Do Pensions Reduce Debt?

Evidence from China's New Rural Pension Scheme[1]

Wei Chen

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Abstract

This paper studies the causal impact of receiving pension payments on debt behavior among older adults, using a natural experiment around China's New Rural Pension Scheme (NRPS), one of the world's largest social pension programs. Using a *regression discontinuity* and a *difference-in-differences* (RD-DID) research design and four waves of the China Health and Retirement Longitudinal Survey (CHARLS), I find that the introduction of the NRPS reduced debt among older adults, and increased their ability to shield themselves against shocks, especially for those with lower socioeconomic status. My findings indicate that receiving NRPS payments has a statistically significant negative impact on debt, although it is modest in size and is observed for formal debt only. This finding is consistent with the life-cycle hypothesis, which suggests that receiving cash payments increases income, and thereby reduces borrowing and indebtedness. However, this result is not consistent with the literature on pension schemes or cash transfers in developing countries, which suggests that receiving such payments should lead to a decline in informal debt. I provide potential explanations for this discrepancy, including psychological effects, a substitution between debt and consumption, credit constraints, and bequeathing considerations. These findings have important implications for pension programs and cash transfers in countries with a relatively weak safety net.

1. Introduction

According to the Federal Reserve Bank of New York, total debt among Americans aged 70 or older increased 543% to $1.1 trillion between 1999 and 2019, which is the largest increase across all age groups. Meanwhile, China's households have been among the world's best savers--until recently. China household debt and income ratio suppressed the US after 2015 and remains increasing after. In only five years between 2015 and 2019, household debt has surged to 128% of household income, and 56% of Chinese GDP. The middle-aged and older adults predominantly contribute to this large increase. There are many reasons why older populations hold debt. First, they may hold debt accrued at younger ages that carries over into retirement. For example, a recent study shows that the households in India take on more mortgages in later stage of life, which may reflect intergenerational transfers, and they often hold a positive debt balance by the age of retirement (Ramadorai et al., 2017). Second, in countries that have no or poor-quality old-age health insurance programs, experiencing health shocks, unexpected medical bills, or the death of a spouse greatly increases the risk of indebtedness for older adults. Third, having to support children and grandchildren may exacerbate the financial difficulties of people in this age group. Moreover, if an individual cannot make a repayment, the failure to pay often leads to more debt, which could cause the person to become entangled in a debt spiral. The financial risks associated with the growing debt burden among the older population appear to be growing. Unsurprisingly, indebtedness often causes health issues, such as stress, anxiety, and depression (Bridges & Disney, 2010; Drentea, 2000; Song et al., 2020; Sweet et al., 2013).

Old-age pensions are an essential mechanism to insure the financial stability of the older population, especially in the context of global aging. While receiving a reliable stream of payments

can certainly change an individual's financial status, whether it releases the person from debt is unclear for two reasons. First, old-age pensions are not available in most developing countries, and to the extent that such pensions are available, the amounts they provide may not be substantial enough to help with indebtedness. Second, pensions can have ambiguous effects on debt. On the one hand, according to the life-cycle hypothesis, receiving a cash payment will increase income, thereby reducing borrowing and indebtedness. On the other hand, the permanent income hypothesis suggests that a higher level of future income boosts current consumption, which may undermine the income effect, and could even lead to more debt. There is evidence on prevalence of both of these effects (McKay et al. 2008; Amaglobeli et al. 2019; Zheng and Zhong 2016; Q. Zhao, Li, and Chen 2016). It is unclear which effect dominates in low- and middle-income countries, where health care systems and social assistance may be absent. Moreover, identifying the direction of this effect is even more complex in the context of informal borrowing, which is often more prevalent in low- and middle-income countries and harder to measure.

In this paper, I investigate the impact of receiving pension payments on the debt behavior of pension beneficiaries in China using a natural experiment that arises from the rollout of China's New Rural Pension Scheme (NRPS), which is one of the world's largest social pension programs. To my knowledge, this is the first paper in the literature to identify a causal relationship between the introduction of the NRPS and the debt behavior of older adults. Enacted in late 2009, the NRPS eventually covered nearly all 2,853 counties and 326 million rural residents (one-quarter of the total population) in China, according to the China Statistical Yearbook 2012. Within the setting of the NRPS, I assess the causal impact of receiving pension payments by exploiting the quasi-random variation in the pension age under the NRPS eligibility rules. I use a combination of a regression discontinuity design and a difference-in-differences design to answer the question of

whether receiving pension payments reduces debt and protects the older population against shocks. The paper also shows the heterogeneity of this potential impact across various population groups.

For several reasons, the introduction of the NRPS in China is ideal for studying the effect of pensions on debt behavior in the context of a society that is aging and has weak social protections. First, China has the world's largest population and lacks universal old-age insurance, despite having a rapidly aging population. Second, between 1990 and 2018 in China, life expectancy increased from 66 years to 77 years, while the fertility rate dropped from 2.3 to 1.7. As a result of these trends, the old-age dependency ratio in China increased from 10 to 16 between 2009 and 2019, or twice as fast as in the U.S. (according to the World Bank). While this pattern is similar to that in other countries like Japan and Germany, in China, the safety net for older people is relatively weak. Finally, Chinese household debt has been skyrocketing. Since 2007, Chinese household debt has grown 23% each year, on average. In mid-2017, the average Chinese household had a debt burden equivalent to about 106% of their disposable income (or 1% higher than that of their counterparts in the U.S.) (Hays, 2018). Despite these trends, relatively little is known about debt levels among the older population in China. This may be in part because much of this debt is accrued through informal borrowing, which is rarely explicitly recorded. In general, data on debt among older people are scarce, and studies examining the impact of pension income on debt behavior are also rare.

This paper contributes to the broad literature on pension benefits. More importantly, it helps to fill the research gap on debt issues among the older population. Taking advantage of the rich financial and demographic information in China Health and Retirement Longitudinal Survey (CHARLS), this study contributes to our understanding of the overall debt situation and the financial decision-making processes among older cohorts.

The paper reports three main results. First, an essential aim of the NRPS is to improve the financial status of rural residents, and to reduce their poverty rate. The results indicate that the program has to some extent been effective in meeting this goal in terms of indebtedness. Receiving NRPS benefits is shown to consistently reduce both the amount and the incidence of formal debt. However, the analysis also indicates that receiving NRPS benefits had no significant impact on levels of informal debt, or on the overall amount of debt. In the mechanisms section, I provide potential explanations for this discrepancy, including psychology effects, a substitution between debt and consumption, credit constraints, and bequeathing considerations.

The second main result is that receiving NRPS payments may have increased the collateral and the credibility of older people who had low socioeconomic status or experienced shocks. For those older people who had an emergency where I measured in the data by having experienced a shock while in a disadvantaged financial situation, borrowing often served as a financial tool for smoothing consumption. The paper investigates the debt behavior of older individuals after they experienced a personal shock or a community-wide aggregate shock. The results show that among lower-income people of all ages who were undergoing a financial shock, and who were not receiving pension payments, there was no new incidence of borrowing. However, among individuals aged 65 to 75 who were receiving pension payments, new borrowing after experiencing a shock increased up to 10%[2]. Similarly, the findings indicated that individuals who were living in a community that underwent at least one major natural disaster in the past five years held nearly 60% less debt on average if they were receiving NRPS payments than their counterparts who were living in the same community, but were not receiving NRPS payments.

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[2] The sample is restricted to individuals who were between ages 50 and 70 in 2011, and to pension beneficiaries who were aged 60 or older.

Finally, I found that receiving NRPS benefits had heterogeneous effects across demographic groups. For example, males (who usually carry more debt than females), those who were living in an urban area, and those who had no spouse were observed to have larger declines in formal debt. These effects were found to be more pronounced for the lower-income group, which is in line with the literature. These findings suggest that people with lower socioeconomic status tended to perceive their pension payments as an important new income source, which, in turn, changed their debt behavior.

Existing literature on the relationship between receiving pension benefits or cash transfers and people's financial status has, for example, shown that receiving pension payments improved the financial status of older rural adults and reduced their informal borrowing in rural Bangladesh (Islam and Maitra 2012; Kochar 1995). Moreover, a study conducted in Niger found that households receiving pension benefits were less likely to borrow from friends and family to offset debt repayments (Hoddinott, Sandström, and Upton 2018). However, many other studies have also pointed out that having pension income tends to increase people's consumption and to reduce their precautionary savings, which could lead them to accrue even more debt (Amaglobeli et al. 2019; Zheng and Zhong 2016; Q. Zhao, Li, and Chen 2016).

In addition, the literature has shown that receiving pension benefits is closely associated with many variables that are related to the beneficiary's financial status. There is, for example, evidence that it improves health (Cheng et al. 2018a), reduces labor supply (Ning et al. 2016; Lin et al. 2018) which is close related to older adults' health (Mitra et al., 2020) , crowds out private transfers, promotes independent living (Jung, Pirog, and Lee 2016; Cheng et al. 2018b), and increases the probability of labor migration for the beneficiary's children (Eggleston, Sun, and Zhan 2018).

A large body of research has also shed light on the effects of the introduction of the NRPS. These studies have, for example, found that receiving pension payments has positive effects on household consumption expenditures (Zhao, Li, and Chen 2016), has negative effects on the labor supply of the beneficiary (Blake 2004; Ranchhod 2006; de Carvalho Filho 2008), and has no effects on the saving rate (Q. Li, Wang, and Zhao 2018). While the question of whether receiving pension payments crowds out private transfers from children and grandchildren has not been conclusively answered (Maitra and Ray 2003; Ning et al. 2019; Jensen 2004), there is evidence that it supports independent living and reduces the likelihood of co-residing with extended family (Chen 2017; Cheng et al. 2018b). Moreover, it has been shown that effects of receiving NRPS benefits tend to be more pronounced for those with lower SES (Q. Li, Wang, and Zhao 2018).

The remainder of the paper proceeds as follows. In Section 2, I provide a history of efforts to provide the rural population in China with pensions. Then, in Section 3, I describe the details of the data used in this study. In Sections 4 to 8, I outline the empirical strategy employed in the study; present the descriptive statistics, main results, heterogeneous effects, effects of shocks, and robustness test; and discuss and test the mechanisms that might explain these findings. In the final section, I conclude with a discussion of the results of the study and their policy implications and propose directions for future research.

2. Background of the NRPS

The New Rural Pension Scheme (NRPS) was announced by the General Office of the State Council in China on September 4, 2009. The program was enacted in response to the accelerated urbanization of the country, the aging of the population, and the erosion of traditional forms of family support and cohabitation in rural China in particular.

Pensions aimed at the rural population were introduced by the State Council as early as 1990 as part of the 7th Five-Year Plan (Dorfman et al. 2013). At that time, the pension program was mainly financed by individuals, and pension payments were available only after the participants turned a certain age. For example, individuals contributing an average of 2-20 *CNY* per month would receive a matching subsidy of 2 *CNY* from the local government. Thus, the pension benefit amounts were low. By 2006, 88% of the beneficiaries of this program were receiving payments that were lower than the lowest subsistence allowances in their local community. At its peak coverage level before 2009, only 80 million rural workers were participating in the program, and roughly 600,000 individuals were receiving pension benefits (Dorfman et al. 2013). Moreover, low levels of trust in the pension fund's security due to governance concerns contributed to the low participation rates. Its low pension benefit amounts and inflexible options for contributing prevented the program from expanding further.

In 1999, the government recognized the limited effectiveness and sustainability of the rural pension scheme. The pension program was no longer permitted to expand, and the existing participants were moved to commercial insurers. The number of participants dropped to around 55 million. At that time, most of the participants were living in the coastal provinces. Even worse, the low matching contribution was often not made. This situation lasted until the end of 2005, when the Central Party Committee (CPC) and the State Council proposed "Building a New Socialist Countryside," and committed to providing universal social insurance coverage starting in 2006 under the newly enacted Law on Social Insurance.

In late 2009, the pilot NRPS was implemented in 11% of all rural counties based on the principle of providing "basic insurance and wide coverage with flexibility and sustainability." It

took four years for the program to fully cover nearly all of China's 2,853 counties (see Figure 1). By early 2012, the NRPS had around 250 million contributors and approximately 100 million beneficiaries. An advantage of this new rural pension scheme over previous pension programs is that it provides for basic pensions. In the contribution stage, local governments provide subsidies of at least 30 *CNY* per year, and an additional 100 *CNY* for those with lower incomes. In the pension payment stage, the central government subsidizes 100% of the payment amounts in the Central and Western regions and 50% in the Eastern region. Local governments subsidize the remaining 50% of the payment amounts in the Eastern region and provide additional pension benefits. Moreover, compared to previous pension schemes, the NRPS offers more flexible contributions. Participants are given the option to contribute at one of five levels: 100, 200, 300, 400, or 500 *CNY*. However, the 30 *CNY* flat matching rate is low relative to the matching-defined-contribution (MDC) rates in other developing countries (normally 1:1), which discourages people from contributing more. Therefore, the majority of participants contribute at the 100 *CNY* level (Chen, Eggleston, and Sun 2018).

The NRPS eligibility criteria are presented in Figure 2. Individuals who are over age 15 and have a rural household registration are eligible to participate in the program. The contribution length is 15 years, but those who were already over the age of 45 at the time the NRPS went into effect could make a lump-sum payment as a catch-up contribution. In addition, those individuals who were aged 60 or older at the time of the implementation could still receive NRPS payments as long as their eligible children were enrolled in the program[3]. The participants could start receiving their NRPS payments after they reached the age of 60. The payment has two components.

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[3] In some communities, there is a "bonding policy" under which parents can receive NRPS payments even if they are over age 45 provided their children have enrolled in and are contributing to the program.

One is the basic noncontributory pension account that provides a flat pension payment of 55-60 *CNY* per month[4] that is not related to the contribution amount. The other is an individual pension account that is based on each individual's contributions and matching subsidies over the years. According to CHARLS 2011, these pension payments account, on average, for 15% of an individual beneficiary's earned income. Since the only income most people living in rural areas receive is from agriculture, the NRPS payments may account for a larger portion of income for the older age group than for the younger age group (Chen, Eggleston, and Sun 2018).

