The Power of Social Pensions: Evidence from China's New Rural Pension Scheme

Wei Huang and Chuanchuan Zhang*

Abstract

This paper utilizes the county-by-county roll-out of China's New Rural Pension Scheme (NRPS) and finds that, among age-eligible people, the pension scheme leads to higher household income and food expenditure, less farm work, better health, and lower mortality. In addition, the NRPS shifts age-ineligible adults from farm work to nonfarm work but does not significantly affect their income, expenditure, or health. No significant evidence shows that the NRPS affects private transfers or health behaviors. These findings provide relevant evidence of the impacts of social pensions on individual behaviors and welfare for developing countries today and developed countries in the past. (*JEL* classifications: H55, I38, O20)

Keywords: Pension, Health, Elderly

*Wei Huang: National University of Singapore, National Bureau of Economic Research (NBER), and Institute of Labor Economics (IZA) (e-mail: huangw@nber.org); Chuanchuan Zhang: School of Economics, Central University of Finance and Economics (e-mail: ccz.zhang@gmail.com). We thank the editors Professor Ben Olken and Professor Ilyana Kuziemko and the referees for their constructive comments. We also thank Amitabh Chandra, David Cutler, Richard Freeman, Edward Glaeser, Lawrence Katz, Adriana Lleras-Muney, and David Wise for their helpful suggestions. We are also grateful for the comments received at theHarvard labor lunch, NBER-SAIF meeting, Peking Unviersity workshop, and CEC workshop. Wei Huang is also grateful for financial support from the Sloan Foundation to NBER for the Post-Doctoral Fellowship Program on the Economics of an Aging Workforce (Grant 2013-10-22) and startup fund support from the National University of Singapore (WBS: R-297-000-138-133). Chuanchuan Zhang acknowledges financial support from the National Natural Science Foundation of China (71503282) and the Fok Ying-Tong Education Foundation for Young Teachers in the Higher Education Institutions of China. All errors are ours.

"To care for those who once cared for us is one of the highest honors."

— Tia Walker, The Inspired Caregiver: Finding Joy While Caring for Those You Love

1 Introduction

Because of low fertility and rapid population aging, old-age support in rural China faces unprecedented challenges and has become a serious social problem. In 2009, to support the elderly in rural regions, the Chinese government launched a large social pension program, the New Rural Pension Scheme (NRPS). The NRPS is an unprecedented welfare program covering the largest population in human history. In 2011, 89 million rural pensioners received pension benefits and 326 million rural residents participated in the NRPS. By the end of 2012, the Chinese government allocated more than 262 billion yuan (approximately US$41 billion) to the NRPS.[1] Meanwhile, the poverty rate in China decreased significantly, from 14.7 percent in 2008 to 7.9 percent in 2011 and then further declined to 1.9 percent in 2013.

Exploiting the temporal and regional variation in the implementation of the NRPS, we aim to address the following questions: First, how does the provision of pensions affect household behaviors, such as labor supply, income, transfers, and expenditures? Second, do pensions affect the health of pension recipients and, if so, what is the possible mechanism? Third, how does the provision of pensions affect people of different ages, such as age-eligible seniors and age-ineligible adults?

The answers to these questions are important for several reasons. First, although most developed countries established public pension programs nearly 100 years ago and most retirees are

[1] A comparable program is the National Rural Employment Guarantee Scheme in India (NREGA, later named as MGNREGA), which aims to enhance livelihood security in rural areas by providing at least 100 days of wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work. The Indian government declared that the NREGA program, which has covered all the districts in India since April 1, 2008, was "the largest and the most ambitious social security and public works programme" in the world (Shah et al. 2015, p. ix). According to the Minister of Rural Development in India, approximately 50 million households were provided employment under the MGNREGA program every year from 2008 to 2012, and approximately US$25 billion was spent to pay wages from 2006 to 2012 (Shah et al., 2015). The Chinese NRPS exceeds the MGNREGA program in terms of enrollees and financial input.

covered by formal retirement schemes, the noncontributory public transfer program remains an important component of the social security system. Second, similar to the NRPS, over the past two decades, many developing countries have introduced or expanded large social pension programs to cover the vulnerable elderly who are not covered by formal retirement schemes (Willmore, 2007; Levy and Schady, 2013) Such programs include social pension reforms in South Africa (Case and Deaton, 1998; Duflo, 2000; Jensen, 2004), Brazil (de Carvalho Filho, 2008, 2012), and India (Kaushal, 2014). Therefore, the effects of the NRPS not only provide suggestive evidence for the effects of pension programs in developed countries throughout history, which has not been rigorously examined, but also insights for evaluating and reforming noncontributory public transfer programs in developing countries today. In addition, the impacts of these programs on individual behaviors and social welfare are of great importance in themselves, given the large number of beneficiaries and huge financial inputs.

The NRPS was launched in 2009, rolled out on a county-by-county basis, and covered all the counties in mainland China by the end of 2012. Once a county was covered, all of that county's rural population who are aged 16 years and older could *voluntarily* participate.[2] During the roll-out period, enrollees aged 60 years and older could receive a fixed pension, regardless of previous earnings or income, of 55 yuan (approximately US$9) per month. Among rural households with members aged 60 years and older, the median monthly income *per capita* in our sample is only 200 *yuan*. In our nationally representative sample, approximately 8 percent of seniors have a household income of less than 55 *yuan* per month. Therefore, we emphasize that 55 yuan is not a trivial amount for rural seniors and expect large impacts among age-eligible rural seniors. Correspondingly, we follow Jensen (2004) to explore the impacts among rural people younger

[2]Only those with rural *hukou* could participate. *Hukou* is a household registration system in China that refers to the registered residency status of a particular individual (Cheng and Selden, 1994). In its original legislation, the *hukou* system was justified as having been created to "maintain social order, protect the rights and interests of citizens and to be of service to the establishment of socialism." Citizens were divided into agricultural or non-agricultural *hukous* (commonly referred to as rural or urban) and further categorized by location of origin. In recent China, individuals are free to move and relocate. For most migrants in China, however, the *hukou* may not be altered. Social insurance and welfare programs in China are connected to the *hukou* system, which assigns benefits based on rural and urban status. The NRPS only targets older rural people. Most of the older urban population is covered by the urban basic old-age insurance scheme, which is independent of the NRPS, and a combination of pay-as-you-go and funded systems.

than 60 years, who comprise a natural comparison group since they are eligible to participate in the NRPS but are not eligible to receive the pension. We also explore the impacts among urban *hukou* people in the same counties. We expect little effect among this group because urban seniors are not eligible for the NRPS and the existing pension policy for urban seniors is independent of the implementation of the NRPS.

We combine data from the two largest ongoing individual surveys covering 2010 to 2013 to identify the effects of the program. This nationally representative sample includes more than 70,000 observations from more than 300 counties. We use the county-by-county roll-out of the NRPS and employ the difference-in-differences (DID) methodology to identify the effects of the NRPS provision. The validity of the DID estimation should not be taken for granted, as the pilot counties in each round of the NRPS were not chosen randomly. We divide the counties by the starting year of the NRPS and plot a series of separate local macroeconomic indexes from 1999 to 2012, including gross domestic product (GDP) *per capita*, share of rural population, government revenues and expenditures, savings, and number of hospital beds. We find no significant parallel pretrends across counties for these indexes.

We first examine the impact of the NRPS on incomes and expenditures. Rural people older than 60 years are 25 percentage points more likely to receive a pension after the introduction of the NRPS. Consistent with the NRPS policy, the introduction of the scheme has small and insignificant effects on pension receipt among rural citizens younger than 60 years and among China's urban population. Consistently, the NRPS increases household income, total expenditure, and food expenditure among rural people older than 60 years. No significant evidence shows that the NRPS crowds out private transfers. By contrast, for rural people younger than 60 years and urban individuals older than 60 years, we find no evidence of any significant effects on household incomes, expenditures, or private transfers.

We follow the same methodology to examine the effects on labor supply. Among rural people older than 60 years, we find that the NRPS significantly reduces labor supply by 3.0 percentage points. Dividing labor supply into farm work and nonfarm work, we find that the NRPS sig-

nificantly reduces the proportion of farm work by 3.6 percentage points. The magnitude of the reduction in labor supply is comparable to the impact of the expansion of pensions in India, as estimated by Kaushal (2014). Our estimates also imply an elasticity of labor supply with respect to nonlabor income of -0.32. The income effect on labor supply is consistent with comparable estimates in previous studies (Blundell et al., 1998; Ashenfelter et al., 2010; Cesarini et al., 2017), where the income effects range from -0.1 to -0.5. Similarly, for rural people younger than 60 years and urban individuals older than 60 years, we find no evidence of a significant effect on labor supply. Interestingly, among rural adults younger than 60 years, the NRPS significantly reduces the proportion of farm work by 5.8 percentage points and increases the proportion of nonfarm work by 3.3 percentage points. The results suggest that the NRPS-induced higher (expected) income deters people from doing heavy farm work, while those younger than 60 years need to pay the current pension premiums and therefore participate in income-generating jobs such as nonfarm work.

Finally, we investigate the effects on health outcomes for the elderly. Among rural people older than 60 years, the NRPS improves health status in terms of disability and being underweight. The magnitudes range from 10 to 15 percent of the mean values. Using panel data on the oldest (65 years or older) population in China, we also find that the NRPS lowers the mortality rate by 12 percent. Our calculations suggest an income-mortality elasticity of -0.38, which is comparable to the elasticity of -0.21 suggested by Jensen and Richter (2004). There is no significant effect on health behaviors, such as smoking, medical care usage, inpatient and outpatient hospital visits. Furthermore, we find no significant effects on any of the above health outcomes among pension-ineligible groups.

The results suggest that pension provision affects the behavior, health, and welfare outcomes of people of different ages. On the one hand, rural people older than 60 years benefit from the pension program: they are less likely to do farm work, and they spend more money on food, implying that they are less likely to live on the crops they have grown. This effect may further contribute to reducing the health risks of malnutrition or physical dysfunction, which could be especially relevant for those older than 60 years. On the other hand, the effects on age-ineligible

adults (i.e., the middle-aged) are less clear.

