The Power of Social Pensions

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Abstract

This paper comprehensively examines the impacts of social pensions on people of different ages. Utilizing the county-by-county rollout of China's New Rural Pension Scheme (NRPS), we find 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 to non-farm work but does not significantly affect their income, expenditure or health. Finally, among younger children, the NRPS increases their pocket money receipts, adds to the time their grandparents cared for them, improves their health and their attendance in school. (*JEL* classifications: H55, I38, O20)

Keywords: Pension, Health, Elderly

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"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

The world's population is aging rather rapidly. As such, many countries are considering starting or reforming their social pension programs to better support the lives of the elderly. A natural question to ask is how these social pensions affect the individual behaviors and welfare of the elderly. The answer to this question is crucial because the effects are key parameters for evaluating and designing efficient pension programs and retirement policies, especially given that governments usually are constrained by tight fiscal budgets.

In spite of an established strand of literature on this topic, the answers are still far from satisfactory. The major reason is that the variations in an individual's pension income seldom exhibit exogenous or policy-induced shocks (Attanasio and Rohwedder, 2003). There are some exceptions, such as the social pension expansion in South Africa (Duflo, 2000; Case and Deaton, 1998; Jensen, 2004), Russia's pension system collapse (Jensen and Richter, 2004), and social pension reforms in the United States (Kruegerand and Pischke, 1992; Snyder and Evans, 2006). However, because of certain data limitations, the findings in the literature are insufficient to provide a comprehensive evaluation of pension policy,[1] and are sometimes even contradictory.[2]

This paper tries to address the following questions: First, how do pension provisions affect the household behaviors, such as labor supply, incomes, transfers and expenditures? Second, do pensions affect the health of pension recipients and if so, what is the possible mechanism? Third, how does the pension provision affects people of different ages, such as age-eligible seniors and

[1] Social pension reform in South Africa was universal and expanded quickly, and the data samples in the related studies are very small. Changes in pension benefits in industrial countries are usually based on individual previous earnings, which could be correlated with underlying personal tastes or characteristics (Coile and Gruber, 2000; Chan and Stevens, 2004).

[2] Snyder and Evans (2006) find that higher pension income leads to higher retiree mortality because of social isolation, while other studies such as Case (2001) and Jensen and Richter (2004) find that higher pension income leads to improved retiree health status. These conflicting findings suggest limited knowledge about the mechanisms of how social pensions affect health and other welfare outcomes.

children? By answering these questions, this paper aims to contribute to the current literature by providing a more comprehensive understanding about individual responses toward pension policies and relevant welfare implications.

Using the exogenous variation in the New Rural Pension Scheme (NRPS) implementation and the latest nationally representative sample from China, we systematically examine the effects of a pension provision on income, labor supply, consumption and health. The NRPS, launched in 2009, was rolled out on a county-by-county basis and by the end of 2012 covered all the counties in mainland China. Once a county was covered, all of that county's rural population aged 16 years and over were able to *voluntarily* participate.[3] During the period of rolling out, the enrollees aged 60 years and older could receive a fixed pension, regardless of previous earnings or income, of 55 yuan (i.e., about US $9) per month, which is over 30 percent of rural household income per capita among those aged over 60.

The NRPS is an unprecedented welfare program covering the largest population in human history. By the end of 2012, China's governments had allocated more than 262 billion yuan (i.e., about US $41 billion) to the NRPS. The number of Chinese citizens receiving pensions reached 140 million by the end of 2014, and the total number of participants was approximately 430 million. Meanwhile, the poverty rate in China significantly decreased from 14.7 percent in 2008 to 7.9 percent in 2011 and then further declined to 1.9 percent in 2013 (WHO data, poverty line = $1.90 dollar a day).

The data from this study are derived from the two largest ongoing individual surveys covering the years from 2010 to 2013, exactly when the NRPS expanded. This nationally representative sample includes over 70,000 observations from more than 300 counties. We use the county-by-

[3]Hukou is a household registration system in China, which refers to a registered residency status of a particular individual in this system (Cheng and Selden, 1994). In its original legislation, the hukou system was justified as created to "maintain social order, protect the rights and interests of citizens and to be of service to the establishment of socialism". Eeach citizen was 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 relocated. 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 the rural old people. Most urban old population are covered by the urban basic old-age insurance scheme, which is independent of the NRPS and is a combination of pay-as-you-go and funded systems.

county rollout of the NRPS and employ the Difference-in-Differences (DID) methodology to identify the consequential effects.

We first examine the impact of the NRPS on labor supply, incomes and expenditures. Rural age-eligible people (i.e., the pension-eligible group) are 25 percentage points more likely to receive a pension since the introduction of the NRPS, while there is no significant effect on pension receipt among China's rural citizens younger than 60 years of age or among the nation's urban population. Among the pension-eligible group, we find that the NRPS significantly increases household incomes and food expenditures by 17.6 and 9.6 percent, respectively, and reduces the labor supply by 3.0 percentage points (6.2 percent of the mean). In contrast, for pension-ineligible people, we find no evidence of any significant effects on household incomes, expenditures, and private transfers.

We follow the same methodology to investigate the effects on the health outcomes of elderly. Among the pension-eligible people, the NRPS provision reduces disability, malnutrition (measured by underweight) and mortality rates by 3.2 percentage points (11.4 percent), 1.8 percentage points (11.3 percent), and 2.2 percentage points (14.4 percent), respectively.[4] Meanwhile, there is no significant effect on health behaviors like smoking or medical care usage such as inpatient and outpatient hospital visits. We find no significant effects on any of the above health outcomes among those pension-ineligible groups, either. As an exploration of the external validity of our findings, we also use cross-country aggregate-level data and show that the introduction of social pensions also reduced mortality of age-eligible people but not for age-ineligible people.

Finally, we find significant effects of the NRPS on children. After the introduction of the NRPS, more Chinese children receive pocket money, more boys report excellent health, more preschool boys are cared for by their grandparents, and more girls receive education in schools.

The above analysis suggests how pensions affect the behavior, health, and welfare outcomes of people of different ages. Above all, the age-eligible rural people benefits from the pension program. They are less likely to do farm work and spend more money on food, implying that they are less

[4]Our calculation suggests that the income-mortality elasticity ranges from 0.18 to 0.60, which is comparable to 0.21suggested by Jensen and Richter (2004).

likely to live on the crops they have grown. This in turn reduces the health risks of malnutrition or physical dysfunction , which could be especially true for those over 60 years old. In addition, the NRPS improves children's outcomes. This may be partly because 1) the older pensioners help to take care of children, and 2) households receiving pensions are able to provide more resources to these children (e.g., more pocket money). Finally, we find only limited significant evidence of any welfare improvement for the adult people who are ineligible for pensions. Therefore, we conclude that social pensions significantly benefit the pension-eligible elderly (i.e., the oldest people) and the children (i.e., the youngest ones), while the effects among the age-ineligible adults (i.e., the middle-aged ones) are less clear.

Validity of the DID estimation must not be taken for granted. The major concern is that the DID effects may reflect different potential trends across the counties. The empirical results above may help to alleviate this concern since they show that the NRPS-induced effects on income and health are much smaller and insignificant among the age-ineligible and *hukou*-ineligible groups. Since the NRPS began in different years in different counties, we plot a series of separate local macroeconomic indices from 2003 through 2009, including GDP per capita, worker salaries, government revenues and expenditures, and the number of doctors, hospital beds, and mortality rates. We find no significant unparalleled pre-trends across counties for these indices.

These findings make several contributions to the ongoing literature. First, our comprehensive analysis on the effects of a pension program strengthens the literature that investigates the effects of pension programs on individuals' behaviors (Case and Deaton, 1998; Madrian and Shea, 2001; Attanasio and Rohwedder, 2003; Attanasio and Brugiavini, 2003; Bitler et al., 2005; French, 2005; Ardington et al., 2009; Aizer et al., 2017) and contributes to a better understanding of the effect of social benefits. In addition, our findings also provide new evidence on the causal effects of income on health (Case and Wilson, 2000; Case, 2001; Frijters et al., 2005; Jensen and Richter, 2004; Snyder and Evans, 2006; Evans and Moore, 2011, 2012; Aizer et al., 2017). More importantly, our analysis on a series of possible outcomes suggests several reasons that explain why pensions improve individual health status or welfare outcomes. Finally, the effects among the age-ineligible

people are relevant to the literature on the indirect or spill-over effects of public policies (Atalay and Barrett, 2015; Staubli and Zweimüller, 2013; Gustman and Steinmeier, 2015), and the results on the well-being of children especially highlight the role of intra-household resource allocations as discussed in Duflo (2000, 2003).

2 Background of the NRPS

Although last thirty years have witnessed China's great development, poverty is still a salient problem in China. By the end of 2008, over 250 million people in China would be considered poor according to the poverty line proposed by the World Bank (daily income < $1.90). The Chinese government has established an urban old-age security system with both relatively high coverage rate and generosity since early 1990s, but leaves the rural elders to mainly rely on family support. Because of the absence of old-age social security programs, the poverty problem is much severer among the rural elderly.For example, 67.5 percent of China's rural elderly people have no labor income and 91 percent live on transfers from their children. According to a recent online survey, 35.4 percent of respondents consider "rearing the old" as the most important problem in rural China.[5] These facts motivated the Chinese government to initiate the social pension program in 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 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. Figures 1a through1d show the counties in mainland China covered by the NRPS in each year from 2009 to 2012. Approximately 12 percent (about 320) of all the counties were covered in the first wave (2009) and 16 percent (450 counties) covered in the next year (2010); 38 percent (about 1,075 counties) started the program in the third wave (2011) and the remaining (34 percent) were covered in the last wave (2012). In this study, we exploit

[5]Source: http://toutiao.com/i6243882674679726593/.

the county-by-county rollout of the NRPS and conduct DID regressions to identify the effects of the new pension scheme provision. China's central government decided which counties the NRPS would be initiated in each year. As stated in the official documents, the government aimed to evenly distribute the approved counties across regions in the first wave. In the next two years, the central government tended to start the NRPS earlier in the counties in China's middle and western regions.

