



Land reallocation responses to China's New Rural Pension Scheme: Evidence from a regression discontinuity design

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ABSTRACT

This study examines how labor reallocation has been associated with land reallocation following the implementation of the New Rural Pension Scheme (NRPS) in 2009. Based on data from the China Health and Retirement Longitudinal Survey (CHARLS) gathered during two periods (2013 and 2015), it uses the discrete changes generated by the new program's rules to identify the impact on land reallocation, as represented by the amount of land rented out by the elderly and their spouses. The age 60 NRPS eligibility threshold is associated with large increases in land rented out. The most important channel identified is the increase in the number of adult-children migrants, which reduces the number of farm workers and may help relax credit constraints. In contrast, the NRPS program has had no impact on the extent of elderly labor; there are no changes in their time spent caring for grandchildren or paid work in the labor market. A deeper examination of the welfare effect shows that despite labor and land reallocation, the NRPS has had no impact on either household consumption or elderly well-being. This study contributes to the literature by connecting land (as a factor of production) with the pension scheme, which may have policy implications regarding how money transfer programs would affect land and labor reallocation and individual welfare in other countries in the global context.

1. Introduction

China's aging society has seen a rapid increase in the elderly population. In 1950, there were only 41 million people aged 60 and over, but this figure had increased to 160 million by 2009 (Zhou et al., 2015), and to 241 million by 2017, which constituted 17.3% of the total population. Liu (2014) estimated that the elderly population in China would exceed 487 million by 2053, thus making up 35% of the total population. As the most populated of the nations that face similar aging profiles, China will encounter unprecedented challenges in dealing with the large costs associated with the situation (Chen et al., 2018; Singh, 2018; Wang and Chen, 2014; Zhao et al., 2014). There will be significant implications for the elderly in China, most of whom live in rural areas that lack well-developed institutional support (Liu et al., 2016).

To cope with rural China's aging issue, the Chinese government launched the New Rural Pension Scheme (NRPS) in 2009 to provide better social security for senior-aged rural citizens. Earlier, rural residents relied primarily on their cropland's asset value, which was considered the principal method to provide for their basic living needs

(Wang et al., 2020). The question arose of whether those who receive pension payments are inclined to put their land up for lease because of the decline in the asset value of their cropland and NRPS's role as social security. This study addresses this question by examining whether, and to what extent, the NRPS has resulted in land reallocation; identifying the mechanisms through which the process occurs; and investigating whether it is associated with an improvement in rural elderly welfare.

There are three main lines of research relevant to this study. First, a rapidly growing line of research explores the effects of the NRPS on a number of outcome variables (other than land reallocation). It includes Ning et al. (2016), who observed no significant changes in the elderly labor supply; Eggleston et al. (2018) and Li et al. (2018), who had mixed results regarding the migration decisions of the adult children of the elderly; increased household expenditure (Zheng and Zhong, 2016); and improved elderly living arrangements (Cheng et al., 2018b). However, none of the studies on the welfare and labor reallocation effects of the NRPS in China's rural areas has examined the impact of the program on land reallocation. This question is crucial because land reallocation is likely to be linked to labor reallocation. For instance, Ma and Mu (2020)

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demonstrated that off-farm employment is one way that rural labor responds to land requisition, and Gao et al. (2020) found that labor migration from rural areas to urban cities led to land transfer.

Second, numerous developing economies have demonstrated the benefits of government transfers or social pension programs for senior citizens (Ardington et al., 2009). Studies have also examined how those programs affected the elderly and their families (Amuedo-Dorantes and Juarez, 2015). However, their primary focus was on the response of labor supply to such programs. For instance, Kaushal (2014) found that India's pension program, introduced in 2016, was associated with a decreased employment rate of men aged 55–70 with a relatively low level of education, and with increased family expenditures and decreased poverty. In contrast, Ardington et al. (2009) discovered that great transfers of cash to seniors resulted in a growing employment rate of prime-aged adults, which occurred mainly through migration. De Carvalho Filho (2008) observed that seniors' access to pensions was a significant factor in worker retirement in rural Brazil, which increased the probability of not working by 38 percent and reduced the total working hours per week by 22.5.

Third, numerous studies have focused directly on land issues in China's rural areas. A majority of the empirical research has examined the land rental market, through which land use can be reallocated (Brandt et al., 2017; Deininger and Jin, 2005; Feng et al., 2010; Gao et al., 2021; Grosjean and Kontoleon, 2009; Hui and Bao, 2013; Kimura et al., 2011; Long et al., 2009, 2014; Liu et al., 2008; Min et al., 2017; Mullan et al., 2011; Wang et al., 2015; Zhang et al., 2019). For instance, Kimura et al. (2011) established that the market for rented land was the most practical avenue to efficiently achieve allocation of land among households in China. Min et al. (2017) examined the crucial role of ethnicity, aging population, and land tenure security in the way smallholders participate in China's rental market. In China, land reallocation was also influenced by insecure land rights and limited social protections. Ma (2020) noted that eliminating this type of nonproductive value would promote land consolidation and labor relocation to off-farm sectors. However, far less work has been done regarding the potential impact of large social transfers (e.g., NRPS) on land rental behavior.

This study makes valuable contributions to the literature in three respects. First, research has shown that land transfers have recently become prominent in China. However, there is little information on whether the NRPS, in providing financial support to the elderly, has contributed to the renting out of land in rural China. This study is one of the first to address the issue.¹ Second, it answers the question of why this increase in renting out has occurred, mainly by linking it to the labor supply's response to NRPS. While other investigations revealed that the NRPS has led to labor reallocation, this study examines whether this is associated with land reallocation. Third, compared to the most relevant study (Wang et al., 2019), it uses a more reliable method (regression discontinuity design) that addresses potential endogeneity issues and indicates whether labor and land reallocation will lead to further welfare gains. This process provides important inferences regarding the efficacy of the NRPS, and has great implications for rural labor and land policies.

Utilizing data gathered from two waves (2013 and 2015) of the China Health and Retirement Longitudinal Survey (CHARLS) and conducting an analysis based on regression discontinuity (RD) design, this study examines the effect of pension receipts from the NRPS on land reallocation, and investigates how this effect is mediated by labor reallocation. In general, the results suggest that receiving pension benefits from the NRPS leads to the elderly renting out more of their land. The pension benefits contribute to an increase in the number of migrants among the adult-aged children of senior-aged parents, which reduces the amount of household farm labor and helps relax credit constraints.

However, the NRPS does not lead to welfare and well-being gains.

This remainder of this paper is organized as follows. Section 2 provides details on the NRPS program. Section 3 reviews the sources of data tapped for this study and presents an identification strategy to address the endogeneity issue that stems primarily from the self-selection bias. Section 4 provides the main estimates, comprises discussions on competing mechanisms that may explain the key results, and examines whether the pension scheme leads to further welfare and well-being gains. Section 5 provides the conclusions.

2. Background and literature

Economic reforms since the 1970s have improved the living standards of virtually all of China's vast population, although the elderly in rural areas have not benefited much (Li et al., 2021). In the absence of a rural old-age pension system, own-labor income and family support (such as financial support from their adult children) were the main origins of financial support for the rural elderly (Cai et al., 2012; Shi, 2006). To address this issue, in 1986, the government selected certain rich counties to serve as pilots for a rural pension system (Huang and Zhang, 2021; Zhu et al., 2021). That scheme did not work well, with a very low take-up rate, due mainly to the high financial burden it placed on families. Shi (2006) argued that the eventual failure of that rural pension policy to evolve consistently into an efficient and comprehensive system was directly associated with the different opinions among bureaucrats regarding the kind of welfare that rural seniors needed. The scheme ended in 1998 due to its unsustainable finances and was replaced in 2009 by the NRPS in the official document "State Council Guidance Regarding the Development of New Rural Pension Pilot (China [2009] No. 32)" from the State Council of China. The government had implemented NRPS in 320 pilot counties. This number grew to 838 pilot counties by 2010, and to 1914 and 2853 counties by the end of 2010 and 2012, respectively.

NRPS participation is voluntary for rural citizens (those with rural *hukou* in China's household registration system) who are 16 years old or older, provided that they are not studying in school and do not receive a basic urban pension. There are three parts of the NRPS: an individual premium (*ge ren jiao fei*), a subsidy from the village-level collective (*ji ti bu zhu*), and a government subsidy (*zheng fu bu tie*). The individual premium has five income groups: 100, 200, 300, 400, or 500 yuan per individual per year, with the rule being "higher contribution, higher benefits." Those who cannot afford to pay it are likely to receive a subsidy from the village-level collective; the amount varies by village according to the degree of economic development. With regard to the government subsidy, the central government pays the entire non-contributory basic pension for low-income families in the central and western regions, and half of those in the east. Local governments are required to fund no less than 30 yuan per year for all participants, although extremely poor groups—for example, people with disabilities—are likely to receive more financial support.

The NRPS benefit comprises two components: basic pension and contributory pension. The basic component changes slightly in line with GDP growth and inflation, having increased from 55 yuan to 70 yuan per month in 2014. It also varies by region, from as high as 380 yuan per month in Beijing and Shanghai to 55 yuan per month in the poorest regions (Cheng et al., 2018a). The contributory component is calculated using the accumulated contribution information from the participant's individual account, as shown above.²

A person aged 60 is eligible for NRPS if he or she can contribute for 15 years. Those aged 45 and over when participating in NRPS have to contribute annually until age 60. Seniors who are 60 years old or older with eligible children who can contribute to the scheme can directly

¹ A most recent attempt is Zhu et al. (2021). But they focus more on the renting decision and they do not look into welfare effect.

² One calculates the benefit by dividing the amount in the individual's account at age 60 by 139.

receive the basic pension. It can be viewed as a “family binding” arrangement. Table 1 presents the eligibility rules for receiving NRPS payments, which indicate that only NRPS participants 60 or over can receive the monthly pension.

This study focuses on whether and to what extent the NRPS led to changes in the area of land rented out by the elderly and their spouses, which is probably associated with the different labor supply responses of these people and their adult children (see Fig. 1).