3. **Data**

This study is focused on rural China. As shown in Figure 1, nearly all 2,853 counties in China rolled out the NRPS between 2009 and 2012 on a staggered schedule. Assuming the local governments followed the NRPS age eligibility rules, the causal effect of the introduction of the pension program can be estimated using a regression discontinuity (RD) design that compares all participants within a narrow band around the age cutoff. Incorporating a difference-in-differences design enables me to compare the counties before and after the NRPS rollout at the county level. The sample includes only individuals with a rural household registration.

The sample is a panel of individuals drawn from four waves of the China Health and Retirement Longitudinal Study, CHARLS (2011, 2013, 2015 and 2018). CHARLS is a nationally representative Chinese household survey of individuals aged 45 years or older and their spouses (Y. Zhao et al. 2020). The first wave of CHARLS in 2011 interviewed 17,587 respondents in 10,257 households. Since the main analysis uses the age cutoff as a discontinuity design, I restrict the sample to ± 10 years from age 60 in baseline, and present a narrower bandwidth of ± 5 years

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[4] In some richer regions, the basic pension payment could be 150-360 CNY per month (Chen, Eggleston, and Sun 2018).

in Appendix 4. As the NRPS is a rural pension program, only those individuals who have a rural household registration are eligible to contribute. I further restrict the sample accordingly. The final sample includes individuals aged 50 to 70 with a rural household registration in 2011 who participated in at least two survey waves.

Over the study period, about 17% of individuals dropped out of the sample, and 87% of them were alive at the end of the period. Most of the individuals who dropped out were recorded as not responding. I provided a series of t-tests to compare the groups who were and were not included in the sample in Appendix 1. The results showed that the individuals who were more likely to drop out of the sample were disproportionately older, male, and less educated, and had relatively high levels of informal debt and total debt. They may be a group where perhaps NRPS may have larger effect effects and f or this reason, this paper might underestimate the true effects of receiving pension payments.

CHARLS collected information on the respondents' financial status, such as their labor income, household income, public and private transfers, assets, and debts. The information on debt includes outstanding balances, monthly payments, mortgage interest payments, credit card balances, bank loans, and personal loans from friends and family. I used this information to construct five debt variables: the amount and the incidence of formal and informal debt, the double incidence of debt, and the total amount of debt. The formal debt is defined as the total outstanding mortgage debt divided by two if the individual was either married or separated, loans from banks or financial institutions (not including mortgages), and credit card debt. The informal debt is defined as the debt borrowed from friends or family. Double incidence is defined as the respondent having both formal and informal debt at the time of the interview.

CHARLS also collects information on the NRPS, including for the year the NRPS was implemented in each community. Moreover, for each individual, CHARLS collects information on whether the person participates in the NRPS, and if so, how much the individual is contributing, and how much they are receiving in benefit payments. I have constructed two NRPS variables for the main analysis. *NRPS_Receipt* refers to a respondent who is currently receiving NRPS pension benefits. *NRPS_Eligible* refers to a respondent who contributes to the NRPS and is aged 60 or older and is thus eligible to receive NRPS payments.

4. Methodology

4.1 Fixed effects

The empirical strategy starts with an individual fixed-effects specification with the year and the county fixed effects to account for unexplained year-to-year and county-to-county variations in debt behavior. The fixed-effects specification absorbs time-invariant factors such as individual characteristics, changes in the macro-environment over the years, and the different policies and socioeconomic status in each county. It removes time-invariant omitted variable bias across individuals, and only exploits within-group (such as within counties and years) variation. The use of this approach is appropriate in this study because debt behavior may differ dramatically over the years and across counties. For example, in counties with a limited supply of formal credit, the interest rates for formal borrowing might be relatively high. Thus, the people in these counties might be less involved in formal borrowing than their counterparts in other counties.

$$Y_{i,c,t} = \alpha\, NRPS\_Receipt_{i,c,t} + \beta X_{i,c,t} + \delta_{c,t} + \varphi_t + \varepsilon_{i,c,t} \qquad (1)$$

where i,c,t indicate individual, county, and year. *NRPS_Receipt$_{i,c,t}$* is a dummy variable for whether individuals received NRPS payments. $Y_{i,c,t}$ is the outcome variable, which is one of the debt variables. $X_{i,c,t}$ is a vector of covariates, which includes gender, marital status, education, and the number of children at the baseline, age and quadratic age. $\delta_{c,t}$ and φ_t are the county and year fixed effects.

However, the use of a fixed-effects model has some drawbacks. In addition, there may be time-varying unobservable variables that affect both debt behavior and the likelihood of receiving NRPS payments. For example, the government could increase the likelihood of receiving NRPS benefits while also improving credit access.

4.2 Regression discontinuity-difference-in-differences (RD-DID)

I exploit the eligibility to receive NRPS payments dependent on the age cutoff in a regression discontinuity design (Lee and Card 2008). As Figure 2 shows, individuals aged 60 or older qualify for NRPS payments, conditional having previously contributed to the program. This generates a discontinuity in age and quasi-random variation in the treatment status.

The RD model's treatment effect is determined solely by the age cutoff along with the forcing variable *Age*. I rescaled this variable so that the program eligibility cutoff is centered at zero. Individuals aged 60 or older are assigned to the treatment group ($t_i = 1$), while those under age 60 are assigned to the control group ($t_i = 0$). In other words, the assignment rule is $W_i = 1$ {$x_i \geq c$, $\forall$ i}, x indicates the respondent's normalized age, and c is zero. The local average treatment effect (LATE) of receiving NRPS payments, τ_{RD}, can be estimated as the difference between the regression functions at the discontinuity c (Kanz 2016). Intuitively, it may be assumed that around

the cutoff age, other variables do not change. Thus, the differences in the observed ex-post outcomes (debt behavior) should come only from receiving NRPS payments.

$$Y_{i,c,t} = \alpha NRPS\_Receipt_{i,c,t} + \beta Age_{i,c,t} + \Gamma X_{i,c,t} + \tau_{c,t} + \psi_t + \upsilon_{i,c,t}$$

where $NRPS\_Receipt_{i,c,t}$ indicates whether the individual received the NRPS payments, and $Age_{i,c,t}$ is the running variable. $X_{i,c,t}$ is the same vector of covariates from the fixed-effects model. $\tau_{c,t}$ and ψ_t are the county and year fixed effects.

Bandwidth choice is one of the most consequential decisions in RD analysis. Since the context of debt varies significantly by different age cohorts, I fix the bandwidth to be 10 years for the main analysis. A decrease in the bandwidth will result in lower bias of the local polynomial estimator but a higher variance (Cattaneo et al., 2019), thus, I check a narrower bandwidth in 5 years in Appendix 4. In Appendix 11, I also present the RD results using one common MSE-optimal bandwidth for the RD treatment effect estimator, the triangular kernel to construct the local-polynomial estimators, and three types of confidence intervals: conventional and bias-corrected RD estimates with conventional variance estimator and bias-corrected RD estimates with robust variance estimator[5] (Calonico et al., 2014; Dasgupta et al., 2020).

Restricting the sample to only the NRPS participants in the RD specification above considerably limits the sample. Next, I apply a fuzzy difference in discontinuity approach to analyze the causal impact of receiving NRPS payments that are endogenous by exploiting the staggered rollout of the NRPS between 2009 and 2012 along with discontinuities that arise from

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[5] The conventional interval ignores the bias term and uses the conventional standard error. The bias-corrected confidence internal corrects the bias estimate from the conventional point estimator and ignores the variability introduced in the bias correction step. And the robust bias-corrected confidence interval corrects the bias and has a larger standard error.

the age eligibility rule of receiving the NRPS payments. The reason using fuzzy design is that each individual's status as a NRPS recipient in the data, shown in Figure 3, indicates a probability of treatment discontinuous at the cutoff, but not to the degree of a definitive zero to one jump. I restrict the sample to individuals with a rural household registration only.

While I observe each individual's status as a NRPS recipient in the data (shown in Figure 3), whether the person actually receives NRPS payments may be endogenous for two reasons. First, enrollment in the pension program is voluntary. If those who participated in the NRPS are systematically different from those who did not, my results will suffer from self-selection bias. For example, suppose that those individuals with lower incomes or poorer health tend to be more concerned about their future financial stability, and are therefore more likely to enroll in the pension program. In that case, my results may capture the debt patterns associated with the socioeconomic characteristics of these individuals, rather than the effects of the NRPS payments. In Appendix 3, I conducted several t-tests that showed that there were no significant differences between the individuals who enrolled in the program and the rest of the sample in terms of education, health, income, household wealth, and labor status. Additionally, whether an individual is eligible to enroll in the program does not depend on their past work history or on their financial state. To test the robustness of the results, I also used an inverse probability weighting method in the robust tests section as another way to address the potential bias associated with participating in the NRPS (see Table 6). Second, whether an individual receives NRPS payments may depend on the process for claiming benefits in each community, or the person's level of motivation to claim the benefits after reaching the eligible age. Although I include community fixed effects, the unobserved characteristics of the payment recipients may still be systematically different from those of the individuals who did not claim their NRPS payments. In this paper, I address this issue

by using as an instrumental variable (IV) eligibility to receive NRPS payments. I also used this variable to interact with the indicator *Above60* and normalized age variable *Nage*. For the IV to be valid, there are two assumptions. One is the instruments do not have a direct effect on the outcome variable, only indirectly through the treatment variable. An individual's eligibility to participate in the program and receive NRPS payments does not reflect their financial status, their past working history and the amount they contribute to the program. I also showed previously there is no systemic pattern in their socioeconomic status for those participating in the NPRS (Appendix 3). It is reasonable to believe that the first assumption is satisfied. The second assumption is the instruments are highly associated with the explanatory variable which is endogenous. To satisfy this assumption, I test the association between four IVs and the variable *Enrolled* in the first stage. Next, I use the residuals from the first stages Equation (1) in the second stage Equation (5) (RD-DID) for the variables related to *Enrolled*.

First Stage:

$$
\begin{aligned}
Enrolled\_Vars_{i,c,t} = {} & \alpha_0 + \alpha_1\, Eligible_{c,t} + \alpha_2\, Above60_{i,c,t} + \alpha_3\, Nage_{i,c,t} + \alpha_4\, Nage_{i,c,t} * \\
& Eligible_{c,t} + \alpha_5\, Nage_{i,c,t} * Above60_{i,c,t} + \alpha_6\, Eligible_{c,t} * Above60_{i,c,t} + \alpha_7\, Eligible_{c,t} * \\
& Above60_{i,c,t} * Nage_{i,c,t} + \alpha_8\, X_{i,c,t} + \delta_c + \xi_t + \varepsilon_{i,c,t}
\end{aligned} \tag{1}
$$

Second Stage:

$$
\begin{aligned}
Debt_{i,c,t} = {} & \beta_0 + \beta_1\, Enrolled_{i,c,t} + \beta_2\, Above60_{i,c,t} + \beta_3\, Nage_{i,c,t} + \beta_4\, Nage_{i,c,t} * \\
& Enrolled_{i,c,t} + \beta_5\, Nage_{i,c,t} * Above60_{i,c,t} + \beta_6\, Enrolled_{i,c,t} * Above60_{i,c,t} + \\
& \beta_7\, Enrolled_{i,c,t} * Above60_{i,c,t} * Nage_{i,c,t} + \beta_8\, X_{i,c,t} + \delta_c + \xi_t + \mu_{i,c,t}
\end{aligned} \tag{2}
$$

where $Debt_{i,c,t}$ in equation (2) are the outcome variables of interest for individual i in county c and year t. $Enrolled_{i,c,t}$ takes the value one if individual i in county c and year t is treated, i.e.,

enrolled in the program. Equation (1) is a linear probability model where $Enrolled\_Vars_{i,c,t}$ are the four endogenous variables related to $Enrolled_{i,c,t}$, and they are $Enrolled_{i,c,t}$, $Nage_{i,c,t} *$ $Enrolled_{i,c,t}$, $Enrolled_{i,c,t} * Above60_{i,c,t}$ and $Enrolled_{i,c,t} * Above60_{i,c,t} * Nage_{i,c,t}$.

The parameter of interest here is β_6, which captures the difference-in-difference intention-to-treat effect since the treatment effect is $Above60_{i,c,t} * Enrolled_{i,c,t}$. Moreover, α_4, α_5, and α_7 capture the interaction effects around age cutoff. The model incorporates the differences in the timing of the NRPS rollout and the age discontinuity design.

5. Results

5.1 Descriptive statistics

Table 1 Panel A describes the sample of 8,473 respondents, split by those who were below or above age 60 and were living in rural China at the 2011 baseline. In both groups, 49% of the respondents were male. Of the individuals in the sample, 84% of those who were younger and 80% of those who were older were married. On average, the respondents had two to three children, with the older group having slightly more children. One-quarter of the respondents were living in an urban area. On average, the older cohorts were holding about half as much debt as the younger cohorts: i.e., the double incidence rates were, respectively, 4% and 8%. In both groups, informal debt was more prevalent than formal debt: 33% of the younger adults and 22% of the older adults owed money through informal channels, while 12% of the younger adults and 6% of the older adults owed formal debt. The amount of informal debt owed was also higher: the average informal debt amount was 9,526 *CNY* for the younger adults and 5,542 *CNY* for the older adults, while the

average formal debt amount was 4,484 *CNY* for the younger adults and 1,628 *CNY* for the older adults.

Figure 4 shows the overall debt patterns over different cohorts. Figure 4 (a) indicates that, in general, people were holding less debt as they got older, and gradually reduced their debt over the eight-year study period; i.e., between 2011 and 2018. The proportion of indebtedness decreased between waves, which might be attributable to China's economic slowdown in 2015. Figure 4 (b) shows a different pattern for the informal debt amounts. The overall reduction in debt amounts between 2011 and 2013 was mostly driven by formal debt at all ages and informal debt at older ages. Between 2013 and 2015, the total decrease in debt amounts was mainly driven by the informal debt channel. The patterns between formal and informal debt amount were similar in between 2015 and 2018. Moreover, Figure 4 indicates an even higher level of total debt amount for the younger cohorts in 2018 compared to it in 2015, which is in line with the trend of increasing household debt among middle and older adults.

