The Determinants of Happiness of China's Elderly Population

Hau Chyi · Shangyi Mao

Abstract   "Three generations under one roof" is an old Chinese saying used to describe a desired living arrangement. The traditional concept of happiness for a Chinese elderly person is being able to "play with grandchildren with candy in mouth, enjoy life with no cares." In a fast-changing economy like China, how does society, especially the elderly themselves, view these traditional values? Using the 2005 Chinese General Social Survey, we study the determinants of happiness of the Chinese elderly. We are particularly interested in whether living with their child and whether living with their grandchild affect the happiness of the elderly. An important empirical concern is that unobserved permanent income may affect both the living arrangements of the elderly and their level of happiness. We include property ownership variables as proxies and also adopt an instrument variable approach to identify the causal relationship between the elderly's happiness and their living arrangements. We find that, conditional on living with a grandchild, living with one's child has a negative effect on the elderly's happiness. Furthermore, elderly Chinese who live with grandchildren are associated with a much higher degree of happiness than their counterparts.

Keywords   Happiness · Chinese Elderly · Living Arrangement

H. Chyi
Hanqing Advanced Institute of Economics and Finance and School of Economics,
Renmin University of China, Beijing, China
e-mail: hauchyi@gmail.com

S. Mao (✉)
The Wang Yanan Institute for Studies in Economics, Xiamen University, Fujian, China
e-mail: m.cherish@gmail.com

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1 Introduction

With the population aged 60 and above accounted for more than 10% in 2000, China has since been an ageing society.[1] In 2009, there were 167 million Chinese aged sixty and older,[2] which accounted for 12.5% of the total population. If the elderly population was ranked as a single country, it would be the seventh largest in the world (Population Reference Bureau 2009). Under the United Nations' medium fertility and mortality assumptions, the number of the elderly aged 65 or older will climb to 329 million people in 2050 (Chen and Liu 2009), which is larger than the size of the current U.S. population. Thus, it is of significance to study the determinants of the elderly's happiness for the assistance of government, family and the community.

In the last three decades, China has undergone a huge transformation. These dramatic changes in Chinese society may have changed the Chinese elderly's traditional values. Old China has a strong tradition of the extended family and of patrilocal living arrangements. This tradition is reflected in abundant Chinese idioms describing the traditional concept of happiness. For example, happiness for the elderly is from their children pleasing them by living with them (*cheng huan xi xia*), having three generations living together under one roof (*san dai tong tang*), and insisting that harmony in the family is the basis for success in any undertaking (*jia he wan shi xing*). However, in recent decades, the number of older people living in nontraditional households has increased. Based on micro data sets of the Chinese censuses of 1982, 1990, and 2000, Zeng and Wang (2003) find that the percentages of men aged 65 and above who lived apart from their children were 32.1, 32.4, and 40.1 in 1982, 1990, and 2000 respectively; the corresponding percentages for women aged 65 and above were 26.4, 26 and 31.3 respectively. These data show clearly that after 1990, the living arrangements of Chinese elderly changed with increasing numbers living apart from their children.

Living with one's own child has conflicting effects on an elderly's happiness. On one hand, living with their children provides the elderly with easy access to get emotional and daily life support; on the other hand, coresiding with their children can create tensions and conflicts. This living arrangement transition seems to indicate that living with their children is negatively associated with the elderly's happiness. Furthermore, the birth of a grandson is the most important aspect of their children's marriages in the old Chinese society. As an old saying goes, "There are three cardinal offences against filial piety, having no male heir is the gravest." As the number of the elderly's grandchildren has decreased, due to China's family planning policy, a further interesting empirical question is that whether Chinese elderly still favor a male grandchild. Or, as the old Chinese saying goes, they are now happy so long as they can "play with grandchildren with candy in mouth, enjoy life with no cares" (*han yi nong sun*).

In view of the transformation of living arrangements, our work represents a fresh attempt to understand whether these traditional values still hold as well as the factors that may be related to the happiness of Chinese elderly. In particular, this paper addresses the following questions: (1) What is the relationship between living with one's own child and an elderly's reported level of happiness. (2) Conditional on the living arrangement, does an

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[1] Besides the definition stated above, an alternative definition of an ageing society is one with the population above the age of 65 accounted for 7% of the total population. This particular portion of population in China reached 6.96% in 2000 (The Fifth Census, National Bureau of Statistics of China).

[2] Source: the Statistical Communiqué of the People's Republic of China on the 2009 National Economic and Social Development.

elderly report different levels of happiness if he/she lives with a grandchild? (3) Do the elderly still value the traditional concept of favoritism towards a grandson?

Significantly, we find that living with a grandchild has a positive effect on the elderly's happiness. However, having controlled for this effect, living with their children has a negative effect on the elderly's happiness. Finally, we find no evidence that the elderly feel more favorable toward grandsons versus granddaughters if the elderly already lives with a grandchild. Other factors are in accordance with the happiness literature, details of which can be seen in Sect. 5.

This research contributes to the literature in three ways. First, we provide an analysis of the determinants of the Chinese elderly's happiness, particularly the intra-family relationships. Second, in the existence of uncontrolled factors that may affect both elderly's living arrangements and their happiness, we are aware that there may also be a reverse causation. In order to explore and deal with this cause-and-effect muddle, we employ the instrumental variable (IV) method, that allows us to describe a distinct causality.[3] Third, we provide insights for policy makers and professionals to improve their perceptions and understanding of the lives of Chinese elderly.

The remainder of this paper is organized as follows. Section 2 provides a literature review. We present the empirical model in Sect. 3 and describe the data set as well as the reasons why our proposed instruments work in Sects. 4 and 4.1. We set out our results in Sect. 5 and discuss how intra-family relationship affect the elderly's happiness. Finally, Sect. 6 concludes.