First, if the NRPS increases the probability that the adult children in a given household migrate, the elderly will be more likely to put their land up for lease. Ji et al. (2018) verified this fact, and found that labor migration from rural areas had a positive effect on land rentals in rural China, mostly because fewer young workers were available for farming and the landholders were likely to be less credit constrained if they received remittances. In addition, Shi (2018) reported that migration from rural to urban areas had a negative net impact on both labor and land productivity in agriculture. This finding also provides evidence as to why adult children’s migration was one of the key mechanisms through which the NRPS affected land reallocation: As more labor left the agricultural sector and migrated to cities, the elderly tended to rent out their land, since otherwise their household-level productivity would fall. Eggleston et al. (2018) examined the 2012 Survey of Senior Citizens in Shandong, China, and found that providing care for seniors was a constraint on rural labor migration and that the NRPS had helped to relax it, thus resulting in a higher probability that those whose parents reached the age of eligibility for pensions would become migrants. In contrast, the NRPS could also have the opposite effect, with a reduction in adult children’s migration if the pension benefits are shared by other family members (Li et al., 2018). However, as the pension is only a small amount of money, it is unlikely that other family members would be able to fully rely on it. For the elderly themselves, this small amount of money could be very useful for their basic life. In this way, the pension will probably trigger the adult children’s migration, which may encourage the renting out of land.

Second, if the NRPS led to a reduced elderly labor supply due to its income effect, they might not rent out their land because they would then have more time to farm. A particular line of research has examined whether and to what extent pensions influence the elderly labor supply. For example, using data gathered from two periods of the CHARLS, Ning et al. (2016) did not find evidence that the NRPS reduced the likelihood of elderly engagement in the labor force. In contrast, using a case from the United States, Ruhm (1996) argued that pensions would decrease labor supply of some age groups but increase it in others, thus leading to a complex and vague aggregate effect that is not well known. In the Chinese context, we may expect our results to be consistent with those of Ning et al. (2016), which suggest no change in the labor force engagement of the elderly.

Third, due to the migration of adult children, the NRPS may have led the elderly to spend more time caring for their grandchildren. Ardington et al. (2009) verified this fact in South Africa, where the pension system led to increased employment among the pensioners’ adult children, primarily through labor migration. This effect can be attributed to household resource increase and to the presence of senior-aged citizens, who are able to raise small children. Li et al. (2018) demonstrated that the NRPS increased the hours that elderly men in rural China spent caring for grandchildren. If this is true, the NRPS program may have a positive influence on the area of rented land, since the elderly would

have less time to farm if they were caring for grandchildren.

Fourth, as a social security program, the NRPS may encourage the elderly to use this (small) amount of money to avail of health services. For instance, using the CHARLS, Cheng et al. (2018a, b) demonstrated that the NRPS had a beneficial impact on the health of rural seniors. If so, those receiving pension payments would have better health, and would be more likely to keep and cultivate their land instead of renting it out. However, there is a rapidly growing literature that establishes that in rural China, most aging people are still engaged in formal labor or work long hours in the informal sector (Pang et al., 2004). It suggests that those who do not receive pension payments are also likely to spend much time caring for their grandchildren. If the NRPS does not reduce the time spent on these tasks, elderly well-being is unlikely to have improved.

The four channels mentioned above are all ways in which family labor may be reallocated. It is associated with the last potential channel, which is that those receiving pension payments are more likely to buy agricultural production tools as labor substitutes. This move, in turn, relates to research on how the loss of labor affects agricultural production (Shi, 2018). Accordingly, the NRPS may lead to more land being rented out because the elderly have more agricultural production tools. However, we may expect this effect to be limited as the pension benefits are small amounts.

In sum, all five channels work by obtaining more money and reducing agricultural labor, which increase the probability that land is rented out. However, the first channel is most likely to operate. It relaxes the credit constraint, meaning that the rural elderly rely mainly on the social security function of land, which is their dominant source of income and basic food. In the absence of other income, the elderly also feel restricted with regard to consumption and investment. Receiving pension payments is a means of mitigating these concerns, and potential remittances from their adult children, who may earn a higher income in the cities (Shi, 2021), can further relax the financial constraints, especially regarding the basic living standard (e.g., food). It also corresponds to labor constraints, which implies that the loss of agricultural labor reduces the possibility that the elderly cultivate their land. If the other four channels do not play a role, we may expect no changes in the elderly’s welfare and well-being as they may still work until they are no longer able to or spend more time caring for their grandchildren.

Based on these observations, we propose the following three hypotheses:

Hypothesis 1. The elderly who are eligible to receive pension benefits are more likely to rent out their land than those who are ineligible.

Hypothesis 2. Changes in renting out are mainly driven by changes in adult children’s migration decisions, which result in a reduction in farm work and an increased income.

Hypothesis 3. Pension receipts from the NRPS do not result in more welfare and well-being.

3. Data and empirical strategy

3.1. Data

This study utilizes the data gathered from the 2013 and 2015 waves of the CHARLS. Following a multi-stage stratified random probability proportional to size sampling strategy, CHARLS obtained an effective national sample of residents 45 years old and older. The baseline data of CHARLS were collected in 2011, with 17,708 individuals interviewed in 450 residential committees or villages from 150 districts or counties. The first and second follow-up surveys were completed in 2013 and

Table 1
Eligibility rules for receiving NRPS benefits.

Age	NRPS insurant	
	No	Yes
<60	N (Group 1)	N (Group 3)
≥60	N (Group 2)	Y (Group 4)

Notes: N denotes non-pension receipt, and Y denotes pension receipt.

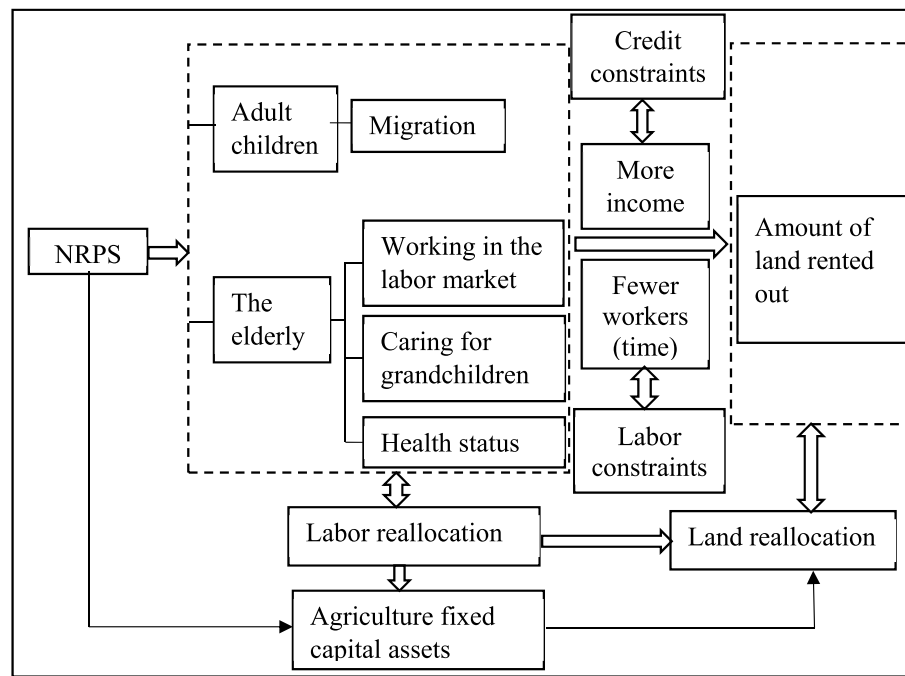


Fig. 1. The effect of NRPS on land reallocation via labor reallocation.

2015 with samples of 18,604 and 21,095 individuals, respectively.³

We restricted the sample to rural residents between the ages of 45 and 80,⁴ and excluded some entries with missing inputs and those of participants with pensions aside from the NRPS.⁵ Under NRPS rules, it is impossible for those below age 60 or who have not participated in the NRPS, to receive its pension benefits. Thus, we excluded some outliers that were inconsistent with this rule. This process yielded a final sample of 6758 elderly individuals.

The CHARLS datasets contain abundant information, including demographic, family, and health background, and income, work, retirement pension, expenditure, and assets. Our main variable of interest was the pension receipt from the NRPS, a dummy variable that was 1 if the participant was receiving monthly pension payments, and 0 otherwise. This variable has been widely adopted in research related to the NRPS (Eggleston et al., 2018; Li et al., 2018; Ning et al., 2016).

We included gender, age, educational attainment, marital status, family size, number of adult children, and cash held by the respondent and their spouse as control variables.⁶ Age is one of the most widely used variables in the literature. For instance, Deng et al. (2019) studied the effect of famine experiences on rural land transfer and how it changed with age. We included gender because land policies are not gender neutral in some aspects. For instance, women have greater odds at becoming “landless” at marriage (Chen and Summerfield, 2007), which suggests that they may differ from men with regard to land transfer decisions. The marital status of the respondents is important because it is associated with gender issues. We included educational attainment because this form of human capital inevitably affects land transfer

decisions, as revealed in other studies (Jiang et al., 2019). We included the size of the family and number of adult children because they are linked to labor constraints, while the cash held by the respondent and their spouse corresponds to credit constraints.

The primary dependent variable was land reallocation, represented by the amount of land rented out by the respondent and their spouse. The land rented out variable has been commonly used as a proxy for land transfer in the literature related to Chinese land issues (Deininger and Jin, 2005). We also used other outcome variables to identify the mechanisms through which pension receipts may have affected land allocation. These included the number of their adult children who were migrants, the time spent by the elderly caring for grandchildren and in the paid labor market, the health status of the respondents, and the total value of their agricultural production tools. The background provides the reasons why we chose these variables.

Table 2 summarizes the statistics for the sample, while Table 3 provides descriptive statistics by treatment status. Among the respondents, 68% were participants of the NRPS, of whom 45% received monthly pension benefits (30% of the full sample). Most importantly, the treatment and control groups varied considerably on most of the control variables. For instance, nearly half of the sample (49%) was men, and the sub-sample of those with pension receipts (the treatment group) had a majority of men (56%). In addition, the elderly who received pension payments were less educated and less likely to be married, had smaller families and more adult children, and held less cash. This situation suggested that self-selection into pension receipt status was likely, and that we would need to address it using appropriate regression techniques. The main outcome variable, the mean amount of rented land, was 0.55 mu for the full sample and 0.50 and 0.67 mu for the control and treatment groups, respectively. It provides preliminary evidence on land reallocation through the NRPS, which we can only confirm accurately once we address the endogeneity issue arising from the self-selection problem. Regarding the other outcome variables, the elderly who receive monthly pension payments have more adult children migrants, and they spend less time caring for grandchildren or working in the paid labor market.

³ We only chose the two follow-up surveys because their quality was much greater than that of the baseline survey.

⁴ There are probably not many individuals over 80 who have final say in the decision to rent out their land.

⁵ These pensions include commercial pensions, supplemental pension insurance from firms, urban resident pensions, and pension subsidies for the oldest people.

⁶ There are no signs shown using a non-parametric approach. The focus is on the impact of pension receipts, rather than the influence of these control variables on land reallocation.