[Insert Table 1 and Figure 4 Here]

5.2 Fixed effects

Table 2 gives results for the fixed-effects specification. All five debt measures are negatively and significantly associated with receiving NRPS payments. For example, columns (1) - (4) indicate that receiving NRPS payments reduced formal debt amounts by 12% (or *CNY* 300 on average) at the 1% significance level, and reduced informal debt amounts by 13% (or *CNY* 767 on average) at the 1% significance level. In terms of the likelihood of indebtedness, respondents who were receiving NRPS payments were 1.1 % less likely to hold formal debt and were 1.4% less likely to

hold informal debt. The total debt amount decreased by 19% among those individuals who were receiving NRPS payments. Double incidence also decreased significantly, but the magnitude was less than 1%, and the chances of having an outstanding balance of either debt decreased by 2%.

[Insert Table 2 Here]

5.3 Regression discontinuity-difference-in-differences (RD-DID)

5.3.1 Testing validity of the RD design

Identification using the approach of the RD model requires the presence of a discontinuity in the treatment status and the age at or above the program age cutoff c. To ensure that this is the case, I first verify whether or not the program eligibility rules were enforced, in the sense that all of the qualifying individuals who were aged 60 or older and were participating in the NRPS were receiving pension payments, while those who were under age 60 or were not participating in the NRPS[6] were not receiving payments. According to the data, the eligibility rule was adhered to in almost all cases, except that 26 out of 16,345 individuals (0.16%) claimed that they had received payments without meeting the program's age criteria. I excluded them from the main analysis. There were 14% of qualified individuals who did not claim their NRPS payments for some reason (see Figure 3), which I will address with the IV approach in the next model.

[Insert Figure 3 Here]

Another assumption is that in the local neighborhood near the cutoff, the number of observations below the cutoff should not differ significantly than the ones above it. The underlying assumption is that the enrollment of the NRPS program should not differ near the cutoff age. Appendix 8 illustrates this scenario.

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[6] Or they were living in a county where the "bonding policy" was in place, but their children were not participating in the NRPS.

I also check for discontinuities in the baseline background characteristics for the respondents such as education, household registration and residence, marital status and ADLs. The corresponding graphical representations are provided in Appendix 9.

5.3.2 Graphical Tests for Discontinuities

Finally, Figure 5 shows the graphical tests for discontinuities in debt variables at the program eligibility cutoff age with and without the NRPS. The solid lines represent local linear regressions for each side of the cutoff based on the underlying data shown as the black dots, and the dashed lines represent 95% confidence intervals. In Appendix 10, I included the graphs with quadratic fit, which show a consistent story. Figure 5 (a) indicates that the amount of formal debt declined is only observed in the persons enrolled in the NRPS. Visually, this drop is clear around the cutoff age 60. While the decline pattern is not shown in the graph on the left, where individuals did not enroll in the NRPS program or receive the NRPS payments. Figure 5 (b) shows a sharp decline in the formal debt incidence right after the age of 60 for those enrolled or received the NRPS payments but not in the others. However, for informal debt, there was no significant pattern both in amount and incidence around the age cutoff of 60.

5.3.3 RD-DID

The results of the RD-DID model are reported in Table 3, and a breakdown of types of formal debt is reported in Appendix 4.

Table 3 Panel A shows the first stages of four IVs. The coefficients of *Eligible* in column (1), *Enrolled_Nage* in column (2), *Enrolled_Above60* in column (3), and Enrolled_Nage_Above60 in column (4) all indicate a positive correction at the 1% significance level. Moreover, the joint F-test also shows a significance association at the 1% level.

Table 3 Panel B shows the second stage of the RD-DID model. Unlike the FE model, the results indicate a decline of debt amount and incidence only in the formal channel. For example, columns (1) and (2) suggest that receiving NRPS payments reduced the formal debt amount by 53% (*CNY* 1,324 or $211) and the incidence by 6.5% from the average, at the 10% and 5% significance level. Meanwhile, the declines in the informal debt are insignificant even at the 10% significance level. It also appears that receiving NRPS payments did not have a significant influence on the overall debt amount. This is surprising, given that informal borrowing is more prevalent in developing countries (Wagstaff 2007). Additionally, the coefficients for *Male* in all columns show a positive associate between being a male and debt, while individuals with a spouse show a positive effect on formal debt and living in urban hold more formal debt and less informal debt on average.

As the summary descriptive shows, people generally held less debt over time. Hence, the age effect is controlled in all of the regressions. Similarly, as there was an economic slowdown in 2015 in China[7], the year fixed effect is controlled for to account for the macroeconomic changes. The results are robust on different bandwidths, and the analysis based on a five-year bandwidth yields the same conclusion as the analysis reported in Appendix 4.

[Insert Table 3]

6. Heterogeneous effects and shocks

6.1 Individual level

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[7] The growth rate in China in 2015 was only 6.9%, compared to 7.3% in the previous year, and was thus the slowest in a quarter of a century.

I explore the heterogeneous effects at the individual level by gender, education, marital status, and household income at the baseline in Figure 6 and Table 4. In these subsamples, the effect of receiving NRPS payments was observed for formal debt only. On average, receiving NRPS payments reduced both the amount and the incidence of formal debt twice as much among males as it did among females. Those individuals who were living in an urban area or who had no spouse experienced a larger decline in formal debt. Interestingly, receiving NRPS payments influenced the lower-income group, but not the higher-income group.

[Insert Table 5 Panel A Here]

6.2 Community level

I also explore the heterogeneous effects at the community level by socioeconomic status (the aggregate expenditures of the village are used as a proxy), level of out-migration, whether the community had difficulties getting loans, and whether the one-child policy was strictly enforced. As in the case of the individual-level effects, I found that the pension effects were significant for all of the debt variables in the villages with low socioeconomic status, while the pension effects were significant for the formal debt only in the villages with high socioeconomic status. In the communities where it was difficult to get loans, receiving NRPS payments had no significant impact on formal debt, but there was a significant drop in informal debt. I also found large effects in communities with higher levels of out-migration. Interestingly, the results showed that in the counties where the one-child policy was strictly enforced, the effects of receiving NRPS payments were significant for all of the debt measures, while in the other counties, the effects of receiving NRPS payments were significant only for formal debt measures and for double incidence.

[Insert Table 5 Panel B Here]

6.3 Shocks

The results above suggest that, on average, receiving NRPS payments reduced formal debt. However, for those individuals who had low consumption levels or were experiencing a shock, the priority may have been not to pay back existing debt, but to borrow. Here, I investigated two types of shocks: when an individual was the victim of a major fraud (the amount lost was in the top 40% among all frauds), and when an individual was living in a community that had at least one major natural disaster in the past five years. I tested whether receiving NRPS payments led to increases in borrowing among these individuals, perhaps by acting as additional collateral for those who needed to borrow.

I first identified in the dataset the individuals who had been the victim of a major fraud before 2015 in data[8]. I determined which individuals had experienced a major fraud by looking at those who answered yes to the question of "Has someone tried to defraud you?" and indicated that the amount they lost was in the top 40% among all fraud amounts. A graphic test on the new debt incidence is shown in Figure 7. The rows indicate the individuals with low (1st) or high (2nd) wealth in the baseline 2011, and the columns indicate whether the individuals were receiving NRPS payments. The solid lines represent the individuals who had experienced a major fraud, and the dashed lines represent the rest of the sample. On the one hand, among the individuals who were not receiving NRPS payments, those with higher levels of wealth tended to borrow significantly more while in the younger age group (below 60), and there was no difference after age 60. On the

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[8] A total of 663 individuals experienced a fraud, and 257 had lost a large amount, accounting for 3% of the whole sample.

other hand, no new borrowing was observed in the low-wealth group, which might suggest that these individuals faced credit constraints. At the same time, the new debt incidence among those individuals who had been the victim of a fraud, were receiving NRPS payments, and had a higher level of wealth tended to remain stable (at zero, or even at below zero). However, among the low-wealth group who had been the victim of a fraud, individuals of almost all ages increased their borrowing compared to the control group who did not experience a fraud, and the incidence of new debt taken on between the ages of 65 and 75 increased by up to 10%. Generally, people with higher wealth levels continued to borrow despite having experienced a fraud, and regardless of whether they were receiving NRPS payments. However, the results also indicated that those individuals who had less wealth had better access to informal credit when they experienced a shock if they were receiving NRPS payments. This result is consistent with the literature suggesting that rural residents are more likely to borrow from friends and family to cope with shocks (Wagstaff 2007).

Nevertheless, it could be argued that the 3% of the sample who experienced a major fraud is not large enough to reflect the experiences of the majority. I also measured the effects of shocks at the community level by identifying those communities that had experienced at least one major natural disaster in 2011, such as a flood, drought, fire, earthquake, typhoon, or snowstorm. I constructed a dummy variable to identify those communities, and interacted it with the NRPS payment status. The results displayed in Table 6 indicate that having suffered a natural disaster in the past was positively and significantly associated with a higher level of debt in all measures. However, within the same community, those individuals who were receiving NRPS payments held, on average, nearly 60% less debt than those who were not receiving NPRS payments (column (5)).

[Insert Figure 7 Here]

7. Robustness Tests

This section presents three additional sensitivity checks: (i) using inverse probability weighting as an alternative empirical strategy to account for the potential self-selection bias from the voluntary feature of the NRPS; (ii) estimating the NRPS effect using the RD-DID model at the household level to include the characteristics of the spouse, the balanced panel, and the cross-sectional data in all four waves; and (iii) assessing the NRPS effect using the RD-DID model with the CHARLS 2008 pilot data, which are based on a different sample than the CHARLS panel used in the main study.

7.1 Inverse probability weighting (IPW)

As the NRPS is a voluntary program, participation in it may be correlated with the outcome variables. In other words, it may appear that some of the individuals who participated in the NRPS program had particular patterns that are also associated with debt behavior, but these patterns are not addressed by the RD-DID model. In Appendix 3, I provided a series of t-tests to show that this is unlikely to be the case. To confirm the robustness of the results by excluding this self-selection bias, I employed a probit model following Ning et al. (2016), and used it as an inverse probability weighting in the FE model.

Probit model:

$$Participated\_NRPS_{i,c,t} = \Omega X_{i,c,t} + \rho_c + \eta_t + \mu_{i,c,t}$$

Weighting function:

$$PW_i = \sqrt{\frac{NRPS_i}{\hat{P}(NRPS_i=1)}} + \sqrt{\frac{1-NRPS_i}{1-\hat{P}(NRPS_i=1)}}$$

The results are reported in Table 7. Panel A shows the results of the probit model: namely, that age and education contribute to the probability of participating in the program, controlling for the community and the year fixed effects. Next, I applied this probability as weighting to the fixed-effects model, which previously showed negatively impacts on all debt measures (Table 2). The new results with IPW are in line with the main results from the RD-DID model (Table 4 Panel B). In other words, the new results suggest that the NRPS effect is only significant for the formal debt and double incidence, but is not significant for the informal debt or the total debt amount. These findings reinforce the main analysis results.

[Insert Table 7 Here]

7.2 Household level, balanced panel, and cross-sectional sample

It could be argued that when studying rural developing countries, it is more appropriate to apply the concept of debt at the household level, rather than at the individual level. Therefore, I reorganized the sample at the household level. Among the households that were receiving NRPS payments, I distinguished between those with at least one person receiving NRPS payments, and those with two people receiving NRPS payments. The results from the RD-DID model did not differ for these two groups. In Table 8, I provide the results for those households with at least one person receiving NRPS payments. Overall, these findings are consistent with my main results (Table 4 Panel B), but they are significant at a lower level.

[Insert Table 8 Here]

I also present the consistent cross-sectional results in a balanced panel (respondents are recorded in all four waves) and for all four waves in Appendix 5 and 7.

7.3 Pilot Study

To ensure that the main results were not driven by a particular sample from CHARLS, I used another sample collected by the CHARLS team, and re-estimated the RD-DID model to rule out this possibility.

Before the 2011 baseline survey, the CHARLS team conducted a pilot study in 2008 in two provinces in China on a sample of individuals aged 45 or older, and followed them up in 2012. The timing of these two waves fell perfectly before and after the NRPS implementation. I therefore take advantage of the two years as the before and after timing variable, and use whether the individuals who turned 60 in 2008 as the treatment to design a difference-in-differences setting.

$$Y_i = \alpha + \beta\, T_i + \gamma\, t_i + \delta\, (T_i \cdot t_i) + \varepsilon_i$$

where i represents each individual, and T is a dummy variable indicating the treatment effect, defined as one if treated and zero if controlled; and t is the timing variable, defined as one if it is after and zero if it is before. ε is a random and unobserved error term. δ is the coefficient of the DID NRPS effect. Table 9 describes a story that is consistent with the main analysis: i.e., that receiving NRPS payments significantly reduced people's formal debt, rather than their informal debt.

[Insert Table 9 Here]

8. **Mechanisms**

27

My results are consistent with the life-cycle hypothesis, which suggests that receiving cash payments increases income, and thereby reduces borrowing and indebtedness; but they are inconsistent with prior empirical evidence suggesting that there is a negative association between cash transfers and informal debt in developing countries. Why would receiving pension payments reduce debt, while having a significant impact on debt borrowed through formal channels, but not through informal channels? In this section, I propose four hypotheses for these findings, and provide tests and explanations for each of them.