2 Literature Review

Using samples from developed countries, studies focusing on the determinants of happiness are well established. Different relationships between happiness and other specific variables have been explored in recent works. As Layard (2005) states, most of the research points to there being seven main factors for happiness, these are family relationships, income, work, community and friends, health, freedom, and a philosophy of life. Recently factors for happiness in developing countries has been studied as well (see Graham and Felton 2005 on Latin American countries; Kingdon and Knight 2006 on South Africa; Rossi et al. 2007 on Uruguay; Selim 2008 on Turkey). They find that the determinants of happiness in developing countries are similar to those in advanced countries.

Nowadays, research has emerged on the determinants of happiness using Chinese data. Knight, Song and Gunatilaka (2009) use the rural sample of the 2002 National Household Survey to study the determinants of the subjective wellbeing of residents of rural China. They find that personal characteristics such as age, health, and financial wealth are significantly correlated with the reported levels of happiness. They also find that the effect of relative income (household income versus the village average) is an important determinants for an individual's subjective happiness, but that the level of absolute income is not significantly correlated with levels of happiness. Moreover, they show that outlook on life, social comparisons and aspirations influence the level of individuals' happiness.

Appleton and Song (2008) examine the relationship between life satisfaction and different individual variables in urban China. Using the urban data of the 2002 Chinese Household Income Project Survey, they find that factors for life satisfaction are similar to

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[3] Oswald (2007) points out that the IV method is among ones that build causality between two variables.

those from other countries. Moreover, they find that membership of the Communist Party and political participation raise life satisfaction.

Knight and Gunatilaka (2007, 2008) analyze why rural–urban migrant households settled in urban China have lower average happiness compared to rural households. They examine the sample of the 2002 Rural–Urban Migrant Household Survey. They suggest that the migrants have changed their income reference group to urban residents and that their now higher aspiration lead to unhappiness.

Jiang et al. (2009) study how the income inequality affect individual's happiness of different social groups in urban China. They classify groups in terms of their *hukou* (registered residence) status into three groups: rural migrants, "born" urban residents, and people who have changed their *hukou* identity from rural to urban ("acquired" urban residents). By analyzing the urban and migrants' data of the 2002 Chinese Household Income Project Survey, they find that migrants and "acquired" urban residents suffer from unhappiness when horizontal inequality (income disparity between migrants and urban residents) increases, but this horizontal inequality has a much smaller effect on urban residents. They conclude that *hukou* identity determines the effects of factors for individual's happiness.

We are not aware of any economic research on the elderly's happiness in China, but studies focused on elderly people can be found in psychology and sociology research. Chou and Chi (1999) analyze the determinants of life satisfaction of elderly Chinese living in Hong Kong. The data comes from a 3-year longitudinal study of a typical community sample of the elderly aged 70 years and over in Hong Kong. They find that younger elderly persons with less financial strain, better social support, fewer somatic symptoms and more education report a higher level of life satisfaction 3 years later. Li et al. (2007) explore the differences between groups of mainland Chinese minority and majority elderly in terms of financial strain and its connection with life satisfaction and health outcomes. They find that self-rated financial strain is significantly negatively related to life satisfaction and self-rated health for both the minority and the majority groups, but it is only negatively associated with the activities of daily living of the minority group, which are eating, dressing, using the toilet, bathing, getting in and out of bed, and mobility or locomotion at home.

Chen and Short (2008) use the 1998 Chinese Longitudinal Healthy Longevity Survey to investigate the effect of the household living arrangements on the subjective well-being of the oldest old, those aged 80 and older in China. In their analysis, first, they focus on the effects of living with a spouse or their children, living with others, and living alone. Next, they explore the subjective well-being of people living with family. Finally, for the oldest old living with their children, they investigate whether there are difference in the effects of living with a son or with a daughter. They find that living alone is associated with lower subjective well-being, but living with a spouse or their children can have a positive effect on subjective well-being. In addition, they find that living with a daughter is positively linked to the oldest old's emotional health compared to living with a son.

Most studies of the determinants of Chinese happiness focus on individual's economic status, but Chen and Short (2008) show that living arrangements are important to the elderly's happiness. Thus we cannot ignore nonmaterial factors. Almost all literature uses ordinary least squares (OLS) or the ordered probit approach to model their empirical regression. Knight et al. (2009) use the IV approach to control for the endogenous problem, but it is being used for only the income variable. In this paper, we use the IV approach to solve the endogenous problem of living arrangements. Next section discusses sources of the endogeneity issue and Sect. 4 discusses the instrumental variables we propose.

3 Empirical Specifications

We treat the level of happiness of an individual i, H_i^*, as a measure of the indirect utility. We specify H_i^* as a function of a set of nonpecuniary (NP_i) and pecuniary (P_i) variables and an individual's unobserved preference shifter (ϵ_i):

$$H_i^* = \alpha_0 + \alpha_1 NP_i + \alpha_2 P_i + \varepsilon_i. \tag{1}$$

As in most of the studies in the literature, this paper uses self-rated happiness (H_i) as a proxy of an individual's utility or true happiness (see, for example, Frey and Stutzer 2002; Dolan et al. 2008). Since reported happiness is a categorical variable ranging from one (least happy) to five (happiest), the econometric model can be written as

$$\begin{aligned} H_i^* &= \alpha + \alpha_1 NP_i + \alpha_2 P_i + \varepsilon_i \\ H_i &= m \ \text{ if } \tau_m \leq H_i^* < \tau_{m+1} \ \text{ for } m = 1 \text{ to } 5, \end{aligned} \tag{2}$$

where H_i^* is the unobserved latent variable, m are the five discrete categories (1 to 5), τ_m are four estimated intercept terms, and ε_i represents the usual error term.

