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How Do Public Pensions Reshape Eldercare and Social Norms with Son Preference? Evidence from China

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Abstract

Using variations in the timing of the New Rural Pension Scheme (NRPS) across rural Chinese counties, we examine its effects on eldercare and social norms. Our findings are three-fold: (1) Married sons are less likely to live with and care for their parents than married daughters. (2) Parents reduce the bride price of their sons, but not the dowry of their daughters. (3) The sex ratio at birth becomes less biased. Our study suggests that public pension provision significantly affects the patrilocal eldercare mode and leads to a more balanced gender preference by altering cultural practices.

JEL Classification: D10, H55, J10

Keywords: Pension; Eldercare mode; Sex ratio; Brideprice; Co-residence

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1 Introduction

How do people prepare for life in old age? The answer to this critical question may affect not only household decisions, such as eldercare (Bonsang, 2009) and inter-vivo transfer (Cox, 1987), but also the economy by altering saving behaviors (Laitner, 1988), investment in children's human capital (Becker et al., 2016), and fertility choices (Cremer et al., 2011). In many countries, family "is important in traditional societies in large measure" (Becker, 1981) and constitutes an essential source of support in old age (Barczyk and Kredler, 2018 and Byrne et al., 2009).

In societies that adhere to traditional eldercare modes, the introduction of a pension program can have a significant impact on intra-household resource allocation by reducing the need for eldercare services provided by children. Furthermore, related outcomes such as investment in children and fertility decisions may also depart from the traditional mode. Therefore, the introduction of a social pension program can be a potent force that alters not only the family but also the entire economy (Becker, 1981; Bau, 2021; Danzer and Zyska, 2022). The nature of this transition may vary due to different pre-existing traditions or social norms across ethnicities, cultures, and nations. In this study, we employ a quasi-experimental approach, specifically, the introduction of the New Rural Pension Scheme (NRPS), to investigate how a large-scale modern social pension program affects the eldercare mode and related social norm outcomes in rural China.

In rural China, eldercare has traditionally been provided by family members, with adult children being the primary caregivers for elderly parents. Due to low incomes and limited savings among elderly individuals, they heavily rely on their children for support. Among rural elderly individuals aged 60 or older in China, the average annual labor income is only 1,870 yuan (approximately US$310), and the average savings amount is only 3,740 yuan (US$620), according to data from the China Health and Retirement Longitudinal Studies (CHARLS) 2011–2015. Sons are expected to bear most of the responsibility for eldercare, with married sons and their wives living with and caring for the parents, while married daughters move out of the family home. In rural areas, 32.6% of elderly individuals live with their sons, while only 8.4% live with their daughters.[1] This son-dependent eldercare mode is accompanied by a high brideprice paid by the groom's parents, which serves as a means of purchasing eldercare services provided by their daughter-in-law. The average brideprice paid by grooms' parents is 19,690 yuan (US$2,800), and the average dowry paid by brides' parents is only 11,440 yuan (US$1,600).[2] This mode has also resulted in a strong son preference and a biased sex ratio in China (Ebenstein and Leung, 2010). In rural China, the sex ratio (defined as the number of males per 100 females) at birth reached 117.6 in 2015.[3]

To explore the potential effects of a pension program on this traditional eldercare mode and

[1] Data soucres: CHARLS & CFPS 2010–2016; the sample is restricted to parents aged 55–85.
[2] Data source: CHARLS 2015; the sample is restricted to marriages during 2000–2015.
[3] Data source: 2015 mini census.

related social norms, we develop a conceptual framework based on the rural Chinese setting. In this model, parents can invest in the pension program and/or in their children to finance their eldercare. The introduction of a pension program is expected to reduce the need for eldercare provided by children, which may crowd out parental investment in children. Assuming that investment in a son has a higher return than investment in a daughter, we find that the introduction of a new pension program can weaken the son preference because it provides another channel through which people can prepare for old age. Using data from CHARLS 2011–2015, we show that a high brideprice is associated with a high likelihood that a male child will co-reside with parents, whereas dowry does not have a significant association with the likelihood that a female child will co-reside with parents. Therefore, the model predicts that a pension program will have the following effects: i) a more significant reduction in eldercare provided by sons than by daughters, ii) a larger reduction in investments in sons than in daughters, and iii) a weakened son preference.

The staggered county-by-county rollout of NRPS provides a quasi-experimental setting that allows for valid identification of the program's effects. The first round of pilot counties adopted NRPS in 2009, followed by the second round in 2010, and the remaining two rounds in 2011 and 2012. During the rollout period of 2009–2012, the basic pension benefit for people aged 60 years and above was 660 yuan (US$110) per year, regardless of previous earnings or income. This basic pension benefit accounted for 28% of the median per capita income of rural households and was more than the income of 8% of senior citizens. People younger than 60 years can also participate in NRPS but are not yet eligible to receive the benefits. NRPS increased not only the current income of elderly individuals aged above 60 but also the expected lifetime income for all individuals. Therefore, we expect NRPS to potentially affect a series of decisions related to eldercare for individuals at different stages of the life cycle. To estimate the program's potential impacts quantitatively, we use a staggered difference-in-differences (DD) framework based on a two-way fixed effect model and an event study approach.

Using three waves of data from the China Health and Retirement Longitudinal Studies (CHARLS 2011, 2013, and 2015) and four waves of data from the China Family Panel Study (CFPS 2010, 2012, 2014, and 2016), we analyze the effect of NRPS on the eldercare arrangements of elderly individuals. By combining these two data sources, we can thoroughly explore the variations in the timing of NRPS implementation across counties. We find that NRPS reduces the time support (including co-residence and physical help) provided by adult children, especially married sons. Specifically, NRPS reduces the probability that a married son will co-reside with his parents by 6.5 percentage points (ppt; 22%) and the likelihood that he will provide physical help by 10.3 ppt (36%). However, NRPS does not significantly affect the co-residence decisions and provision of care by married daughters.

Using retrospective data from CHARLS 2015, which solicited data on parental transfer at the time of the child's marriage (i.e., brideprice and dowry), we use marital transfer as a proxy for parental investment in children and show that marital transfer can serve as an exchange

for eldercare support. We find that the pension program also exerts sex-asymmetric effects on the parental payments given to children who are marrying; specifically, the pension program reduces brideprice by 32% but does not significantly affect dowry. This result provides supportive evidence for the second prediction.

Finally, we employ micro-level data from the 2015 Chinese mini census to analyze the effect of NRPS on the sex ratio of newborns as a measure of parental son preference. Unlike Danzer and Zyska (2022), we do not find any effect of NRPS on the number of newborns in China, probably because of the strict fertility restriction of the One-Child Policy. Instead, NRPS has increased the likelihood that a newborn would be female by 3.3 ppt, which is equivalent to reducing the sex ratio by 15 ppt. Moreover, we obtain no significant evidence that NRPS affects marital patterns (who married and when they were married) or fertility, suggesting that the effects on brideprice and sex ratio are not driven by self-selection.

However, the validity of the empirical results should not be taken for granted. Considering the potential unobserved confounding factors at the county-year level, we use the urban sample in the same counties to conduct a placebo test because NRPS only targets individuals with rural registration. We find insignificant effects of NRPS on the outcomes for the urban sample. On this basis, we also estimate a difference-in-difference-in-differences (DDD) model and find that the results are consistent with the staggered DD estimates.

In addition, the staggered DD estimates can be influenced by the heterogeneous trends of outcomes across counties. Therefore, we conduct an event study analysis to examine the dynamic effects of NRPS. Consistent with the parallel trend assumption, we do not find any significantly differential trends before NRPS implementation across counties. Furthermore, we find that the effects on brideprice and sex ratio are persistent and stable two to four years after NRPS was introduced to the county. Using the urban sample as a reference group, we also conduct estimations based on a dynamic difference-in-differences (dynamic DD) model and obtain significant differences in the treatment effects between the rural and urban samples for all outcome variables.

Although the consistent results of DDD, event study, and dynamic DD alleviate the concerns about staggered adoption designs, we follow recent literature and use an alternative estimand to check robustness (De Chaisemartin and d'Haultfoeuille, 2020). DDD and dynamic DD use the urban sample (never treated group) as the control group. Event study and dynamic DD allow for time-varying treatment effects. We find that the new approaches do not materially change our baseline results.

These results provide a coherent story that is in line with the three predictions of our model. We conclude that a pension program can affect eldercare arrangements and social norms in terms of family decisions at different points in time. For example, it reduces the incentive for young parents to use sex selection technology to have a male child, discourages middle-aged parents from providing a high brideprice when their sons marry, and reduces the likelihood that aging parents will co-reside with and receive care from their sons. In summary, we provide

three pieces of evidence that jointly demonstrate that a pension program can change cultural practices by affecting the traditional eldercare norm and investment in children.

Our study contributes to research on the effects of pension programs. Broadly speaking, by investigating a series of outcomes related to eldercare and social norms throughout the lifecycle of rural China residents, this study contributes to the growing literature on the effects of social pensions in developing countries (Ardington et al., 2009, Case and Deaton, 1998, and Duflo, 2000) and adds to studies on pension reforms in developed countries (Bitler et al., 2005, Madrian and Shea, 2001, and Snyder and Evans, 2006). Among these studies, Attanasio and Brugiavini (2003) and Feng et al. (2011) found that a reduction in pension wealth increases the saving rates of young adults. Moreover, Jensen (2004) and Juarez (2009) showed that pension programs in South Africa and Mexico reduce private transfers from children, whereas Huang and Zhang (2021) reported that NRPS in China does not affect private transfers. Our findings contribute to the literature by analyzing the gender-asymmetric effect of pension on eldercare arrangement.

Our findings also contribute to the growing literature on the impact of pensions on cultural outcomes by providing novel evidence from China, a society with patrilocal customs. Particularly, Bau (2021) found that pension policies reduce daughters' post-marriage co-residence with parents and educational investment in daughters in traditionally matrilocal groups in Indonesia, and reduce sons' post-marriage co-residence with parents and educational investment in sons in traditionally patrilocal ethnic groups in Ghana. Using NRPS as a quasi-experiment, we show that the pension program reduces the possibility of sons living with and providing physical help to their parents and that the program affects brideprice and sex ratio in China, a patrilocal society. These empirical results jointly suggest that son preference is partly driven by the son-dependent eldercare mode and provide further evidence that pensions can change the son preference culture.

There are a few studies on pension programs in China that also analyze the impact on old-age support and sex ratio. Park and Shan (2020) find that NRPS leads to a larger reduction in upward transfers for adult sons than daughters. They also find that after the introduction of the NRPS, parents' investment in daughters decreases while investment in sons increases.[4] Their findings are explained by the altruism between parents and children and imply that parents are more altruistic toward sons than daughters, while our findings are consistent with parents' exchange motive and suggest that parental transfer and son preference are driven by the son-dependent eldercare mode. In addition, two studies analyze the effect of the Old Rural Pension Scheme (ORPS) in China, which was implemented in 1991. Ebenstein and Leung (2010) and

[4]We use different measures of NRPS rollout time. Park and Shan (2020) use the self-reported participation in the program and we use the official document of the exact timing of the NRPS implementation across counties provided by China's State Council Leading Group Office of Poverty Alleviation and Development. Moreover, the two outcome variables we use, marital transfer and sex ratio, are available before the introduction of the NRPS, which allows us to check pretrends and conduct robustness checks related to the staggered DD design with heterogeneous treatment effects.

Zhang (2015) find that an increase in county-level ORPS availability is associated with a slower increase in the sex ratio at birth.[5] Compared to ORPS, NRPS offers a much wider coverage and more generous pension benefits. Our study uses more rigorous measures of pension rollout and richer analysis approaches to strengthen the identification. Moreover, we provide three pieces of gender-asymmetric evidence (i.e., eldercare support, martial transfer, and sex ratio) to jointly deliver a comprehensive story about how pension shapes parents' series of behaviors related to son preference social norms.

Our study is also related to the literature on gender differences. For example, our findings provide a new explanation for the difference between brideprice and dowry from the perspective of eldercare mode. Our work differs from most previous studies, in which brideprice and dowry were considered pecuniary transfers to clear the marriage market (see Becker, 1981 and its follow-up studies).[6] Our findings provide a new explanation for why brideprice is much larger than dowry in China. Parents use brideprice as an investment in return for the eldercare service provided by sons and daughter-in-laws, while dowry does not serve as an investment in the eldercare provided by daughters.

Additionally, we add to the literature on the biased sex ratio in Asian countries (Rosenzweig and Schultz, 1982, Sen, 1990, Edlund, 1999, Gupta, 2005, Oster, 2005, Anderson, 2007, Qian, 2008, Chen et al., 2013, Sun and Zhao, 2016, Alfano, 2017, Jayachandran, 2017, Hong Chew et al., 2018, Almond et al., 2019) by providing new empirical evidence suggesting that the unbalanced sex ratio could have resulted from the social norm of relying on sons for old-age support.[7]

The remainder of the paper proceeds as follows. Section 2 provides background information on NRPS. Section 3 develops a life cycle model with a series of decisions related to eldercare modes. Section 4 presents an introduction to the data, and Section 5 gives a discussion of the empirical specifications. Section 6 provides the empirical results, including robustness checks. The last section concludes the study.

2 Background

In rural China, the traditional provision of support to elderly people by family members has faced serious challenges due to the fertility restrictions first imposed in the 1970s. Millions of elderly people in rural China suffer from a lack of support, and this problem has been exacer-

[5]Ebenstein and Leung (2010) use the participation rate of villages within a county as the measure of ORPS's availability within the county. Zhang (2015) uses whether the county-average ORPS participation rate is above the national mean to define program's availability. In contrast, we use the official document of the pension implementation time to measure whether NRPS is available in each county.

[6]Refer to Anderson (2007) for a detailed summary of such literature. Zhang and Chan (1999) and Brown (2009) argued that a dowry can enhance the bargaining power of the bride. Ashraf et al. (2020) showed that the brideprice custom provides an incentive for parents to invest in their daughters' education.

[7]In the Chinese context, Li et al. (2011) and Ebenstein (2010) showed a causal link between the "missing girls" phenomenon and enforcement of the one-child policy. Chen et al. (2013) found that access to ultrasound examinations facilitates prenatal sex selection. In addition to the fertility policy, Almond et al. (2019) found that land reform increases the sex ratio, possibly through the income channel.

bated by the migration of many young rural people to cities since the early 2000s. According to a recent online survey, 35.4% of respondents consider "rearing the old" to be the most important problem affecting rural China.[8]

The Chinese government first implemented the social pension program, which is now known as NRPS, in rural areas in 2009. The original plan was to achieve national coverage by 2020,[9] but NRPS developed rapidly and achieved universal coverage by the end of 2012 after four rounds of expansion. Several reasons account for the quick expansion, and these include the strong financial support from the central government to the less-developed regions, the high level of pension benefits that are attractive to rural residents, and an important policy to deal with the aging problem in rural China. Moreover, NRPS served as a main political achievement of Premier Wen, who wanted to accomplish full coverage within his term (2003–2013). Therefore, the introduction of NRPS to each county is largely unexpected for rural residents. Data on the timing of NRPS coverage across various counties are available from China's State Council Leading Group Office of Poverty Alleviation and Development (also used in Huang and Zhang, 2021). Figures 1a–1d show the counties in mainland China that were covered by NRPS from 2009 to 2012.[10] In this study, we exploit this county-by-county rollout of NRPS and conduct DD regressions to identify the effects of the new pension scheme provision.

Once a county is covered by NRPS, all rural people aged 16 years and older (excluding students) can voluntarily participate in the scheme. To be eligible for pension benefits, program enrollees aged 45 years and older must pay the premiums continuously until they reach 60 years of age. Enrollees younger than 45 years must pay the premiums continuously for at least 15 years before they can claim any pension benefit. Participants can choose an annual contribution of 100, 200, 300, 400 or 500 RMB.