8.1 Psychology effect - debt account aversion

The psychology literature suggests that when people are making decisions, the attributes that are difficult to evaluate are given less weight (Hsee 1996; Denes-Raj and Epstein 1994; Pacini and Epstein 1999; Gigerenzer and Hoffrage 1995). One reason people may stray from the normative theory of paying off the highest interest rate loan first is that they tend to treat repayment decisions as asset allocation. When the options become too complex, people tend to use a more naive diversification heuristic: namely, the 1/n heuristic (dividing the payment evenly across all accounts) (Benartzi and Thaler 2001). As a result, when a person cannot pay off all of the debts at once, paying all of the different debts equally result to maintain the diversity of the loans. Nevertheless, a large body of research has also shown that people often do not prefer to have a diversity of debt accounts. This suboptimal behavior is called the "debt account aversion" phenomenon: i.e., when the main goal is perceived as difficult, people tend to adopt more manageable sub-goals that bring them more motivation and satisfaction. In other words, when paying off all of their loans is difficult, they choose to pay off an individual loan first (to minimize the total number of accounts). Thus, while people often pay off their debts equally to avoid engaging in an overly complex analysis,

when the debt amounts differ, people tend to prioritize reducing the number of channels of debt over lowering the total amount of debt (by paying off the loans with the highest interest rates more quickly) (Amar, Ayal, Cryder 2011). Therefore, there may be a tendency to repay the types of debt with smaller amounts first. Since the main results suggest that there was a decline in double incidence, I suspect that this behavior may be attributable to debt account aversion.

For this hypothesis to be valid, an individual's formal debt should be in smaller amounts than their informal debt before they turn 60. This was indeed the case for the individuals in our sample based on the mean debt values for those who held both formal debt (32,116 *CNY*) and informal debt (35,182 *CNY*) in 2011. However, I also observed that the debt pattern differed more among the individuals with a larger amount of formal debt at baseline than the main results would suggest. That is, receiving NRPS payments should have had a larger impact on informal than formal debt. To test this hypothesis, I identified the individuals with both formal and informal debt, and split them into two groups: Group A, who had larger formal than informal debt amounts; and Group B, who had smaller formal than informal debt amounts. Within this setting, we would expect to find that receiving NRPS payments affected the formal debt more significantly in Group B and the informal debt more significantly in Group A. The results indicate that the story in Group A was different, as receiving NRPS payments still significantly reduced their formal debt rather than their informal debt. I therefore reject this hypothesis.

[Insert Table 10 Panel A Here]

8.2 Impacts on children

If parents in China die while holding formal loans, their children are responsible for paying back these loans only if they receive an inheritance. By law in China, when parents pass away, their debts are deducted from their savings accounts and assets. Thus, having formal debt is more costly

for inheritance purposes. If this hypothesis is valid, we should observe that the effects are lower among people who do not own land or houses or do not have children. Therefore, I divided the sample into two groups, with the people who did not own land or houses or did not have children being assigned to Group A, and the rest being assigned to Group B.

I re-estimated the main analysis for both groups. As Table 10 shows, the results were the opposite of those I expected: in Group A, the only significant reductions were for the informal debt; while for Group B, the only significant reductions were for the formal debt. However, the finding that those individuals who were receiving NRPS payments and had no land or houses or did not have children were less likely to prioritize their formal debt was consistent with my expectations. Conversely, those who had children and owned houses or land may have been more concerned about having an outstanding balance in their formal debt accounts. Yet in my sample, only 9% of individuals did not have children, and among those with children, only 5% did not own any land, and more than 50% owned their primary residence. In other words, the majority of individuals in the sample cared about the potential negative impact on their children's inheritance of defaulting on their formal debt.

[Insert Table 10 Panel B Here]

8.3 Interest rates and substitution effects

While pensions start providing "extra" cash immediately after the participants reach the eligibility age, in the NRPS, the basic pension and the matching payment amounts for the individual accounts are both quite low. Thus, receiving a small amount of "extra" cash may trigger a reallocation between formal debt, informal debt, and consumption. Theory suggests that the optimal way to pay off debt is to pay down the debt with the highest interest rate first. If the reduction of formal debt rather than of informal debt by a person who has multiple debts or deficient on consumption

is motivated by a desire to pay off the debt with the high interest rate first, the effect should be concentrated among the participants who carried a debt with a higher formal interest rate. I again divided the sample into two groups. Group A was made up of individuals who had a higher probability of having a low interest rate when borrowing from formal channels. These individuals were identified in the data using the following criteria: having a party member in the family (children, siblings or parents); more social capital (the participation in social activities used as a proxy); and living in a community where bank competition was higher (with the number of banks in the community used as a proxy). The rest of the sample was in Group B. The sample was then split into groups depending on whether they belonged to the high formal interest rate group.

For this hypothesis to be valid, we should see that the NRPS effect was smaller or less significant for the beneficiaries in the low interest rate group. The results confirm this hypothesis. Individuals in the low interest rates group are shown less affected by the NRPS in the formal debt both in the magnitude and significance level. I also found a large reduction in informal debt amount for the low interest rates group at the 10% significance level but not the other group.

[Insert Table 10 Panel C Here]

8.4 Credit constraints

Many studies have shown that the probability of having credit constraints increases with age, while social capital – which is understood to be positively associated with informal borrowing – generally accumulates with age (McDonald & Mair, 2010). Thus, older cohorts tend to borrow more from informal channels. I also described a similar phenomenon in Section 7.3: i.e., that in

cases in which receiving NRPS payments reduced credit constraints, it affected the informal channel only.

If receiving NRPS payments relieves informal credit constraints, it may be assumed that people who are collecting such payments can borrow more from their family and friends when they need to, or even substitute formal debt with informal debt, thereby offsetting a portion of the informal debt repayment so that there were no significant changes overall. Conversely, formal borrowing depends less on social capital or interpersonal trust, and decreases persistently with age. Thus, there should be less new debt through formal channels.

To test this hypothesis, the key variable to be compared is the level of new borrowing in both formal and informal channels. However, as this information is vaguely defined in the dataset, I lack the evidence I would need to prove this assumption.

9. Conclusion

Household debt levels have surged in recent years, and the largest increases in debt have been observed among the older population. However, studies on debt among older adults are scarce, and there is even less research on existing programs designed to reduce debt levels among this cohort. This may be due to a lack of available data, especially on informal borrowing, which is often more prevalent than formal borrowing in developing countries. This paper used a natural experiment arising from the introduction of China's New Rural Pension Scheme (NRPS), which is one of the world's largest social pension programs, to study the impact of receiving old-age pension payments on debt behavior among older adults. To the best of the author's knowledge,

this is the first paper in the literature to causally identify the effects of receiving pension payments on debt among older adults.

The results provide evidence that receiving pension benefits reduces the indebtedness of older adults, especially of those with lower SES. However, a significant reduction was observed for formal debt only. While this finding is consistent with the life-cycle hypothesis, it is not consistent with the literature on pension schemes or cash transfers in some developing countries, which suggests that these payments are associated with a decline in informal debt (Islam and Maitra 2012; Kochar 1995; Hoddinott, Sandström, and Upton 2018). Looking at the potential mechanisms for my findings regarding the formal debt, which may be perceived as a more negative type of debt for rural older adults, I argue that there may be substitution between formal debt, informal debt, and consumption when the pension benefits are limited. This hypothesis is in line with the literature on the effects of the introduction of the NRPS, which suggests that it has led to an increase in consumption. The paper also points out there may be credit constraints among individuals with lower wealth, and that receiving pension payments increased the new borrowing incidence among the individuals with lower wealth who experienced a financial shock by up to 10%. Finally, receiving NRPS payments was found to have heterogeneous effects across individuals with different demographic backgrounds. Compared to their counterparts, males (who usually carry more debt than females), people who were living in an urban area, and people without a spouse were observed to experience larger declines in their formal debt levels.

The main results are in line with those of the literature, which has suggested that pensions have a positive effect on reducing indebtedness among the individuals and households who are beneficiaries. The main insight is that even a pension that is modest in size still represents a powerful financial tool for those with a lower SES, or for those who are vulnerable to shocks.

While receiving extra cash payments did not translate into significant reductions of informal debt in the short run[9] for the individuals in our study sample, it reduced their formal debt and provided them with more credibility when they needed to borrow. This observation is consistent with the life-cycle hypothesis, which emphasizes that people tend to save when they experience an income increase to smooth their future consumption, instead of consuming today.

These findings have important implications for reforms of pension programs in similar countries with a relatively weak safety net. Although I found that the effectiveness of pensions is significant, albeit limited, I also observed that there are considerable credit constraints among the older population. The results suggest that to reduce the overall debt levels and improve the financial status of older adults more effectively, larger basic pension amounts and higher matching contribution rates are needed to incentivize participation, and to discourage the substitution of consumption.

The results also point to possible directions for future research. This paper used data from 2011 to 2015, which included the longest seven-year in which the beneficiaries of the NRPS were receiving payments. It would be useful to observe the effects over a longer time horizon, and evaluate and compare them with short-term effects. The paper also made an assumption in the mechanisms section regarding the differences in the interest rates of formal and informal debt. It would be more convincing to use observed interest rate data (i.e., bank loans or personal/loan-level data). In the context of global aging and the weakening of family support, more research is needed to explore financial stability among the older population.

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[9] The NRPS rollout started in late 2009, and the last wave of CHARLS was collected in 2015. Hence, the longest possible period of receiving payments we could cover was 2009-2015 (seven years).

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Figure 1: New Rural Pension Scheme (NRPS) Coverage over Time

(a) First round, 2009, 320 counties, 11%

(b) Second round 2010, 838 counties, 29%

(c) Third round 2011, 1,914 counties, 67%

(d) Fourth round 2012, nearly all 2,853 counties, 100%

Notes: This graph displays the staggered rollout of the coverage of the NRPS in rural China between 2009 and 2012. Panel A shows that NRPS coverage was 11% in the first round in November 2011, was 29% between July 2010 and October 2010, and then increased sharply to 67% between July 2011 and September 2011. At the end of 2012, the NRPS covered nearly all 2,853 communities. The data for county-level NRPS coverage are from the list of pilot counties, and the data on the timing of the rollouts were released by the Chinese government. Thank you for Dr. Xi Chen for providing this list.

Figure 2: Eligibility Rules of the NRPS
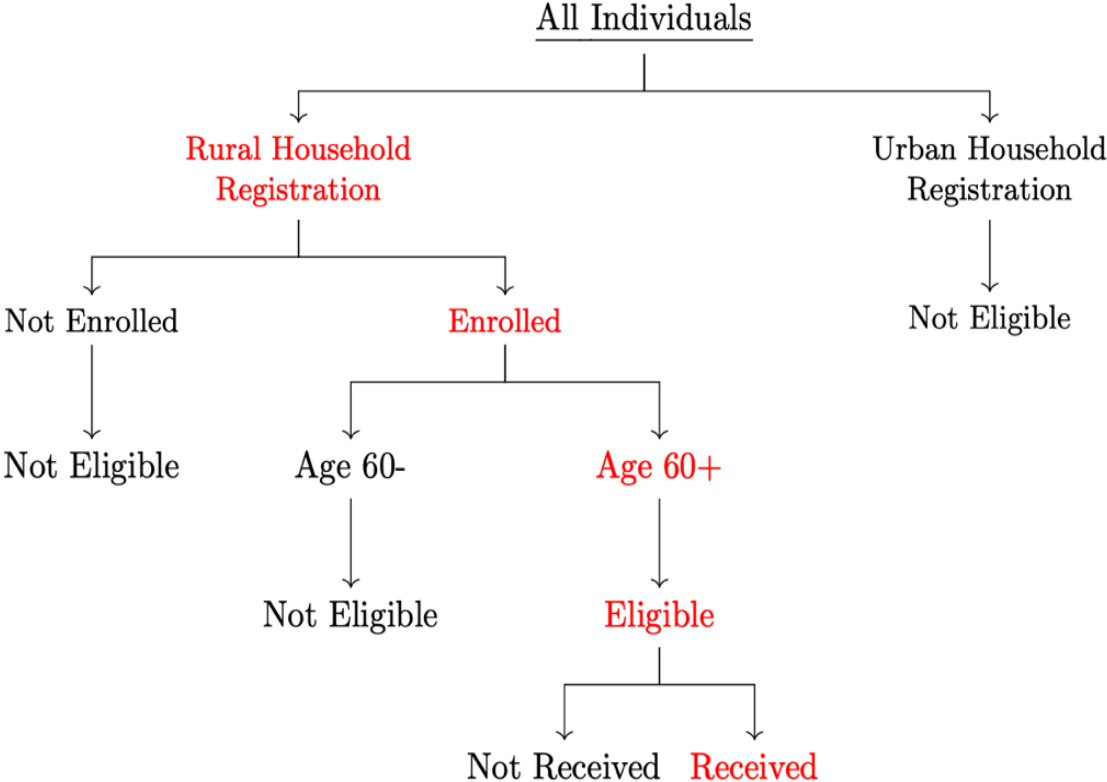
Figure 3: Probability of Receiving NRPS Payments
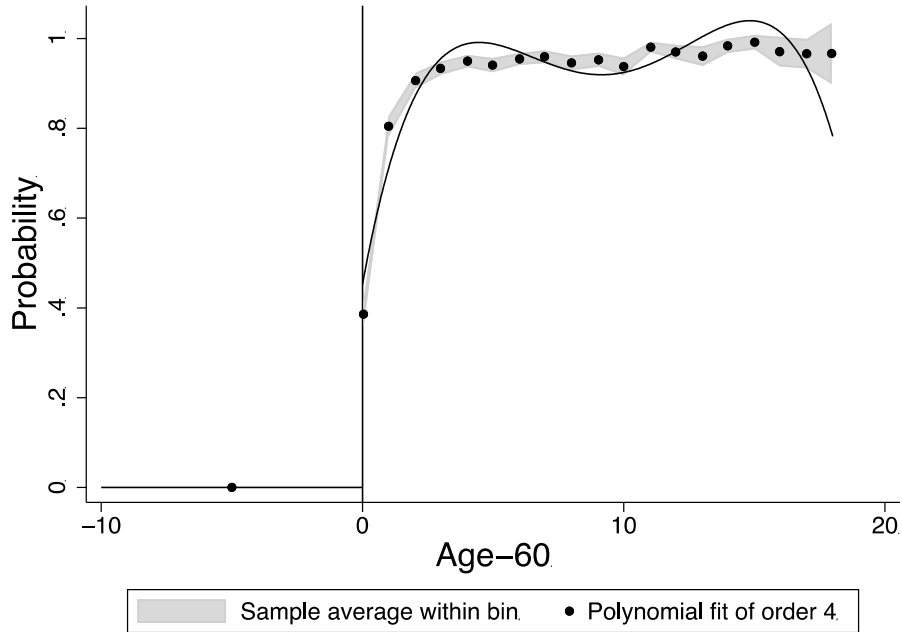
Notes: This figure plots the probability of receiving NRPS payments among individuals with a rural household registration. The x-axis shows the age of 10 years, the age of 60 years, and 15 years after the age of 60 years. At the age of 60 (t=0), the probability of receiving payments jumps from 0% to 40%, and increases further after the age of 60. Given that individuals need to participate in the program first before receiving the benefits[10] after turning age 60, the probability is not one after age 60.

