Children, support in old age and social insurance in rural China

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Abstract: Most people in rural China have no plans for retirement other than the ingrained Chinese tradition that children care for old parents. Actually there are also no sources of social support such as social old-age insurance to rely on in rural people' old age for a long time in China. In 1992, a social old-age insurance program, rural pension program, was initiated by the Chinese government to firstly establish a social security system in China's rural area. The rural pension program experienced rapid development in the beginning years but grounded to halt after 1998. Since either children or pension program provides support for elderly, we expected that these two can be viewed as substitutes to some extent. Using data from China's 2005 mini-census, we find that rural people who have at least one son are less likely to participate in pension program and each additional son and daughter both decreases their participation rate. Moreover, the effect of an additional son is much larger than that of an additional daughter. In addition, both evidence from mini-census and China Health and Retirement Longitudinal Study show that peasants accessing to pension are less likely to rely on their children for support in old age. These findings suggest that demand for children, especially for sons are partly driven by concerns relating to care in old age; children and formal social old-age insurance are substitutes for support in old age. We then expect that implementation of social old-age insurance may mitigate rural people' demand for children, especially sons and thus correct China's severe sex ratio bias to some extent. We test this hypothesis using the difference-in-differences strategy, and find that increase of sex ratio at the region level slowed down after the implementation of the rural pension program. Overall, our empirical analysis in this paper implies that sex ratio bias is partly due to demanding for sons for support in old age and carrying out social old-age insurance in rural China are helpful in mitigating demand for children and correcting sex ratio bias.

Key words: children; rural pension; sex ratio
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1. Introduction

In China, especially in rural area, raising children for old age support is an ingrained tradition for a long time. This tradition has somewhat changed in urban area as the development of social insurance system. For rural people, who almost have no social insurance to rely on until recently, still have to rely on their adult children for support in old age (Shi, 2006). According to China's 2005 mini-census, about 70.64% of the elderly aged 65 and above are mainly supported by their family members. One more thing, sons rather than daughters are traditionally expected to take care of parents in old age. This is usually attributed to China's traditional patrilineal family system and patrilocal culture. Although these traditions have changed to some extent in urban area, they are still quite prevalent in rural area. Under this traditional culture, parents call in a daughter-in-law for each of their sons, and after marriage sons are entitled to co-reside with their parents until family division occurs or until both of their parents pass away; family property is also usually inherited by sons, and sons are obliged to take care of their old age parents (Li et al, 2004). The fact that adult children, especially adult sons serve as providers of support in old age resulted in high fertility rate and son preference in China's rural area. Patterns of births indicate that parents seldom stop giving birth until they have at least one son (Zeng, et al. 1993; Ebenstein, 2010).

In order to promote modernization by slowing the rapid growth of China's population, the Chinese government initiated a population control campaign in 1970 which advocates one family to have no more than two children. Thereafter the voluntary family planning became a strictly enforced family planning policy in 1979, i.e. one family is only permitted to have one child. In rural area, where farmers' overwhelming desire for sons who can serve as labor sources and sources of support in old age has made the one-child policy difficult to enforce. Consequently, the government relaxed the one-child policy in 1984 to "1.5 child policy" in most of rural areas. Parents whose first child is female are allowed to give a second birth; otherwise, only one child is allowed (Zeng, 2007). Despite nationwide resistance from rural families, the Chinese government had succeeded in reducing population size. China's total fertility rate decreases from six births per woman in 1970 to two births per woman in 1980 and further to 1.5 births in 2007. One unanticipated consequence of the family planning policy was a rapid rise of

sex-ratio at birth (Ebenstein, 2010; Li Hongbin et al 2010).[1] The rural people, who want to have a son but are not allowed to have more than two children, try their best to give birth a son at the first parity through prenatal selection or abortion. Sex ratio at birth increased from 108.47 in 1981 to 120.56 in 2008 (see Figure 1). High sex ratio bias implies a large number of men would fail to find a spouse, which may cause violent crime and other socioeconomic problems (Ebenstein and Jennings, 2008; Edlund et al., 2010) .

Figure 1

It was hypothesized that given the strict family planning policy, the fact that sons rather than daughters serve as providers of support in old age and lacking of old-age insurance are main reasons of the higher sex ratio at birth in rural China (Zeng, 2005). Using data from China Household Income Survey, Ebenstein and Leung (2010) firstly show that an important motivation for having a son is to secure a viable source of support in old age and female deficit is related to a missing market for social insurance. On the basis of their study, using a new large dataset, this paper examines how the presence of sons or daughters affects the pension enrollment decisions of the rural people, how accessing to pension program affects their choices of support in old age and how accessing to social old-age insurance affect rural people's fertility behavior. In all, we try to find out whether sons and social old-age insurance are substitutes and thus carrying out social old-age insurance can mitigate demand for sons and thereafter correct sex ratio bias. Our paper shares the same research purpose with Ebenstein and Leung (2010) that it studies the relationship between absence of sons and pension enrollment decision and examines the impact of availability of pension on sex ratio. However, Ebenstein and Leung (2010) use a much smaller dataset than us, which only cover about one hundred counties. And, partly due to the limitation of the dataset, its estimation results suffer from several problems: first, when examining the impact of no sons on pension participation, its setup fails to control total number of children[2] and region fixed effect, which probably overestimate the impact of sons; second, since the households in its sample has not yet finished childbearing history, there may be severe reverse effect considering the

[1] Sex ratio is defined as the number of male per 100 female.
[2] It is impossible to calculate the total number of children in CHIS data since only children living with parents are surveyed.

impact of the pension program on fertility behavior established in the second part of the paper; third, the sex ratio of the birth cohorts from 1991 to 2000 is not appropriate for serving as the post-program sex ratio under the difference-in-differences framework, since the program is still under development during 1991 to 2000, it is clearly that the development of the program between 1991 and 2000 would be affected by the fertility pattern during this period. Under the difference-in-differences framework, the post-program sex ratio should be calculated using the birth cohorts after 1998, in which year the program stops to receive new participants; finally, limited by the dataset, only sex ratios in 95 regions have been examined, which may could not reflect the nationwide situation. In this paper, we use data from China's 2005 mini-census, the largest dataset that qualified for the purpose of our study. We restrict our sample to parents who have finished their childbearing history in estimating the impact of number of sons and daughters on parents' enrollment decisions in an attempt to avoid the reverse effect and also add region dummies to eliminate the unobservable relevant factors. We find impact similar to Ebenstein and Leung (2010), but with a much smaller magnitude, especially after controlling for region fixed effects. We also find parents who had pension benefits are less likely to rely on their family members for support. These findings do suggest that demand for children, especially sons, is driven by concerns relating to care in old age. Using data from a newly conducted household survey, China Health and Retirement Longitudinal Study (CHARLS), we estimate the impact of accessing to social old-age insurance on peasants' choice of support in old age. We find people accessing to social old-age insurance are significantly less like to choose children as providers of support in old age. This result re-confirms our evidence from mini-census data. Finally, we examine the impact of implementation of pension program on sex ratio at the region level. We employ the standard difference-in-differences (DID) strategy. Sex ratio of birth cohorts from 1999 to 2005 is used as post-program sex ratio at birth, while sex ratio of birth cohorts from 1985 to 1991 is used as before-program sex ratio at birth. We also take into account of the different mortality rates between male and female across ages by calculating the mortality-adjusted sex ratio. The identification assumption for the validity of our DID strategy is formally tested. Our empirical results suggest that carrying out pension program in rural China significantly mitigated sex ratio. Our more convincing estimation results confirm the conclusion of Ebenstein and Leung (2010) that carrying out pension program mitigated the increase in sex ratio at

birth, however, with a much smaller magnitude.

