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Working Paper

The Heterogeneous Impact of Pension Income on Elderly Living Arrangements: Evidence from China's New Rural Pension Scheme

GLO Discussion Paper, No. 80

Provided in Cooperation with:
Global Labor Organization (GLO)

Suggested Citation: Cheng, Lingguo; Liu, Hong; Zhang, Ye; Zhao, Zhong (2017) : The Heterogeneous Impact of Pension Income on Elderly Living Arrangements: Evidence from China's New Rural Pension Scheme, GLO Discussion Paper, No. 80, Global Labor Organization (GLO), Maastricht

This Version is available at:
https://hdl.handle.net/10419/162069

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The Heterogeneous Impact of Pension Income on Elderly Living Arrangements: Evidence from China's New Rural Pension Scheme[☆]

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April 2017

ABSTRACT

This paper investigates the impact of pension income on living arrangements of the elderly. Taking advantage of a unique opportunity due to the recent establishment and expansion of the New Rural Pension Scheme in China, we explicitly address the endogeneity of pension status and pension income through a fixed-effect model with instrumental variable approach by exploiting exogenous time variation in the program implementation at county level. We find an overall positive effect of pension income on independent living as well as considerable heterogeneity. The positive income effects of the NRPS are concentrated among the elderly with adult children living nearby, of higher socio-economic status, and with better health at baseline; for other groups, the effects are insignificant. We also find that more generous programs exhibit larger effects. Our results highlight that living arrangement is multidimensional in rural China.

JEL classification: J12, H55, I38
Keywords: pension income; living arrangements; heterogeneity; China

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[☆] We would like to express appreciation for comments from three anonymous referees, the editor Junsen Zhang, participants of the 2015 Annual Conference of the Chinese Economist Society, the 29th Annual Conference of the European Society for Population Economics, the 1st World Congress of Comparative Economics; and seminars at Central University of Finance and Economics and Renmin University of China. The collection of the data used in this study was supported by NIH R01 grant (R01-AG023627) and the United Nations Fund for Population Activities. This study was supported by the National Natural Science Foundation of China (Grant No. 71110107025, No. 71173227, No. 71673313, and No. 71233001), the National Social Science Fund of China (Grant No. 13CJY028), and Training Program for Major Fundamental Research of Central University of Finance and Economics (Grant No. 14ZZD001).

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1. Introduction

As a result of declines in fertility and mortality, population aging is becoming a major public policy concern in many countries. Some developing countries such as Brazil, South Africa, and China have recently introduced or expanded social pension programs to elderly informal sector workers who are not covered by existing pension provisions (Jung and Tran, 2012).

China has the largest elderly population in the world. According to the most recent census, in 2010 there were 178 million people aged over 60 and 119 million over 65, accounting for 13.3% and 8.9% of China's total population; about 60 percent of them live in rural areas. Despite China's high economic growth during the past three decades, the rural elderly remain poorer and more vulnerable than the urban elderly, due to the large rural-urban disparity, low savings, lack of pension support, and heavy reliance on family support (Cai et al., 2012). The estimated consumption poverty rate for rural elderly was around 28.7 percent in 2006, compared to 6% for urban elderly in China (Cai et al., 2009).

To improve the welfare of the rural elderly, in 2009 the Chinese government launched the New Rural Pension Scheme (NRPS) in China. It was first implemented in 320 pilot counties in 2009, was then expanded to 838 counties in 2010, and covered nearly all counties by 2012.[1] By the end of 2011, about 89 million rural elderly had received pension payments under the NRPS. In this paper, we examine the effect of NRPS participation and NRPS income on living arrangements of the Chinese elderly.

Living arrangements have long been regarded as a key dimension of quality of life and an important indicator of long-term care demand in old age (Pezzin et al., 1996; Hoerger et al., 1996; Dostie and Léger, 2005; Bethencourt and Ríos-Rull, 2009; Connelly et al. 2014). This importance has led to a growing body of research on the effect of income or social security payments on living arrangements of the elderly. The existing empirical literatures, primarily focusing on developed countries, have mixed results. Studies on the United States show constantly that the increase in

[1] China has 2,852 county-level administrative areas in 2012.

pension income has led to a rise in independent living by the elderly, suggesting that independence is a normal good (Mutchler and Burr, 1991; Costa, 1997 and 1999; McGarry and Schoeni, 2000; Engelhardt et al., 2005). In contrast, using a sample of Italian parents aged 37 to 74, Manacorda and Moretti (2006) find that higher levels of parental income increase the probability of cohabitation. Of the few studies on developing countries, Edmonds et al. (2005) show that in South Africa pension income has not increased the likelihood of black elderly women's independent living, but resulted in changes in household composition. They find more young children, more young women, but fewer prime-age women in households with pension-eligible women. Hamoudi and Thomas (2014) report that pensioners are more likely to live with adult family members who have lower human capital in South Africa. Moreover, Johar and Maruyama (2011) show that in Indonesia the elderly parents with higher income or pension have lower likelihood of cohabitation, while cohabitation is largely driven by the potential gains and costs of children.

Living arrangement is even more important in rural China: traditionally living with adult children is the primary mechanism through which the elderly obtain care and support (Benjamin et al., 2000). However, the increasing mass rural-to-urban migration and shrinking family size inevitably have eroded the foundation of the Chinese traditional intergenerational support system. For example, Cai et al. (2012) show that the share of rural elderly living with adult children has dropped from nearly 70 percent in 1991 to just over 40 percent in 2006.

Several recent studies have explored the elderly living arrangement in China, but find different results about the income effect. Meng and Luo (2008) find that increases in pension income significantly raise the probability that the elderly live independently, though their estimated income effect is much lower than that found in the United States. Cai et al. (2006) show that coresidence is not correlated with pension receipt at low levels of pension income, but there is a positive correlation at high levels of pension income. However, these two studies are on urban Chinese elderly. Lei et al. (2015) show that Chinese rural elderly with higher income are more likely to live with or live near their adult children. Connelly et al. (2015) find a

significant negative association between pension receipt and coresidence in rural China. However, the above studies mainly look at cross-sectional snapshot and do not take account of the endogeneity of pension income. Such endogeneity could be important, and is likely to arise from reverse causality or unobserved heterogeneity, such as preference and unobserved lifetime earnings, correlated with pension status/income as well as with living arrangement.[2]

Using panel data from the Chinese Longitudinal Healthy Longevity Survey, this study makes several contributions. First, taking advantage of a unique opportunity due to the recent establishment and expansion of the NRPS, we address the endogeneity of pension income by applying a fixed-effect model with instrumental variable correction (FE-IV) by exploiting exogenous time variation in the NRPS implementation at the county level as our instrumental variable.

Second, Manacorda and Moretti (2006) suggest that parents may have different preferences for living arrangement across countries, which may help explain different findings for different countries in the literature. Our study highlights the multidimensionality of living arrangement and explicitly investigates the heterogeneity of the income effect on elderly living arrangements. Three possible aspects of heterogeneity are explored: geographic proximity of adult children, long-term care needs, and socio-economic status (SES) of the elderly. This is the main distinction of our paper from the existing literature.

Last but not least, our study adds to the limited literature on the evaluation of social pension programs in developing and transition countries (Kakwani and Kalanidhi, 2005; Palacios and Sluchynsky, 2006; Barrientos, 2009). Four recent studies evaluate the impact of the NRPS. Ning et al. (2016) show that the NPRS has no significant effect on labor force participation of the rural elderly, suggesting little

[2] Several studies investigate the impact of multigenerational coresidence on labor force participation of household members in China. For example, Maurer-Fazio et al. (2011) find that coresidence with elderly parents has significantly increased married women's participation in market work in urban China. Connelly et al. (2014) show a significant quantitatively important negative effect of coresidence with adult children on the labor force participation of both male and female elders in rural China, but no significant effect on the labor force participation of urban elders.

improvement of rural elders' wellbeing associated with the NRPS. However, Chen (2015) finds a significant increase in service consumption among the elderly who are eligible for pension receipt and a significant reduction in multigenerational co-residence. Eggleston et al. (2016) show that pension income has reduced rural elders' dependence on instrumental support from their adult children, and increased the migration of adult children, but had no effect on elderly living arrangement. Cheng et al. (2016) find that the NRPS has improved the health outcomes of its enrollees.

In this paper, we show that the NRPS benefits, although modest, have important implications for the elderly living arrangement. Specifically, we find an overall positive effect of pension status and pension income from the NRPS on elderly independent living as well as considerable heterogeneous effects. The positive effects of the NRPS are concentrated among the elderly with adult children living in the same village, of higher SES (e.g. possessing better financial status, having more education), and without IADL disability at baseline; for other groups, the effects of the NRPS are insignificant. Overall, our results suggest that the rural elderly residents with higher SES and better health are more likely to live independently after receiving pension income. We also provide evidence that generous programs exhibit larger effects than stingy programs. Given that many countries are entering into aging society, our study has important policy relevancy to other countries as well.

The remainder of the paper is organized as follows. Section 2 provides background of the NRPS in China. Section 3 outlines a simple conceptual framework, which allows us to conceptualize heterogeneous income effects on elderly living arrangements. Section 4 specifies our estimation strategy. In section 5 we describe the data and variables used in the analysis. Section 6 presents the main results, including validating the assumptions of our empirical strategy. Section 7 deals with panel attrition. Section 8 concludes the paper.

2. Rural Pension System in China

During the 1950s through the 1970s, in accordance with its urban-oriented development strategy and state-owned economy, China's first formal pension scheme mainly covered urban workers, while the rural residents could only depend on their land and families for old-age support (Shi, 2006). In the 1990s, the government attempted to establish some form of rural pensions on a pilot basis in some well-off counties, financed primarily by individual contributions. Partly due to inadequate subsidies from the government, the pilot schemes had inadequate funding, and collapsed in most pilot areas (Li, 2007).

It was estimated that over 90 percent of the rural elderly did not have any pension coverage in 2007 (Shen and Williamson, 2010). Meanwhile, the traditional family support to the rural elderly has faced great challenges due to the reduced family size associated with the family planning policy since the late 1970s and the increase of rural-to-urban migration since the late 1980s (Giles et al., 2010).

In order to provide a basic social safety net for rural residents, in 2009 the Chinese government launched a nationwide project known as the New Rural Pension Scheme (NRPS). The scheme began as a pilot in 320 rural counties in 2009 (about 11 percent of all rural counties), selected by central and provincial governments, and was expanded to 838 counties in 2010 (29 percent), to 1,914 counties (67 percent) in 2011 and to nationwide by 2012.

The NRPS is a voluntary social pension program consisting of a basic pension and an individual contributory pension account. All rural residents aged 16 or above who are not in school and not enrolled in an urban pension scheme are eligible to participate.

Different from the previous pilot one, the NRPS is financed by a combination of individual contributions and subsidies shared between central and local governments. Financial support from rural collectives is encouraged but not mandated. Central government bears the full cost of the non-contributory element for the relatively poor central and western regions, and half the cost for eastern regions. Individual contributions, ranging from 100 to 500 Chinese yuan per year at the choice of the

enrollee,[3] and a partial matched contribution by central or local governments, which is at least 30 Chinese yuan per year and is higher for larger individual contributions, are paid into individual accounts and accumulated at a one-year deposit interest rate. The NRPS is currently pooling at the county level, and is targeted at pooling at the provincial level when feasible.

Participants who have contributed for 15 years will be eligible for a pension at age 60. Those aged 45–59 can contribute during their working lives or pay a lump sum to cover any shortfall in the vesting period of 15 years of contribution. At the time the program is introduced, despite paying no contribution to the NRPS, those older people aged 60 and over can directly receive the basic pension benefit as long as their eligible adult children participate in the program.[4] In some areas, the elderly aged 60 and over are also allowed to pay a lump sum to cover shortfall on vesting contributions, which may or may not be subsidized, depending on local policies.

The NRPS benefits include a basic flat rate pension and a monthly payment from the individual account. The monthly payment from the individual account is equal to the accumulated amount in the individual account divided by 139.[5] The level of the basic flat rate pension varies across regions, with a minimum value of 55 Chinese yuan per month, which is financed mainly by the central government. Local governments are encouraged to make additional contributions at their discretion. For example, the basic pension benefit of rural residents in Beijing was about 280 Chinese yuan per month in the starting year, due to additional contributions from local government, whereas in some other regions the old people only receive a basic monthly pension of 55 Chinese yuan. The minimum value of 55 Chinese yuan per month is close to the 2008 poverty threshold set at 783 Chinese yuan per year by the

[3] 1 US dollar is about 6.62 Chinese yuan on December 31, 2010.

