***	0.006***	-0.004***	0.002***	0.001***	-0.007***	-0.010***	0.003	-0.003**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.010)	(0.001)
Loan (logarithm)	0.003*	-0.000*	-0.003*	0.007***	-0.005***	-0.003***	0.004*	0.005**	-0.014	0.001
	(0.002)	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.018)	(0.002)
Own a house	0.000	-0.000	-0.000	0.011	-0.007	-0.004	-0.027*	-0.006	-0.174	0.121***
	(0.013)	(0.002)	(0.011)	(0.017)	(0.011)	(0.006)	(0.015)	(0.016)	(0.128)	(0.017)
Value of the houses (logarithm)	-0.013***	0.002***	0.011***	-0.012***	0.008***	0.004***	-0.012***	-0.017***	0.147***	0.030***
	(0.003)	(0.000)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.003)	(0.026)	(0.003)
Own land	0.010	-0.001	-0.008	0.019	-0.012	-0.007	0.013	0.005	0.275***	0.020
	(0.011)	(0.002)	(0.009)	(0.013)	(0.008)	(0.005)	(0.012)	(0.013)	(0.103)	(0.013)
Observations	7,045	7,045	7,045	7,045	7,045	7,045	7,045	6,392	7,045	7,045

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. (1) and (2) are ordered logistic regressions reported with marginal effects; (3), (4) and (6) are logistic regressions reported with marginal effects; (5) is OLS estimation.

Table A2

Estimation of caring time for grandchildren on the grandparents' quality of life: full sample.

Variables	Physical						Psychological		Financial	
	(1) Health			(2) Health change			(3) Body pains	(4) Depression	(5) *Ln* Support from children	(6) Living with children
	Bad	Fair	Good	Worse	About the same	Better				
Caring time (logarithm)	-0.002	0.000	0.001	0.001	-0.001	-0.000	0.000	-0.004**	0.103***	0.014***
	(0.001)	(0.000)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.014)	(0.002)
Male	-0.039***	0.006***	0.033***	-0.020*	0.013*	0.007*	-0.139***	-0.127***	-0.644***	-0.034***
	(0.009)	(0.002)	(0.008)	(0.012)	(0.008)	(0.004)	(0.011)	(0.012)	(0.093)	(0.011)
Married	-0.003	0.000	0.003	0.010	-0.006	-0.004	-0.017	-0.072***	-0.176	-0.052***
	(0.011)	(0.002)	(0.009)	(0.014)	(0.009)	(0.005)	(0.013)	(0.013)	(0.108)	(0.013)
Age	0.027***	-0.004***	-0.023***	0.012**	-0.008**	-0.004**	0.023***	0.030***	0.460***	-0.046***
	(0.005)	(0.001)	(0.004)	(0.006)	(0.004)	(0.002)	(0.006)	(0.006)	(0.045)	(0.005)
Age squared	-0.000***	0.000***	0.000***	-0.000	0.000	0.000	-0.000***	-0.000***	-0.003***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Live in village	0.017	-0.003	-0.015	0.028	-0.018	-0.010	0.045***	0.065***	0.189	-0.029*
	(0.014)	(0.002)	(0.012)	(0.017)	(0.011)	(0.006)	(0.017)	(0.018)	(0.135)	(0.017)
Live in city	-0.036**	0.006**	0.030**	0.007	-0.005	-0.003	-0.043*	-0.004	-0.033	0.042**
	(0.018)	(0.003)	(0.015)	(0.022)	(0.014)	(0.008)	(0.023)	(0.024)	(0.172)	(0.021)
Retired	0.012	-0.002	-0.010	-0.018	0.011	0.006	-0.014	-0.032	-0.623***	-0.018
	(0.018)	(0.003)	(0.015)	(0.023)	(0.014)	(0.008)	(0.024)	(0.025)	(0.177)	(0.022)
Number of children	0.005	-0.001	-0.004	0.004	-0.003	-0.001	0.009*	-0.005	0.493***	0.064***
	(0.005)	(0.001)	(0.004)	(0.006)	(0.004)	(0.002)	(0.005)	(0.006)	(0.045)	(0.006)
Number of grandchildren over 16	0.005*	-0.001*	-0.004*	-0.003	0.002	0.001	0.001	0.007**	0.038	-0.008***
	(0.003)	(0.000)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.003)	(0.025)	(0.003)