The rest of the paper is laid out as follows. Section 2 briefly introduces the pension program carried out in rural China. Section 3 describes the datasets we are using. Section 4 provides empirical results. In section 5, we conclude.

2. Pension Programs in China's Rural Area

In China's rural area, the traditional old-age support system is based on collective system and family before 1978 and singly based on family after the introduction of the Household Responsibility System in 1978. Before 1978, most farmers receive basic guarantees provided by the collectives, such as employment and income and old age security; after 1978, when people totally lose the ability to work, they are taken care of by their own family members, mainly their adult children (Wang, 2006). In early 1980s, the Chinese government tried establishing social security system in urban area. The milestone of this trial is the promulgation of "*Decision on endowment insurance reform of enterprise workers*" in 1991, which marks the establishment of urban basic endowment insurance system. The government's endeavor to establish social security system is synchronous in urban and rural area. Also in 1991, the Chinese government carried out pilot projects for establishing an old-age social insurance system in rural area, and then formally promulgated "*Basic Program of Rural Old-age Pension at region level (Trial)"* (Ministry of Civil Affairs, 1992) as regulations in the next year. The rural old-age pension program was initiated under the supervision of the Ministry of Civil Affairs and is funded by individual contributions with supplemental collective-sponsored contributions and governmental policy support (Wang, 2006). By the end of 1992, the Ministry had expanded the program to over 1000 regions, thereafter throughout China (Leisering et al, 2002). According to the document "*Basic Program of Rural Old-age Pension at region level (Trial)"* (Ministry of Civil Affairs, 1992), all rural residents aged 20-60 years were eligible to participate in the pension program and promised to receive pension benefits once they turn 60 years old.

Figure 2

The rural pension program was highly popular among peasants and experienced rapid expansion

since 1992. It was estimated that more than 75.42 million farmers had underwritten the insurance scheme by the end of 1997. Figure 2 depicts the development of the program from 1995 to 2007. It is shown that despite the initial success of the rural pension program during the early 1990s the development of program ground to halt after 1998. Poor management, intimidating recruitment tactics and embezzlement and suspicions related to the financial sustainability of the promised returns mitigate support from the central government (Zeng, 1995; Shi, 2006; Wang, 2006). The work of rural old-age pension program was transferred from the Ministry of Civil Affairs to the Ministry of Labor and Social Security[3] in 1998. Political conflict eroded internal support for the program, and the Asian financial crisis also provided the impetus for a fundamental change in policy orientation (Shi, 2006). The State Council acclaimed to rectify the existing business and to stop accepting new business in 1999. The percentage of farmers insured sharply declined in the following years, falling from 15.4 percent in 1997 to 11.0 percent in 2004 (Wang, 2006). Regions participating in this rural pension program decreased from 2100 in 1999 to 1887 in 2004 (Zeng, 2005). It is estimated that the participation rate is less than 3% by the end of 2005[4].

It is a pity that the first trial of establishing social old-age insurance system in China's rural area ends in failure. After about ten years of the stagnation of the rural old-age pension program, the Chinese government restarts to carry out social old-age insurance in China in 2009, which is now named as new rural old-age pension program (NRPP). NRPP has been developing rapidly since the implementation. By the end of 2010, there was a coverage rate of 24%. In the work discussion meeting on rural social insurance held in Dec. 2011, the vice Minister Hu Xiaoyi said NRPP would cover all rural areas by the end of 2012, eight years earlier than originally planned.

3. Data

China's 2005 mini-census

This is the main dataset we are using in this paper, and is also the largest individual-level dataset qualified for our research purpose. The mini-census consists of basic demographic information for

[3] Now it is named Ministry of Human Resources and Social Security (MOHRSS).
[4] Data come from *China agricultural statistics yearbook*, 2005.

individual respondents and also contains information regarding respondents' participation in social insurance (including pension and health insurance), work status and source of old-age support. For female respondents aged from 16 to 64, we also have their fertility information.

Figure 3

Individual-level data are employed to examine the effects of number and sex composition of children on parents' pension enrollment decision. Subjects are restricted to household head and spouse of household head, and further restricted to female aged from 50 to 64 and male whose spouse aged from 50 to 64. In the 2005 mini-census, women aged 65 or above have not been asked about information on fertility, thus have no information on number of children. Restricted to female aged above 50 and male whose spouse aged above 50 are for two concerns: first, people in this group are more likely to participate in the social insurance and thus they are the people we are concerning (see Figure 3); second, more importantly, restricting to female who are at least 50 year old could do us a favor in avoiding two-way effect in our econometric analysis, which will be discussed in detail later. We further classify observations by their types of work unit and restrict our sample to those who are self-employed (operators of land contract and those work individual business), work in other types of enterprises or not at work[5]. People who work in governments and institutions or formal enterprises are often mandated to participate in social insurance or enroll other types of insurance, and therefore have high participation rates (see Table A1). Since we focus on individuals' voluntary enrollment decision, we exclude those subjects whose enrollments are probably mandatory. Also, we want to assure that the pension program enrolled by rural people is the rural pension program initiated in 1992. The timing of this pension program is exploited in estimating the impact of accessing to pension on sex ratio with a difference-in-differences identification strategy. It is worth to mention that whether the pension program enrolled by rural people is the rural pension program or not does not matter for estimating the impact of children on enrollment decisions. Finally, we are left with 181080 observations[6]. Strictly speaking, since the questionnaire only asks about information on availability of social insurance in general type rather than specific, we cannot guarantee that the pension program adopted by the subjects are China's

[5] See Table A1 in the Appendix for classification of types of work unit. We use the same classification of China's 2005 mini-census.
[6] For more detailed information on restriction rules and number of observation, please see Table A2 in the Appendix.

rural pension program. For our restricted sample, however, it is most probably that the pension program enrolled by them is the rural pension program. During that period in China, the rural pension program is the only pension program available for rural people. The mean participation rate of the pension program in our sample is also very close to the officially reported participation rates of China's rural pension program.

Basic descriptive statistics of selected variables are displayed in Table 1. The first column of Table 1 shows a general picture of the whole sample, while columns two and three disaggregated the sample by pension participation status. The significant signs indicate that the characteristic in that row (e.g., presence of sons) is significantly different between the two groups (e.g., pension=1/pension=0). 3.2% of subjects in our final sample participate in pension program. On average, one individual has 1.57 sons and 1.43 daughters and the probability of having at least one son and daughter is 91% and 81%, respectively. On average, group without pension have higher probability of having at least one son, larger total number of sons and daughters, lower education achievements, higher proportion of minorities, lower individual income, household income and wealth than group accessing to pension, and are more likely to work and younger than group without pension. All differences are statistically significant.

Table 1

We also use a subsample of the individual-level data to examine whether accessing to pension mitigates old parents' dependency on their family members. This subsample consists of individuals who are aged from 60-64. Summary statistics of the subsample are reported in the last three columns of Table 1. Column 4 shows a general picture, while columns 5 and 6 disaggregated the sample by pension participation status. The comparison between column 5 and column 6 reveals similar pattern as that between column 2 and column 3.