The pension benefits are from two sources: one is the accumulated fund in the individual's account, and the other is the basic pension benefit. To claim the basic pension benefit, rural residents need to meet only the criterion of age eligibility, namely, they must be at least 60 years of age. All enrollees aged 60 years or older at the start of NRPS were eligible to receive 55 RMB (i.e. approximately 9 USD) per month regardless of their previous earnings or income.[11] In 2014, these benefits increased to 75 RMB per month. According to 2015 CHARLS data, the average labor income of rural elderly in 2015 was 123 RMB per month, the average monetary transfer they received from adult children was 203 RMB per month and the monthly expenditure on food consumption was 304 RMB.[12] Therefore, the pension accounted for 61%

[8]Source: http://toutiao.com/i6243882674679726593/ (accessed in December 2020).

[9]Source: http://www.gov.cn/zwgk/2009-09/04/content_1409216.htm.

[10]Approximately 11% of all counties ($N = 320$) were covered in the first wave (2009), and 16% (450 counties) were covered in the next year (2010). Another 38% (1,075 counties) joined the program in the third wave (2011), and the remaining counties (35%, 983 counties) were covered in the last wave (2012).

[11]In some provinces, people older than 60 years must meet a pre-requisite to claim pension benefits; specifically, one of the pensioner's offspring must also participate in the program.

[12]Labor income includes agricultural and non-agricultural income. We use the 2015 wave of CHARLS instead of earlier waves because transfers between parents and all of their children are only available in the 2015 CHARLS.

of the labor income, 37% of the transfer and 25% of the food expenditure for rural elderly. The size of the pension is economically non-trivial given that the elderly in rural China have low incomes.

The basic pension benefit is similar to a defined benefit plan but with no work limits. The pension benefit is eligible to all participates aged above 60 and they do not need to retire to claim the benefit. However, it differs from the usual defined benefit pension plans because it is fully sponsored by the government, rather than employers. The basic pension benefit also differs from government-sponsored social welfare programs, which are usually means-tested. Rather, the benefit is similar to the universal basic income programs discussed in Hanna and Olken (2018). The government is responsible for making investment decisions and managing the plan's investments; it guarantees a rate of return that equals the one-year time deposit rate for the annual deposit.

By the end of 2012, the central and local governments in China had contributed more than 262 billion RMB (approximately 41 billion USD) to NRPS; more than 232 billion RMB (approximately 37 billion USD) was contributed by the central government. In 2012, 89 million rural seniors began to receive a pension. By the end of 2014, the number of pensioners had increased to 140 million, and the total number of rural participants was approximately 426 million.

3 Conceptual Framework

In this section, we present a conceptual framework that captures parental decisions regarding sex selection, parental transfers to children, and eldercare modes. We compare the responses of individuals who participated and did not participate in a pension program.

We assume that households live for three periods. In the first period, parents decide whether to use sex selection technology to determine the sex of their newborn. In the second period, which corresponds to the time of a child's marriage, parents can make two investments to secure old-age support. One is the marital payments to their children, and the other is the pension investment. In the last period, parents receive eldercare provided by their children and pension benefits. It is noteworthy that the eldercare provided by children increases with parental transfer.

In a patrilocal society like China, sons are primarily responsible for taking care of elderly parents. As shown in Table 1, 30.1% of male adult children live with their parents, while only 5.8% of female adult children do so. Consequently, the return to parental transfer on eldercare could differ between children's gender. Specifically, parental transfer at the son's marriage (brideprice) is strongly correlated with the eldercare provided, whereas that at the daughter's marriage (dowry) has little impact on eldercare. Appendix Table B1 examines the correlation between parental transfer at marriage and eldercare services provided by children using CHARLS & CFPS 2010–2016. The results show that a 1 percent increase in parental transfer to sons is associated with a 0.017 ppt increase in the likelihood that a son will live with

his parents. However, parental transfer to daughters has no significant relationship with the likelihood that a daughter will co-reside with her parents. Thus, empirical evidence suggests that transfer to sons yields a much higher return in terms of eldercare compared to transfer to daughters.

In cases where the pension is not an available option, parents have to rely on their adult son's family when they get old in the third period. In exchange, they invest in brideprice in the second period. Additionally, they are inclined to use sex selection technology to increase the likelihood of having male newborns in the first period, ensuring their chances of receiving eldercare in the third period.

Once the pension scheme becomes available, it has two effects on the eldercare provided by children. Firstly, the pension program serves as an income transfer for those already older than 60. Assuming the eldercare provided by children decreases with parental income because wealthier parents can buy more formal care, pension reduces the eldercare provided by children. Secondly, the pension program serves as a new saving tool that reduces the need for consumption smoothing through a marital transfer. As a result, the amount of parental transfer at the time of a child's marriage decreases, and accordingly, the provision of eldercare services by that child also decreases. Moreover, as we find that brideprice is highly correlated with the eldercare provided by sons, while dowry does not affect the eldercare provided by daughters, the provision of pensions will mainly reduce brideprice but not dowry. Consequently, the pension will have a larger crowding-out effect on the eldercare provided by sons compared to daughters.

Lastly, the pension program provides an alternative investment tool to smooth consumption for parents. Therefore, the advantage of having a son to secure old-age support is weakened by the pension program. In other words, the parents of sons obtain less benefit from using brideprice to "purchase" eldercare services. As a result, parents are less likely to use sex selection technology when they plan to have a baby and the sex ratio declines.

We formalize the intuition in a three-period model, the details of which are shown in Appendix A. The conceptual framework generates three testable predictions, as follows:

- Hypothesis 1 (Period 3): The pension scheme reduces the eldercare provided by sons more than that provided by daughters.
- Hypothesis 2 (Period 2): The pension scheme reduces brideprice to a greater extent than dowry.
- Hypothesis 3 (Period 1): The pension scheme increases the likelihood that a newborn will be female.

In the following sections, we will test these three predictions one by one.

4 Data

4.1 CHARLS and CFPS

In the first part of the analysis, we use data from the China Family Panel Studies (CFPS) and the China Health and Retirement Longitudinal Studies (CHARLS) to analyze the effect of NRPS on the eldercare mode.

CHARLS is a biennial survey that aims to follow a nationally representative sample of Chinese residents aged 45 years and older. It was designed as the Chinese equivalent of the United States Health and Retirement Survey. The baseline national wave of CHARLS was fielded in 2011, and sampled approximately 10,000 households and 17,500 individuals in 150 counties and districts. CHARLS contains information on the demographics, family structures, incomes, transfers, pension program enrollment status, health status, and eldercare modes of elderly people in China. Moreover, CHARLS collects basic demographic information on all children of the participants and records whether they co-reside with their parents and provide time and financial support to their parents.

CFPS is a nationally representative biennial longitudinal survey of Chinese families and individuals. It was designed as the Chinese equivalent of the United States Panel Study of Income Dynamics. The first national wave of CFPS was conducted in 2010, during which 15,000 households and 33,600 individuals in 162 counties and districts were sampled. CFPS contains information on the demographics, family structures, incomes, pension program enrollment, and eldercare mode (if applicable) of each family member living in a surveyed household.[13] For non-co-residing family members (e.g., non-co-residing children), CFPS still provides basic demographic information through a family relationship map. This map allows us to observe the co-residence arrangements made between parents and all of their children.

This study uses data from the 2011, 2013, and 2015 waves of CHARLS and from the 2010, 2012, 2014, and 2016 waves of CFPS. To exploit effectively the regional and temporal variations in NRPS expansion from 2009 to 2012, we pool CFPS and CHARLS data to yield a large sample. For the pooling to work, we double check the way the two surveys collect information on the dependent and independent variables, including co-residence arrangement and the education and age of parents and children, to ensure that they are identical.[14] CFPS and CHARLS cover 162 and 150 counties, respectively, and only 5 counties are covered by both. The main sample comprises 55,708 individual-year observations (i.e., 37,756 from CFPS and 17,952 from CHARLS), which we construct by linking 10,602 parents with 18,220 children. In the sample, only 19% of counties were covered by NRPS in 2010; this proportion increased to 31% in 2011 and 69% in 2012. All counties were covered at the time of the 2013 survey.

The descriptive statistics of the sample based on the combined CHARLS and CFPS data are

[13]The eldercare mode questions in CFPS are similar to those in CHARLS, except that CFPS data do not distinguish which children provide eldercare.

[14]The pooled sample is only used to analyze the effect of NRPS on the co-residence arrangements between parents and adult children. Co-residence is defined as living in the same household for CFPS and CHARLS.

presented in Panel A of Table 1. In the rural sample, the average ages of the parents and adult children are 66 and 36 years, respectively. Adult children are defined as children above age 18. In addition, the average education years of the parents and adult children are 5.0 and 7.6 years. Meanwhile, 56.1% of adult children are male and 88.8% are married. On average, parents have 3.6 children; 19.4% of adult children co-reside with their parents but the likelihood differs largely by gender. The figure is 30.1% for male children and only 5.8% for female children. In the urban sample, the average ages of the parents and adult children are 65 and 34 years, and the average education years are 6.7 and 10.1 years. The likelihood that adult sons co-reside with parents is 38.4%, while the likelihood is 13.9% for adult daughters.

We further use CHARLS data to analyze the effect of NRPS on the provision of physical help from children, because such information is unavailable from CFPS data. The CHARLS first asks whether parents need help in basic activities and daily activities.[15] For those people who need help, it further asks who (spouse, children, relative, neighbor, others) provide help. The descriptive statistics are shown in Panel B of Table 1. The physical help provider question is only applicable to parents who need help (30.3% of the elderly), so the number of observations is smaller than that for co-residence. We find that on average, 23.2% of rural adult children in the sample provide physical help to their parents in need of help; 28.8% of the male children provide help to their parents, but only 14.7% of the female children do so. Altogether, the result suggests that sons mainly bear the responsibility of caring for their parents.

In addition, we use CHARLS 2015 data to obtain retrospective information on the parental transfers paid at the times of the children's marriages.[16] In China, the transfer from the groom's parents is called brideprice, which is usually paid to the bride's parents; the transfer from the bride's parents is called dowry, which is usually paid to the child couple. During 2000–2015, 1,769 marriages with brideprice information and 1,024 marriages with dowry information in the rural area were recorded. The average brideprice was approximately 22,726 RMB, and the average dowry value was 13,245 RMB. In most cases, brideprice is received by bride's parents, while dowry is received by the young couple. Brideprice serves as a means of purchasing elder-care service to be provided by daughter-in-laws and dowry is used to increase the bargaining power of the bride in the young couple (Zhang and Chan (1999) and Brown (2009)).

4.2 Chinese Census

The third part of our analysis uses micro-level data from the 2015 mini census to conduct an analysis related to the sex ratio of newborns.[17] The census collects basic information on

[15]Basic activities include jogging 1 km, walking 1 km, walking 100 meters, getting up from a chair after sitting for a long period, climbing several floors, stooping, kneeling or crouching, reaching or extending arms above shoulder level, carrying weights over 10 jin, and picking up a small coin from a table. Daily activities include dressing, bathing, eating, getting into or out of bed, using toilet, controlling urination and defecation, doing household chores, cooking, shopping, making phone calls, taking medications, and managing money.

[16]CFPS only provides information on the parental transfers from the bride's parents, not those from the groom's parents.

[17]Every 10 years (e.g., 1990, 2000, and 2010), China conducts a national population census; in the middle of every 10-year period (e.g., 1995, 2005, and 2015), China also conducts a mini census that samples 1 percent of

individuals and households, such as demographics and the statuses of migration, marriage, and fertility.[18] Panel C of Table 1 presents the summary statistics on the sex ratio and birth order from the 2015 mini census. Among rural children born between 2005 and 2015, only 45.5% were female, suggesting a biased sex ratio of 1.20 males per female. The analysis further reveals that 52%, 38%, and 10% of the newborns were first, second, and higher-order births, respectively.

5 Empirical Specification

Our empirical analysis tests the three predictions generated by our model. In particular, we use the rollout design of NRPS to explore the differences between the before-to-after changes in the outcomes of the treated group and those of the control group. We try different specifications with various definitions of the treatment and control groups.

5.1 Staggered DD

Using variations in the timing of NRPS provision across counties, we estimate two sets of DD equations following Hoynes et al. (2012). In the first set of DD regressions, we use instantaneous responses as dependent variables, including whether adult children live with their parents and whether adult children provide physical help to their parents in the survey year. The specification is as follows:

$$y_{itc} = \alpha + \beta NRPS_{tc} + \gamma X_{itc} + \eta_t + \eta_c + \psi_{itc}, \tag{1}$$

In Equation (1), y_{itc} represents the potential outcome of individual i living in county c in survey year t. The key independent variable, $NRPS_{tc}$, captures the treatment effect of NRPS. For the instantaneous responses, $NRPS_{tc}$ equals 1 if the scheme was introduced to county c during or before the survey year t. We control for survey year fixed effects η_t and county fixed effects η_c.

In the second set of DD regressions, we use retrospective events as dependent variables, including the logarithm of bride price and dowry transferred to children married in year t and an indicator of whether a baby born in year t is female. The regression model is still the same as Equation (1), but t represents the event year, i.e., marital year or birth year. The key independent variable, $NRPS_{tc} = 1$, if the scheme was introduced to county c during or before the event year t.[19] We control for marital/birth year fixed effects η_t and county fixed effects η_c.

the national population. By using a multi-stage probability sampling method, each census and mini census draws a nationally representative sample that covers 31 provinces and municipalities in China.

[18] We link the newborn children (born between 2005 and 2015) with their parents via the revealed relationship to household head. Since these children are still young in 2015, the chance that they separate from their parents is small.

[19] When the outcome variable is the gender of the newborn, $NRPS_{ct} = 1$ if the scheme was introduced more than a half year before the birth year and $NRPS_{ct} = 0$ if the scheme was introduced more than a half year after the birth year. We remove the children born within a half year before and after NRPS implementation year because

We use the Ordinary Least Squares Model (OLS) when the dependent variable is a continuous variable (i.e., martial transfer), and the Linear Probability Model (LPM) when the dependent variable is a dummy variable (i.e., co-residence, physical help, and sex of newborn). The covariates include the survey/event year dummies η_t, county dummies η_c, and demographic controls X_{itc}. In the regressions on co-residence arrangement, physical help, and marital transfer, the demographic controls include the age and education level of the child and parent.[20] In addition, we run regressions separately by the children's sex because the model predicts that the effects of NRPS may differ between sons and daughters due to the gender-specific eldercare arrangement. In the regression on sex ratio, the demographic controls include the ethnicity, age, and education level of parents. All standard errors are clustered at the county level.

In this study, we define the treatment group as all individuals living in counties with NRPS rather than elderly aged above 60 with NRPS. This is because NRPS increases not only the current income for the elderly aged above 60 but also the expected lifetime income for all individuals. When individuals are forward-looking, the introduction of a pension program increases their future income and provides security to elderly life. Therefore, the decisions related to eldercare at different life stages, such as fertility decision (for young parents), transfer to children (for middle-aged parents), and eldercare service from children (for older-aged parents) can be affected. Moreover, the treatment group includes individuals not enrolled in the pension program, and hence, we estimate the intention-to-treat effect.

Our DD framework has several potential issues. The first one is that the valid identification relies on the key assumption that the trends in the treatment and control groups are parallel in the absence of treatment. However, the pilot counties may be different from other counties in certain dimensions, which will raise an issue if the pilot counties also exhibit different trends in the examined outcomes. In Figures 2 and 3, we demonstrate that before 2009, counties with different NRPS implementation years had similar trends in terms of a series of macroeconomic indicators, including the gross domestic product (GDP) per capita, salary, population, natural growth rate, government revenues and expenditure, number of primary school students, and number of doctors.

Secondly, during the period of NRPS expansion, there could be other reforms going on at the same time. Therefore, the timing of NRPS could be correlated with these unobserved confounding factors.