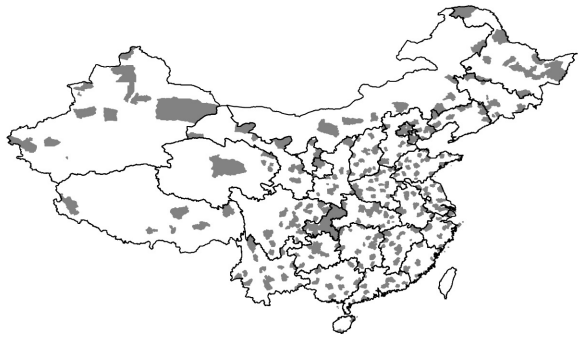
After a county was covered by the NRPS, all rural people 16 years of age and older (excluding students) can voluntarily participate in the scheme. All of the enrollees aged 60 years or older at start of the NRPS are eligible to receive 55 yuan (i.e., about $9) per month, regardless of previous earnings or income. In 2014, the benefits increased to 75 yuan per month. But there is a pre-requisite, all pensioners' offspring are required to participate and choose either 100, 200, 300, 400 or 500 RMB as the level of their annual contribution. Starting from the pension eligible age of 60, the pension benefits for a pensioner is the sum of the accumulated total funds in the individual account, plus the basic pension benefits. According to the formula, the funds in the accumulated individual accounts are paid out as follows: at the age of 60, a pensioner begins receiving a monthly benefit (1/139 of the total accumulation) from their individual account and a basic pension benefit (55 yuan per month until the end of 2014, after which time it increased to 75 yuan).[6] Therefore, this pension scheme was a defined contribution plan with a minimum pension guarantee fully funded by the government and individual contributions. Since there is almost no variation in pension generosity across regions when data collected, we only exploit the variation in timing of the NRPS implementation to identify the effects.

It is noteworthy that the amount of 55 yuan per month is not trivial for China's rural elderly. To make a comparison, among the rural households with 60 years or older people, median of monthly income per capita including all transfers, is approximately 200 yuan in our sample. This amount

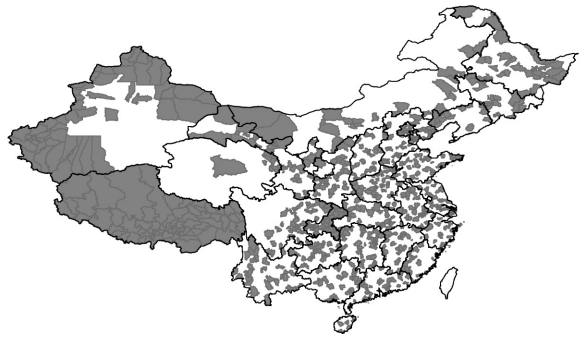
[6]For instance, a participant, who at the age of 45 chooses to pay a yearly premium of 100 RMB will have a total amount of 1,838 RMB accumulated in their individual account (assuming a one-year deposit rate at the age of 60) and will receive a monthly benefit of 68.22 RMB (1838/139+55). Those who are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

Figure 1: County-by-county rollout of the NRPS over Time

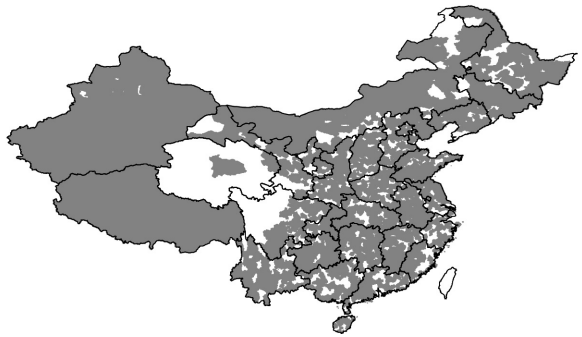
(a) First round, November 2009



(b) Second round, July - October 2010)



(c) Third round, July - September 2011



(d) Fourth round, July - October 2012

Note: The county rollout 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.

of money may also guarantee the basic survival of an older person living. For example, in the rural regions of Shandong province, a senior who solely relies on his/her pension may purchase one large or two small steamed buns or a bowl of rice per day.[7]

The NRPS refers to the "new" rural pension scheme to distinguish it from the old rural pension scheme 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 the widespread mismanagement of the funds and the insignificance of the program (Shi, 2006; Wang, 2006). In 2005, the enrollment rate for the old pension scheme had dropped to less than 3 percent, according to China Agricultural Statistical Yearbooks.

This is the first time such a large and generous welfare program existed in rural China. The NRPS is also an unprecedented welfare program having covered the largest population in human history. By the end of 2012, China's central and local governments had contribute more than 262 billion yuan (i.e. about $41 billion) into the NRPS with more than 232 billion (i.e. about $37 billion) from the central government. In 2012, there were 89 million rural seniors who began receiving pensions. By the end of 2014, the number of pensioners increased further to140 million, and the total number of rural participants was approximately 426 million (65 percent).

The pension distribution method is determined by each local government. 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 offspring) must travel to designated places in local villages to get their pensions.

The NRPS funding is strictly regulated to avoid corruption and fraud. To ensure that eligible pensioners receive the pensions that they quality for, the central government requires local govern-

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

ments provide the personal information, which is updated annually, of each enrollee. Then, after verification, the appropriate funding amount is calculated. Because a pensioner's offspring can go and pick up their parent's pension, in situations where the pensioners are ill, confined to bed or live in less developed regions, evidence that the pensioner is alive must be provided. This evidence could be a recent video or certification from a local government official who had personally and recently visited the pensioner.

3 Data

The China Family Panel Studies (CFPS) and the China Health and Retirement Longitudinal Studies (CHARLS)

The main sample used in our study is from the China Family Panel Studies (CFPS) and the China Health and Retirement Longitudinal Studies (CHARLS). The CFPS is a biennial survey designed to be the Chinese equivalent of the US Panel Study of Income Dynamics (PSID). The first national wave was conducted in 2010. The five main parts of the 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 aged 45 years and older, and is designed to be the Chinese equivalent of the Health and Retirement Survey (HRS) in the United States. More details about the two datasets are provided in the Appendix section of this paper. The baseline national wave of the CHARLS was fielded in 2011. This study uses the 2010 and 2012 waves of CFPS, and the 2011 and 2013 waves of the CHARLS.

To best exploit the regional and temporal variations in the NRPS expansion from 2009 to 2012, we pool the CFPS data and the CHARLS data together to make a larger sample. It should be noted that CFPS data and CHARLS data are both nationally representative and consistent in variables used in this exercise. The CFPS covers 162 counties and the CHARLS 150 counties. Only 5 counties are covered by both. This main sample comprises over 70,000 observations (i.e., about 34,000 from CFPS and 36,000 from CHARLS). In the sample, 49 percent individuals are male. The individuals are aged 59 on average and 72 percent of them have rural *hukou*. In the sample,

only 19 percent of counties covered by the NRPS in 2010, then it increased to 31 percent in 2011 and 69 percent in 2012. All counties are covered in 2013 survey.[8] During the period, the proportion of rural individuals participating any pension program also increased from 13 percent in 2010 to 26 percent in 2011, to 57 percent in 2012 and 70 percent in 2013. Not all eligible people participate in the NRPS immediately after its implementation. First, information transition takes some time and some eligible people may not even be aware of the NRPS implementation. Second, Chinese rural people who have experienced the introduction and collapse of the old rural pension scheme might not express much interests at first glance because of lack of confidence in government. Finally, it is possible that the adult children of eligible people may not want to participate given they have to contribute. We will present the other summary statistics when reporting regression results.

Because of different counties sampled in two surveys, we include the data source dummy and interact it with the counties throughout the whole analysis. In addition, we also re-weight the sample by the representative population in the region and find the results are very robust. Finally, we also conduct the analysis using each data and find the results are consistent in general.[9]

The Chinese Longitudinal Healthy Longevity Survey (CLHLS)

The Chinese Longitudinal Healthy Longevity Survey (CLHLS) is a longitudinal survey that aims to improve understanding of Chinese citizens healthy longevity. The baseline survey of the CLHLS was conducted in 1998; follow-up surveys with replacements for deceased were conducted every three years in a randomly selected half of the total number of counties and cities in 22 out of 31 provinces in mainland China. However, the earlier waves only surveyed people older than 80 years and had a smaller sample size. We therefore chose the sample that began in 2005, which also included citizens from the ages of 65-79 years. Since the 2005 survey, the CLHLS followed respondents in 2008, 2011 and 2014. In addition to the information on basic demographics and socioeconomic status, the data also provide the survival status for all of the seniors in each wave, as

[8]CHARLS and CFPS data were almost collected before the NRPS expansion every year. The county coverage at survey is mainly determined by the NRPS coverage in the previous year.

[9]All the results are consistent in sign tests but the magnitude and significance vary in the two data sets. We do not report the results here but they are available upon request.

well as recorded date of those who died. On average, these individuals are aged 84 and 45 percent are men. During the period 2005-2011, one-year mortality rate is 13 percent and people survive for 4.4 years on average.

4 Methodology and Empirical Results

4.1 Who Receives a Pension from the NRPS?

The first question to investigate is, who started to receive pensions from the NRPS. The answer is important in order to understand and interpret the results of our research into the possible effects of the NRPS provision. 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:

$$Receipt^s_{ict} = \alpha^s_0 + \alpha^s_1 NRPS^s_{ct} + \delta^s_c + \delta^s_t + X^s_{ict} + \varepsilon^s_{ict} \tag{1}$$

The superscript s indicates a specific subsample, which can be a group of people with certain characteristics. The dependent variable, $Receipt^s_i$, is an indicator of the household of individual i who may have received any pension. The key independent variable, $NRPS_{ct}$, is another 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 education level of individual i. The coefficient on $NRPS_{ct}$, α^s_1, captures the short-term effects of the NRPS on pension receipt in subsample s. All of the standard errors are clustered at the county level.

We first divide the sample by *hukou* status and age and conduct the regressions as shown in Eq. (1) in each subsample. The results are shown in Figure 2a. Each point and the corresponding intervals plot the coefficient α^s_1 with the 90 percent confidence interval from the separate regression estimation of equation (1) in subsample s. The plotted points show the effects of the NRPS coverage on outcome variables among the individuals in corresponding subsamples. First, all of the effects among China's urban population are statistically insignificant. Second, among rural

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

As shown in the figure, the immediate take up rate ranges from 20 to 40 percent, which is consistent with the low take-up rate of social programs in other countries (Currie, 2004). Besides the reasons stated in previous section, there are some additional explanations. First, the regression here only identify one-year short-term effects. In addition, it also takes time for local governments to design policy details and prepare necessary documents.