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[10] In some communities, there is a "bonding policy" under which parents can receive NRPS payments even if they are over age 45 provided their children have enrolled in and are contributing to the program.

Figure 4: Debt

(a) Total Debt Amount and Incidence
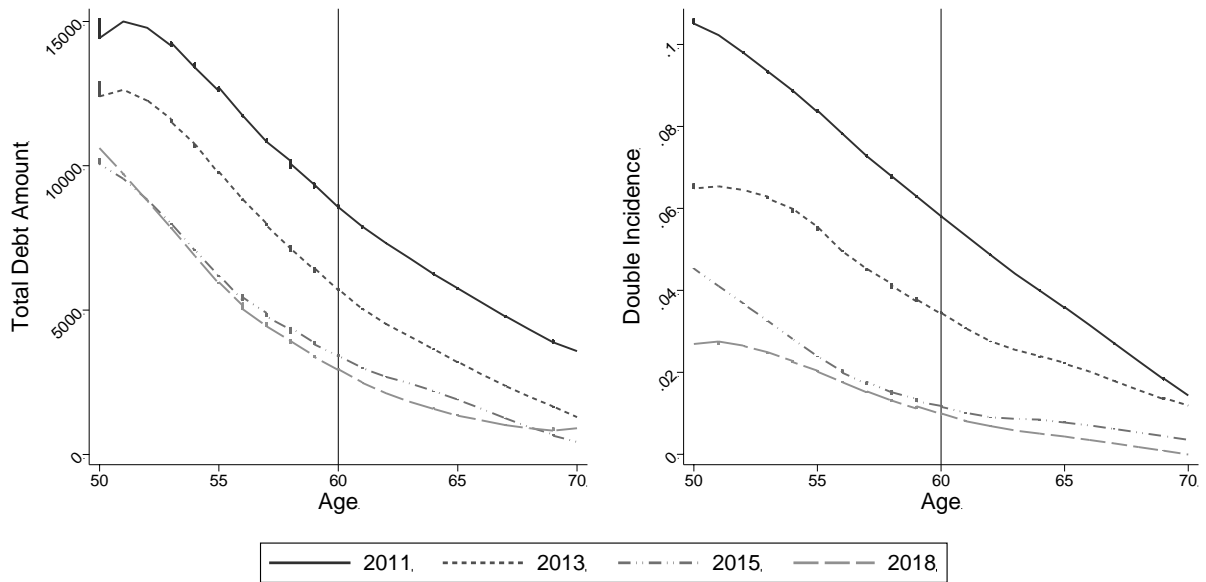
(b) Formal Amount versus Informal Amount
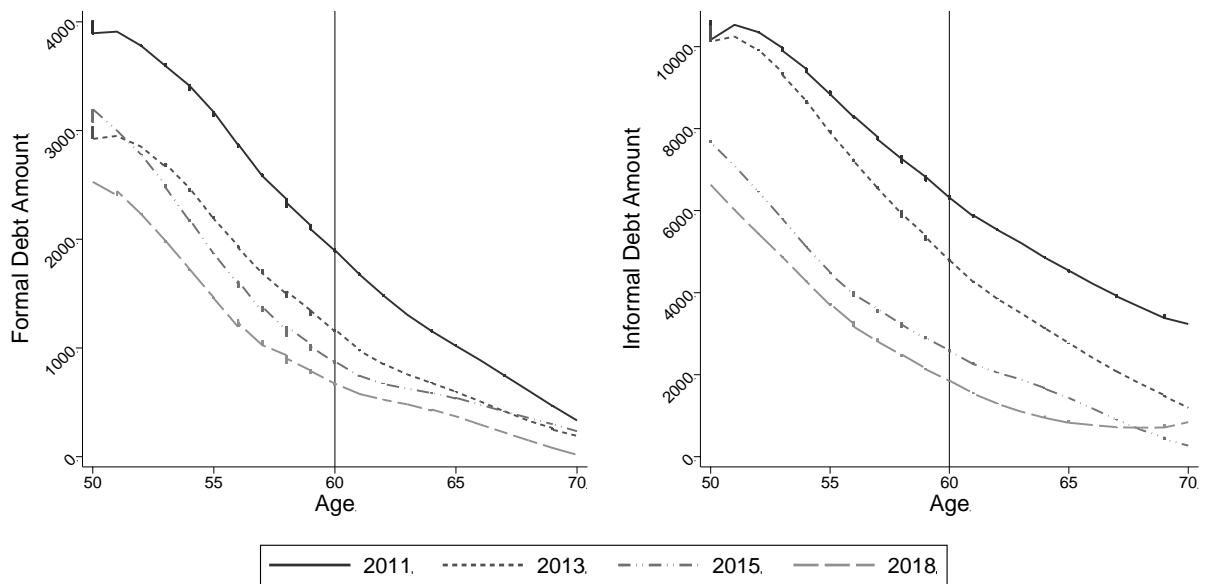
Notes: Figure (a) shows total debt amount on the left and the incidence on the right. Figure (b) shows the formal amount on the left and the informal amount on the right

(c) Debt Amount and Incidence Between Waves
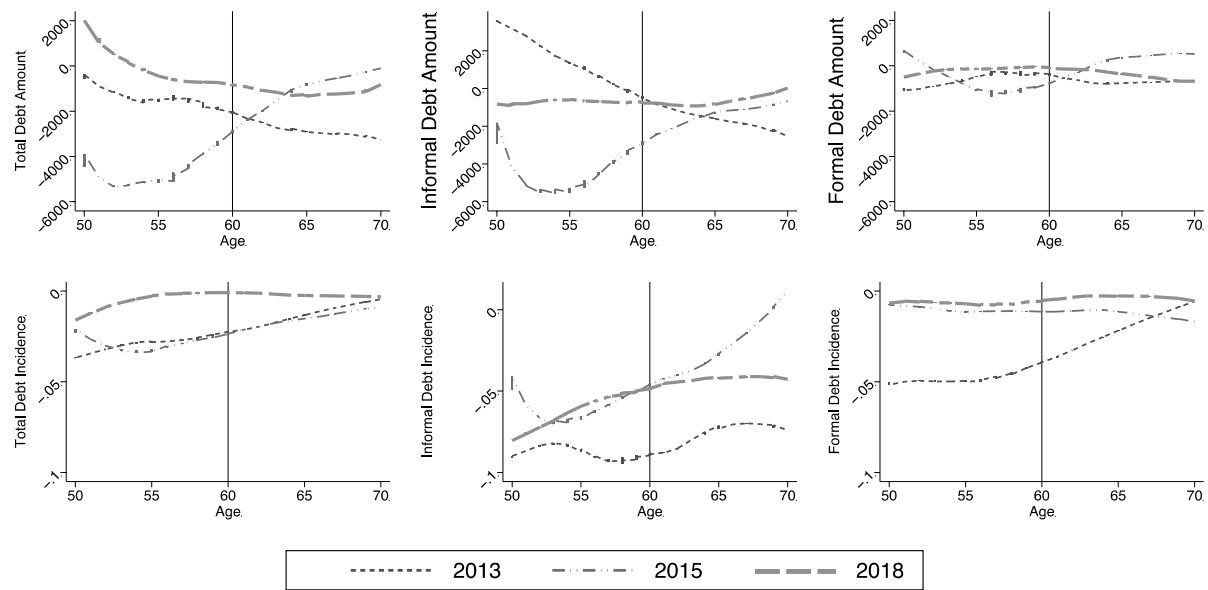
Notes: Figure (c) shows the debt amount and the debt incidence between waves. The first row indicates the total, formal, and informal new debt amount. The second row indicates the total, formal, and informal debt incidence. Debts between waves are defined based on the difference between two waves.

Figure 5: Regression Discontinuity Plots

(a) Formal Debt Amount with the NRPS
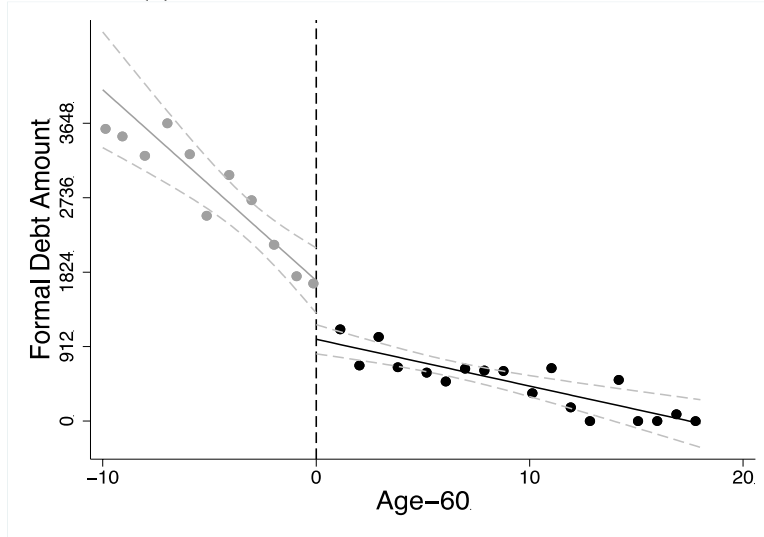
(b) Formal Debt Amount without the NRPS
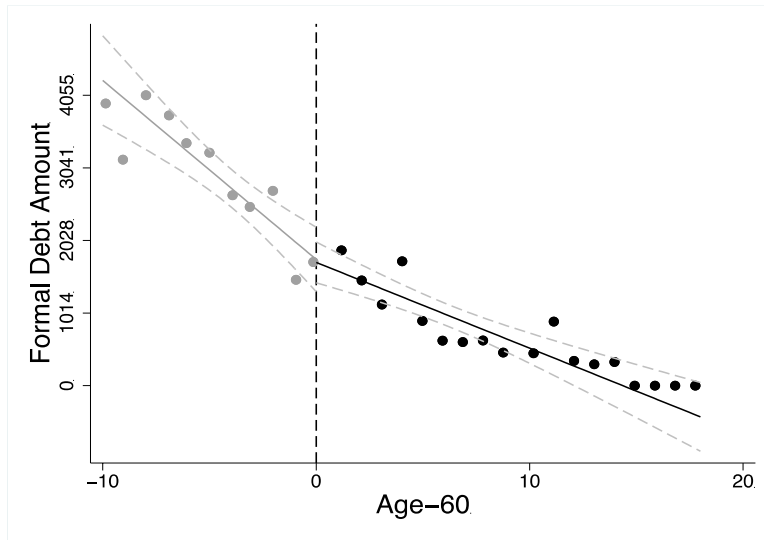
Notes: Figure (a) and (b) shows graphical tests for discontinuities in the formal debt amount with or without the NRPS. The first row indicates the changes in the formal debt amount (*CNY*) with the NRPS, and the second row indicates it without the NRPS. The solid lines present local linear regressions to each side of the cutoff, and the dashed lines around each year are 90% confidence intervals. The horizontal lines at zero represent age 60.

(c) Formal Debt Incidence with the NRPS
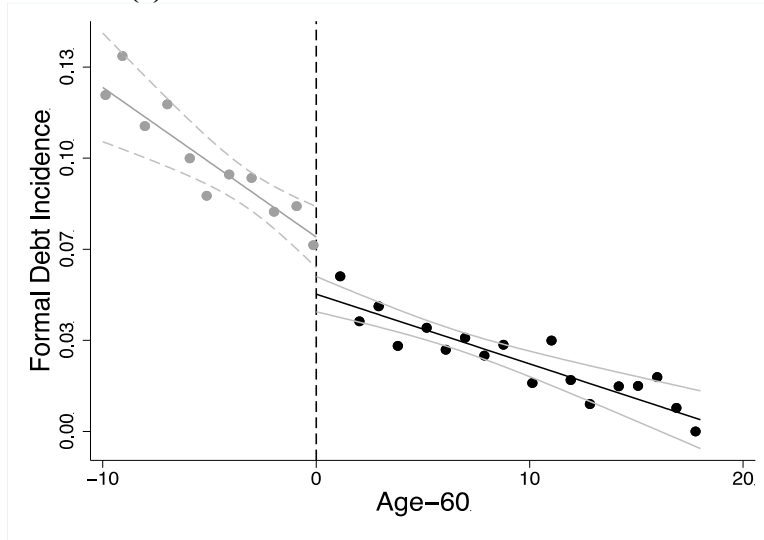
(d) Formal Debt Incidence without the NRPS
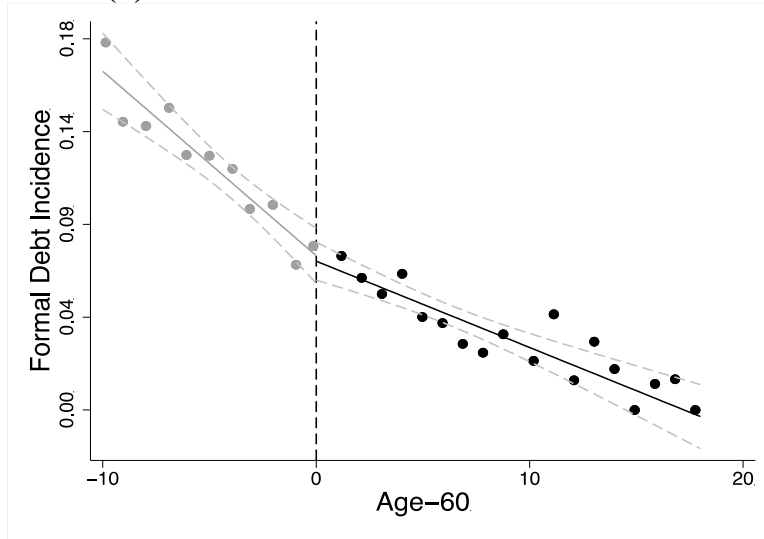
Notes: Figure (c) and (d) have the same structure as the plots in Figure (a) and (b), but for formal debt incidence.