Moreover, a few recent studies have pointed out that two-way FE regressions in the case of staggered adoption designs can be problematic when heterogeneous treatment effects exist across groups and over time (Callaway and Sant'Anna, 2021, De Chaisemartin and d'Haultfoeuille,

the treatment effect on these children is ambiguous. Firstly, the news of introducing NRPS may spread before the implementation of NRPS. Therefore, individuals may respond even before the introduction of NRPS. Secondly, the response of fertility may exhibit a delay, because it takes nine months to give birth to a child.

[20] One potential concern is that children's education could be endogeneous to the pension program. However, these children were already above age 18 when NRPS was implemented, so their education is not affected by the pension. We also control for the children's sex when running regressions on the entire sample.

2020, Goodman-Bacon, 2021, Sun and Abraham, 2021). These studies have demonstrated that two-way FE regressions estimate the weighted sums of the average treatment effects in each group and period, with weights that may be negative.

The identification of our study is based on the assumption that rural residents were not aware of the exact implementation time of NRPS. As explained in Section 2, the original plan of NRPS was to achieve national coverage in ten years, and the rapid expansion was largely unforeseen. Additionally, rural residents had limited access to information about what was happening in other rural counties, and many were unaware of the NRPS even after it was introduced in their home county. Therefore, we believe that any anticipation effect is relatively small in our context. Even if such an effect exists, it would lead to an underestimation of our results.

To address these issues, we use certain approaches to verify the assumptions and check the robustness. These approaches include examining the potential effects in the comparison group and implementing a triple-difference analysis, event study approach, and dynamic DD. Lastly, we follow De Chaisemartin and d'Haultfoeuille (2020) to refine the two-way FE estimates.

5.2 Comparison Group and Triple-difference Estimation

Social insurance and welfare programs in China are connected to the *hukou* system which assigns benefits on the basis of rural and urban *hukou* status. The Chinese government established an urban old-age security system with a relatively high coverage rate and generous payment in the early 1990s; it is independent of NRPS and a combination of pay-as-you-go and funded systems. During NRPS rollout years, no significant changes were made to the pension policy in urban China and its pension benefits grew steadily across the country. Given that NRPS targets rural residents, we expect it to have little effect on the urban sample because people with an urban *hukou* are not eligible to participate.

Therefore, we use equation (1) to re-estimate the effect of NRPS on people with an urban *hukou* (registration) in the same counties as a placebo test. However, the concurrent implementation of any other policy (besides NRPS) at the county level might have affected the urban sample. Using the urban sample for a robustness check, we examine whether other events occurred simultaneously with NRPS rollout.

We also adopt a DDD model that compares the treatment effects between the rural and urban samples:

$$y_{itc} = \beta NRPS_{tc} * R_i + \gamma X_{itc} + \eta_{tr} + \eta_{cr} + \psi_{ict}, \tag{2}$$

where R_i is a region indicator, that equals one if living in rural areas and zero if living in urban areas. The interaction of $NRPS_{tc}$ and R_i demonstrates the effect of NRPS on rural residents compared with urban residents. Since there exist rural and urban regions within each county, we control for individual demographic characteristics (X_{itc}), county by region fixed effects (η_{cr}), and survey/event year by region fixed effects (η_{tr}).

5.3 Event Study Approach and Dynamic DD Estimation

We follow Duflo (2001) and Dobkin et al. (2018) to apply an event study approach to test the pre-trend assumption and allow for time-varying treatment effects. We use linear two-way fixed-effect regressions with leads and lags of treatment, as shown in the following equation:

$$y_{itc} = \sum_{\substack{-K \leq l \leq K \\ l \neq -1}} \beta_l D_{tc}^l + \gamma X_{itc} + \eta_t + \eta_c + \psi_{ict}, \tag{3}$$

where $D_{tc}^l = 1\{t - E_c = l\}$ is an indicator for being l years relative to county c's NRPS starting year E_c, and it varies across counties. For example, β_0 captures the effect of NRPS during its implementation year. We include K lags and K leads in the regression and normalize the effect in period $l = -1$ (one year before NRPS implementation) to be zero. The pattern of estimates of β_l, $l < 0$ (before NRPS implementation) provides a test for the parallel trend assumption. The stable and insignificant coefficients of β_l, $l < 0$ provide consistent evidence for this assumption. Meanwhile, the estimates of β_l, $l \geq 0$ (after NRPS implementation) show the lagged or persistent effects of NRPS.[21]

Given that we do not observe the eldercare arrangement (co-residence arrangement and physical help to parents) before NRPS because CHARLS/CFPS only began in 2009/2010, we conduct an event study analysis only for marital transfer and sex ratio. For marital transfer, we set $D_{tc}^0 = 1$ when the child couple got married in NRPS implementation year. For sex ratio, we set $D_{tc}^0 = 1$ when the child was born a half year before and after NRPS implementation time.

The event study analysis has a few merits. Firstly, the patterns of the estimates for the periods prior to NRPS implementation provide a direct test of the unparallel pre-trends between the treated and control groups. Secondly, the patterns present the results in a straightforward manner so that we can observe whether the outcomes began to change significantly in the year when NRPS started. This observation will provide indirect evidence on the validity of our estimation given a small chance of contemporary confounding factors changing the outcomes in the same manner. Thirdly, the event study results present an estimation of the effects in the following years, which enables us to observe whether the effects are persistent or not. Lastly, the event study design allows for time-varying dynamic effects, thereby alleviating the concerns caused by staggered DD.[22]

Having both rural and urban samples enables us to conduct dynamic DD estimates, i.e., the event study version of the DDD estimation. Therefore, we also follow Fadlon and Nielsen

[21] In practice, we trim the data by keeping observations with relative year from $-K-1$ to $K+1$, and we bin the $-K-1$ and $-K$ into $-K$ and bin $K+1$ and K into K.

[22] To obtain the parametric estimates, we also follow Dobkin et al. (2018) and apply the following:

$$y_{itc} = \sum_{0 \leq l \leq K} \beta_l D_{tc}^l + \gamma X_{itc} + \eta_t + \eta_c + \psi_{ict} \tag{4}$$

Different from Eq. (3), the estimation here uses all the prior periods as reference. The estimated coefficients on D_{tc}^l(s) present the conditional mean difference with the reference group.

(2019) and run a dynamic DD analysis by using the urban sample as the control group as follows:

$$y_{itc} = \sum_{\substack{-K \le l \le K \\ l \neq -1}} \beta_l D_{tc}^l * R_i + \sum_{\substack{-K \le l \le K \\ l \neq -1}} \mu_l D_{tc}^l + \gamma X_{itc} + \eta_{tr} + \eta_{cr} + \psi_{ict}. \tag{5}$$

The interactions of D_{tc}^l and R_i demonstrate the time-varying effects of NRPS on rural residents compared with urban residents. By conducting the dynamic DD estimation, we can further control for the county-year level confounding factors and provide another set of tests in the case of unparallel pre-trends.

5.4 Heterogeneous Treatment Effects

Emerging studies show that the staggered DD design with heterogeneous treatment effects can potentially be subject to estimation bias. Therefore, we refine the two-way FE estimates in two ways.

Firstly, we estimate the treatment effect on the pilot counties that implemented NRPS in 2009 (referred to as "first treatment"). We remove the observations after NRPS implementation in the counties that implemented NRPS after 2009. For example, in the regression on sex ratio, we exclude children born after 2010 when their county implemented NRPS in 2010. In other words, we only retain the "not-yet-treated" observations in the late treatment group and they serve as the control group.

Secondly, we follow De Chaisemartin and d'Haultfoeuille (2020) and compute a new estimand by using the did_multiplegt Stata package (referred to as "CD2020"). This estimand identifies the effect of the treatment in groups that switch treatment, at the time when they switch.

6 Empirical Results

6.1 Impact of NRPS Roll-out on Enrollment

Firstly, we examined the validity of the official document we used to record the NRPS roll-out across counties as a measure of NRPS implementation. To achieve this, we analyzed the effect of NRPS roll-out on self-reported enrollment rates, utilizing data from CHARLS and CFPS from 2010 to 2016. We estimated the following equation:

$$Enroll_{ict}^s = \alpha^s + \beta^s NRPS_{ct}^s + \gamma^s X_{itc} + \eta_t^s + \eta_c^s + \psi_{itc}$$

The dependent variable, $Enroll_{ict}^s$, is an indicator of whether individual i enrolled in the NRPS. The key independent variable, $NRPS_{ct}$, is an indicator of whether county c implemented the NRPS in year t, based on the official document. The covariates include survey year dummies (η_t), county dummies (η_c), and other demographic controls (X_{ict}), such as gender and

education.

We divided the entire sample into subgroups s based on age and hukou eligibility. Figure 4 presents the results for each subgroup. The findings suggest that NRPS coverage increases enrollment rates by 30% to 40% for individuals with rural hukou across different age groups (45 to 75 years old). The NRPS roll-out had no impact on individuals with urban hukou, which supports using the urban sample as a placebo test.

It should be noted that this coefficient captures the short-term effects of the NRPS on pension enrollment. In the long run, the NRPS has a high take-up rate. According to CHARLS, as of 2015, 70.5% of elderly individuals aged 60 to 75 were enrolled in the NRPS. The take-up rate was 63.0% for individuals aged 45 to 59 and 49.4% for those aged 30 to 44.

6.2 Impact of NRPS on Eldercare and Marital Transfers

Eldercare arrangement. We use data from CHARLS and CFPS 2010–2016 to analyze the effect of NRPS on decisions regarding the eldercare mode for aging parents. This analysis corresponds to the last period in our model. We analyze the effects of NRPS on two measures of the eldercare mode: whether adult children live with their parents, and whether adult children provide physical help to their parents.

The first panel of Table 2 shows the effect of NRPS on the co-residence decisions of rural adult children. Co-residence is defined as whether an adult child lives with his/her parents in the same house. Co-residence data are available from both CHARLS 2011–2015 and CFPS 2010–2016. We restrict our sample to rural adult children with parents aged 55-85. We follow the DD specification in Eq. (1) and control for the characteristics of the parent and child. The results in the first panel of Appendix Table B2 show the robustness of the model when child-related and parent-related controls are excluded.

Column (1) of Panel A in Table 2 shows that the introduction of NRPS led to a 3.1 ppt (16.0%) reduction in the likelihood of co-residence for all rural adult children. However, co-residence alone may not reflect eldercare pattern because young adult children may opt to co-reside with their parents to reduce their living expenses (Rosenzweig and Zhang, 2020; Dai et al., 2021). Married children are more likely to provide eldercare when living with the elderly, and traditionally, sons bear most of the responsibility for eldercare. Therefore we divide the sample by marital status and child gender and show the results in Columns (2) and (3). We find that the effect is concentrated among married sons, whose likelihood of co-residence decreased by 6.5 ppt (21.6%) after the introduction of NRPS, but did not have a significant effect on married female children. The coefficient for sons is significantly smaller than that for daughters with a p-value < 0.01. This sex-based asymmetry supports the model's first prediction that a pension program reduces the eldercare provided by sons to a greater extent than that provided by daughters. This is unlikely to be driven by an improvement in the health of the elderly (shown in Huang and Zhang, 2021) because this mechanism will lead to a decline in old-age support from both sons and daughters. In addition, the likelihood of co-residence

did not change significantly among unmarried children. These results suggest that rural seniors received less care provided by married sons after the introduction of NRPS.

We also conduct a parallel analysis of the effect of NRPS on the physical help provided by children to obtain direct evidence on old-age support using CHARLS data, which include information on whether individual children offer daily care to their parents. Specifically, we use the data from CHARLS 2011–2015 to identify the physical help exchanged in each parent–child pair. Similar to the co-residence analysis, the sample is restricted to rural adult children with parents aged 55-85. In addition, the sample is further restricted to parents in need of help because physical help information is only available for these parents. As shown in Appendix Table B3, we estimate the effects of NRPS on whether the parents need help following the DD specification in Eq. (1) and find no evidence that NRPS affects the number of parents who need help.[23]

As shown in the first column of Panel B in Table 2, NRPS leads to a reduction in the probability that children will provide physical help to their parents, although not statistically significant. After further dividing the adult children by their marital status and child gender, we find that the effect of NRPS is concentrated on married sons, as shown in Columns (2) and (3). Specifically, NRPS reduces the likelihood that married sons provide physical help to their parents by 10.3 ppt (35.8%), whereas the effect on female children is not statistically significant. The differences between the two coefficients is statistically significant with a p-value < 0.01. These results remain robust after we exclude the control variables of the characteristics of the parent and child, as shown in Panel B of Appendix Table B2. This finding provides further support to the first prediction of our model that a pension program reduces the eldercare provided by sons more than that provided by daughters. Furthermore, NRPS has no significant effect on unmarried children.

We also check the effect of NRPS on financial transfers from adult children to parents but do not find any significant effect. This is consistent with Huang and Zhang (2021). Park and Shan (2020) find that pension reduces inter-vivo transfer from sons but not daughters. This different finding could be driven by the different measures we use as mentioned in the introduction. Nevertheless, their finding is consistent with our story — pension crowds out old-age support from sons more than daughters.

Brideprice and dowry. After examining the effect of NRPS on decisions regarding the eldercare mode for aging parents, we move on to analyze the effect of the pension scheme on parental transfers to children at the time of marriage. This analysis corresponds to the decisions made in the second period in our model. We use data from CHARLS 2015, which provides retrospective information about brideprice and dowry given by sons' and daughters' parents, respectively. We restrict our sample to marriages that occurred between 2000 and 2015 in rural

[23]Only parents who answered having any difficulty with basic activities or daily activities will answer the question who provides help. We test whether NRPS affects whether parents have difficulties in basic and daily activities and their self-assessed levels of difficulties in these activities.

areas. In addition, the sample is further restricted to the married children whose parents made transfer to them at the time of marriage. More than 60 percent of married sons received transfer from parents at the time of marriage, and the percentage is 43% for married daughters.[24] Traditionally, parents are more likely to make marital payments to sons than daughters due to the biased sex ratio. Appendix Table B4 shows no significant evidence for any impact of NRPS on whether parents made transfer to children at the time of marriage, which suggests that the pension program has no effect on the extensive margin. Panel C of Table 2 presents the results of the DD model for the effect of NRPS on the amount of marital transfer after controlling for characteristics of the parent and child. The results estimated without controls are similar, as shown in Panel C of Appendix Table B2.

NRPS exerts a significantly negative effect on the brideprice given by sons' parents (Column 2) but does not affect the dowry given by daughters' parents (Column 3). For sons who were married on or after the introduction of NRPS, brideprice declined by 32.3%. This finding is consistent with our model's second prediction that a pension program reduces brideprice, but not dowry. The coefficients of brideprice and dowry are statistically significantly different with a p-value < 0.01.

We speculate that the co-residence arrangements of sons who were married after the implementation of NRPS are more likely to be affected than those of daughters because these sons' parents gave a lower brideprice after the introduction of NRPS. To test this conjecture, we divide married children into two groups based on whether they were married before or after the implementation of NRPS. Table 3 shows a 7.6 ppt decrease in the likelihood of co-residence with parents among male children married after NRPS implementation, and a 6.5 ppt decrease among male children married before NRPS. The likelihood that a male child will provide physical help is reduced by 10.5 and 13.4 ppt among those married before and after NRPS implementation, respectively. The results are consistent with the hypothesis that children married after the implementation NRPS reduce their eldercare further compared to those married before the NRPS, although the differences in the co-residence arrangement and provision of physical help between the two groups are not statistically significant. We also do not observe a significant difference in the likelihood that female children who married before or after NRPS will co-reside with their parents or provide physical help.

Park and Shan (2020) find that pension reduces parents' educational investment in daughters but increases their investment in sons. Their result is more likely to be explained by the altruistic motive — parents care more about sons than daughters. In contrast, our result that parents reduce marital transfer to sons but not daughters is consistent with the exchange motive.

Placebo results using the urban sample. Our DD specifications raise potential concerns that the pilot counties were not chosen randomly, and that other events may have co-occurred with

[24] 40% (57%) of married sons (daughters) reported that they did not receive parental transfer at the time of marriage. Among those who reported marital payments, all of them reported non-zero values.