Number of grandchildren under 16	0.004	-0.001	-0.003	0.001	-0.001	-0.000	0.002	0.009**	0.094***	0.004
	(0.003)	(0.000)	(0.003)	(0.004)	(0.002)	(0.001)	(0.004)	(0.004)	(0.030)	(0.004)
Number of sibling	0.005	-0.001	-0.004	0.001	-0.001	-0.001	0.007	-0.003	0.091**	-0.002
	(0.004)	(0.001)	(0.004)	(0.005)	(0.003)	(0.002)	(0.005)	(0.005)	(0.042)	(0.005)
Parents can take care of themselves	0.040*	-0.006*	-0.034*	0.107***	-0.068***	-0.039***	0.050**	0.021	-0.341	0.025
	(0.022)	(0.003)	(0.018)	(0.028)	(0.018)	(0.010)	(0.025)	(0.026)	(0.211)	(0.025)
Enrolled in pension program	-0.059***	0.009***	0.050***	-0.029	0.018	0.011	-0.073***	-0.087***	-0.485***	-0.010
	(0.017)	(0.003)	(0.014)	(0.021)	(0.013)	(0.008)	(0.023)	(0.024)	(0.165)	(0.020)
Enrolled in health insurance (policy & primary)	0.005	-0.001	-0.004	0.021	-0.013	-0.008	-0.005	-0.051***	0.195	-0.006
	(0.015)	(0.002)	(0.013)	(0.019)	(0.012)	(0.007)	(0.018)	(0.019)	(0.148)	(0.018)
Have social activities in the last mouth	-0.031***	0.005***	0.026***	-0.019*	0.012*	0.007*	-0.012	-0.027**	0.313***	-0.005
	(0.009)	(0.002)	(0.008)	(0.012)	(0.007)	(0.004)	(0.011)	(0.011)	(0.091)	(0.011)
Contact with non-coresident children monthly	0.005	-0.001	-0.004	-0.001	0.001	0.000	0.000	0.015	1.304***	-0.256***
	(0.010)	(0.002)	(0.008)	(0.012)	(0.008)	(0.004)	(0.012)	(0.012)	(0.095)	(0.010)
See non-coresident children monthly	-0.037***	0.006***	0.031***	-0.022*	0.014*	0.008*	-0.023*	-0.033***	0.011	-0.128***
	(0.010)	(0.002)	(0.008)	(0.012)	(0.008)	(0.005)	(0.012)	(0.012)	(0.097)	(0.012)
Saving (logarithm)	-0.007***	0.001***	0.006***	-0.004***	0.002***	0.001***	-0.007***	-0.010***	0.003	-0.003**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.010)	(0.001)
Loan (logarithm)	0.003*	-0.000*	-0.003*	0.007***	-0.005***	-0.003***	0.004*	0.005**	-0.013	0.001
	(0.002)	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.018)	(0.002)
Own a house	0.000	-0.000	-0.000	0.011	-0.007	-0.004	-0.027*	-0.006	-0.174	0.121***
	(0.013)	(0.002)	(0.011)	(0.017)	(0.011)	(0.006)	(0.015)	(0.016)	(0.128)	(0.017)
Value of the houses (logarithm)	-0.013***	0.002***	0.011***	-0.012***	0.008***	0.004***	-0.012***	-0.017***	0.147***	0.030***
	(0.003)	(0.000)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.003)	(0.026)	(0.003)
Own land	0.009	-0.001	-0.008	0.019	-0.012	-0.007	0.013	0.005	0.274***	0.020
	(0.011)	(0.002)	(0.009)	(0.013)	(0.008)	(0.005)	(0.012)	(0.013)	(0.103)	(0.013)
Observations	7,045	7,045	7,045	7,045	7,045	7,045	7,045	6,392	7,045	7,045

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. (1) and (2) are ordered logistic regressions reported with marginal effects; (3), (4) and (6) are logistic regressions reported with marginal effects; (5) is OLS estimation.

Table A3

Estimation of number of grandchildren cared on the grandparents' quality of life: full sample.

Variables	Physical						Psychological		Financial	
	(1) Health			(2) Health change			(3) Body pains	(4) Depression	(5) *Ln* Support from children	(6) Living with children
	Bad	Fair	Good	Worse	About the same	Better				
Number of grandchildren cared	-0.016**	0.002**	0.013**	-0.005	0.003	0.002	-0.005	-0.020**	0.481***	0.071***
	(0.008)	(0.001)	(0.006)	(0.009)	(0.006)	(0.003)	(0.009)	(0.009)	(0.074)	(0.009)
Male	-0.039***	0.006***	0.033***	-0.021*	0.014*	0.008*	-0.140***	-0.126***	-0.669***	-0.037***
	(0.009)	(0.002)	(0.008)	(0.012)	(0.008)	(0.004)	(0.011)	(0.011)	(0.092)	(0.011)
Married	-0.003	0.000	0.003	0.011	-0.007	-0.004	-0.016	-0.073***	-0.155	-0.050***