We then restrict the sample to those aged 60 years or older with rural *hukou* in Figure 2b. Panel A shows the point estimates for men and women, respectively. The effects are significant for both men and women but the difference between these two, is insignificant. Panel B divides the sample by education level; the effects among the three groups are similar (i.e., all of the coefficients are between 0.2 and 0.3). Panel C divides the sample by the 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 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

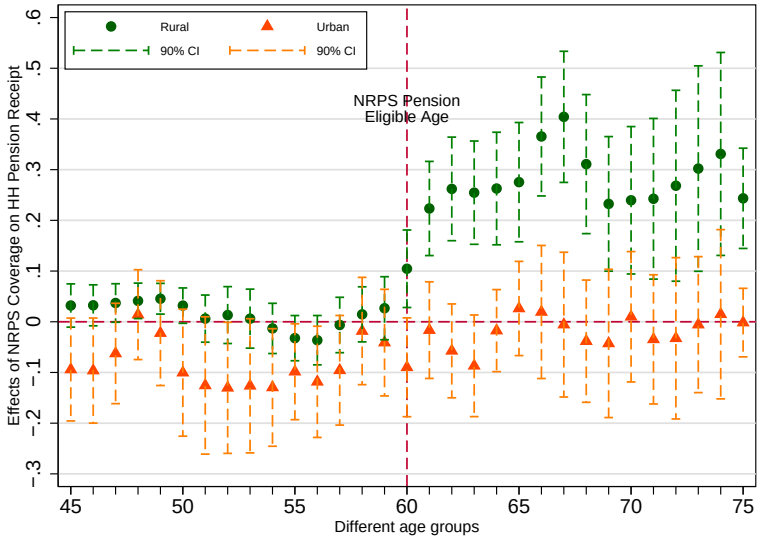
We use the same framework to investigate behavioral responses to the NRPS:

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

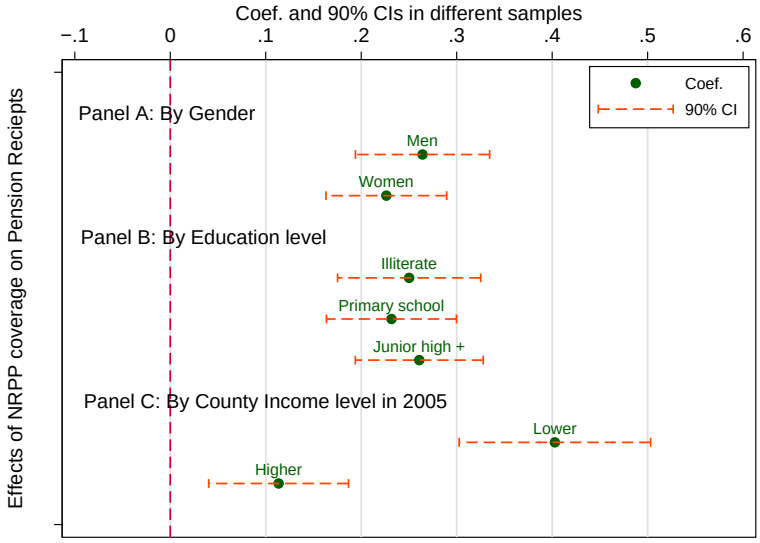
The dependent variable Y_{ict} is the potential outcome to examine, which can be household incomes, expenditures, private transfers, etc. All of the other variables are the same as those in Eq. (1). The standard errors are also clustered at the county level. The estimation is based on the dif-

Figure 2: 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 above divides the sample by the type of hukou (i.e. urban or rural) and age in 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), respectively. Each point and the corresponding 90 percent confidential interval are based a separate regression of Eq. (1). The plotted points show the effects of the NRPS coverage on pension receipts among the individuals in corresponding subsamples. *The confidential intervals are calculated based on the standard errors clustered at the county level.*

ferences between before-after changes in outcomes of the treated group and during the same time period in the control group.[10] 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 they may not be randomly selected and the DID estimator, β_1, is subject to a number of limitations discussed below.

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 plot relevant economic indices for the counties covered in different NRPS waves and find that the time trends in outcome variables of the counties with different NRPS implementation years are fairly parallel before 2009. Second, we explore a couple of potential comparison groups to test the robustness and validity of our results. The first comparison group is urban *hukou* people in the same counties. It is expected that there would be little effect among thembecause the urban seniors are not eligible for the NRPS and the existing pension policy for urban seniors is independent of the NRPS implementation. The other comparison group is naturally the rural people younger than 60 years of age (Jensen, 2004). However, we argue that these groups may not be good control groups. First, urban and rural people differ in many ways. It is possible that these differences could be correlated with the NRPS implementation timing and the central government may start this program in areas with bigger urban-rural income gap. Second,those younger than 60 years in the NRPS covered villages may form different expectations since the enrollees are able to receive pension once they reach the pension-eligible age, and the enrollees with ages below 60 also need to pay premiums.

Given the above considerations, we divide the whole sample based on both age and *hukou* eligibility - rural people 60 years of age or older, rural people younger than 60 years, urban people 60 years of age or older and urban people younger than 60 years old. The first is the only group of

[10]The estimation leads to the intention-to-treat (ITT) 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 rollout, because previous literature such as Angelucci and De Giorgi (2009) find 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.

people who are eligible to both enroll in the pension scheme and receive 55 yuan per month. The second group of people are eligible to participate in, but not to receive the pensions. The third and the fourth groups are ineligible to participate in the NRPS.

Because of data limitation, we used the current county of residence rather than registered county in the regression. One concern is about migration. If the factors affecting migration are correlated with both the timing of NRPS implementation and outcomes such as income and health, the estimates will be biased. We argue this could not be a serious issue. First, among the rural seniors, 98 percent are living in their registered county. In addition, we also show that the timing of NRPS are not correlated with cross-county migration. We will come back to this later.

Thanks to the panel characteristics of CHARLS and CFPS data, we are able to further control for individual fixed effects in the analysis. By doing so, we are able to capture the individual time-invariant confounding factors. However, we do not use this setting in the main analysis for several reasons. First, the attrition rate is as high as 34 percent and thus controlling for individual fixed effects might suffer from sample selection bias. In addition, because we only have at most two periods for each individual, including the individual fixed effects would exaggerate the attenuation bias caused by measurement errors. In the later section, we will show that the results are consistent in general.

4.2.2 Effects of the NRPS on Incomes, Labor Supply and Expenditures

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 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 2, the estimates suggest that the NRPS coverage ($NRPS_{ct}$) significantly increases the probability of a household receiving a pension by 24.5 percentage points among rural households with people aged 60 years or above. Consistent with this, the NRPS coverage also significantly increases household income by 17.6 percent. In contrast, Panel B shows that the effects among rural but age-ineligible people are much smaller and insignificant. Columns 3 and 4 of Table 3

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 treated group (rural people with ages 60 and above) and corresponding comparison group (urban people with ages 60 and above or rural people with ages below 60), and report the F-statistics and p-values in the bottom of corresponding column. For example, the F-statistic and p-value in column 3 of Panel A tests 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 urabn sample together and using urban old people as a control group. As shown in Table 1, the estimates in treated group are significantly different from those in both comparison groups.

The NRPS-induced household income changes may originate not only as a consequence of receiving a pension, but because pensioners may also alter their labor supply behaviors (Gruber, 1994; Gruber and Wise, 1997, 2002). Table 2 further displays the results of our examination of the labor supply response to the NRPS. Among the rural people, labor supply significantly reduces by 3.0 percentage points (6.4 percent of mean) for those aged 60 years or older and although statistically insignificant, by 2.6 percentage points (3.6 percent of mean) for those younger than 60 years. The difference between the estimates from the two groups is statistically insignificant.

The next two columns further 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. 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 60 years of age also 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 from 45 to 49 years of age, who are farther away from the pension-eligible age. The results in Table B1 suggest that these people may not reduce their labor

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

Sample	(1) Rural *hukou*	(2) Rural *hukou*	(3) Urban *hukou*	(4) 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
$NRPS_{ct}$	0.245***	0.176***	-0.023	0.041
	(0.039)	(0.068)	(0.016)	(0.055)
Observations	21,434	20,584	8,601	8,298
R-squared	0.448	0.219	0.644	0.303
F-statistics	–	–	86.6	15.8
P-value	–	–	0.00	0.00
Panel B: Age-ineligible group (45-59)				
Mean of Y	0.07	10.12	0.28	10.71
$NRPS_{ct}$	0.012	0.058	0.013	0.005
	(0.011)	(0.060)	(0.011)	(0.044)
Observations	28,795	27,575	10,145	9,822
R-squared	0.091	0.195	0.335	0.274
F-statistics	42.1	4.87	–	–
P-value	0.00	0.03	–	–

Note: The data are from those 45 years of age and older in the CHARLS and the CFPS. 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 differencesbetween the estimates in the comparison group and those in the treated group. Specifically, the F-statistics and P-values in columns 1 and 2 of 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 and * p<0.1*

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-statistics	–	–	–	6.69
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	28,376	28,334	28,334	9,797
R-squared	0.225	0.208	0.209	0.315
F-statistics	0.06	1.42	3.80	–
P-value	0.80	0.23	0.05	–

Note: The data are from those 45 years of age and older in the CHARLS and the CFPS. The covariates in the regressions in each column include age and its square, and dummies for gender, education level, survey year and county. All of 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 of Panel B test the difference between the estimates in Panel A and Panel B in the same column; The F-statistics in columns 4 in Panel A test the difference between the estimates in columns 1 and 4 in Panel A.

**** p<0.01, ** p<0.05 and * p<0.1*

supply over all. Although some people give up farm work, yet more take non-farm work which have offset the effects. Our results are consistent with Angelucci and De Giorgi (2009) and also suggest that we need to exercise caution when interpreting results from an econometric framework that combines the age-ineligible people as control group. Consistent with our expectation, Column 4 in Table 4 shows that there is no significant effect among urban people.

The first two columns in Table 3 examine the effects of the NRPS on the received transfer of households. 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's. The last two columns of Table 3 examine the effects on total expenditure and food expenditure. Our results suggest that the NPRS significantly increases food expenditures by 9.6 percent. The effect on total expenditure is positive but small and statistically insignificant.

The effects on living arrangements and migration are also important. If the size of a household shrinks as a consequence of the NRPS, the above results would be misleading, as it is unclear whether the higher income *per capita* is caused by more income or larger household. In addition, if healthier people move to regions that just started the NRPS, our estimates would over estimate the effects. Case and Deaton (1998) expected that the short-term effect of pensions on the living arrangements and migration decisions should be small. However, they did not provide empirical evidence on this important presumption due to data limitations. To shed some light on these issues, Table B2 in the Appendix investigate the effect of the NRPS on household size and cross-county migration for these 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 for the short-term effects of the NRPS on household size or migration.