These findings contribute to several strands of the literature. By comprehensively analyzing the impact of China's NRPS, on various outcomes, we provide new answers to the questions of whether and how social pensions improve the well-being of seniors. The paper therefore contributes to the growing literature on social pensions in other developing countries (Ardington et al., 2009; Case, 2001; Case and Deaton, 1998; Case and Wilson, 2000; Duflo, 2000, 2003; Jensen, 2004; Juarez, 2009; Kaushal, 2014) and also adds to studies on pension reforms in developed countries (for examples Attanasio and Rohwedder, 2003; Attanasio and Brugiavini, 2003; Bitler et al., 2005; Madrian and Shea, 2001; Snyder and Evans, 2006).

In addition, by estimating the effects on income, labor supply, and mortality, we can estimate the elasticity of labor supply with respect to nonlabor income among older people in rural China. On the one hand, this adds to the literature on the income effects of labor supply (e.g., Krueger and Pischke, 1992; Diamond and Gruber, 1999; Gruber and Wise, 2002; Mastrobuoni, 2009; Gustman and Steinmeier, 2015; Cesarini et al., 2017). On the other hand, the significant evidence that the provision of pension improves health outcomes provides new evidence to the mixed findings in this literature by Case and Wilson (2000), Case (2001), Jensen and Richter (2004), and Snyder and Evans (2006).

Finally, most of the existing studies on the pension system in China, such as Feldstein (1999), Leisering et al. (2002), Wang (2006), Feng et al. (2011), and Fang and Feng (2018), are descriptive and introductory. This paper contributes to this literature by providing a rigorous analysis of the effects of the recent provision of social pensions in China on a series of outcomes.

2 Background of the NRPS

Although the past 30 years have witnessed great development of China, poverty is still a salient problem in the country. By the end of 2008, more than 250 million people in China would be considered poor according to the poverty line proposed by the World Bank (daily income less than

US$1.90). The Chinese government established an old-age security system with a relatively high coverage rate and generous payments for urban employees in the early 1990s, but the rural elderly were still mainly to rely on family support. Because of the absence of old-age social security programs, the poverty problem was much more severe among the rural elderly. For example, according to China's mini-census survey conducted at the end of 2005, 67.5 percent of China's rural elderly people have no labor income, and 91 percent live on transfers from their children. The situation motivated the Chinese government to initiate a social pension program in the country's rural regions.

The NRPS started in September 2009 and reached universal coverage by the end of 2012 after four rounds of expansions. We requested data on the timing of the NRPS coverage across counties from China's State Council Leading Group Office of Poverty Alleviation and Development and received their official formal reply.[3] Figures 1a through 1d show the counties in mainland China that were covered by the NRPS each year from 2009 to 2012. Approximately 12 percent (about 320) of all the counties were covered in the first wave (2009), 16 percent (450 counties) in the second wave (2010), 38 percent (about 1,075 counties) in the third wave (2011), and the remaining 34 percent in the last wave (2012). In this study, we exploit the county-by-county roll-out of the NRPS and conduct DID regressions to identify the effects of the new pension scheme. China's central government decided in which counties the NRPS would be initiated each year. As stated in the official documents, the government aimed to distribute the approved counties evenly across regions in the first wave. In the next two years, the central government tended to start the NRPS earlier in counties in the country's middle and western regions.

After a county was covered by the NRPS, all rural people who were age 16 years or older (excluding students) could voluntarily participate in the scheme. All the enrollees who were age 60 years or older at the start of the NRPS were eligible to receive 55 yuan (about US$9) per

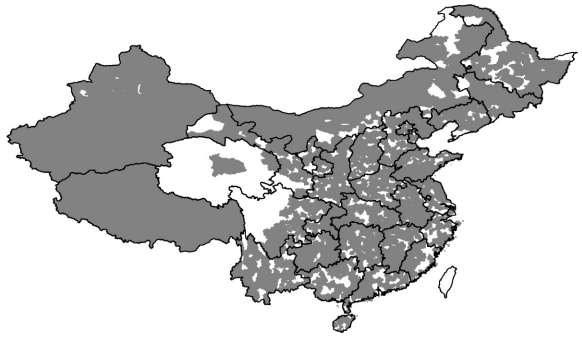
[3]Specifically, this information was formerly provided by the Ministry of Civil Affairs (MCA), the administrative department in charge of the NRPS. Management of the NRPS has been transferred to the Ministry of Human Resources and Social Security (MHRSS). One needs to apply to the MHRSS for this information. Disclosure Office of Government Information. 2009-2012. "County list of Pilot New Rural Pension Scheme." Ministry of Human Resources and Social Security of the People's Republic of China. http://www.mohrss.gov.cn/gkml/gklxfs/. (accessed June, 2016)

Figure 1: County-by-County Roll-Out of the NRPS over Time

(a) First round, November 2009

(b) Second round, July - October 2010)

(c) Third round, July - September 2011



(d) Fourth round, July - October 2012

Note: The county roll-out data for the NRPS coverage are from the State Council Leading Group Office of Poverty Alleviation and Development. The data are not public and the researchers needed to apply for the data directly from the office. The maps are for illustrative purposes only and are not indicative of the actual geographic information.

month, regardless of previous earnings or income. But there is a prerequisite for pensioners with adult children: their children are required to participate, and they must choose 100, 200, 300, 400, or 500 yuan as their annual contribution.[4]

Starting from age 60, the pension benefits are the sum of the accumulated total funds in the individual's account plus the basic pension benefit. The basic pension benefit is similar to a defined benefit plan but with no work limits, which is similar to the universal basic income plan discussed in Hanna and Olken (2018). This differs from the usual defined benefit pension plans or government-sponsored social welfare programs: it is fully sponsored by the government instead of employers, and the basic pension benefit is not means-tested. The individual account is a defined contribution plan. The government is responsible for making investment decisions and managing the plan's investments. The government guarantees a rate of return, which equals the one-year time deposit rate.[5]According to the formula, pension benefits are paid out as follows: at age 60, a pensioner begins receiving a monthly benefit (1/139 of the total accumulation) from their individual account and a basic pension benefit of 55 yuan per month.[6]

When the NRPS started, there were no deposits in the individual account among the rural enrollees who were ages 60 and above. Therefore, they only received the basic pension benefit from the government. Since there was almost no variation in the amount of the pension payment across regions when the data were collected, we only exploit the variation in the timing of the implementation of the NRPS to identify the effects.[7] There may be a concern that the consequential

[4]Based on our field experience, it has been difficult to implement this requirement. Because some adult children of the age-eligible elderly were working outside the county and unable to enroll, the requirement lowered the take-up rate and delayed the expansion of the program. A director in the Ministry of Human Resources and Social Security, who is in charge of the NRPS, told us that the government abandoned this requirement to promote the participation of the rural elderly.

[5]China has a segregated and complicated pension system, consisting of several schemes covering different groups. The NRPS is different from other pension programs covering urban workers or unemployed urban residents. Fang and Feng (2018) provide an overview of China's pension system.

[6]For instance, a participant who at age 45 chooses to pay a yearly premium of 100 yuan will have a total amount of 1,838 yuan accumulated in their individual account (assuming the rate of return to the individual's account funds equals the one-year deposit rate) and will receive a monthly benefit of 68.22 yuan (1838/139+55). Those who were already age 60 years at the time the pension program started automatically receive a basic pension benefit (i.e., 55 yuan per month) without paying any premiums. The Chinese government increased the basic pension benefit to 75 yuan per month in 2014.

[7]The monthly pension benefits (including the basic pension benefit and the individual account payments) during the period under study are merely the basic pension benefit. The basic pension benefit (55 yuan per month) was set by

effects of the NRPS could be small, as the pension benefit amounts to only 55 yuan per month. However, it is noteworthy that 55 yuan per month is not a trivial amount for China's rural elderly because they are very poor. Figure 2 plots the distribution of household income *per capita* among the rural seniors. Among rural households with members age 60 years or older, the median monthly income *per capita*, including transfers from the government and relatives, is approximately 200 yuan in our sample. There is a significant proportion (about 8%) of senior people whose household income is less than 55 yuan per month. For households with extremely low income, the increase in household income could be over 100 percent because of the additional 55 yuan. It is also noteworthy that this amount of money may be enough to guarantee the basic survival of an older person, because prices are low in rural China. For example, in the rural regions of Shandong province, a senior who relies solely on his/her pension could purchase one large or two small steamed buns or a bowl of rice per day.[8]

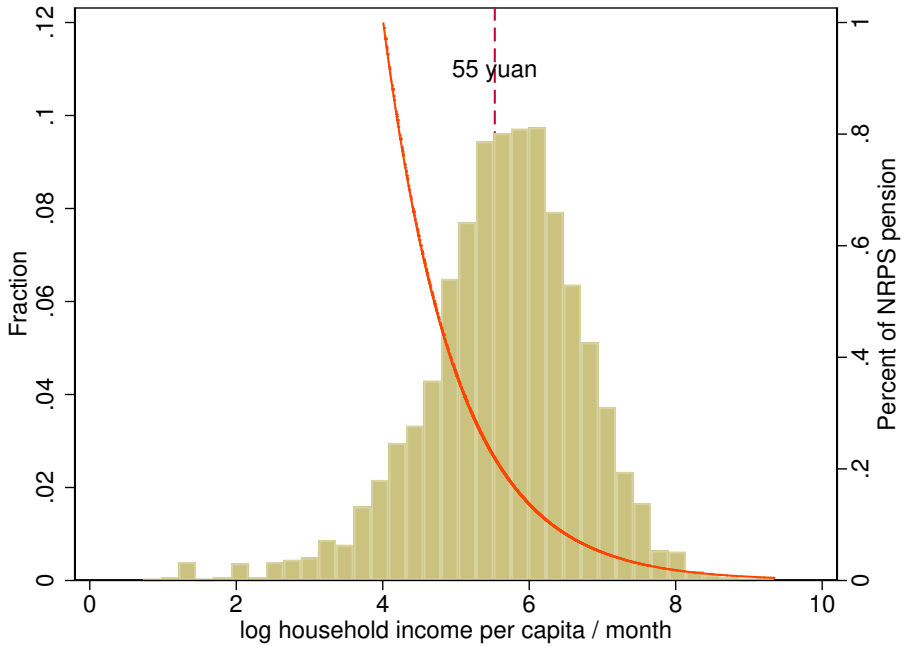
The NRPS refers to the "new" rural pension scheme to distinguish it from the old rural pension scheme, which was initiated in 1992. The old rural pension scheme was somewhat like an organized savings account, with premiums accumulated in an individual account and accrued at a low interest rate (Leisering et al., 2002). At the height of the old rural pension scheme, 75.4 million people in China invested in these accounts, but the amount of pension it afforded each retiree was very small. Development of the old pension scheme stagnated after 1998, partly due to widespread mismanagement of the funds and the insignificance of the program (Shi, 2006; Wang, 2006). In 2005, the enrollment rate in the old rural pension scheme had dropped to less than 3 percent, according to China Agricultural Statistical Yearbooks.