	(0.011)	(0.002)	(0.009)	(0.014)	(0.009)	(0.005)	(0.013)	(0.013)	(0.108)	(0.013)
Age	0.027***	-0.004***	-0.023***	0.013**	-0.008**	-0.005**	0.024***	0.030***	0.470***	-0.045***
	(0.005)	(0.001)	(0.004)	(0.006)	(0.004)	(0.002)	(0.006)	(0.006)	(0.045)	(0.005)
Age squared	-0.000***	0.000***	0.000***	-0.000*	0.000*	0.000*	-0.000***	-0.000***	-0.003***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Live in village	0.017	-0.003	-0.014	0.027	-0.017	-0.010	0.045***	0.065***	0.185	-0.029*
	(0.014)	(0.002)	(0.012)	(0.017)	(0.011)	(0.006)	(0.017)	(0.018)	(0.135)	(0.017)
Live in city	-0.036**	0.006**	0.030**	0.007	-0.005	-0.003	-0.043*	-0.003	-0.037	0.041*
	(0.018)	(0.003)	(0.015)	(0.022)	(0.014)	(0.008)	(0.023)	(0.024)	(0.172)	(0.021)
Retired	0.012	-0.002	-0.010	-0.017	0.011	0.006	-0.014	-0.032	-0.602***	-0.015
	(0.018)	(0.003)	(0.015)	(0.023)	(0.014)	(0.008)	(0.024)	(0.025)	(0.178)	(0.022)
Number of children	0.005	-0.001	-0.004	0.004	-0.002	-0.001	0.009*	-0.004	0.483***	0.063***
	(0.005)	(0.001)	(0.004)	(0.006)	(0.004)	(0.002)	(0.005)	(0.006)	(0.045)	(0.006)
Number of grandchildren	0.005*	-0.001*	-0.004*	-0.003	0.002	0.001	0.001	0.007**	0.037	-0.008***
over 16	(0.003)	(0.000)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.003)	(0.025)	(0.003)
Number of grandchildren	0.005	-0.001	-0.004	0.002	-0.001	-0.001	0.003	0.009**	0.103***	0.005
under 16	(0.003)	(0.000)	(0.003)	(0.004)	(0.002)	(0.001)	(0.004)	(0.004)	(0.030)	(0.004)
Number of sibling	0.005	-0.001	-0.004	0.001	-0.001	-0.001	0.007	-0.003	0.090**	-0.003
	(0.004)	(0.001)	(0.004)	(0.005)	(0.003)	(0.002)	(0.005)	(0.005)	(0.042)	(0.005)
Parents can take care of	0.040*	-0.006*	-0.034*	0.107***	-0.068***	-0.039***	0.050**	0.020	-0.336	0.025
themselves	(0.022)	(0.003)	(0.018)	(0.028)	(0.018)	(0.010)	(0.025)	(0.026)	(0.212)	(0.025)
Enrolled in pension program	-0.059***	0.009***	0.050***	-0.030	0.019	0.011	-0.074***	-0.087***	-0.492***	-0.010
	(0.017)	(0.003)	(0.014)	(0.021)	(0.013)	(0.008)	(0.023)	(0.024)	(0.165)	(0.020)
Enrolled in health insurance	0.005	-0.001	-0.004	0.021	-0.013	-0.008	-0.005	-0.051***	0.194	-0.006
(policy & primary)	(0.015)	(0.002)	(0.013)	(0.019)	(0.012)	(0.007)	(0.018)	(0.019)	(0.148)	(0.018)
Have social activities in the	-0.030***	0.005***	0.026***	-0.019	0.012	0.007	-0.012	-0.027**	0.315***	-0.005
last mouth	(0.009)	(0.002)	(0.008)	(0.012)	(0.007)	(0.004)	(0.011)	(0.011)	(0.091)	(0.011)
Contact with non-coresident	0.005	-0.001	-0.004	-0.001	0.001	0.000	0.000	0.015	1.301***	-0.256***
children monthly	(0.010)	(0.002)	(0.008)	(0.012)	(0.008)	(0.004)	(0.012)	(0.012)	(0.096)	(0.010)
See non-coresident children	-0.036***	0.006***	0.031***	-0.022*	0.014*	0.008*	-0.022*	-0.032***	0.002	-0.129***
monthly	(0.010)	(0.002)	(0.008)	(0.012)	(0.008)	(0.005)	(0.012)	(0.012)	(0.097)	(0.012)
Saving (logarithm)	-0.007***	0.001***	0.006***	-0.004***	0.002***	0.001***	-0.007***	-0.010***	0.003	-0.003**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.010)	(0.001)
Loan (logarithm)	0.003*	-0.000*	-0.003*	0.007***	-0.005***	-0.003***	0.004*	0.005**	-0.013	0.001
	(0.002)	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.018)	(0.002)
Own a house	0.000	-0.000	-0.000	0.011	-0.007	-0.004	-0.027*	-0.007	-0.166	0.123***
	(0.013)	(0.002)	(0.011)	(0.017)	(0.011)	(0.006)	(0.015)	(0.016)	(0.128)	(0.017)
Value of the houses	-0.013***	0.002***	0.011***	-0.012***	0.008***	0.004***	-0.012***	-0.016***	0.148***	0.030***
(logarithm)	(0.003)	(0.000)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.003)	(0.026)	(0.003)
Own land	0.010	-0.001	-0.008	0.020	-0.012	-0.007	0.013	0.005	0.278***	0.020
	(0.011)	(0.002)	(0.009)	(0.013)	(0.008)	(0.005)	(0.012)	(0.013)	(0.103)	(0.013)
Observations	7,045	7,045	7,045	7,045	7,045	7,045	7,045	6,392	7,045	7,045