NRPS. We, therefore, use the urban sample to conduct a placebo test.[25] As shown in Table 4, we find no significant impact of NRPS on co-residence arrangements, physical help to parents, or parental transfer at children's marriage for the urban sample.

6.3 Impact of NRPS on Having a Female Birth

We use micro-level data from the 2015 mini census to examine the effect of NRPS on having a female birth, which corresponds to the sex selection decision made in the first period of the model.

We restrict the sample to children born between 2005 and 2015 with an agricultural *hukou*.[26] The first two columns in Table 5 show the results of the DD estimation without and with controls. As presented in Column (2), the introduction of NRPS led to a 3.27 ppt increase in the chance that a newborn would be female. The sex ratio of newborns in rural areas in 2008 was 1.20 males per female, so our result suggests that NRPS led to a 15 ppt (12.5 percent) decrease in the sex ratio. The size of this effect is 75% of the effect of China's land reform in 1978–1984 as noted in Almond et al. (2019), where land reform was shown to have led to an increase in the sex ratio from 1.1 to 1.3 males per female among newborns (20 ppt) in four years after the reform. The magnitude is larger than the impact of ORPS. Ebenstein (2010) and Zhang (2015) find that the ORPS reduces the sex ratio at birth by 9 percent and 2 ppt, respectively. This is not surprising because NRPS has a higher take-up rate compared to ORPS (70% vs 15%).

We also use children born with urban *hukou* in a placebo test and present the results in the next two columns. The LPM results show that the point estimates are one-scale smaller and insignificant, suggesting that the effects among rural children are not driven by unobserved county–year level confounding factors.

We also analyze whether the effect of NRPS on the sex ratio varies by birth order. As shown in Appendix Table B5, NRPS increases the likelihood of having a female newborn for the first birth and the second or higher-order birth by 3.18 and 3.20 ppt, respectively. The difference between the first birth and subsequent birth is not statistically significant, suggesting that NRPS affects both types of births at a similar magnitude.

One potential concern is that the relaxation of one-child policy after 2010 could affect our results on sex ratio.[27] Our identification of the NRPS treatment effect relies on the county-by-county rollout. Only if the relaxation of the one-child policy has the same roll-out pattern would it be a problem. However, the one-child policy is a national movement and has been controlled by the birth year fixed effects. Moreover, during the NRPS rollout periods (2009 – 2013), the relaxation of the one-child policy mainly affects young couples of which both the

[25] Table 1 reports the summary statistics of the urban sample.

[26] In the 2015 mini census, an agricultural *hukou* was defined as whether the respondent had rural land contract rights, as some of the provinces had removed the differences between an agricultural and non-agricultural *hukou*.

[27] Before 2011, rural China implemented the 1.5 children policy, where families with a girl can have a second child; urban China implemented the one-child policy. Since November 2011, parents in which both the husband and the wife are single child can have two children. Starting from December 2013, parents in which one of the couple is single child can have two children. After October 2015, all families can have two children.

husband and the wife are single children. In the rural area, very few young couples are qualified because most of them have siblings. Therefore, the reform of the one-child policy is unlikely to be a confounding factor.

Another concern is that China government banned the sex-selective abortion in 2003. However, Das Gupta (2019) and Xiong (2022) show that the policy is not effective because the sex ratio is still quite biased after the banning of sex-selection. This is because parents can still find other ways to discover the sex of fetus, such as bribing the doctor. In fact, using several waves of Chinese census, we show in Figure 7 that the sex ratio at birth in rural China remained quite stable after 2003 and only declined after 2009, the implementation of NRPS.

6.4 Triple-difference Estimation Results

We pool the rural and urban sample together and further implement a DDD model to formally compare the treatment effects between the rural and urban samples. The results remain robust for the co-residence arrangement (Panel A of Appendix Table B6), physical help to parents (Panel B of Appendix Table B6), marital transfer from parents (Panel C of Appendix Table B6), and probability of having a female birth (Column 3 of Appendix Table B7), because the interactions between the rural and NRPS indicators are statistically significant.

6.5 Event Study and Dynamic DD Results

Event study. Figure 5a presents the results of the event study (Eq. (3)) on the effect of NRPS on marital transfer. The regression coefficients are reported in Appendix Tables B8 and B9 for brideprice and dowry, respectively. The effect of NRPS on brideprice is close to zero for marriages in rural areas that occurred four years before NRPS implementation year, which supports the parallel trend assumption. We also observe a significant and negative effect on brideprice for marriages in rural areas that occurred during NRPS implementation year, and this negative effect persisted for two years after the introduction of the scheme. Brideprice is reduced by 47% and 78% for sons who were married on and one year after NRPS implementation year, respectively, compared with those married one year before NRPS implementation.

By contrast, we find no effect of NRPS on dowry before and after NRPS implementation, as shown in Figure 5c. This result confirms that the pension has a gender-asymmetric effect on marital transfer.

Figure 6a presents the results of the event study on having a female birth. The regression coefficients are reported in Appendix Table B10. Similarly, we find that none of the lagged variables are significantly different from zero and no obvious trend is observed. The effect of NRPS on having a female birth is relatively small on NRPS starting year (half year before and after the NRPS implementation), because pregnancy lasts nine months. The probability of having a female child at birth increases by 3.2–4.6 ppt between one and four years after the introduction of NRPS, compared with children born one year before NRPS implementation.

We further perform a placebo test on the event study analysis by using the urban sample. In

general, all lags and leads are statistically insignificant, as shown in Figures 5a, 5c, and 6a.[28] This result is expected, because a rural pension scheme has little effect on urban areas.

We also report the parametric event study results on brideprice, dowry, and female birth by applying Eq. (4). As shown in the first column of Appendix Tables B8 – B10, the results are close to those from Eq. (3). No material changes in the estimates are observed.

Dynamic DD. We present dynamic DD results on marital transfer and sex ratio in Figures 5b, 5d, and 6b. Relative to the urban sample, NRPS has significant effects on brideprice and sex ratio of the rural sample during NRPS implementation year, and the effect persists for two to four years after the implementation. The magnitudes reported in the figures are consistent with those in Tables 2 and 5.

6.6 Issues of Staggered DD Design

To address the concerns of staggered DD design with heterogeneous treatment effects, we implement two robustness checks. We present the results on parental transfer at marriage by using the first treatment and CD2020 in Panels A and B of Appendix Table B11, respectively. The corresponding robustness checks for sex ratio are presented in the first two columns of Appendix Table B7. The results are robust when these alternative estimators are used. However, we do not have data on co-residence arrangement and physical help before NRPS treatment, so the first treatment and CD2020 cannot be applied to these two outcome variables.

6.7 Other Confounding Factors

Marriage decisions. We are also concerned that NRPS may have affected the marital pattern. Corno et al. (2017) found that income shocks affect the marital age because marital payments are a source of consumption smoothing. If this result remains true for NRPS, then the effect on brideprice could have been driven by a change in the marital age, rather than a change in the eldercare mode. We use data from the 2010 census to examine the effect of NRPS on the timing of marriage, because the 2015 mini census did not solicit information on the marital year. We regress the number of marriages at the county level on whether the county had implemented NRPS and use the county and marital year fixed effects as the regression controls. We find no evidence that the pension program affected the number of marriages, as shown in Appendix Table B12. We also use CHARLS 2015 data to check whether NRPS affected the characteristics of newly married couples. We regress the education levels and marital ages on the NRPS indicator and control for the county and marital year fixed effects for rural adult children married between 2000 and 2015. Again, we find no evidence that the pension program affected the education levels or marital ages of married children, as shown in Appendix Table B13.[29] These findings suggest that NRPS did not affect who got married and when they were married. Rather, the negative effect of NRPS on brideprice was most likely driven by a change

[28]The effect of NRPS on brideprice for the urban sample is even positive, though not statistically significant at the 10% level. If anything, we underestimate the effect on the rural sample.

[29]To be consistent, we use the same sample as that in the parental transfer analysis shown in Table 2.

in the eldercare mode, namely, switching from informal care provided by sons to formal care.

Fertility. Moreover, NRPS may have affected the sex ratio through channels other than the eldercare mode. For example, NRPS may have affected the desire of young couples for a child. Appendix Table B14 analyzes the effect of NRPS on the birth of children in rural households, including whether couples had a newborn and whether they had second- or higher-order births, during the period of 2005 to 2015. We use data from the 2015 mini census to run the same specification as that in Eq. (1). We find that the effects of NRPS on the number of newborns, as well as on second- or higher-order births, are neither economically nor statistically significant. Therefore, we find no evidence that NRPS affects the fertility of young couples. This is mainly because the fertility decision in China faces a binding constraint due to the fertility policy.

Migration. Another possible concern in this study is migration. All individuals with a rural *hukou*, including rural residents and migrants in urban areas, are eligible to participate in NRPS. Given that county registration data were collected in the 2015 mini census, we use the registered county in our regressions on the sex ratio. However, CHARLS and CFPS data only include information about the current county of residence, but not the county of registration. We therefore define the treatment status based on whether the parent's resident county had implemented NRPS in our regressions on co-residence status, physical care, and marital transfer. If the factors that affect migration are correlated with NRPS implementation timing and the outcomes, the estimates will be biased. However, this is not a serious problem in our analysis. Firstly, among rural elderly people aged 55-85, only 3% were not living in their registered counties at the time of the survey. Secondly, Huang and Zhang (2021) showed that NRPS does not affect the cross-county migration of elderly people.

7 Conclusions

The aging of societies in many countries is widely recognized. Given the rapid increase in the proportion of elderly citizens, many developing countries have introduced or expanded large social pension programs to cover vulnerable elderly people in inadequate eldercare markets (Willmore, 2007, Levy and Schady, 2013).[30]

This study analyzes how a pension program may affect a series of behaviors related to the eldercare mode and social norms across the lifecycle by exploiting the introduction of NRPS in rural China. We use the county-by-county rollout of NRPS to exploit several estimation strategies. Firstly, we find that in the counties that have implemented NRPS, children are less likely to live with or provide physical help to their parents, especially after marriage. In addition, these negative effects on co-residence and physical help are mainly observed among married male children, but not married female children. Our findings imply that the pension program allows for greater independence and less reliance on eldercare provided by sons.

Aside from the effects of the pension program on the eldercare received by aging parents,

[30]Such programs include social pension reforms in South Africa (Krueger and Pischke, 1992, Case and Deaton, 1998, Duflo, 2000, Jensen, 2004), Brazil (de Carvalho Filho, 2008, 2012), and India (Kaushal, 2014).

we find that the pension also affects the decisions of young parents, including the parental transfer at the time of the child's marriage and the use of sex selection technology prior to childbirth. In particular, NRPS reduces the brideprice given by sons' parents but does not affect the dowry given by daughters' parents. NRPS has also led to a less biased sex ratio by increasing the proportion of female newborns. These findings imply that the son-dependent eldercare mode is an important reason for son preference.

Our findings demonstrate the powerful ability of a pension scheme to transform a traditional eldercare mode to a modern approach. The pension program reflects a national cultural change in which the state and formal financial markets would be a greater source of support for old age. By reducing the demand for informal care provided by sons, NRPS is gradually shifting the norm of support for elderly people and has introduced an opportunity for formal eldercare. With this program, parents will reduce their son preference, leading to a more equal marital transfer between sons and daughters, as well as a less-biased sex ratio. Our findings suggest that social policies can shift the son-preference culture.

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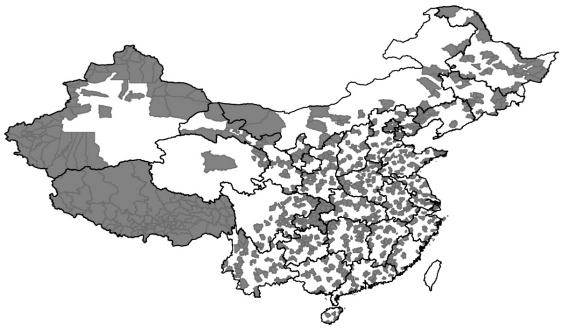
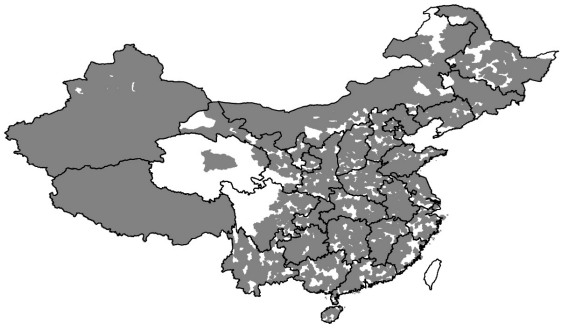
Figure 1: County-by-county Rollout of the New Rural Pension Scheme over Time

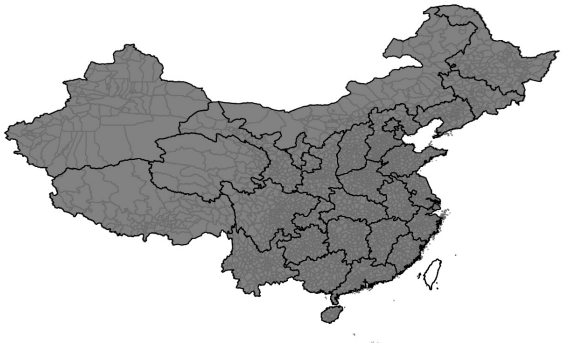
(a) First round, November 2009



(b) Second round: July–October 2010

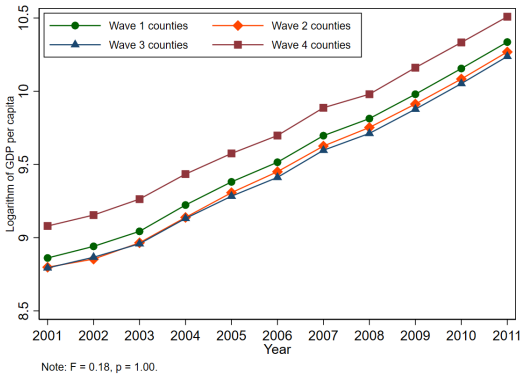


(c) Third round, July–September 2011

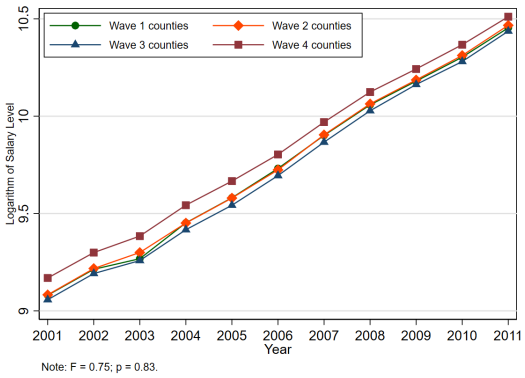


(d) Fourth round: July–October 2012

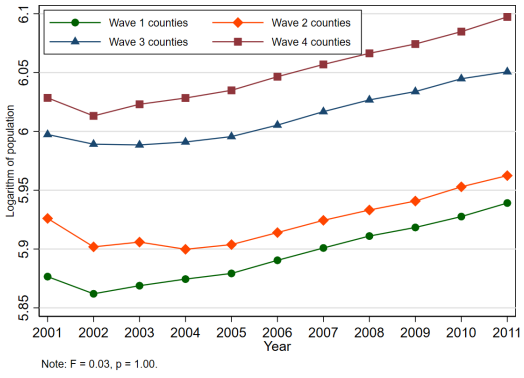
Figure 2: Examination of Pre-trends in the County Characteristics, by NRPS Starting Year