Note that the parameters (α_1, α_2) do not carry sub-index, i. This implies we assume that the dependent variable is interpersonally comparable. For example, an individual who answered a "four" is happier than another who answered a "two." As a result, an increase in the explanatory variable has the same effect on H_i^* across i. We take the position that happiness across individuals can be compared. There is a long literature discussing whether subjective happiness across different economic agents are comparable. For example, Helliwell (2010) argues that differences of subjective well-being among individuals are largely explicable by the same theoretically plausible variables. Ferrer-i-Carbonell and Frijters (2004) also conclude that estimation results are relatively immune to the assumption that happiness is cardinal or ordinal.

In this paper, we investigate the following questions: (1) What is the relationship between living with one's own child and an elderly's reported happiness. (2) Conditional on the living arrangement, does an elderly report different levels of happiness if he/she lives with a grandchild? (3) Do the elderly still value the traditional concept of favoritism towards a grandson?

To investigate the first and the second research questions, we include two indicator variables (a) whether the elderly lives with his/her child and (b) whether the elderly lives with a grandchild as main variables in interests. A negative estimator of the former variable indicates that detrimental aspects of living with one's own child outweigh positive ones. Meanwhile, a positive estimator of the second variable implies that modern Chinese elderly still enjoy living with their grandchildren. The third research question is investigated by adding a third variable (c) whether the elderly lives with a granddaughter to the previous regression. A nonsignificant estimate of this variable indicates that Chinese elderly no longer favor a grandson over a granddaughter.

As the two latter variables are arguably determined by whether an elderly person's child decides to have a child of his/her own, these variables are treated as exogenous in Eq. (1). On the other hand, at least three confounding effects on an elderly's happiness may be captured by the coefficient of "lives with child." To make clear the effects that we are able to capture in the empirical specification, we discuss what they are and how they are represented in our specification in more details below. The first factor that may be reflected by the living arrangement variable is the effect of permanent income. The permanent income hypothesis states that the level of permanent income is a major economic

determinant of an individual's level of consumption, hence their indirect utility. Most importantly, elderly with more wealth can afford to live separately, while people with lower wealth are forced to live with their children. Since it is next to impossible to measure permanent income accurately due to the data restriction of an empirical model (Bollen et al. 2007), two broad sets of proxy variables are commonly used in empirical studies: housing characteristics and possession of durable goods (Kolenikov and Angles 2009). In our study, we include the logarithm of total family income in 2004,[4] as well as variables that measure real estate assets, including home ownership and the number of rooms in the house as proxies for the level of permanent income.[5] Once we have controlled permanent income separately in the main regression by the proxy variables, the estimate for the effect of "lives with children" should be interpreted as "holding permanent income (and other controlled variables) constant, whether living with one's own child increases the individual's happiness".[6]

The second effect that "lives with children" is likely to capture is the potential tension and conflict between the two generations living under one roof that is likely to reduce elderly's levels of happiness. We suspect that the main source of this negative effect is the elderly's having to share the "power" of the family once the elderly's children are grown. For example, adult Chinese men are generally the bread earners and the heads of the household. Having to live with their children after retirement, elderly men may have to consult with their grown-up sons (or son-in-laws) on family decisions that they used to be able to decide alone. Similarly, elderly women who used to run their households according to their wills now have to share with their daughters (or daughter-in-laws). Having controlled for the permanent income and "lives with grandchild," we may hence find our coefficient of "lives with children" negative due to this reason.

Finally, a third factor that needs to be considered is an individual's own disposition, that is not observed by researchers. Knowing that living with their children can bring tension and conflict into the family, an elderly with better disposition may be more willing to live with their children. Since this factor is not empirically observed, an OLS estimation, combining a negative effect of living together and a positive effect of unobserved own disposition, will be biased upward. In other words, we may erroneously conclude that living with one's own child improves an elderly's happiness, when in fact, it has a detrimental effect.[7]

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[4] Total family income combines all sources of income from the elderly's family members, including wages, various bonuses, allowances, profits, dividends, net income from businesses, interest from bank deposits, and contributions from relatives and friends.

[5] A possible proxy for permanent income is the gross square footage of the house where the elderly person resides. Empirically however, it has too many missing values in the data set we use (2005 Chinese General Social Survey). As a result, the number of rooms of a house is adopted as a variable.

[6] As permanent income is not measurable, proxy variables that we use for I_i may be contaminated with measurement error that lead to bias in estimating the effect of permanent income on the elderly's happiness. As mentioned in footnote 9, estimates from instrumenting both family income and living arrangement do not different greatly from the reported main estimates. As a result, we choose not to deal with the measurement error in permanent income.

[7] Due to concerns over the existence of the unobserved factors, we also choose to not include some attitudinal variables that are common in the literature, such as comparing economic status with others, how often one contacts relatives and friends, and opinions on important issues etc, as they might be outcome variables as well and have similar problems of endogeneity.

We propose a two-stage least square (2SLS) with instrumental variables to control for the endogeneity issue.[8] In Sect. 4.1, we will discuss the instrumental variables we choose and evaluate their appropriateness.

Besides a 2SLS model, we also estimate an ordered probit model and an ordered probit model with instrumental variables. The main advantage of the ordered probit model over either the OLS model or the 2SLS model in our study is that it is more flexible. In a linear model, an individual who answers a "four" implies that he is twice as happy as an individual who only answers a "two." The ordered probit model does not have this restriction. On the other hand, econometric theories examining the validity of instrumental variables are readily established under a 2SLS model setup. As far as we know, this is not the case for the ordered probit model. As a result, we present estimation results under different econometric specifications to examine their robustness.