Table 2

To assess the impact of accessing to old-age social insurance on sex ratio, we aggregate the sex

ratio by age group at the region level and employ the difference-in-differences strategy to examine the effects of the pension program on sex ratio. Sex ratios at birth are particularly high in central China and along the south-eastern coast where son preference is known to be intense and where China's fertility regulations are strictly enforced (Gu et al, 2007). The spatial heterogeneity in the sex ratio distortions suggests that a region-level analysis of China's fertility trends may help to identify the factors underlying the increase in the sex ratio at birth. Panel A of table 2 reports the sex ratio of different birth cohorts calculated at the region level. Column 1 of Table 2 shows a general picture of the whole sample, while columns two and three disaggregated the sample by the level of participation rate of the pension program, i.e. high or low. All regions in which average participation rates of pension program are above the mean level of the whole sample are categorized into the group "high", otherwise, "low". It can be seen from the first three columns that sex ratios among all regions have largely increased since 1978. However, regions with higher participation rates of pension have lower sex ratios after 1998. Since some regions in our sample have very small sampled population size, the calculated sex ratios may be imprecise. Therefore, we also conduct a restricted sample, which exclude those regions in which sampled population size is smaller than one hundred.[7] Sex ratio of the restricted sample is slightly different from the whole sample: sex ratios in regions having higher pension participation rates are slightly higher. The comparison between the two groups categorized by the level of participation rate of the pension program in the restricted sample also shows similar pattern to those in the whole sample. In later sections, we use the whole sample to examine the nationwide effect of the pension program on sex ratio at birth, and use the restricted sample to run the same regressions as robustness check. It is worth noting that sex ratios calculated in panel A are actually not the sex ratio at birth for each birth cohort since mortality rates of male and female for each birth cohort are probably different. If we want to obtain sex ratio at birth, we need to adjust the mortality rate for each gender across various birth cohorts. In panel B we calculate the adjusted sex ratio to obtain sex ratio at birth for each birth cohorts for male and female separately. The adjusted sex ratios in each group are slightly different from the unadjusted.

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[7] This means total population in that region is less than 50 thousands since our data is a 20% sample of the 1% population sample survey.

In Sept. 2009, the Chinese government initiates the new rural pension program. By the end of 2010, more than 24% rural people have been covered by this program. CHARLS, conducted in 2011, have detailed information on social insurance. Using data from CHARLS, we investigate the impact of accessing to pension on choices of old-age support of rural people to see whether availability of social insurance affects parents demand for children for support in old age. This also can provide us insights on potential impact of this new rural pension program on people's economic behavior relating to old-age support.

CHARLS is a biennial survey being conducted by the National School of Development (China Center for Economic Research) at Peking University. CHARLS aims to be representative of the residents of China age 45 and older, with no upper age limit. The sample size of the baseline survey in 2011 is around 10,000 households and more than 16,000 individuals. CHARLS is part of a set of longitudinal aging surveys that include surveys in the United State, England, nineteen countries in continental Europe, Korea, Japan, and India. CHARLS aims to set up a high quality, nationally representative and publicly available micro-database that provides a wide range of information about the households of the elderly and also individual information on the elderly respondents and their spouses.

4. Empirical Analysis

4.1. Effects of Number and Sex Composition of Children on Pension Enrollment Decision

In this section we examine the impact of number and sex composition of children on pension enrollment decision. We employ two specifications. For the first specification, we estimate the following equation:

$$pension_i=\beta_0+\beta_1 anysons_i+\beta_2 children_i++\beta_3 X_i+u_i \qquad (1)$$

where *pension* is a dummy variable indicating whether the subject i participating in the rural pension program, *anysons* is a dummy variable indicating whether having at least one son, *children* denotes the total number of children. *X* is a set of covariates which may also relate to pension enrollment decision.

Subscript *i* denotes observation *i*, which is defined at the individual level. This specification allowes us to isolate the impact of presence of sons condition on numbers of children.

An alternative specification as follows is used to capture the impact of sons and daughters simultaneously.

$$pension_i = \beta_0 + \beta_1 sons_i + \beta_2 daughters + \beta_3 X_i + u_i \qquad (2)$$

The covariates in equation (1) and equation (2) include age, age square, education level, ethnicity, work status, log values of income, household income and house value.

Table 3

We first estimate equation (1) and equation (2) using the whole sample, and then estimate them separately for male and female. Estimates from equation (1) are displayed in panel A of Table 3. Panel B displays estimates from equation (2). As shown in column 1, presence of sons decreases the probability of pension enrollment by 2.12 percentages, while each additional child decreases the probability of pension enrollment by 0.93 percentages. The effects are 66% and 29% at the mean level considering the mean participation rate of 3.2%. Adding other covariates increases the coefficient of presence of sons to 0.0221 and leaves the coefficient of children unchanged. Although we have added individual and family observable characteristics, unobservable region characteristics such as the characteristics of the local governments may also affect individual's enrollment decision and fertility decision simultaneously. For instance, implementation of family planning policy and pension program could be both more intensive in some regions because of higher executive power of the local governments. Therefore, we further use region dummies to capture region fixed effects. Effects of presence of sons and number of children largely decrease to 0.68 and 0.20 percentages respectively. . Partly as a robustness check, we further estimate equation (1) using a restricted sample which excludes regions in which there are no insurants[8]. These regions may have not implemented rural pension program and respondents in these regions are thus "never takers". As our anticipation, the effects of presence of sons and number of

[8] Although it is not exactly true, we take regions without insurants as those have not implemented the program.

children both change to larger. In this case, controlling for covariates and region fixed effects, presence of sons increases the likelihood of pension enrollment by 1.05 percentages, while each additional child reduce the probability of participating in the pension program by 0.36 percentages. Our estimates are much smaller than that in Ebenstein and Leung (2010), in which total number of children is missed in the model specification and no region fixed effects are controlled.

From column 5 to column 8, we estimate equation (1) using male subsample. The estimates from various model specifications are similar to that using the whole sample, but all with a slightly smaller magnitude. This is a mirror of the estimates obtained from female subsample from column 9 to column 12, of which the magnitudes are all slightly larger than that using the whole sample. Considering the mean participation rates of male and female are 3.68% and 2.98% respectively, a larger coefficient for female suggests that the impacts of presence of sons and number of children on pension enrollment are larger for female than that for male. This difference by gender shows mothers are more sensitive to their adult children in old-age support.

We estimate equation (2) and display the results in panel B of Table 3. With this specification, we treat number of sons and number of daughters as continuous variable, and capture the effects of sons and daughters at the same time. Estimates using the whole sample are displayed from column 1 to column 4. One additional son decreases the probability of enrollment by 0.27 percentages. One additional daughter decreases the probability of enrollment by 0.17 percentages, less about one third than the effect of an additional son. In column 2, we add other covariates, the impact of both son and daughter largely increase. Effects of one additional son and one additional daughter are 0.45 and 0.37, respectively. We further include region dummies in the regression, effects of sons and daughters both slightly increase. In column 4, we estimate equation (2) using the restricted sample, effect of sons increase to 0.60, while effect of daughters decrease to 0.32.

Estimates from male and female subsample are displayed in the following columns. For the male subsample, coefficients of sons and daughters are -0.0129 and -0.0072, respectively. The coefficients increase after adding other covariates but largely decrease after controlling the region fixed effects. Estimates using female subsample are larger than male with various model specifications. This is

consistent with results from estimating equation (1).