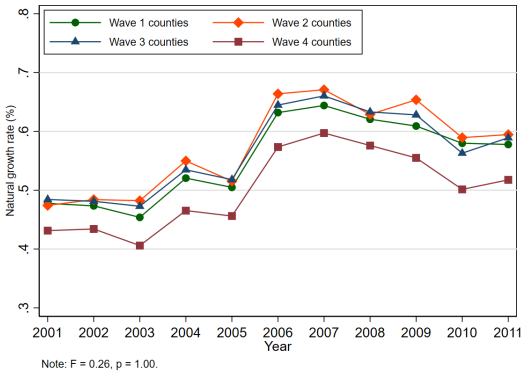
(a) GDP per capita



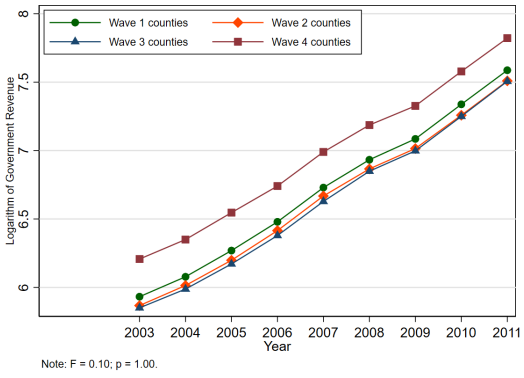
(b) Salary



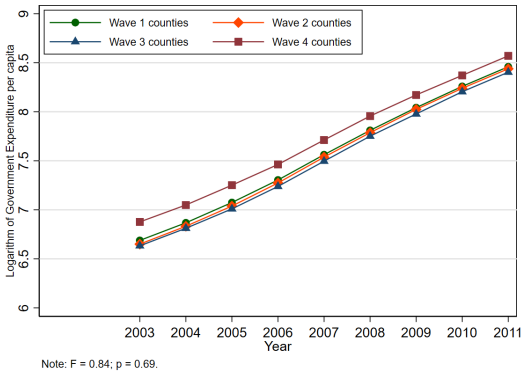
(c) Population



(d) Natural growth rate



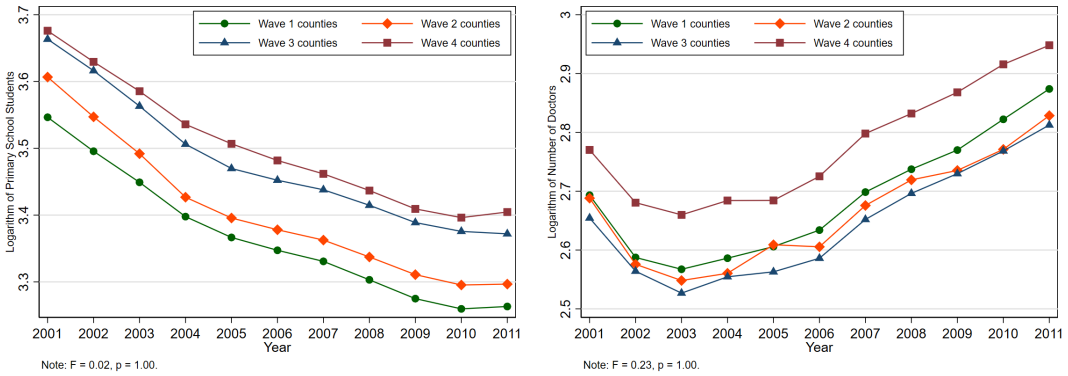
(e) Government revenue



(f) Government expenditure

Notes: The economic indexes from different counties are from the China County (City) Social and Economic Statistical Yearbooks. The counties are grouped by the different starting years of the NRPS. Wave 1, 2, 3, 4 counties refer to counties that implemented NRPS in 2009, 2010, 2011, and 2012, respectively. Each figure plots the mean values of the logarithm of the economic indexes from 2001 to 2011.

Figure 3: Examination of Pre-trends in the County Characteristics, by NRPS Starting Year (Cont'd)



(a) Number of primary school students (b) Number of doctors

Notes: The economic indexes from different counties are from the China County (City) Social and Economic Statistical Yearbooks. The counties are grouped by the different starting years of the NRPS. Wave 1, 2, 3, 4 counties refer to counties that implemented NRPS in 2009, 2010, 2011, and 2012, respectively. Each figure plots the mean values of the logarithm of the economic indexes from 2001 to 2011.

Figure 4: Effect of NRPS Roll-out on Enrollment Rates

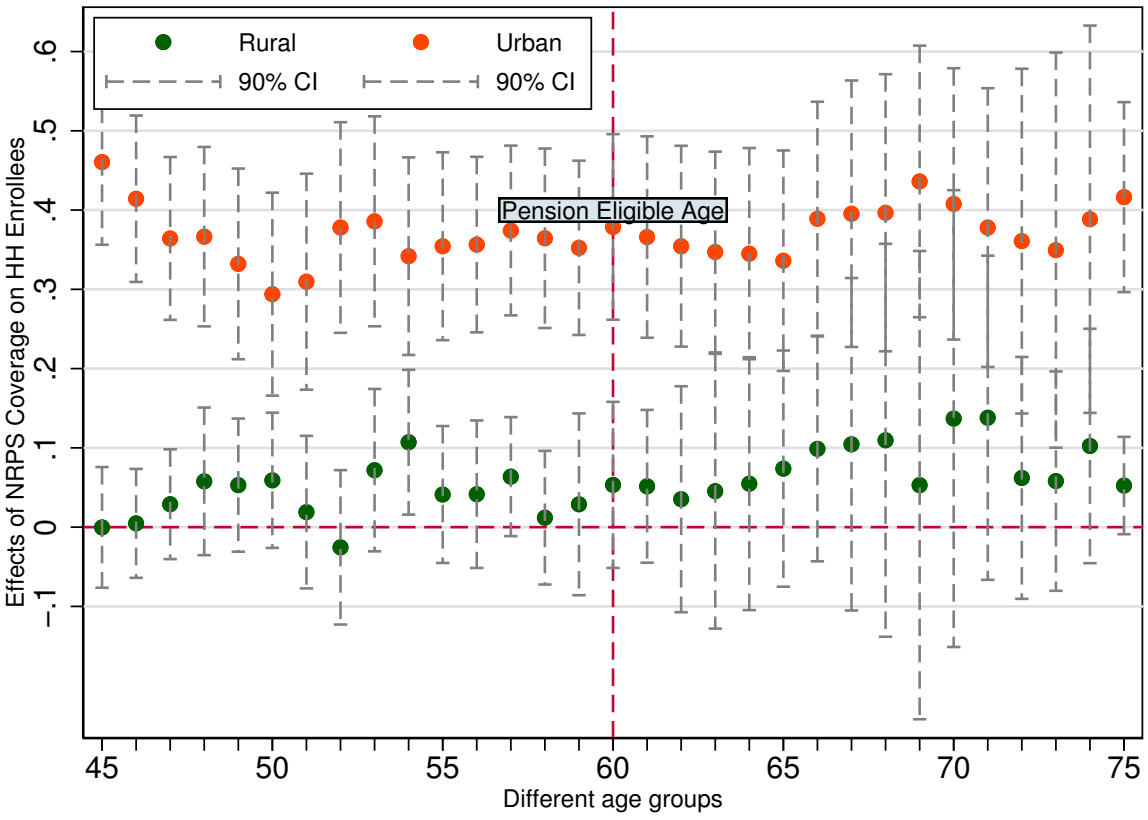
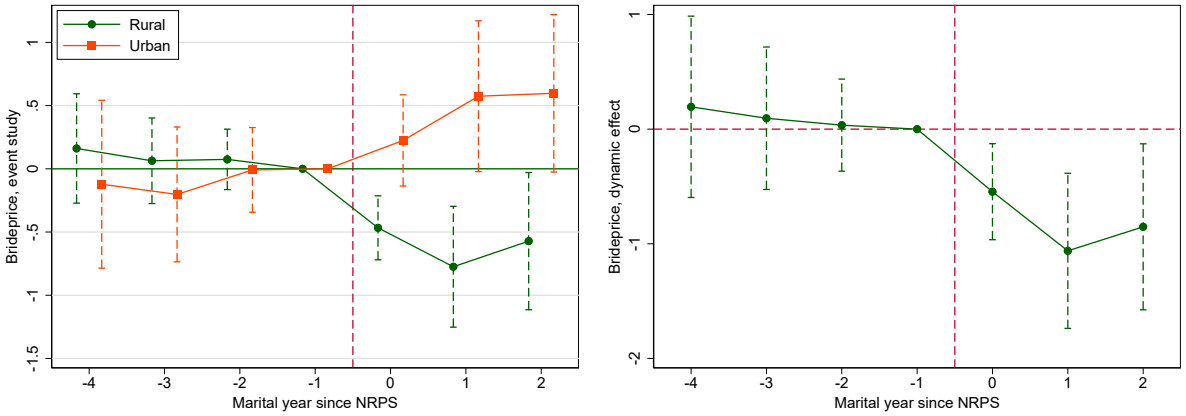
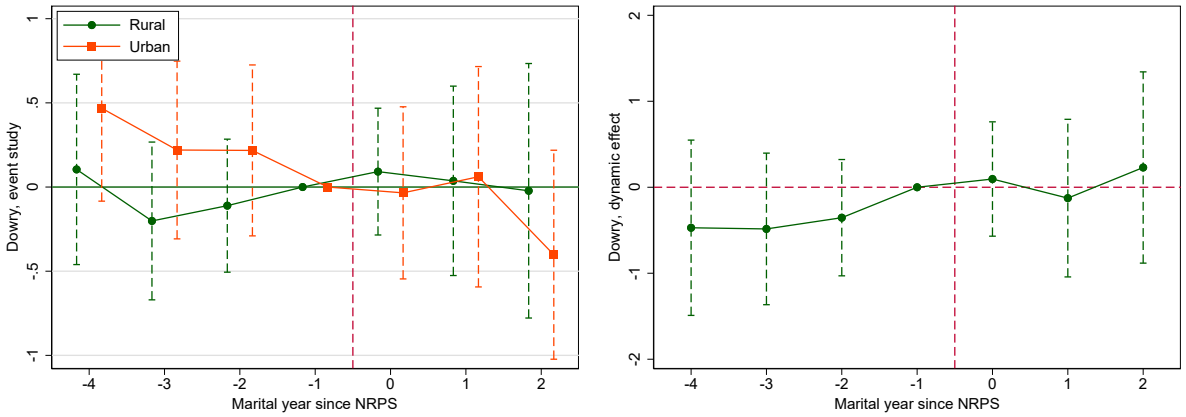


Figure 5: Effect of NRPS on Marital Transfer



(a) Brideprice, event study, by type of registration

(b) Brideprice, dynamic DD

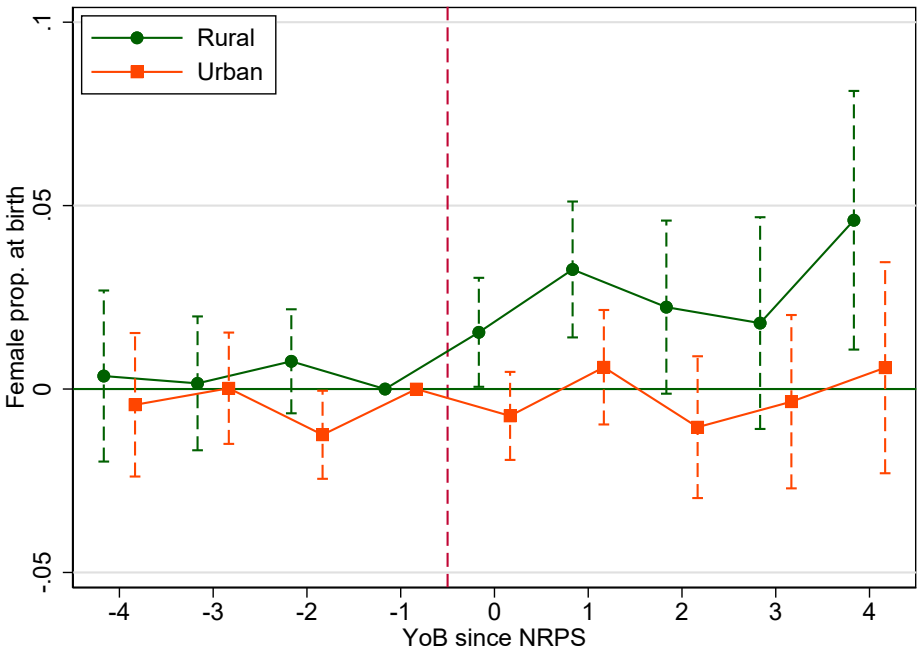


(c) Dowry, event study, by type of registration

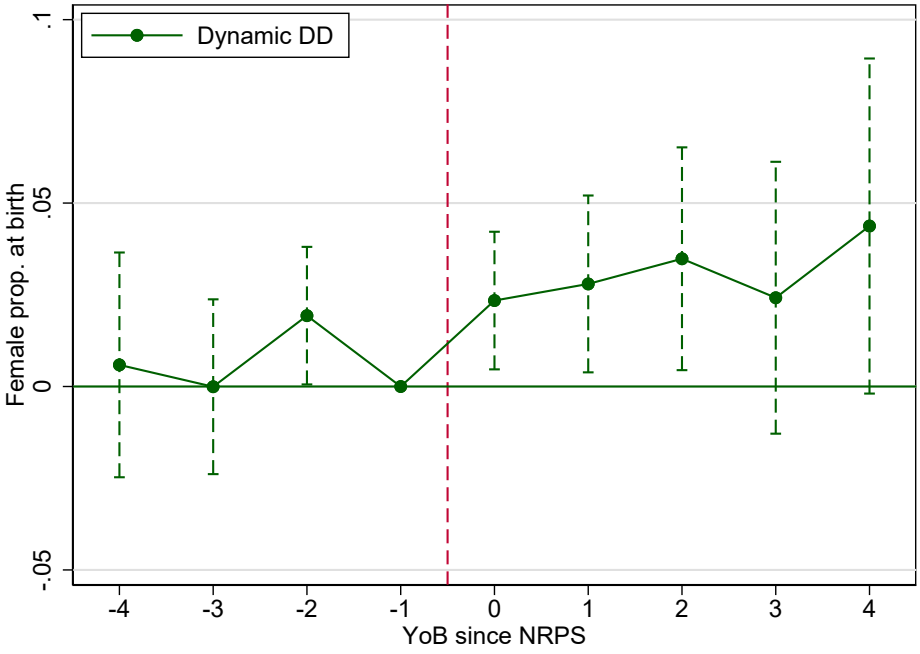
(d) Dowry, dynamic DD

Notes: Data are from the China Health and Retirement Longitudinal Study 2015. The dependent variable is the logarithm value of brideprice in Panels A and B and the logarithm value of dowry in Panels C and D. Equation (3) (event study model) is estimated in Panels A and C for the rural or urban sample and the coefficients of D_{ct}^{l} are reported. Equation (5) (dynamic DD model) is estimated in Panels B and D by using the full sample and the coefficients of the interactions between R_i and D_{ct}^{l} are reported. The marital year just before NRPS implementation is the reference group. The x axis indicates the difference between the marital year and NRPS implementation year. We also report the 90% confidence interval. We restrict the sample to adult children who were married between 2000 and 2015.