We further control for total family income and number of rooms in a family's living space. Both of which are used as proxy variables for the level of permanent income.[9] Besides the variables in interests and proxy variables for permanent income, we also include a set of nonpecuniary variables that have been widely adopted by the literature discussed in Sect. 2, including whether the elderly is widowed,[10] has a Communist Party membership, the elderly's self-rated health,[11] age, gender and educational level. Since marriage in China is nearly universal and couples generally live together, we omit whether an elderly person has been married and whether he/she lives with his/her spouse as independent variables. We focus on the Chinese elderly. An Chinese elderly person is defined according to the "Law of the People's Republic of China on the Protection of Rights and Interests of the Elderly," which refers to elderly as citizens whose age is 60 years old and above. Chinese statutory age of retirement is 60 for males, 50 for female manual employees and 55 for nonmanual employees.[12] We hence assume all of them are retired and omit employment status as an independent variable.

Finally, another important component of the indirect utility function is the relative price level that an individual faces. Although price level per-se should not affect individual happiness, a person who resides in a region with higher relative price level has lower purchasing power and generally faces higher income inequality. Chinese National Bureau of Statistics does provide national and provincial levels of CPIs according to rural and urban areas. However, because the commodities used to calculate the basket are specific to the local outlets, price comparisons across regions in a cross-sectional setting like our study

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[8] Due to the cross-sectional nature of our data, we can not eliminate this unobserved factor by comparing changes in individual happiness between periods. Also note that the endogenous variable "living with their children" is dichotomous. Angrist and Krueger (2001) state that, even if the underlying second-stage relationship is nonlinear, linear instrumental variables estimates typically capture an average effect of economic interest analogous to the LATE parameter for dummy endogenous regressors.

[9] As empirically, less than 3% of our sample elderly are working, we choose not to control for this variable. Furthermore, Knight et al. (2009) raise a concern that income may also be endogenous. They use years of education of a respondent's father and spouse as the instrumental variables of the income variable. We also use these instrumental variables to estimate our model. Since the results do not vary much, these results are not reported.

[10] As all elderly have been married at some point, and if they are married, almost all of them live together, we do not control for the marital status in the study.

[11] We note that the self-rated health may itself be determined by variables that contribute to an elderly's happiness and are not observed to us. If this is the case, inclusion of this variable may create a bias. Qualitatively, empirical results do not vary much whether we choose to include the variable or not. In the reported version, we choose to include this variable.

[12] The statute can be seen at this web page http://trs.molss.gov.cn/was40/mainframe.htm

is not appropriate (Brandt and Holz 2006). To this end, we include the provincial, urban and the interaction of these two dummy variables to control for the variation in price levels across various locations.

4 Data

Our sample comes from the 2005 Chinese General Social Survey (henceforth the 2005 CGSS). The CGSS is an annual cross-sectional survey of urban and rural Chinese households. So far, only the 2003 and 2005 CGSS are available to the public. The 2005 survey contains information on members of the whole family of the respondent regardless of their residence, hence it is suitable for the purpose of our study. On the other hand, the 2003 CGSS only has information on members who live in the same house with the respondent.

The 2005 CGSS is stratified with 10,372 households that are selected at random from more than 100 districts and counties in 28 of the 31 provinces of mainland China, these are Anhui, Beijing, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Neimenggu, Shanghai, Shanxi, Shaanxi, Shandong, Sichuan, Tianjin, Xinjiang, Yunnan, and Zhejiang. An eligible household member is randomly selected to be the survey respondent from each sample household.

Our primary measure of happiness is derived from a single question in the survey i.e., "Generally speaking, how do you personally feel about your life?" The self-rated level of happiness in the 2005 CGSS has five categories as follows: 1 = very unhappy; 2 = unhappy; 3 = so–so; 4 = happy; 5 = very happy. Everyone in the survey answers this question.

Our analysis focuses on elderly Chinese with at least one surviving child at the time of the survey.[13] Excluding cases with missing values for analytic variables, the final sample size is of 1,533 individuals ranging from 60 to 94 years old. About 70% of the sample of elderly were aged between 60 and 70 years old.

In our study, we investigate whether living with his/her children and his/her grand-children affect an elderly Chinese person's self-rated level of happiness. We define " lives with children" as being where at least one child's usual residence is the same as the elderly person's address. We defined "lives with grandchildren" as the elderly person lives with at least one grandchild. Table 1 shows the sample distribution and mean levels of happiness according to these two variables of interest. In each category, the first number is the ratio of observations to the total observations, while the second number (in the bracket) is the mean level of happiness of that category. As we can see, about 55% of the sample elderly live apart from their children and grandchildren. Another 34.4% live with their children. Also, 30.2% of the sample live with grandchildren. Only 19.6% of the sample still live in a traditional arrangement of "three generations under one roof."

Variation in the level of happiness across the categorization in Table 1 assist us in identifying the effects of the variables of interests. Among the four categories, elderly who live with their children but who live without their grandchildren have the the lowest unconditional level of happiness. On the other hand, elderly with grandchildren, regardless of living arrangements, generally have higher levels of self-rated happiness. Moreover, elderly who live with their grandchildren but who live apart from their children have the

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[13] The 2005 CGSS does not distinguish between an biological child, a stepchild or an adopted child.