The NRPS is the first such large and generous welfare program in rural China. The NRPS is also an unprecedented welfare program, covering the largest population in human history. In 2011,

the central government. Although the local governments are allowed to provide more generous pensions to the elderly, they have to sponsor such extra payments themselves. In practice, most of the local governments pay the basic pension benefit of 55 yuan per month. A few counties provided a larger pension benefit, such as 60 or 65 yuan per month. Unfortunately, we do not have information about which counties followed the "55 yuan" standard or which provided a larger amount.

[8]The website (http://toutiao.com/i6271139303825342977/) shows what one yuan may buy in rural Shandong province.

Figure 2: Distribution of Household Income of Seniors in Rural China



Note: Data are from the CHARLS and CFPS. The orange solid line denotes the 55 yuan as a percentage of household income for households at different income levels.

89 million rural seniors began receiving pensions. By the end of 2012, China's central and local governments had contributed more than 262 billion yuan (about US$41 billion) to the NRPS, with more than 232 billion yuan (about US$37 billion) from the central government.

The pension distribution method is determined by the local governments. Anecdotal evidence from some counties in Jiangsu and Zhejiang suggests that the local government establishes individual bank accounts for each pensioner and automatically transfers the pensions to these accounts. In some less developed regions, however, pensioners (or their children) must travel to designated places in local villages to collect their pensions.

The NRPS funding is strictly regulated to avoid corruption and fraud. To ensure that eligible pensioners receive the pensions for which they qualify, the central government requires local governments to provide the personal information, which is updated annually, of each enrollee. After verification, the appropriate funding amount is calculated. Pensioners' children can pick up their parent's pension if the pensioner is ill, confined to bed, or lives in a less developed region. In this

case, the pensioner's child must provide evidence that the pensioner is alive. This evidence could be a recent video or certification from a local government official who has personally and recently visited the pensioner.

3 Data

3.1 China Family Panel Studies and China Health and Retirement Longitudinal Studies

The main sample used in our study is from the China Family Panel Studies (CFPS) and the China Health and Retirement Longitudinal Studies (CHARLS) (Zhao et al., 2015a,b; Institute of Social Science Survey, Peking University, 2015).[9] The CFPS is a biennial survey designed to be the Chinese equivalent of the U.S. Panel Study of Income Dynamics. The first national wave of the CFPS was conducted in 2010. The five main parts of the CFPS questionnaire include data collected on communities, households, household members, adults, and children. The CHARLS is also a biennial survey that aims to collect a nationally representative sample of Chinese residents ages 45 years and older. The survey is designed to be the Chinese equivalent of the Health and Retirement Survey in the United States. More details about the two data sets are provided in the appendix. The baseline national wave of the CHARLS was fielded in 2011. This study uses the 2010 and 2012 waves of the CFPS and the 2011 and 2013 waves of the CHARLS.

To exploit the regional and temporal variations in the expansion of the NRPS from 2009 to 2012, we pool the CFPS and CHARLS data to make a larger sample. The CFPS and CHARLS data are nationally representative and consistent for the variables used in this exercise. The CFPS covers 162 counties, and the CHARLS covers 150 counties. This main sample comprises more than 70,000 observations (about 34,000 from the CFPS and 36,000 from the CHARLS). In the

[9]CFPS data: Institute of Social Science Survey, Peking University, 2015, "China Family Panel Studies (CFPS)", https://doi.org/10.18170/DVN/45LCSO, Peking University Open Research Data Platform, V20; CHARLS data: Yaohui Zhao; John Strauss; Gonghuan Yang, 2015, "China Health and Retirement Longitudinal Study (2011 baseline)", https://doi.org/10.18170/DVN/IZU8OF, Peking University Open Research Data Platform, V1 and Yaohui Zhao; John Strauss; Gonghuan Yang, 2015, "China Health and Retirement Longitudinal Study(2013 wave2)", https://doi.org/10.18170/DVN/AQIU6C, Peking University Open Research Data Platform, V1.

sample, 49 percent of the individuals are male. The individuals are age 59 on average, and 72 percent of them have rural *hukou*. In the sample, only 19 percent of the counties were covered by the NRPS in 2010, then it increased to 31 percent in 2011 and 69 percent in 2012. All the counties were covered in the 2013 survey. Since the CHARLS and CFPS surveys were conducted during the summer vacation, and the pilot counties in each round were decided in the second half of each calendar year, the CHARLS and CFPS data were collected before the implementation of the NRPS in each calendar year. Therefore, whether a county is affected by the NRPS is determined by whether the county belongs to the previous round of the NRPS pilot. According to our sample, the proportion of rural individuals participating in any pension program increased from 13 percent in 2010 to 26 percent in 2011, 57 percent in 2012 and, 70 percent in 2013.

Not all eligible people participated in the NRPS immediately after its implementation. First, the transmission of information about the NRPS took some time and some eligible people might not have been aware of the roll-out of the NRPS. Second, rural people in China who experienced the introduction and collapse of the old rural pension scheme might not have expressed much interest at first because they may have lacked confidence in the government. Finally, it is possible that the adult children of eligible people did not want to participate, given that they would have had to contribute.[10]

Because different counties were sampled in two surveys (CFPS and CHARLS), we include a dummy variable for the data source and interact it with the counties throughout the analysis. In addition, we re-weight the sample by the representative population in the region and find that the results are very robust. Finally, we conduct the analysis using each data set and find that the results are consistent in general.[11]

[10] In a recent study, Zhang (2019) argues that the prior belief of relying on children for old-age support decreases the take-up of pension benefits among the rural elderly.

[11] The results are consistent in sign tests, but the magnitude and significance vary in the two data sets. The results are reported in Appendix B.

3.2 Chinese Longitudinal Healthy Longevity Survey

The Chinese Longitudinal Healthy Longevity Survey (CLHLS) is a longitudinal survey that aims to improve understanding of Chinese citizens' healthy longevity (Center for Healthy Aging and Development Studies, 2016).[12] The baseline survey of the CLHLS was conducted in 1998; follow-up surveys with replacements for the deceased were conducted every three years in a randomly selected half of the total number of counties and cities in 22 of the 31 provinces in mainland China. However, the earlier waves only surveyed people older than 80 years, and the sample sizes were smaller. Therefore, we chose the sample that began in 2005, which also included citizens ages 65-79 years. Since the 2005 survey, the CLHLS followed respondents in 2008, 2011, and 2014. For each year interviewed, the CLHLS collectsinformation on basic demographics,socioeconomic status, and health outcomes among the old people. The average age of individuals in the CLHLS is 84, and 45 percent of the respondents are men. The CLHLS data are for the oldest old and are not directly comparable to the CHARLS and CFPS data.

We use CLHLS data to investigate the impact of the NRPS on mortality because the data provide the survival status of respondents when interviewed and the recorded dates of death for those who were deceased. To do so, we construct an individual panel for mortality from 2006 to 2014. Specifically, if a person is alive in 2014, then this variable is consistently equal to zero for the nine years. If the person died in year t, the value of this variable is set to zero for the years prior to year t and is set to one for year t and missing for the years that follow. In this way, we generate a dummy variable to denote the individual mortality status in each year. During 2005-2011, the one-year mortality rate was 13 percent, and people survived for 4.4 more years on average. We could not construct a similar panel for other variables, such as income, labor supply, and health.

[12]Center for Healthy Aging and Development Studies, 2016, "The Chinese Longitudinal Healthy Longevity Survey (CLHLS)-Longitudinal Data (1998-2014)", https://doi.org/10.18170/DVN/XRV2WN, Peking University Open Research Data Platform, V1

4 Methodology and Empirical Results

4.1 NRPS Beneficiaries

Who started receiving pensions from the NRPS? The answer is important for understanding and interpreting the results of our research into the possible effects of the NRPS. By doing so, we can also test for the mechanical effects of the NRPS and provide evidence of policy effectiveness. Following the strategy of Hoynes et al. (2012), we estimate the following equation:

$$Receipt_{ict}^{s} = \alpha_0^s + \alpha_1^s NRPS_{ct}^{s} + \delta_c^s + \delta_t^s + X_{ict}^{s} + \varepsilon_{ict}^{s} \tag{1}$$

The superscript s indicates a specific subsample, which can be a group of people with certain characteristics. The dependent variable, $Receipt_i^s$, is an indicator of the household of individual i who may have received a pension. The key independent variable, $NRPS_{ct}$, is an indicator of whether county c implemented the NRPS in year t. The covariates include county dummies (δ_c), year dummies (δ_t), and other demographic controls (X_{ict}) such as gender, age and its square, and dummies for the education level of individual i. The coefficient on $NRPS_{ct}$, α_1^s, captures the short-term effects of the NRPS on pension receipt in subsample s. All the standard errors are clustered at the county level.

We divide the whole sample based on age and *hukou* eligibility: rural people age 60 years or older, rural people younger than age 60, urban people age 60 years or older, and urban people younger than age 60. The first is the only group of people who are eligible to enroll in the pension scheme and receive 55 yuan per month. The second group of people are eligible to participate in the NRPS but not to receive the pension. The third and the fourth groups are ineligible to participate in the NRPS. We conduct the regressions as shown in equation (1) for each subsample. The results are shown in Figure 3, panel a. Each point and the corresponding intervals plot the coefficient α_1^s with the 95 percent confidence interval from the separate regression estimation of equation (1) for subsample s. The plotted points show the effects of NRPS coverage on the outcome variables among the individuals in the corresponding subsamples. First, all the effects among China's urban

population are statistically insignificant. Second, among rural Chinese younger than age 60, the effects are insignificant, and not significantly different from those among urban individuals. Third, among rural people who are older than age 60, all the effects are positively significant. The general pattern is fairly consistent with the policy's design and verifies that only rural people over age 60 years are eligible to receive a pension.