Figure 4

In conclusion, the estimation results show that presence of sons decreases their parents' likelihood of participating in the pension program. Both additional sons and additional daughters make the parents less likely to participate in the pension program. In addition, effect of additional daughters is smaller than effect of additional sons. These results suggest that lacking children, especially sons increases the rural people's demand for social insurance for support in old age. This is consistent with the traditional argument that children, especially sons are viewed as provides of support in old age by rural people. On the other side, these results imply that absence of social insurance will make children, especially sons more necessary to rural people for support in old age. In terms of providers of support in old age, sons and social insurance can serve as substitutes for each other. Of course, one should be cautious to interpret the effects of number and sex composition of children as causal. One concern may be the reverse causality, that is, women's fertility decision may have been affected by availability of pension benefits. This concern, however, does not quite necessary under our specification. We have restricted the sample to female aged 50 and older and male whose spouse is 50 and older. All these individuals (or their spouse) should have finished their fertility history when they were making decisions in participating in the pension program that started in 1992. Figure 4 displays female's probability of giving birth by age using China's Census 1990. Female aged from 50 to 64 in 2005 is corresponding to the age cohort from 35 to 50 in 1990. Women in these age groups in China's rural areas have nearly finished their fertility history. A second concern is that the participation of pension is affected by whether the program has been introduced there; therefore, characteristics of local governments may simultaneously affect the fertility behaviors of residents and availability of the pension program. We also eliminate this concern by estimating within estimators with region fixed effects controlled. Controlling for region fixed effects indeed decreases the impacts of sons and daughters by a large amount, but the impacts are still statistically significant and large. A third concern is that parents who are more likely to participate in formal social insurance are also less likely to desire many children and concern about having a son. In our regressions, we have controlled a set of individual characteristics and family characteristics, which

may capture the effect of "preference". And including these covariates do not change the estimates much. Anyway, in next section we directly examine whether accessing to pension decreases rural parents' desire for children as providers of support in old age. These can provide further evidence to verify our interpretation that adult children, especially sons and formal social old age insurance are viewed by parents as substitute for each other in providing support in old age.

4.2. Access to pension and choice of providers of support in old age

In this section we relate accessing to pension and the number and sex composition of children to old age people's source of support in old age. We restrict our sample to individuals aged from 60-64[9], summary statistics of this subsample are listed in the last three columns of Table 1. Using the mini-census data, we examine whether accessing to pension mitigates old parents' dependency on their family members. Specifically, we estimate the following equation

$$familysupport_i = \beta_0 + \beta_1 pension_i + \beta_2 anysons_i + \beta_3 children_i + \beta_4 X_i + u_i \quad (3)$$

where *familysupport* is a binary variable indicating whether the elderly rely on their family members, definitions of other variables are the same to equation (1). Subscript *i* denotes observation *i* which is defined at the individual level.

As an alternative specification, we estimate equation (4) to capture the effects of sons and daughters simultaneously,

$$familysupport_i = \beta_0 + \beta_1 pension_i + \beta_2 sons_i + \beta_3 daughters_i + \beta_4 X_i + u_i \quad (4)$$

Estimation results from equation (3) are reported in Table 4. The baseline regression results in column 1 indicate that old parents who are access to pension program are 15.27 percentages (or 67% at the mean level, i.e. 0.1527/0.2272) less likely to rely on their family members in the whole sample. Presence of sons increases the probability of relying on family members by 0.85 percentages, but is

[9]As we have pointed out above, in the 2005 1% Population Sample Survey, women aged 65 and older have not been asked about information on childbearing, thus have no information on number of children. For simplicity, males are also restricted to those aged from 60 to 64. We choose age 60 as the cutoff point to restrict our sample to elderly.

insignificant. Each additional child increases the probability of relying on family members by 1.86 percentages. Adding other controls largely increases the magnitude of the coefficient of presence of sons to 0.0354, while coefficient on number of children decreases to 0.0045; both coefficients are statistically significant at the 1% level. Effect of pension largely increases to 38.1 percentages. Region dummies are further included in column 3, estimates do not change much. Accessing to pension decreases the probability of relying on family member by 36.95 percentages, presence of sons increases the probability by 2.78 percentages, and each additional child increases the probability by 0.56; all estimates are statistically significant at the 1% level. We then estimate equation (3) using male and female subsample separately. There are no large differences between estimates using total sample and subsample. What we can see is the estimates on sons and daughters using male subsample are slightly larger than estimates using female subsample, while estimate on pension is slightly smaller. These results suggest that father is more desiring for social insurance for support in old age than mother.

We estimate equation (4) and show results in panel B of table 4. Number of sons and number of daughters are both treated as continuous variable. Estimates on pension are almost the same as that in panel A across various model specifications. Including sons and daughters at the same time allows us to make a comparison between effect of sons and daughters. In the baseline regression, having pension decreases the probability of relying on family members by 15.13 percentages, one additional son increases the probability of relying on family member by 2.82 percentages, and one additional daughter increases the probability by 1.24 percentages. Effect of sons are more than doubled than the effect of daughters, which suggests the rural people rely more on sons for support in old age. Effect of pension increases to 38.15 after adding other covariates, and effects of sons and daughters decrease to 0.95 and 0.40. In our final specification with region dummies, effect of pension is 37 percentages and the effects of sons and daughters are 0.98 and 0.52 percentages, respectively. Effect of sons is still about double of the effect of daughters. Estimation results using subsample are displayed in the following six columns. We find consistent results with that using the whole sample. Comparison between estimates using male and female shows father relies more on social insurance while mother relies more on their children.

Table 4

In conclusion, the estimation results in table 4 suggest that accessing to pension mitigates old parents' dependency on their family members, while additional sons and daughters both increase the probability of relying on family members for old-age support. Moreover, effect of sons is much larger than effect of daughters. Our estimation results are robust to various model specifications. These results are consistent with the hypothesis that formal old age support such as pension program could substitute old-age support provided by children, and sons are more valuable than daughters in providing support in old age.

Table 5

We further confirm these results using CHARLS data. Different from our mini-census data, CHARLS asks the respondent the expectation on choice of support in old age other than the current source of support in old age. This allows us to examine the impact of accessing to social insurance on parents' intention instead of ex post status concerning support in old age. Respondents can choose from five choices: children, savings, pension or retirement salary, commercial pension insurance and others. We firstly describe the choices of rural respondents in table 5. More than 80% rural people answered that children are the provider for support can be relied on in old age. This percent is even larger for female, suggesting female relies more on children than male, which is consistent with our previous results in Table 4. The second important provider can be relied on is pension or retirement salary. 9.42% male and 7.09% female think they can rely on pension or retirement salary. In the following column in table 5, we firstly separate the group by whether NRPP is available to the rural people, in other word, whether there is NRPP implemented in that community. It is shown that 78.19% respondents choose to reply on children if there is NRPP available and 85.31% if otherwise. This comparison suggests that available to pension mitigates the rural people's dependency on children for support in old age. As a mirror, 10.58% respondents choose to rely on pension or retirement salary if there is NRPP available, and 4.52% if otherwise. Similar pattern is found for male and female. In the last column, we redefine two groups by whether the respondents having enrolled in NRPP. People enrolled are different to people to whom NRPP is available to some extent. The former group is somewhat self-selected. People who want to rely on social insurance rather than children are more likely to enroll than those who are more

desired to rely on children for support in old age. As a result, "enrolled" people as a group is less likely to rely on children but more likely to rely on pension than the "available" group. The results are just as what we anticipated. 12.57% "enrolled" people choose to rely on pension or retirement salary, while 10.58% "available" people choose to rely on pension or retirement salary. Comparison between enrolled and not enrolled people again shows that accessing to pension mitigates the rural people's dependency on children for support in old age.