Notes: 1. Robust standard errors are in parentheses; 2.Significant level: *p<0.1 **p<0.05 ***p<0.01; 3. (1) and (2) are ordered logistic regressions reported with marginal

effects; (3), (4) and (6) are logistic regressions reported with marginal effects; (5) is OLS estimation.

Table A4
Providing care, quality of life and satisfaction: Ordered logistic regressions with marginal effects, full sample.

Variables	Life satisfaction									
	(1)					(2)				
	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied
Providing care for grandchildren (yes)	-0.005***	-0.012***	-0.026***	0.032***	0.011***	-0.004***	-0.012***	-0.023***	0.027***	0.011***
	(0.001)	(0.004)	(0.008)	(0.009)	(0.003)	(0.001)	(0.004)	(0.007)	(0.009)	(0.004)
Health (poor)						0.005***	0.014***	0.027***	-0.033***	-0.013***
						(0.002)	(0.004)	(0.008)	(0.010)	(0.004)
Health (good)						-0.015***	-0.041***	-0.080***	0.097***	0.039***
						(0.002)	(0.004)	(0.008)	(0.009)	(0.004)
Health change (worse)						0.003*	0.008*	0.015*	-0.018*	-0.007*
						(0.001)	(0.004)	(0.008)	(0.009)	(0.004)
Health change (better)						0.007***	0.018***	0.036***	-0.043***	-0.017***
						(0.001)	(0.004)	(0.007)	(0.009)	(0.004)
Body pains (yes)						-0.004*	-0.010*	-0.020*	0.024*	0.010*
						(0.002)	(0.006)	(0.011)	(0.013)	(0.005)
Depression						0.022***	0.061***	0.119***	-0.145***	-0.058***
						(0.002)	(0.005)	(0.008)	(0.009)	(0.004)
Supports from children (logarithm)						-0.000**	-0.001***	-0.002***	0.003***	0.001***
						(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
live with children (yes)						-0.001	-0.003	-0.006	0.007	0.003
						(0.001)	(0.003)	(0.007)	(0.008)	(0.003)
Male	-0.001	-0.003	-0.007	0.009	0.003	0.002**	0.007**	0.013**	-0.016**	-0.006**
	(0.001)	(0.003)	(0.007)	(0.008)	(0.003)	(0.001)	(0.003)	(0.007)	(0.008)	(0.003)
Married	-0.005***	-0.015***	-0.031***	0.038***	0.014***	-0.005***	-0.013***	-0.025***	0.031***	0.012***
	(0.001)	(0.004)	(0.008)	(0.010)	(0.004)	(0.001)	(0.004)	(0.008)	(0.009)	(0.004)
Age	0.002***	0.006***	0.013***	-0.016***	-0.006***	0.001*	0.003*	0.006*	-0.007*	-0.003*
	(0.001)	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	0.000***	0.000***	-0.000**	-0.000**	-0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Live in village	0.003	0.008	0.016	-0.020	-0.007	0.001	0.002	0.003	-0.004	-0.001
	(0.002)	(0.005)	(0.010)	(0.012)	(0.004)	(0.002)	(0.005)	(0.009)	(0.011)	(0.005)
Live in city	0.001	0.003	0.007	-0.008	-0.003	0.002	0.006	0.011	-0.013	-0.005
	(0.002)	(0.006)	(0.013)	(0.015)	(0.006)	(0.002)	(0.006)	(0.012)	(0.014)	(0.006)
Retired	0.004	0.010	0.021	-0.025	-0.009	0.003	0.008	0.016	-0.020	-0.008
	(0.002)	(0.006)	(0.013)	(0.016)	(0.006)	(0.002)	(0.006)	(0.012)	(0.015)	(0.006)
Number of children	-0.000	-0.001	-0.002	0.003	0.001	-0.000	-0.001	-0.002	0.002	0.001
	(0.001)	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.002)