[4] In practice, the project counties vary considerably in their enforcement of this family-binding requirement. It has been even dropped gradually in some areas. Unfortunately it is difficult to obtain the precise information about its enforcement at county level. However, it can help explain the low take-up rate among the rural elderly as well as the positive association between program duration and individual pension status in our data. Future evaluation based on additional data would be necessary to specify the benefits and costs of family binding provisions.

[5] As the life expectancy in 2009 was 71.5 years in China, the average duration of benefits is 11.5 years, or 139 months, for a 60-year old individual.

Chinese government, equals 11 percent of the 2009 average per capita net income in rural China,[6] and is about 18 percent of the per capita consumption expenditure of rural households in 2008.[7] According to the official statistics, the NRPS pensioners received a basic pension benefit at an average monthly rate of 78.6 Chinese yuan in March 2013,[8] which may not be adequate to cover all living costs, but can help to pay for the basic necessities.

3. Conceptual Framework

Following the literature (Becker, 1981; Hoerger et al., 1996; Pezzin et al., 1996), we assume a neoclassical model of family decision-making, where the frail elderly parents and adult children jointly determine the living arrangement to maximize family utility.[9] The elderly parents can live independently or cohabit with adult children,[10] either of which is associated with a separate utility function $U = U(C, L, S, H(FC, IC; H^0); \tau)$ defined over a vector of consumption (C), leisure (L), household services (S), the elderly parents' health (H), and a taste parameter (τ).[11] The taste parameter τ reflects the preference for privacy and independence. Conditional on initial health status (H^0), the elderly parents' health can be produced by health inputs, including formal care purchased in the market (FC) and informal care provided by adult children (IC).[12]

[6] The replacement rate from the basic pension benefit of the NRPS is lower than those from the social pensions in most OECD countries, which range from 20 to 40 percent and have a cross-country average of around 30 percent (Cai et al., 2012).

[7] The annual per capita consumption expenditure of rural households was 3,661 Chinese yuan in 2008, and food spending accounted for nearly half of total consumption.

[8] The data can be found in the government report available online: http:// www.mohrss.gov.cn/ncshbxs/NCSHBXSgongzuodongtai/201305/t20130531_104217.htm

[9] An alternative modeling strategy is to allow for separate preferences among elderly parents and adult children, and explain the intergenerational living arrangement decision in the context of bargaining models (Pezzin and Schone, 1999; Yamada, 2006).

[10] We do not consider the choice to live in a nursing home, because it is rare in rural China.

[11] It is important to note that grand-parenting is also an aspect of multigenerational coresidence in China. Although it can be incorporated in the framework, we cannot empirically examine the implications of this dimension due to data limitation. For this reason, we do not consider grand-parenting here. Moreover, the literature finds that coresidence is largely dependent on elderly parents' needs rather than adult children's needs in China (Lei et al., 2015; Bian et al., 1998).

[12] Note that theoretically informal care from adult children is an important health input in health production of the elderly parents, but the effect of coresidence on health of the elderly is inconclusive both theoretically and empirically (Maruyama, 2015).

A family solves its utility maximization problem in two stages. First, for each type of living arrangement, the family chooses the optimal bundle of goods, housing services, and optimal level of health to be produced, yielding an indirect utility subject to the arrangement-specific budget constraints. Second, the family chooses the optimal living arrangement which yields higher indirect utility.

$$V_0\left(P_{FC}, P_{IC}, P_S, Y; H^0, \tau\right) = U(C_0^*, L_0^*, S_0^*, H_0^*(FC_0^*; IC_0^*; H^0); \tau)$$

$$V_1\left(P_{FC}, P_{IC}, P_S, Y; H^0, \tau\right) = U(C_1^*, L_1^*, S_1^*, H_1^*(FC_1^*; IC_1^*; H^0); \tau) \quad (1)$$

where V_0 and V_1 represent the indirect utility functions corresponding to independent living and coresidence, respectively; P_{FC} is the price of formal care, P_{IC} indicates the opportunity cost (such as forgone earnings) or shadow price of informal caregiving time, P_S is the unit living cost, and the price of other consumption has been normalized to 1; Y is the family's total nonearned income (Cox, 1987; Costa, 1997); * denotes optimal values. Independent living will be chosen if

$$V_0\left(P_{FC}, P_{IC}, P_S, Y; H^0, \tau\right) > V_1\left(P_{FC}, P_{IC}, P_S, Y; H^0, \tau\right) \quad (2)$$

An increase in the parent's income may expand the family budget constraint, and affects the optimal choice for the living arrangement. The family may benefit from intergenerational coresidence through reduced unit living costs, and more efficient informal care provided by adult children, while living independently is associated with a gain of privacy and increased autonomy (Rosenzweig and Zhang, 2014). It is assumed that people have a desire for privacy and autonomy, other things being equal (Ermisch, 1981; Hoerger et al., 1996; Engelhardt et al., 2005). The tradeoff between independence and coresidence is subject to many factors, based on equation (2). Therefore, we hypothesize that the effect of an increase in parents' income may operate in a heterogeneous manner on living arrangement. We consider three possible sources of heterogeneity.

The first source is elderly parents' access to their adult children. Adult children are the main providers of unpaid informal care and household services for the elderly in addition to their spouses. When the elderly parents live with adult children, the shadow price of informal care-giving time is lower due to reduced travel costs (i.e.,

$P_{IC,1} < P_{IC,0}$); unit living costs are also reduced due to economies of scale (i.e., $P_{S,1} < P_{S,0}$). However, the price differences between independent living and coresidence are not fixed, but decrease as the elderly parents have easier access to their adult children. The closer adult children live to the elderly parents, the smaller the price differences are. When the increase in income is small, as in the case of the NRPS, the decision of shifting living arrangement might be more sensitive when the elderly and adult children live in the same community.

The second source is the preference for privacy and autonomy. The literature on developed countries provides empirical evidence that people with a desire for privacy and autonomy may act more fully on their preferences when they can afford it (Ermisch, 1981; Engelhardt et al., 2005). We hypothesize that people with a greater demand for privacy and autonomy may be more likely to choose an independent life style given an income rise, *ceteris paribus*. Although the data provide no direct measure of individual preference, we examine how the income effect varies with individual initial SES, as the literatures show that demand for privacy and autonomy provided by independent living is generally greater for people of higher SES (Michael et al., 1980; Costa, 1997; McGarry and Schoeni, 2000).

The third source is long-term care needs, mainly based on the physical and mental health status of the elderly (H^0). Because long-term care system is underdeveloped in rural China, most long-term care is provided informally by unpaid spouses, adult children, or hired help. When the income of the elderly increases, potential substitution among these three sources of informal care may lead to different choices of optimal bundle and living arrangement. However, given the modest pension payment from the NRPS, the family with parents in great need for informal care will gain more utility from coresidence. Thus, the income effect on living arrangement may vary with parents' health status and marital status (related to the source of informal care).

4. Empirical Strategy

To investigate the impact of pension income from the NRPS on elderly living arrangements, we estimate the following model using two-wave panel data:

$$Y_{ijt} = \beta_0 + \beta_1 Pension_{ijt} + \beta_2 X_{ijt} + \beta_3 Z_{jt} + \beta_4 v_t + c_i + \varepsilon_{ijt} \qquad (3)$$

where *i*, *j* and *t* index individual, county and year, respectively. Y_{ijt} denotes the living arrangement choice of the elderly *i* in county *j* at period *t*. $Pension_{ijt}$ has two measures: one is an indicator variable for whether the elderly *i* participated in the NRPS at time *t*, and the other is measured by the natural logarithm of monthly pension benefits the elderly *i* received at time *t* for positive pension income and takes on the value 0 for zero pension income (i.e., non-pensioners). X_{ijt} contains a vector of observed household and individual characteristics, and Z_{jt} is a vector of county level controls, while c_i represents unobserved county, household or individual characteristics that are fixed across *t*. v_t is a wave effect. ε_{ijt} is a disturbance term.

The coefficient β_1 of $Pension_{ijt}$ is our main interest. However, the OLS estimates may suffer from selection bias, and it is difficult to separate the effect of pension from cohort heterogeneity. As our sample focus on the rural elderly (aged 60 to 84 years) with no other types of pension, those living in the project counties are all eligible for the local NRPS. They can choose to enroll and directly receive basic pension benefits without contributing, conditional on the enrollment of their eligible adult children, and may be allowed to receive higher pension benefits by paying a lump sum to cover shortfalls in vesting contributions in some places. The pensioners and non-pensioners may differ in their adult children's unobserved behavior, household preference, family ideology, etc.

For example, the elderly's living arrangements may be determined partly by migration decisions of their adult children, which are unobserved in our data. In particular, when the migration probability of the adult children is high, it will be natural to observe a high proportion of independent living and a low take-up rate of the NRPS by the elderly, due to the low motivation of their adult children to enroll in a local pension program as well as increased independent living of parents resulting from left-behind by their migrated children. Moreover, filial piety has been a central

value of traditional Chinese culture and has continued to help maintain family care for the elderly despite substantial economic development and social change. Adult children with strong belief in filial piety may be more likely to enroll their parents in the NRPS; meanwhile, they may tend to live with their parents to provide family support. In both scenarios, the OLS estimate will underestimate the income effect on independent living because of bias from omitted variables.

We deal with the endogeneity of $Pension_{ijt}$ by exploiting the exogenous time variation of the NRPS implementation at the county level as the instruments for the individual's enrollment status and pension income. Three dummies variables are created to measure whether the duration of the NRPS in a county exceeds 6 months, one year or two years at time of survey.

As the NRPS currently operates on a local basis, rural elderly with a local *hukou* but no other public pensions in the program counties are eligible for free basic pension as long as their eligible adult children enroll in the program. However, young rural residents had lower incentive to participate or choose a higher premium level, due to the disincentive design of the NRPS, difficulty in understanding the NRPS, and low levels of trust in government projects (Lei et al., 2013; Chen et al., 2015).[13] It took time to successfully implement the NRPS at the village level, to educate the low-educated rural residents about the program, and to convince them to take it up; another channel to increase program take-up is through social learning, which also takes time (Liu et al., 2014).[14] Moreover, the family-binding requirement has been relaxed gradually in practice in some counties. Thus, individual pension status of the elderly people should be positively correlated with the introduction and the duration of the NRPS at the county level. In fact, measured in wave 2011/12, the NRPS enrollment rate was 39 percent, 20 percent, and 11 percent for counties starting the program in 2009, 2010, and 2011 in our sample, respectively.

[13] This distrust stems mostly from the previous experience that local governments have consistently imposed a number of taxes and fees on rural residents but misused those funds in the past (Yip and Hsiao, 2009).

[14] In the 2011/12 survey, the non-pensioners in the program counties were asked about the reasons why they had no social pension. The primary reasons were "do not know" (about 52%), "cannot afford the payment" (26%), and "not necessary" (20%).

Our measure of monthly pension income is not conditional on pension receipt in that year, but takes on the value 0 for those with no pension income (i.e. non-pensioners). The main reason for the correlation between program duration and the amount of pension income is that the elderly people in counties with longer program duration are more likely to enroll in the NRPS and receive the pension benefits. A minor reason is that the program counties usually started with lower levels of basic pension benefits, due to fiscal pressures created by the newly implemented program, and are likely to raise basic pension in line with local average earnings growth and inflation when it has been implemented longer (State Council, 2009). According to national statistics, the average annual benefits per pensioner (deflated to RMB in 2009) have increased from 488 Chinese yuan in 2009 to 912 Chinese yuan in 2014.

Overall, those rural residents with higher education level, more exposed to insurance system before and having more trust in the government are likely to be the compliers.

One concern on identification is that an elderly person might migrate from a non-NRPS county to a NRPS county to obtain pension benefits, and this would bias our results. However, such migration is highly unlikely due to the eligibility requirement that the enrollee must have a local *hukou*. Under the *hukou* system it is generally difficult to change the *hukou* location across counties, and even harder for the elderly, since they are unlikely to change their *hukou* through marriage migration or going to college, the two main channels for *hukou* mobility in China. Therefore, migration for the NRPS is not an issue here.[15]

The timing of starting the NRPS at the county level was mainly decided by the central and provincial governments, and should be uncorrelated with a family's choice of living arrangement and its unobserved characteristics. However, non-random implementation timing may be a concern if any county-level observed or unobserved characteristic that affects both the trend of household living arrangement and program

[15] Cai et al. (2012) show that 82.1 percent of rural migrants are younger than age 40 in 2006.

implementation is not controlled for in the estimation. Table 1 compares the observable characteristics across program and non-program counties before and after the NRPS,[16] including share of elderly independent living, total agricultural population,[17] urbanization (measured by the percentage of nonagricultural population to total population in the county), GDP per capita, and government spending per capita,[18] and hospital beds per 10,000 persons.[19] Column (3) shows that program counties had higher levels of urbanization, GDP per capita, government spending per capita and hospital beds per 10,000 persons prior to the program.