In summary, our above analysis examines how Chinese households responds to the NRPS

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

VARIABLES	(1) Received private transfer (Yes = 1)	(2) Log(Received private transfer)	(3) Log(HH total expenditure)	(4) Log(HH food expenditure)
Panel A: Age-eligible group (60+)				
Mean of Y	0.38	6.67	9.48	8.55
$NRPS_{ct}$	0.001	0.129	0.032	0.096*
	(0.028)	(0.101)	(0.044)	(0.058)
Observations	21,300	8,099	16,220	15,906
R-squared	0.148	0.196	0.189	0.262
Panel B: Age-ineligible group (45-59)				
Mean of Y	0.45	7.05	9.86	8.76
$NRPS_{ct}$	-0.015	-0.039	-0.012	0.036
	(0.025)	(0.093)	(0.033)	(0.051)
Observations	28,447	12,871	23,024	22,702
R-squared	0.264	0.240	0.196	0.284

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

**** p<0.01, ** p<0.05 and * p<0.1*

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

4.2.3 Effects of the NRPS on Health and Healthcare Usage

In this section, we investigate the effects of the NRPS on self-reported fair/poor health, reported disability, and malnutrition.[11] We also use principal component analysis (PCA) on the three dimensions, and obtain a score for unhealthiness for the full sample.[12] 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. Our results listed in Panel A show that the mean value of the unhealthiness score is 0.31 for the age-eligible and -0.14 for the age-ineligibles. The estimates in Panel A show that the NRPS coverage significantly reduces the unhealthiness score by 0.12 among age-eligible people, indicating a 0.1 standard deviation improvement in healthiness. In contrast, the estimate for the sample in the age-ineligible group is insignificant and much smaller in magnitude, which is 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 disability rate by 3.2 percentage points and likelihood of being underweight by 1.7 percentage points. Because disability represents physical health and underweight measures nutrition status, the results of health echo those in farm work and food expenditure. As

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

[12]This measure has zero mean and ranges from -1.37 to 3.35, with a standard deviation of 1.1.

Table 4: Effects of the NRPS on Health Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Data	CHARLS & CFPS					CLHLS	
Sample	Rural *hukou*				Urban *hukou*	Rural *hukou*	Urban *hukou*
Variables	Unhealthiness score	Reported fair or poor health (Yes =1)	Reported disability (Yes = 1)	Underweight (Yes =1)	Unhealthiness score	One-year mortality	
Panel A: Age-eligible group (60+)							
Mean of Y	0.312	0.740	0.280	0.153	-0.00106	0.150	0.102
$NRPS_{ct}$	-0.117***	-0.015	-0.032*	-0.017*	0.030	-0.0217**	-0.00678
	(0.045)	(0.020)	(0.017)	(0.010)	(0.041)	(0.00952)	(0.0136)
Observations	17,723	21,175	21,493	17,861	7,139	29,871	9,047
R-squared	0.167	0.071	0.197	0.120	0.160	0.139	0.196
F-statistics	–	–	–	–	13.9	–	0.86
P-value	–	–	–	–	0.00	–	0.35
Panel B: Age-ineligible group (45-59)							
Mean	*-0.139*	*0.713*	*0.108*	*0.0588*	-0.293	–	–
$NRPS_{ct}$	-0.042	-0.009	-0.010	0.000	-0.023	–	–
	(0.036)	(0.018)	(0.010)	(0.006)	(0.034)	–	–
Observations	24,568	28,647	28,899	24,611	8,316	–	–
R-squared	0.112	0.062	0.125	0.054	0.086	–	–
F-statistics	3.74	0.11	2.79	3.23	–	–	–
P-value	0.05	0.74	0.09	0.07	–	–	–

Note: The data are from the CHARLS and the CFPS and are restricted to a sample of Chinese citizens 45 years of age 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 of 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 1-4 of Panel B test the difference between the estimates in Panel A and Panel B in the same column. The F-statistic in column 5 in Panel A tests the difference between the estimates in columns 1 and 5 in Panel A, and that in column 7 tests the difference between columns 6 and 7 in Panel A.
**** p<0.01, ** p<0.05 and * p<0.1*

rural old people tend to work less on farms and purchase more food after the NRPS implementation, the health risk caused by poor working status or malnutrition could be alleviated, especially for people over 60 years of age.

In the age-eligible group, the coefficients are about half or one-third of those in Panel A and are 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. Column 5 shows that there are no statistically significant effects for urban people. In addition, the F-statistic and P-value suggest a significant difference between the effects of the NRPS on health for rural and urban people.

Table 5 examines the effects of the NRPS on individual behaviors such as healthcare usage and smoking. The estimates in Columns 1 and 2 suggest little effect on healthcare usage measured by inpatient and outpatient care. The estimates are insignificant and small in magnitude. As smoking is an important explanation in previous literature that more income may lead to unhealthiness (Chaloupka and Warner, 2000; Ruhm, 2000), we investigate the effects of the NRPS on smoking in the last column. The results does not show any significant effect. In summary, we do not find any significant evidence for the effects of the NRPS on behaviors such as healthcare usage and smoking.

Since we pool the two datasets and conduct the above regressions, it may be a concern that the above results may not be nationally representative because of different population are identified in the two datasets. Table B3 provides the regression results weighted by the represented population size of each datasets, which are fairly consistent with our above results. Table B4 reports the estimation results after controlling for individual fixed effects, which are again consistent in general.

Table 5: Effects of the NRPS on Healthcare Usage and Health Behaviors

Sample	(1)	(2) Rural *Hukou*	(3)
Variables	Outpatient care (Yes = 1)	Inpatient care (Yes = 1)	Smoke currently (Yes =1)
Panel A: Age-eligible group (60+)			
Mean of Y	*0.258*	*0.167*	*0.282*
$NRPS_{ct}$	-0.012	0.004	-0.004
	(0.015)	(0.012)	(0.009)
Observations	21,457	17,336	19,887
R-squared	0.072	0.204	0.321
Panel B: Age-ineligible group (45-59)			
Mean of Y	*0.221*	*0.111*	*0.302*
$NRPS_{ct}$	-0.010	-0.013	-0.004
	(0.012)	(0.009)	(0.007)
Observations	28,796	22,318	27,314
R-squared	0.057	0.246	0.432
F-statistics	0.01	1.64	0.00
P-value	0.91	0.20	1.00

Note: The data are from the CHARLS and the CFPS and are restricted to a sample of Chinese citizens 45 years of age 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 of 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 of the estimates in the comparison group and those in the treated group. Specifically, the F-statistics and P-values of Panel B test the difference between the estimates in Panel A and Panel B in the same column.
**** p<0.01, ** p<0.05 and * p<0.1*

4.2.4 Effects of the NRPS on Mortality

We transfer the CLHLS data to an individual balanced panel from 2006 to 2014, then use a dummy variable to denote the individual mortality status in the period.[13] We then use this individual 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 Eq. (3) could be interpreted as the effects on one-year mortality. All of the other variables are the same as those in Eq. (2) except that we include an indicator δ_{ia} here to capture whether individual i is lost in the following years (i.e., attrition). All of the standard errors are also clustered at the county level.[14]

The last two columns in Table 4 presents the results. Column 6 shows that the NRPS reduced mortality by 2.2 percentage points (14.4 percent of the mean) among the treated group, and Column 7 shows the insignificant effects on the urban group.[15] Therefore, the estimates provide significant evidence for the effect of social pensions on mortality.

Our findings shed some light on the mixed findings in the literature. For example, Jensen (2004) found 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) found a significant increase in mortality when the elderly receive more pension. Based on the estimates in Table 4, our back-of-the-envelope calculation of mortality-income elasticity in this study ranges from 0.18

[13] If a person is alive in 2014, then this variable is consistently equal to zero for the nine years. And 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 equal to one for year t and missing for the years that follow. By doing so, we use best the time of the death and its variation.

[14] The CLHLS does not provide information on *hukou* type. Therefore, we use their residency type and eligibility for a retirement plan to address this. Living in rural regions and ineligibility for any retirement plan is defined as *rural* status; living in urban regions and eligibility for any retirement plan is defined as *urban* status. We use whether the individual i is eligible for a retirement scheme because of the fact that those who enjoy retirement schemes generally have urban *hukou* and are not eligible for the NRPS. By doing so, we actually 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.

[15] Although the F-test cannot reject the null hypothesis for the coefficient difference 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.

to 0.60, compared to 0.21 in Jensen (2004).[16]

Table B5 in the Appendix section further investigates the causes of death. The results show that the NRPS-induced mortality reduction is due mainly to a lower likelihood of death without severe 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 shows that dropping the lost people does not change our results.

4.2.5 Effects of the NRPS among Children

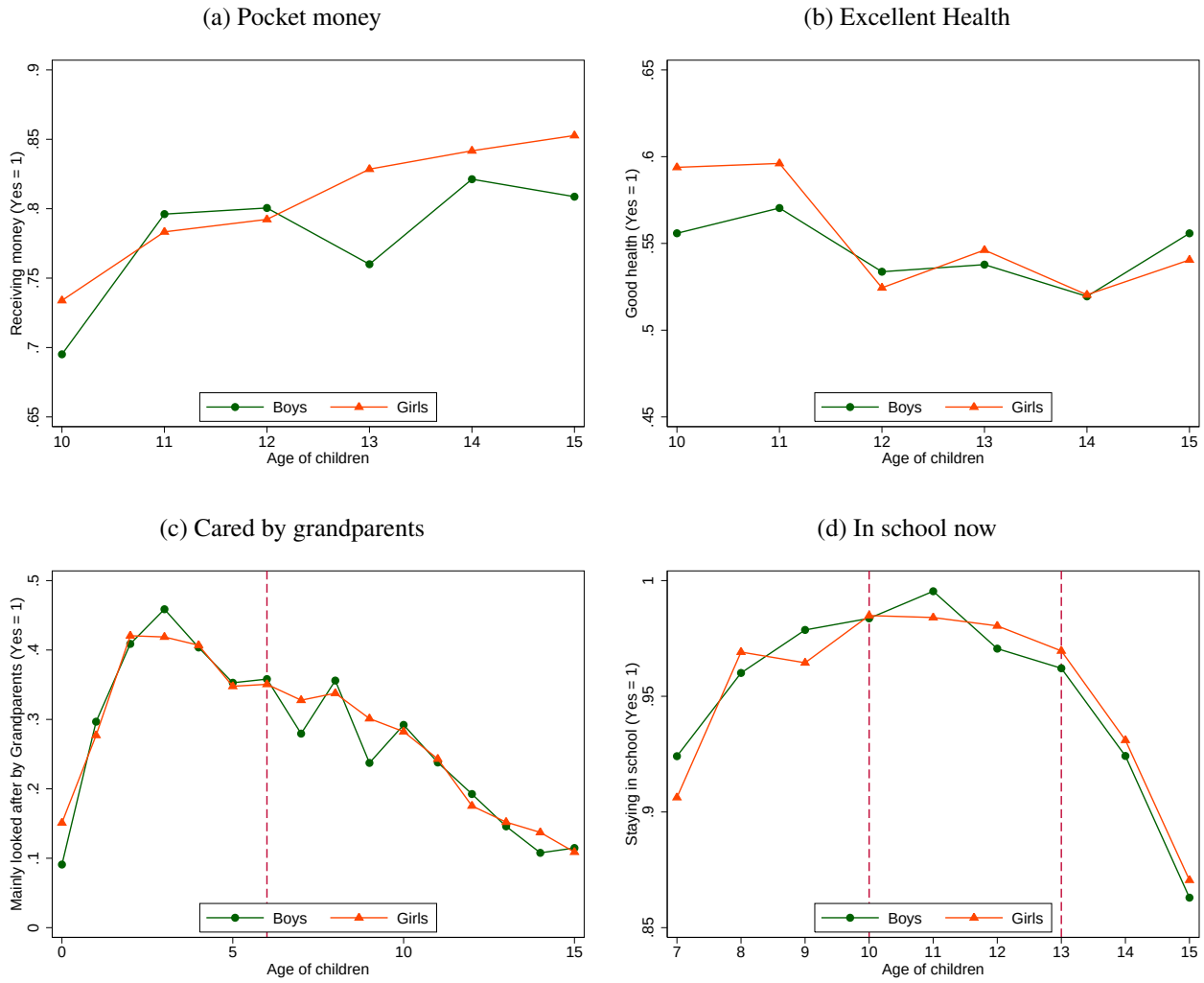
The above analysis shows that the NRPS has a significant effect on labor and health outcomes for the elderly, indicating a direct and substantial improvement in their well-being. It could also impact other household members given the intra-household resource allocations. Previous studies such as Duflo (2000, 2003) have shown that expanding social pension improves children's health. Inspired by this literature, in this section we examine whether the NRPS program has had similar effect on the outcomes of children in China.