As shown in Figure 3, panel a, the immediate take-up rate ranges from 20 to 40 percent, which is far from 100 percent. In addition to the reasons stated in the previous section, the low take-up rate may have been because the regressions here only identify short-term effects. Further, it took some time for local governments to design the policy details and prepare the necessary documents for the implementation of the NRPS.

In Figure 3, panel b, we restrict the sample to those ages 60 years or older with rural *hukou*. Panel A shows the point estimates for men and women. The effects are significant for men and women, but the difference between the two is insignificant. Panel B divides the sample by education level; the effects among the three groups are similar (i.e., all the coefficients are between 0.2 and 0.3). Panel C divides the sample by county income level in 2005 and shows that the effect of the NRPS on receipts in poorer regions is much larger than that in wealthier regions. This finding is consistent with the expectation that people in regions with higher levels of poverty would have a higher incentive to enroll in the NRPS.

4.2 Effects of the NRPS

4.2.1 Econometric Model

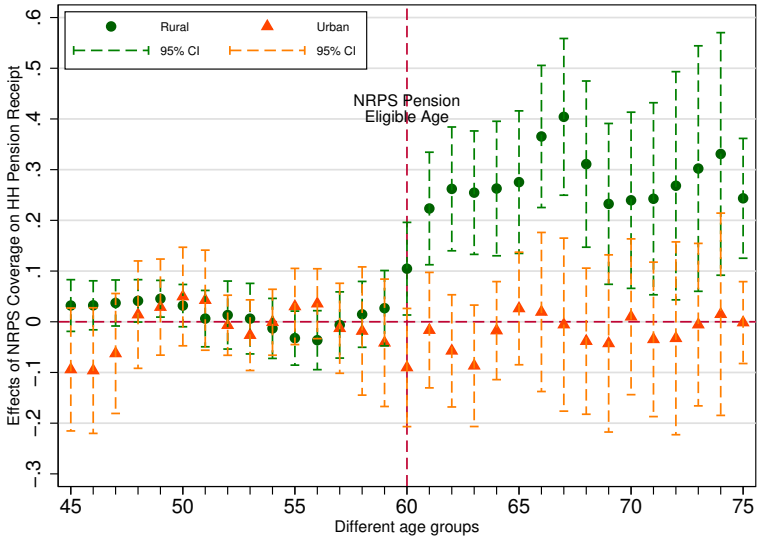
We use the same framework to investigate behavioral responses to the NRPS:

$$Y_{ict} = \beta_0 + \beta_1 NRPS_{ct} + \delta_c + \delta_t + X_{ict} + \varepsilon_{ict} \tag{2}$$

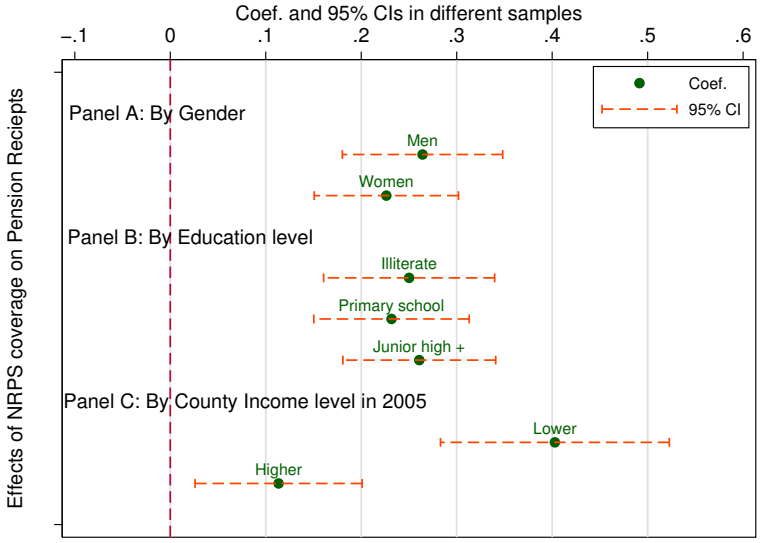
The dependent variable Y_{ict} is the potential outcome: household incomes, expenditures, private transfers, and so forth. All the other variables are the same as those in equation (1). The standard errors are clustered at the county level. The estimation is based on the differences between before-

Figure 3: Effects of the NRPS on Pension Receipts

(a) By type of *hukou* and age



(b) By gender, education and initial income level



Note: The data are from the CFPS and the CHARLS. Panel a divides the sample by the type of hukou (urban or rural) and age (years). Panel b only uses the pension-eligible sample and divides it by gender (panel A), education level (panel B), and county income level (panel C). Each point and the corresponding 90 percent confidence interval are based on a separate regression of equation (1). The plotted points show the effects of the NRPS coverage on pension receipts among the individuals in the corresponding subsamples. The confidence intervals are calculated based on the standard errors clustered at the county level.

after changes in outcomes of the treated group and during the same time period in the control group.[13] The validity of our identification depends on the exogeneity of the introduction of the NRPS across counties. Since counties implemented the NRPS in different years, the counties may not be randomly selected and the DID estimator, β_1, is subject to several limitations.

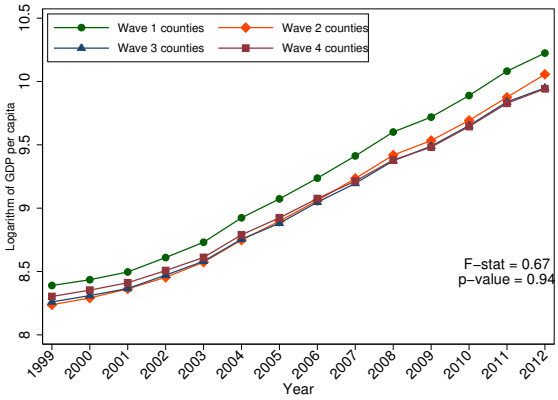
Most importantly, the estimation presumes that the trend of the outcome variable Y_{ict} in the treated group would be parallel to that in the control group had the NRPS not been introduced. We provide several pieces of evidence for this. First, we match the data to the counties and plot the economic indexes over the calendar years by the wave in which the county started the NRPS. Figure 4, panel a, shows the pattern for the logarithm of GDP *per capita*. The time trends are fairly parallel across the counties with different NRPS starting years. Similar patterns are found for the other outcome variables, including share of rural population, government revenues and expenditures, savings, and hospital beds. These results suggest that there are no significant differences in the county-level economic indexes, regardless of the year in which the NRPS was implemented. We also conduct F-tests for parallel trends in the economic indexes. The F-stat and corresponding p-values are reported in each figure. The tests suggest there are no significant nonparallel trends.

Since there are two waves of CLHLS data (i.e., 2005 and 2008) before the introduction of the NRPS, we use these two waves of data and estimate the main model on the health, labor supply, and income outcomes in this pretreatment period. Specifically, we conduct a series of placebo tests to investigate how the regressions would look if the NRPS had happened two to four years before the actual implementation in the counties. The relevant outcomes include self-reported health fair or poor, health worse than previous year, depression, disabled, life quality fair or poor, working status, and household income. Table B1 in the appendix reports the results. For each outcome, we have three separate regressions for different periods. In the 21 regressions, only one is significant at the 10 percent level. These results suggest that the pre-trends of these outcomes are not significantly

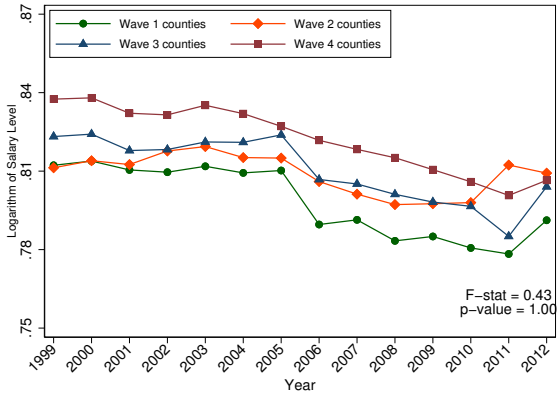
[13]The estimation leads to the intention-to-treat effects, averaging across individuals enrolled and not enrolled in the NRPS. We do not estimate the treatment on the treated effects, which can be obtained through instrumenting the individual take-up status by the NRPS roll-out, because previous literature, such as Angelucci and De Giorgi (2009), finds that the cash transfer program also indirectly affects the behaviors of the ineligible households in the same villages. The treatment on the treated effects estimated at the individual level could be misleading if this spillover effect exists.