-----Table 1-------

To address the concern of non-random program timing, we control for all time-invariant unobserved determinants of living arrangement that may be correlated with program timing using fixed effects (FE) specifications, as well as a rich set of time-varying county characteristics. Thus, our main empirical strategy is FE-IV. In addition, we conduct several empirical checks on the validity of our identification assumption in section 6.

5. Data and Variables

5.1 The Chinese Longitudinal Healthy Longevity Survey

Our data come from the Chinese Longitudinal Healthy Longevity Survey (CLHLS) administered by the Center for Healthy Aging and Development Studies at Peking University and co-sponsored by the National Institute on Aging of the United States. This survey was first conducted in 1998 with a focus on the oldest-old, aged 80 and above. The follow-up waves, with replacement sample for deceased elderly, were conducted in 2000, 2002, 2005, 2008/09, and 2011/12.[20] Beginning in 2002,

[16] As nearly all counties had been exposed to the NRPS by the 2011/12 survey, counties that had been exposed for more than 6 months are termed "program counties", whereas those counties that had not are considered as non-program counties. Our study sample consists of 169 program counties and 189 non-program counties.

[17] It reflects rural-to-urban migration or population loss from the county.

[18] Urbanization, GDP per capita and government spending per capita reflect the development and urbanization level of the county.

[19] It helps control for geographic variation in health care delivery.

[20] The latest wave of the CLHLS was collected in 2014 and is not available at present.

younger elderly have been added to the survey.[21] The CLHLS randomly selected half of the counties and cities in 22 of the 31 provinces in China.[22] The survey combines an in-house interview and a basic physical examination. It contains extensive information on individual and household characteristics: living arrangements, family support, SES, health status, demographic variables, etc. The CLHLS is a high-quality data set with low non-response rate. Full details of the sampling design, response rates, and data quality assessment are described in Zeng et al. (2002) and Gu (2008).

In this study, we mainly use the two recent waves of the CLHLS data (2008/09 and 2011/12) and focus on the sample of the young-old (60–74) and the middle-old (75–84) in rural China.[23] We exclude approximately 2.7 percent of respondents with missing values for pension status, 18.2 percent of respondents who had a retirement pension, private pension, or other social pension during the period 2008/09–2011/12, and less than 1 percent of respondents who reside in elderly centers or nursing homes, or have no living adult children. These restrictions result in a sample of 2,769 rural respondents who (or whose close family members) had been interviewed in wave 2008/09. Of these, 486 respondents (17.6 percent) died before the 2011/12 survey, and 407 (14.7 percent) were lost to follow-up (we return to the attrition issues in Section 7). The remaining 1,876 respondents from 358 sample counties form the main study sample. This has given us a balanced panel of 3,752 person-year observations.

5.2 Dependent variable

Following the previous literature, we define dependent variables measuring whether the respondent is living independently or with others. Based on the residential setting and household composition of the respondents, we consider the elderly living alone or living with a spouse to be living independently; we also treat

[21] The newly added sample focuses on younger elderly aged 65–79; of the 1,879 respondents in our main sample, 74 respondents were aged 60-65 in wave 2008/09 and almost all of them (except one respondent) were over the age of 65 in the 2011/12 survey.

[22] The sample provinces include 7 eastern provinces, 3 north-eastern provinces, 8 central provinces, and 4 western provinces, hosting approximately 85% of China's total population.

[23] We do not include the oldest-old sample in the main analysis, because the oldest-old population is not the focus of the existing literature (besides, there are few oldest-old observations in the existing studies), and their living arrangement may be dictated by health care need instead of economic concerns.

the elderly who live with parents/in-laws or with children under age 15[24] as living independently. Reference persons living in an extended family, such as living with adult children, siblings, relatives, or other adults, are defined as coresidents.[25]

Figure 1 presents the change of living arrangement of rural elderly based on the CLHLS data from 1998 to 2011/12 with adjustment of the sampling weights. Consistent with Cai et al. (2012), independent living among rural elderly had increased for the young-old (age 60–74), the middle-old (age 75–84), and the oldest-old (age 85 and above). Over half of the rural elderly aged 60–84 lived independently in wave 2011/12. As age increases, the elderly are more likely to reside with adult children or others.

-----Figure 1-------

5.3 The NRPS status and individual pension income

The key independent variables include a dichotomous measure indicating individual participation in the NRPS and a continuous variable measured by the natural logarithm of monthly pension benefits. For those with zero pension income we add 1 before taking the log transformation. The CLHLS did not gather the information on the NRPS at the individual or county levels directly, but asked the respondents whether they were covered by a retirement pension, social pension, or private pension in waves 2008/09 and 2011/12. As the NRPS was implemented in rural areas beginning in 2009, those respondents who reported no social pension in wave 2008/09 but having social pension in wave 2011/12 are considered as the NRPS pensioners.[26] In wave 2011/12, 419 respondents (about 22 percent) participated in the NRPS, and received an average 89 Chinese yuan pension income per month.

[24] Among those we classify as independent living, 1 person-year observations (0.03 percent of the study sample) lived with parents/in-laws, and 19 person-year observations (0.52 percent of the study sample) lived with children under age 15.

[25] We exclude institutionalized individuals because they account for less than 1 percent of the study sample. The results are very similar when we include them, no matter whether they are classified as living with others or as living independently.

[26] We believe that this is a reasonable measure, as there was no expansion of other social pension programs in rural China during the study period. But we have to acknowledge the possibility of misclassification which can lead to attenuation bias in the estimated treatment effect (Lewbel, 2007); to the extent that the bias exists, our estimates provide a lower bound of the effect of the NRPS.

We use an instrumental variable approach to address the endogeneity of the enrollment decision and pension income from the NRPS. According to the lists of the NRPS pilot counties authorized by China's central and provincial governments, we are able to determine whether and when each sample county in the CLHLS implemented the NRPS.[27] It is worth noting that interviews in wave 2011/12 took place from July 2011 through September 2012. To take into account this temporal variation, we construct three dummies variables measuring whether the NRPS has been implemented in the county for over 6 months but less than one year, over one year but less than two years, or over two years at time of survey, using the interview dates and dates of the official announcement of the pilot lists.[28]

5.4 Other explanatory variables and descriptive statistics

We control for other factors that may affect the living arrangement of the elderly, such as family financial resources, characteristics of the children, health, and socio-demographic variables of the elderly as well as county-level characteristics.

To investigate the impact of kin availability on independent living, we include the number of adult children alive at interview.

For the elderly, we include two binary variables to measure their financial resources: one indicator is a self-reported evaluation of financial independence, which equals one if the respondents report relying on spouses or their own labor income as main financial support and zero otherwise; and another indicator measures whether

[27] The CLHLS covers a total of 535 rural counties. Due to sample restriction shown in Table A1, the study sample includes 358 counties: 63 (18 percent) belong to the first-wave pilot counties, 87 (24 percent) belong to the second-wave pilot counties, and 208 belong to the third-wave pilot counties. The exposed rates are consistent with national data presented in Section 2. Among the 358 counties, 76 had been exposed for over 6 months, 66 for over one year, and 27 for over two years at the time of survey 2011/12. The 189 counties that had not been exposed or had been exposed less than 6 months are considered as non-program counties.

[28] We do not know the exact dates of program initiation for each county. As the government made announcements about the first two waves of pilots on 31st September 2009 and 30th September 2010, respectively, we assume that it was October 2009 for the first pilot counties, October 2010 for the second pilot counties. The third wave of pilots rolled out in July 2011. Although our measures of program duration may have measurement errors, we first mitigate this measurement error by discretizing the program duration into three dummies; and second, the official announcement may already affect the behavior of rural households in anticipation of a pension in the near future.

the respondent owns his/her current house or apartment.

Health variables include instrumented activities of daily living (IADL) and cognitive functions. The survey questions about IADL and cognitive functions are based on an international standard questionnaire adapted to the Chinese culture and social context with careful pilot testing (Zeng et al., 2002). Specifically, we use a binary variable indicating whether the respondent can finish eight daily activities without assistance, including visiting the neighbors, doing shopping, cooking a meal, washing clothes, walking continuously for 1 kilometer, lifting a weight of 5 kilograms, continuously crouching and standing up three times, and taking public transportation. It is coded 1 if no restriction in these activities was reported and 0 otherwise. Following the literature (Crum et al., 1993; Folstein et al., 1975), we use the Mini-Mental State Examination (MMSE) to detect cognitive impairment of the elderly. The MMSE in the CLHLS includes five dimensions: orientation, reaction, calculation, recall, and language, with a total score ranging from 0 to 30.

Other variables of the elderly include years of schooling, occupational category before age 60, age, gender, ethnicity), and marital status.

-----Table 2-------

In Table 2, among the comparison group who had no pension in either wave, the proportion living independently declined from 54.5 percent in wave 2008/09 to 51.5 percent in wave 2011/12, partly due to aging. However, the percentage of the NRPS pensioners who lived independently has increased slightly, from 51.1 percent to 52.9 percent, during the study period. Standard *t*-tests indicate no significant difference in living arrangement and individual/household characteristics between the pensioners and non-pensioners at baseline, except that the pensioners were more likely to be Han Chinese,[29] and to have a white-collar job before age 60. In wave 2011/12 the elderly pensioners were more likely to have better health status in terms of IADL.

[29] Han Chinese is the majority ethnic group in China, and accounts for more than 90% of the total population.

6. Main Results

6.1 First stage

As noted above, we estimate equation (3) and address the endogeneity of the NRPS enrollment and pension income using IV approach. Table 3 shows the first-stage results from the OLS estimation using cross-sectional data from wave 2011/12 as well as the FE estimation using the panel sample.

-----Table 3-------

For all specifications, the results show that a longer duration of the NRPS implementation at the county level is positively associated with the likelihood that an elderly person participates in the NRPS as well as individual pension incomes. The strong correlations between the indicators of program duration and individual pension status and income have a partial *F*-statistic over 190 in the FE estimations. The FE estimates indicate that the elderly people in counties with the NRPS implementation over two years are 76.2 percent more likely to receive the pension than those in the non-program counties (i.e. counties without the NRPS or with the NRPS introduced within 6 months).

Moreover, we find that age has a negative and convex effect on the likelihood of the NRPS enrollment. The OLS estimates show that being Han Chinese is positively associated with the NRPS enrollment and pension income.

6.2 Results for the whole sample

As we have panel data with one wave before and one wave after the program implementation, we examine living arrangement dynamics using two specifications. In Table 4, columns 1–4 are based on wave 2011/12 and report the results for the change in living arrangement, which is equal to one if an elderly transited from coresidence to independent living between waves 2008/09 and 2011/12, zero if no changes occurred and negative one if an elderly transit out of independent living. Columns 5–8 are based on panel 2008/09–2011/12 and report the results from the FE and FE-IV specifications.

The OLS estimates in columns 1 and 3 show that both the NRPS enrollment and pension income have no association with the change of elderly living arrangement.

After correcting for the endogeneity bias using the IV approach, the estimates of the NRPS enrollment in column 2 and pension income in column 4 are both positive and significant at the 10% level, and of larger magnitude than the OLS estimates, suggesting that the pensioners are less likely to transit from independent living to coresidence than the non-pensioners as they were aging over the study period, i.e. the NRPS has a positive effect on independent living arrangement.

Consistent with the IV estimates, the FE-IV estimates in columns 6 and 8 show similar positive and significant (at the 5% level) effects on the likelihood of independent living. We find that participation in the NRPS has significantly increased the likelihood of the pensioners living independently by 18.5 percentage points. The coefficient on the log pension income is 0.046, implying that a 100 percent increase in the monthly pension income of the elderly raises the likelihood of independent living by 4.6 percentage points.[30]

-----Table 4-------

Our FE-IV estimate of the coefficient β_1 identifies a local average treatment effect (LATE) (Imbens and Angrist, 1994), which corresponds to the effect of pension income on elderly living arrangement induced by the NRPS implementation. It is of particular interest for policy makers as many countries use social pension to improve the wellbeing of the elderly population.