The CFPS data includes a separate section for children from birth to 15 years of age that collects information on their demographics, education, health and living conditions. We confine our analysis in this paper to rural children and choose four outcomes: receiving pocket money, health status, care status, and as students, their in-school rate.[17] Figures 3a-3d present the mean value against age for the four variables, by gender. On average, 80 percent of the children receive pocket money and 55 percent report having excellent health. Figure 3c shows that about 20 percent of the infants (i.e., children from birth to two years of age) were mainly taken care of by their

[16]Importantly, this sample is different from the CHARLS and the CFPS samples since it overweights people over 80 years of age and those with lower incomes. In this sample, the median household income in 2005 is 3,000 yuan and the average household size in the CLHLS sample is 2.9 persons. However, there is no information in the CLHLS about participation in the new pension scheme. We therefore conducted a back-of-the-envelope calculation suggesting that mortality-income elasticity ranges from 0.18 to 0.6 (i.e., the 0.18 elasticity is based on the assumption that all seniors participated and the 0.6 elasticity supposes that the NRPS participation rate coverage is 0.3).

[17]The CFPS survey collected information on the general health status of children over 10 years of age and whether or not they had received any pocket money. It also collected information from heads of households about who was taking care of these children and if they were in school.

Figure 3: Children outcomes over age and by gender



Note: The data are from the CFPS (2010-2012) of children from birth to 15 years of age. The gender-specific mean values are plotted against age.

grandparents. The proportion reaches at peak at ages three and four (i.e., about 40-45 percent) and then goes down as the children grow up. Figure 3d presents an inverse-U shape for the proportion of in-school children over age of 6 years. The rate increases before the children reach the age of 10 years, indicating some were delayed going to school; after the age of 13, the rate declines rapidly, which implies that some children dropped out.

We now conduct regressions to investigate whether and how the NRPS influenced these out-

comes. Specifically, we estimate

$$Y_{ict} = \theta_0 + \theta_1 NRPS_{ct} + \delta_c + \delta_t + \delta_{ag} + e_{ict} \tag{4}$$

The dependent variable, Y_{ict}, now represents children's outcomes. All of the other covariates are the same as those in Eq. 1. Considering the non-linearity in age patterns for children, we include the gender-age dummies, δ_{ag}, in the regressions. All of the standard errors are clustered at the county level.

Table 6 presents the results. Column 1 shows that the NRPS increases the likelihood of children in this group having pocket money by 7-8 percentage points (10 percent) for both boys and girls. However, we are unable to verify if the pocket money is provided by their grandparents (i.e. pensioners), as the CFPS does not contain information on the sources of the pocket money. Column 2 presents the results of the health status of children from 10 to 15 years of age. It shows that the NRPS significantly increases the likelihood of excellent health being reported by 10.6 percentage points (19 percent) for boys, but that it has no statistically significant impact on the health status of girls. Columns 3 and 4 report the results for care status. We separate the children into two groups: preschool children and those from 7 to 15 years of age. We find a significant effect of the NRPS on the care status among preschool aged boys. More specifically, the NRPS increases the likelihood of boys being taken care of by their grandparents by 7.8 percentage points (22 percent). We find no significant effects for older boys or for girls in either age group.

The last three columns in Table 8 show the results for staying in school, by three different age groups. The three age groups are: 7-10, 11-13 and 14-15, which cover primary in-school age, junior middle school age (or graduation age from primary school) and the junior middle school graduation age, respectively. We find that the NRPS increases the in-school or attendance rates for girls from 7-10 years old and for girls 14 and15 years old. This suggests that the NRPS provision reduces the proportion of girls who are delayed in attending school at earlier ages and the dropout rate for older girls. Based on these results, we conclude that the NRPS increases the female human

capital accumulation.

4.3 Pre-trends Tests

Our previous analysis provides sound evidence for the effects of the NRPS among pension-eligible people and among children. However, the validity of the DID methodology cannot be taken for granted. For example, if the counties in the first wave of the NRPS demonstrated a more rapid improvement in the health of their citizens or their economic development prior to 2009, the effects identified by the DID estimation may just pick up the heterogeneous trends rather than the actual effects of the NRPS. The heterogeneous trends may be caused by county-year level unobserved factors.We have already provided some evidence above to alleviate this concern that the NRPS-induced effects on income and health are much smaller and insignificant among China's rural population younger than 60 years of age and the country's urban population older than 60 years. Nevertheless, we plot the trends before the treatment (i.e., pre-trends) to test whether this presumption is true.

To shed some light on this issue, we collect prefecture-year panel data from 2003 to 2009 about the local economy, including the local GDP, local salary levels, government revenues, government expenditures, and sanitary conditions such as the number of registered doctors and number of beds in each of the local hospitals.[18]

Then we match the data to the counties and plot the economic indices over the calendar years by which wave the county started the NRPS. 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. We also conduct a regression of the interactions between the year and county group dummies. The F-test cannot reject the null hypothesis for the interactions (F-statistic = 0.19 and the P-value = 0.99). Similar patterns are also found for the other outcomes, including salary, government revenues and expenditures, and the quantity of doctors and hospital beds. These results suggest

[18]The micro-level data we use are from 2010 onwards. Therefore it is not possible to plot and compare the pre-trends for both the treated and the control groups using data from the CHARLS and the CFPS. Prefecture is one level higher than at the county level according to the administrative system in China. There are no county-level statistical data for our selected variables. The data include local economic balanced panel information from 2003-2009 from 279 prefectures (97 percent of all counties) in mainland China.

Table 6: Impact of the NRPS on the outcomes of children

Dependent variable	(1) Having pocket money (Yes = 1)	(2) Excellent health (Yes = 1)	(3) Being looked after by grandparents (Yes = 1)	(4)	(5)	(6) Currently in school (Yes = 1)	(7)
Sample	Ages 10-15	Ages 10-15	Ages 0-6	Ages 7-15	Ages 7-10	Ages 11-13	Ages 14-15
Panel A: Results for Boys							
$NRPS_{ct}$	0.072*	0.106***	0.078**	-0.021	-0.035	0.007	-0.003
	(0.040)	(0.040)	(0.036)	(0.028)	(0.022)	(0.028)	(0.050)
Observations	2,452	2,449	3,160	3,694	1,769	1,300	861
R-squared	0.163	0.315	0.142	0.131	0.189	0.202	0.183
Mean of dep. var.	0.780	0.546	0.359	0.216	0.961	0.976	0.892
Panel B: Results for Girls							
$NRPS_{ct}$	0.083**	0.019	-0.024	0.018	0.030*	-0.023	0.086*
	(0.041)	(0.047)	(0.036)	(0.032)	(0.018)	(0.018)	(0.045)
Observations	2,320	2,317	2,737	3,382	1,563	1,158	865
R-squared	0.163	0.292	0.140	0.131	0.298	0.220	0.250
Mean of dep. var.	0.808	0.552	0.355	0.223	0.957	0.978	0.900

Note: The data are from the CFPS (2010-2012) of children from birth to 15 years of age. The covariates in the regressions in each column include dummies for gender, age, survey year and county. All of the standard errors are clustered at the county level.
**** p<0.01, ** p<0.05 and * p<0.1*

that there are no significant differences in the county-level economic indices, regardless of the year the NRPS was implemented.

The mortality record data since 2005 provides information from four years prior to implementation of the NRPS. Figure 5 plots the mortality rates over each year since 2006 by the county with different NRPS starting years. Prior to 2009, there are no obvious different trends across the various groups. We also conduct a regression for the sample prior to 2009, and the joint F-test cannot reject the null hypothesis (F-statistic = 1.48 and P-value = 0.15). After 2009, mortality frequently declined the most when the county was initially covered by the NRPS. For example, the mortality rate in those counties that were in the first wave of NRPS implementation dropped by 1.8 percentage points from 13.8 to 12.0 percent from 2009 to 2010, while the mortality of all of the other counties actually increased during this same period. We emphasize that this is not purely accidental because those counties in the second and fourth waves of the NRPS implementation followed a similar pattern.[19]

4.4 Discussion of the NRPS Results

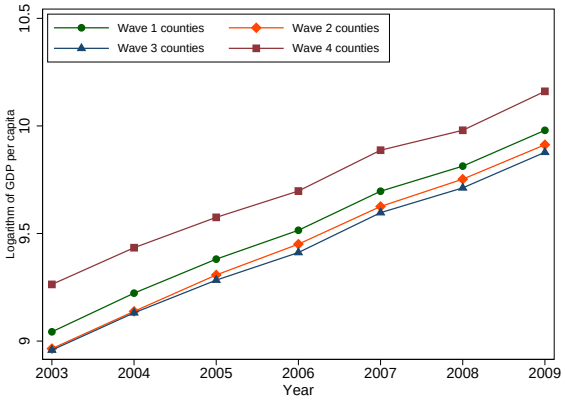
Table 7 summarizes the effects of the NRPS on rural people of different ages. In general, we find that the NRPS increases the proportion of people receiving a pension among the age eligible group. Among age eligible rural people, the NRPS also increases household income, lowers the labor supply, and increases expenditures on food. These results suggest that the pension receivers are more likely to purchase food rather than grow it for themselves. Consistently, we find an improved health status among these people in terms of lower rates of disability, malnutrition and mortality. The results imply that less labor intensive work and less constraint in liquidity seem to be important reasons that the pension induced better health. We do not find that the NRPS significantly affects household size, transfers, migration, smoking or healthcare usage.