Figure 4: Examination of Pre-trends in the Counties, by NRPS Starting Year

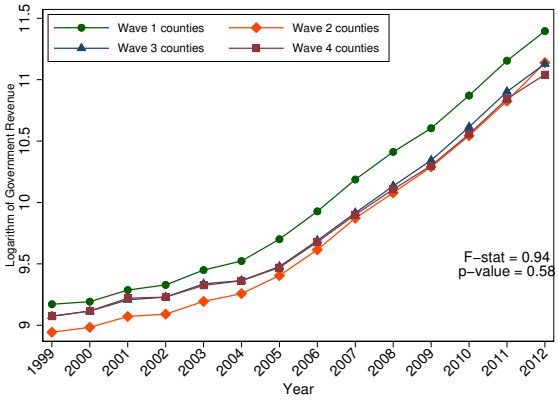
(a) Log(GDP *per capita*)



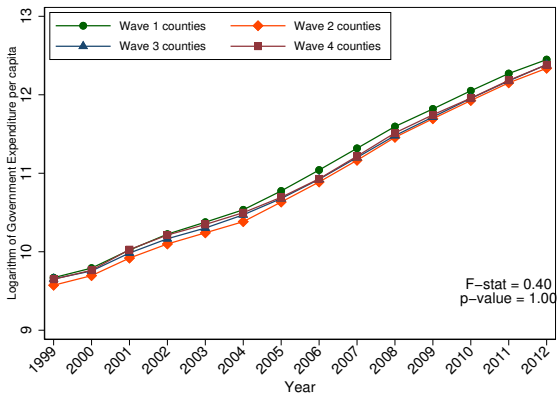
(b) Share of rural population



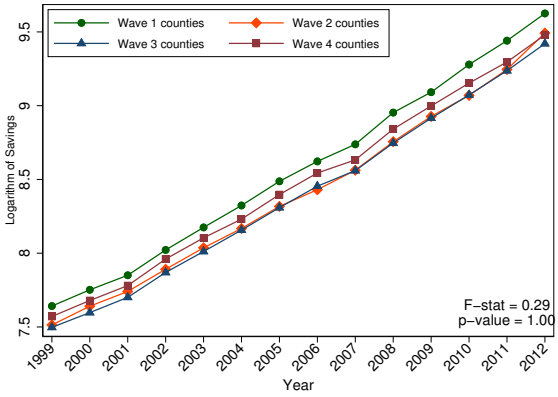
(c) Log(Government Revenue)



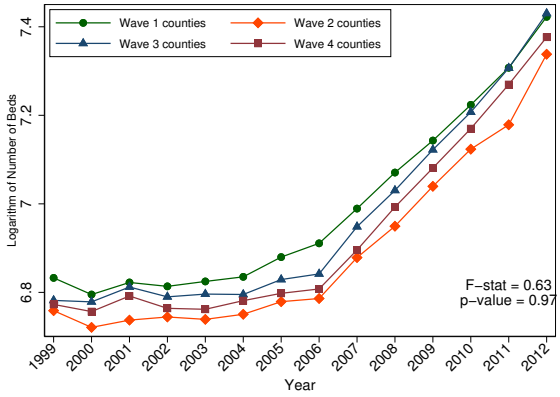
(d) Log(Government Expenditure)



(e) Logarithm of Saving



(f) Log(Number of Beds in Hospitals)



Note: The economic indexes from different counties are from the China County (City) Social and Economic Statistical Yearbooks. The counties are grouped by the different starting years of the NRPS. Each figure plots the mean values of the logarithm of the economic indexes from 1999 to 2012.

relevant to the timing of the NRPS implementation.

In our main analysis, we divide the whole sample based on age and *hukou* eligibility, leaving us with one treated group (rural people age 60 years or older) and three comparison groups (rural people younger than age 60, urban people age 60 years or older, and urban people younger than age 60). We use the comparison groups to test the robustness and validity of the results. It is acknowledged that these groups may not be ideal control groups. First, urban and rural people differ in many ways. Second, those younger than age 60 in the villages covered by the NRPS may have different expectations, since the enrollees can receive a pension once they reach the pension-eligible age, and enrollees who are younger than age 60 must pay premiums.

Because of data limitations, we used the current county of residence rather than the registered county in the regression. One concern is about migration. If the factors affecting migration are correlated with the timing of the implementation of the NRPS and outcomes such as income and health, the estimates will be biased. We argue that this is not a serious issue. First, among the rural seniors, 97 percent are living in their registered county. Second, we show that the timing of the roll-out of the NRPS is not correlated with cross-county migration. We will come back to this later.

4.2.2 Effects of the NRPS on Household Income

Table 1 shows the results of the effects of the NRPS on receiving a pension and household incomes. Panels A and B present the results for those age 60 years or older and those younger than 60 years, respectively. The first two columns examine the effects of those with rural *hukou*. Consistent with Figure 3, the estimates suggest that NRPS coverage ($NRPS_{ct}$) significantly increases the probability of a household receiving a pension by 25 percentage points among rural households with people age 60 years or older. Consistent with this, NRPS coverage also significantly increases household income by 18 percent. In contrast, panel B shows that the effects among rural but age-ineligible people are much smaller and insignificant. Columns 3 and 4 in Table 1 show that there are no significant effects of the NRPS on pension receipts and household incomes among urban households

in China.

We also compare the estimates between the treated group (rural people ages 60 and older) and the corresponding comparison group (urban people ages 60 and older or rural people younger than age 60). The F-statistics and p-values are reported at the bottom of the corresponding columns in Table 1. For example, the F-statistic and p-value in panel A, column 3, test the differences between the estimates in columns 1 and 3 of panel A. The significant difference implies a significant estimate if we conduct a triple-difference estimation pooling the rural and urban samples together and using urban old people as the control group. As shown in the table, the estimates for the treated group are significantly different from those for both comparison groups.

It should be noted that pension receipt is based on reported measures. According to the experience of the interviewers from CHARLS, many old people in rural areas did not realize that they were receiving a pension from the government.[14] The measurement error is not random for pension receipt, because those who did not receive any pension should not misreport that they had a pension. Therefore, our estimates on the effects on pension receipt may be attenuated.

There may be a concern that the effects of the NRPS on income are too large. As we have discussed in the background section, rural seniors in China are very poor. The large effects of the NRPS are mainly driven by the very poor seniors. In a regression where we dropped the poorest seniors whose household *per capita* income was less than the payment of the NRPS (about 8 percent of the sample), the coefficient of the NRPS on household income is 0.1, which is 40 percent lower than the estimate in Table 1. Consistently, as shown in Figure 3, panel b, the impact on pension receipt is also larger in the lower-income regions.

4.2.3 Effects of the NRPS on Labor Supply

The NRPS-induced changes in household income may originate not only as a consequence of receiving a pension, but also because pensioners may alter their labor supply behavior (Gruber, 1994; Gruber and Wise, 1997, 2002). Table 2 displays the results of our examination of the labor

[14] They might call it "support" from the government but have no idea about whether it is a "pension." Or, their children might collect the pension money for them and not tell them.

Table 1: Effects of the NRPS on Pension Receipts and Household Income, by Type of *hukou* and Age Eligibility

	(1)	(2)	(3)	(4)
Sample	Rural *hukou*		Urban *hukou*	
Variables	Household receiving pension (Yes = 1)	Log (Household income)	Household receiving pension (Yes = 1)	Log (Household income)
Panel A: Age-eligible group (60+)				
Mean	0.43	9.67	0.63	10.64
$NRPS_{ct}$	0.250***	0.176***	-0.022	0.041
	(0.040)	(0.068)	(0.017)	(0.055)
Observations	20,584	20,584	8,292	8,298
R-squared	0.440	0.219	0.641	0.303
F-statistics	–	–	41.9	2.76
P-value	–	–	0.00	0.09
Panel B: Age-ineligible group (45-59)				
Mean of Y	0.07	10.12	0.18	10.71
$NRPS_{ct}$	0.009	0.058	0.001	0.005
	(0.011)	(0.060)	(0.014)	(0.044)
Observations	27,573	27,575	9,821	9,822
R-squared	0.116	0.195	0.283	0.274
F-statistic	45.6	4.87	–	–
P-value	0.00	0.03	–	–

Note: The data are from the CHARLS and CFPS for individuals ages 45 years and older. The covariates in the regressions in each column include age and its square, and dummies for gender, education level, survey year and county. All the standard errors are clustered at the county level.

The F-statistics and p-values at the bottom of each panel test the significance of the differences between the estimates in the comparison group and those in the treated group. Specifically, the F-statistics and p-values in columns 1 and 2 in panel B test the difference between the estimates in panel A and panel B in the same column; the F-statistics in columns 3 and 4 in panel A test the difference between the estimates in columns 1 and 3, and columns 2 and 4, respectively.

**** p<0.01, ** p<0.05, * p<0.1.*

supply response to the NRPS. Column 1 shows that, among rural people, labor supply significantly decreases by 3.0 percentage points (6.4 percent of the mean) for those age 60 years or older and, although statistically insignificant, by 2.6 percentage points (3.6 percent of the mean) for those younger than age 60. The difference between the estimates for the two groups is statistically insignificant.

The next two columns in Table 2 show these effects through the classification of the type of work (i.e., farm work and non-farm work). The NRPS significantly reduces the proportion of farm work by 3.6 and 5.8 percentage points for age-eligible and age-ineligible people, respectively.[15] However, for age-ineligible people, the NRPS increases the proportion of non-farm work by 3.3 percentage points. One candidate explanation is that the NRPS-induced higher (expected) income deters people from doing heavy farm work (i.e., the deterring effect), while those younger than age 60 need to pay the current pension premiums and therefore participate in income-generating jobs such as non-farm work (i.e., the liquidity effect). Therefore, we examine this by only looking into the effects among those ages 45 to 49 years, who are farther from the pension-eligible age. The results in Table B2 in the appendix suggest that these people may not reduce their labor supply. Although some people give up farm work, yet more take on non-farm work which offsets the effects. Our results are consistent with those in Angelucci and De Giorgi (2009) and suggest that we need to exercise caution when interpreting the results from an econometric framework that combines the age-ineligible people as a control group. Consistent with our expectation, column 4 in Table 2 shows that there is no significant effect among urban people.

The effects on labor supply are consistent with the income effects established in the literature. For example, Gruber and Wise (2002) review estimates from 11 industrial countries and find that a reform that delays benefit eligibility by three years reduces the proportion of men ages 56 to 65 in the labor force by 23 to 36 percent. The magnitude of the reduction in labor supply is comparable to the impact of the expansion of pensions in India (Kaushal, 2014). Kaushal (2014) finds that

[15]That only farm work dropped upon being covered by the NRPS but not non-farm work suggests that the labor supply effects may not end up in lower income, given that farm work usually brings in little cash flow but provides food for own consumption.

Table 2: Effects of the NRPS on Labor Supply

	(1)	(2)	(3)	(4)
		Rural *hukou*		Urban *hukou*
VARIABLES	Working now (yes = 1)	Doing Farm work (yes = 1)	Doing Non-farm work (yes = 1)	Working now (yes = 1)
Panel A: Age-eligible group (60+)				
Mean of Y	0.477	0.424	0.054	0.121
$NRPS_{ct}$	-0.030*	-0.036**	0.006	0.017
	(0.018)	(0.018)	(0.006)	(0.011)
Observations	21,290	21,264	21,264	8,484
R-squared	0.284	0.246	0.092	0.267
F-statistic	–	–	–	6.02
P-value	–	–	–	0.01
Panel B: Age-ineligible group (45-59)				
Mean of Y	0.727	0.544	0.184	0.453
$NRPS_{ct}$	-0.026	-0.058**	0.033**	0.003
	(0.022)	(0.024)	(0.015)	(0.020)
Observations	28,334	28,334	28,334	9,797
R-squared	0.225	0.208	0.209	0.315
F-statistic	0.06	1.42	3.80	–
P-value	0.80	0.23	0.05	–

Note: The data are from the CHARLS and CFPS for individuals ages 45 years and older . The covariates in the regressions in each column include age and its square, and dummies for gender, education level, survey year and county. All the standard errors are clustered at the county level. The F-statistics and p-values at the bottom of each panel test the significance of the differences between the estimates in the comparison group and those in the treated group. Specifically, the F-statistics and p-values in columns 1-3 in panel B test the difference between the estimates in panel A and panel B in the same column; the F-statistics in column 4 in panel A test the difference between the estimates in columns 1 and 4 in panel A.