Table 2
Summary statistics.

Variable	Definition	Mean	SD	Min	Max	N
NRPS	Receiving pension payments (= 1)	0.30	0.46	0	1	6758
NRPSp	Participating in NRPS (= 1)	0.68	0.47	0	1	6758
Age	Age of the respondent	59.53	9.09	45	80	6758
Gender	The respondent is male (= 1)	0.49	0.50	0	1	6758
Education	High school and above (= 1)	0.18	0.38	0	1	6758
Family size	Number of family members	2.77	1.44	0	12	6758
Marriage	The respondent is married (= 1)	0.77	0.42	0	1	6758
NOAC	Number of adult children	2.60	1.33	0	11	6758
Cash	Cash held by the respondent and their spouse (yuan)	1949	7544	0	200000	6758
Landout	Amount of land rented out (<i>mu</i>)	0.55	2.84	0	60	6758
NOADm	Number of adult children who are migrants	0.67	0.97	0	8	6758
Grandchildren	Hours spent taking care of grandchildren, last year	980	2108	0	8736	6758
Work	Hour of paid labor, last year	412	304	0	2016	856
Health	Self-reported health status of the elderly	2.930	1	1	5	2934
Agri. assets	Total value of respondent's fixed capital assets	1181	12034	0	700000	6758

Notes: Educational attainment was a dummy variable that was 1 if the highest diploma achieved was junior high school or above, and 0 otherwise. The number of adult children migrants includes those living separately from the elderly parents (non-co-resident adult children).

Table 3
Descriptive statistics by treatment status.

Variable	No pension receipt		Pension receipt		Difference
	Mean	N	Mean	N	
NRPS	0	4763	1	1995	1.00***
NRPSp	0.55	4763	1	1995	0.45***
Age	55.69	4763	68.70	1995	13.01***
Gender	0.46	4763	0.56	1995	0.10***
Education	0.21	4763	0.10	1995	-0.11***
Family size	2.89	4763	2.46	1995	-0.43***
Marriage	0.83	4763	0.63	1995	-0.19***
NOAC	2.30	4763	3.32	1995	1.02***
Cash	2273	4763	1175	1995	-1098***
Landout	0.50	4763	0.67	1995	0.17**
NOADm	0.46	4763	1.18	1995	0.72***
Grandchildren	1038	4763	841	1995	-197***
Work	413	747	406	109	-7.00
Health	2.98	2213	2.79	721	0.19***
Agri. assets	1307.77	4763	877.96	1995	429.81

Notes: Educational attainment was a dummy variable that was 1 if the highest diploma achieved was junior high school and above, and 0 otherwise. The number of adult children migrants included those who lived separately from the elderly parents (non-co-resident adult children). * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

3.2. Empirical strategy

To examine the causal effect of the NRPS on the land-renting decisions of the elderly, we have to address the endogeneity problem that arises from selection bias. Since the NRPS is not randomly assigned to rural residents, the socio-economic characteristics of individuals, households, and regions affect the participation decision, which is likely to confound the impact of the NRPS on the elderly's decision to put their land up for lease.

To address this issue, this study used the regression discontinuity (RD) approach, which is applicable to a non-experimental setting as a method for examining treatment effects. "The treatment is determined by whether an observed assignment exceeds a known cutoff point" (Lee and Lemieux, 2010). In this study, the age discontinuity in the benefit structure of the NRPS drives this method, along the lines discussed in Section 2. Since this pension has an eligibility age, we examined the causal effect of the NRPS on land reallocation within an RD framework, which had been commonly utilized in research (Ardington et al., 2009; Battistin et al., 2009; Card et al., 2008; Chang, 2013; Deshpande, 2016; Miller et al., 2013). In the case of the NRPS, some studies have utilized the RD design, based on age eligibility at 60, to ascertain the impact of the NRPS in China on a number of outcome variables, including adult children's migration (Eggleston et al., 2018), elderly labor supply (Ning et al., 2016), and the behavior of adult children in transferring funds to elderly parents (Ning et al., 2018). The details of the application of this approach in this study are explained below.

Let D be the time from age 60, when rural residents become eligible to receive pension payments, with the deterministic rule of eligibility status being 1 ($D \geq 0$). This variable can take on positive values (if rural residents are 60 or over) as well as negative values (if they are under 60). Let (Y_1, Y_0) be the two potential outcomes associated with receiving or not receiving pension payments, respectively. In this study, Y_1 and Y_0 denote the amount of land rented out by the respondent and their spouse, corresponding to receiving or not receiving pension benefits, respectively. The casual effect of NRPS on the amount of land rented out is then defined as $\beta = Y_1 - Y_0$ which is not observable because receiving a pension reveals Y_1 but conceals Y_0 .

As shown in Table 1, pension eligibility does not mean that rural residents are receiving pension payments, while those who are still ineligible cannot receive the pension.⁷ The probability of receiving pension payments for those under 60 ($D < 0$) is 0 by definition, while the probability of receiving pension benefits for those with positive values of D ($D \geq 0$) is less than 1. This result indicates a discontinuity (with a size of less than 1) at the threshold for eligibility, which helps address the endogeneity problem stemming from the self-selection into access to pension payments.

3.2.1. Sharp RD or fuzzy RD?

As shown in Section 2, numerous studies have used age eligibility to sidestep issues of self-selection and examine the causal impact of pension programs (and other social transfers). As discussed in the literature, there are two designs, "sharp" and "fuzzy," where the treatment probability rises discontinuously at the threshold point.⁸ Rather than in the design of sharp RD, where the treatment probability jumps from 0 to 1 at the threshold (here, at age 60), the probability jumps by less than 1 in the fuzzy RD design. It is principally because, even when treatment eligibility mainly depends on the cutoff, some eligible patients

⁷ It is possible that some village committees did not follow the pension eligibility rule, e.g., they provided pension payments for their relatives who were under 60 years old. This resulted in a small fraction of people under 60 in the sample receiving pension benefits. We excluded these observations, since they may confound the estimates.

⁸ See Calonico et al. (2014), Cattaneo et al. (2016), and Calonico et al. (2017) for the most up-to-date software packages for RD designs.

may not receive care due to noncompliance. For instance, the people in Group 2 from Table 1 are 60 and over, but they do not receive pension payments. Therefore, fuzzy RD is more appropriate for this study.

In the fuzzy RD design, treatment probability is written as:

$$Pr(T=1|X=x) = \gamma + \delta Z + g(x-60) \quad (1)$$

where T denotes treatment status (receiving pension payments), X denotes age, and $Z = 1(X \geq 60)$ indicates whether the age exceeds the cutoff point (60).⁹ Building on it, the following two-equation system describes the fuzzy RD design:

$$Y = \alpha + \tau T + f(X-60) + \varepsilon \quad (2)$$

$$T = \gamma + \delta Z + g(X-60) + v \quad (3)$$

where the treatment effect τ is estimated by instrumenting the treatment dummy T with Z . Substituting equation (3) into equation (2) yields the following reduced form:

$$Y = \alpha_{\eta} + \tau_{\eta} Z + f_{\eta}(X-60) + \varepsilon_{\eta} \quad (4)$$

where $\tau_{\eta} = \tau\delta$ can be considered as an “intention-to-treat” effect. In other words, as shown in Imbens and Lemieux (2008), the average causal impact of the treatment, $\tau = \frac{\tau_{\eta}}{\delta}$, can be interpreted as the ratio of the jump in the outcome’s regression (here, the amount of land rented out) on age to the jump in the treatment indicator’s regression (here, pension receipt) on age:

$$\tau = \frac{\lim_{a \downarrow 60} E(y_i|X_i = 60) - \lim_{a \downarrow 60} E(y_i|X_i = 60)}{\lim_{a \downarrow 60} E(p_i|X_i = 60) - \lim_{a \downarrow 60} E(p_i|X_i = 60)} = \frac{E(y_i|D = 0^+) - E(y_i|D = 0^-)}{E(p_i|D = 0^+) - E(p_i|D = 0^-)} \quad (5)$$

As shown in Battistin et al. (2009), for this result to hold, the mean value of Y_0 conditional on D must be a function of D at $D = 0$. It suggests that a jump in Y around eligibility age can be interpreted as a causal impact only if there is no discontinuity in Y around that cutoff in the absence of a pension receipt. This situation assumes a smooth outcome profile at $D = 0$ in the counterfactual case of no pension receipt. We show that this is the case through the robustness checks below.

3.2.2. Polynomial regression or local linear regression?

The fuzzy RD design can perform estimation via polynomial regression or local linear regression. In an RD design, local linear regression provides a non-parametric method for estimating the treatment effect. The central idea is to estimate a regression over a window of width on both sides of the cutoff point. It can be done using different kernels (e.g., rectangular, triangular), but makes little difference in practice (Lee and Lemieux, 2010). The regression on the cutoff point’s left-hand side is:

$$Y = \alpha_l + \beta_l(X-60) + \varepsilon, 60-h \leq X < 60 \quad (6)$$

and the regression on the cutoff point’s right-hand side is:

$$Y = \alpha_r + \beta_r(X-60) + \varepsilon, 60 \leq X < 60+h \quad (7)$$

Conveniently, we can estimate the following pooled regression, because the regression can directly produce the estimated treatment effect:

$$Y = \alpha_l + \tau T + \beta_l(X-60) + (\beta_r - \beta_l)T(X-60) + \varepsilon, 60-h \leq X \leq 60+h \quad (8)$$

The most difficult question for local linear regression is the bandwidth selection. We follow Imbens and Lemieux (2008) in choosing the bandwidth. Although local linear regression is the most widely used approach in the literature, it has the limitation that there are fewer data as the area examined narrows.

For comparative purposes, we adopted a simple method of imple-

menting RD design by estimating two (polynomial) regressions on each side of the cutoff point. The regression on the cutoff point’s left-hand side ($X < 60$) is:

$$Y = \alpha_l + f_l(X-60) + \varepsilon \quad (9)$$

The regression on the cut-off point’s right-hand side ($X \geq 60$) is:

$$Y = \alpha_r + f_r(X-60) + \varepsilon \quad (10)$$

Treatment effect can be estimated more directly by running a pooled regression on both sides of the cutoff point, including interaction terms between the treatment dummy T and X :

$$Y = \alpha_l + \tau T + \beta_l f(X-60) + (\beta_r - \beta_l) T f(X-60) + \varepsilon \quad (11)$$

From an applied perspective, since there is no compelling reason to assume that the true model is linear, the regression model in the literature tends to include polynomial functions of X , as shown in Equation (11) by $f(X-60)$, to relax the linearity assumption. Employing more flexible specifications by adding polynomials in X as regressors is a vital means of checking the robustness of the RD estimates (Lee and Lemieux, 2010).