In contrast, we find little evidence for the effects of the NRPS among age ineligible adults. In Appendix C, we use cross-country aggregate-level data to investigate whether the introduction

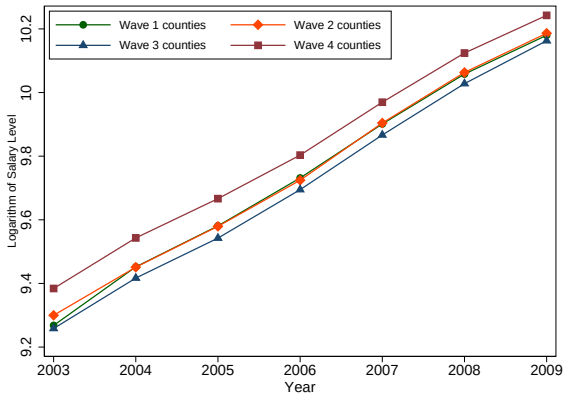
[19]For those counties in the second wave of the NRPS implementation, mortality dropped by 4.36 percentage points from 2010 to 2011 while those for the other three counties dropped 1.35, 4.12 and 1.82 percentage points, respectively. For those counties in the fourth wave, mortality dropped by 2.1 percentage points from 2012 to 2013.

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

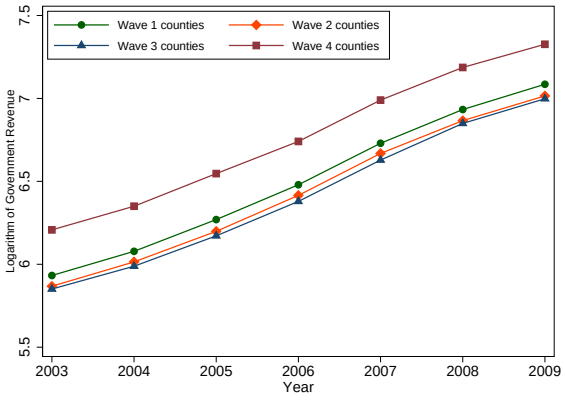
(a) Log(GDP per capita)



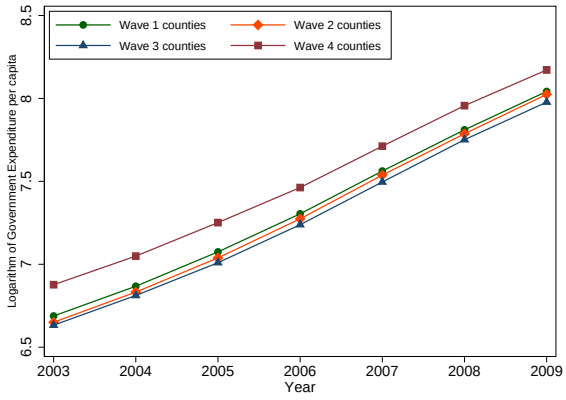
(b) Log(Salary)



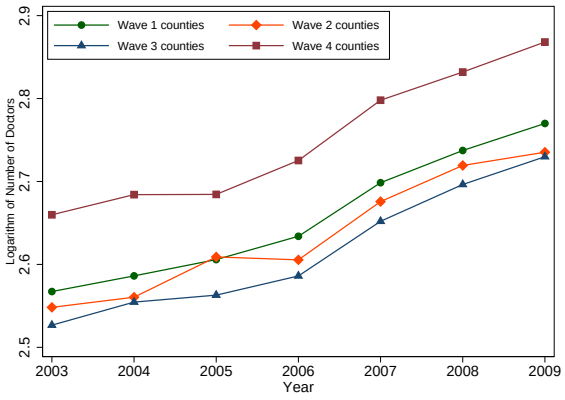
(c) Log(Government Revenue)



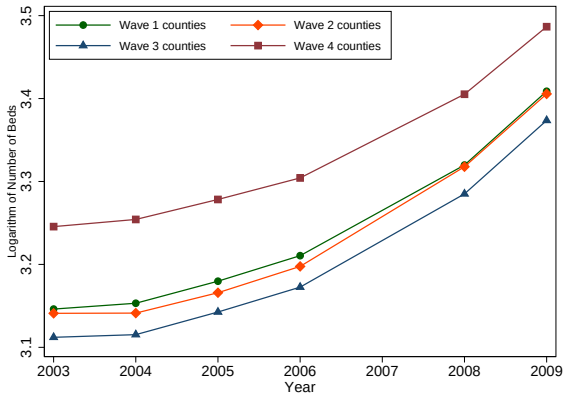
(d) Log(Government Expenditure)



(e) Log(Number of Doctors)

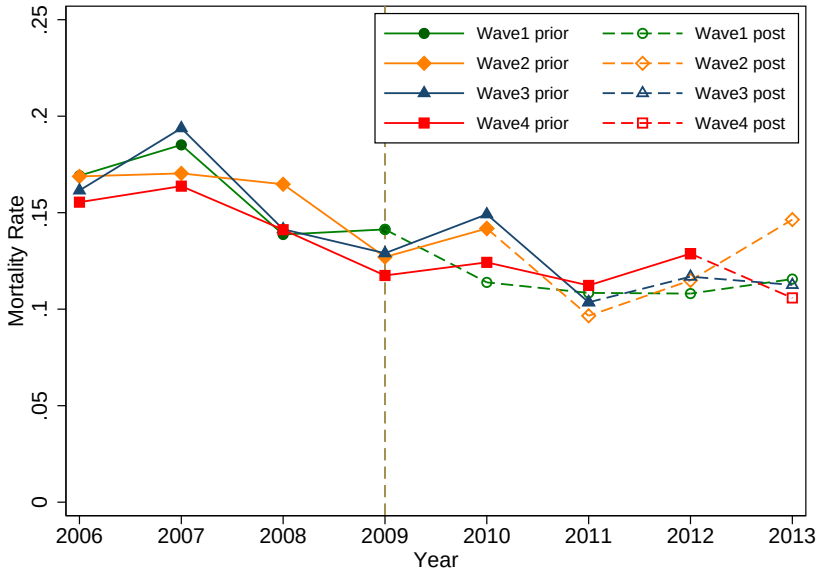


(f) Log(Number of Beds in Hospitals)



Note: The economic indexes from different prefectures are from the China City Statistics Yearbook 2004-2010. The prefectures are grouped by the different starting years of the NRPS. Each figure plots the mean values of the logarithm of the economic indexes from 2003 to 2009.

Figure 5: Mortality Time Trends in Counties, by the NRPS Starting Year



Note: The mortality data are from the CLHLS 2005-2014. The sample is divided by the different starting years of the NRPS. For each subsample, we plot the mean of mortality against the calendar year, with solid lines for the period prior to implementation of the NRPS while dash lines represent the period after implementation of the NRPS.

Table 7: Summary of the Effects of the NRPS

	(1)	(2)	(3)	(4)	(5)
Groups	Effects of the NRPS on outcomes in specific group				
Panel A: Effects among rural adults					
	Pension receipt	Household Income	Labor supply	Food expenditure	Health
Age eligible	+	+	-	+	+
Age ineligible	No	No	No	No	No
Panel B: Effects among children					
	Pocket money	Reported Health	Cared by grandparents		Education
Children	+	+	+		+

Note: This table summarizes the findings in the above analysis. The sign "+" stands for significantly positive, "-" for significantly negative, and "No" for insignificant effects found. The effects on children's health and whether they are being cared for by their grandparents are found only among boys while effects on education are found among girls.

of social pensions has led to reduced mortality of people with different ages. 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.

Similar to Duflo (2000, 2003), we also find better outcomes for children after implementation of the NRPS. In general, children are more likely to receive pocket money, to be cared for by their grandparents, to report better health and to stay in school. The rural elderly are less of a burden to their families or households because of the NRPS. Therefore, rural households are able to allocate more resources, including money and time, on child rearing. These results also suggest that the NRPS may have far-reaching consequences on China's the next generation.

5 Conclusion

This paper examines the effects of the social pension provision on the lives of elderly citizens in China in terms of income, expenditures, private transfers, labor supply, health and mortality. Compared to previous literature on pension, we provide more detailed and comprehensive evidence from more micro-level data from China. By exploiting a policy experiment, introduction of the NRPS in China, we first find that rural Chinese citizens 60 years of age and older have a 25 percentage points higher probability of receiving a pension immediately after the introduction of the NRPS. Meanwhile, the NRPS increases the household income by 17.6 percent, food expenditures by 9.6 percent and reduces labor supply by 3.0 percentage points (6.2 percent) .

Furthermore, after implementation of the NRPS the rates of reported disability and malnutrition decline by 3.2 percentage points (11.4 percent) and 1.8 percentage points (11.3 percent), respectively. In addition, our analysis of an individual-year panel composed of those aged 65 years and older in CLHLS shows that in the short term, implementation of the NRPS reduces the mortality by 2.2 percentage points (14.4 percent). In contrast, among the people who are ineligible for pension benefits, we do not find any significant effects on pension receipts, income, labor supply, health and mortality.

Finally, we examine the effects of the NRPS on children 15 years of age or younger. We find that the NRPS generally leads to higher chances of children in this age group receiving pocket money, being taken care of by their grandparents, demonstrate improved self-reported health status, and have a higher probability of school attendance, although the results vary across gender and age groups.

Our findings support the ongoing literature that documents the effects of social pensions or similar cash transfer programs on individual behaviors and welfare. Given that the world's population is rapidly aging, our analysis shows that a small portion of resources in a less developed economy such as China may generate substantial welfare improvements when these resources are properly allocated to vulnerable groups, e.g. the rural elderly in this study.