We reexamine the impact of accessing to NRPP on choice of old-age support in a regression framework that allows us to partial out the effects of other covariates. In specific, we estimate the following equation using CHARLS data,

$$childsupport_i = \beta_0 + \beta_1 pension_i + \beta_2 sons_i + \beta_3 daughters_i + \beta_4 X_i + u_i \quad (5)$$

the variable *childsupport* is constructed by categorizing the choices of support for old age in table 5 into two types: children and others. *childsupport* equals 1 if the respondents choose to rely on children, equals zero otherwise. *pension* is a dummy indicating whether NRPP is available (or whether the respondents enrolled in NRPP). *sons and daughters* denote number of sons and number of daughters. *X* is a set of covariates including age, gender, education level, and marriage status.

Table 6

Estimation results are displayed in Table 6. People living in communities where NRPP has been implemented are 7.52 percentages less likely to rely on children for support in old age. The effects for male and female are 7.17 percentages and 7.83 percentages, respectively. Enrolled people are 3.11 percentages less likely to rely on children for support in old age. This effect is much smaller than that in column 1, which may reflect the "self-selection" of the insurants as we has discussed in previous section. The effects for male and female are 3.32 percentages and 2.84 percentages, respectively. Across various model specifications, the effects of sons and daughters are all positively significant. Moreover, effects of sons are always larger than that of daughters.

The evidence shown in Table 5 and Table 6 confirm our argument concluded from Table 4. That is accessing to pension lowers the parents' demand for children for support in old age. We also see that sons concern more than daughters as provider of support in old age.

So far, we have shown that presence of sons, additional sons and daughters all significantly decrease parents' pension participation rates, and the impact of sons is much larger than that of daughters. These estimation results suggest that children, especially sons, are important sources of support for rural people in old age, and pension program and adult children could be substitutes in providing support in old age. We have also directly shown that accessing to pension program decreases old parents' dependency on their family members, which is further reassured by evidence from CHARLS data. Overall, the pension program has effective function in providing support in old age for rural people. Due to the long lasting family planning policy, the probability of presence of sons and number of children in rural households has both largely decreased. Figure 5 plots the probability of having at least one son and number of children by age. It can be seen that for married women younger than 45, who probably give birth after 1980, a large proportion of them have no sons and number of children drops much. As the support from children declined, the rural family has to seek for alternative support in old age now. Without other types of support, the family would try its best to give birth at least one son through various methods such as artificial abortion and drowning of infants, which consequently lead to "missing girls" or sex ratio bias. Our above estimation results imply that lack of social insurance would result in higher demand of parents for children, especially sons on whom to depend when they turn to old. Since parents view sons more valuable than daughters, in other word, have son preference, lack of social insurance combined with fertility restriction would probably lead to sex ratio bias. In other words, accessing to social insurance such as rural pension program and NRPP may be helpful in mitigating parents' dependency on children, especially sons and thus correct the sex ratio bias to some extent. Ebenstein and Leung (2010) have made a tentative conclusion using data on 95 regions in China. They found that the implementation of rural pension program has a large impact on sex ratio at birth. However, as we have discussed in the introduction section, their results suffer from some potential problems. In next section, we use a new nationwide dataset and employ the standard difference-in-differences strategy to examine whether the implementation of the rural old age pension

program have mitigated the increase of sex ratio calculated at the region level.

Figure 5

4.3. Effects of Pension Program on Sex Ratio at birth

The introduction of the rural pension program in 1992 provides a quasi-natural experiment for us to examine the impact of pension program on sex ratio at birth. We use the difference-in-differences (DID) identification strategy as used by Duflo (2001), in which the impact of one school construction program in Indonesia on education attainment and labor market consequences have been examined. Sex ratio at birth has increased nationwide before and after the implementation of the program, i.e. the sex ratio at birth after 1998, in which year the program stops to receive new participants, is higher than the sex ratio before 1992, in which year the program was introduced nationwide (see Table 2). However, if the program indeed has impacts on sex ratio at birth, sex ratio at birth would increase less in regions where pension program is more intensively implemented. The difference in these differences can be interpreted as the causal effect of the program, under the assumption that in the absence of the program, the increase of sex ratio would not have been systematically different among regions with different level of availabilities of pension. It is possible that the pattern of increase in sex ratio at birth could vary systematically across regions, which may contaminate the DID estimates. However, the identification assumption can be tested explicitly here because all birth cohorts before 1992 cannot be affected by the program. The increase in sex ratio at birth between cohorts in those birth cohorts should not differ systematically across regions. To exploit the variation in treatment density across regions and cohorts, the above identification strategy is generalized to a regression framework as follows:

$$sexratio_{jc}=\beta_0+\beta_1 D\_after_c+\beta_2 R_j+\beta_3 D\_after_c\times pension\_high_j+u_{jc} \quad (6)$$

where $sexratio_{jc}$ is the sex ratio of birth cohort c in region j, D_after_c is a dummy indicating whether the birth cohorts belongs to the "young" group, i.e. those born after 1998, $pension\_high_j$ is a dummy indicating whether the program's availability is "high" in region j. "High" level is defined as above the mean participation rate in the whole sample. The pension participation rate is calculated as the average

participation rate of the pension program of residents aged from 27 to 47. Persons belonging to these age cohorts are exposed to the pension program, and probably give birth after the stagnation of the program. In other words, people in these age cohorts are those treated by the program, therefore we use their pension participation to measure the intensity of the pension program. R_j is a region fixed effect. Then, the coefficient of the interaction term $D\_after_c \times pension\_high_j$ i.e. β_3 is the treatment effect of the pension program.

It is worth noting that the sex ratio we calculated so far is not the actual sex ratio at birth. To obtain sex ratio at birth we need to adjust the mortality rates of male and female in various birth cohorts. More important, if the mortality rate of male and female vary for various age groups comparing sex ratio between older groups and younger groups would not capture the exact change of sex ratio at birth. It is widely discussed that due to son preference mortality rate of girls are higher than boys. In this case, sex ratio of older birth cohorts will be higher than their sex ratio at birth. Our estimates will be biased. However, in this case, the difference in mortality rate between girls and boys is also result of son preference. If accessing to pension does mitigate son preferences, mortality rate of girls will be more close to mortality rate of boy and thus results in lower sex ratio. Without adjusted sex ratio, our estimates may capture the potential effect on mortality rate. We are both interested in the impact on sex ratio birth and the final resulted sex ratio, thus we first estimate equation (6) using the unadjusted sex ratio and then estimate using the sex ratio after adjusting gender specific mortality rates of each birth cohort.

Table 7

Results from estimating equation (6) are reported in column 1 of Table 7. The suggested effect is that high pension availability decreases the sex ratio by about 15.7. Considering the sex ratio at birth in 2005 is as high as 119, a large effect as such could changes the sex ratio to a normal level, i.e. 103. Since some of the regions are too small in population size to calculate precise sex ratio, our calculations of sex ratio may be too noisy. As a robustness theck, we restrict sample to regions in which the sampled

population size is larger than one hundred.[10] Estimator using restricted sample is -11.621 as shown in column 3. This effect is smaller in magnitude than that using unrestricted sample, but we view this as a more robust result.

To eliminate the confounding effect of mortality rates by age group, we regress equation (6) using the adjusted sex ratio, which can be viewed as sex ratio at birth. We obtain an estimate as large as -13.108 using the total sample. This estimate is smaller than the unadjusted result. Estimated effect using the restricted sample in column 7 is -11.927, only slightly larger than the unadjusted effect. Whether adjust the mortality rate or not doesn't make a large difference. These estimation results from equation (6) suggest a large effect of accessing to pension on sex ratio at birth.