Number of grandchildren over 16	-0.000	-0.000	-0.001	0.001	0.000	-0.000	-0.000	-0.001	0.001	0.000
	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)
Number of grandchildren under 16	0.000	0.000	0.001	-0.001	-0.000	0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.001)	(0.002)	(0.003)	(0.001)	(0.000)	(0.001)	(0.002)	(0.003)	(0.001)
Number of sibling	0.001	0.002	0.005*	-0.006*	-0.002	0.001*	0.003*	0.005*	-0.007*	-0.003*
	(0.001)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.001)
Parents can take care of themselves	-0.000	-0.000	-0.001	0.001	0.000	-0.003	-0.009	-0.018	0.022	0.009
	(0.003)	(0.008)	(0.016)	(0.019)	(0.007)	(0.003)	(0.008)	(0.015)	(0.018)	(0.007)
Enrolled in pension program	0.000	0.001	0.002	-0.003	-0.001	0.003	0.007	0.014	-0.016	-0.007
	(0.002)	(0.006)	(0.012)	(0.015)	(0.005)	(0.002)	(0.006)	(0.011)	(0.014)	(0.005)
Enrolled in health insurance (policy & primary)	-0.003*	-0.009*	-0.020*	0.024*	0.009*	-0.003	-0.008	-0.015	0.018	0.007
	(0.002)	(0.005)	(0.011)	(0.014)	(0.005)	(0.002)	(0.006)	(0.011)	(0.013)	(0.005)
Have social activities in the last mouth	0.001	0.002	0.005	-0.006	-0.002	0.002*	0.006*	0.012*	-0.014*	-0.006*
	(0.001)	(0.003)	(0.007)	(0.008)	(0.003)	(0.001)	(0.003)	(0.006)	(0.008)	(0.003)
Contact with non-coresident children monthly	-0.001	-0.003	-0.006	0.008	0.003	-0.001	-0.004	-0.007	0.008	0.003
	(0.001)	(0.003)	(0.007)	(0.009)	(0.003)	(0.001)	(0.004)	(0.007)	(0.009)	(0.003)
See non-coresident children monthly	-0.002*	-0.006*	-0.014*	0.016*	0.006*	-0.000	-0.001	-0.002	0.003	0.001
	(0.001)	(0.003)	(0.007)	(0.009)	(0.003)	(0.001)	(0.004)	(0.007)	(0.008)	(0.003)
Saving (logarithm)	-0.000	-0.000	-0.001	0.001	0.000	0.000	0.001	0.001	-0.001	-0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Loan (logarithm)	0.000*	0.001*	0.002*	-0.003*	-0.001*	0.000	0.001	0.001	-0.001	-0.000
	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Own a house	0.000	0.001	0.001	-0.002	-0.001	-0.000	-0.000	-0.001	0.001	0.000
	(0.002)	(0.005)	(0.010)	(0.012)	(0.004)	(0.002)	(0.005)	(0.009)	(0.011)	(0.004)
Value of the houses (logarithm)	-0.002***	-0.005***	-0.011***	0.013***	0.005***	-0.001***	-0.003***	-0.005***	0.006***	0.002***
	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)
Own land	-0.000	-0.001	-0.002	0.002	0.001	-0.001	-0.002	-0.004	0.005	0.002
	(0.001)	(0.004)	(0.008)	(0.009)	(0.003)	(0.001)	(0.004)	(0.007)	(0.009)	(0.004)
Observations	6,939	6,939	6,939	6,939	6,939	6,361	6,361	6,361	6,361	6,361

Notes: 1. Robust standard errors are in parentheses; 2. Significant level: *p<0.1 **p<0.05 ***p<0.01.

Table A5

Caring time, quality of life and satisfaction: Ordered logistic regressions with marginal effects, full sample.