**** p<0.01, ** p<0.05, * p<0.1.*

a social pension of US$1.5 per month provided to low-income male seniors in India led to a 2.8 percentage points lower labor supply among the eligible group. In addition, our estimates imply an income elasticity of labor supply of -0.32. This is comparable to the elasticity of -0.17 estimated by Cesarini et al. (2017), -0.19 estimated by Blundell et al. (1998), and -0.23 estimated by Ashenfelter et al. (2010).

4.2.4 Effects of the NRPS on Private Transfers and Household Expenditure

The first two columns in Table 3 examine the effects of the NRPS on the transfers that households received. The estimates show no significant effects, suggesting that the NRPS did not crowd out private transfers to the elderly. Our results differ from those of Jensen (2004), who finds that each South African rand of public pension income to the elderly leads to a 0.25–0.30 rand reduction in private transfers. One possible reason is that pension benefits in South Africa are much more generous, almost double the amount paid by the NRPS. The last two columns in Table 3 examine the effects on total expenditures and food expenditures. Our results suggest that the NRPS increases food expenditures by 9.6 percent, which is significant at the 10 percent level. The effect on total expenditures is positive but small and statistically insignificant. The effects of the NRPS in the comparison groups are smaller and insignificant. Because of the large standard errors, however, we cannot conclude that the impacts in the comparison groups are significantly different from those in the policy relevant group.

The effects on living arrangements and migration are also important. If the size of a household shrinks because of the NRPS, the above results would be misleading, as it is unclear whether the higher income *per capita* is caused by the greater income or smaller household. In addition, if healthier people move to regions that just started the NRPS, our estimates would overestimate the effects. Case and Deaton (1998) expected that the short-term effect of pensions on living arrangements and migration decisions should be small. However, they do not provide empirical evidence on this important presumption due to data limitations. To shed some light on these issues, Table B3 in the appendix investigates the effect of the NRPS on household size and cross-county

Table 3: Effects of the NRPS on Receipt of Private Transfers and Household Expenditures

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Rural *hukou*				Urban *hukou*			
	Received private transfer (yes = 1)	Log(Received private transfer)	Log(HH total exp)	Log(HH food exp)	Received private transfer (yes = 1)	Log(Received private transfer)	Log(HH total exp)	Log(HH food exp)
Panel A: Age-eligible group (60+)								
Mean of Y	0.39	6.68	9.55	8.55	0.38	7.43	10.2	9.3
$NRPS_{ct}$	0.005	0.170	0.058	0.096*	0.012	0.175	-0.000	0.044
	(0.031)	(0.110)	(0.043)	(0.058)	(0.031)	(0.157)	(0.039)	(0.039)
Observations	15,833	6,098	15,429	15,906	6,812	2,582	6,633	6,923
R-squared	0.164	0.226	0.204	0.262	0.221	0.362	0.275	0.310
F-statistic	–	–	–	–	0.03	0.00	1.20	0.65
P-value	–	–	–	–	0.86	0.97	0.27	0.42
Panel B: Age-ineligible group (45-59)								
Mean of Y	0.43	7.00	9.91	8.76	0.36	7.54	10.39	9.30
$NRPS_{ct}$	0.001	-0.001	-0.003	0.036	0.031	-0.026	-0.012	0.009
	(0.027)	(0.103)	(0.032)	(0.051)	(0.023)	(0.153)	(0.036)	(0.039)
Observations	22,456	9,697	22,151	22,702	8,302	3,001	8,275	8,477
R-squared	0.278	0.254	0.206	0.284	0.273	0.345	0.278	0.294
F-statistic	0.04	2.20	2.25	1.60	–	–	–	–
P-value	0.85	0.14	0.13	0.21	–	–	–	–

Note: The data are from the CHARLS and CFPS for individuals ages 45 years and older. The covariates in the regressions in each column include age and its square, and dummies for gender, education level, survey year, and county. All the standard errors are clustered at the county level.

**** p<0.01, ** p<0.05, * p<0.1.*

migration among rural people. Only 3 percent of China's citizens are registered for *hukou* in one county but currently living in another county. Consistent with the expectation in Case and Deaton (1998), the estimates do not show any significant evidence of short-term effects of the NRPS on household size or migration.

In summary, the above analysis examines how Chinese households responded to the NRPS in terms of incomes, labor supply, and expenditures. Households with pension-eligible people are more likely to receive a pension and work less, especially less farm work. These households also have higher incomes and spend more money on food. Therefore, our results suggest that people receiving pensions tend to purchase more food and grow less for themselves. This may improve the health status of the elderly, because intensive farm work and poor nutrition are potentially harmful.

4.2.5 Effects of the NRPS on Health

In this section, we investigate the effects of the NRPS on self-reported fair/poor health, reported disability, and malnutrition.[16] We also use principal component analysis on the three dimensions and obtain a z-score for unhealthiness for the full sample. This comprehensive measure is similar to the "metabolic syndrome" used in previous literature (e.g., Kling et al., 2007; Anderson, 2012; Hoynes et al., 2016), which may improve the statistical power of our analysis by aggregating multiple measures.

Table 4 shows the results. The first column presents the unhealthiness score for rural people. The estimates in panel A show that NRPS coverage significantly reduces the unhealthiness score by 0.12 among age-eligible people, indicating a 0.12 standard deviation improvement in healthiness. In contrast, the estimate for the sample in the age-ineligible group (in panel B) is insignificant and much smaller in magnitude, at about one-third of that shown in panel A.

The next three columns present the results for different health measures. More specifically, the NRPS significantly reduces the rate of disability by 3.2 percentage points and the likelihood

[16]The disability variable is constructed based on a set of activities, including walking, cooking, dining, traveling, shopping, and doing housework. In the CHARLS and the CFPS, the respondents were asked whether they had difficulty doing any of these activities. We define the respondents as disabled if they indicated that they had difficulty doing these activities.

Table 4: Effects of the NRPS on Health Outcomes

	(1)	(2)	(3)	(4)	(5)
Data	CHARLS & CFPS				CLHLS
Variables	Unhealth--iness score	Fair/poor health (yes =1)	Reported disabled (yes = 1)	Under-weight (yes =1)	One-year mortality
Panel A: Age-eligible group (60+) & Rural sample					
Mean of Y	0.312	0.740	0.280	0.153	0.150
$NRPS_{ct}$	-0.124***	-0.016	-0.032*	-0.017*	-0.0217**
	(0.045)	(0.020)	(0.017)	(0.010)	(0.00952)
Observations	17,861	21,310	21,494	17,861	29,871
R-squared	0.163	0.067	0.188	0.120	0.139
Panel B: *Age-eligible group (60+) & Urban sample*					
Mean of Y	-0.001	0.741	0.180	0.067	0.102
$NRPS_{ct}$	0.028	0.008	0.001	-0.007	-0.00678
	(0.038)	(0.024)	(0.013)	(0.007)	(0.0136)
Observations	7,171	8,509	8,667	7,171	9,047
R-squared	0.161	0.054	0.196	0.110	0.196
F-statistic	7.53	0.80	2.59	0.67	0.86
P-value	0.01	0.37	0.10	0.41	0.35
Panel C: Age-ineligible group (45-59) & Rural sample					
Mean	*-0.139*	*0.713*	*0.108*	*0.0588*	--
$NRPS_{ct}$	-0.039	-0.010	-0.010	0.000	--
	(0.034)	(0.018)	(0.010)	(0.006)	--
Observations	24,611	28,689	28,899	24,611	--
R-squared	0.111	0.062	0.091	0.054	--
F-statistic	4.59	0.14	2.79	3.23	--
P-value	0.03	0.70	0.09	0.07	--
Panel D: Age-ineligible group (45-59) & Urban sample					
Mean	-0.293	0.705	0.053	0.035	--
$NRPS_{ct}$	-0.022	0.007	-0.006	-0.010	--
	(0.031)	(0.021)	(0.006)	(0.006)	--
Observations	8,330	9,875	10,218	8,330	--
R-squared	0.086	0.080	0.089	0.067	--

Note: The data are from the CHARLS and the CFPS and are restricted to a sample of Chinese citizens ages 45 years and older. The covariates in the regressions in each column include age and its square and dummies for gender, education level, survey year and county. All the standard errors are clustered at the county level. The F-statistics and p-values at the bottom of the panel test the significance of the differences between the estimates in the comparison group and those in the treated group. Specifically, the F-statistics and p-values in columns 1-4 in panel B and Panel C test the difference with the estimates in panel A in the same column. The F-statistic in column 5 in panel B tests the difference with the estimates in panel A.
**** p<0.01, ** p<0.05, * p<0.1.*

of being underweight by 1.7 percentage points. As rural old people tend to work less on farms and purchase more food after the NRPS implementation, the health risk caused by poor working conditions or malnutrition could be alleviated, especially for people older than age 60 years.

Panel B shows that there are no statistically significant effects for urban people. In addition, the F-statistic and p-value suggest that there is a significant difference between the effects of the NRPS on the health of rural and urban people. In Panel C, for the age-ineligible group, the coefficients are about half or one-third of those in panel A and statistically insignificant. The F-tests suggest that the differences between the effects in the age-eligible group and those in the age-ineligible group are statistically significant at the 10 percent level.

Table B4 in the appendix examines the effects of the NRPS on individual behaviors such as health care usage and smoking. The estimates in all the columns suggest that there is little effect on behaviors such as inpatient care and outpatient care. We do not find that increased income leads to increased unhealthiness, which is suggested by previous literature (Chaloupka and Warner, 2000; Ruhm, 2000).