To minimize the bias from using polynomial regressions, we employed the two-stage least squares (2SLS) estimator τ in the following equation, using $Z_i = 1(X \geq 60)$ as the instrumental variable for pension receipt T :

$$y_i = \alpha + \tau T + \beta f(X-60) + \gamma \cdot 1(X \geq 60) f(X-60) + \varepsilon_i \quad (12)$$

4. Results

4.1. Overall effects on land renting out

4.1.1. Graphical evidence

Fig. 2 plots the probability that respondents reported receiving pension payments according to their normalized age (set to 0 at age 60). The vertical axis is the dummy indicator for pension receipt (1 if receiving an NRPS payment, 0 otherwise). Panel A uses a linear regression, while Panels B, C, and D applied second-, third-, and fourth-degree polynomial terms, respectively. Based on a fuzzy design, we see sharp jumps from the fitted value of the pension receipt at the age cutoff (less than 1) in every panel. Consistent with the age eligibility rule, this result presents strength in the fuzzy RD design’s first stage.

Fig. 3 displays the relationship between the amount of land rented out (the outcome variable of interest) and the respondent’s normalized age using a variety of polynomial terms. Every panel shows a large jump in the amount of land rented out at the cutoff age (when the respondent turned 60). Together with Fig. 2, it provides preliminary evidence for the effect of pension payments on land reallocation, thus suggesting that those who receive pension benefits are more inclined to put their land up for lease.

4.1.2. Fuzzy RD estimation

To determine the extent to which pension receipts affected respondents’ land rental decisions, we calculated fuzzy RD estimates using the method discussed in Section 3. Table 4 shows the results of the first-stage estimations, using local linear regressions in columns 1 and 2, and 2SLS with polynomial terms in column 3. These estimation methods yielded similar results to those above: Consistent with the graphical evidence, those above the eligibility cutoff point were more likely to receive pension payments.

Panel A in Table 5 provides the fuzzy RD estimates (treatment effect τ). Using local linear regression, Column 1 provides the most parsimonious specifications as a useful benchmark, where eligibility is the only regressor. Consistent with the graphical evidence above, the treatment effect of receiving pension payments is significant and large in magnitude (5 mu). It is identical to the result in Column 2, which adds some control variables and indicates that pension receipt increases the rented

⁹ Note that in the case of sharp RD, $\gamma = 0, g(\cdot) = 0$, and $\delta = 1$.

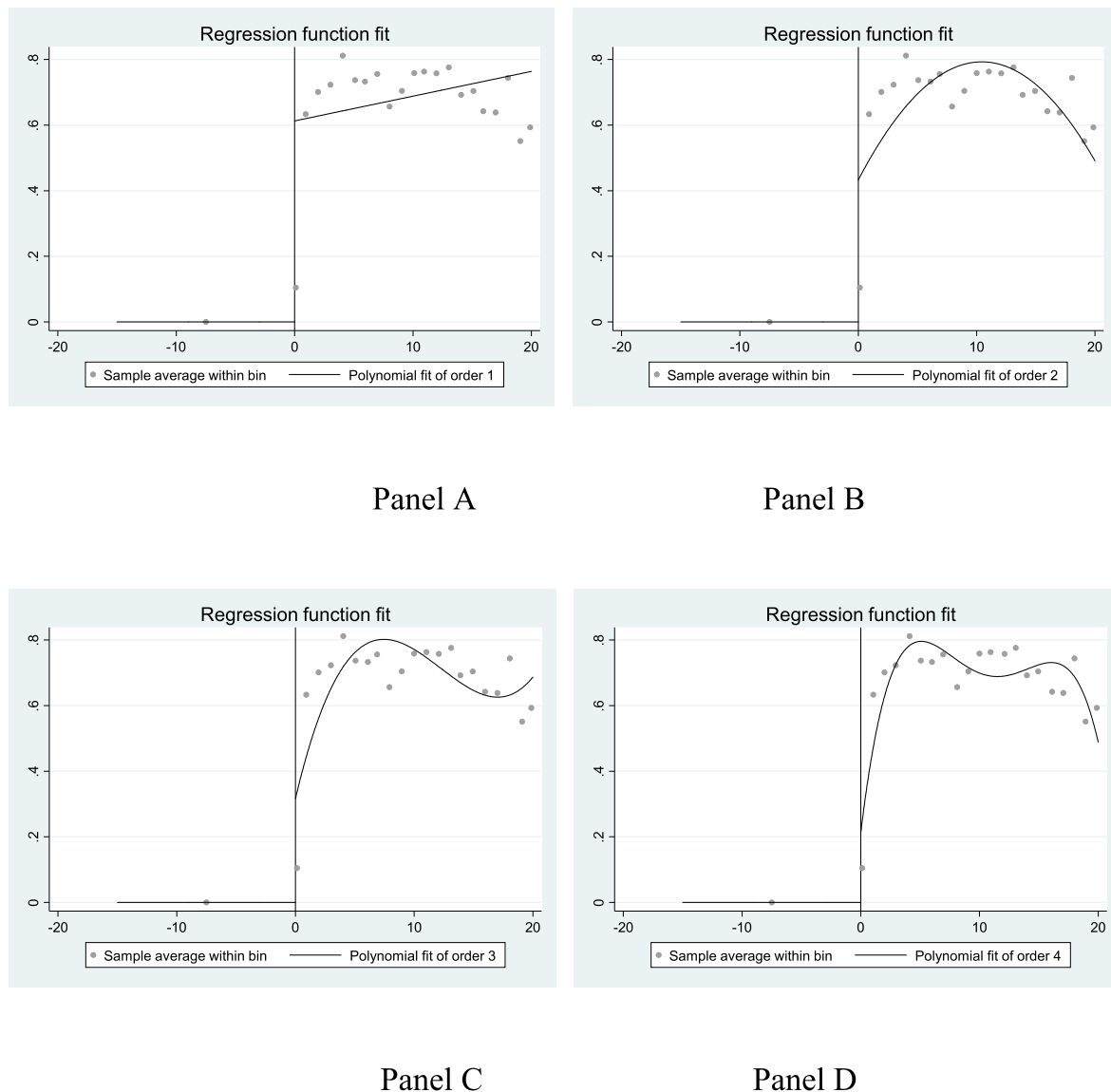


Fig. 2. Pension Receipts by Normalized Age.

Notes: The age threshold was 60, normalized to 0. These panels present the relationship between the respondent's relative age and the status of pension receipt. The dots represent the sample mean of the dummy variable (1 if receiving pension payment, 0 otherwise) in each bin. The continuous lines represent the regression of the indicator variable on the relative age, using linear regression in Panel A and second-, third-, and fourth-degree polynomials in Panels B, C, and D, respectively.

land out by 5 mu.

For comparative purposes, Table 5 also reports the results using 2SLS with a fourth-degree polynomial term in Column (3); the coefficient on pension receipt remains close to 5 mu. It confirms the validity of the local linear regressions results, thus suggesting that receiving pension payments resulted in land reallocation: The elderly who received pension benefits were more inclined to put their land up for lease.

As the result of interest is the treatment effect, the discussion above mainly refers to the coefficients on pension receipt. In contrast, Panel B of Table 5 gives the reduced-form estimator, τ_{H} , which is associated with the intention-to-treat effect. The coefficients of eligibility age remain positive and statistically significant using both local linear regressions and 2SLS with polynomial terms. However, the intention-to-treat effect was much smaller than the treatment effect, as not all of those above the eligibility age cutoff received pension payments. Combined with the results in Panel A, it is clear that the NRPS eligibility threshold at age 60 is associated with a large increase in the amount of rented land. It suggests that Hypothesis 1 is verified. The following robustness checks further confirm this finding.

4.1.3. Robustness

For our empirical strategy to be valid, only the treatment status (receiving pension payments) should change discretely at the critical cutoff prior to treatment; all other factors should change smoothly with the running variable, especially at the cutoff. To collect evidence of the validity of the RD estimates, we checked for discontinuities in other control variables that could confound the results. Figure A1 in the Appendix displays the relationship between normalized age and some of the control variables chosen in this study such as gender, education level, family size, number of adult children, marital status, and the cash held by the respondent and their spouse. Figure A1 infers that these control variables did not have significant jumps at the eligibility age cutoff, thus suggesting no breaks around the cutoff.

Our empirical strategy also relies on the assumption that there was no precise sorting around the cutoff (McCrary, 2008). For instance, if the respondents anticipated the implementation of the pension scheme, they were more likely to misreport their age or manipulate other factors in response to the NRPS. However, manipulation of this sort should not be expected, because it may bias the estimates. Using McCrary's (2008)