Figure 6: Effect of NRPS on Sex Ratio



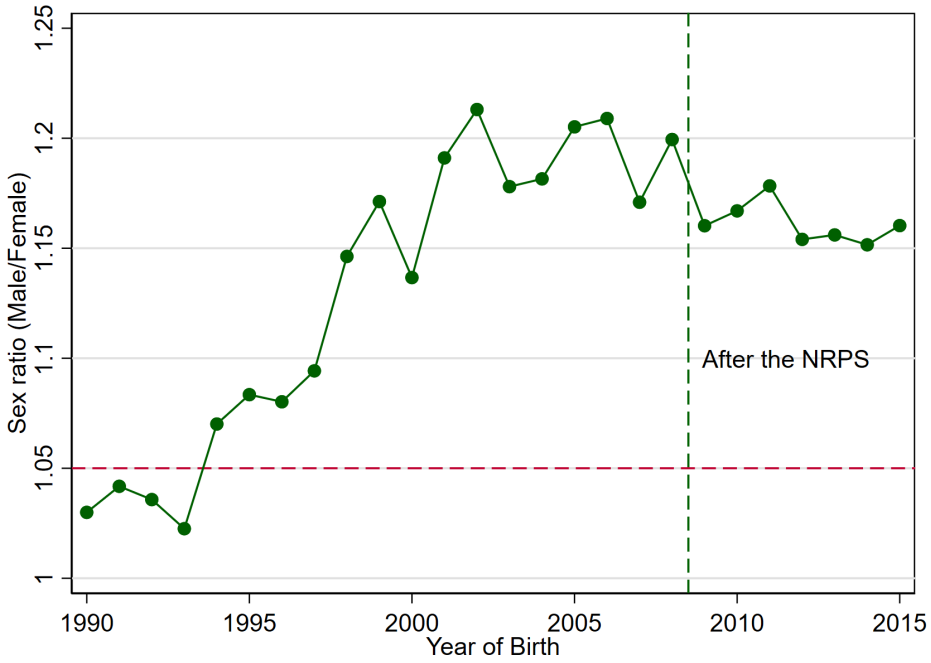
(a) Event study results, by type of registration



(b) Dynamic DD

Notes: Data are from the 2015 mini census. The dependent variable is a dummy variable indicating whether the newborn is female. Equation (3) (event study model) is estimated in Panel A for the rural or urban sample and the coefficients of D_{ct}^{l} are reported. Equation (5) (dynamic DD model) is estimated in Panel B by using the full sample and the coefficients of the interactions between R_i and D_{ct}^{l} are reported. The birth year just before NRPS implementation is the reference group. The x axis indicates the difference between the birth year and NRPS implementation year. We also report the 90% confidence interval. We restrict the sample to individuals born between 2005 and 2015.

Figure 7: Time Trend of Sex Ratio



Notes: Data are from the 2015 mini census.

Table 1: Summary Statistics

	Rural			Urban		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Panel A: CHARLS & CFPS						
Parent sample						
Age (years)	38,518	66.056	6.940	17,190	64.503	6.122
Education (years)	38,518	4.952	4.197	17,190	6.741	4.564
Number of children	38,518	3.567	1.412	17,190	2.952	1.388
Child sample						
Male	38,518	0.561	0.496	17,190	0.543	0.498
Age (years)	38,518	36.277	7.279	17,190	34.399	5.234
Education (years)	38,518	7.588	4.323	17,190	10.078	4.221
Whether married	38,518	0.888	0.315	17,190	0.863	0.343
Whether co-resides with parents in the same home	38,518	0.194	0.395	17,190	0.272	0.445
Male child	21,609	0.301	0.458	9,337	0.384	0.486
Female child	16,909	0.058	0.234	7,853	0.139	0.346
Panel B: CHARLS						
Whether the child provides physical help to parents	3,900	0.232	0.422	1,526	0.255	0.434
Male child	2,346	0.288	0.453	880	0.300	0.459
Female child	1,554	0.147	0.355	646	0.193	0.395
Value of brideprice (RMB)	1,769	22,726	23,084	915	24,982	25,586
Value of dowry (RMB)	1,024	13,245	16,853	619	18,088	21,938
Panel C: 2015 mini census						
Female (Yes = 1)	73,546	0.455	0.498	107,554	0.463	0.499
Han ethnicity	73,546	0.868	0.338	107,554	0.879	0.327
Parent's age (years)	70,014	32.906	5.791	101,231	33.078	5.580
Parent's education (years)	70,014	9.320	2.141	101,231	10.606	2.969
First birth	72,241	0.520	0.500	104,825	0.610	0.488
Second birth	72,241	0.382	0.486	104,825	0.315	0.465

Notes: Panel A uses data from CHARLS & CFPS 2010–2016 and restricts the sample to rural/urban adult children with parents aged 55-85. Panel B uses data from CHARLS 2015 and restricts the sample to rural/urban adult children with parents aged 55-85. Panel C uses data from 2015 mini census micro-level data and restricts the sample to rural/urban children born between 2005 and 2015.

Table 2: Effect of NRPS on Eldercare Outcomes in the Rural Sample

Sample	(1) All	(2) Married Male	(3) Married Female	(4) Unmarried
A. The dependent variable is whether co-reside with parents (Yes = 1)				
NRPS	-0.031**	-0.065***	0.012	-0.030
	(0.014)	(0.019)	(0.008)	(0.067)
Observations	38,518	18,306	15,901	4,311
B. The dependent variable is whether provide physical help to parents (Yes = 1)				
NRPS	-0.038	-0.103**	-0.056	-0.044
	(0.033)	(0.052)	(0.061)	(0.137)
Observations	3,899	1,920	1,459	520
C. The dependent variable is the log parental transfer at the child's marriage				
NRPS	–	-0.323**	0.141	–
	–	(0.132)	(0.214)	–
Observations	–	1,769	1,024	–
County fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Child controls	YES	YES	YES	YES
Parent controls	YES	YES	YES	YES

Notes: 1. The first panel uses data from CHARLS & CFPS 2010–2016, the second panel uses data from CHARLS 2011–2015, and the last panel uses data from CHARLS 2015.

2. The dependent variables in the first, second, and last panels are a dummy variable indicating whether the adult child lives with the parents, a dummy variable indicating whether the child provides physical help to the parents, and the log value of the parental transfer at the child's marriage, respectively. The parent controls include the parental education level and age, and the child controls include the child's sex, education level, and age. We focus on a sample of rural adult children who were married between 2000 and 2015 in all three panels and a sample of rural adult children with parents aged 55-85 in the first two panels.

3. We use the LPM model in the first two panels and the OLS model in the last panel. Standard errors are in parentheses and clustered at the county level.

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

Table 3: Effect of NRPS on the Eldercare Provided by Married Children by Marital Year in the Rural Sample

	(1)	(2)
Sample	Male	Female
A. The dependent variable is whether co-reside with parents (Yes = 1)		
Marital year $<$ NRPS year $\leq$ survey year	-0.065***	0.012
	(0.018)	(0.007)
NRPS year $\leq$ marital year $\leq$ survey year	-0.076**	0.023
	(0.036)	(0.034)
Observations	18,306	15,901
B. The dependent variable is whether provide physical help to parents (Yes = 1)		
Marital year $<$ NRPS year $\leq$ survey year	-0.105*	-0.057
	(0.055)	(0.066)
NRPS year $\leq$ marital year $\leq$ survey year	-0.134*	-0.047
	(0.077)	(0.086)
Observations	1,920	1,459
County fixed effects	YES	YES
Year fixed effects	YES	YES
Child controls	YES	YES
Parent controls	YES	YES

Notes: 1. The first panel uses data from CHARLS & CFPS 2010–2016, and the second panel uses data from CHARLS 2011–2015.

2. The dependent variable is a dummy variable indicating whether the adult child lives with the parents in the first panel, and a dummy variable indicating whether the child provides physical help to the parents in the second panel. Parent controls include the parental education level and age, and child controls include the child's sex, education level, and age. We focus on a sample of rural married adult children with parents aged 55-85.

3. In both panels, we use the LPM model. Standard errors are in parentheses and clustered at the county level.

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

Table 4: Placebo Test – Effect of NRPS on Eldercare Outcomes in the Urban Sample

Sample	(1) All	(2) Married Male	(3) Married Female	(4) Unmarried
A. The dependent variable is whether co-reside with parents (Yes = 1)				
NRPS	0.010	0.008	0.026	-0.035
	(0.021)	(0.033)	(0.019)	(0.057)
Observations	17,190	7,687	7,155	2,348
B. The dependent variable is whether provide physical help to parents (Yes = 1)				
NRPS	0.049	0.194	0.018	0.132
	(0.049)	(0.119)	(0.078)	(0.340)
Observations	1,526	722	588	216
C. The dependent variable is the log parental transfer at the child's marriage				
NRPS	–	0.147	0.042	–
	–	(0.182)	(0.340)	–
Observations	–	915	619	–
County fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Child controls	YES	YES	YES	YES
Parent controls	YES	YES	YES	YES

Notes: 1. The first panel uses data from CHARLS & CFPS 2010–2016, the second panel uses data from CHARLS 2011–2015, and the last panel uses data from CHARLS 2015.

2. The dependent variables in the first, second, and last panels are a dummy variable indicating whether the adult child lives with the parents, a dummy variable indicating whether the child provides physical help to the parents, and the log value of the parental transfer at the child's marriage, respectively. Parent controls include the parental education level and age, and child controls include the child's sex, education level, and age. We focus on a sample of urban adult children who were married between 2000 and 2015 in all three panels and a sample of urban adult children with parents aged 55-85 in the first two panels.

3. We use the LPM model in the first two panels and the OLS model in the last panel. Standard errors are in parentheses and clustered at the county level.

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

Table 5: Effect of NRPS on the Probability of Having a Female Child

	(1)	(2)	(3)	(4)
Sample	Rural	Rural	Urban	Urban
The dependent variable is whether the newborn is a girl (Yes = 1)				
NRPS	0.0336***	0.0327***	0.0075	0.0070
	(0.0107)	(0.0106)	(0.0090)	(0.0090)
Observations	69,941	69,941	101,189	101,189
County fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Parent controls	No	Yes	No	Yes

Notes: 1. Data are from the 2015 mini census micro-level data.

2. The dependent variable is a dummy indicating whether the newborn is female. Parent controls include the parents' ethnicity, age, age squared, and education. We focus on a sample of rural (or urban) individuals born between 2005 and 2015.

3. We use the LPM model. Standard errors are in parentheses and clustered at the county level.

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

APPENDIX

Appendix A Model

In this section, we develop a stylized lifecycle model that captures parental decisions regarding sex selection, parental transfers to children, and the eldercare mode and then compare the responses of people who did and did not participate in a pension program.

The model contains three periods. In the first period, parents decide whether to use sex selection technology to determine the sex of their newborn. In the second period, which corresponds to the time of a child's marriage, the parents decide the amount of wealth to transfer to their children. When a pension program is available, the parents also put money in their pension fund. In the last period, parents receive eldercare provided by their children and pension benefits (if applicable). Here, the children provide eldercare to their parents based on the parental transfer received during the second period either because of an implicit contract (Ehrlich and Lui, 1991) or a manipulation of the children's preferences (Becker et al., 2016). Parents differ in their income and cost of sex-selection. We assume that parents are wealthier in the second period than in the third period and therefore have an incentive to achieve consumption smoothing between the two periods through investments in their children and/or pensions.[31]

We solve the model backwards by analyzing the investment decisions in the second period. If no pension program is available, then the parents' optimization problem is

$$\max_{B_j} u(y_y - B_j) + \beta u(y_o + T_j(B_j, y_o)) \quad j \in \{m, f\}, \tag{6}$$

where j indicates the sex of the child (m denotes male and f denotes female), y_y is the parental income in the second period (when parents are young), y_o is the parental income in the third period (when parents are old), and B_j is the parental transfer at the child j's marriage.

$T_m(B_m, y_o)$ and $T_f(B_f, y_o)$ are the eldercare provided by sons and daughters in the last period, respectively. We assume that $T_j()$ has the following functional form:

$$T_j(B_j, y_o) = g_j(B_j) - h_j(y_o),$$

where $g_j()$ is an increasing and concave function in B_j and $h_j()$ is an increasing and concave function in y_o. We assume that $T_m(0, y_o) > T_f(0, y_o)$ for any y_o, that is, sons will provide more eldercare to parents compared with daughters even when parents provide no transfer to their children. This assumption is likely to hold in a patrilocal society such as in China, where sons bear the major responsibility of providing eldercare. We further assume that $g'_m(B) > g'_f(B)$

[31] For the ease of illustration, the model only considers parents' exchange motive but not the altruistic motive. The exchange motive predicts that parents' behaviors (fertility preference and investment in children) are affected by their eldercare arrangement, and a pension program will reduce investment in sons because parents are less dependent on sons for eldercare. The altruistic motive implies that parents invest in their children because of love, and it predicts that a pension program will increase investment in sons more than daughters if parents care more about sons.

for any B, implying that the marginal return of parental transfer is higher for sons than for daughters. Appendix Table B1 examines the correlation between parental transfer and eldercare service provided by children using CHARLS & CFPS 2010–2016. We find that a 1 percent increase in parental transfer to sons is associated with a 0.017 ppt increase in the likelihood that a son will live with his parents. However, parental transfer to daughters has no significant relationship with the likelihood that a daughter will co-reside with her parents. Therefore, the empirical evidence supports the assumption that $g'_m(B) > g'_f(B)$. Together, the two assumptions imply that $T_m(B, y_o) > T_f(B, y_o)$ for any B and y_o, that is, holding parental transfer and income fixed, sons always provide more eldercare to parents than daughters do.

When a county introduces a pension program, the parents' optimization problem becomes

$$\max_{B_j} u(y_y - B_j - P) + \beta u(y_o + RP + g_j(B_j) - h_j(y_o + RP)) \quad j \in \{m, f\},$$

where P is the pension premium payment and R is the return on the pension investment. A pension program leads to a direct increase in income by RP and a crowding out effect from the decline in eldercare provided by children (eldercare declines from $g_j(B_j) - h_j(y_o)$ to $g_j(B_j) - h_j(y_o + RP)$). We assume that the direct effect is larger than the crowding out effect, i.e., the net return of a pension program is positive ($RP - h_j(y_o + RP) + h_j(y_o) > 0$ for $j \in \{m, f\}$). Given that most rural residents only choose the minimum level of pension premium (100 RMB per year), we do not model the choice of pension premium. Instead, we assume that individuals always pay a fixed pension premium when the program is available.[32] For individuals to be willing to pay the fixed pension premium P, the return to pension must not be smaller than the return to marital transfer, i.e., $R(1 - h'_j(y_o + RP)) \geq g'_j(B_j)$. We focus on the contrast between a world without and a world with NRPS (extensive margin), rather than on the difference in the pension investment amount (intensive margin). Allowing individuals to choose the investment amount will not affect our predictions.

We define the optimal level of a parental transfer to child $j \in \{m, f\}$ to be B_j^1 and B_j^0 and the eldercare provided by child j to be T_j^1 and T_j^0 in situations with and without a pension program, respectively. The model can thus predict how a pension program will affect the parental transfer and eldercare provided by children, as in the following proposition:

Proposition 1. $B_j^1 \leq B_j^0$ and $T_j^1 \leq T_j^2$, for $j \in \{m, f\}$.

The proof of this proposition is shown in Appendix B. Firstly, the pension program serves as an income transfer for those already older than 60 and thus reduces the eldercare provided by children (T_j declines with parental income). Secondly, the pension program serves as a new saving tool that reduces the need for consumption smoothing through a marital transfer. As a result, the amount of parental transfer at the time of a child's marriage decreases, and

[32] Some individuals may choose not to participate in NRPS. The model predicts that the introduction of NRPS will have no effect on these non-participants.

the provision of eldercare services by that child also decreases (T_j increases with parental transfer).[33]

Regarding the relative decrease in the marital transfer to sons compared with the transfer to daughters and the relative decrease in the eldercare provided by sons compared with the eldercare provided by daughters, we establish the following proposition:

Proposition 2. If $g'_f(0) \leq \Phi_f$ and $g'_m(0) > \Phi_m$, $|B_m^1 - B_m^0| \geq |B_f^1 - B_f^0|$ and $|g_m(B_m^1) - g_m(B_m^0)| \geq |g_f(B_f^1) - g_f(B_f^0)|$, where $\Phi_j = \frac{u'(y_y)}{\beta u'(y_o + g_j(0) - h_j(y_o))}$.

Generally, the relative decrements in brideprice and dowry are ambiguous, as shown in Appendix B. When the return on a dowry is relatively low and the return on a brideprice is relatively high, a pension program leads to a larger reduction in the latter than in the former. In an extreme case, the parents provide a marital transfer of zero to a daughter (a corner solution) when the pension is unavailable; consequently, a pension program leads to a decrease in brideprice, whereas dowry remains to be zero.[34] This assumption is likely to hold because we identify a significant positive correlation between brideprice and eldercare provided by sons but observe no significant correlation between dowry and eldercare provided by daughters, as shown in Table B1.