Since we pooled the two data sets to conduct the above regressions, it may be a concern that the results may not be nationally representative because different populations are identified in the two data sets. Table B5 in the appendix provides the regression results weighted by the represented population size of each data set, which are fairly consistent with our above results. Furthermore, Table B6 in the appendix reports the estimation results usng the CHARLS and CFPS data sets, respectively. Most of the results are consistent in sign but differ in magnitude and significance.

CHARLS and CFPS are longitudinal surveys, which allows us to control for individual fixed effects in the analysis. However, we do not use this setting in the main analysis. We use essentially repeated cross-sections for sample size considerations, given that a significant share of the sample (i.e., about 10-15 percent) is replaced across rounds. In addition, including individual fixed effects may exaggerate the attenuation bias caused by measurement errors. Table B7 in the appendix examines the correlation between attrition and the timing of the NRPS coverage across counties. The results suggest that there were no significant differences in attrition rate across the regions with

different starting years of the NRPS. Therefore, as a further check of the robustness of our main results, we exploit the longitudinal component of the sample by controlling for individual fixed effects and report the results in Table B8 in the appendix. The results are consistent in general.

The pattern of missing data also differs for different outcomes. In general, the proportions of missing variables in the original sample are 4 percent for income, 5 percent for labor supply, 20 percent for health, and 28 percent for expenditure. Therefore, the coefficients are not comparable across different tables. For each outcome, we conduct the analysis with different samples, such as the sample without missing values in income variables or the sample without missing values in health variables, and so forth. The results are plotted in Figures B1 to B3 in the appendix. In summary, our estimates are consistent for different subsamples without missing observations for different categories of outcomes.

4.2.6 Effects of the NRPS on Mortality

We follow the methodology in Jensen and Richter (2004) and use the individual-level panel data to match the NRPS coverage and conduct the following regression:

$$Die_{it} = \gamma_0 + \gamma_1 NRPS_{ct} + \delta_c + \delta_t + X_{ict} + \delta_{ia} + \varepsilon_{ict} \tag{3}$$

The new dependent variable is an indicator of whether individual i died between time t and $t+1$, which equals one if yes and zero otherwise. Therefore, the coefficients in equation (3) could be interpreted as the effects on one-year mortality. All the other variables are the same as those in equation (2), except that we include an indicator δ_{ia} to capture whether individual i is lost in the following years (i.e., attrition). All the standard errors are also clustered at the county level.[17]

The last two columns in Table 4 present the results. Column 9 shows that the NRPS reduced mortality by 2.2 percentage points among the treated group, and column 10 shows the insignificant

[17]The CLHLS does not provide information on *hukou* type. Therefore, we use residency type and eligibility for a retirement plan to address this. Living in a rural region and ineligibility for any retirement plan is defined as *rural* status; living in an urban region and eligibility for any retirement plan is defined as *urban* status. We use whether individual i is eligible for a retirement scheme because those who enjoy retirement schemes generally have urban *hukou* and are not eligible for the NRPS. Thus, we choose people living in rural regions who have no retirement plan as the treated group and those living in urban regions with a retirement plan as the comparison group.

effects on the urban group. Although the F-test cannot reject the null hypothesis for the difference between the coefficients, due to large standard errors in the comparison group, the magnitude in the treated group is over three times larger than that in the comparison group. Therefore, the estimates provide significant evidence for the effect of social pensions on mortality. These findings shed some light on the mixed findings in the literature.[18]

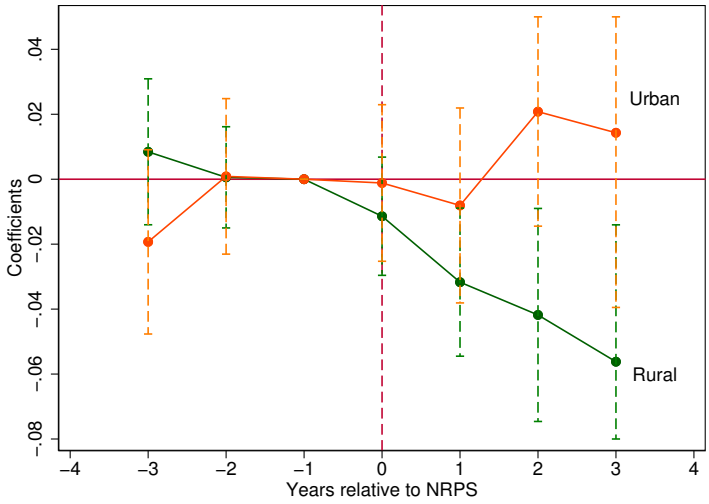
In addition, we conduct an event study analysis for the effects on mortality and present the results in Figure 5. As the figure shows, before the implementation of the NRPS, the coefficients are insignificant and small in magnitude. Just after implementation of the NRPS, the mortality rate starts to drop, and the decline is negatively significant one year later. In contrast, we conduct parallel analysis for urban people. All the coefficients are insignificant and there is no specific trend for the urban sample. Table B9 in the appendix presents the regression results.

It is worthwhile to discuss about the magnitudes of the impact on mortality as well. Our estimates suggest that the NRPS reduced the mortality rate by 2.2 percentage points (12 percent of the mean value before the NRPS). The CLHLS data are for the oldest of the population with a mean age of 85. This sample is different from the CHARLS and CFPS samples, since the CLHLS oversamples people over age 80. In this sample, the median monthly household income *per capita* in 2005 was 90 yuan, which was even less than that in the CHARLS and CFPS sample. Therefore, we conducted a regression to estimate the effects on household income among those older than age 70, using the CHARLS and CFPS sample, which yielded a positive and significant coefficient of 0.28. Based on the estimates in Table 4, our back-of-the-envelope calculation of the mortality-income elasticity in this study is about 0.38, which is a bit larger compared to the estimate of 0.21 by Jensen (2004). However, our estimate should be taken with caution, because those older than age 70 in CFPS and CHARLS may not be comparable to those in CLHLS.

Table B10 in the appendix further investigates the causes of death. The results show that the NRPS-induced reduction in mortality is mainly due to a lower likelihood of death without severe

[18]For example, Jensen (2004) finds that after the Russian pension system collapsed in 1998, income declined by 24 percent and the two-year mortality rate increased by 5 percent. But Snyder and Evans (2006) find a significant increase in the mortality rate when the elderly receive greater pensions.

Figure 5: Event Study for the Effects of the NRPS on Mortality among the Oldest Old in Rural China



Note: The mortality data are from the CLHLS 2005-2014. We conduct separate regressions for rural and urban samples in CLHLS. The regression equation is $Die_{it} = \gamma_0 + D_{ct}^{NRPS} + \delta_c + \delta_t + X_{ict} + \delta_{ia} + \varepsilon_{ict}$*, where the* D_{ct}^{NRPS} *is the number of years relative to NRPS implementation in county c (e.g., the variable equals -1 if it is the year before the NRPS, 0 if it is the year when the NPPS was implemented). The other variables are the same as those in equation (3). Due to space limitation, we truncate the lower bound at -0.08 and the upper bound at 0.05 in the figure.*

disease. This is reasonable because deaths caused by severe disease are generally less likely to be prevented through improved nutrition or reduced work. In addition, the attrition rate in the CLHLS panel is 8 percent, which is not trivial when compared to the mortality rates. The last column in Table B10 shows that dropping the lost individuals does not change our results.

4.2.7 Other Results

In Appendix C, using Human Mortality Database (HMD) data, we estimate the short-term effects of pension availability on mortality. Consistently, the results show that the introduction of social pensions significantly reduces mortality among age-eligible people; in contrast, the comparable effects among age-ineligible people are much smaller and statistically insignificant. Specifically, the estimates in panel A in Table C2 show that the introduction of social pensions significantly reduces mortality among age-eligible people by 1.6 to 2.2 percent. These estimates may not be directly comparable to our estimates using CLHLS. First, the CLHLS only covers those older than age 65 and over-samples those older than age 80. Second, we have no information on increased income among the age-eligible people in the HMD countries. Finally, the social pension programs in European countries are typical ones, but the NRPS was similar to a public transfer program in the first few years of implementation. Therefore, the schemes in European countries may not be comparable to the NRPS in China.

In Appendix D, we find better outcomes for children after the implementation of the NRPS in the CFPS. Children are more likely to receive pocket money, be cared for by their grandparents, report better health, and stay in school. These results are consistent with the findings in Duflo (2000, 2003) and suggest that the NRPS may have far-reaching consequences for China's next generation. Unfortunately, we cannot provide accurate mechanisms for these results because of data limitations.

5 Conclusion

This paper examined the effects of the introduction of a unprecedented and massive pension program in rural areas in a developing country. Using the nationally representative data from China and exploring the variation in county-by-county roll-out of the NRPS, we examined the impacts of the social pension provision on the lives of elderly citizens in terms of income, expenditures, private transfers, labor supply, health, and mortality.

After the introduction of the NRPS, age-eligible rural people have a 25 percentage points higher probability of receiving a pension. Consequently, the NRPS increases household income, decreases labor supply, and increases expenditures on food. These results suggest that the pension receivers are more likely to purchase food rather than grow it themselves. Consistently, we find improved health status among pension receivers in terms of lower rates of disability, malnutrition, and mortality. The results imply that less labor-intensive work and less liquidity constraint seem to be important reasons why the pension induced better health. We do not find that the NRPS significantly affects household size, transfers, migration, smoking, or health care usage. And we find little evidence of effects of the NRPS among age ineligible adults.

Our estimates suggest that the NRPS improves nutrition and reduces farm work, which may contribute to improved health of the elderly, and that children receive more resources. Therefore, our results suggest that the NRPS improves the welfare of age-eligible people (i.e., the oldest group) but does not significantly affect the welfare of adults who are not yet eligible to receive pensions.