(e) Informal Debt Amount with the NRPS
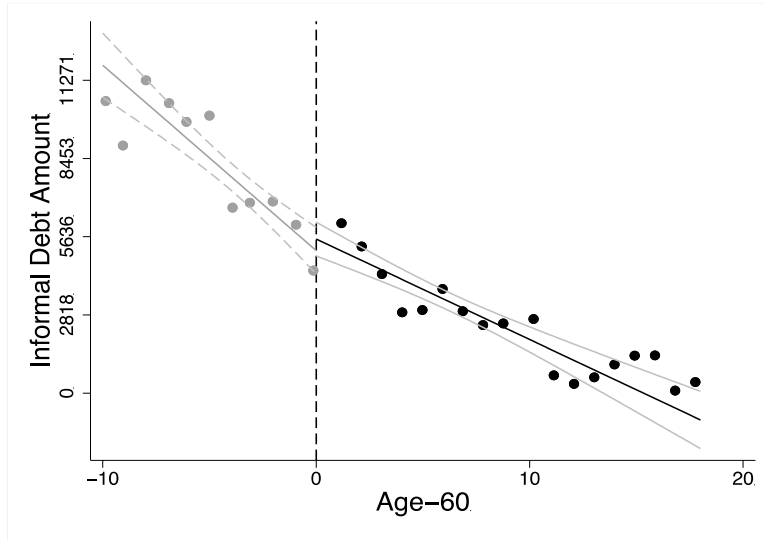
(f) Informal Debt Amount without the NRPS
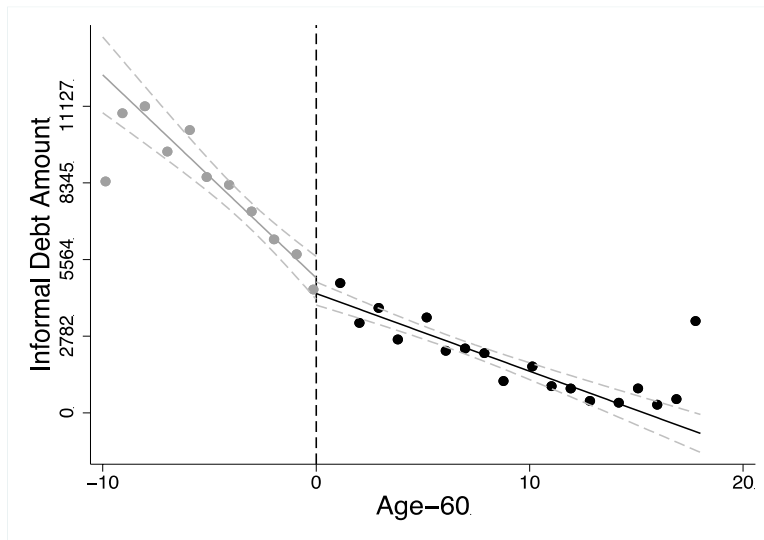
Notes: Figure (e) and (f) have the same structure as the plots in Figure (a) and (b), but for informal debt amount.

(g) Informal Debt Incidence with the NRPS
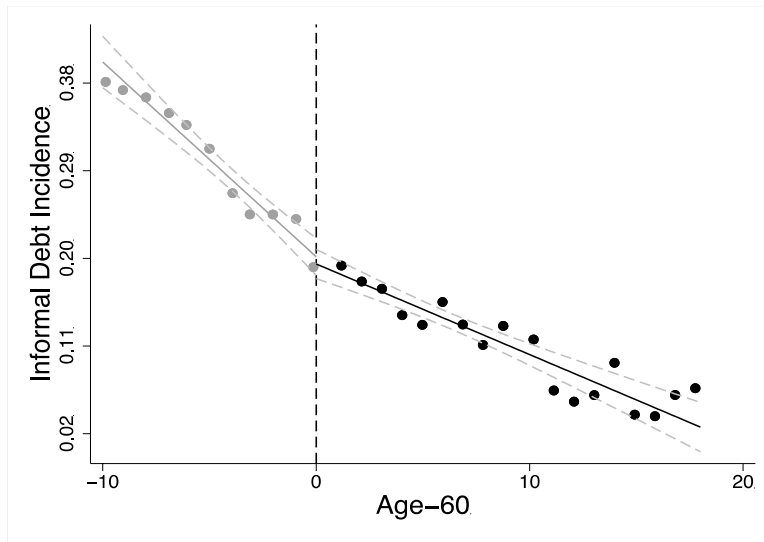
(h) Informal Debt Incidence without the NRPS
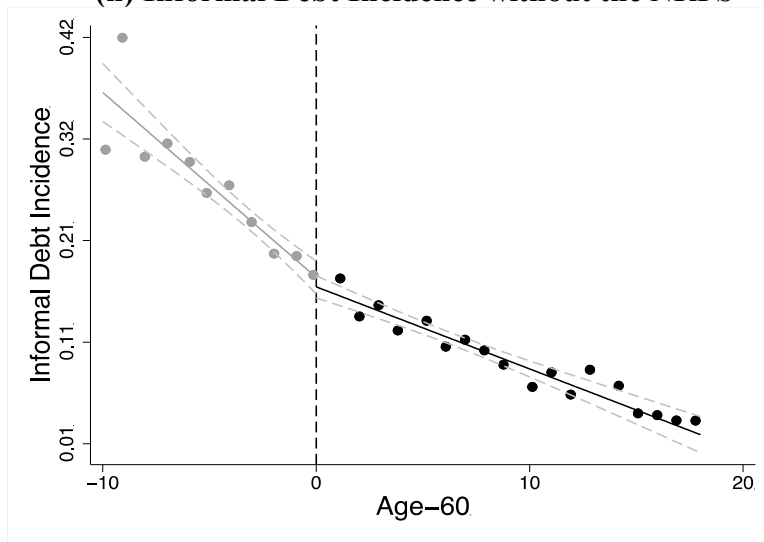
Notes: Figure (g) and (h) have the same structure as the plots in Figure (a) and (b), but for informal incidence.

Figure 6: Heterogeneous Effects – Individual

(a) Gender

(b) Marital Status
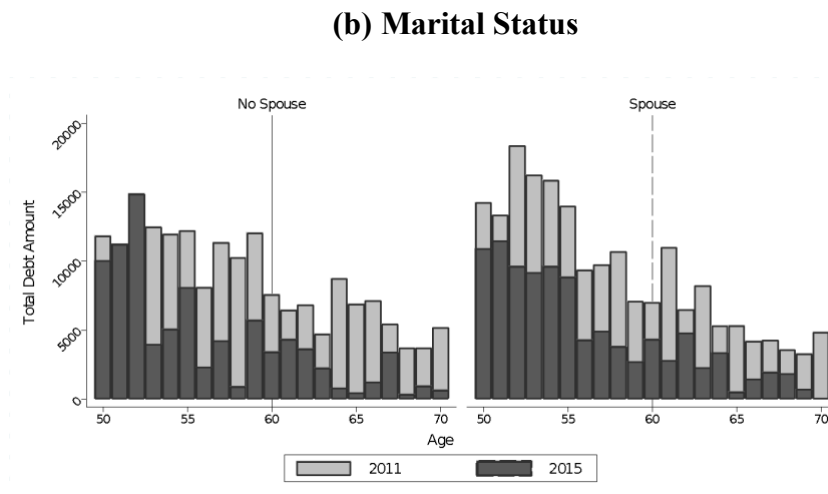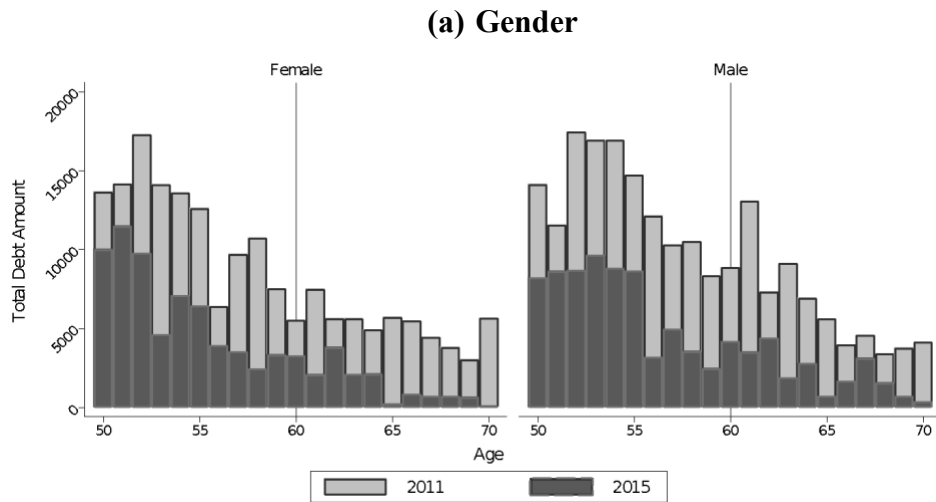
Notes: The figure shows the heterogeneous effects on the total debt amounts at the individual level. The bars indicate the total amount of debt in 2011 (dark gray) and 2015 (light gray). Figure (a) shows the differences by gender, and Figure (b) shows the differences by marital status.

Figure 7: Shocks – Fraud
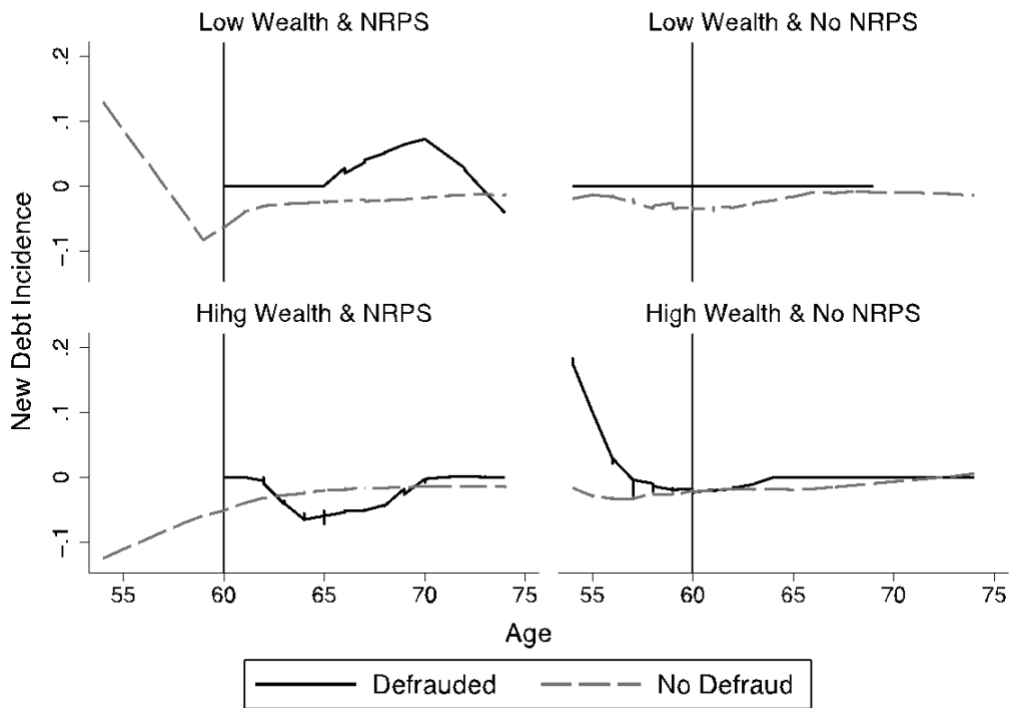
Notes: The figure shows the patterns in the new debt incidence among the individuals who experienced a major fraud before 2015. The solid lines represent the new debt incidence of those who experienced a fraud, while the dashed lines represent the new debt incidence of those who did not. New debt incidence occurred when an individual who had no debt in 2013 appeared to hold some debt in 2015. The rows display low or high levels of wealth, as defined at the 2011 baseline; and the columns indicate whether individuals were receiving NRPS payments.

Table 1 Panel A: Descriptive Statistics in 2011

Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
	Below Age 60, N = 4,718				*Above Age 60, N = 3,755*			
Formal Debt Amount	4,483.63	26333.85	0	1,000,000	1,627.80	13,840.20	0	410,000
Formal Debt Amount (LN)	1.18	3.21	0	13.82	0.52	2.16	0	12.92
Formal Debt Incidence	0.12	0.33	0	1	0.06	0.24	0	1
Informal Debt Amount	9,525.76	25,334.92	0	400,000	5,542.35	23,335.81	0	500,000
Informal Debt Amount (LN)	3.10	4.55	0	12.90	1.94	3.83	0	13.12
Informal Debt Incidence	0.33	0.47	0	1	0.22	0.41	0	1
Total Debt Amount	13,862.94	40,483.12	0	1,000,000	7,103.91	30,069.92	0	670,000
Total Debt Amount (LN)	3.49	4.75	0	13.82	2.11	3.99	0	13.42
Double Debt Incidence	0.08	0.28	0	1	0.04	0.19	0	1
Received NRPS	0.00	0.00	0	0	0.20	0.40	0	1
Participated NRPS	0.28	0.45	0	1	0.28	0.45	0	1
Eligibility NRPS	0.00	0.00	0	0	0.28	0.45	0	1
Age	54.95	2.73	50	59	64.21	3.13	60	70
Male	0.49	0.50	0	1	0.49	0.50	0	1
Married	0.84	0.37	0	1	0.80	0.40	0	1
Number of Children	2.35	1.07	0	9	3.19	1.42	0	10
Living in Urban	0.26	0.44	0	1	0.23	0.42	0	1
Education - Low	0.51				0.60			
Education - High	0.49				0.40			

Notes: This table reports summary statistics for the debt and the respondents' demographic information at the individual level (see the household-level summary in the Appendix) at the 2011 baseline. The amount of debt is recorded in *CNY,* and the incidence is a dummy variable indicating whether an individual held any level of debt. Double incidence occurred when an individual had both formal and informal debt.