Now we turn to an alternative specification. Instead of compressing the intensity of the program into a dummy indicating high level or low, we examine the intensity of the program in a continuous manner. Specifically, we estimate the following equation

$$sexratio_{jc}=\beta_0+\beta_1 D\_after_c+\beta_2 R_j+\beta_3 D\_after_c\times pension_j+u_{jc} \quad (7)$$

where $pension_j$ is a continuous variable that denotes the average participation rate of the pension program of residents aged from 27 to 47 in region j.[11] All other specifications are the same to equation (6).

As shown in column 2 of Table 7, one percentage point higher pension participation rate decreases the sex ratio by about 0.65. Since the average participation rate of the pension program is 3.2%, the total nationwide effect of the pension program is as high as 2.1, only a moderate effect though it is statistically significant at 1% level. Estimate of equation (7) using the restricted sample is reported in column (4), which is as high as 0.42. This effect is one third less than that using the total sample, but is still statistically significant at the 5% level. Our adjusted results using total sample and restricted sample are -0.598 and -0.408, respectively. Either is smaller than the unadjusted ones. Our estimates by regressing equation (7) suggest a nationwide effect of the rural pension program ranges from 1.3 to 2.1.

[10] This means that the total population of the region is more than two hundred thousand, since our dataset is a 1/5 random draw of the 2005 1% sample survey.
[11] Unit of *pension* is %.

This is much smaller than the effect estimated by Ebenstein and Leung (2010). The effect of rural pension program estimated by Ebenstein and Leung (2010) is more than 10 using OLS. Their instrumental estimate is even ten times larger, which does not make sense. Their model specification overestimates the effect of the rural pension program on sex ratio. But our results are consistent with Ebenstein and Leung (2010) in the aspect that implementation of the rural program significantly lowered the sex ratio at birth.

Whether our DID estimates are consistent rely on the assumption that in the absence of the pension program, the increase of sex ratio would not have been systematically different among regions with different level of availabilities of pension. We explicitly test this assumption by conducting a falsification experiment. We compare the sex ratio between birth cohorts 1985~1991 and birth cohorts 1978~1984. If the growth patterns of sex ratio between the control group and treatment group are not systematically different from each other, we should not see a significant difference in the changes of sex ratio between the two groups. On the other hand, if before the introduction of the pension program, increase trend of sex ratio at birth is systematically different among regions, for instance, sex ratio at birth increases faster (or slower) in those regions in which the program is more intensively implemented, then the implementation of the program would show significant impact on sex ratio at birth. However, the impact of the "program" is very small and never significant across various specifications as shown in panel B of Table 7. Although it is not definitive evidence, it is reassuring.

5. Conclusions

In this article, using China's 2005 mini-census data, we show that parents who have at least one son are associated with higher pension participation rate. The total number of sons and daughters are both negatively related to parents' participation rate, especially for the number of sons. We also find parents who access to pension are less likely to rely on their family members, which are further confirmed by evidence from CHARLS. Our empirical results consistently suggest that pension and children, especially sons both can provide old age support for elderly and can partly substitute for each other. Moreover, exploiting the difference-in-differences strategy, we find that the implementation of the rural pension program has significantly decreased the sex ratio at birth, although with only moderate magnitudes

ranging from 1.3 to 2.1.

These two related pieces of evidence established in this paper lead to insights that one of the causes of sex ratio bias since 1980s in China is the lack of social insurance in China's rural area. Worrying about their support in old age, peasants have strong desire for children, especially sons. Since total number of birth is restricted by the family planning policy, peasants could not have as many children as they desire, therefore they have even stronger desire to have sons since sons are more valuable than daughters in providing support in old age. They have either the incentives or the capabilities to use various methods such as sex-selective induced abortion to achieve their desire. It is well accepted that serious sex ratio bias will have large negative impacts on the Chinese society (Edlund et al, 2007; Ebenstein and Jennings, 2008). Conclusions of this paper suggest that implementation of social old age support systems in rural China could be helpful in correcting sex ratio bias. We acknowledge that the impact of social old age support systems may not be large enough to turn the sex ratio at birth to normal level, considering the moderate impact of the rural pension program. Although son's role in providing support in old age has been widely emphasized (Das Gupta et al. 2003; Greenhalgh and Winckler 2005), desiring for sons is also rooted in other reasons. First, under China's traditional patrilineal family system sons are expected to continue their family lines. Second, family wealth including land tenure is customarily inherited by sons rather than daughters. Finally, sons have better labor outcomes than daughters, and therefore are more likely to bring benefits to parents (Qian, 2008). Significantly decline of son preference and thus the decline of sex ratio may need normative change within the society as a whole, as what has been happened in South Korea (Chung and Das Gupta, 2007), or reconsideration and redesign of the family planning policy, as proposed by Zeng (2007).

Our paper also provides first piece of insights on the potential impacts of new rural pension program on rural people's socioeconomic behaviors. The Chinese government initiated the NRPP in Sept. 2009 (State Council, 2009). By the end of 2010, there was a coverage rate of 24% of NRPP. In the work discussion meeting on rural social insurance held in Dec. 2011, the vice Minister Hu Xiaoyi said NRPP would cover all rural areas by the end of 2012, eight years earlier than originally planned. The old rural pension program is the Chinese government's first attempt to established social old-age insurance

system in rural areas, but it failed after a short term of rapid expansion. The new rural pension program is much more ambitious than the old one, whether it will succeed and whether the socioeconomic conditions required have been well prepared are all still ambiguous. However, one thing is definitive, that is this pension program will affect the socioeconomic behavior of the rural people from various aspects. Using a newly conducted household survey in China, we have shown that the implementation of this new rural pension program affects the choice of older rural people for providers of support in old age. Our analysis on the old rural pension program also implies that this new pension program will probably affect rural people's fertility behavior and thus be helpful in correcting sex ratio bias. Hopefully, similar analysis in this paper can be done in future by estimating the impact of NRPP on rural people's fertility behaviors once qualified data are available.

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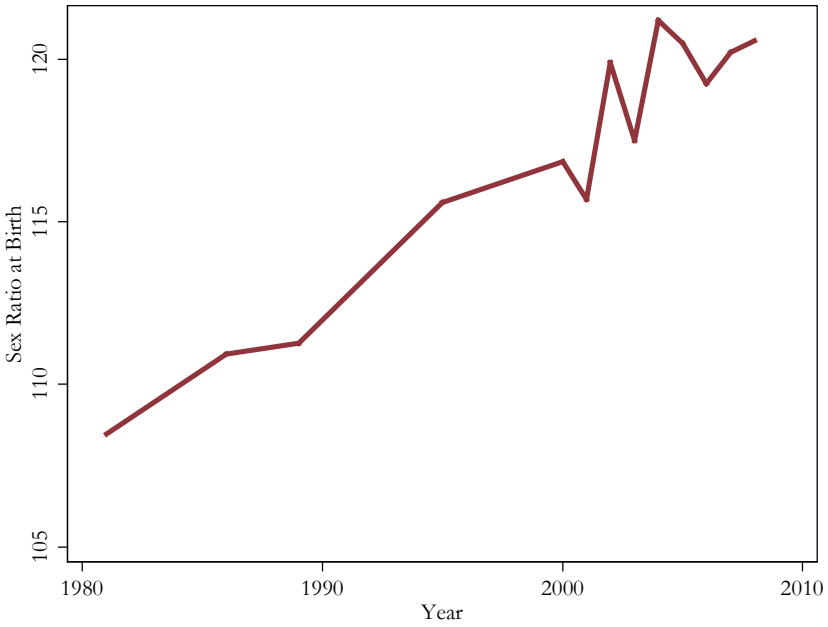

Figure 1 Sex Ratio at Birth: 1981~2008

Source: Handbook of Population and Family Planning Data, pp. 130, edited by National Population and Family Planning Commission, 2008.