Table 1 Sample distribution

			Lives with grandchildren		
			No	Yes	Obs.
Lives with children	No		54.9% (3.44)	10.6% (3.48)	1,005
	Yes		14.8% (3.24)	19.6% (3,43)	528
	Obs.		1069	464	1,533

% indicates the percentages of different sub-sample

mean of happiness of different sub-sample in parenthesis

Table 2 Descriptive statistics

Variable	Male (n = 814)	Female (n = 719)	Total (n = 1,533)	Coding scheme
Happiness	3.45 (.758)	3.37 (.784)	3.41 (.771)	1 (very unhappy) to 5 (very happy)
Lives with children	.34 (.473)	.35 (.478)	.34 (.475)	0 (no), 1 (yes)
Son	25.1%	26.0%	25.5%	
Daughter	6.3%	7.0%	6.6%	
Both	2.4%	2.2%	2.3%	
Lives with grandchildren	.30 (.459)	.30 (.460)	.30 (.460)	0 (no), 1 (yes)
Grandson	14.3%	14.1%	14.2%	
Granddaughter	10.9%	10.4%	10.7%	
Both	5.0%	5.8%	5.4%	
ln(family income)	9.31 (1.045)	9.15 (1.017)	9.24 (1.035)	4.61 to 13.82
Owns estate	.92 (.273)	.93 (.250)	.93 (.262)	0 (no), 1 (yes)
Number of rooms	2.61 (1.376)	2.47 (1.246)	2.54 (1.318)	1 to 9
Widowed	.15 (.358)	.33 (.472)	.24 (.425)	0 (no), 1 (yes)
Age	68.08 (6.014)	67.71 (5.797)	67.91 (5.914)	60 to 94
Education	.27 (.446)	.13 (.342)	.21 (.406)	0 (otherwise), 1 (high school or above)
Good health	.43 (.496)	.32 (.467)	.38 (.485)	0 (otherwise), 1 (good or above)
So-so health	.31 (.464)	.33 (.470)	.32 (.467)	0 (otherwise), 1 (so-so)
Bad health	.25 (.436)	.35 (.478)	.30 (.458)	0 (otherwise), 1 (bad or very bad)
Communist	.30 (.458)	.11 (.311)	.21 (.407)	0 (no), 1 (yes)
Urban	.59 (.492)	.68 (.467)	.63 (.483)	0 (no), 1 (yes)
Instruments				
Age of eldest child	39.95 (8.227)	42.66 (7.716)	41.22 (8.102)	14 to 75
Number of children	2.29 (1.317)	2.42 (1.432)	2.35 (1.374)	1 to 6

highest level of reported happiness. We would like to see whether these simple correlations still exist after we control socio-economic factors and possible unobserved heterogeneity.

The first three variables in Table 2 details the mean self-rated happiness and the patterns of living arrangements based on the genders of the elderly, the elderly's children and their grandchildren. The mean self-rated happiness is 3.41, with sampled elderly men slightly happier (3.45) than their female counterparts (3.37). There are three characteristics worth noting. First, living arrangements for both elderly men and women in our sample are quite

similar, with 34% and 35% respectively of elderly men and women living with their children. Second, of the 34% of elderly people in our sample who live with their children, more than 80% indicate this is with their sons. This pattern is consistent with the patriarchal and patrilocal traditions in China. But this pattern is very different from experiences in western countries, where elderly members are far more likely to live with their daughters (if they live together at all, see Coward and Cutler 1991). Third, the proportions of people living only with grandsons or only granddaughters are 14.2% and 10.7% of the total sample, respectively, while 5.4% living with both grandson and granddaughter. This data variation allows us to evaluate whether Chinese elderly favors grandsons to granddaughters.

Finally, we see that about 30% of the sample of elderly live with their grandchildren, yet only about 20% of the total sample report "three generations under one roof." This implies that 10% of the elderly people live with their grandchildren, but not with their children. This reflects a distinctive Chinese phenomenon where the second generation chases work into other areas and leave their children behind to be taken care of by their parents.

For the means, standard deviations, and the extreme values of the rest of the variables used in this study, Table 2 shows that on average, elderly men are less likely to be widowed, likely to be more educated, and more likely to be a Communist Party member than their female counterparts. Of the sample of elderly, 63% live in urban areas, while the remainder elderly Chinese live in rural areas. To control for possible differences in the level of happiness due to regional variation, we include dummy variables for the city, the province, and the interaction terms.

4.1 Selecting Instrumental Variables

As described in Sect. 3, knowing that living with their own children can create tensions and hence have detrimental effect on their happiness, elderly with higher (unobserved) disposition may be more willing to live with their offspring. This may lead to an upward bias to the OLS estimation. We propose an IV method to control for the possible endogeneity issue of whether an elderly lives with his/her child. Our instruments include the number of alive children of an elderly person, the age of the elderly person's eldest child and its squared term. Below, we show sample patterns of our instrumental variables and the variable in doubt. In Sect. 5, we will further use established econometric methods to test whether our instrumental variables violates the identification assumptions.

There are no elderly who had no child at the time of survey in our sample of elderly Chinese. The last panel of Table 2 indicates that on average, our sample has 2.3 children and the average age of their eldest child is 41 years old. The distributions of the elderly person's number of children and the age of the eldest child respectively indicate that there are significant variation in both variables. More than 50% of the elderly Chinese have either one or two children, while the remainder have three or more children. Also, more than 50% of the eldest children of the elderly Chinese are aged between 35 and 45 years old, with the rest roughly equally distributed outside this region. There are more than 93% of the elderly Chinese's eldest children aged thirty and older.