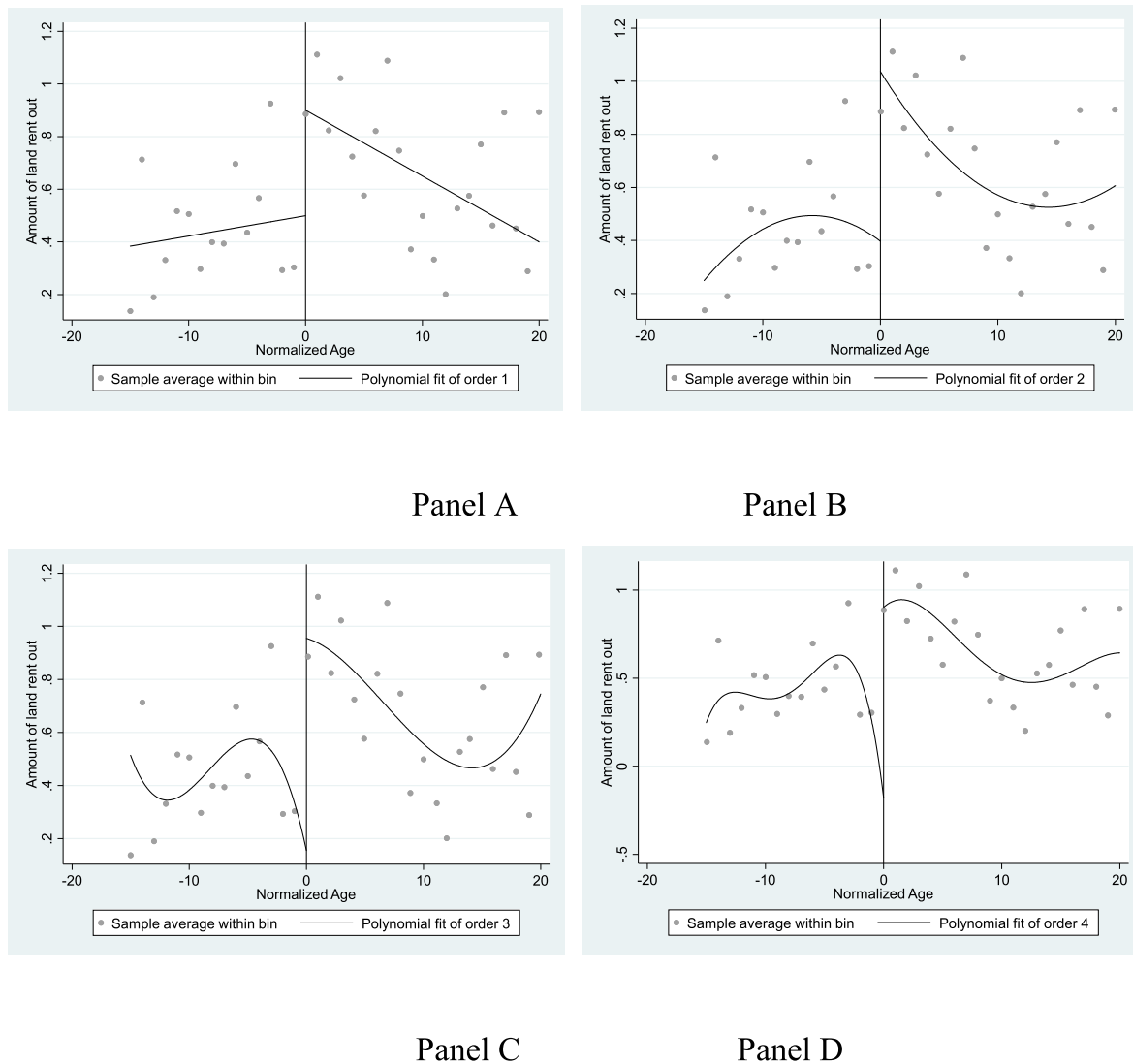


Fig. 3. Amount of Land Rented Out by Normalized Age.

Notes: This figure uses the full sample, with a pension-eligible age of 60. These panels plot the fitted values from regressions of the amount of land rented out on normalized age using various polynomial terms: first degree in Panel A, second degree in Panel B, third degree in Panel C, and fourth degree in Panel D.

Table 4
First-stage RD estimations on pension receipts.

	Local linear regression		2SLS with polynomial
	(1)	(2)	
Eligibility age (≥ 60)	0.166*** (0.021)	0.163*** (0.021)	0.211*** (0.040)
Control variables	N	Y	Y
N	6758	6758	6758

Notes: This table discloses the impact of eligibility age on pension receipts. Column (1) utilized local linear regressions without control variables, while column (2) included control variables and Column (3) used 2SLS.

density test, Fig. 4 displays the density of normalized ages around the threshold. The test did not reject the null hypothesis of continuity.¹⁰

Finally, to check the robustness, we ran a placebo test on the RD

estimates in order to examine the impact of pension receipt on the amount of land rented out at the placebo-assumed age cutoffs. In accordance with RD continuity rules, the outcome variable was not expected to change at any other cutoff, because the “windfall” had not yet been received. As shown in Panels A to D in Table 6, consistent with expectations, none of the RD estimates at the age cutoffs of 58, 59, 61, or 62 was statistically significant.

4.2. The channel of labor supply responses

As stated in Section 2, the influence of NRPS on land reallocation was associated with labor supply responses. To provide evidence for the role these responses played in the elderly’s decision to rent out their land, we examined how pension receipt affected the elderly’s adult children’s migration and the elderly’s labor supply (working in the paid labor market and caring for their grandchildren).

First, we revealed the effect of pension receipt on the number of adult children migrants in Panel A of Table 7. Using local linear regression, Column 1 shows that the coefficient of pension receipt was 1.376, which remains identical (1.360) when more control variables are included in Column 2. This result suggests that receiving pension payments probably increased the number of adult children migrants. It echoes the

¹⁰ The *t*-statistic result was 0.066.

Table 5
RD estimation on renting out land.

	Local Linear Regression		2SLS
	(1)	(2)	(3)
Panel A. Treatment effect			
Pension receipt	5.089*** (0.667)	5.169*** (2.010)	4.998*** (1.737)
Bandwidth	3.464	3.434	
Control variables	N	Y	Y
Polynomial terms	1	1	
Sample size	6758	6758	6758
Panel B. Reduced-form estimator (intention-to-treat effect)			
Age eligibility	0.846*** (0.309)	0.843*** (0.307)	1.055*** (0.388)
Bandwidth	3.464	3.434	
Control variables	N	Y	Y
Polynomial terms	1	1	
Sample size	6758	6758	6758

Notes: This table gives the impact of pension receipt on land reallocation, where Panel A presents the treatment effect and Panel B shows the reduced-form estimator (intention-to-treatment effect). Pension receipt is a dummy variable that equals 1 if the respondent received pension payments, and 0 otherwise. Control variables included gender, education level of the respondent, family size, number of adult children of the respondent, marital status, and the amount of cash the respondent and their spouse held. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

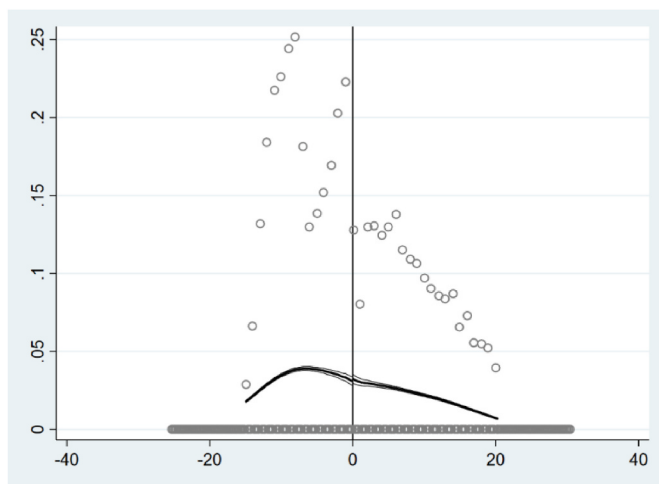


Fig. 4. The density of the running variable (normalized age).

finding of Eggleston et al. (2018), who reported an abrupt change in the probability of migration among adult children whose parents were just below or above the NRPS-eligible age. Those with a parent reaching the cutoff age were more inclined to migrate than their counterparts, which suggests that these households were credit-constrained and that the NRPS helped to mitigate this constraint. The old saying in Confucianism, “while your parents are alive, do not journey afar,” has changed with the introduction of a new pension program.

An opposing argument is from Li et al. (2018), who utilized the 2011 and waves of the CHARLS data and found that NRPS coverage significantly reduced the probability of out-migration in adult children by 6.3 percentage points. It echoes findings in South Africa, where the probability of adult children migrating decreased when their elderly parents received rural pensions (Bertrand et al., 2003); it was interpreted that adult children shared their parents’ pension benefits. However, this situation did not seem to be the case in rural China, since the NRPS’ pension payment is very small. The major reason for the different conclusions of our study, Eggleston et al. (2018), and Li et al. (2018), is that their coefficients of interest were NRPS participation, rather than NRPS

Table 6
Placebo test, allowing changes at other age cutoffs.

	(1)	(2)
Panel A. Age Cutoff at 58		
Pension receipt	133.97 (92.263)	133.80 (91.194)
Bandwidth	2.622	2.606
Panel B. Age Cutoff at 59		
Pension receipt	-7.587 (14.376)	-7.918 (18.571)
Bandwidth	4.715	4.657
Panel C. Age Cutoff at 61		
Pension receipt	0.593 (0.747)	0.706 (0.690)
Bandwidth	4.910	5.172
Panel D. Age Cutoff at 62		
Pension receipt	0.999 (1.675)	1.062 (1.769)
Bandwidth	2.858	2.616
Notes on all panels		
Control variables	N	Y
Sample size	6758	6758

Notes: This table reports results using ages 58, 59, 61, and 62 as counterfactual age cutoffs. We used local linear regression with a triangle kernel and chose the bandwidth via the method described in Imbens and Lemieux (2008). Other control variables are excluded in column (1) but included in column (2). *denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 7
RD estimations of the migration of adult children and the Elderly’s labor supply.

	Local linear regressions	
	(1)	(2)
Number of migrants among adult children		
Pension receipt	1.376*** (0.270)	1.360*** (0.361)
Bandwidth	6.133	4.735
Control variables	N	Y
Sample size	6758	6758
Time spent for caring for grandchildren		
Pension receipt	1374.5 (2351)	981.93 (2454.3)
Bandwidth	3.012	2.960
Control variables	N	Y
Sample size	6758	6758
Time spent in the paid labor market		
Pension receipt	1009.3 (771.48)	1141.6 (810.26)
Bandwidth	2.448	2.240
Control variables	N	Y
Sample size	856	856
Health status of the elderly		
Pension receipt	0.264 (0.61)	0.467 (0.71)
Bandwidth	5.136	4.675
Control variables	No	Yes
Sample size	2934	2934
Agriculture assets labor market		
Pension receipt	-5154.9 (6601.1)	-4164.4 (6829.6)
Bandwidth	2.557	2.547
Control variables	N	Y
Sample size	6758	6758

Notes: Control variables included gender, respondent’s education level, family size, number of respondent’s adult children, marital status, and the amount of cash the respondent and their spouse held. *denotes statistical significance at the 10% level, **at the 5% level, and ***at the 1% level.

pension receipt, and they mainly focused on the effect of intention-to-treat. Using a regression discontinuity design that minimizes the endogeneity issue, this study demonstrates that the positive influence of pension receipt on adult children's migration results in fewer young farmers and more remittances from migrants, which helps relax credit constraints (Atamanov & Van den Berg, 2012), thus leading to a greater probability of leasing land.

The validity of this mechanism was further confirmed. Table 8 presents the heterogeneous effects by two sub-group types, comparing the elderly with fewer adult children to those with more adult children, and those with less cash on hand to those with more cash. The results in Columns (1) and (2) reveal that the elderly with fewer adult children were more inclined to rent out their land, thereby indicating that the loss of farm workers was probably the reason that migration affected land rental decisions. Another potential reason is increased income, since the elderly received remittances from their adult children. With more money on hand, they did not have to rely on their agricultural income, and thus were more inclined to rent out their land. Comparing the results in Columns (3) and (4) in Table 8, we found that, as expected, those with more cash on hand were more inclined to rent out their land.