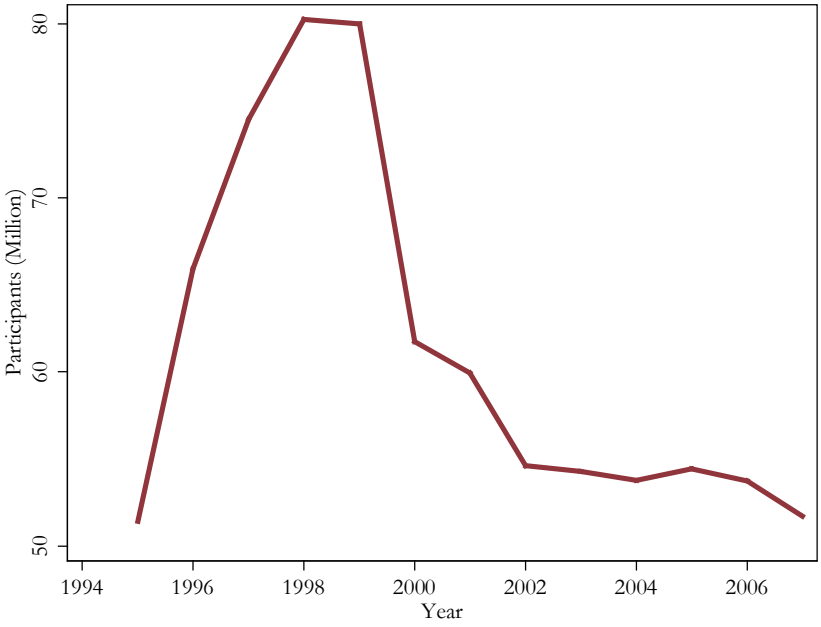

Figure 2 Coverage of Rural Old-age Pension Program

Source: Data before 1998 come from *Statistic Communiques of the Ministry of Civil Affairs,* corresponding years; data after 1998 come from National Bureau of Statistics.

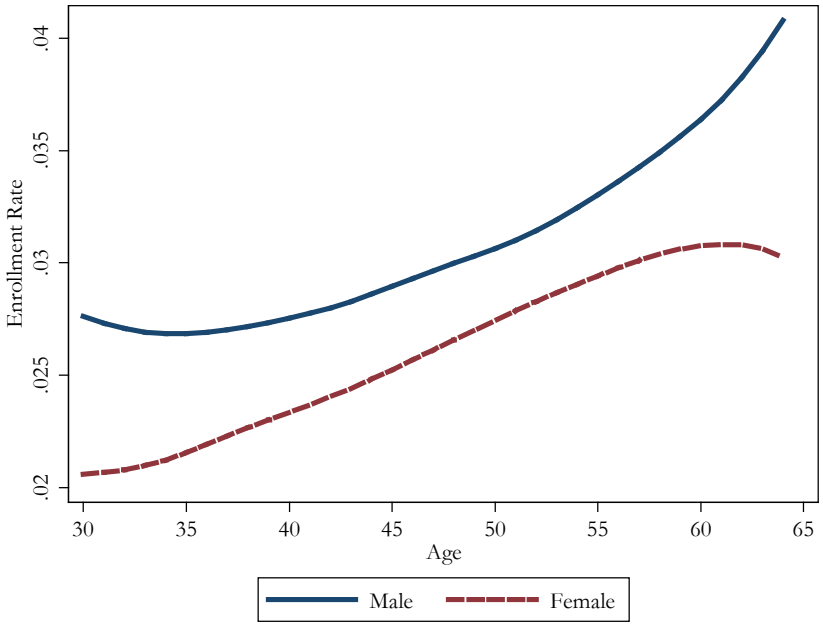

Figure 3 Pension Enrollment Rates by Age and Gender

Source: 2005 1% Population Sample Survey: *Rural subsample*.
Notes: Sample has been restricted by types of work unit.

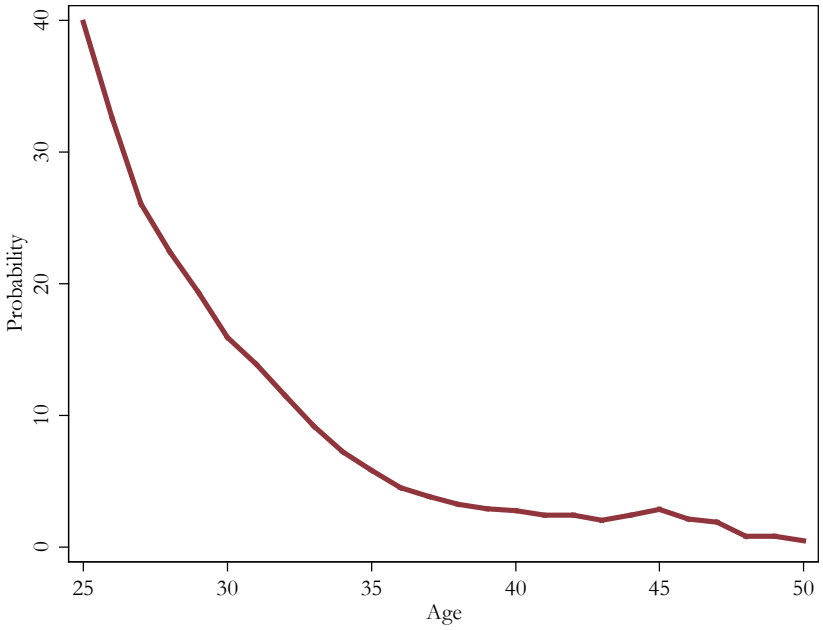

Figure 4 Women's Probability of Giving Birth

Source: China Census 1990.

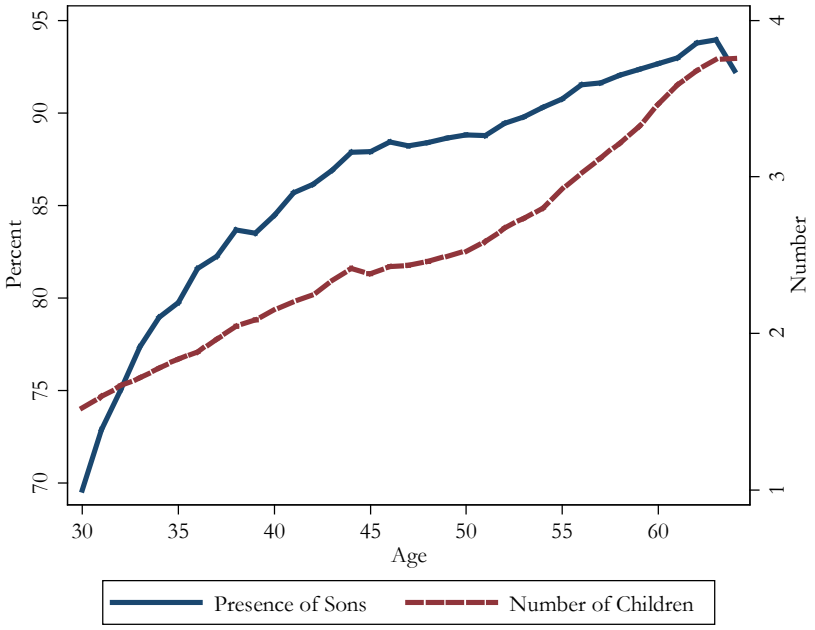

Figure 5 Women's Probability of having sons and number of children

Source: 2005 1% Population Sample Survey

Table 1 Sample Averages of the 2005 1% Population Sample Survey: *Individual Level*