Proper instrumental variables should satisfy two properties. First, these variables should be significantly correlated with the variables in doubt. Guo (2000) documents that the number of surviving children has an effect on the living arrangements of the elderly in China. Sereny (2009) also suggests that having more children increases the likelihood of the elderly living apart from their children. This is reasonable, as adult children are more likely to move away from their parents' house when they establish a new family. On the

other hand, Chinese filial piety requires adult children to take care of their elderly parents. As a result, they may decide to live with their parents when the elderly are too old to look after themselves. Using our sample, we find that there is a negative correlation between an elderly person's number of children and whether the elderly person lives with their children.[14] On the other hand, our sample suggests a concave relationship between how likely an elderly person lives with their children and the age of his/her eldest child. This concave relationship suggests that as children age, they are more likely to move away from their parents' homes. However, as parents get older, many of them move in with their children so that they can either be taken care of, or to provide care to their grandchildren. In response to this significant, concave relationship, we also include the squared term of the age (divided by 100) as an instrumental variable.

Second, instrumental variables should be uncorrelated with unobserved heterogeneity. It is possible that an elderly's own disposition can indeed contribute to both decisions of wanting a new child (hence number of children) and the happiness *before* the elderly's last child was born. For example, the traditional emphasis on male child in China may have been the reason why even after a string of daughters, parents still want an additional child. But such grudge is unlikely to have sustained through these parents' old ages. Chen and Silverstein (2000) find that the number of children does not correlate with elderly parents' morale. To examine this using our sample, we first obtain the residuals of happiness by regressing happiness on the set of included variables regress the residuals against the number of children of an elderly person and against the age of the elderly person's eldest child.These results are available upon request. The predicted lines are almost horizontal, indicating that the instrumental variables are essentially uncorrelated with the residuals.

5 Results

The bottom panel of Table 3 shows the results of our first stage regression and statistical tests on the validity of our instrumental variables. As we have more instrumental variables than the potentially endogenous variable, we can conduct over-identification test by a Hansen's J statistic (Baum et al. 2010) incorporated in Stata's ivreg2 package. Our instrumental variables are all significantly correlated with living with their children at the 1% confidence level. As the P value of Hansen's J statistic is 0.3484, we cannot reject the joint null hypothesis that the instruments are valid instruments. These tests provide support for the validity of our instrumental variables.

The upper panel of Tables 3 and 4 present our results from the regression models on happiness. Table 3 pertains to the whole sample, whereas Table 4 divides the sample into two groups, elderly men and elderly women. Each table shows four specifications. The first displays the OLS model results, the second displays the results of the 2SLS model, the third shows the ordered probit model estimation, and the fourth indicates the results of the ordered probit model with instrumental variables (IV Oprobit). The regression results of 2SLS model and of IV Oprobit model are similar. "Lives with children" has negative effect on the elderly's happiness and is statistical significant at the 1% level in both models. "Lives with grandchildren" has positive effect on the elderly's happiness and is statistical significant at the 1% level in both models. In fact, all four methods result in similar signs and magnitudes between independent variables and happiness.

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[14] These results are available upon request.

Table 3 Whole sample regression results

Variable	Linear		Nonlinear	
	OLS	2SLS	Ordered probit	IV Oprobit
Variables of interest				
Lives with children	−.163*** (.045) [.0003]	−.397*** (.133) [.0027]	−.267*** (.072) [.0002]	−.669*** (.208) [.0013]
Lives with grandchildren	.087* (.047) [.0613]	.175*** (.065) [.0070]	.145* (.075) [.0517]	.298*** (.103) [.0039]
Other variables				
ln(family income)	.199*** (.025) [.0001]	.221*** (.028) [.0001]	.327*** (.042) [.0001]	.360 (.042) [.0001]
Owns estate	.146* (.079) [.0643]	.149* (.077) [.0526]	.235** (.126) [.0629]	.238** (.115) [.0377]
Number of rooms	.058*** (.016) [.0005]	.059*** (.017) [.0004]	.096*** (.027) [.0004]	.097*** (.026) [.0003]
Widowed	−.165*** (.049) [.0007]	−.136*** (.051) [.0077]	−.270*** (.078) [.0005]	−.216*** (.080) [.0068]
Male	−.061 (.038) [.1100]	−.059 (.038) [.1160]	−.106* (.062) [.0860]	−.102 (.063) [.1055]
Age	.014*** (.003) [.0001]	.013*** (.003) [.0002]	.023*** (.006) [.0001]	.021*** (.005) [.0001]
Education	.078 (.052) [.1320]	.064 (.051) [.2165]	.143* (.085) [.0935]	.116 (.083) [.1606]
Good health	.238*** (.042) [.0001]	.234*** (.042) [.0001]	.407*** (.070) [.0001]	.395*** (.072) [.0001]
Bad health	−.213*** (.046) [.0001]	−.217*** (.046) [.0001]	−.347*** (.074) [.0001]	−.347*** (.075) [.0001]
Communist	.141*** (.045) [.0018]	.125*** (.046) [.0059]	.241*** (.075) [.0012]	.210*** (.078) [.0068]
Significance of exclusion restrictions in first stage equation				
The number of children (P valUe)		0.0015		
Age of the eldest child (P value)		0.0001		
Square of age of the eldest child/100 (P value)		0.0001		
F-test of excluding instruments (P value)		0.0001		
Hansen's J statistic, for overidentification of all instruments (P value)		0.3484		

Table 3 continued

Variable	Linear		Nonlinear	
	OLS	2SLS	Ordered probit	IV Oprobit
Observations	1,533	1,533	1,533	1,533

Robust standard errors in parenthesis, *P* values in square bracket

Control variables for interaction of urban and provincial residence have been included in all regressions but are not reported

*, ** and *** Statistical significance at the 10%, 5% and 1% levels

Instrumented variables regression results are generated using the Baum et al. (2010), ivreg2.ado and Roodman (2009), cmp.ado programmes for Stata