Panel B: Corrections

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Formal Debt Amount	1											
(2) Formal Debt Incidence	0.451***	1										
(3) Informal Debt Amount	0.244***	0.206***	1									
(4) Informal Debt Incidence	0.119***	0.275***	0.517***	1								
(5) Double Debt Incidence	0.347***	0.797***	0.293***	0.417***	1							
(6) NRPS_Receipt	-0.035***	-0.059***	-0.036***	-0.056***	-0.050***	1						
(7) Eligibility NRPS	-0.043***	-0.064***	-0.040***	-0.061***	-0.058***	0.812***	1					
(8) Normalized Age	0.027**	0.017	0.022**	0.021*	0.014	0.008	-0.036***	1				
(9) Male	0.044***	0.066***	0.010	0.015	0.048***	-0.005	0.001	-0.011	1			
(10) Married	0.017	0.008	0.009	-0.004	0.005	-0.022**	-0.021*	-0.030***	0.031***	1		
(11) Number of Children	-0.019*	-0.022**	-0.007	-0.020*	-0.003	0.131***	0.154***	0.038***	-0.099***	0.041***	1	
(12) Living in Urban	0.025**	0.018*	0.028***	-0.040***	0.004	0.006	0.000	0.015	-0.009	0.012	-0.068***	1

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2: Fixed-Effects Model

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
NRPS_Receipt	-0.116***	-0.011***	-0.130***	-0.014***	-0.187***	-0.005**
	(0.027)	(0.003)	(0.046)	(0.005)	(0.049)	(0.002)
Male	0.201***	0.020***	0.176***	0.022***	0.266***	0.012***
	(0.029)	(0.003)	(0.046)	(0.005)	(0.048)	(0.002)
Nage	-0.047***	-0.005***	-0.112***	-0.011***	-0.129***	-0.003***
	(0.003)	(0.000)	(0.005)	(0.001)	(0.006)	(0.000)
Nage^2	0.001***	0.000***	0.002***	0.000***	0.002***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Married	0.098***	0.010***	-0.101*	-0.015**	-0.032	0.004
	(0.035)	(0.004)	(0.057)	(0.006)	(0.060)	(0.003)
Education = 1	0.016	0.003	0.014	-0.006	0.044	-0.001
	(0.035)	(0.004)	(0.057)	(0.006)	(0.060)	(0.003)
Education = 2	0.080**	0.007*	-0.044	-0.018***	0.015	0.002
	(0.038)	(0.004)	(0.062)	(0.007)	(0.065)	(0.003)
Education = 3	0.251***	0.026***	0.091	-0.004	0.254***	0.008**
	(0.047)	(0.005)	(0.071)	(0.007)	(0.075)	(0.004)
Constant	0.560***	0.064***	2.418***	0.271***	2.554***	0.048***
	(0.044)	(0.005)	(0.073)	(0.008)	(0.077)	(0.004)
Observations	30,078	30,078	29,717	30,078	30,078	30,078
Adjusted R^2	0.069	0.067	0.103	0.090	0.112	0.046
Community FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Table 3: Regression Discontinuity Model

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
NRPS_Receipt	-0.498**	-0.056**	0.068	0.009	-0.095	-0.030*
	(0.2130)	(0.0231)	(0.2740)	(0.0287)	(0.2740)	(0.0175)
Observations	10,519	10,519	10,345	10,519	10,519	10,519
Community FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Notes: This table shows the results from the regression discontinuity model. *NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments. Each column reports the results from a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount, and double debt incidence. All regressions include the community and the year fixed effects, and control for gender, age, marriage status, education, and the number of children. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4: Regression Discontinuity-Difference-in-Difference (RD-DID) Model

Panel A First Stage

VARIABLES	(1) Enrolled	(2) Enrolled_Nage	(3) Enrolled_Above60	(4) Enrolled_Nage_Above60
Eligible	0.450***	-0.118	-0.074***	-0.238***
	(0.015)	(0.100)	(0.011)	(0.088)
Above60	-0.036***	0.016	0.018*	0.017
	(0.012)	(0.086)	(0.010)	(0.084)
Nage	0.004**	-0.029***	-0.005***	-0.030***
	(0.002)	(0.011)	(0.001)	(0.010)
Eligible_Nage	-0.000	0.543***	-0.002	0.006
	(0.003)	(0.019)	(0.002)	(0.013)
Nage_Above60	-0.000	0.079***	0.008***	0.079***
	(0.002)	(0.020)	(0.002)	(0.020)
Eligible _Above60	0.057***	0.367***	0.670***	0.098
	(0.016)	(0.108)	(0.012)	(0.099)
Eligible_Nage_Above60	-0.006**	0.050*	-0.004*	0.587***
	(0.003)	(0.027)	(0.002)	(0.023)
Male	-0.017***	0.015	-0.008*	-0.034
	(0.006)	(0.039)	(0.005)	(0.035)
Married	0.005	-0.038	0.001	-0.020
	(0.007)	(0.051)	(0.006)	(0.046)
Education = 1	0.002	-0.056	-0.001	-0.036
	(0.007)	(0.051)	(0.006)	(0.046)
Education = 2	0.007	0.030	0.001	0.062
	(0.008)	(0.055)	(0.007)	(0.050)
Education = 3	-0.003	-0.126**	-0.011	-0.077
	(0.008)	(0.057)	(0.007)	(0.049)
year = 2013, 2013	0.225***	-0.021	0.109***	0.480***
	(0.008)	(0.052)	(0.006)	(0.038)
year = 2015, 2015	0.214***	0.061	0.112***	0.478***
	(0.009)	(0.054)	(0.007)	(0.045)
year = 2018, 2018	0.163***	-0.086	0.079***	0.263***
	(0.009)	(0.062)	(0.008)	(0.056)
Constant	0.039***	-0.133	-0.018*	-0.118
	(0.012)	(0.083)	(0.010)	(0.079)
Observations	29,388	29,388	29,388	29,388
Adjusted R-squared	0.319	0.610	0.502	0.560
F-value	1098.26	188.82	1167.98	179.88
Prob > F	0.000	0.000	0.000	0.000
Year FE	Y	Y	Y	Y
Community FE	Y	Y	Y	Y

Notes: This table shows the first stage results from the RD-DID model. *NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments, and *NRPS_Eligible* is a dummy variable indicating whether an individual is eligible to receive NRPS payments. There are two age variables controlled for in the regressions: *NAge* is the normalized age centered at 60 to capture the linear age effect, and *NAge^2* is the squared normalized age to capture the non-linear age effect. *Edu* is the education background, and ranges from low (1) to high (3). The regression includes the community and year fixed effects, and control for gender, age, marriage status, education, and the number of children. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel B Second Stage

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
Enrolled	0.256	0.032	-0.338	-0.042	-0.261	0.023
	(0.312)	(0.032)	(0.493)	(0.051)	(0.500)	(0.027)
Enrolled_Nage	0.094	0.011*	-0.033	-0.002	-0.025	0.009*
	(0.059)	(0.006)	(0.084)	(0.009)	(0.086)	(0.005)
Enrolled_Above60	-0.531*	-0.065**	0.025	-0.002	-0.088	-0.047
	(0.310)	(0.033)	(0.470)	(0.049)	(0.488)	(0.029)
Enrolled_Nage_Above60	-0.047	-0.006	0.074	0.007	0.083	-0.005
	(0.063)	(0.006)	(0.104)	(0.011)	(0.108)	(0.006)
Above60	0.180	0.024	-0.168	-0.014	-0.136	0.018
	(0.192)	(0.020)	(0.289)	(0.030)	(0.299)	(0.018)
Nage	-0.107***	-0.011***	-0.130***	-0.013***	-0.154***	-0.009***
	(0.032)	(0.003)	(0.045)	(0.005)	(0.046)	(0.003)
Nage_Above60	0.050	0.005	0.031	0.004	0.030	0.005
	(0.035)	(0.004)	(0.061)	(0.006)	(0.063)	(0.003)
Male	0.211***	0.021***	0.185***	0.021***	0.279***	0.013***
	(0.029)	(0.003)	(0.047)	(0.005)	(0.050)	(0.002)
Married	0.096**	0.009*	-0.107	-0.016*	-0.039	0.003
	(0.046)	(0.005)	(0.084)	(0.009)	(0.088)	(0.004)
livingUrban2011	0.250***	0.048***	-3.297***	-0.210***	-2.219***	-0.083***
	(0.043)	(0.004)	(0.090)	(0.007)	(0.070)	(0.004)
Education==1	0.010	0.003	0.003	-0.007	0.034	-0.002
	(0.037)	(0.004)	(0.071)	(0.007)	(0.075)	(0.003)
Education==2	0.063	0.006	-0.068	-0.020**	-0.011	0.000
	(0.045)	(0.005)	(0.082)	(0.008)	(0.085)	(0.004)
Education==3	0.236***	0.024***	0.056	-0.007	0.222**	0.006
	(0.059)	(0.006)	(0.093)	(0.010)	(0.103)	(0.005)
Constant	0.473***	0.050***	3.785***	0.418***	3.664***	0.065***
	(0.170)	(0.018)	(0.270)	(0.028)	(0.275)	(0.015)
Observations	29,834	29,834	29,483	29,834	29,834	29,834
Adjusted R-squared	0.068	0.066	0.103	0.089	0.112	0.045
Year FE	Y	Y	Y	Y	Y	Y
Community FE	Y	Y	Y	Y	Y	Y

Notes: This table shows the second results from RD-DID model. *NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments, and here, an IV variable of NRPS eligibility is used for receiving the payment. There are two age variables controlled for in the regressions: *NAge* is the normalized age centered at 60 to capture the linear age effect, and *NAge^2* is the squared normalized age to capture the non-linear age effect. *Edu* is the education background, and ranges from low (1) to high (3). Each column reports the results from a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount and double debt incidence. All regressions include the community and the year fixed effects, and control for gender, age, marriage status, education, and the number of children. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Heterogeneous Effects

Panel A Individual Effects

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
			Gender			
Male						
NRPS_Receipt	-0.237***	-0.024***	-0.120	-0.009	-0.195	-0.016***
	(0.0717)	(0.0077)	(0.1150)	(0.0127)	(0.1190)	(0.0059)
Female						
NRPS_Receipt	-0.106**	-0.013**	-0.017	0.001	-0.063	-0.007*
	(0.0496)	(0.0054)	(0.1060)	(0.0115)	(0.1110)	(0.0041)
			Residence			
Living in Rural						
NRPS_Receipt	-0.135**	-0.015***	-0.006	0.003	-0.047	-0.011**
	(0.0552)	(0.0058)	(0.1080)	(0.0118)	(0.1120)	(0.0044)
Living in Urban						
NRPS_Receipt	-0.291***	-0.030***	-0.231	-0.021	-0.369**	-0.014**
	(0.0893)	(0.0103)	(0.1710)	(0.0172)	(0.1740)	(0.0063)
			Marriage Status			
Without a Spouse						
NRPS_Receipt	-0.264**	-0.030**	-0.220	-0.027	-0.332*	-0.014
	(0.1050)	(0.0119)	(0.1950)	(0.0215)	(0.2010)	(0.0088)
With a Spouse						
NRPS_Receipt	-0.146***	-0.015***	-0.029	0.001	-0.075	-0.011***
	(0.0522)	(0.0056)	(0.1030)	(0.0110)	(0.1040)	(0.0042)
			Individual Income			
Low						
NRPS_Receipt	-0.185***	-0.020***	-0.032	-0.002	-0.077	-0.015***
	(0.0501)	(0.0053)	(0.1050)	(0.0114)	(0.1070)	(0.0040)
High						
NRPS_Receipt	-0.114	-0.011	-0.142	-0.002	-0.316	0.006
	(0.1420)	(0.0148)	(0.2210)	(0.0232)	(0.2320)	(0.0100)
Community FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Notes: This table shows the heterogeneous effects by gender, residence, marriage status, and individual income level. *NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments. Each column reports the results of a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount, and double debt incidence. All regressions include the community and the year fixed effects. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel B Community Effects

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Formal Debt Amount (LN)	Formal Debt Incidence	Informal Debt Amount (LN)	Informal Debt Incidence	Total Debt Amount (LN)	Double Debt Incidence
Socioeconomic Status						
__Low__						
NRPS_Receipt	-0.171**	-0.019	-0.292*	-0.026*	-0.309*	-0.018***
	(0.0737)	(0.0088)	(0.1670)	(0.0149)	(0.1820)	(0.0063)
__High__						
NRPS_Receipt	-0.287***	-0.032***	-0.300	-0.027	-0.423**	-0.018***
	(0.0562)	(0.0054)	(0.1900)	(0.0181)	(0.1920)	(0.0068)
Out-migration						
__Low__						
NRPS_Receipt	-0.159***	-0.018***	-0.256	-0.026	-0.313*	-0.012***
	(0.0298)	(0.0034)	(0.1820)	(0.0159)	(0.1710)	(0.0007)
__High__						
NRPS_Receipt	-0.280***	-0.031***	-0.311*	-0.026	-0.383*	-0.024***
	(0.0787)	(0.0100)	(0.1880)	(0.0178)	(0.2100)	(0.0076)
Difficulty for Villages to Get Loans						
__Easy__						
NRPS_Receipt	-0.268***	-0.030***	-0.252	-0.021	-0.341**	-0.020***
	(0.0491)	(0.0056)	(0.1620)	(0.0143)	(0.1670)	(0.0062)
__Difficult__						
NRPS_Receipt	-0.117	-0.011	-0.461**	-0.047**	-0.471**	-0.012*
	(0.0736)	(0.0072)	(0.2150)	(0.0226)	(0.2230)	(0.0067)
One-child Policy						
__Strict__						
NRPS_Receipt	-0.249***	-0.024***	-0.389***	-0.038***	-0.460***	-0.018***
	(0.0719)	(0.0083)	(0.0977)	(0.0070)	(0.0986)	(0.0071)
__Loose__						
NRPS_Receipt	-0.232***	-0.027***	-0.254	-0.022	-0.327	-0.019***
	(0.0290)	(0.0038)	(0.2010)	(0.0196)	(0.2090)	(0.0046)