Next, we address the sex selection decision in the first period. For each pregnancy, parents choose whether to reveal the child's sex or not. Parents' objective function in period $t \in \{0, 1\}$ (without and with pension) is

$$\max_{s \in \{0,1\}} s(U_m^t - c) + (1 - s)(0.5U_m^t + 0.5U_f^t) \tag{7}$$

where s is an indicator of whether to use the gender selection technology. $U_j^0 = \max_{B_j}(u(y_y - B_j) + \beta u(y_o + g_j(B_j) - h_j(y_o)))$ and $U_j^1 = \max_{B_j}(u(y_y - B_j - P) + \beta u(y_o + RP + g_j(B_j) - h_j(y_o + RP)))$ for $j = m, f$. Parents can choose to use the gender selection technology (such as ultrasound and abortion) with cost c, which makes sure that parents get a boy, or do not use the gender selection technology and get a boy with 50% chance and a girl with 50% chance. c captures the cost of revealing child's sex and varies by parents' income or preferences. Parents with a lower c are more likely to choose to reveal the sex of the child.

[33] One alternative channel is that pension can change the opportunity cost of providing eldercare service. Park and Shan (2020) shows that pensions can change parents' educational investment in children. However, we focus on the eldercare provided by adult children. These children were adults who have already completed their education at the survey time, while Park and Shan (2020)'s results on education are for those who were children when the plan was implemented.

[34] In reality, dowry is not equal to zero because it serves other purposes. For example, Zhang and Chan (1999) showed that a dowry can increase the bargaining power of the bride in her new conjugal household. Similarly, in addition to purchasing eldercare services, brideprice can also help clear the marriage matching market in the context of China's biased sex ratio (Becker, 1981). In this model, we focus only on eldercare investment as an incentive for providing brideprice or dowry and not on other possible incentives.

Without a pension program, the benefit of having a male child is

$$V^0 = U_m^0 - U_f^0 = \max_{B_m}(u(y_y - B_m) + \beta u(y_o + g_m(B_m) - h_m(y_o))) - \max_{B_f}(u(y_y - B_f) + \beta u(y_o + g_f(B_f) - h_f(y_o))). \quad (8)$$

With a pension program, the benefit of having a male child becomes

$$V^1 = U_m^1 - U_f^1 = \max_{B_m}(u(y_y - B_m - P) + \beta u(y_o + RP + g_m(B_m) - h_m(y_o + RP))) - \max_{B_f}(u(y_y - B_f - P) + \beta u(y_o + RP + g_f(B_f) - h_f(y_o + RP))). \quad (9)$$

Parents will prefer to use such technology if

$$\begin{aligned} & U_m^t - c > 0.5U_m^t + 0.5U_f^t \\ \Rightarrow \quad & V^i > 2c \quad \text{for } i \in \{0, 1\}. \end{aligned}$$

Therefore, we have the following proposition with regard to the son preference:

Proposition 3. $V^1 \leq V^0$ if $B_m^0 > B_f^0$ and $h'_m(y_o) > h'_f(y_o)$.

After a pension program becomes available, the benefit of having a male child declines when two conditions hold. Firstly, the optimal brideprice was higher than the optimal dowry before the pension program was introduced. This condition is upheld in our case, given that we observe a much higher brideprice relative to dowry in rural China before the introduction of NRPS. Secondly, the eldercare provided by sons is more sensitive to parental income than that provided by daughters. As shown in Table 3, NRPS led to a larger decline in the eldercare provided by sons than by daughters among children married before the scheme was implemented. This situation suggests that even for children whose marital transfers are unaffected by NRPS, the eldercare provided by sons declines faster than that provided by daughters after parents have pensions.

This proposition suggests that a pension program provides an alternative investment tool with which to smooth consumption; hence, the parents of a son obtain less benefit from using brideprice to "purchase" eldercare services. Therefore, parents are less likely to use sex selection technology, and the sex ratio declines. The formal proof of this proposition is shown in Appendix B.

The model generates three testable predictions, as follows:

- Hypothesis 1 (Period 3): The pension scheme reduces the eldercare provided by sons more than that provided by daughters.
- Hypothesis 2 (Period 2): The pension scheme reduces brideprice to a greater extent than dowry.

- Hypothesis 3 (Period 1): The pension scheme increases the likelihood that a newborn will be female.

For simplicity, we do not consider the savings decision in this model. Elderly people in rural China have limited savings, contrast with the high saving rates in urban households (Wei and Zhang, 2011). Among elderly people aged 60 years or older in rural China, the average savings amount is only 3,740 yuan (US$620).[35] Incorporating savings in this model will introduce another tool to finance eldercare, but it will not change our main predictions, i.e., pensions can crowd out eldercare provided by sons and therefore reduce investment in sons. Why do rural elderly prefer to use pension and marital transfer rather than savings to finance their eldercare? Firstly, pension and marital transfer are highly attractive because they offer a high rate of return. In particular, the pension program is heavily subsidized by the government. Secondly, pension and marital transfer are annuities and can hedge against the risk of mortality, whereas savings can be used up during a long life. A more general model that also allows for saving decision will predict that the pension will crowd out both private household savings and eldercare provided by children. Since rural elderly have little savings and heavily rely on the eldercare service provided by children, the crowding-out effect on savings is relatively small compared to old-age support.

This stylized model also assumes a full-commitment environment, such that children provide care to their parents based on the marital transfer. Compared with the pension, which is a formal type of insurance that guarantees payments, brideprice as an investment in eldercare is subject to the problem of limited commitment (Kotlikoff and Spivak, 1981). Studies have documented that many rural parents are left behind by adult children who work in urban areas (Connelly and Maurer-Fazio, 2016; Zhong, 2019). Allowing for this problem of limited commitment in the model will decrease the expected return of parental investment in children. This condition can be captured by changing parents' optimization problem in the second period into $\max_{B_j} u(y_y - B_j - P) + \beta p u(y_o + RP + g_j(B_j) - h_j(y_o + RP)) + \beta(1-p)u(y_o + RP)$ for $j \in \{m, f\}$, where p is the probability that the child will fulfill the commitment. The predictions are still upheld under the new optimization problem.

Appendix B Proof of Propositions

In this appendix, we prove the three propositions in the model section.

Proposition 1. $B_j^1 \leq B_j^0$ and $T_j^1 \leq T_j^2$, for $j \in \{m, f\}$.

A pension program can affect the eldercare provided by children in two ways. Firstly, a pension program provides a windfall income to elderly people older than 60 years who participate in the program. As $T_j = g_j(B_j) - h_j(y_o)$ declines in parental income, the eldercare provided by children declines.

[35] Data source: CHARLS 2011–2015.

Secondly, a pension program provides an investment option for parents. Therefore, parents may reduce their marital transfer to their children, who may then reduce the provision of eldercare services to the parents in response. Below we formally prove the second channel.

Without a pension program, the first-order condition is

$$u'(y_y - B_j^0) = \beta u'(y_o + g_j(B_j^0) - h_j(y_o))g_j'(B_j^0) \quad j \in \{m, f\} \tag{10}$$

With a pension program, the first-order condition becomes

$$u'(y_y - P - B_j^1) = \beta u'(y_o + RP + g_j(B_j^1) - h_j(y_o + RP))g_j'(B_j^1) \quad j \in \{m, f\} \tag{11}$$

Recall that both $u()$ and $g_j()$ are concave functions. We assume that the net return of a pension program is positive, i.e., $RP - h(y_o + RP) + h_j(y_o) > 0$. Therefore, a pension program leads to an increase in the left-hand side (LHS) of Eq. (10) and a decline in the right-hand side (RHS) of Eq. (10). We can easily show that the LHS of Eq. (10) increases and the RHS decreases in B_j. Therefore, the equation can only be re-balanced by reducing B_j. As $g_j(B_j)$ increases in B_j, a decrease in parental transfer B_j leads to a decrease in the eldercare provided by children.

Proposition 2. If $g_f'(0) \leq \Phi_f$ and $g_m'(0) > \Phi_m$, $|B_m^1 - B_m^0| \geq |B_f^1 - B_f^0|$ and $|g_m(B_m^1) - g_m(B_m^0)| \geq |g_f(B_f^1) - g_f(B_f^0)|$, where $\Phi_j = \frac{u'(y_y)}{\beta u'(y_o + g_j(0) - h_j(y_o))}$.

When $g_f'(0) \leq \frac{u'(y_y)}{\beta u'(y_o + g_f(0) - h_f(y_o))}$, the LHS of Eq. (10) is greater than the RHS of Eq. (10) at $B_f = 0$ for female children. Recall that LHS increases and RHS decreases in B, suggesting that no interior solution exists for the maximization problem in Eq. (6) for female children. The maximizer is the corner solution at $B_f^0 = 0$, i.e., the parents provide a dowry of zero to daughters. Given that $g_m'(0) > \frac{u'(y_y)}{\beta u'(y_o + g_m(0) - h_m(y_o))}$, an interior solution exists for brideprice transferred to male children, i.e., $B_m^0 > 0$.

When a pension program becomes available, dowry remains at the corner solution because $g_f'(0) \leq \frac{u'(y_y - P)}{\beta u'(y_o + RP + g_f(0) - h_f(y_o + RP))}$ remains true. Consequently, dowry does not change. We have shown that, without a pension, brideprice has an interior solution. According to Proposition 1, brideprice will decline after the introduction of a pension program. Therefore, $|B_m^1 - B_m^0| > |B_f^1 - B_f^0| = 0$ and $|g_m(B_m^1) - g_m(B_m^0)| > |g_f(B_m^1) - g_f(B_m^0)| = 0$.

In general, it remains unclear whether a pension leads to a greater decrease in brideprice than in dowry. Here, we provide a counter-example in which a pension program leads to a larger decline in dowry than in brideprice. Suppose that $u(y) = \log(y)$, $g_j(B_j) = \gamma_j B_j$, and $h_j(y) = 0$ for $j \in \{m, f\}$. The first-order condition in Eq. (10) becomes

$$B_j^0 = \frac{\beta \gamma_j y_y - y_o}{(1 + \beta)\gamma_j}.$$

The first-order condition in Eq. (11) becomes

$$B_j^1 = \frac{\beta\gamma_j(y_y - P) - (y_o + RP)}{(1+\beta)\gamma_j}.$$

Therefore, we have

$$B_j^1 - B_j^0 = \frac{-(\beta\gamma_j P + RP)}{(1+\beta)\gamma_j}.$$

Given that the return on dowry is lower than the return on brideprice, we obtain $\gamma_f < \gamma_m$. From the equation above, we know that $|B_f^1 - B_f^0| > |B_m^1 - B_m^0|$.

Proposition 3. $V^1 \leq V^0$ if $B_m^0 > B_f^0$ and $h'_m(y_o) > h'_f(y_o)$.

To prove the last proposition, we define

$$\begin{aligned} h(y_y, y_o) = &\max_{B_m}(u(y_y - B_m) + \beta u(y_o + g_m(B_m) - h_m(y_o))) \\ &- \max_{B_f}(u(y_y - B_f) + \beta u(y_o + g_f(B_f) - h_f(y_o))) \end{aligned}$$

Referring to the envelope theorem, we have

$$\frac{\partial h}{\partial y_y} = u'(y_y - B_m(y_y, y_o)) - u'(y_y - B_f(y_y, y_o))$$

where $B_m(y_y, y_o)$ and $B_f(y_y, y_o)$ are the optimal parental investments for a son's and daughter's parents, respectively, when the parental incomes are (y_y, y_o). Given that $u()$ is a concave function, if $B_m(y_y, y_o) > B_f(y_y, y_o)$, then $\frac{\partial h}{\partial y_y} > 0$.

Referring to the envelope theorem, we also have

$$\begin{aligned} \frac{\partial h}{\partial y_o} = &\beta u'(y_o + g_m(B_m(y_y, y_o)) - h_m(y_o))(1 - h'_m(y_o)) \\ &- \beta u'(y_o + g_f(B_f(y_y, y_o)) - h_f(y_o))(1 - h'_f(y_o)) \end{aligned}$$

Given that $u()$ is a concave function and $g_m(B) - h_m(y_o) = T_m(B, y_o) > T_f(B, y_o) = g_f(B) - h_f(y_o)$ for any (B, y_o), if $B_m(y_y, y_o) > B_f(y_y, y_o)$, then $u'(y_o + g_m(B_m(y_y, y_o)) - h_m(y_o)) < u'(y_o + g_f(B_f(y_y, y_o)) - h_f(y_o))$. In addition, $h'_m(y_o) > h'_f(y_o)$ for any y_o. Therefore, $\frac{\partial h}{\partial y_o} < 0$.

We have proven that h increases in y_y and decreases in y_o. Given that a pension program increases y_o and reduces y_y, we prove that $V^1 = h(y_y - P, y_o + RP) < h(y_y, y_o) = V^0$.

Appendix C Additional Results

Table B1: Effects of Parental Transfer at Marriage on Co-residence (Rural)

	(1)	(2)
Sample	Son	Daughter
Log of parental transfer at children's marriage	0.017*	0.002
	(0.009)	(0.010)
Observations	1,711	775
County fixed effects	YES	YES
Year fixed effects	YES	YES

Notes: 1. Data are from CHARLS & CFPS 2010–2016.

2. The dependent variable is a dummy indicating whether the child lives with the parents. We focus on a sample of rural adult children who were married between 2000 and 2015.

3. We adopt the LPM model. Standard errors are in parentheses and clustered at the county level.

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

Table B2: Effect of NRPS on the Eldercare Outcomes in the Rural Sample (Without Controls)

	(1)	(2)	(3)	(4)
Sample	All	Married Male	Married Female	Unmarried
A. The dependent variable is whether co-reside with parents (Yes = 1)				
NRPS	-0.040***	-0.082***	0.010	-0.020
	(0.014)	(0.020)	(0.008)	(0.073)
Observations	38,518	18,306	15,901	4,311
B. The dependent variable is whether provide physical help to parents (Yes = 1)				
NRPS	-0.053	-0.104**	-0.074	-0.105
	(0.033)	(0.048)	(0.050)	(0.108)
Observations	3,899	1,920	1,459	520
C. The dependent variable is the log parental transfer at the child's marriage				
NRPS	–	-0.290**	0.179	–
	–	(0.131)	(0.219)	–
Observations	–	1,769	1,024	–
County fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES

Notes: 1. The first panel uses data from CHARLS & CFPS 2010–2016, the second panel uses data from CHARLS 2011–2015, and the last panel uses data from CHARLS 2015.

2. The dependent variable is a dummy variable indicating whether the adult child lives with the parents in the first panel, a dummy variable indicating whether the child provides physical help to the parents in the second panel, and the log value of the parental payment at the child's marriage in the third panel. We only include the county and year fixed effects in the regressions. We focus on a sample of rural adult children who were married between 2000 and 2015 in all three panels and a sample of rural adult children with parents aged 55-85 in the first two panels.

3. We use the LPM model in the first two panels and the OLS model in the last panel. Standard errors are in parentheses and clustered at the county level.

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

Table B3: Effect of NRPS on Whether Parents Need Help (Rural)

	(1) Any difficulty with all activities	(2) Level of difficulty with all activities	(3) Any difficulty with basic activities	(4) Level of difficulty with basic activities	(5) Any difficulty with daily activities	(6) Level of difficulty with daily activities
NRPS	0.030	-0.007	0.020	0.019	0.004	-0.027
	(0.132)	(0.035)	(0.130)	(0.055)	(0.093)	(0.027)
Observations	5,598	5,598	5,595	5,595	5,598	5,598
County fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Child controls	YES	YES	YES	YES	YES	YES
Parent controls	YES	YES	YES	YES	YES	YES

Notes: 1. We use data from CHARLS 2011–2015.