Variables	Life satisfaction									
	(1)					(2)				
	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied
Caring time (logarithm)	-0.001***	-0.002***	-0.003***	0.004***	0.001***	-0.001***	-0.001***	-0.003***	0.003***	0.001***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Health (poor)						0.005***	0.014***	0.028***	-0.034***	-0.013***
						(0.002)	(0.004)	(0.008)	(0.010)	(0.004)
Health (good)						-0.015***	-0.041***	-0.080***	0.097***	0.039***

						(0.002)	(0.004)	(0.008)	(0.009)	(0.004)
Health change (worse)						0.003*	0.008*	0.015*	-0.018*	-0.007*
						(0.001)	(0.004)	(0.008)	(0.009)	(0.004)
Health change (better)						0.007***	0.018***	0.036***	-0.043***	-0.017***
						(0.001)	(0.004)	(0.007)	(0.009)	(0.004)
Body pains (yes)						-0.004*	-0.010*	-0.020*	0.024*	0.010*
						(0.002)	(0.006)	(0.011)	(0.013)	(0.005)
Depression						0.022***	0.061***	0.119***	-0.145***	-0.058***
						(0.002)	(0.005)	(0.008)	(0.009)	(0.004)
Supports from children						-0.000**	-0.001***	-0.002***	0.003***	0.001***
(logarithm)						(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
live with children (yes)						-0.001	-0.003	-0.006	0.007	0.003
						(0.001)	(0.003)	(0.007)	(0.008)	(0.003)
Male	-0.001	-0.003	-0.007	0.009	0.003	0.002*	0.007**	0.013**	-0.016**	-0.006**
	(0.001)	(0.003)	(0.007)	(0.008)	(0.003)	(0.001)	(0.003)	(0.007)	(0.008)	(0.003)
Married	-0.005***	-0.015***	-0.031***	0.038***	0.014***	-0.005***	-0.013***	-0.025***	0.030***	0.012***
	(0.001)	(0.004)	(0.008)	(0.010)	(0.004)	(0.001)	(0.004)	(0.008)	(0.009)	(0.004)
Age	0.002***	0.006***	0.013***	-0.015***	-0.006***	0.001*	0.003*	0.006*	-0.007*	-0.003*
	(0.001)	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	0.000***	0.000***	-0.000**	-0.000**	-0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Live in village	0.003	0.008	0.016	-0.020	-0.007	0.001	0.002	0.003	-0.004	-0.001
	(0.002)	(0.005)	(0.010)	(0.012)	(0.004)	(0.002)	(0.005)	(0.009)	(0.011)	(0.005)
Live in city	0.001	0.003	0.007	-0.008	-0.003	0.002	0.006	0.011	-0.013	-0.005
	(0.002)	(0.006)	(0.013)	(0.015)	(0.006)	(0.002)	(0.006)	(0.012)	(0.014)	(0.006)
Retired	0.004	0.010	0.021	-0.025	-0.009	0.003	0.008	0.016	-0.020	-0.008
	(0.002)	(0.006)	(0.013)	(0.016)	(0.006)	(0.002)	(0.006)	(0.012)	(0.015)	(0.006)
Number of children	-0.000	-0.001	-0.002	0.003	0.001	-0.000	-0.001	-0.002	0.002	0.001
	(0.001)	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.002)
Number of grandchildren over	-0.000	-0.000	-0.001	0.001	0.000	-0.000	-0.000	-0.001	0.001	0.000
16	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)
Number of grandchildren	0.000	0.000	0.001	-0.001	-0.000	0.000	0.000	0.000	-0.000	-0.000
under 16	(0.000)	(0.001)	(0.002)	(0.003)	(0.001)	(0.000)	(0.001)	(0.002)	(0.003)	(0.001)
Number of sibling	0.001	0.002*	0.005*	-0.006*	-0.002*	0.001*	0.003*	0.005*	-0.007*	-0.003*
	(0.001)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.001)
Parents can take care of	-0.000	-0.000	-0.001	0.001	0.000	-0.003	-0.010	-0.018	0.022	0.009
themselves	(0.003)	(0.008)	(0.016)	(0.019)	(0.007)	(0.003)	(0.008)	(0.015)	(0.018)	(0.007)
Enrolled in pension program	0.000	0.001	0.002	-0.003	-0.001	0.003	0.007	0.014	-0.017	-0.007
	(0.002)	(0.006)	(0.012)	(0.015)	(0.005)	(0.002)	(0.006)	(0.011)	(0.014)	(0.005)
Enrolled in health insurance	-0.003*	-0.009*	-0.020*	0.024*	0.009*	-0.003	-0.008	-0.015	0.018	0.007
(policy & primary)	(0.002)	(0.005)	(0.011)	(0.014)	(0.005)	(0.002)	(0.006)	(0.011)	(0.013)	(0.005)
Have social activities in the	0.001	0.002	0.005	-0.006	-0.002	0.002*	0.006*	0.012*	-0.014*	-0.006*
last mouth	(0.001)	(0.003)	(0.007)	(0.008)	(0.003)	(0.001)	(0.003)	(0.006)	(0.008)	(0.003)