Notes: This table shows the heterogeneous effects by socioeconomic status, out-migration, difficulty for villages to get loans, and one-child policy at the community level. *NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments. Each column reports the results of a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount, and double debt incidence. All regressions include the community and the year fixed effects. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6: Natural Disaster

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
NRPS_Receipt #Disaster	-0.084**	-0.015***	-0.436***	-0.050***	-0.400***	-0.014***
	(0.0355)	(0.0043)	(0.1010)	(0.0110)	(0.0789)	(0.0035)
NRPS_Receipt	-0.202***	-0.020***	-0.107	-0.005	-0.194	-0.013***
	(0.0403)	(0.0044)	(0.1320)	(0.0117)	(0.1520)	(0.0031)
Disaster	0.146***	0.018***	0.132*	0.019**	0.197**	0.010**
	(0.0426)	(0.0052)	(0.0760)	(0.0090)	(0.0764)	(0.0042)
Male	0.321***	0.034***	0.323***	0.036***	0.458***	0.020***
	(0.0570)	(0.0054)	(0.0643)	(0.0053)	(0.0831)	(0.0051)
Nor_Age	-0.060***	-0.006***	-0.147***	-0.014***	-0.166***	-0.004***
	(0.0070)	(0.0007)	(0.0014)	(0.0003)	(0.0032)	(0.0006)
Nor_Age^2	0.001***	0.000***	0.002***	0.000***	0.002***	0.000***
	(0.0003)	(0.0000)	(0.0004)	(0.0001)	(0.000)	(0.0000)
Married	-0.070***	-0.011***	-0.193***	-0.022***	-0.200***	-0.007***
	(0.0187)	(0.0030)	(0.0452)	(0.0035)	(0.0394)	(0.0018)
Living in Urban	0.005	0.002	-0.273***	-0.031***	-0.269***	-0.001
	(0.0695)	(0.0071)	(0.0431)	(0.0043)	(0.0657)	(0.0034)
Education = 1	-0.059***	-0.006***	-0.189***	-0.024***	-0.187***	-0.006***
	(0.0109)	(0.0010)	(0.0426)	(0.0061)	(0.0485)	(0.0009)
Education = 2	-0.039**	-0.005***	-0.313**	-0.044***	-0.310***	-0.004*
	(0.0165)	(0.0019)	(0.1220)	(0.0113)	(0.1110)	(0.0023)
Education = 3	0.084***	0.007***	-0.180	-0.027*	-0.073	-0.005
	(0.0224)	(0.0022)	(0.1530)	(0.0147)	(0.1430)	(0.0040)
Constant	0.271***	0.031***	1.534***	0.207***	1.501***	0.024***
	(0.0205)	(0.0063)	(0.0578)	(0.0161)	(0.0979)	(0.0046)
Observations	23,548	23,548	23,209	23,548	23,548	23,548
Adjusted R-squared	0.027	0.025	0.046	0.037	0.056	0.019
Community FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Notes: This table shows the impact of receiving NRPS payments on individuals who experienced a community-level shock. *NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments. *Disaster* is a dummy variable indicating whether individuals were living in a community that had at least one major natural disaster in the past five years. The major natural disasters include flood, drought, fire, earthquake, typhoon, snowstorm, and other disasters as of 2011. Each column reports the results from a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount, and double debt incidence. All regressions include the community and year fixed effects. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Inverse Probability Weighting
Panel A: Probit Model

	(1)
VARIABLES	NRPS_Receipt
Age	0.157***
	(0.0027)
Male	0.005
	(0.0254)
Spouse	0.046
	(0.0305)
Living in Urban	-0.332
	(0.3890)
Education = 1	0.083***
	(0.0320)
Education = 2	0.048
	(0.0337)
Education = 3	-0.246***
	(0.0389)
Constant	-11.150***
	(0.2740)
Observations	22,942
Community FE	Y
Year FE	Y

Notes: This table shows the results from the probit model. *NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments. The regression includes the community and the year fixed effects. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel B: Inverse Probability Weighting

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
NRPS_Receipt	-0.186***	-0.020***	-0.097	-0.011	-0.176**	-0.010***
	(0.0409)	(0.0045)	(0.0730)	(0.0079)	(0.0760)	(0.0034)
Male	0.276***	0.029***	0.183***	0.022***	0.304***	0.017***
	(0.0426)	(0.0045)	(0.0683)	(0.0072)	(0.0712)	(0.0036)
Age	-0.047***	-0.004***	-0.116***	-0.011***	-0.131***	-0.003***
	(0.0044)	(0.0005)	(0.0069)	(0.0008)	(0.0072)	(0.0004)
Married	-0.025	-0.007	-0.252***	-0.028***	-0.211**	-0.008*
	(0.0534)	(0.0057)	(0.0843)	(0.0089)	(0.0884)	(0.0045)
Education = 1	-0.042	-0.003	0.034	-0.004	0.050	-0.006
	(0.0505)	(0.005)	(0.086)	(0.0092)	(0.0887)	(0.0044)
Education = 2	0.110*	0.011*	-0.103	-0.026***	-0.013	0.002
	(0.0574)	(0.0061)	(0.0915)	(0.0097)	(0.0954)	(0.0048)
Education = 3	0.239***	0.023***	0.109	-0.004	0.298***	0.003
	(0.0692)	(0.0072)	(0.1050)	(0.0109)	(0.1100)	(0.0056)
Constant	3.150***	0.312***	8.931***	0.887***	9.857***	0.243***
	(0.2970)	(0.0314)	(0.4710)	(0.0511)	(0.4870)	(0.0260)
Observations	16,994	16,994	16,797	16,994	16,994	16,994
Adjusted R^2	0.076	0.077	0.107	0.090	0.117	0.055
Community FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Notes: This table shows the results from the fixed-effects model with the inverse probability weighting obtained from the previous probit model. *NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments. There are two age variables controlled for in the regressions: *Nor_Age* is the normalized age centered at age 60 to capture the linear age effect, and *Nor_Age^2* is the squared normalized age to capture the non-linear age effect. *Edu* is the education background, and ranges from low (1) to high (3). Each column reports the results from a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount, and double debt incidence. All regressions include the community and the year fixed effects, and control for gender, age, marriage status, education, and the number of children. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Household-Level Data

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
NRPS_Receipt	-0.141*	-0.032*	-0.057	0.002	-0.090	-0.027*
	(0.0802)	(0.0166)	(0.1210)	(0.0228)	(0.1310)	(0.0137)
Nor_Age	-0.053***	-0.010***	-0.119***	-0.019***	-0.140***	-0.008***
	(0.0076)	(0.0015)	(0.0101)	(0.0020)	(0.0114)	(0.0012)
Nor_Age^2	-0.000	-0.000*	0.000	0.000	0.000	-0.000*
	(0.0003)	(0.0001)	(0.0006)	(0.0001)	(0.0006)	(0.0001)
Spouse	0.205***	0.031**	0.203**	0.019	0.260**	0.028**
	(0.0576)	(0.0145)	(0.1000)	(0.0203)	(0.1090)	(0.0115)
Living Urban	-0.135*	-0.013	-0.497***	-0.059***	-0.539***	-0.017
	(0.0733)	(0.0161)	(0.1030)	(0.0184)	(0.1170)	(0.0120)
Education = 1	0.041	-0.005	0.097	-0.001	0.117	-0.002
	(0.0697)	(0.0168)	(0.1170)	(0.0209)	(0.1220)	(0.0136)
Education = 2	0.002	-0.029*	-0.070	-0.032	-0.088	-0.008
	(0.0634)	(0.0152)	(0.1100)	(0.0194)	(0.1120)	(0.0126)
Education = 3	0.228***	0.028	0.142	-0.025	0.273**	0.008
	(0.0801)	(0.0181)	(0.1230)	(0.0213)	(0.1350)	(0.0148)
Constant	0.795***	0.132***	1.983***	0.471***	2.282***	0.0794***
	(0.1080)	(0.0322)	(0.1880)	(0.0569)	(0.2220)	(0.0190)
Observations	16,317	16,317	16,317	16,317	16,317	16,317
Adjusted R^2	0.030	0.039	0.055	0.041	0.064	0.031
Community FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Notes: This table shows the results from the RD-DID model at the household level. *NRPS_Receipt* is a dummy variable indicating whether a household includes at least one person who received NRPS payments, and here, an IV variable of NRPS eligibility is used for receiving payments. There are two age variables that reflect the oldest age among the couples, and that are controlled for in the regressions: *Nor_Age* is the normalized age centered at 60 to capture the linear age effect, and *Nor_Age^2* is the squared normalized age to capture the non-linear age effect. *Edu* is the education background, and ranges from low (1) to high (3). Each column reports the results from a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount, and double debt incidence. All regressions include the community and the year fixed effects, and control for age, marriage status, education, and number of children. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 9: Pilot Data

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
Age#Time	-0.820***	-0.075***	0.032	0.013	-0.242	-0.063***
	(0.2750)	(0.0291)	(0.3510)	(0.0384)	(0.3820)	(0.0228)
Age	-0.521***	-0.050***	-1.167***	-0.130***	-1.440***	-0.023*
	(0.1620)	(0.0189)	(0.2230)	(0.0257)	(0.2460)	(0.0127)
Time	1.101***	0.084***	0.507	0.034	0.782**	0.088***
	(0.2520)	(0.0256)	(0.3110)	(0.0338)	(0.3370)	(0.0211)
male	0.406***	0.037***	0.438**	0.055***	0.601***	0.029***
	(0.1220)	(0.0133)	(0.1850)	(0.0202)	(0.1970)	(0.0100)
Nor_Age^2	-0.001	-0.000	0.000	0.000	-0.001	-0.000
	(0.0009)	(0.0001)	(0.0016)	(0.0002)	(0.0016)	(0.0001)
spouse	0.420***	0.024	-0.306	-0.050*	-0.074	0.0161
	(0.1340)	(0.0159)	(0.2340)	(0.0261)	(0.2410)	(0.0121)
Constant	-0.101	0.027	2.246***	0.288***	2.249***	-0.006
	(0.2500)	(0.0275)	(0.3820)	(0.0429)	(0.4010)	(0.0223)
Observations	1,955	1,955	1,926	1,955	1,955	1,955
Adjusted R^2	0.142	0.141	0.096	0.094	0.125	0.111
Community FE	Y	Y	Y	Y	Y	Y

Notes: This table shows the results from the DID model. *Time* is a dummy variable indicating whether it is before (2008) or after (2012) the NRPS was implemented. *Age* is a dummy variable, with one indicating age 60 or older, and zero indicating otherwise. *Nor_Age^2* is the squared normalized age at 60 to capture the non-linear age effect. Each column reports the results from a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount, and double debt incidence. All regressions include the community and the year fixed effects, and control for gender, age, marriage status, education, and the number of children. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 10: Mechanisms
Panel A Psychology effect - Debt Account Aversion

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
Formal Large						
NRPS_Receipt	-1.771**	-0.151**	-0.614	-0.035	-1.821*	-0.050
	(0.6990)	(0.0690)	(0.8280)	(0.0871)	(0.9500)	(0.0633)
Formal Smaller						
NRPS_Receipt	-0.298	-0.006	-1.457*	-0.150*	-0.842	-0.058
	(0.7490)	(0.0716)	(0.8180)	(0.0833)	(0.8250)	(0.0542)
Community FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Notes: This table shows the results from the RD-DID model in two groups. *Formal Large* indicates the individuals holding a larger formal than informal debt amount, while *Formal Smaller* indicates the individuals holding a smaller formal than informal debt amount. *NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments, and here, an IV variable of NRPS eligibility is used for receiving payments. Each column reports the results from a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount, and double debt incidence. All regressions include the community and the year fixed effects, and control for gender, age, marriage status, education, and the number of children. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel B: Impacts on the Children

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
No land and house or no child						
NRPS_Receipt	-0.239	-0.022	-0.712**	-0.096***	-0.699**	-0.026*
	(0.1760)	(0.0191)	(0.3040)	(0.0333)	(0.3260)	(0.0144)
Others						
NRPS_Receipt	-0.167***	-0.018***	-0.036	0.000	-0.100	-0.011***
	(0.0479)	(0.0052)	(0.0960)	(0.0103)	(0.0981)	(0.0038)
Community FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Notes: This table shows the results of the RD-DID model in two groups. *No land and house or no child* indicates the individuals who did not have any land or houses, or who did not have any children; while *Others* indicates the rest of the individuals in the sample. *NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments, and here, an IV variable of NRPS eligibility is used for receiving payments. Each column reports the results from a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount, and double debt incidence. All regressions include the community and the year fixed effects, and control for gender, age, marriage status, education, and the number of children. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel C: Interest rates and Substitution Effect

VARIABLES	(1) Formal Debt Amount (LN)	(2) Formal Debt Incidence	(3) Informal Debt Amount (LN)	(4) Informal Debt Incidence	(5) Total Debt Amount (LN)	(6) Double Debt Incidence
Low Interest Rates						
NRPS_Receipt	-0.164**	-0.017**	-0.206*	-0.014	-0.259**	-0.012**
	(0.0732)	(0.0079)	(0.1210)	(0.0128)	(0.1300)	(0.0055)
High Interest Rates						
NRPS_Receipt	-0.168***	-0.019***	0.063	0.005	-0.002	-0.012**
	(0.0601)	(0.0065)	(0.1230)	(0.0129)	(0.1230)	(0.0048)
Community FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Notes: This table shows the results of the RD-DID model in two groups. *Low interest rates indicates the individuals with higher probability to have low interest rates in formal borrowing, while Others indicates the rest of the individuals in the sample. NRPS_Receipt* is a dummy variable indicating whether an individual received NRPS payments, and here, an IV variable of NRPS eligibility is used for receiving payments. Each column reports the results from a measure of debt variables as a dependent variable: log formal debt amount, formal debt incidence, log informal debt amount, informal debt incidence, log total debt amount, and double debt incidence. All regressions include the community and the year fixed effects, and control for gender, age, marriage status, education, and the number of children. Robust standard errors are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.