To facilitate the comparison between our results and the ones in the literature, we obtain an elasticity of coresidence with respect to pension income of −0.097 (=[−0.046]/[1−0.528]) for rural elderly when evaluated at the sample mean. This is larger in magnitude than those of Meng and Luo (2008); they find an elasticity of −0.018 to −0.037 for urban elderly in China. The difference may not reflect that the rural elderly respond more elastically to pension income in their living arrangement decisions, but instead result from the downward bias in the estimates of Meng and

[30] In the CLHLS data, we have the information on total annual household income, but unfortunately cannot distinguish between the income of elderly parents and that of co-residing adult children. Following the previous literature (Engelhardt et al., 2005; Jensen, 2003), we exclude the continuous measure of household income due to concerns over endogeneity in the empirical analysis. As a robustness check, we add controls for non-pension household income, and obtain similar results.

Luo (2008), which does not address the endogeneity problem. Another possible reason is that although the pension income accounts for only 11 percent of the 2009 average per capita net income in rural China, it represents a substantial increase in the income of the elderly who often had no income before the NRPS (Chen, 2015; Zhang et al., 2014; Eggleston et al., 2016). In our sample, 60.6% had no income and mainly relied on financial support from their adult children. Moreover, as it identifies a local average treatment effect, the FE-IV estimate also tends to be larger in magnitude when there is positive selection into the program.

Nonetheless, our estimated elasticity of coresidence with respect to pensions is much lower than those found in the literature on the United States, e.g., an elasticity of −0.77 in Costa (1997), and an elasticity of −0.4 in Engelhardt et al. (2005). One explanation is that the pension income and the replacement rate from the NRPS are very low compared to social security in the United States. The other potential explanation is that living arrangement is multidimensional in China, and we will discuss that in detail in a later subsection.

Furthermore, in Table 4, columns 5–8 indicate an inverse U-shaped relationship between age and the likelihood of independent living: the marginal effect of age is positive up to 72–74 years and negative thereafter.[31] This finding is consistent with the literatures on urban China (Cai et al., 2006; Meng and Luo, 2008; Connelly et al., 2014). They find that the probability of coresidence declines until age 67–74, and then starts to increase with age. Columns 1–4 show that the effect of age on the change in living arrangement is also quadratic. Note that the change in living arrangement is typically negative after age 72 in our sample. The quadratic specification implies that the decrease (increase) in independent living is larger (smaller) for older cohorts until age 78 and then becomes smaller afterwards. In addition, the OLS estimates show that number of living children is associated with a higher likelihood of living

[31] Note that it is hard to distinguish between the linear age effect and the linear time trend due to the multicollinearity problem. But the quadratic age effect is robust to the exclusion of time trend. We also find similar results when we control for cohort dummies.

independently.[32]

6.3 Validity of the Identification Assumption

To establish the causal relationship, our key identification assumption is that the implementation timing of the NRPS at the county level is independent of the time-varying factors in the error term of equation (3). However, program timing is not random as shown in Table 1. To address this concern, we present several tests that support the validity of our empirical strategy.

Because the main potential threat comes from the county-level heterogeneity, we first estimate the intent-to-treat (ITT) effect of the NRPS (i.e., the difference between program and non-program counties) using the difference-in-differences (DID) approach. In Table 5, Panel A presents the intent-to-treat (ITT) estimates which can be interpreted as the average impact of the program on living arrangement of eligible elderly persons. We first report simple DID estimates (column 1), and then control for observable covariates, province fixed effects (column 2), county fixed effects (column 3), and individual fixed effects (column 4). The coefficient estimates associated with the program remains positive, large and significant, but become smaller in magnitude with the inclusion of individual fixed effects. It suggests that the eligible sample in the program counties is 6.9% more likely to live independently than those in the non-program counties. As about 36% of the eligible sample in the program counties chose to participate in the NRPS, the treatment effect on the treated may be recovered by dividing the ITT estimate by the share of eligible elderly in the program counties receiving pension income under certain assumptions (i.e., 0.069/0.36=0.19, which is close to 0.185 of the FE-IV estimate in Table 4) (Bloom, 1984).

To account for the time variation of treatments across counties, we also re-estimate the above specifications using program timing, which takes the values from 0 to 3 indicating non-program counties, counties exposed to the NRPS for over 6

[32] This finding is consistent with Lei et al. (2015) based on the CHARLS national baseline sample. Although unreported here, we find that having more adult children is associated with a higher likelihood of living independently but near adult children. It is probably because there is a potential free-rider problem in caregiving decisions among siblings (Maruyama and Johar, 2016). Giles and Mu (2007) also provide some evidence that conflict among siblings over care for the elderly was the third most important source of conflict in rural China.

months, over one year, and over two years. As reported in the second part of Panel A, the coefficient estimates associated with the timing variable are positive and significant, consistent with the baseline estimates.

-----Table 5-------

In Panel B, we use the rural retired sample that had retirement pensions, and check whether there are other time-varying unobserved county-level heterogeneity that are correlated with both program timing and changes in elderly living arrangement during the study period 2008/09-2011/12.[33] Since the rural retired sample was not eligible for the NRPS but shared the same county-level heterogeneity with our main study sample, we expect that the NRPS program at county level would not have any effects on them. Panel B shows that the estimates are always statistically insignificant and even negative in some regressions for the rural retired sample.[34]

Another important threat to identification is a correlation between the county-level rollout and pre-program change in elderly living arrangement. We conduct two tests to check for this possibility. First, we carry out a placebo test and assume that the (nonexistent) NRPS had been introduced in pilot counties during 2005–2008. Panel C in Table 5 reports the estimated impact of the nonexistent program on our study sample, using waves 2005–2008/09. The coefficient estimates are generally negative, small and statistically insignificant, suggesting no different living-arrangement dynamics between the elderly in program and non-program counties prior to the NRPS.

Second, we regress pre-program changes in county-level proportion of independent living (from wave 2005 to wave 2008/09) on indicators for the year in which the NRPS was introduced in the county. Panel D in Table 5 reports the estimates on dummies variables for counties exposed in 2009 and 2010 with those counties exposed in 2011 as the base group. The results show that pre-program

[33] For example, program and non-program counties may be different with respect to return migration after the global financial crisis in 2008, or to formal elderly care systems.

[34] The sample size of the rural retired may be not large enough to produce a precise estimate. To address this concern, we randomly draw a similar sample size as the rural retired sample from our eligible sample ten times, and re-estimate equation (3). The results based on the smaller samples (available upon request) are similar to our baseline results in Table 4.

changes in living arrangement in the county are uncorrelated with the year of program implementation in all regressions.

Although we have to admit that the validity of the identification assumption is fundamentally untestable, Table 5 provides supportive evidence for the validity of our FE-IV approach.

6.4 Heterogeneous Effects and Channels

The literature suggests that with increasing resources, proximity of adult children may be more important in caring for the elderly than coresidence (Giles and Mu, 2007; Bian et al., 1998).[35] Cai et al. (2012) show that more than half of the rural elderly who lived independently had one or more adult children residing in the same village in 2003. Therefore, we specify a multinomial panel logit model to analyze elderly living arrangement further, with coresidence as the base case and independent living with and without adult children living in the same village as alternatives. To ease interpretation of the results, we report odds ratios in Table 6. Columns (1) and (2) show no significant difference between pensioners and non-pensioners in the likelihood of living independently with or without adult children nearby (odds-ratios are 1.123 and 0.872). After individual fixed effects are controlled for in columns (3) and (4), the results show that compared with the non-pensioners, the pensioners are more likely to live independently with adult children nearby (odds-ratio 1.401), but less likely to live independently with no adult children nearby (odds-ratio 0.356), although both estimates are statistically insignificant. In columns (5) and (6), we use the two-stage residual inclusion (2SRI) method to correct for endogeneity bias in the multinomial logit model (Terza et al., 2008).[36] We find that the pensioners are about

[35] The literatures show that poor health of elderly parents and their care needs have constrained labor migration of adult children (Eggleston et al., 2016). Giles and Mu (2007) find that at least one adult child will either return to the village or choose not to migrate when elderly parents become ill.

[36] Terza et al. (2008) show that the 2SRI estimator is generally consistent in nonlinear models with endogenous regressors. In our application, we estimate the first stage using a linear FE specification and the second stage using a multinomial logit model with fixed effects. The standard errors for the second stage should be adjusted for the inclusion of first-stage residuals. However, bootstrap standard errors could not be computed here, as about 70% of the respondents are dropped due to no changes in living arrangement across waves, and the sample is actually not large enough for the bootstrap to be properly applied.

four times as likely to live independently with children nearby (compared to coresidence) as the non-pensioners (odds-ratio 3.956, $p<0.05$). As expected, the NRPS enrollment is still insignificant for independent living without adult children living in the same village.[37]

-----Table 6-------

Taken together, the findings in Table 6 show that most of the income effect from the NRPS on the independence of rural elderly was concentrated among those with adult children still residing in the same village. Our main findings in Table 4 do not necessarily represent a collapse of family-based support for them, since the children in the same village can still provide care for their parents.[38]

Next, we investigate different mechanisms underlying the decisions about elderly living arrangements by looking at heterogeneous income effects along SES dimension. To do so, we divide the sample into different subgroups according to the baseline characteristics. Each cell in Tables 7 and 8 represents a different regression and reports the parameter estimate for individual NRPS enrollment (columns 1, 2) or pension income (columns 3, 4).

-----Table 7-------

In Panels A and B of Table 7, we examine subgroups by the baseline economic independence and homeownership of the elderly. Both the FE and FE-IV estimates indicate an insignificant effect of pension income for the elderly without economic independence or having no homeownership at baseline. However, for the elderly who are economically independent or own their homes at baseline, we find significant positive income effects, and the implied elasticities of coresidence with respect to

[37] In an earlier version of the paper, we examined the differential effects of pension income with respect to the presence of adult children living nearby in the baseline wave. Consistently, we find that the income effects are stronger for those with adult children in the same village and insignificant for those without nonresident adult children in the same village at baseline.

[38] Lei et al. (2015) find that children living far away provide more financial support to their parents, suggesting that transfers from children to parents tend to be a substitute for co-residence in China. It is beyond the scope of this paper to explore the impact of the NRPS on private transfer due to data limitation of the CLHLS, but it is an important topic for future research. We do not make a distinction between living with adult sons and living with adult daughters in this analysis, because fewer than 4% of our study sample were living with adult daughters, and this small percentage is consistent with the social norm in China.

pension income are −0.159 and −0.182. A possible explanation is that due to the low level of pension benefits, the rural elderly can hardly rely on the NRPS income alone to meet their preference of living arrangement. In situations where the elderly have more financial capacity at baseline, additional income from the NRPS will be more likely to induce them to live independently. Our finding provides evidence for the S-shaped relationship between independent living and income suggested in the literature (Michael et al., 1980; Costa, 1997), implying that the impact of an income rise on independent living may be small at low income levels, become sizable at higher income, and then decrease again. Our results belong to the first two segments of the S-shaped relationship.

Panel C of Table 7 shows the estimates by education group. For the literate elderly, the estimates indicate a significant increase in the likelihood of independent living, and the implied elasticity of coresidence to pension income is −0.174. In contrast, we find an insignificant effect for the illiterate elderly. This finding is consistent with McGarry and Schoeni (2000), but appears inconsistent with Engelhardt et al. (2005), who find that the positive effect of social security on independent living is concentrated among the lower-educated elderly in the United States. However, this should not be surprising, given the fact that the elderly population in rural China has much lower education level than those in the United States.[39] This is consistent with the finding that the income effects are stronger for those with better economic status at baseline. On the whole, those findings suggest that the elderly people of higher SES are more likely to live on their own after receiving pension income.[40]

-----Table 8-------

Table 8 investigates the channel of long-term care needs by examining whether

[39] Over half of the elderly sample had no education (defined as being illiterate in our study), while those with a high school education or less account for about 48 percent of the sample, classified as the less educated elderly by Engelhardt et al. (2005).

[40] We should point out that although the results in Table 7 are consistent with the hypothesis of privacy concern, there may be other rationales as well. For example, better educated elderly may be more independent both financially and psychologically so that the shadow price of living alone is lower.

pension income has differential effects for the elderly by marital and health status at baseline. Panel A suggests that the NRPS enrollment has positive and significant (at the 10% level) effects on independent living for the married couples, but no significant effect for the widowed, while pension income has significant (at the 10% level) positive effects for both groups. This finding is inconsistent with the literature on the United States (Engelhardt et al., 2005; Costa, 1997). Those authors suggest that compared to married couples, widowed elderly have limited income sources, and their decisions with respect to living independently are more sensitive to income. We posit that in rural China married couples may be less reliant on adult children for informal care or social interaction, and their living arrangements are thus more sensitive to pension income.

Now we turn to the estimates based on the baseline health status in Panel B. For the group with no IADL limitation at baseline, the likelihood of living independently has increased due to the NRPS take-up, and the estimated elasticity of coresidence to monthly pension benefits is −0.137. However, among those with IADL limitation at baseline, we find that the estimates are small and insignificant.