Contact with non-coresident children monthly	-0.001	-0.003	-0.006	0.008	0.003	-0.001	-0.004	-0.007	0.009	0.003
	(0.001)	(0.003)	(0.007)	(0.009)	(0.003)	(0.001)	(0.004)	(0.007)	(0.009)	(0.003)
See non-coresident children monthly	-0.002*	-0.007*	-0.014*	0.017*	0.006*	-0.001	-0.001	-0.003	0.003	0.001
	(0.001)	(0.003)	(0.007)	(0.009)	(0.003)	(0.001)	(0.004)	(0.007)	(0.008)	(0.003)
Saving (logarithm)	-0.000	-0.000	-0.001	0.001	0.000	0.000	0.001	0.001	-0.001	-0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Loan (logarithm)	0.000*	0.001*	0.002*	-0.003*	-0.001*	0.000	0.001	0.001	-0.001	-0.000
	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Own a house	0.000	0.001	0.001	-0.002	-0.001	-0.000	-0.000	-0.001	0.001	0.000
	(0.002)	(0.005)	(0.010)	(0.012)	(0.004)	(0.002)	(0.005)	(0.009)	(0.011)	(0.004)
Value of the houses (logarithm)	-0.002***	-0.005***	-0.011***	0.013***	0.005***	-0.001***	-0.003***	-0.005***	0.006***	0.002***
	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)
Own land	-0.000	-0.001	-0.002	0.002	0.001	-0.001	-0.002	-0.005	0.006	0.002
	(0.001)	(0.004)	(0.008)	(0.009)	(0.003)	(0.001)	(0.004)	(0.007)	(0.009)	(0.004)
Observations	6,939	6,939	6,939	6,939	6,939	6,361	6,361	6,361	6,361	6,361

Notes: 1. Robust standard errors are in parentheses; 2. Significant level: *p<0.1 **p<0.05 ***p<0.01.

Table A6

Number of grandchildren cared, quality of life and satisfaction: Ordered logistic regressions with marginal effects, full sample.

Variables	Life satisfaction									
	(1)					(2)				
	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied
Number of grandchildren cared	-0.005***	-0.015***	-0.031***	0.037***	0.013***	-0.005***	-0.014***	-0.027***	0.032***	0.013***
	(0.002)	(0.004)	(0.009)	(0.011)	(0.004)	(0.002)	(0.004)	(0.008)	(0.010)	(0.004)
Squared number of grandchildren cared	0.001**	0.003**	0.006**	-0.008**	-0.003**	0.001*	0.003*	0.005*	-0.006*	-0.003*
	(0.001)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)
Health (poor)						0.005***	0.014***	0.027***	-0.033***	-0.013***
						(0.002)	(0.004)	(0.008)	(0.010)	(0.004)
Health (good)						-0.015***	-0.041***	-0.080***	0.097***	0.039***
						(0.002)	(0.004)	(0.008)	(0.009)	(0.004)
Health change (worse)						0.003*	0.008*	0.015*	-0.018*	-0.007*
						(0.001)	(0.004)	(0.008)	(0.009)	(0.004)
Health change (better)						0.007***	0.019***	0.036***	-0.044***	-0.017***
						(0.001)	(0.004)	(0.007)	(0.009)	(0.004)
Body pains (yes)						-0.004*	-0.010*	-0.020*	0.024*	0.009*
						(0.002)	(0.006)	(0.011)	(0.013)	(0.005)
Depression						0.022***	0.061***	0.119***	-0.145***	-0.058***
						(0.002)	(0.005)	(0.008)	(0.009)	(0.004)
Supports from children						-0.000**	-0.001***	-0.002***	0.003***	0.001***