In addition, by comprehensively examining the effects of the NRPS on a series of outcomes among people of different ages, this paper enables analysis of whether and how pension programs affect the welfare of people of different ages. Our estimates suggest that the NRPS improves nutrition and reduces farm work, which may contribute to the improved health of the elderly , and that more resources are received by children. Therefore, our results suggest that the NRPS improves the welfare of the age eligible people (i.e., the oldest group) and the children's (i.e. the youngest group). But there is little evidence to conclude how this pension affects the welfare of adults who are not yet eligible to receive pensions.

Although we exploit a natural experiment in China and employ the DID model in identifying the causal effects of a new pension program on a series of outcomes, our study still has some limitations. One is the measurement errors of the reported income and expenditures. As mentioned in previous studies (e.g., Moore and Welniak 2000; Bound et al. 2001; Meyer and Sullivan 2003 etc.), reported income and expenditures suffer serious measurement errors and the coefficients must be interpreted carefully. Finally, as the social pension program under study was been only initiated relatively recently, we lack knowledge about its long-term effects.

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Online Appendix

A. Data Description

The China Family Panel Studies (CFPS) CFPS is a biennial survey and is designed to be complementary to the US Panel Study of Income Dynamics (PSID). The first national wave was conducted in collaboration with the Institute of Social Science Survey at the Peking University and the Survey Research Center at the University of Michigan from April 2010 to August 2010. The five main parts of the questionnaire include data on communities, households, household members, adults and children.

The 2010 round covered approximately 14,000 households in 25 provinces, in which 95 percent of China's population reside. The population is divided into six sub-population areas including five large provinces (Guangdong, Gansu, Liaoning, Henan, and Shanghai) and the remaining 20 provinces. The final sample is made to be representative of these 25 provinces through careful weighting.

The survey sample was obtained by a three-stage cluster sampling with unequal probabilities. In the first stage, 16 counties were sampled from the four of the large provinces and 32 township-level units from Shanghai, and 80 counties from the other 20 provinces, with probabilities proportional to population size (PPS). In total, there were 144 counties and 32 township-level units. In the second stage, two or four administrative villages or resident committees were sampled with PPS in each county or town. Together there were 640 villages or resident committees. In the third stage, 28-42 households were sampled from each village or resident committee, and in all there were about 16,000 households.

The final national representative sample covers 14,960 households and 33,600 adults (aged 16+ years). A follow-up survey of the CFPS was conducted in 2012, which covers 13,448 households and 35,729 adults; 12,724 households and 26,385 adults were originally covered in the baseline survey.

The China Health and Retirement Longitudinal Studies (CHARLS) The CHARLS aims to collect a high quality nationally representative sample of Chinese residents ages 45 and older to serve the needs of scientific research on the elderly. The baseline national wave of the CHARLS was fielded in 2011. The individuals will be followed up every two years. This study used both the 2011 and 2013 waves of the study. In the base line survey, the sample was drawn in four stages. County-level units (counties or urban districts) were sampled directly. All county-level units in all of the provinces except Tibet were stratified into eight regions, by whether they were urban districts or rural counties, and based on county GDP data. They were sorted based on this stratification and 150 were randomly chosen proportional to population size. These counties cover 28 out of 30 provinces, other than Tibet. After the county units were chosen, the National Bureau of Statistics helped the CHARLS team to sample villages and communities within county units using recently updated village level population data. The CHARLS sample used administrative villages in rural areas and neighborhoods, which comprise one or more formal resident committees, in urban areas as the primary sampling units (PSUs). The CHARLS then sampled three PSUs within each county-level unit, using PPS sampling, for a total of 450 PSUs. In each PSU, the CHARLS team constructed sampling frame using Google Earth based maps. A computer assisted personal interview (CAPI) program was then used to sample households and to conduct the interviews using laptops. All age-eligible sample households with people who were willing to participate in the survey were interviewed: 10,257 households containing 18,245 respondents aged 45 years and over and their spouses were ultimately interviewed. The follow-up survey covers 10,979 households containing 19,666 respondents, with 16,159 (9,185) out of 18,245 (10,257) individuals (households) in the baseline survey successfully re-interviewed and 3507 individuals in 2,053 households newly interviewed. The main questionnaire includes information on basic demographics, family, health status, health care and health insurance, work, retirement and pension, and household economy (income, consumption and wealth).

The Chinese Longitudinal Healthy Longevity Survey (CLHLS) The CLHLS is a longitudinal survey conducted by the Center for Healthy Aging and Family Studies in Peking University, sponsored and supported by the National Institute on Aging, United Nations, Duke University and the Max Planck Institute for Demographic Research. Demographic and statistical methods are used to analyze data in the longitudinal surveys with the research goal of determining which factors, out of a large set of social, behavioral, biological, and environmental risk factors play an important role in healthy longevity.

The baseline survey was conducted in 1998, with follow-up surveys with replacements for deceased elders conducted in 2000, 2002, 2005, 2008, 2011 and 2014 in a randomly selected half of the total number of counties and cities in the 22 out of 31 provinces in mainland China. The survey areas covered 1.1 billion people, 85 percent of China's total population. An enumerator and a nurse, or a medical school student, conducted the interviews and performed a basic health examination at each interviewee's home. We use data from the longitudinal datasets staring from the 2005 wave. The 2005 wave interviewed 15,638 Chinese citizens, 25 of whom were younger than 65 years of age, 4,955 who were in the 65-79 years of age group and 10,658 who were 80+ years old (including 2,797 centenarians, 3,952 nonagenarians and 3,909 octogenarians).

B. Other Results of the NRPS

This section shows other results of the NRPS mentioned in main text.

Table B1 shows the results for labor supply among those rural people aged between 45 and 49. Table B2 shows the effects of the NRPS on living arrangement and cross-county migration. There is no evidence for any significant effects on cross-county migration or household size. Table B3 shows the results weighted by represented population, and Table B4 shows the results using individual fixed effects. The results show no material difference with those in main text. Finally, Table B4 shows additional results for the mortality in CLHLS.

Table B1: Effects of the NRPS on Labor Supply , Ages 45-49 and Rural *hukou*

Variables	(1) Working now (Yes = 1)	(2) Farm work (Yes = 1)	(3) Non-farm work (Yes =1)
Mean of Y	0.761	0.534	0.228
$NRPS_{ct}$	0.003	-0.043	0.045*
	(0.027)	(0.029)	(0.023)
Observations	10,568	10,549	10,549
R-squared	0.238	0.231	0.245

Note: The data are from those from 45 to 49 years of age in the CFPS and the CHARLS. The covariates in the regressions in each column are the same with those in 1.
**** p<0.01, ** p<0.05 and * p<0.1*

Table B2: Effects of the NRPS on Living Arrangement and Migration

VARIABLES	(1) Log(Household size)	(2) Cross-county migrants (Yes =1)
Panel A: Age-eligible group		
$NRPS_{ct}$	0.001	-0.021
	(0.014)	(0.018)
Observations	20,870	11,518
R-squared	0.265	0.133
Panel B: Age-ineligible group		
$NRPS_{ct}$	-0.001	-0.007
	(0.011)	(0.011)
Observations	28,240	16,445
R-squared	0.290	0.145

Notes: The data are from those 45 years of age and above in the CHARLS and the CFPS. 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 and * p<0.1*

Table B3: Effects of the NRPS in eligible group, weighted by represented population size in each dataset

Dependent variables	(1) HH receiving pension (Yes = 1)	(2) Log (HH income)	(3) Log(HH expenditure)	(4) Log(Food expenditure)	(5) Working (Yes = 1)	(6) Farm work (Yes = 1)	(7) Non-farm work (Yes = 1)
Mean of Y	0.43	9.67	9.478	8.551	0.477	0.424	0.053
$NRPS_{ct}$	0.254***	0.178**	0.032	0.096*	-0.029	-0.030	0.001
	(0.039)	(0.070)	(0.044)	(0.058)	(0.019)	(0.019)	(0.009)
Observations	21,434	20,584	16,220	15,906	21,158	21,133	21,133
R-squared	0.435	0.221	0.189	0.262	0.304	0.275	0.136

	(8) Unhealthiness score	(9) Reported fair/poor health (Yes =1)	(10) Reported disable (Yes = 1)	(11) Underweight (Yes =1)
Mean of Y	0.312	0.740	0.304	0.153
$NRPS_{ct}$	-0.126***	-0.020	-0.044**	-0.017*
	(0.048)	(0.054)	(0.020)	(0.009)
Observations	17,723	21,175	21,164	17,726
R-squared	0.165	0.195	0.191	0.120

Notes: The data are from those 45 years of age and above in the CHARLS and the CFPS. All the regressions are weighted by represented population of the datasets. 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 and * p<0.1*

Table B4: Effects of the NRPS in eligible group, individual fixed effects controlled

Dependent variables	(1) HH receiving pension (Yes = 1)	(2) Log (HH income)	(3) Log(HH expenditure)	(4) Log(Food expenditure)	(5) Working (Yes = 1)	(6) Farm work (Yes = 1)	(7) Non-farm work (Yes = 1)
Mean of Y	0.43	9.64	9.478	8.551	0.65	0.467	0.184
$NRPS_{ct}$	0.234***	0.179***	0.027	0.092	-0.028	-0.037**	0.008
	(0.038)	(0.068)	(0.046)	(0.061)	(0.017)	(0.018)	(0.006)
Observations	17,302	15,964	10,204	9,852	17,136	17,086	17,086
R-squared	0.709	0.693	0.723	0.672	0.742	0.736	0.644

	(8) Unhealthiness score	(9) Reported fair/poor health (Yes =1)	(10) Reported disable (Yes = 1)	(11) Underweight (Yes =1)
Mean of Y	0.312	0.740	0.304	0.153
$NRPS_{ct}$	-0.117**	-0.003	-0.025	-0.020*
	(0.047)	(0.021)	(0.016)	(0.011)
Observations	12,400	16,730	17,308	12,558
R-squared	0.677	0.496	0.699	0.769

Notes: The data are from those 45 years of age and above in the CHARLS and the CFPS. All the regressions are weighted by represented population of the datasets. 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 and * p<0.1*

Table B5: Effects of the NRPS on Mortality in CLHLS

Sample	(1)	(2) Full sample	(3)	(4) Sample without lost individuals
Variables	One-year mortality	Died due to severe disease (Yes =1)	Died without severe disease (Yes =1)	One-year mortality
Panel A: Living in rural area and having no retirement scheme				
Mean of Y	0.150	0.0541	0.0962	0.157
$NRPS_{ct}$	-0.0217**	-0.00426	-0.0174**	-0.0223**
	(0.00952)	(0.00638)	(0.00793)	(0.00981)
Observations	29,871	29,871	29,871	28,407
R-squared	0.139	0.060	0.122	0.137
Panel B: Living in urban area and having retirement scheme				
Mean of Y	0.102	0.0568	0.0456	0.124
$NRPS_{ct}$	-0.00678	-0.00195	-0.00483	-0.00798
	(0.0136)	(0.0107)	(0.00939)	(0.0155)
Observations	9,047	9,047	9,047	7,456
R-squared	0.196	0.125	0.179	0.201
F-statistics	0.86	0.04	1.03	–
P-values	0.35	0.84	0.31	–

*Note: The data are from Chinese citizens 45 years of age and above in the CLHLS. The last column dropped the lost ones in the data. The covariates in the regressions in each column include age and its square, and dummies for gender, education level, calendar year, county and whether the individual was lost in the years. All the standard errors are clustered at the county level. The F-statistics at the bottom of each panel test whether the differences with those for rural residents age 60 years and older are statistically significant or not. *** p<0.01, ** p<0.05 and * p<0.1*

Table C1. Social Pension Programs in 10 countries

Country	Year introduced	Age of eligibility
Belgium	1924	65
Canada	1927	65
Denmark	1891	65
Finland	1937	65
France	1956	65
Italy	1969	65 and 3 months
Norway	1936	67
Sweden	1913	65
Switzerland	1948	65 (men) 60 (women)
United States	1937	65

Note: Data are from Cutler and Johnson (2004) and the Pension-Watch website (http://www.pension-watch.net/about-social-pensions).