Overall, we find that the income effect on independent living is concentrated in the group with higher SES and better health status. In contrast to the rural elderly dependent on financial support or informal care provided by adult children, the group with higher SES and better health actually has a choice between coresidence and independent living, as they have relatively many economic and physical resources. The results in Tables 7 and 8 suggest that living independently might be a preferred rather than a forced choice of the elderly people in rural China (Thøgersen and Ni, 2008), at least for the elderly people of higher SES and better health.

6.5 Heterogeneous Effects by Program Generosity

It is likely that the impact of the NRPS may vary considerably with the generosity of the pension program (Cai et al., 2006). The program generosity differs across counties for two reasons. First, the basic pension payment in program counties ranged from 55 to 330 Chinese yuan per month in 2011, depending on local government subsidies. Second, counties with the same amount of basic pension may

have different impacts due to different living costs and income levels. Thus, we construct our measure of program generosity for each NRPS county by dividing its basic pension benefit by its GDP per capita.[41] We split the program counties into generous program counties and stingy program counties, and compare each group with the non-program counties.

-----Table 9-------

The results in Table 9 show that both the ITT estimates and the FE-IV estimates are positive and significant for the generous counties. However, the coefficient estimates are smaller and insignificant for the stingy counties. Thus far, we have shown evidence of two sources of heterogeneous treatment effects: heterogeneity in response to treatment and heterogeneity in treatment. One concern with the subgroup analysis is the possibility that a certain group of the elderly may be likely to live in counties with generous programs. We check the sensitivity of our subgroup results by focusing on generous counties and stingy counties respectively. We obtain a very similar pattern regarding the heterogeneous responses by individual characteristics for rural elderly in both generous and stingy counties, though the pattern is stronger in generous counties but slightly weak in stingy counties.

7. Panel Attrition

A typical concern when using panel data is the attrition bias. As illustrated in the data section, given the age and frailty of the sample, 17.6 percent of the baseline sample died between surveys, and 14.7 percent were lost to follow-up in the 2011/12 survey. If attrition is not random, potential bias will arise.

Since the CLHLS collected some information, including social pension status, on the deceased persons before their death by interviewing a close family member of theirs in the 2011/12 survey, we estimate the effects of the NRPS enrollment and pension income on living arrangement of the deceased sample. The NRPS take-up rate among the deceased sample in their last year of life was around 7.6 percent, which is much lower than that among the survivors. In Table 10, we report the OLS

[41] Ideally, we should use the annual per capita disposable income of rural household in each county; but to our knowledge, there are no complete data publically available in China.

and IV estimates of equation (3) for the deceased sample, controlling for individual characteristics at baseline and in their last year of life as well as county level variables, The results show no significant effect of the NRPS for the deceased sample.

-----Table 10-------

We additionally address the concern of potential attrition bias due to loss of follow-up in two ways. First, we test for selective attrition due to observables by investigating whether those lost to follow-up (i.e., attritors) differ in baseline outcome and characteristics from the follow-up sample (i.e., non-attritors). At first look, the descriptive statistics in Appendix Table A2 shows that the attritors and non-attritors have no significant difference in the proportion of independent living, but differ in several observed individual characteristics, such as age, education, homeownership, number of living children, and health status.

The FE framework of our main analysis mitigates the concern regarding attrition due to observables and unobservables that are time-invariant. To formally test for attrition bias due to time-varying observables, we follow Becketti et al. (1988) and Ding and Lehrer (2010), and regress the baseline living arrangement on baseline characteristics and their interactions with a binary indicator for attrition, using the full sample of wave 2008/09. Table 11 shows that the estimated coefficients of the attrition indicator and its interaction terms with time-varying observables are jointly insignificant. It implies that the attritors are not systematically different from the non-attritors in terms of their baseline characteristics and behavioral relationship, and suggests that attrition due to observables can be safely ignored.[42]

-----Table 11-------

8. Conclusion

This paper has estimated the impact of pension income from the NRPS on living arrangement of the elderly aged 60 to 84 in rural China, using the time variation of the NRPS implementation at county level as the instrument. The overall results suggest

[42] Gu (2008) states that the proportion of loss to follow-up between waves of the CLHLS is low relative to those of some panel surveys of older persons conducted in Western countries (e.g., Mihelic and Crimmins, 1997).

that the NRPS enrollment or pension income has significantly increased independent living of the rural elderly, with an implied income elasticity of coresidence at −0.097. Given the traditional norms regarding intergenerational coresidence in rural China and limited income from the NRPS, this finding is somewhat striking, but is consistent with Chen (2015; 2016), who finds that the NRPS leads to a large and significant reduction in intergenerational coresidence among the elderly reaching age 60, and a significant increase in migration of their adult sons in Guizhou province. The possible explanation is that the modest pension income from the NRPS means a substantial income increase for rural elders who typically depended on support from family members before the NRPS. We also find evidence that more generous programs exhibit larger effects on living arrangement of the pensioners than less generous programs. These findings highlight the important contribution of the rising income to the remarkable decline in coresidence with their adult children by both urban and rural elderly in China during the past three decades (Zeng and Wang, 2003; Benjamin et al., 2000; Palmer and Deng, 2008; Cai et al., 2012; Connelly et al., 2014; 2015).

Further, we explore several mechanisms behind the impact of pension income on elderly living arrangement. We find that the positive income effects are concentrated among the elderly with adult children living in the same village, of higher SES, and without IADL limitation at baseline. It suggests that living independently might be a preferred choice of the elderly people with high SES and better health in rural China.

Though our results do not speak directly to whether the NRPS would improve the welfare of the elderly or not through living arrangement, our study is an important step to such welfare evaluation. In the literature there is mixed evidence for an association of intergenerational coresidence and the well-being of the elderly, despite general belief that coresidence may provide old-age security for the elderly. A few studies show that living with children is associated with better psychological well-being (Chen and Silverstein, 2000; Silverstein et al., 2006; Do and Malhotra, 2012; Connelly et al. 2014) and self-reported health (Liu and Zhang, 2004). Others find that coresidence is associated with health disadvantages (Li et al., 2009; Silverstein et al., 1996). Two recent serious studies have provided some solid

empirical evidence on this regard. Kochar (2000) shows that parents benefit from coresidence in the form of the joint consumption of household public goods. However, Johar and Maruyama (2014) find that, after dealing with endogeneity, coresidence has significantly increased the 7-year mortality rate of the elderly, and there is considerable heterogeneity in the coresidence effect. More work should investigate this issue further. The multi-dimensionality of elderly living arrangement highlighted in this paper is probably one of the reasons for the mixed results in the literature.

Moreover, given the increasing trend in the proportion of the elderly living independently in China, our findings provide important policy information on the development of elderly care systems and social pension programs in China as well as in other developing countries.

References

Barrientos A (2009) Social pensions in low-income countries. In: Holzmann R, Robalino D, Takayama N (eds) Closing the coverage gap: The role of social pensions and other retirement income transfers. The World Bank, Washington, DC, pp 73–84

Becker GS (1981) A treatise on the family. Harvard University Press, Cambridge

Becketti S, Gould W, Lillard L, Welch F (1988) The panel study of income dynamics after fourteen years: An evaluation. J Lab Econ:472-492

Benjamin D, Brandt L, Rozelle S (2000) Aging, wellbeing, and social security in rural northern china. Population Devel Rev 26:89-116

Bethencourt C, R ós-Rull J-V (2009) On the living arrangements of elderly widows. Int Econ Rev 50:773-801

Bian F, Logan JR, Bian Y (1998) Intergenerational relations in urban china: Proximity, contact, and help to parents. Demography 35:115-124

Bloom HS (1984) Accounting for no-shows in experimental evaluation designs. Eval Rev 8:225-246

Cai F, Giles J, Meng X (2006) How well do children insure parents against low retirement income? An analysis using survey data from urban china. J Public Econ 90:2229-2255

Cai F, Giles J, O'Keefe P, Wang D (2012) The elderly and old age support in rural china: Challenges and prospects. World Bank, Washington DC

Cai F, Giles J, Wang D (2009) The well-being of china's rural elderly. Background Paper for East Asia Social Protection Team, The World Bank, Washington DC

Chen X (2015) Old age pension and intergenerational living arrangements: A regression discontinuity design. Rev Econ Househ:1-22

Chen X (2016) Old-age pension and extended families: How is adult children's internal migration affected? Contemporary Econ Pol 34:646–659

Chen X, Hu L, Sindelar J (2015) Leaving money on the table? Pension enrollment decisions in rural china. Paper presented at the 7th IZA/CIER Annual Workshop on Research in Labor Economics, Beijing, China

Chen X, Silverstein M (2000) Intergenerational social support and the psychological well-being of older parents in china. Res Aging 22:43-65

Cheng L, Liu H, Zhang Y, Zhao Z (2016) The health implications of social pensions: Evidence from china's new rural pension scheme. J Compar Econ, forthcoming, doi:http://dx.doi.org/10.1016/j.jce.2016.12.002

Connelly R, Iannotti M, Maurer-Fazio M, Zhang D (2015) Coresidency, ethnicity, and happiness of china's rural elders. Eurasian Geogr Econ 56:70-88

Connelly R, Maurer-Fazio M, Zhang D (2014) The role of coresidency with adult children in the labor force participation decisions of older men and women in china. IZA Discussion Paper, No. 8068

Costa DL (1997) Displacing the family: Union army pensions and elderly living arrangements. J Polit Economy 105:1269-1292

Costa DL (1999) A house of her own: Old age assistance and living arrangements of older nonmarried women. J Public Econ 72:39-60

Cox D (1987) Motives for private income transfers. J Polit Economy 95:508–546

Crum RM, Anthony JC, Bassett SS, Folstein MF (1993) Population-based norms for the mini-mental state examination by age and educational level. J Am Med Assoc 269:2386-2391

Ding W, Lehrer SF (2010) Estimating treatment effects from contaminated multiperiod education experiments: The dynamic impacts of class size reductions. Rev Econ Statist 92:31-42

Do YK, Malhotra C (2012) The effect of coresidence with an adult child on depressive symptoms among older widowed women in south korea: An instrumental variables estimation. J Gerontol B Psychol Sci Soc Sci 67:384-391

Dostie B, Léger PT (2005) The living arrangement dynamics of sick, elderly individuals. J Human Res 40:989-1014

Edmonds E, Mammen K, Miller DL (2005) Rearranging the family? Income support and elderly living arrangements in a low income country. J Human Res 40:186-207

Eggleston K, Sun A, Zhan Z (2016) The impact of rural pensions in china on labor migration. World Bank Econ Rev:lhw032. doi:10.1093/wber/lhw032

Engelhardt GV, Gruber J, Perry CD (2005) Social security and elderly living arrangements: Evidence from the social security notch. J Human Res

40:354-372

Ermisch JF (1981) An economic theory of household formation. Theory and evidence from the general household survey. Scot J Polit Economy 28:1-19

Folstein MF, Folstein SE, McHugh PR (1975) “Mini-mental state”: A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 12:189-198

Giles J, Mu R (2007) Elder parent health and the migration decision of adult children:Evidence from rural china. Demography 44: 265-288

Giles J, Wang D, Zhao C (2010) Can china's rural elderly count on support from adult children? Implications of rural-to-urban migration. J Popul Ageing 3:183-204

Gu D (2008) General data quality assessment of the clhls. In: Yi Z, Poston DL, Vlosky DA, Gu D (eds) Healthy longevity in china. The springer series on demographic methods and population analysis vol 20. Springer, Dordrecht, the Neitherlands, pp 39-60

Hamoudi A, Thomas D (2014) Endogenous coresidence and program incidence: South africa's old age pension. J Devel Econ 109:30-37

Hoerger TJ, Picone GA, Sloan FA (1996) Public subsidies, private provision of care and living arrangements of the elderly. Rev Econ Statist 78:428-440

Imbens GW, Angrist JD (1994) Identification and estimation of local average treatment effects. Econometrica 62:467-475

Jensen RT (2003) Do private transfers ‘displace’ the benefits of public transfers? Evidence from south africa. J Public Econ 88:89-112

Johar M, Maruyama S (2011) Intergenerational cohabitation in modern indonesia: Filial support and dependence. Health Econ 20:87-104

Johar M, Maruyama S (2014) Does coresidence improve an elderly parent's health? J Appl Econometrics 29:965-983

Jung J, Tran C (2012) The extension of social security coverage in developing countries. J Devel Econ 99:439-458

Kakwani N, Subbarao K (2005) Aging and poverty in africa and the role of social pensions. Social Protection Discussion Paper 521, The World Bank, Washington, DC