The NRPS provision to the elderly in rural China is similar to the universal basic income plans discussed in Hanna and Olken (2018). The evidence is important and relevant for the pension reforms in developing countries today and developed countries in the past. On the one hand, our findings build up the literature on recent pension reforms in many developing countries, such as South Africa (Duflo, 2000; Case and Deaton, 1998; Jensen, 2004), Brazil (de Carvalho Filho, 2008, 2012), and India (Kaushal, 2014). Our results show that a small portion of resources in a developing economy may generate substantial welfare improvements when these resources are

properly allocated to vulnerable groups, such as the rural elderly in this study. On the other hand, our findings also help to understand the impacts of the introduction of social pensions in developed countries in the past. When Social Security was introduced in the U.S. in the 1930s, the elderly got pension benefits for free and a large share of the U.S. population was still living in rural areas. This is very similar to the implementation and background of the NRPS.

There are some limitations in our study. One is measurement errors in reported pension receipts, income, and expenditures. As mentioned in previous studies (e.g., Moore and Welniak, 2000; Bound et al., 2001; Meyer and Sullivan, 2003), reported variables suffer serious measurement errors and the coefficients must be interpreted carefully. Finally, as the social pension program under study was initiated relatively recently, we lack knowledge about its long-term effects.

References

Anderson, Michael L, "Multiple inference and gender differences in the effects of early intervention: A reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects," *Journal of the American Statistical Association*, 2012.

Angelucci, Manuela and Giacomo De Giorgi, "Indirect Effects of an Aid Program: How Do Cash Transfers Affect Ineligibles' Consumption?," *American Economic Review*, 2009, *99* (1), 486–508.

Ardington, Cally, Anne Case, and Victoria Hosegood, "Labor Supply Responses to Large Social Transfers: Longitudinal Evidence from South Africa," *American Economic Journal: Applied Economics*, 2009, *1* (1), 22–48.

Ashenfelter, Orley, Kirk Doran, and Bruce Schaller, "A Shred of Credible Evidence on the Long-run Elasticity of Labour Supply," *Economica*, 2010, *77* (308), 637–650.

Attanasio, Orazio P and Agar Brugiavini, "Social security and households' saving," *The Quarterly Journal of Economics*, 2003, pp. 1075–1119.

_ **and Susann Rohwedder**, "Pension wealth and household saving: Evidence from pension reforms in the United Kingdom," *American Economic Review*, 2003, pp. 1499–1521.

Bitler, Marianne P, Jonah B Gelbach, and Hilary W Hoynes, "Welfare reform and health," *Journal of Human Resources*, 2005, *40* (2), 309–334.

Blundell, Richard, Alan Duncan, and Costas Meghir, "Estimating labor supply responses using tax reforms," *Econometrica*, 1998, pp. 827–861.

Bound, John, Charles Brown, and Nancy Mathiowetz, "Measurement error in survey data," *Handbook of Econometrics*, 2001, *5*, 3705–3843.

Calonico, Sebastian, Matias D Cattaneo, and Rocio Titiunik, "Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs," *Econometrica*, 2014, *82* (6), 2295–2326.

Case, Anne, "Does Money Protect Health Status? Evidence from South African Pensions," Working Paper 8495, National Bureau of Economic Research October 2001.

_ **and Angus Deaton**, "Large Cash Transfers to the Elderly in South Africa," *Economic Journal*, 1998, pp. 1330–1361.

_ **and Francis Wilson**, "Health and well-being in South Africa: Evidence from the Langeberg Survey," *Research Program in Development Studies, Princeton, NJ (December). Processed*, 2000.

Center for Healthy Aging and Development Studies, "The Chinese Longitudinal Healthy Longevity Survey (CLHLS)-Longitudinal Data (1998-2014)," 2016.

Cesarini, David, Erik Lindqvist, Matthew J. Notowidigdo, and Robert Ostling, "The Effect of Wealth on Individual and Household Labor Supply: Evidence from Swedish Lotteries," *American Economic Review*, December 2017, *107* (12), 3917–46.

Chaloupka, Frank J and Kenneth E Warner, "The economics of smoking," *Handbook of Health Economics*, 2000, *1*, 1539–1627.

Cheng, Tiejun and Mark Selden, "The origins and social consequences of China's hukou system," *The China Quarterly*, 1994, *139*, 644–668.

Cutler, David M and Richard Johnson, "The birth and growth of the social insurance state: Explaining old age and medical insurance across countries," *Public Choice*, 2004, *120* (1-2), 87–121.

de Carvalho Filho, Irineu Evangelista, "Old-age benefits and retirement decisions of rural elderly in Brazil," *Journal of Development Economics*, 2008, *86* (1), 129–146.

_ , "Household income as a determinant of child labor and school enrollment in Brazil: Evidence from a social security reform," *Economic Development and Cultural Change*, 2012, *60* (2), 399–435.

Diamond, Peter and Jonathan Gruber, "Social security and retirement in the United States," in "Social security and retirement around the world," University of Chicago Press, 1999, pp. 437–473.

Duflo, Esther, "Child health and household resources in South Africa: Evidence from the Old Age Pension program," *American Economic Review*, 2000, pp. 393–398.

_ , "Grandmothers and Granddaughters: Old-Age Pensions and Intrahousehold Allocation in South Africa," *The World Bank Economic Review*, 2003, *17* (1), 1–25.

Fang, Hanming and Jin Feng, "The Chinese Pension System," Working Paper 25088, National Bureau of Economic Research September 2018.

Feldstein, Martin, "Social security pension reform in China," *China Economic Review*, 1999, *10* (2), 99–107.

Feng, Jin, Lixin He, and Hiroshi Sato, "Public pension and household saving: Evidence from urban China," *Journal of Comparative Economics*, 2011, *39* (4), 470–485.

Gruber, Jonathan, "The incidence of mandated maternity benefits," *American Economic Review*, 1994, pp. 622–641.

_ **and David A. Wise**, "Social Security Programs and Retirement around the World: Micro Estimation," Working Paper 9407, National Bureau of Economic Research December 2002.

_ **and David Wise**, "Social Security Programs and Retirement around the World: Introduction and Summary of Papers by...," Working Paper 6134, National Bureau of Economic Research August 1997.

Gustman, Alan L and Thomas L Steinmeier, "Effects of social security policies on benefit claiming, retirement and saving," *Journal of Public Economics*, 2015, *129*, 51–62.

Hanna, Rema and Benjamin A. Olken, "Universal Basic Incomes versus Targeted Transfers: Anti-Poverty Programs in Developing Countries," *Journal of Economic Perspectives*, November 2018, *32* (4), 201–26.

Hoynes, Hilary, Diane Whitmore Schanzenbach, and Douglas Almond, "Long-Run Impacts of Childhood Access to the Safety Net," *American Economic Review*, April 2016, *106* (4), 903–34.

_ , Douglas L Miller, and Jessamyn Schaller, "Who Suffers During Recessions?," *Journal of Economic Perspectives*, 2012, *26* (3), 27–47.

Institute of Social Science Survey, Peking University, "China Family Panel Studies (CFPS)," 2015.

Jensen, Robert T, "Do private transfers displace the benefits of public transfers? Evidence from South Africa," *Journal of Public Economics*, 2004, *88* (1), 89–112.

_ and Kaspar Richter, "The health implications of social security failure: Evidence from the Russian pension crisis," *Journal of Public Economics*, 2004, *88* (1), 209–236.

Juarez, Laura, "Crowding out of private support to the elderly: Evidence from a demogrant in Mexico," *Journal of Public Economics*, 2009, *93* (3), 454–463.

Kaushal, Neeraj, "How public pension affects elderly labor supply and well-being: Evidence from India," *World Development*, 2014, *56*, 214–225.

Kling, Jeffrey R, Jeffrey B Liebman, and Lawrence F Katz, "Experimental analysis of neighborhood effects," *Econometrica*, 2007, *75* (1), 83–119.

Krueger, Alan and Jorn-Steffen Pischke, "The effect of social security on labor supply: A cohort analysis of the notch generation," *Journal of Labor Economics*, 1992, *10* (4), 412–437.

Leisering, Lutz, Sen Gong, and Athar Hussain, *People's Republic of China: Old-age Pensions for the Rural Areas: from Land Reform to Globalization*, Asian Development Bank, 2002.

Levy, Santiago and Norbert Schady, "Latin America's social policy challenge: Education, social insurance, redistribution," *Journal of Economic Perspectives*, 2013, *27* (2), 193–218.

Madrian, Brigitte C and Dennis F Shea, "The Power of Suggestion: Inertia in 401 (k) Participation and Savings Behavior*," *Quarterly Journal of Economics*, 2001, *116* (4), 1149–1187.

Mastrobuoni, Giovanni, "Labor supply effects of the recent social security benefit cuts: Empirical estimates using cohort discontinuities," *Journal of Public Economics*, 2009, *93* (11), 1224–1233.

Meyer, Bruce D and James X Sullivan, "Measuring the Well-Being of the Poor Using Income and Consumption.," *Journal of Human Resources*, 2003, *38* (4).

Moore, Jeffrey C and Edward J Welniak, "Income measurement error in surveys: A review," *Journal of Official Statistics*, 2000, *16* (4), 331.

Ruhm, Christopher J, "Are Recessions Good for Your Health?," *Quarterly Journal of Economics*, 2000, *115* (2), 617–650.

Shah, Mihir, Neelakshi Mann, Varad Pande et al., "MGNREGA Sameeksha: An Anthology of Research Studies on the Mahatma Gandhi National Rural Employment Guarantee (2005) Act 2006-2012," Technical Report 2015.

Shi, Shih-Jiunn, "Left to market and family–again? Ideas and the development of the rural pension policy in China," *Social Policy & Administration*, 2006, *40* (7), 791–806.

Snyder, Stephen E and William N Evans, "The effect of income on mortality: Evidence from the social security notch," *Review of Economics and Statistics*, 2006, *88* (3), 482–495.

Wang, Dewen, "China's Urban and Rural Old Age Security System: Challenges and Options," *China & World Economy*, 2006, *14* (1), 102–116.

Willmore, Larry, "Universal pensions for developing countries," *World Development*, 2007, *35* (1), 24–51.

Zhang, Chuanchuan, "Family support or social support? The role of clan culture," *Journal of Population Economics*, 2019, *32* (2), 529–549.

Zhao, Yaohui, John Strauss, and Gonghuan Yang, "China Health and Retirement Longitudinal Study (2011 baseline)," 2015.

_ , _ , and _ , "China Health and Retirement Longitudinal Study (2013 wave2)," 2015.