Table 4 Gender regression results

Variable	Male				Female			
	OLS	2SLS	Oprobit	IV Oprobit	OLS	2SLS	Oprobit	IV Oprobit
Variables of interest								
Lives with children	-.140** (.060) [.0197]	-.332** (.163) [.0420]	-.235** (.099) [.0177]	-.559** (.266) [.0359]	-.195*** (.065) [.0029]	-.546** (.213) [.0104]	-.315*** (.102) [.0021]	-.922*** (.326) [.0047]
Lives with grandchildren	.161** (.064) [.0123]	.242*** (.087) [.0057]	.274*** (.105) [.0089]	.409*** (.144) [.0044]	.007 (.067) [.9210]	.131 (.082) [.1844]	.011 (.106) [.9199]	.229 (.154) [.1375]
Other variables								
ln(family income)	.154*** (.034) [.0001]	.169*** (.035) [.0001]	.259*** (.057) [.0001]	.282*** (.057) [.0001]	.264*** (.040) [.0001]	.303*** (.045) [.0001]	.429*** (.063) [.0001]	.485*** (.062) [.0001]
Owns estate	.001 (.102) [.9982]	.004 (.100) [.9688]	.001 (.168) [.9930]	.008 (.153) [.9558]	.250** (.123) [.0427]	.244** (.118) [.0387]	.395** (.191) [.0391]	.370** (.177) [.0362]
Number of rooms	.054** (.021) [.0106]	.056*** (.021) [.0088]	.091*** (.035) [.0097]	.093*** (.035) [.0073]	.049** (.024) [.0479]	.053** (.025) [.0323]	.084** (.038) [.0277]	.089** (.040) [.0266]
Widowed	-.324*** (.074) [.0001]	-.310*** (.074) [.0001]	-.543*** (.120) [.0001]	-.513*** (.117) [.0001]	-.004 (.070) [.9524]	.054 (.079) [.4950]	-.001 (.111) [.9911]	.100 (.116) [.3892]
Age	.017*** (.004) [.0001]	.016*** (.004) [.0002]	.029*** (.007) [.0001]	.027*** (.007) [.0001]	.008 (.005) [.1171]	.008 (.005) [.1476]	.014 (.008) [.1025]	.012 (.008) [.1292]
Education	.127** (.062) [.0393]	.119** (.060) [.0463]	.217** (.102) [.0342]	.200** (.103) [.0525]	.037 (.092) [.6896]	-.001 (.094) [.9956]	.094 (.149) [.5262]	.026 (.141) [.8528]
Good health	.242*** (.054) [.0001]	.235*** (.054) [.0001]	.413*** (.091) [.0001]	.398*** (.097) [.0001]	.274*** (.065) [.0001]	.277*** (.065) [.0001]	.468*** (.109) [.0001]	.459*** (.110) [.0001]
Bad health	-.188** (.065) [.0037]	-.194** (.064) [.0024]	-.318*** (.106) [.0028]	-.325*** (.108) [.0026]	-.241*** (.066) [.0003]	-.241*** (.065) [.0002]	-.389*** (.105) [.0002]	-.376*** (.105) [.0004]
Communist	.166*** (.055) [.0025]	.155*** (.055) [.0047]	.281*** (.091) [.0019]	.260*** (.093) [.0052]	.107 (.084) [.2020]	.070 (.086) [.4130]	.179 (.137) [.1926]	.109 (.145) [.4519]
Observations	814	814	814	814	719	719	719	719

Robust standard errors in parenthesis, *P* values in square bracket

Control variables for urban and provincial residence have been included in all regressions but are not reported

*, ** and *** Statistical significance at the 10%, 5% and 1% levels

Instrumented variables regression results are generated using the Baum et al. (2010), ivreg2.ado and Roodman (2009), cmp.ado programmes for Stata

Table 5 Regression results of grandchildren's gender

Variable	Linear		Nonlinear	
	OLS	2SLS	Ordered probit	IV Oprobit
Variables of interest				
Lives with children	−.163*** (.045) [.0003]	−.396*** (.133) [.00029]	−.266*** (.072) [.0002]	−.667*** (.208) [.0014]
Lives with grandson	.099* (.053) [.0628]	.185*** (.068) [.0069]	.165* (.085) [.0522]	.312*** (.109) [.0042]
Only lives with granddaughter	.067 (.065) [.3052]	.160* (.082) [.0500]	.110 (.106) [.2974]	.270** (.127) [.0341]
Other variables				
ln(family income)	.199*** (.026) [.0001]	.221*** (.028) [.0001]	.326*** (.042) [.0001]	.360*** (.042) [.0001]
Owns estate	.145* (.079) [.0652]	.149* (.077) [.0532]	.234* (.126) [.0636]	.238** (.115) [.0381]
Number of rooms	.057*** (.017) [.0006]	.059*** (.017) [.0004]	.095*** (.027) [.0004]	.096*** (.027) [.0003]
Widowed	−.166*** (.049) [.0007]	−.137*** (.051) [.0076]	−.270*** (.078) [.5677]	−.216*** (.080) [.0066]
Male	−.061 (.038) [.1109]	−.059 (.038) [.1166]	−.106* (.062) [.0866]	−.102 (.063) [.1060]
Age	.014*** (.003) [.0001]	.013*** (.003) [.0001]	.023*** (.006) [.0001]	.021*** (.005) [.0001]
Education	.078 (.052) [.1308]	.064 (.051) [.2145]	.144* (.085) [.0922]	.116 (.083) [.1590]
Good health	.239*** (.042) [.0001]	.235*** (.042) [.0001]	.409*** (.070) [.0001]	.396*** (.072) [.0001]
Bad health	−.213*** (.046) [.0001]	−.216*** (.046) [.0001]	−.346*** (.075) [.0001]	−.346*** (.075) [.0001]
Communist	.142*** (.045) [.0017]	.126*** (.046) [.0057]	.243*** (.075) [.0012]	.212*** (.078) [.0066]
Observations	464	464	464	464