Given that we also expected the elderly to alter their labor supply in response to receiving pensions, we first explored how the NRPS affected the time the elderly spent taking care of their grandchildren. The rationale is that, if they spent more time caring for their grandchildren while they received pension benefits, they would spend less time farming and would be more likely to rent out their land. The results from Panel B in Table 7 reveal that the coefficients on pension receipt were large in magnitude but not statistically significant, thus suggesting that receiving pension payments did not increase the time the elderly spent taking care of their grandchildren. This situation was probably because even if their adult children remained with them, the elderly in rural China already spend a lot of time caring for their grandchildren.

Other studies have verified these types of intergenerational ties. For instance, Chen et al. (2011) point out that intergenerational solidarity was denoted by not only a significant amount of care provided by grandparents who lived in the same household, but also by extensive involvement in childcare by non-co-resident grandparents. In addition, evidence has been reported that providing care for their grandchildren led to more emotional support from their adult children (Cong and Silverstein, 2011) but poorer self-reported health status (Chen and Liu, 2012). The research suggests that, since elderly care for grandchildren is prevalent in rural China, pension receipts do not increase the time they spent caring for their grandchildren. Therefore, it is not likely to be an important mechanism through which NRPS affects land re-allocation.

We further examined whether and to what extent pension receipts influenced the elderly's time spent working in the paid labor market. There is a probability that receiving pension payments would cause seniors to drop out of the labor market and make them less likely to rent out their land since they would have more time to farm. Ning et al. (2016) examined the effect of NRPS on elderly labor but found no evidence that pension receipt significantly decreased the time they spent working. This result is consistent with the findings in Panel C of Table 7: there was no significant effect of the pension receipt on the time spent

working. Introducing a social pension was not likely to change the pattern of "working until you drop" for the rural elderly in China (Pang et al., 2004).

Subsequently, we examined whether the health status of the rural seniors improved, which may prevent them from renting out land. The proxy we utilized was the elderly's self-reported health status, which ranged from one (*very poor*) to five (*very good*). The results in Table 7 indicate that receiving pension payments did not affect the health status of the elderly. This finding contradicts that of Cheng et al. (2018a), who discovered a beneficial effect. The primary reason for the difference may be that Cheng et al. (2018a) employed objective measures to ascertain for the health status of the elderly, including cognitive function, physical health, and psychological well-being, while we used their self-reported health status. Accordingly, our results suggested that improving the health status of the elderly was not the mechanism through which the NRPS affected land reallocation.

As a final mechanism check, we investigated whether receiving pension payments resulted in increased expenditure on agricultural production tools such as tractors, threshers, water pumps, and processing equipment. We utilized the total value of these tools (in Chinese yuan) as the dependent variable, and examined whether it was positively associated with pension receipt. Table 7 established that receiving pension payments had no significant effect on the total value of agricultural tools, thus suggesting that this mechanism did not play a role.

Combining our findings, we concluded that adult children's migration was the most important mechanism identified in this study. The two reasons that migration played a major role were: (i) the loss of farm workers, and (ii) increased income. Pension receipt from the NRPS increased the number of adult children migrants, thus suggesting that it relaxed the elderly's credit constraints and left fewer workers in the household for farming, which probably resulted in more land rented out to others. Thus, Hypothesis 2 is verified.

4.3. Impact on welfare and well-being

The results of this study have demonstrated that pension receipt from the NRPS causes a large rise in the amount of land rented out, which is associated with an increase in the number of adult migrants. This process explains how the factors (both land and labor) in households have been reallocated by this new pension system in rural China. The following questions are relevant for a normative assessment of those changes: (i) whether the pension led to welfare gains at the household level, and (ii) to what extent the pension reflected a change in the well-being of the elderly.

There are several indicators of welfare and well-being that have been utilized extensively in the literature (Bairolia et al., 2018; de Brauw and Giles, 2018; Ding, 2017; Kaushal, 2014; Liang et al., 2017; Ng et al., 2017; Scharf and Rahut, 2014; Zheng and Zhong, 2016).¹¹ Following this literature and to examine question (i) above, we chose household consumption expenditures as our variable to measure welfare.¹² We chose this variable because empirical evidence in many countries has indicated that consumption expenditures are measured with greater accuracy than incomes (Lanjouw and Lanjouw, 2001). The other commonly employed indicator of well-being in this study [if reported by the elderly, this concerns question (ii)] is the self-assessed life satisfaction reported by the elderly, which ranged from one (*not at all satisfied*) to five (*completely satisfied*).

First, we examined the effect of pension receipt on household consumption expenditures. Table 9 provides the results of the local linear regressions. Panel A presents the impact of pension receipt on

Table 8
Heterogeneous effects using local linear regressions.

	Adult children		Cash	
	(1) Fewer	(2) More	(3) Less	(4) More
Pension receipt	5.442*** (2.086)	−5.585 (6.167)	3.598* (2.136)	5.968* (3.544)
Bandwidth	3.627	2.637	3.132	4.902
Control variables	Y	Y	Y	Y
N	6191	567	5363	1395

Notes: * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

¹¹ Knight and Gunatilaka (2010) and Knight et al. (2009) used self-reported happiness as a proxy for subjective well-being, but this survey lacked a similar indicator.

¹² See also Kaushal (2014), Scharf and Rahut (2014), and Deshpande (2016).

Table 9
RD estimates on household consumption expenditure.

	(1)	(2)	(3)	(4)
Panel A, consumption expenditures in the prior week				
	Food		Eating out	
Pension receipt	−108.99 (161.89)	−109.56 (159.64)	−101.34 (93.68)	−113.21 (104.65)
Bandwidth	3.675	3.649	4.431	4.171
Control variables	No	Yes	No	Yes
Sample size	6089	6089	6620	6620
Panel B, consumption expenditures in the prior month				
	Communication fees		Local transportation	
Pension receipt	26.074 (371.14)	−34.515 (312.87)	180.95 (309.31)	148.68 (319.15)
Bandwidth	4.179	4.753	3.432	3.352
Control variables	No	Yes	No	Yes
Sample size	6289	6289	6458	6458
Panel C, consumption expenditures in the prior year				
	Clothing		Medical expenditures	
Pension receipt	1473.9 (1220.8)	1316.1 (1091.1)	−8363.2 (6640.3)	−9276.1 (7221.9)
Bandwidth	3.400	3.822	6.223	6.026
Control variables	No	Yes	No	Yes
Sample size	6165	6165	6289	6289

Notes: Local linear regressions were calculated. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

consumption expenditures for two items over the prior week, food and eating out. There was no evidence of increased expenditure on these items. With regard to consumption expenditures on communication and local transportation, the results from Panel B also indicated no significant changes associated with the NRPS program. Panel C reveals that pension receipt had no significant impact on the yearly consumption expenditures on clothing and medical services. All of these results suggest that the households did not share the benefits of the elderly's receipt of pension payments.

Second, we examined whether NRPS led to gains in well-being at the individual level. Table 10 displays the results regarding the impact of pension receipt on life satisfaction status. Although the coefficients for pension receipt in Columns 1–2 are positive, they are all insignificant, thereby suggesting that receiving pension payments did not result in increased life satisfaction. It is consistent with the results in Table 9, which did not identify any increased medical expenditures.

Combining the results from Tables 9 and 10, this section demonstrates that the NRPS led to land reallocation through the mechanism of labor reallocation; however, it did not lead to welfare and well-being gains. This finding verifies Hypothesis 3. Nevertheless, it could be attributed to the fact that in China's rural areas, a majority of the elderly still work on farms or in the paid labor market; those who do not are likely to spend time caring for their grandchildren. Since the NRPS does not reduce the time the elderly spend on these tasks, elderly well-being is unlikely to have improved. By contrast, in the sample, the pension payment made up only 1.2% of the respondent's total household income. Obviously, such a small amount of money was unlikely to increase their consumption. To confirm whether this was the case, we performed a simple simulation to see how welfare would change if the pension's

Table 10
RD estimates on life satisfaction and health status.

	(1)	(2)
	Life satisfaction	
Pension receipt	0.590 (0.56)	0.648 (0.56)
Bandwidth	3.396	3.428
Control variables	No	Yes
Sample size	6622	6622

Notes: Local linear regressions were calculated. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

share of the income in a group of the sample increased. To do so, we generated a dummy variable as a treatment that was equal to 1 if the pension's share of income was higher than 1.2%, and 0 otherwise. We also adopted the propensity score matching method to identify those with similar characteristics in the control and treatment groups. The simulation yielded a counterfactual sample that matched those whose pensions were a lower share of their income with those whose pensions were a higher share of their income. We compared the welfare outcomes of the original sample with the counterfactual sample in which some people's pension made up a higher share of their income. Table A1 in the Appendix presents the results. We discovered that in the group with the increased pension share of income, the rural elderly spent more on local transportation and medical expenditures. Their self-reported health status also increased, although not statistically significantly so. This result suggests that welfare would improve if pension payments were increased. This simple simulation provides preliminary evidence as to why the NRPS does not lead to welfare gains, given that labor and land are reallocated. This result echoes that of Shen (2020), who found that a universal non-contributory social pension for both rural and urban dwellers would lead to large welfare gains for the rural elderly. A greater understanding of this issue remains the task of future research.

5. Conclusion

Drawing on pooled data from two waves (2013 and 2015) of the CHARLS, this study used an RD design to examine the impact of the NRPS on land reallocation, as represented by the amount of land rented out by the elderly and their spouses. The NRPS eligibility threshold of age 60 was associated with a rise in the amount of land rented out, a result that held true even after a series of robustness checks.

We obtained three main findings that verify our three hypotheses. First, we found that this change was associated with labor reallocation in response to the NRPS program, which can be regarded as an important mechanism through which pension receipt leads to land reallocation (Hypothesis 1). Second, the most important channel identified was the increase in the number of adult children migrants, which reduced the number of farm workers and helped relax credit constraints. However, the NRPS did not affect the elderly labor supply; neither the time spent raising grandchildren nor the time spent in the paid labor market was expected to change. Moreover, this factor did not operate by enhancing the health of the elderly and increasing the value of agricultural tools (Hypothesis 2). Third, the NRPS did not lead to welfare and well-being gains (Hypothesis 3).

This study adds to the literature on removing constraints and allowing land transactions. First, Adamopoulos et al. (2017) revealed that there was substantial factor misallocation in agriculture in rural China, including both labor and land (along with capital), which resulted in a reduction in aggregate agricultural productivity. The results of this study suggest that social pension programs can be an important pathway through which household factors can be reallocated toward a more efficient situation. The importance of the migration of the elderly's adult children verifies the connections between labor allocation and land reallocation in the presence of a newly-introduced pension scheme. Second, an interesting follow-up question is whether these resource allocation effects associated with the new pension scheme have delivered household-level welfare gains or individual-level well-being gains. This study did not find any evidence for either of these, thus suggesting that although receiving pension payments helped to relax credit constraints so that land was likely to be reallocated, it could not contribute much because the pension was too small.