Kochar A (2000) Parental benefits from intergenerational coresidence: Empirical

evidence from rural pakistan. J Polit Economy 108:1184-1209

Lei X, Strauss J, Tian M, Zhao Y (2015) Living arrangements of the elderly in china: Evidence from the charls national baseline. China Economic J 8:191-214

Lei X, Zhang C, Zhao Y (2013) Incentive problems in china's new rural pension program. Research in Labor Economics 37:181-201

Lewbel A (2007) Estimation of average treatment effects with misclassification. Econometrica 75:537-551

Li B (2007) Pension reform in china: Who are left out? In: Cook IG, Powell J (eds) New perspectives on china and aging. NOVA Science Publishers, New York, pp 29-48

Li LW, Zhang J, Liang J (2009) Health among the oldest-old in china: Which living arrangements make a difference? Soc Sci Med 68:220-227

Liu G, Zhang Z (2004) Sociodemographic differentials of the self-rated health of the oldest-old chinese. Population Res Pol Rev 23:117-133

Liu H, Sun Q, Zhao Z (2014) Social learning and health insurance enrollment: Evidence from china's new cooperative medical scheme. J Econ Behav Organ 97:84-102

Manacorda M, Moretti E (2006) Why do most italian youths live with their parents? Intergenerational transfers and household structure. J Eur Econ Assoc 4:800-829

Maruyama S (2015) The effect of coresidence on parental health in japan. J Japanese Int Economies 35:1-22

Maruyama S, Johar M (2016) Do siblings free-ride in 'being there' for parents? Quantitative Economics, forthcoming

Maurer-Fazio M, Connelly R, Chen L, Tang L (2011) Childcare, eldercare, and labor force participation of married women in urban china, 1982–2000. J Human Res 46:261-294

McGarry K, Schoeni RF (2000) Social security, economic growth, and the rise in elderly widows' independence in the twentieth century. Demography 37:221-236

Meng X, Luo C (2008) What determines living arrangements of the elderly in urban china. In: Gustafsson BA, Li S, Sicular T (eds) Inequality and public policy in

china. Cambridge University Press, Cambridge, pp 267-286

Michael RT, Fuchs VR, Scott SR (1980) Changes in the propensity to live alone: 1950–1976. Demography 17:39-56

Mihelic AH, Crimmins EM (1997) Loss to follow-up in a sample of americans 70 years of age and older: The lsoa 1984–1990. J Gerontol B Psychol Sci Soc Sci 52B:S37–S48

Mutchier JE, Burr JA (1991) A longitudinal analysis of household and nonhousehold living arrangements in later life. Demography 28:375-390

Ning M, Gong J, Zheng X, Zhuang J (2016) Does new rural pension scheme decrease elderly labor supply? Evidence from charls. China Econ Rev 41:315–330

Palacios R, Sluchynsky O (2006) Social pensions part i: Their role in the overall pension system. Social Protection Discussion Paper 36237, The World Bank, Washington, DC

Palmer E, Deng Q (2008) What has economic transition meant for the well-being of the elderly in china. In: Gustafsson BA, Li S, Sicular T (eds) Inequality and public policy in china. Cambridge University Press, Cambridge, pp 182–203

Pezzin LE, Kemper P, Reschovsky J (1996) Does publicly provided home care substitute for family care? Experimental evidence with endogenous living arrangements. J Human Res 31:650-676

Pezzin LE, Schone BS (1999) Intergenerational household formation, female labor supply and informal caregiving: A bargaining approach. J Human Res:475-503

Rosenzweig M, Zhang J (2014) Co-residence, life-cycle savings and inter-generational support in urban china. National Bureau of Economic Research Working Paper No. 20057

Shen C, Williamson JB (2010) China's new rural pension scheme: Can it be improved? Int J Sociol Soc Policy 30:239-250

Shi SJ (2006) Left to market and family–again? Ideas and the development of the rural pension policy in china. Soc Policy Adm 40:791-806

Silverstein M, Chen X, Heller K (1996) Too much of a good thing? Intergenerational social support and the psychological well-being of older parents. J Marriage Fam:970-982

Silverstein M, Cong Z, Li S (2006) Intergenerational transfers and living

arrangements of older people in rural china: Consequences for psychological well-being. J Gerontol B Psychol Sci Soc Sci 61:S256-S266

State Council (2009) Guiding Suggestions of the State Council on Developing New Rural Pension Scheme Pilot. Document 32 [In Chinese.] Accessed March 13, 2017(link:http://www.mohrss.gov.cn/ncshbxs/NCSHBXSzhengcewenjian/200909/t20090901_83916.html)

Terza JV, Basu A, Rathouz PJ (2008) Two-stage residual inclusion estimation: Addressing endogeneity in health econometric modeling. J Health Econ 27:531-543

Thøgersen S, Anru N (2008) 'He is he, and i am i': Individual and collective among china's rural elderly. Eur J East Asian Stud 7:11-37

Yamada K (2006) Intra-family transfers in japan: Intergenerational co-residence, distance, and contact. Appl Econ 38:1839-1861

Yip W, Hsiao WC (2009) Non-evidence-based policy: How effective is china's new cooperative medical scheme in reducing medical impoverishment? Soc Sci Med 68:201-209

Zeng Y, Vaupel JW, Zhenyu X, Chunyuan Z, Yuzhi L (2002) Sociodemographic and health profiles of the oldest old in china. Population Devel Rev 28:251-273

Zeng Y, Wang Z (2003) Dynamics of family and elderly living arrangements in china: New lessons learned from the 2000 census. China Rev 3:95-119

Zhang C, Giles J, Zhao Y (2014) Policy evaluation of china’s new rural pension program: Income, poverty, expenditure, subjective wellbeing and labor supply. China Econ Q 14:203–230

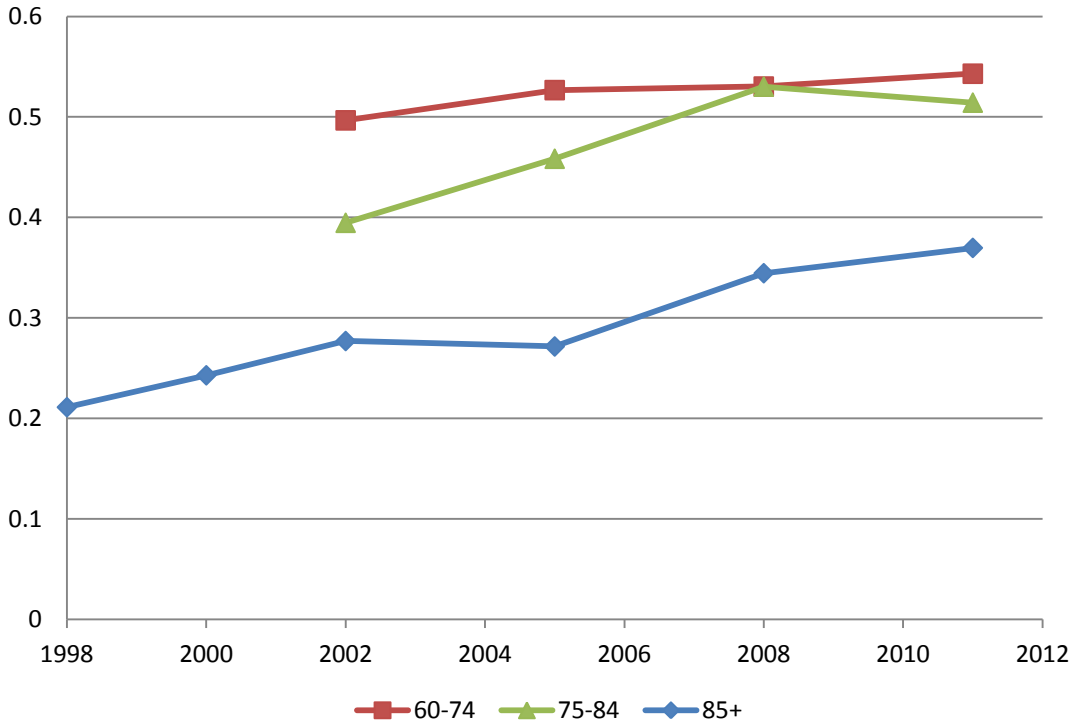

Figure 1 Fraction of Elderly Living Independently in Rural China
Source: the CLHLS from 1998 to 2011/12.
Note: Adjusted for sampling weight.

Table 1 Descriptive Statistics of County Characteristics

	Wave 2008/09			Wave 2011/12			
	Program	No program	Diff.	Program	No program	Diff.	Diff.-in-diff.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Number of counties=358	169	189		169	189		
Share of independent living	0.535	0.595	-0.061	0.458	0.518	-0.060	0.000
	(0.352)	(0.382)		(0.350)	(0.389)		
Total agricultural population (ten thousand)	63.506	61.525	1.981	58.493	57.666	0.827	-1.155
	(29.662)	(34.698)		(29.145)	(34.041)		
Urbanization	25.722	20.937	4.785***	32.258	27.608	4.650**	-0.135
	(17.779)	(13.521)		(19.939)	(17.150)		
GDP per capita (thousand Yuan)	28.842	17.197	11.645***	43.875	28.859	15.017***	3.372
	(22.816)	(12.959)		(28.837)	(18.260)		
Government spending per capita (thousand Yuan)	2.683	2.051	0.633***	4.837	3.387	1.450***	0.817**
	(1.769)	(1.534)		(3.162)	(2.030)		
Hospital beds per 10,000 persons	26.332	22.274	4.058***	29.889	26.232	3.658**	-0.401
	(14.675)	(9.578)		(15.524)	(11.081)		

Notes: 1. In our study sample, program counties include 76 counties that had been exposed for over 6 months, 66 counties that had been exposed for over one year, and 27 counties that had been exposed for over two years at time of wave 2011/12 interviews. The 189 counties that had not been exposed or had been exposed less than 6 months are considered as non-program counties.

2. *t*-test was applied for pairwise comparisons in each wave. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 2 Descriptive Statistics of Individual Characteristics

	Full sample	Wave 2008/09 (pre-reform)		Wave 2011/12 (post-reform)	
		Pensioners (Treated)	Non-pensioners (Control)	Pensioners (Treated)	Non-pensioners (Control)
Number of observations	3752	419	1457	419	1457
Independent living	0.528	0.511	0.545	0.529	0.515
	(0.499)	(0.501)	(0.498)	(0.500)	(0.500)
Monthly pension income (yuan)	8.316	0.000	0.000	88.890***	0.000
	(38.206)	(0.000)	(0.000)	(91.982)	(0.000)
Age	74.362	72.933	72.776	76.055	75.872
	(5.443)	(5.337)	(5.191)	(5.300)	(5.190)
Male	0.494	0.508	0.490	0.508	0.490
	(0.500)	(0.501)	(0.500)	(0.501)	(0.500)
Han	0.917	0.959***	0.905	0.959***	0.905
	(0.275)	(0.198)	(0.293	(0.198)	(0.293)
Married	0.579	0.611	0.604	0.585	0.542
	(0.494)	(0.488)	(0.489	(0.493)	(0.498)
Years of schooling	2.252	2.413	2.270	2.319	2.159
	(2.939)	(2.884)	(2.982)	(2.910)	(2.913)
Economically independent	0.340	0.418	0.387	0.266	0.291
	(0.474)	(0.494)	(0.487)	(0.443)	(0.454)
Owns an apartment	0.591	0.664	0.643	0.548	0.531
	(0.492)	(0.473)	(0.479)	(0.498)	(0.499)
Had a white-collar job before age 60	0.017	0.026*	0.014	0.026*	0.014
	(0.128)	(0.160)	(0.117)	(0.160)	(0.117)
Number of living children	4.239	4.316	4.245	4.248	4.207
	(1.604)	(1.562)	(1.617)	(1.567)	(1.614)
No IADL limitation	0.627	0.709	0.704	0.592**	0.535
	(0.484)	(0.455)	(0.457)	(0.492)	(0.499)
MMSE score	26.448	26.828	26.984	26.098	25.904
	(5.154)	(4.870)	(4.367)	(5.837)	(5.666)

Note: *t*-test was applied for pairwise comparisons of the treated and control groups in each wave. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3 Estimation for the NRPS Enrollment Decision and Pension Income