2. The dependent variables in Columns (1), (3) and (5) are dummy variables indicating whether the parent has any difficulty with all activities, basic activities, and daily activities, respectively. The dependent variables in Columns (2),(4) and (6) are the average self-assessed level of difficulty with all activities, basic activities, and daily activities, respectively. Basic activities include jogging 1 km, walking 1 km, walking 100 meters, getting up from a chair after sitting for a long period, climbing several floors, stooping, kneeling or crouching, reaching or extending arms above shoulder level, carrying weights over 10 jin, and picking up a small coin from a table. Daily activities include dressing, bathing, eating, getting into or out of bed, using toilet, controlling urination and defecation, doing household chores, cooking, shopping, making phone calls, taking medications, and managing money.

3. The parent controls include the parental education level and age, and the child controls include the child's sex, education level, and age. We focus on a sample of rural elderly aged 55-85.

4. We use the LPM model in odd columns and the OLS model in even columns. Standard errors are in parentheses and clustered at the county level.

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

Table B4: Robustness Check – Effect of NRPS on Probability of Parental Transfer

	(1)	(2)
Sample	Married Male	Married Female
The dependent variable is whether to make parental transfer at the child's marriage		
NRPS	-0.013	-0.015
	(0.035)	(0.049)
Observations	5,473	2,991
County fixed effects	YES	YES
Year fixed effects	YES	YES

Notes: 1. All panels use data from CHARLS 2015. The dependent variable is a dummy that indicates whether parents made parental transfer at the child's marriage. The parent controls include the parental education level and age, and the child controls include the child's sex, education level, and age. We focus on a sample of rural adult children who were married between 2000 and 2015.

2. We use the LPM model. Standard errors are in parentheses and clustered at the county level.

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

Table B5: Effect of NRPS on the Probability of Having a Female Child by Birth Order

Sample	(1)	(2)	(3)	(4)	(5)	(6)
	Rural			Urban		
	Two-way FE	First treatment	CD2020	Two-way FE	First treatment	CD2020
The dependent variable is whether the newborn is a girl (Yes = 1)						
A. First birth						
NRPS	0.0318**	0.0283	0.0492*	-0.0075	-0.0019	-0.0209
	(0.0146)	(0.0192)	(0.0263)	(0.0117)	(0.0157)	(0.0230)
Observations	35,896	23,500	10,274	61,031	37,168	17,800
B. Second or higher order birth						
NRPS	0.0320**	0.0600***	0.0524	0.0225	0.0304	0.0050
	(0.0162)	(0.0225)	(0.0239)	(0.0152)	(0.0225)	(0.0298)
Observations	32,981	20,172	8,813	39,008	21,861	9,571
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: 1. Data are from the 2015 mini census micro-level data.

2. The dependent variable is a dummy indicating whether the newborn is female. We focus on a sample of rural (or urban) individuals born between 2005 and 2015. We divide the sample into first birth and second or higher order birth.

3. Two-way FE controls for county and cohort fixed effects. First treatment combines the first-treated sample (children born in counties that introduced NRPS in 2009) and the not-yet-treated sample (children born before NRPS implementation in counties that introduced NRPS in 2010, 2011, and 2012). CD2020 follows de Chaisemartin and D'Haultfoeuile (2020) and applies the didmultiplegt package in Stata. DDD compares the treatment effect between rural and urban regions and controls for county times region and cohort times region fixed effects.

4. In all columns, we use the LPM model. Standard errors are in parentheses and clustered at the county level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table B6: Triple Difference Estimation – Effect of NRPS on Eldercare Outcomes

Sample	(1) All	(2) Married Male	(3) Married Female	(4) Unmarried
A. The dependent variable is whether co-resides with parents (Yes = 1)				
NRPS × Rural	-0.041	-0.073**	-0.014	0.013
	(0.025)	(0.037)	(0.021)	(0.087)
Observations	55,708	25,993	23,056	6,659
B. The dependent variable is whether provide physical help to parents (Yes = 1)				
NRPS × Rural	-0.087	-0.298**	-0.074	-0.188
	(0.056)	(0.123)	(0.097)	(0.296)
Observations	5,425	2,642	2,047	736
C. The dependent variable is the log parental transfer at the child's marriage				
NRPS ×Rural	–	-0.428*	-0.014	–
	–	(0.223)	(0.400)	–
Observations	–	2,684	1,643	–
County X region fixed effects	YES	YES	YES	YES
Year X region fixed effects	YES	YES	YES	YES
Child controls	YES	YES	YES	YES
Parent controls	YES	YES	YES	YES

Notes: 1. The first panel uses data from CHARLS & CFPS 2010–2016, the second panel uses data from CHARLS 2011–2015, and the last panel uses data from CHARLS 2015.

2. The dependent variables in the first, second, and last panels are a dummy variable indicating whether the adult child lives with the parents, a dummy variable indicating whether the child provides physical help to the parents, and the log value of the parental transfer at the child's marriage, respectively. Parent controls include the parental education level and age, and child controls include the child's sex, education level, and age. We focus on a sample of rural and urban adult children who were married between 2000 and 2015 in all three panels and a sample of rural and urban adult children with parents aged 55-85 in the first two panels.

3. All panels adopt the DDD model. We use the LPM model in the first two panels and the OLS model in the last panel.

4. Standard errors are in parentheses and clustered at the county level.

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

Table B7: Robustness Check – Effect of NRPS on the Probability of Having a Female Child

Sample	(1)	(2)	(3)
	Rural		Rural+Urban
	First treatment	CD2020	DDD
The dependent variable is whether the newborn is a girl (Yes = 1)			
NRPS	0.0381**	0.0402**	0.0075
	(0.0148)	(0.0205)	(0.0090)
NRPS × Rural			0.0261*
			(0.0139)
Observations	44,174	21,484	171,130
County FE	Yes	Yes	No
Cohort FE	Yes	Yes	No
County × Region FE	No	No	Yes
Cohort × Region FE	No	No	Yes

Notes: 1. Data are from the 2015 mini census micro-level data.

2. The dependent variable is a dummy indicating whether the newborn is female. We focus on a sample of individuals born between 2005 and 2015.

3. First treatment analyzes the treatment effect for counties implemented NRPS in 2009. It combines the first-treated sample (children born in counties that introduced NRPS in 2009) and the not-yet-treated sample (children born before NRPS implementation in counties that introduced NRPS in 2010, 2011, and 2012). CD2020 follows de Chaisemartin and D'Haultfoeuile (2020) and uses the stata package did_multiplegt. First treatment and CD2020 use the rural sample. DDD uses all data from the rural and urban samples and adopt a difference-in-difference-in-differences model. It compares the treatment effect between rural and urban regions and additionally controls for county times region (rural or urban) and cohort times region fixed effects.

4. In all columns, we use the LPM model. Standard errors are in parentheses and clustered at the county level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table B8: The Impact of NRPS on Brideprice – Event Study and Dynamic DD Estimation

	(1)	(2)	(3)	(4)
Sample	Rural	Rural	Urban	Rural + Urban
Estimation	Event Study	Event Study	Event Study	Dynamic DD
The dependent variable is the log value of brideprice				
Years relative to NRPS implementation				
-4	–	0.161	-0.122	0.195
	–	(0.261)	(0.400)	(0.478)
-3	–	0.064	-0.203	0.095
	–	(0.204)	(0.321)	(0.375)
-2	–	0.075	-0.009	0.035
	–	(0.144)	(0.202)	(0.243)
-1	–	–	–	–
	–	–	–	–
0	-0.370***	-0.467***	0.225	-0.545**
	(0.126)	(0.153)	(0.217)	(0.253)
1	-0.583**	-0.775***	0.574	-1.061**
	(0.234)	(0.288)	(0.359)	(0.409)
2	-0.314	-0.572*	0.597	-0.852*
	(0.256)	(0.327)	(0.376)	(0.437)
Observations	1,613	1,613	875	2,614
County FE	Yes	Yes	Yes	No
Marital Year FE	Yes	Yes	Yes	No
County $\times$ Region FE	No	No	No	Yes
Marital Year $\times$ Region FE	No	No	No	Yes

Notes: 1. This table reports the estimated coefficients in Figures 5a and 5b. All panels use data from CHARLS 2015.

2. The dependent variable is the log value of brideprice. Column (1) reports the coefficients of D_{ct}^{l} in Equation (4) estimated for the rural sample. Columns (2) and (3) report the coefficients of D_{ct}^{l} in Equation (3) estimated for the rural and urban sample, respectively. Column (4) reports the coefficients of the interactions between R_i and D_{ct}^{l} in Equation (5) using the full sample. The marital year just before NRPS implementation is the reference group. The controls include the education level and age of parents and adult children. We focus on a sample of adult children who were married between 2000 and 2015.

3. We use the OLS model. Standard errors in parentheses and clustered at the county level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B9: The Impact of NRPS on Dowry – Event Study and Dynamic DD Estimation

	(1)	(2)	(3)	(4)
Sample	Rural	Rural	Urban	Rural + Urban
Estimation	Event Study	Event Study	Event Study	Dynamic DD
The dependent variable is the log value of dowry				
Years relative to NRPS implementation				
-4	–	0.105	0.468	-0.471
	–	(0.341)	(0.332)	(0.616)
-3	–	-0.201	0.220	-0.485
	–	(0.282)	(0.318)	(0.532)
-2	–	-0.111	0.218	-0.354
	–	(0.238)	(0.305)	(0.408)
-1	–	–	–	–
	–	–	–	–
0	0.194	0.092	-0.035	0.096
	(0.225)	(0.227)	(0.308)	(0.402)
1	0.184	0.037	0.061	-0.126
	(0.316)	(0.339)	(0.394)	(0.554)
2	0.156	-0.022	-0.402	0.230
	(0.414)	(0.456)	(0.373)	(0.672)
Observations	915	915	619	1,534
County FE	Yes	Yes	Yes	No
Marital Year FE	Yes	Yes	Yes	No
County $\times$ Region FE	No	No	No	Yes
Marital Year $\times$ Region FE	No	No	No	Yes

Notes: 1. This table reports the estimated coefficients in Figures 5c and 5d. All panels use data from CHARLS 2015.

2. The dependent variable is the log value of dowry. Column (1) reports the coefficients of D_{ct}^{l} in Equation (4) estimated for the rural sample. Columns (2) and (3) report the coefficients of D_{ct}^{l} in Equation (3) estimated for the rural and urban sample, respectively. Column (4) reports the coefficients of the interactions between R_i and D_{ct}^{l} in Equation (5) using the full sample. The marital year just before NRPS implementation is the reference group. The controls include the education level and age of parents and adult children. We focus on a sample of adult children who were married between 2000 and 2015.

3. We use the OLS model. Standard errors in parentheses and clustered at the county level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B10: The Impact of NRPS on Having a Female Birth – Event Study and Dynamic DD Estimation

	(1)	(2)	(3)	(4)
Sample	Rural	Rural	Urban	Rural + Urban
Estimation	Event Study	Event Study	Event Study	Dynamic DD
The dependent variable is whether the newborn is a girl				
Years relative to NRPS implementation				
-4	–	0.0035	-0.0043	0.0059
	–	(0.0142)	(0.0119)	(0.0186)
-3	–	0.0015	0.0002	-0.0001
	–	(0.0111)	(0.0092)	(0.0145)
-2	–	0.0076	-0.0125*	0.0193*
	–	(0.0086)	(0.0073)	(0.0114)
-1	–	–	–	–
	–	–	–	–
0	0.0134	0.0155*	-0.0073	0.0234**
	(0.0085)	(0.0090)	(0.0073)	(0.0114)
1	0.0310***	0.0326***	0.0059	0.0280*
	(0.0105)	(0.0113)	(0.0095)	(0.0146)
2	0.0210	0.0223	-0.0104	0.0348*
	(0.0130)	(0.0143)	(0.0117)	(0.0185)
3	0.0170	0.0180	-0.0034	0.0242
	(0.0154)	(0.0175)	(0.0144)	(0.0225)
4	0.0453**	0.0460**	0.0058	0.0437
	(0.0183)	(0.0214)	(0.0175)	(0.0278)
Observations	79,059	79,059	113,958	193,020
County FE	Yes	Yes	Yes	No
Cohort FE	Yes	Yes	Yes	No
County $\times$ Region FE	No	No	No	Yes
Cohort $\times$ Region FE	No	No	No	Yes

Notes: 1. This table reports the estimated coefficients in Figure 6. Data are from the 2015 mini census.

2. The dependent variable is a dummy variable indicating whether the newborn is female. Column (1) reports the coefficients of D_{ct}^{l} in Equation (4) estimated for the rural sample. Columns (2) and (3) report the coefficients of D_{ct}^{l} in Equation (3) estimated for the rural and urban sample, respectively. Column (4) reports the coefficients of the interactions between R_i and D_{ct}^{l} in Equation (5) estimated using the full sample. The birth year just before NRPS implementation is the reference group. The controls include the parents' ethnicity, age, age squared, and education. We focus on a sample of individuals born between 2000 and 2015.

3. We use the OLS model. Standard errors in parentheses and clustered at the county level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B11: Robustness Check – Effect of NRPS on Parental Transfer

	(1)	(2)
Sample	Married Male	Married Female
The dependent variable is the log parental transfer at the child's marriage		
A. Rural: Keep first treatment only		
NRPS	-0.373*	0.263
	(0.218)	(0.296)
Observations	1,313	755
B. Rural: de Chaisemartin and D'Haultfoeuille (2020)		
NRPS	-0.439**	0.431
	(0.204)	(0.593)
Observations	1,769	1,024
County fixed effects	YES	YES
Year fixed effects	YES	YES

Notes: 1. All panels use data from CHARLS 2015. The dependent variable is the log value of the parental transfer at the child's marriage. The parent controls include the parental education level and age, and the child controls include the child's sex, education level, and age. We focus on a sample of rural adult children who were married between 2000 and 2015.

2. In panel A, we combine the first-treated sample (marriages in counties that introduced NRPS in 2009) and the not-yet-treated sample (marriages happened before NRPS implementation in counties that introduced NRPS in 2010, 2011, and 2012). In panel B, we following the method of de Chaisemartin and D'Haultfoeuille (2020) and use the stata package did_multiplegt.

3. We use the OLS model. Standard errors are in parentheses and clustered at the county level.

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

Table B12: Effect of NRPS on the Number of Marriages in the Rural Sample

	(1)
Dependent Variable	Number of Marriages
NRPS	0.0047
	(0.3351)
Observations	15,883
County fixed effects	YES
Marital year fixed effects	YES

Notes: 1. Data are from the 2010 census micro-level data.

2. The dependent variable is the number of marriages at the county-year level. The sample is restricted to marriages that occurred during or after 2005 in rural areas.

3. We use the OLS model. Standard errors are in parentheses and clustered at the county level.

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

Table B13: Effect of NRPS on the Marital Ages and Education Levels of Newly Married Children in the Rural Sample

	(1)	(2)
Dependent Variable	Marital Age	Years of Education
NRPS	0.133	-0.060
	(0.182)	(0.123)
Observations	5,486	5,486
County fixed effects	YES	YES
Year fixed effects	YES	YES
Child controls	YES	YES

Notes: 1. Data are from CHARLS 2015.

2. The dependent variable is the marital age of the adult children in the first column, and the years of education of adult children in the second column. We focus on a sample of rural adult children who were married between 2000 and 2015.

3. We use the OLS model. Standard errors are in parentheses and clustered at the county level;

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

Table B14: Effect of NRPS on the Number of Newborns in the Rural Sample

	(1)	(2)
Dependent Variable	Has a newborn	Has a second or higher-order birth
NRPS	-0.0016	-0.0012
	(0.0011)	(0.0017)
Observations	588,775	321,178
County FE	YES	YES
Year FE	YES	YES

Notes: 1. Data are from the 2015 mini census micro-level data.

2. The dependent variable is an indicator of whether a household has a newborn in the first column, and whether the household has a second or higher-order birth in the second column. The sample is restricted to households in rural areas.

3. We use the LPM model. We control for county and year fixed effects, as well as the parents' ethnicity, age, age squared, and education. Standard errors are in parentheses and clustered at the county level.

4. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.