This study may also have important policy implications for China and many other developing economies. First, a reasonable pension system can promote the reallocation of land and labor factors, especially for rural areas, which may significantly improve the efficiency of agricultural production and the income of rural residents. The government needs to further optimize the rural pension system and increase the

subsidy of rural pension on the premise of financial affordability. Second, if we want to promote the welfare of the rural elderly through the pension system, it will be necessary to coordinate the latter from the perspective of urban-rural integration. This process calls for further reforms and policies that will ensure that the elderly actually benefit from the NRPS. For instance, raising the minimum standard for rural residents' basic pensions could be an important step toward improving the income and consumption of the rural elderly (and their families). The construction of nursing homes, alongside better childcare facilities, would also reduce the elderly's burdens in looking after both themselves and their grandchildren in the absence of the adult children.

There are two related issues that are beyond the scope of this study, but which nevertheless offer several avenues in extending this research. First, while the results showed that the NRPS led to more land being rented out by the elderly, it would also be interesting to examine whom they rented their land out to, and whether doing so results in productivity increases. The exploration will deepen our understanding of whether the NRPS can play an active role in supporting rural economic development in the future. Second, policies raising the minimum standards for basic pensions require the analysis of simulations (based on certain scenarios) to investigate which standards lead to the largest gains in welfare and well-being. This study would provide an additional basis for policies aimed at maximizing the positive effects of the pension scheme in rural China.

Appendix

Author statement

I am the sole author of this paper. Those who provided editing and writing assistance but who are not authors, are named in the acknowledgements. The authors declare that this research was conducted in the absence of any relationships that could be construed as a potential conflict of interest.

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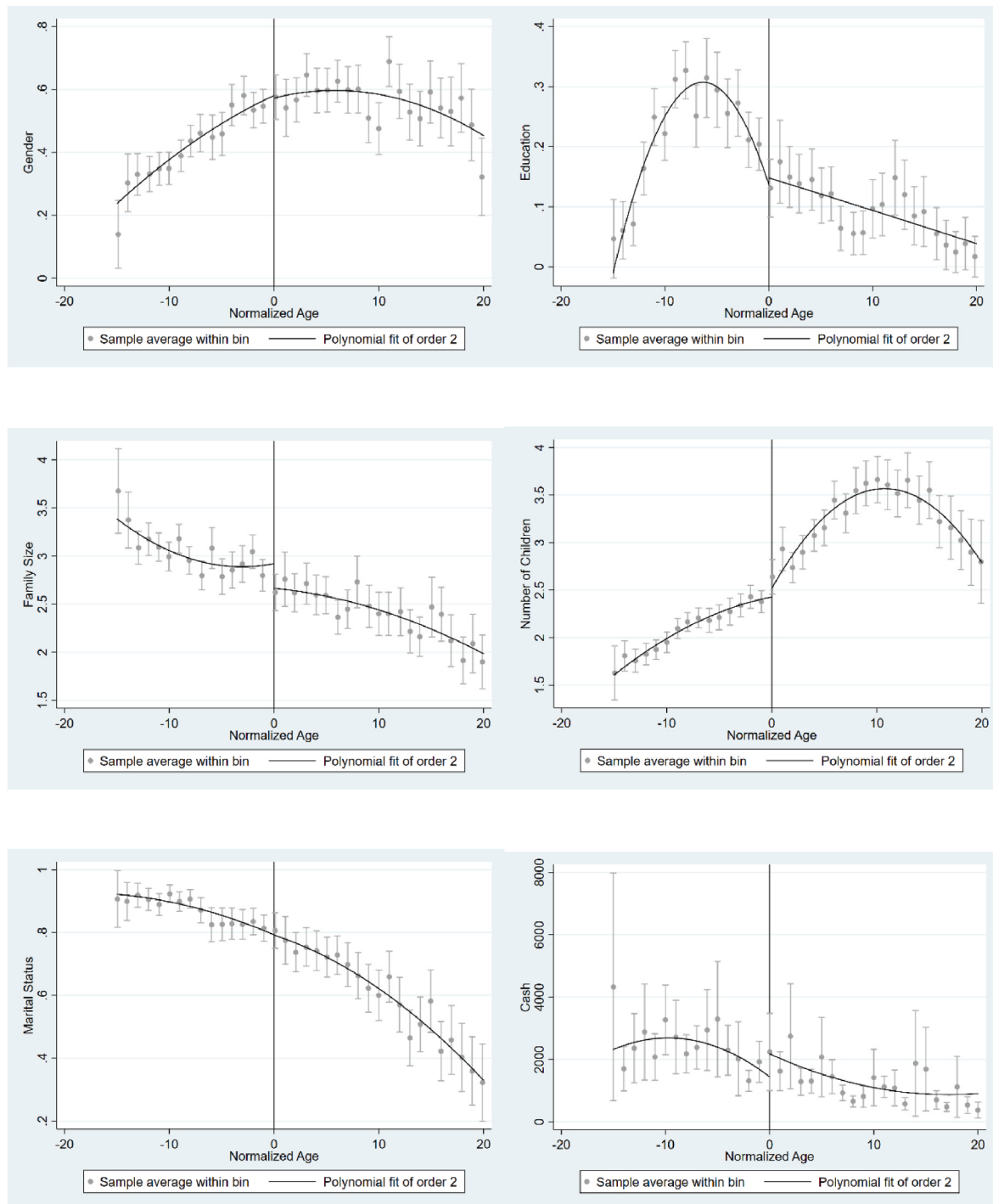


Fig. A1. Testing continuity of predetermined characteristics at the cutoff age.

Notes: This figure uses the full sample of respondents within the 45–80 age range to identify the relationship between the control variables and the respondents' normalized ages. The pension-eligible age was 60. Panel A displays the relationship between the respondent's gender (1 if male, 0 otherwise) and their normalized age. Panel B displays the relationship between the respondent's educational level (1 if high school and above, 0 otherwise) and their normalized age. Panel C displays the relationship between family size and their normalized age. Panel D plots the relationship between the number of adult children of the respondent and their normalized age. Panel E plots the relationship between the respondent's marital status and their normalized age, and Panel F plots the relationship between the cash held by the respondent and their relative age. The lines in each panel represent the regression (with a second-degree polynomial) of the control variables on the normalized age. The bars represent the 90% confidence interval.

Table A1
Welfare changes between the original sample and the counterfactual sample

Variable	Original Sample		Counterfactual sample		Mean Diff
	No	Mean	No	Mean	
Food	6089	183.64	222	158.93	−24.71
Eating out	6620	17.88	233	24.95	7.07
Communication fees	6289	127.39	225	85.43	−41.97
Local transportation	6458	65.87	227	141.59	75.717***
Clothing	6165	1079.73	215	848.35	−231.38
Medical expenditure	6289	4318.92	218	6919.40	2.6e+03***
Life satisfaction	6622	3.20	231	3.14	−0.06
Health status	2934	2.93	71	2.73	0.20