	Enrollment in the NRPS		log (pension income)	
	OLS using wave 2011/12	FE using panel 2008/09–2011/12	OLS using wave 2011/12	FE using panel 2008/09–20011/12
	(1)	(2)	(3)	(4)
Program duration exceeds 6 months	0.282***	0.242***	1.088***	0.947***
	(0.064)	(0.067)	(0.297)	(0.312)
Program duration exceed 1 year	0.425***	0.384***	1.782***	1.605***
	(0.061)	(0.058)	(0.264)	(0.253)
Program duration exceed 2 years	0.803***	0.762***	3.539***	3.386***
	(0.072)	(0.058)	(0.320)	(0.265)
Age	0.019	-0.125**	0.139	-0.526**
	(0.055)	(0.052)	(0.208)	(0.208)
Age squared/100	-0.010	0.070**	-0.083	0.209*
	(0.036)	(0.029)	(0.137)	(0.113)
Married	0.017	0.034	0.043	0.129
	(0.017)	(0.022)	(0.071)	(0.089)
Number of living children	0.004	0.002	0.021	0.023
	(0.005)	(0.017)	(0.022)	(0.070)
Economically independent	-0.020	-0.021	-0.018	-0.071
	(0.020)	(0.018)	(0.087)	(0.076)
Owns an apartment	-0.011	0.014	-0.041	0.062
	(0.021)	(0.019)	(0.082)	(0.069)
No IADL limitation	0.006	-0.002	0.059	0.014
	(0.021)	(0.017)	(0.090)	(0.077)
MMSE score	0.000	-0.000	-0.000	-0.001
	(0.002)	(0.002)	(0.006)	(0.007)
Male	-0.013		-0.069	
	(0.020)		(0.081)	
Han	0.137***		0.537***	
	(0.038)		(0.149)	
Had a white-collar job before age 60	0.040		0.209	
	(0.081)		(0.416)	
Years of Schooling	0.005		0.027	
	(0.004)		(0.019)	
Wave 2011/12		0.163		0.953*
		(0.120)		(0.491)
Constant	-0.761		-6.072	
	(2.135)		(8.167)	
County controls	Yes	Yes	Yes	Yes
Province dummies	Yes	--	Yes	--
Weak instrument test	F=61.81***	F= 198.78***	F=59.33***	F=191.17***
R-squared	0.339	0.418	0.361	0.417
Number of observations	1,829	3,660	1,757	3,516

Note: 1. Robust standard error clustered at county level in parentheses;* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

2. County controls include total rural population, urbanization, GDP per capita, government spending per capita, and hospital beds per 10,000 persons.

3. The number of country in each of the four program duration categories is as in the note 1 in Table 1.

Table 4 Effect of the NRPS on Independent Living for the Rural Elderly

Dependent variable:	Δindependent living (1,0,-1)				independent living			
	Wave 2011/12				Panel 2008/09–2011/12			
	OLS	IV	OLS	IV	FE	FE-IV	FE	FE-IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NRPS enrollment	0.034	0.199*			0.024	0.185**		
	(0.032)	(0.110)			(0.029)	(0.090)		
log (pension income)			0.002	0.050*			-0.000	0.046**
			(0.009)	(0.027)			(0.008)	(0.022)
Age	-0.189**	-0.180**	-0.187**	-0.178**	0.261***	0.258***	0.278***	0.274***
	(0.077)	(0.078)	(0.082)	(0.081)	(0.076)	(0.077)	(0.077)	(0.079)
Age squared/100	0.121**	0.115**	0.120**	0.114**	-0.176***	-0.179***	-0.187***	-0.187***
	(0.051)	(0.051)	(0.054)	(0.054)	(0.036)	(0.037)	(0.037)	(0.039)
Married	-0.001	-0.007	0.002	-0.003	0.133***	0.123***	0.136***	0.125***
	(0.028)	(0.028)	(0.028)	(0.029)	(0.034)	(0.035)	(0.035)	(0.035)
Number of living children	0.006	0.005	0.007	0.006	-0.001	0.008	-0.001	0.009
	(0.007)	(0.007)	(0.008)	(0.008)	(0.028)	(0.026)	(0.028)	(0.025)
Economically independent	0.064**	0.070**	0.068**	0.074**	0.007	0.014	0.011	0.019
	(0.031)	(0.030)	(0.033)	(0.032)	(0.028)	(0.026)	(0.028)	(0.027)
Owns an apartment	0.149***	0.151***	0.151***	0.154***	0.190***	0.192***	0.190***	0.192***
	(0.026)	(0.028)	(0.028)	(0.029)	(0.025)	(0.026)	(0.026)	(0.027)
No IADL limitation	0.035	0.025	0.036	0.021	0.030	0.025	0.030	0.023
	(0.030)	(0.029)	(0.030)	(0.030)	(0.020)	(0.020)	(0.021)	(0.021)
MMSE score	0.008***	0.008***	0.008***	0.008***	0.007***	0.007***	0.007***	0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Wave 2011/12					0.049	0.035	0.043	0.018
					(0.114)	(0.111)	(0.118)	(0.113)
Constant	7.016**	6.652**	6.946**	6.596**				
	(2.916)	(2.939)	(3.084)	(3.070)				
County controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overidentification test		p=0.110		p=0.128		p=0.224		p=0.287
R-squared	0.061	0.045	0.064	0.042	0.085	0.069	0.085	0.064
Number of observations	1803	1803	1733	1733	3,608	3,608	3,468	3,468

Note: 1. Robust standard errors clustered at county level are reported in parentheses;* p<0.10, ** p<0.05, *** p<0.01.

2. Columns (1)–(4) also include controls for gender, ethnicity, years of schooling, and a dummy variable for having a white-collar career before age 60. County controls include total rural population, urbanization, GDP per capita, government spending per capita, and hospital beds per 10,000 persons.

3. The number of country in each of the four program duration categories is as in the note 1 in Table 1.

Table 5 Tests of the Validity of the Identification Assumption

	Dependent variable: Independent living			
	(1)	(2)	(3)	(4)
Panel A: Main study sample (2008/09-2011/12), ITT estimates				
Program×2011/12	0.088***	0.089***	0.076**	0.069**
	(0.033)	(0.031)	(0.033)	(0.030)
R-squared	0.003	0.190	0.325	0.088
Number of observations	3,726	3,647	3,647	3,608
Timing×2011/12	0.038**	0.046***	0.040**	0.032**
	(0.017)	(0.017)	(0.018)	(0.016)
R-squared	0.002	0.191	0.325	0.088
Number of observations	3,726	3,647	3,647	3,608
Panel B: Ineligible sample (2008/09-2011/12), validity checks				
Program×2011/12	-0.023	0.022	-0.032	-0.058
	(0.067)	(0.074)	(0.074)	(0.065)
R-squared	0.007	0.250	0.512	0.168
Number of observations	509	502	502	494
Timing×2011/12	0.012	0.036	0.008	-0.001
	(0.031)	(0.035)	(0.030)	(0.026)
R-squared	0.014	0.254	0.512	0.165
Number of observations	509	502	502	502
Panel C: Study sample in pre-program period (2005-2008/09), validity checks				
"Program"×2008/09	0.002	-0.013	-0.019	-0.015
	(0.031)	(0.030)	(0.031)	(0.029)
R-squared	0.004	0.238	0.340	0.101
Number of observations	3,347	3,344	3,344	3,338
"Timing"×2008/09	-0.001	-0.007	-0.012	-0.010
	(0.015)	(0.015)	(0.016)	(0.015)
R-squared	0.005	0.238	0.340	0.101
Number of observations	3,347	3,344	3,344	3,338
Wave effect	Yes	Yes	Yes	Yes
Household controls	No	Yes	Yes	Yes
County controls	No	Yes	Yes	Yes
Unit FE	No	province	county	individual

Panel D: Relationship between county-level rollout and pre-program living arrangement

Dependent variable: ΔProportion of independent living in the county from 2005 to 2008/09			
Program introduced in 2009	-0.046	-0.041	-0.040
	(0.050)	(0.053)	(0.052)
Program introduced in 2010	-0.032	-0.058	-0.051
	(0.052)	(0.078)	(0.074)
R-squared	0.003	0.114	0.134
Number of observations	294	294	294
P-value of joint test	p=0.610	p=0.638	p=0.671
County controls	No	No	Yes
Unit FE	No	province	province

Note: 1. In panels A–C, linear probability models are estimated, and robust standard errors clustered at county level are reported in parenthesis; the specifications in columns 1 and 2 also include the program/timing indicator.
2. In panel D, all regressions are for the pre-treatment wave 2008/09; robust standard errors are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01. Household controls include age; age squared/100; marital status; number of living children; indicators of being economically independent, owning an apartment, and no IADL limitation; MMSE score. County controls include total rural population, urbanization, GDP per capita, government spending per capita, and hospital beds per 10,000 persons.

Table 6 Multinomial Logit Estimates of Elderly Living Arrangement

	Elderly living arrangement					
	Multinomial logit		Multinomial logit+FE		Multinomial logit+FE+IV	
Independent living	With children nearby	With no children nearby	With children nearby	With no children nearby	With children nearby	With no children nearby
	(1)	(2)	(3)	(4)	(5)	(6)
NRPS enrollment	**1.123**	0.872	**1.401**	0.356	**3.956****	0.106
	(0.201)	(0.266)	(0.354)	(0.349)	(2.113)	(0.261)
Age	2.902***	1.194	6.225***	17.602	6.029***	17.556
	(0.709)	(0.432)	(3.663)	(33.841)	(3.569)	(35.514)
Age squared/100	0.501***	0.897	0.285***	0.195	0.280***	0.217
	(0.082)	(0.222)	(0.098)	(0.194)	(0.097)	(0.226)
Married	1.701***	42.179***	2.510***	7.474**	2.330***	8.348**
	(0.172)	(22.349)	(0.668)	(7.284)	(0.628)	(8.048)
Number of living children	1.173***	0.945	1.021	0.160*	1.103	0.154*
	(0.037)	(0.071)	(0.228)	(0.166)	(0.256)	(0.155)
Economically independent	1.040	0.958	1.055	1.569	1.131	1.476
	(0.134)	(0.166)	(0.228)	(0.922)	(0.247)	(0.983)
Owns an apartment	3.646***	4.077***	3.361***	2.486	3.378***	2.710*
	(0.380)	(0.843)	(0.661)	(1.632)	(0.670)	(1.537)
No IADL limitation	1.104	1.464**	1.096	1.974	1.072	2.097
	(0.106)	(0.275)	(0.216)	(1.113)	(0.215)	(1.207)
MMSE score	1.015*	0.991	1.039**	1.036	1.039**	1.043
	(0.009)	(0.020)	(0.019)	(0.042)	(0.019)	(0.046)
Male	0.968	0.769				
	(0.106)	(0.144)				
Han	1.621**	1.310				
	(0.311)	(0.726)				
Had a white-collar job	0.575*	1.462				
before age 60	(0.167)	(0.832)				
Years of schooling	0.984	1.000				
	(0.020)	(0.035)				
Wave 2011/12	0.918	1.137	1.571	0.282	1.503	0.285
	(0.089)	(0.210)	(1.422)	(0.860)	(1.384)	(0.865)
First-stage residual					0.250**	3.647
					(0.148)	(8.567)
County controls	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	-	-	-	-
Number of observations	3,283	3,283	994	994	994	994

Note: 1. Coresidence is the reference category.

2. Odds ratios and robust standard errors (in parentheses) are reported; * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 7 Effects of the NRPS on Independent Living by the SES Status

Data	Estimate on NRPS enrollment		Estimate on log(pension income)		[mean]
	FE	FE-IV	FE	FE-IV	
	(1)	(2)	(3)	(4)	(5)
Panel A. Subsamples by Economic Independence at Baseline					
Economically independent	0.038	0.306**	0.004	0.070**	[0.560]
	(0.045)	(0.121)	(0.011)	(0.029)	
Weak instrument test		*F*=36.74		*F*=33.77	
Number of observations	1,420	1,420	1,374	1,374	
Economically dependent	0.015	0.056	-0.004	0.016	[0.522]
	(0.037)	(0.090)	(0.011)	(0.022)	
Weak instrument test		*F*=73.74		*F*=77.76	
Number of observations	2,188	2,188	2,094	2,094	
Panel B. Subsamples by Homeownership at Baseline					
House owner	0.020	0.276**	0.001	0.063**	[0.653]
	(0.038)	(0.128)	(0.010)	(0.031)	
Weak instrument test		*F*=49.27		*F*=42.13	
Number of observations	2,328	2,328	2,240	2,240	
Not house owner	0.026	0.068	-0.005	0.025	[0.325]
	(0.052)	(0.089)	(0.014)	(0.021)	
Weak instrument test		*F*=41.77		*F*=38.80	
Number of observations	1,280	1,280	1,228	1,228	
Panel C. Subsamples by Education					
Educated	0.052	0.338***	0.007	0.081***	[0.535]
	(0.040)	(0.079)	(0.010)	(0.019)	
Weak instrument test		*F*=53.11		*F*=49.32	
Number of observations	1,758	1,758	1,688	1,688	
Illiterate	-0.005	0.008	-0.007	0.005	[0.540]
	(0.041)	(0.136)	(0.012)	(0.034)	
Weak instrument test		*F*=53.50		*F*=52.99	
Number of observations	1,844	1,844	1,774	1,774	

Note: 1. Robust standard errors clustered at county level are reported in parentheses; * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

2. Other control variables include age; age squared/100; marital status; number of living children; indicators of being economically independent, owning an apartment, and no IADL limitation; MMSE score; a wave dummy; and time-varying county characteristics such as total rural population, urbanization, GDP per capita, government spending per capita, and hospital beds per 10,000 persons.