Robust standard errors in parenthesis, P values in square bracket

Control variables for urban and provincial residence have been included in all regressions but are not reported

*, ** and *** Statistical significance at the 10%, 5% and 1% levels

Instrumented variables regression results are generated using the Baum et al. (2010), ivreg2.ado and Roodman (2009), cmp.ado programmes for Stata

It should be noted that both IV results of "lives with children" are larger in magnitudes than OLS ones. We take this as a support for implementing the IV method. As discussed in Sect. 3, one important factor that is not controlled in our regression is the elderly's own disposition. Failing to properly control for this unobserved factor, the OLS estimator of "lives with children" captures two conflicting effects and, in turn, shows a smaller magnitude. On the other hand, the IV method uses the likelihood of living with one's own children estimated from the first stage to identify the effect of "lives with children" on the happiness in the second stage. The first stage estimation is based on the individual's number of children and the age of the eldest child that are arguably uncorrelated with an elderly's own disposition. As the IV estimates are arguably immune to the reverse causality problem, we reveal the true effect.

The results demonstrate a strong negative association between happiness and living with their children for both elderly men and elderly women, compared to living apart from their children.As there is no statistical significant difference between living with son or daughter, the regression results are not reported. As can be seen, with instrumental variables, the effect on happiness of living with their children is larger, especially for elderly women. However, living with grandchildren is statistically significant and is positively correlated with happiness when viewing the elderly men. It also has a positive impact on women's happiness but the impact is statistically insignificant. Our results differ from Chen and Short (2008), who suggest that living with their children can have a positive effect on subjective well-being of the oldest old. Differences in aspects of our respective studies include: they only investigate the oldest old, who may need more support from their children; they do not include pecuniary variables in their regression model, this may give their results an upward bias; they do not separate the conflict effects captured by living with one's children. As mentioned before, this variable simultaneously captures the effects of the benefit provided by children's taking care of their elderly parents and the potential tension of the elderly parents living with their offspring.

Since we want to know whether the elderly still value the traditional concept of "prefer boys over girls," which is based on the grandchildren's gender, we divide people into three categories: those who only live with granddaughters, those who live with at least one grandson and those who live apart from grandchildren. Table 5 displays the regression results. Compared to the elderly who live apart from grandchildren, the other two categories of people appear to be happier. Furthermore, we cannot statistically reject the hypothesis that the elderly treat a grandson and a granddaughter equally. But we note that this insignificant difference between genders of grandchildren does not enable us to conclude that the elderly have changed their view of grandsons as better than granddaughters.

The other control variables are not the main focus of this article, but they do merit mention. All the pecuniary variables, including the logarithm of whole family income, the number of rooms in the house and owning his/her estate, are statistically significant and have a positive effect on happiness. These results are consistent with previous studies, which generally suggest a positive association between pecuniary variables and happiness (Clark et al. 2008). Being widowed is statistically significant and is negatively correlated with men's happiness, whereas it is statistically insignificant for women's happiness. Net of other factors, women and people living in rural areas reported higher level of happiness. Age has a statistically significant positive effect on happiness for both men and women, which is in accord with Blanchflower and Oswald (2004). Educational level and Communist Party membership are positively correlated with men's happiness, but they are statistically insignificant for women's happiness. The effect of self-rated health is

consistent with expectations, it affects men's happiness and women's happiness almost the same.

6 Discussions and Concluding Remarks

In recent decades, social structural reforms and economic development occurred in Mainland China have dramatically reshaped social values and people's expectations. As a result, declining trends in the elderly's coresidence with their children have appeared, elderly Chinese parents are more likely to live apart from their children than at any time in the past (see Chen and Silverstein 2000; Zeng and Wang 2003). The family household has been the traditional social support in China. Given that China has become a society with an aging population, the government may start to promote aged care as a family responsibility for economic reasons. In this article, we find that living with their children has a negative effect on the elderly's reported happiness, controlling for other socioeconomic and demographic characteristics. Chen and Short (2008) also focus on the correlation between happiness and living arrangements, but they do not give a clear causality. It is striking that by using the instrumental variable method in our analysis, the causal relationship between living with their children and the elderly's happiness is unidirectional. According to our finding, any government effort to uphold traditional living arrangements would be short-sighted. Nowadays, cultural norms are shifting and the elderly want to have more personal space, hence living with their children is no longer the most desirable living arrangement for them.

In this paper, we also examine whether living with grandchildren affects the elderly's happiness. We detected a positive effect of living with grandchildren on happiness. This finding suggests that, although Chinese grandparents who live with their grandchildren generally take the responsibility of rearing the young, this negative effect seems to have been outweighed by the enjoyment through their grandchildren's living with them. This supports the old Chinese saving that a good life of an elderly person is to "play with grandchildren with candy in mouth." On the other hand, our statistical analysis does not provide us enough evidence that modern Chinese elderly still favor a grandson over a granddaughter. Finally, we also find that other determinants of Chinese elderly people's happiness are in accord with happiness literature.

The literature on happiness generally shows the relationship between different factors and happiness, without demonstrating the cause-and-effect testing. We are optimistic that this article has demonstrated the importance of context for building an understanding of the causal relationship between living arrangements and happiness.

This is one of few happiness studies on the elderly in developing countries. As China is a society with an aging population, more attention needs to be focused on the elderly. This paper sheds a little light on the determinants of the Chinese elderly's happiness. As a result, we hope that more scholars will be inspired to focus on the elderly's happiness.

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