References

- Adamopoulos, T., Brandt, L., Leight, J., Restuccia, D., 2017. Misallocation, Selection and Productivity: A Quantitative Analysis with Panel Data from China. National Bureau of Economic Research.
- Amuedo-Dorantes, C., Juarez, L., 2015. Old-age government transfers and the crowding out of private gifts: the 70 and above program for the rural elderly in Mexico. *South. Econ. J.* 81 (3), 782–802.
- Ardington, C., Case, A., Hosegood, V., 2009. Labor supply responses to large social transfers: Longitudinal evidence from South Africa. *Am. Econ. J. Appl. Econ.* 1 (1), 22–48.
- Atamanov, A., Van den Berg, M., 2012. Heterogeneous effects of international migration and remittances on crop income: evidence from the Kyrgyz republic. *World Dev.* 40 (3), 620–630.
- Bairolia, N., Canning, D., Miller, R., Saxena, A., 2018. The macroeconomic and welfare implications of rural health insurance and pension reforms in China. *J. Econ. Ageing* 11, 71–92.
- Battistin, E., Brugiavini, A., Rettore, E., Weber, G., 2009. The retirement consumption puzzle: evidence from a regression discontinuity approach. *Am. Econ. Rev.* 99 (5), 2209–2226.
- Bertrand, M., Mullainathan, S., Miller, D., 2003. Public policy and extended families: evidence from pensions in South Africa. *World Bank Econ. Rev.* 17 (1), 27–50.
- Brandt, L., Whiting, S.H., Zhang, L., Zhang, T., 2017. Changing property-rights regimes: a study of rural land tenure in China. *China Q.* 232, 1026–1049.
- Cai, F., Giles, J., O'Keefe, P., Wang, D., 2012. The Elderly and Old Age Support in Rural China. The World Bank.
- Calónico, S., Cattaneo, M.D., Farrell, M.H., Titiunik, R., 2017. rdrobust: software for regression-discontinuity designs. *STATA J.* 17 (2), 372–404.
- Calónico, S., Cattaneo, M.D., Titiunik, R., 2014. Robust data-driven inference in the regression-discontinuity design. *STATA J.* 14 (4), 909–946.
- Card, D., Dobkin, C., Maestas, N., 2008. The impact of nearly universal insurance coverage on health care utilization: evidence from medicare. *Am. Econ. Rev.* 98 (5), 2242–2258.
- Cattaneo, M.D., Titiunik, R., Vazquez-Bare, G., 2016. Inference in regression discontinuity designs under local randomization. *STATA J.* 16 (2), 331–367.
- Chang, H.H., 2013. Old farmer pension program and farm succession: evidence from a population-based survey of farm households in Taiwan. *Am. J. Agric. Econ.* 95 (4), 976–991.
- Chen, F., Liu, G., 2012. The health implications of grandparents caring for grandchildren in China. *J. Gerontol. B Psychol. Sci. Soc. Sci.* 67 (1), 99–112.
- Chen, F., Liu, G., Mair, C.A., 2011. Intergenerational ties in context: grandparents caring for grandchildren in China. *Soc. Forces* 90 (2), 571–594.
- Chen, X., Huang, B., Li, S., 2018. Population ageing and inequality: evidence from China. *World Econ.* 41 (8), 1976–2000.
- Chen, J., Summerfield, G., 2007. Gender and rural reforms in China: a case study of population control and land rights policies in northern Liaoning. *Fem. Econ.* 13 (3–4), 63–92.
- Cheng, L., Liu, H., Zhang, Y., Zhao, Z., 2018a. The health implications of social pensions: evidence from China's new rural pension scheme. *J. Comp. Econ.* 46 (1), 53–77.
- Cheng, L., Liu, H., Zhang, Y., Zhao, Z., 2018b. The heterogeneous impact of pension income on elderly living arrangements: evidence from China's new rural pension scheme. *J. Popul. Econ.* 31 (1), 155–192.
- Cong, Z., Silverstein, M., 2011. Caring for grandchildren and intergenerational support in rural China: a gendered extended family perspective. *Ageing Soc.* 32 (3), 425–450.
- de Brauw, A., Giles, J., 2018. Migrant labor markets and the welfare of rural households in the developing world: evidence from China. *World Bank Econ. Rev.* 32 (1), 1–18.
- de Carvalho Filho, I.E., 2008. Old-age benefits and retirement decisions of rural elderly in Brazil. *J. Dev. Econ.* 86 (1), 129–146.
- Deininger, K., Jin, S., 2005. The potential of land rental markets in the process of economic development: evidence from China. *J. Dev. Econ.* 78 (1), 241–270.
- Deshpande, M., 2016. Does welfare inhibit success? The long-term effects of removing low-income youth from the disability rolls. *Am. Econ. Rev.* 106 (11), 3300–3330.
- Ding, Y., 2017. Personal life satisfaction of China's rural elderly: effect of the new rural pension programme. *J. Int. Dev.* 29 (1), 52–66.
- Deng, X., Xu, D., Zeng, M., Qi, Y., 2019. Does early-life famine experience impact rural land transfer? Evidence from China. *Land Use Pol.* 81, 58–67.
- Eggleston, K., Sun, A., Zhan, Z., 2018. The impact of rural pensions in China on labor migration. *World Bank Econ. Rev.* 32 (1), 64–84.
- Feng, S., Heerink, N., Ruben, R., Qu, F., 2010. Land rental market, off-farm employment and agricultural production in Southeast China: a plot-level case study. *China Econ. Rev.* 21 (4), 598–606.
- Grosjean, P., Kontoleon, A., 2009. How sustainable are sustainable development programs? The case of the sloping land conversion program in China. *World Dev.* 37 (1), 268–285.
- Gao, J., Song, G., Sun, X., 2020. Does labor migration affect rural land transfer? Evidence from China. *Land Use Pol.* <https://doi.org/10.1016/j.landusepol.2020.105096>, 2020.
- Gao, X., Shi, X., Fang, S., 2021. Property rights and misallocation: evidence from land certification in China. *World Dev.* 147, 105632.
- Hui, E.C., Bao, H., 2013. The logic behind conflicts in land acquisitions in contemporary China: a framework based upon game theory. *Land Use Pol.* 30 (1), 373–380.
- Huang, W., Zhang, C., 2021. The power of social pensions: evidence from China's new rural pension scheme. *Am. Econ. J. Appl. Econ.* 13 (2), 179–205.
- Imbens, G.W., Lemieux, T., 2008. Regression discontinuity designs: a guide to practice. *J. Econom.* 142 (2), 615–635.
- Ji, X., Qian, Z., Zhang, L., Zhang, T., 2018. Rural labor migration and households' land rental behavior: evidence from China. *China World Econ.* 26 (1), 66–85.
- Jiang, M., Li, J., Paudel, K.P., Mi, Y., 2019. Factors affecting agricultural land transfer-out in China: a semiparametric instrumental variable model. *Appl. Econ. Lett.* 26 (20), 1729–1733.
- Kaushal, N., 2014. How public pension affects elderly labor supply and well-being: evidence from India. *World Dev.* 56, 214–225.
- Kimura, S., Otsuka, K., Sonobe, T., Rozelle, S., 2011. Efficiency of land allocation through tenancy markets: evidence from China. *Econ. Dev. Cult. Change* 59 (3), 485–510.
- Knight, J., Gunatilaka, R., 2010. Great expectations? The subjective well-being of rural-urban migrants in China. *World Dev.* 38 (1), 113–124.
- Knight, J., Song, L., Gunatilaka, R., 2009. Subjective well-being and its determinants in rural China. *China Econ. Rev.* 20 (4), 635–649.
- Lanjouw, J.O., Lanjouw, P., 2001. The rural non-farm sector: issues and evidence from developing countries. *Agric. Econ.* 26 (1), 1–23.
- Lee, D.S., Lemieux, T., 2010. Regression discontinuity designs in economics. *J. Econ. Lit.* 48 (2), 281–355.
- Li, Q., Wang, Y.F., Zhao, Y.H., 2018. The impact of China's new rural pension program on elderly labor, grandchild care, and old-age support. *Fem. Econ.* 24 (2), 265–287.
- Li, M., Zhou, Y., Shi, X., 2021. Who will care for middle aged and elderly parents in rural China? *China World Econ.* 29 (2), 123–150.
- Liang, Y., Niu, X., Lu, P., 2017. The aging population in China: subjective well-being of empty nesters in rural eastern China. *J. Health Psychol.* 1359105317717599.
- Liu, H., Eggleston, K.N., Min, Y.A.N., 2016. Village senior centres and the living arrangements of older people in rural China: considerations of health, land, migration and intergenerational support. *Ageing Soc.* 37 (10), 2044–2073.
- Liu, J., 2014. Ageing, migration and familial support in rural China. *Geoforum* 51, 305–312.
- Long, H., Zou, J., Liu, Y., 2009. Differentiation of rural development driven by industrialization and urbanization in eastern coastal China. *Habitat Int.* 33 (4), 454–462.
- Long, H., Liu, Y., Hou, X., Li, T., Li, Y., 2014. Effects of land use transitions due to rapid urbanization on ecosystem services: implications for urban planning in the new developing area of China. *Habitat Int.* 44, 536–544.
- Liu, Y., Wang, L., Long, H., 2008. Spatio-temporal analysis of land-use conversion in the eastern coastal China during 1996–2005. *J. Geogr. Sci.* 18 (3), 274–282.
- Ma, S., Mu, R., 2020. Forced off the farm? Farmers' labor allocation response to land requisition in China. *World Dev.* 132, 104980.
- Ma, M., 2020. Insecure Land Tenure, Social Protection, and Resource Misallocation: Evidence from China's Agricultural Sector. *Economic Development and Cultural Change*.
- McCrary, J., 2008. Manipulation of the running variable in the regression discontinuity design: a density test. *J. Econom.* 142 (2), 698–714.
- Miller, G., Pinto, D., Vera-Hernandez, M., 2013. Risk protection, service use, and health outcomes under Colombia's health insurance program for the poor. *Am. Econ. J. Appl. Econ.* 5 (4), 61–91.

- Min, S., Waibel, H., Huang, J., 2017. Smallholder participation in the land rental market in a mountainous region of Southern China: impact of population aging, land tenure security and ethnicity. *Land Use Pol.* 68, 625–637.
- Mullan, K., Grosjean, P., Kontoleon, A., 2011. Land tenure arrangements and rural–urban migration in China. *World Dev.* 39 (1), 123–133.
- Ng, S.T., Tey, N.P., Asadullah, M.N., 2017. What matters for life satisfaction among the oldest-old? Evidence from China. *PLoS One* 12 (2), e0171799.
- Ning, M., Gong, J., Zheng, X., Zhuang, J., 2016. Does new rural pension scheme decrease elderly labor supply? Evidence from CHARLS. *China Econ. Rev.* 41, 315–330.
- Ning, M., Liu, W., Gong, J., Liu, X., 2018. Does the New Rural Pension Scheme Crowd Out Private Transfers from Children to Parents? Empirical Evidence from China. *China Agricultural Economic Review*.
- Pang, L.H., de Brauw, A., Rozelle, S., 2004. Working until you drop: the elderly of rural China. *China J.* 52, 73–94.
- Ruhm, C.J., 1996. Do pensions increase the labor supply of older men? *J. Publ. Econ.* 59 (2), 157–175.
- Scharf, M.M., Rahut, D.B., 2014. Nonfarm employment and rural welfare: evidence from the himalayas. *Am. J. Agric. Econ.* 96 (4), 1183–1197.
- Shi, S.J., 2006. Left to market and family—again? Ideas and the development of the rural pension policy in China. *Soc. Pol. Adm.* 40 (7), 791–806.
- Shi, X., 2018. Heterogeneous effects of rural-urban migration on agricultural productivity. *Chin. Agri. Econ. Rev.* 10 (3), 482–497.
- Shi, X., 2021. Moving out but not for the better: health consequences of interprovincial rural-urban migration in China. *Health Econ.*
- Shen, C., Johnson, J., Chi, Z., Williamson, J.B., 2020. Does a universal non-contributory social pension make sense for rural China? *Int. Soc. Secur. Rev.* 73 (2), 3–26.
- Singh, V., 2018. Ageing society and labor policy in China: analyzing policy challenges and options. *Chin. Stud.* 7 (3), 242–250.
- Wang, H., Riedinger, J., Jin, S., 2015. Land documents, tenure security and land rental development: panel evidence from China. *China Econ. Rev.* 36, 220–235.
- Wang, Y., Li, X., He, H., Xin, L., Tan, M., 2020. How reliable are cultivated land assets as social security for Chinese farmers? *Land Use Pol.* 90, 104318.
- Wang, Y., Yang, Q., Xin, L., Zhang, J., 2019. Does the new rural pension system promote farmland transfer in the context of aging in rural China: evidence from the CHARLS. *Int. J. Environ. Res. Publ. Health* 16 (19), 3592.
- Wang, X.Q., Chen, P.J., 2014. Population ageing challenges health care in China. *The Lancet* 383 (9920), 870.
- Zhang, J., Mishra, A.K., Zhu, P., 2019. Identifying livelihood strategies and transitions in rural China: is land holding an obstacle? *Land Use Pol.* 80, 107–117.
- Zhao, Y., Smith, J.P., Strauss, J., 2014. Can China age healthily? *The Lancet* 384 (9945), 723–724.
- Zheng, H.M., Zhong, T., 2016. The impacts of social pension on rural household expenditure: evidence from China. *J. Econ. Pol. Reform* 19 (3), 221–237.
- Zhou, S., Xie, M., Kwan, M.-P., 2015. Ageing in place and ageing with migration in the transitional context of urban China: a case study of ageing communities in Guangzhou. *Habitat Int.* 49, 177–186.
- Zhu, J., Jin, S., Tang, Z., Awokuse, T., 2021. The Effect of Pension Income on Land Transfers: Evidence from Rural China.