C. Cross-Country Evidence from Cohort Data

We use cross-country aggregate-level data to investigate whether the introduction of social pensions has led to reduced mortality in this section. Mortality data are from the Human Mortality Database (HMD).[20] The country-specific timing of the introduction of social pensions is from Cutler and Johnson (2004) and the Pension-Watch website.

We match the HMD information with the available country data as at the introduction of each country's social pension scheme. This matching is restricted to countries with mortality information both before and after the introduction of social pension programs. These criteria result in a sample of 10 countries: Belgium, Canada, Denmark, Finland, France, Italy, Norway, Sweden, Switzerland and the United States. Among these countries, the earliest to introduce a social pension is Denmark (1891) and the most recent is Italy (1969). Table C1 presents these countries and the introductory year of each's social pension program.[21]

[20]The HMD contains detailed cohort life tables by year of birth and gender. A typical observation in the HMD is the mortality rate, per 100,000, for men and women in a particular year in a particular country at a certain age, ranging from 0 to 110. The HMD provides the mortality tables in various years across 38 countries or regions. The country list and available years can be found at: http://www.mortality.org/.

[21]Table 2 of Cutler and Johnson (2004) provides the detailed years of introduction, the case of introduction, type of system and later the changes for social pensions in 20 different countries. The *Pension-Watch* website provides the policy-designed eligible ages for pension schemes across countries. The *Pension-Watch* website is http://www.pension-watch.net/about-social-pensions.

Because both the level and trends in mortality vary greatly over time, we use the regression discontinuity design (RDD) to identify the effects of social pension programs on mortality. We restrict the sample to persons older than 45 years of age because this group of elderly people is generally the targeted population for social pensions. We also drop data on people older than 90 years due to possible misreporting issues and large measurement errors. We define t as the relative year; it is the number of years between when a country introduced social pensions and the data year. For example, t equals -1 if the data year is the year immediately preceding the introduction of social pensions, and equals 1 if the data year is one year after that.

To control for invariant factors such as country, gender and age, which may influence mortality, we keep the sample with a 10-year bandwidth (i.e., $\mid t \mid \leqslant 10$). We divide this sample into 900 different groups (s) based on country (10), gender (2), and age (45). Within each group s, we detrend the logarithm of mortality rate over the relative year by regressing the logarithm of the mortality on the relative year and its square. We then pool the residuals from all of the groups. In this analysis, we follow Ruhm (2000) and weight the residuals by the square root of the represented population size.

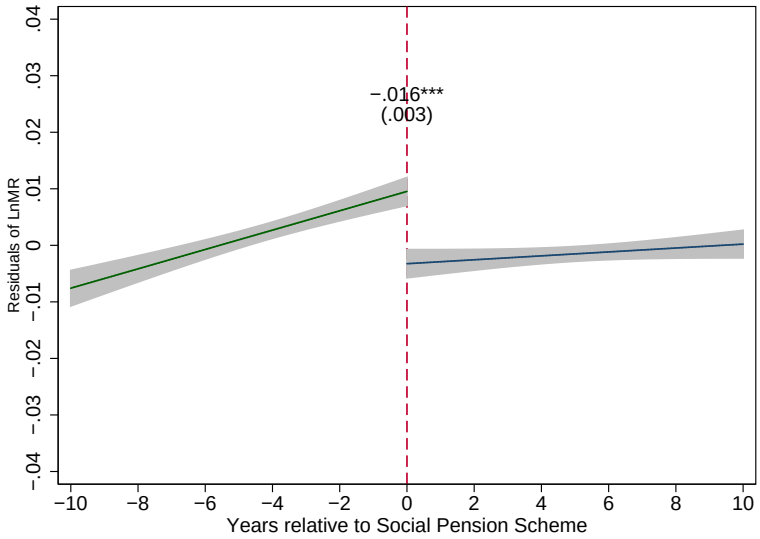
Figures C1a and C1b plot the linearly fit lines and confidence intervals (CIs) over the relative year for the age-eligible (i.e., those at and older than the pension eligibility age), and the age-ineligible (i.e., those younger than the pension eligibility age), respectively. Figure 1a shows that, among the age-eligible people, the introduction of the social pensions significantly reduces mortality by 1.7 percent. In contrast, the reduction in mortality rates after the introduction of social pensions is much smaller (0.3 percent) and statistically insignificant for the age-ineligible people.

We estimate the following equation to further test the robustness of the results:

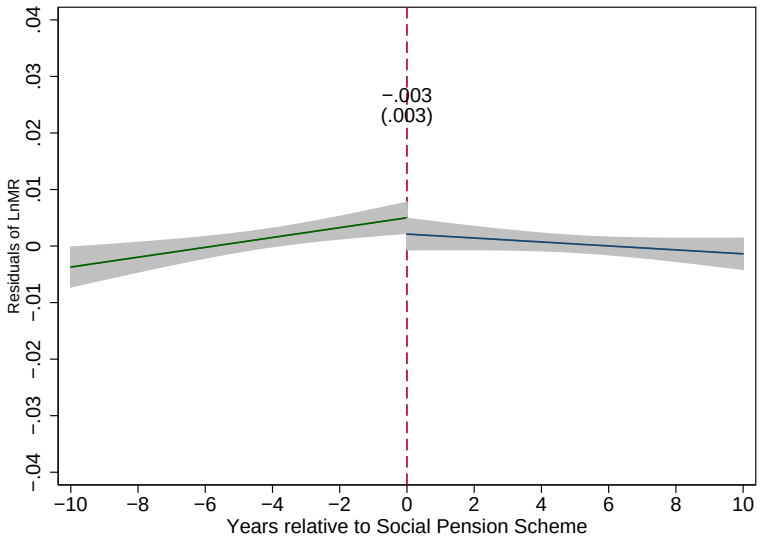
$$lnMR_{gact} = \alpha Post_{ct} + \delta_{gac} + t_{gac} + t_{gac}^2 + \varepsilon_{cagt} \tag{5}$$

The dependent variable, $lnMR_{cagt}$, is the logarithm of the mortality rate of people of age a, gender g in country c in the relative year t. $Post_{ct}$ is an indicator variable, which equals one if the country c had a social pension program in place in year t, and zero if not. The coefficient, α,

Figure C1: Regression Discontinuity Estimation for the Effects of Social Pensions on Mortality



(a) Age-eligible group



(b) Age-ineligible group

Note: The mortality data are from the HMD and the pension time data about timing of pension are from Cutler and Johnson (2004) and Pension-Watch website. For each country-gender-age cell, we regress the logarithm of mortality on the relative year and its square. We then keep and pool the residuals of all of the groups, and plot the linearly fit lines and confidential intervals (CIs) over the relative year.

captures the effects of the introduction of social pension program on mortality in our sample. To control for the potential unobserved confounding factors, we include the fixed effects of gender, age, country and all of the three combined (δ_{gac}) in the regressions. And, for each combination of gender (g), age (a) and country (c), we also control for the linear and square trends in relative year, t_{gac} and t^2_{gac}. For example, for Belgium men who were 70 years of age, we have both linear and square trends and we have another two trends for Belgium women of the same age.

Following the graphic analysis, we report the RD regression results for age-eligible group and age-ineligible group in Panels A and B of Table C2, respectively. The different columns show the different bandwidths - five, six and seven years.[22] The estimates in Panel A consistently show that the introduction of social pensions significantly reduces mortality among age-eligible people by 1.6-2.2 percent. In contrast, the comparable effects among age-ineligible people are much smaller and statistically insignificant. The differences in the coefficients between age-eligible and age-ineligible groups are statistically significant. The last column, following Card et al. (2008, 2009), controls for specific linear trends in each relative year before and after the introduction of social pension programs, which also yields consistent results.

[22] According to Calonico et al. (2014), the "optimal" bandwidth is six years.

Table C2. Regression Discontinuity Results for the Effects of the Introduction of Social Pension Program

	(1)	(2)	(3)	(4)
Variables	Logarithm of Mortality Rate			
Bandwidth	5 years	6 years	7 years	6 years
Trends terms		Relative year and its square		Relative year linear trends before and after pension
Panel A: Age eligible group (pension age threshold and older)				
$Post_{ct}$	-0.022***	-0.017***	-0.016***	-0.022***
	(0.003)	(0.003)	(0.003)	(0.003)
Observations	5,605	6,539	7,421	6,539
R-squared	0.996	0.995	0.995	0.996
Panel B: Age ineligible group (45 - pension age threshold)				
$Post_{ct}$	-0.002	0.003	0.005	-0.001
	(0.003)	(0.003)	(0.003)	(0.004)
Observations	4,331	5,053	5,735	5,053
R-squared	0.994	0.994	0.994	0.994
F-statistics	17.68	19.10	20.48	19.45
P-value	0.00	0.00	0.00	0.00

*Note: Data are from the Human Mortality Database (HMD), Table 2 of Cutler and Johnson (2004) and Pension-Watch website. All of the regressions are weighted by the square root of population size and the standard errors are clustered at the country-gender-age level. The F-statistics at the bottom of the table test the significance of the difference between coefficients in Panels A and B. *** p<0.01, ** p<0.05 and * p<0.1*