(logarithm)						(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
live with children (yes)						-0.001	-0.003	-0.006	0.007	0.003
						(0.001)	(0.003)	(0.007)	(0.008)	(0.003)
Male	-0.001	-0.003	-0.007	0.008	0.003	0.002**	0.007**	0.013**	-0.016**	-0.006**
	(0.001)	(0.003)	(0.007)	(0.008)	(0.003)	(0.001)	(0.003)	(0.007)	(0.008)	(0.003)
Married	-0.005***	-0.015***	-0.031***	0.038***	0.014***	-0.005***	-0.013***	-0.025***	0.030***	0.012***
	(0.001)	(0.004)	(0.008)	(0.010)	(0.004)	(0.001)	(0.004)	(0.008)	(0.009)	(0.004)
Age	0.002***	0.006***	0.013***	-0.016***	-0.006***	0.001*	0.003*	0.006*	-0.007*	-0.003*
	(0.001)	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	0.000***	0.000***	-0.000**	-0.000**	-0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Live in village	0.003	0.008	0.016	-0.020	-0.007	0.001	0.002	0.003	-0.004	-0.002
	(0.002)	(0.005)	(0.010)	(0.012)	(0.004)	(0.002)	(0.005)	(0.009)	(0.011)	(0.005)
Live in city	0.001	0.003	0.007	-0.008	-0.003	0.002	0.005	0.011	-0.013	-0.005
	(0.002)	(0.006)	(0.013)	(0.015)	(0.006)	(0.002)	(0.006)	(0.012)	(0.014)	(0.006)
Retired	0.003	0.010	0.020	-0.025	-0.009	0.003	0.008	0.016	-0.020	-0.008
	(0.002)	(0.006)	(0.013)	(0.016)	(0.006)	(0.002)	(0.006)	(0.012)	(0.015)	(0.006)
Number of children	-0.000	-0.001	-0.002	0.003	0.001	-0.000	-0.001	-0.002	0.002	0.001
	(0.001)	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.002)
Number of grandchildren	-0.000	-0.000	-0.001	0.001	0.000	-0.000	-0.001	-0.001	0.001	0.001
over 16	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)
Number of grandchildren	0.000	0.001	0.001	-0.001	-0.000	0.000	0.000	0.000	-0.000	-0.000
under 16	(0.000)	(0.001)	(0.002)	(0.003)	(0.001)	(0.000)	(0.001)	(0.002)	(0.003)	(0.001)
Number of sibling	0.001	0.002*	0.005*	-0.006*	-0.002*	0.001*	0.003*	0.005*	-0.007*	-0.003*
	(0.001)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.001)
Parents can take care of	-0.000	-0.000	-0.000	0.000	0.000	-0.003	-0.009	-0.018	0.022	0.009
themselves	(0.003)	(0.008)	(0.016)	(0.019)	(0.007)	(0.003)	(0.008)	(0.015)	(0.018)	(0.007)
Enrolled in pension	0.000	0.001	0.002	-0.002	-0.001	0.003	0.007	0.013	-0.016	-0.006
program	(0.002)	(0.006)	(0.012)	(0.015)	(0.005)	(0.002)	(0.006)	(0.011)	(0.014)	(0.005)
Enrolled in health insurance	-0.003*	-0.009*	-0.020*	0.024*	0.009*	-0.003	-0.008	-0.015	0.018	0.007
(policy & primary)	(0.002)	(0.005)	(0.011)	(0.014)	(0.005)	(0.002)	(0.006)	(0.011)	(0.013)	(0.005)
Have social activities in the	0.001	0.002	0.005	-0.006	-0.002	0.002*	0.006*	0.012*	-0.014*	-0.006*
last mouth	(0.001)	(0.003)	(0.007)	(0.008)	(0.003)	(0.001)	(0.003)	(0.006)	(0.008)	(0.003)
Contact with non-coresident	-0.001	-0.003	-0.006	0.008	0.003	-0.001	-0.004	-0.007	0.009	0.003
children monthly	(0.001)	(0.003)	(0.007)	(0.009)	(0.003)	(0.001)	(0.004)	(0.007)	(0.009)	(0.003)
See non-coresident children	-0.002*	-0.006*	-0.013*	0.016*	0.006*	-0.000	-0.001	-0.002	0.003	0.001
monthly	(0.001)	(0.003)	(0.007)	(0.009)	(0.003)	(0.001)	(0.004)	(0.007)	(0.008)	(0.003)
Saving (logarithm)	-0.000	-0.000	-0.001	0.001	0.000	0.000	0.001	0.001	-0.001	-0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)

Loan (logarithm)	0.000*	0.001*	0.002*	-0.003*	-0.001*	0.000	0.001	0.001	-0.001	-0.000
	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Own a house	0.000	0.000	0.001	-0.001	-0.000	-0.000	-0.001	-0.001	0.001	0.001
	(0.002)	(0.005)	(0.010)	(0.012)	(0.004)	(0.002)	(0.005)	(0.009)	(0.011)	(0.004)
Value of the houses	-0.002***	-0.005***	-0.011***	0.013***	0.005***	-0.001***	-0.003***	-0.005***	0.006***	0.002***
(logarithm)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)
Own land	-0.000	-0.001	-0.002	0.002	0.001	-0.001	-0.002	-0.005	0.006	0.002
	(0.001)	(0.004)	(0.008)	(0.009)	(0.003)	(0.001)	(0.004)	(0.007)	(0.009)	(0.004)
Observations	6,939	6,939	6,939	6,939	6,939	6,361	6,361	6,361	6,361	6,361

Notes: 1. Robust standard errors are in parentheses; 2. Significant level: *p<0.1 **p<0.05 ***p<0.01