3. Baseline sample means of independent living for each subgroup are reported in the square brackets.

Table 8 Effects of the NRPS on Independent Living by Marital and Health Status

Data	**Estimate on NRPS enrollment**		**Estimate on log(pension income)**		[mean]
	FE	FE-IV	FE	FE-IV	
	(1)	(2)	(3)	(4)	(5)
Panel A. Subsamples by Marital Status at Baseline					
Married	0.000	0.188*	-0.008	0.046*	[0.606]
	(0.034)	(0.112)	(0.009)	(0.027)	
Weak instrument test		*F*=49.29		*F*=42.72	
Number of observations	2,226	2,226	2,146	2,146	
Widowed	0.060	0.164	0.010	0.042*	[0.432]
	(0.049)	(0.101)	(0.013)	(0.024)	
Weak instrument test		*F*=61.02		*F*=56.49	
Number of observations	1,382	1,382	1,322	1,322	
Panel B. Subsamples by Health Status at Baseline					
No IADL limitation	0.031	0.249***	0.003	0.062***	[0.549]
	(0.037)	(0.084)	(0.009)	(0.020)	
Weak instrument test		*F*=58.16		*F*=59.79	
Number of observations	2,552	2,552	2,460	2,460	
Have IADL limitation	-0.003	0.020	-0.014	0.002	[0.510]
	(0.049)	(0.151)	(0.015)	(0.039)	
Weak instrument test		*F*=29.88		*F*=26.22	
Number of observations	1,056	1,056	1,008	1,008	

Note: 1. Robust standard errors clustered at county level are reported in parentheses; * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

2. Other control variables include age; age squared/100; marital status; number of living children; indicators of being economically independent, owning an apartment, and no IADL limitation; MMSE score; a wave dummy; and time-varying county characteristics such as total agricultural population, urbanization, GDP per capita, government spending per capita, and hospital beds per 10,000 persons. Baseline sample means of independent living for each subgroup are reported in the square brackets.

Table 9 Effects of the NRPS on Independent Living by Pension Generosity

	More generous program		*Less generous program*	
	(1)	(2)	(3)	(4)
Panel A: ITT Estimates				
Program×2011/12	0.092*	0.089**	0.051	0.047
	(0.047)	(0.043)	(0.033)	(0.029)
R-squared	0.343	0.097	0.346	0.085
Number of observations	2,523	2,500	2,653	2,630
Unit FE	County	Individual	County	Individual
Panel B: LATE estimates	FE	FE-IV	FE	FE-IV
NRPS enrollment	-0.000	0.254**	0.068**	0.095
	(0.041)	(0.128)	(0.032)	(0.083)
Weak instrument test		*F*=49.81		*F*=41.49
R-squared	0.094	0.055	0.085	0.084
Number of observations	2,500	2,500	2,630	2,630
log(pension income)	-0.011	0.064**	0.011	0.025
	(0.013)	(0.032)	(0.009)	(0.020)
Weak instrument test		*F*=50.84		*F*=33.17
R-squared	0.092	0.062	0.086	0.085
Number of observations	2,416	2,416	2,554	2,554

Note: 1. Robust standard errors clustered at county level are reported in parentheses; * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

2. Other control variables include age; age squared/100; marital status; number of living children; indicators of being economically independent, owning an apartment, and no IADL limitation; MMSE score; a wave dummy; and time-varying county-level variables such as total rural population, urbanization, GDP per capita, government spending per capita, and hospital beds per ten thousand people.

Table 10 Effect of the NRPS on Independent Living for the Deceased Sample

Dependent variable:	Independent living			
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
NRPS enrollment in last year of life	-0.054	0.081		
	(0.093)	(0.375)		
log (pension income) in last year of life			-0.006	0.015
			(0.020)	(0.089)
Age in last year of life	0.145	0.133	0.148	0.141
	(0.118)	(0.115)	(0.118)	(0.114)
Age squared/100	-0.095	-0.087	-0.097	-0.092
	(0.076)	(0.075)	(0.076)	(0.074)
Married in last year of life	0.195***	0.195***	0.197***	0.198***
	(0.050)	(0.047)	(0.050)	(0.048)
Economically independent in last year of life	0.137	0.137*	0.134	0.134*
	(0.085)	(0.081)	(0.086)	(0.081)
No ADL limitation in last year of life	0.073	0.074	0.071	0.072
	(0.058)	(0.055)	(0.058)	(0.055)
MMSE score in wave 2008	-0.001	-0.001	-0.000	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Number of living children in wave 2008	0.009	0.009	0.009	0.009
	(0.014)	(0.014)	(0.014)	(0.014)
Owns an apartment in wave 2008	0.147***	0.148***	0.149***	0.150***
	(0.048)	(0.047)	(0.049)	(0.047)
Male	0.001	-0.005	0.000	-0.003
	(0.054)	(0.055)	(0.054)	(0.054)
Han	0.101	0.100	0.101	0.100
	(0.103)	(0.102)	(0.104)	(0.102)
Had a white-collar job before age 60	0.056	0.064	0.055	0.059
	(0.166)	(0.158)	(0.166)	(0.158)
Years of schooling	-0.007	-0.006	-0.007	-0.007
	(0.009)	(0.008)	(0.009)	(0.008)
Constant	-6.201	-5.835	-6.345	-6.154
	(4.517)	(4.379)	(4.511)	(4.334)
County characteristics	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes
R-squared	0.222	0.218	0.220	0.218
Number of observations	467	467	465	465

Note: Robust standard errors clustered at county level are reported in parentheses; * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 11 Difference between the Attrited and Non-Attrited Samples

Dependent variable:	Independent living		Independent living	
	Coef.	Robust S.E.	Coef.	Robust S.E.
Age	0.013*	(0.007)	0.014*	(0.008)
Male	-0.097	(0.062)	-0.107*	(0.061)
Han	0.636***	(0.131)	0.421***	(0.122)
Married	0.410***	(0.063)	0.404***	(0.063)
Years of schooling	-0.020*	(0.011)	-0.015	(0.011)
Economically independent	-0.007	(0.079)	-0.010	(0.080)
Owns an apartment	0.780***	(0.067)	0.786***	(0.068)
Had a white-collar job before age 60	-0.179	(0.218)	-0.188	(0.214)
Number of living children	0.078***	(0.020)	0.073***	(0.020)
No IADL limitation	0.078	(0.073)	0.083	(0.074)
MMSE score	0.002	(0.005)	0.003	(0.006)
Constant	-2.576***	(0.695)	-3.276***	(0.768)
Attrition (loss to follow-up)	-0.950	(1.541)	-0.328	(1.839)
Attrition × age	0.018	(0.014)	0.016	(0.014)
Attrition × male	-0.068	(0.147)	-0.070	(0.144)
Attrition × Han	-0.005	(0.328)	0.128	(0.375)
Attrition × married	0.028	(0.145)	0.049	(0.149)
Attrition × years of schooling	-0.014	(0.038)	-0.018	(0.038)
Attrition × economically independent	0.114	(0.205)	0.054	(0.210)
Attrition × owns an apartment	0.499**	(0.206)	0.544**	(0.213)
Attrition × had a white-collar job before age 60	0.555	(0.512)	0.630	(0.519)
Attrition × number of living children	-0.036	(0.058)	-0.041	(0.059)
Attrition × no IADL limitation	0.060	(0.178)	0.053	(0.178)
Attrition × MMSE score	-0.017	(0.015)	-0.012	(0.016)
Attrition × county characteristics	No		Yes	
Attrition × province Dummies	Yes		Yes	
County characteristics	No		Yes	
Province dummies	Yes		Yes	
Number of observations	2,706		2,706	
F-statistic for test on the joint effect of attrition on:				
constant and coefficient estimates	*F*= 8.10	*P*= 0.423	*F*= 8.30	*P*= 0.405
all coefficient estimates but no constant	*F*= 8.09	*P*= 0.324	*F*= 8.21	*P*= 0.315
constant only	*F*= 0.38	*P*= 0.538	*F*= 0.03	*P*= 0.859

Note: Robust standard errors clustered at county level are reported in parentheses; * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

APPENDIX

Table A1 Number of Respondents

Main analysis	Number excluded	Number remaining
CLHLS 2008		16950
Restrict to rural respondents aged 60–84	13,415	3535
Exclude respondents with missing values for social pension	95	3440
Exclude respondents with any other types of social pension	645	2795
Exclude respondents residing in elderly centers or nursing homes	21	2774
Exclude respondents without adult children alive	5	**2769**
Respondents lost to follow-up in 2011/12 survey		**407**
Respondents deceased before 2011/12 survey		**486**
Participated in NRPS		37 (7.61%)
Did not participate in NRPS		449 (92.4%)
Respondents re-interviewed in 2011/12 survey		**1876**
Participated in NRPS		419 (22.33%)
Did not participate in NRPS		1457 (77.67%)

Table A2 2008/09 Characteristics by Attrition Status in 2011/12

The elderly sample in wave 2008/09	**Full sample** *N*=2769	**Attritors** N=407	**Non-Attritors**			**Diff. (3)−(2)**
			All N=2362	Alive N=1876	Deceased N=486	
	(1)	(2)	(3)	(4)	(5)	
Independent living	0.510	0.541	0.505	0.537	0.381	-0.035
	(0.500)	(0.499)	(0.500)	(0.499)	(0.486)	
Age	73.630	71.921	73.925	72.811	78.222	2.003***
	(6.095)	(8.102)	(5.628)	(5.223)	(5.041)	
Male	0.506	0.496	0.507	0.494	0.558	0.011
	(0.500)	(0.501)	(0.500)	(0.500)	(0.497)	
Han	0.922	0.944	0.919	0.917	0.924	-0.025*
	(0.268)	(0.231)	(0.273)	(0.275)	(0.266)	
Married	0.580	0.595	0.578	0.606	0.469	-0.017
	(0.494)	(0.492)	(0.494)	(0.489)	(0.500)	
Years of schooling	2.240	2.522	2.191	2.302	1.765	-0.331**
	(2.961)	(3.157)	(2.924)	(2.961)	(2.741)	
Economically independent	0.366	0.469	0.348	0.394	0.169	-0.122***
	(0.482)	(0.500)	(0.476)	(0.489)	(0.375)	
Owns an apartment	0.627	0.717	0.611	0.648	0.471	-0.106***
	(0.484)	(0.451)	(0.488)	(0.478)	(0.500)	
Had a white-collar job before age 60	0.018	0.022	0.017	0.017	0.019	-0.005
	(0.132)	(0.147)	(0.129)	(0.128)	(0.135)	
Number of living children	4.180	3.764	4.252	4.261	4.217	0.487***
	(1.625)	(1.621)	(1.615)	(1.605)	(1.653)	
No IADL limitation	0.642	0.649	0.641	0.705	0.393	-0.008
	(0.480)	(0.478)	(0.480)	(0.456)	(0.489)	
MMSE Score	26.263	26.833	26.164	26.949	23.136	-0.669**
	(5.570)	(5.007)	(5.657)	(4.483)	(8.154)	
Total agricultural population	70.151	71.167	69.976	69.753	70.838	-1.191
	(35.893)	(33.141)	(36.350)	(36.081)	(37.392)	
Urbanization	20.928	23.524	20.481	20.532	20.283	-3.043***
	(15.673)	(16.867)	(15.418)	(15.597)	(14.720)	
GDP per capita	22.672	25.017	22.268	22.922	19.741	-2.749**
	(20.140)	(20.733)	(20.013)	(20.150)	(19.288)	
Government spending per capita	2.129	2.173	2.122	2.150	2.013	-0.052
	(1.518)	(1.620)	(1.500)	(1.516)	(1.433)	
Hospital beds per 10,000 persons	23.180	24.759	22.908	23.272	21.503	-1.851***
	(10.514)	(10.322)	(10.525)	(10.825)	(9.156)	

Note: *t*-test was applied to test the significance of the difference. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.