	Total			Subsample: Age>=60		
	Total	Pension=1	Pension=0	Total	Pension=1	Pension=0
Pension	0.032					
	(0.177)					
Presence of sons	0.910	0.831	0.913***	0.929	0.876	0.931***
	(0.286)	(0.375)	(0.282)	(0.257)	(0.329)	(0.253)
Presence of daughters	0.809	0.759	0.810***	0.846	0.808	0.847***
	(0.393)	(0.428)	(0.392)	(0.361)	(0.394)	(0.360)
Number of sons	1.574	1.255	1.584***	1.865	1.531	1.877***
	(0.951)	(0.868)	(0.952)	(1.075)	(0.969)	(1.077)
Number of daughters	1.433	1.218	1.440***	1.688	1.465	1.696***
	(1.108)	(1.017)	(1.110)	(1.222)	(1.163)	(1.223)
Age	56.219	56.544	56.208***	62.822	62.949	62.817***
	(4.800)	(4.951)	(4.794)	(2.794)	(2.873)	(2.791)
Male	0.376	0.426	0.374***	0.513	0.575	0.511***
	(0.484)	(0.495)	(0.484)	(0.500)	(0.495)	(0.500)
Literacy	0.244	0.134	0.248***	0.316	0.188	0.321***
	(0.430)	(0.341)	(0.432)	(0.465)	(0.391)	(0.467)
Elementary school	0.546	0.512	0.547***	0.524	0.488	0.525***
	(0.498)	(0.500)	(0.498)	(0.500)	(0.500)	(0.499)
Middle school	0.186	0.293	0.182***	0.142	0.263	0.138***
	(0.389)	(0.455)	(0.386)	(0.349)	(0.440)	(0.345)
High school or above	0.025	0.061	0.023***	0.018	0.062	0.017***
	(0.155)	(0.240)	(0.151)	(0.134)	(0.240)	(0.128)
Minority	0.100	0.042	0.102***	0.106	0.040	0.109***
	(0.300)	(0.200)	(0.302)	(0.308)	(0.196)	(0.311)
Income	2.684	2.968	2.674***	1.991	1.592	2.006***
	(3.282)	(5.270)	(3.194)	(2.817)	(3.460)	(2.789)
Household Income	5.060	5.958	5.030***	3.561	3.075	3.579***
	(5.383)	(8.685)	(5.234)	(4.471)	(5.132)	(4.443)
House Value	0.268	0.495	0.261***	0.237	0.437	0.229***
	(0.685)	(0.749)	(0.682)	(0.784)	(0.834)	(0.782)
At work	0.809	0.734	0.811***	0.628	0.366	0.7533***
	(0.393)	(0.442)	(0.391)	(0.484)	(0.482)	(0.431)
Living rely on family support	0.227	0.192	0.228***	0.337	0.179	0.343***
	(0.419)	(0.394)	(0.420)	(0.473)	(0.383)	(0.475)
Observations	181080	5874	175206	45910	1657	44253

Source: China's 2005 1% Population Sample Survey: *Rural subsample.*

Notes: Collective households are excluded. Sample consists of household head and spouse of household head, excluding those female younger than 50 and male whose spouse is younger than 50. Income and Household Income are measured in thousand yuan, while House Value is measured in one hundred thousand yuan. Standard deviations in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 2 Sex Ratio Calculated at the Regional Level by Pension Enrollment Rate.

	Total			Restricted sample		
	Total	High	Low	Total	High	Low
			Unadjusted			
Sex ratio: Birth cohort 1999 to 2005	122.4	114.6	124.0***	124.0	115.7	125.5***
	(64.8)	(77.9)	(61.8)	(58.6)	(59.8)	(58.2)
Sex ratio: Birth cohort 1985 to 1991	109.8	112.3	109.4***	109.0	110.5	108.7***
	(51.7)	(62.7)	(49.2)	(41.8)	(53.6)	(39.3)
Sex ratio: Birth cohort 1978 to 1984	93.9	95.2	94.2***	94.5	96.7	94.1***
	(49.5)	(65.7)	(45.4)	(41.7)	(58.6)	(37.9)
Observations	2757	458	2299	2430	372	2058
			Mortality rate adjusted			
Sex ratio: Birth cohort 1999 to 2005	123.0	115.2	124.7***	124.6	116.3	126.1***
	(65.1)	(78.3)	(62.1)	(58.9)	(60.1)	(58.5)
Sex ratio: Birth cohort 1985 to 1991	109.9	112.4	109.5***	109.1	110.7	108.8***
	(51.8)	(62.9)	(49.3)	(41.8)	(53.7)	(39.3)
Sex ratio: Birth cohort 1978 to 1984	93.4	94.6	93.7***	94.0	96.2	93.6***
	(49.2)	(65.3)	(45.1)	(41.5)	(58.2)	(37.7)
Observations	2757	458	2299	2430	372	2058

Source: China's 2005 1% Population Sample Survey: *Rural subsample.*

Notes: All regions in which average participation rates of pension program are above the mean level of the sample are categorized into the group "high", otherwise, low. Restricted sample exclude regions in which the sampled population size is smaller than one hundred. Standard deviations in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3 Relationship between Children Sex Composition and Pension Enrollment

	Dependent Variable: Participation in Pension Program											
	Total				Male				Female			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Specification I												
Presence of sons	-0.0212***	-0.0221***	-0.0068***	-0.0105***	-0.0209***	-0.0220***	-0.0063**	-0.0097**	-0.0214***	-0.0221***	-0.0072***	-0.0111***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)
Number of children	-0.0093***	-0.0093***	-0.0020***	-0.0036***	-0.0084***	-0.0090***	-0.0015***	-0.0026***	-0.0099***	-0.0096***	-0.0021***	-0.0038***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Observations	181080	181080	181080	107399	68023	68023	68023	40068	113057	113057	113057	67331
R-squared	0.007	0.024	0.312	0.300	0.005	0.025	0.280	0.268	0.008	0.023	0.356	0.345
Panel B: Specification II												
Number of sons	-0.0027***	-0.0045***	-0.0053***	-0.0060***	-0.0129***	-0.0138***	-0.0032***	-0.0054***	-0.0140***	-0.0138***	-0.0033***	-0.0060***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Number of daughters	-0.0017***	-0.0037***	-0.0039***	-0.0032***	-0.0072***	-0.0079***	-0.0011*	-0.0018*	-0.0090***	-0.0090***	-0.0020***	-0.0036***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Observations	181080	181080	181080	107399	68023	68023	68023	40068	113057	113057	113057	67331
R-squared	0.006	0.023	0.312	0.300	0.005	0.025	0.280	0.268	0.007	0.022	0.356	0.344
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
County dummy	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Restricted sample	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes

Source: China's 1% Population Sample Survey: *Rural subsample.*

Notes: Collective households are excluded. Sample consists of household head and spouse of household head, excluding those female younger than 50 and male whose spouse is younger than 50. Controls included age, age squared, education level, ethnicity, work status, log(Income), log(Household Income) and log(House Value). Restricted sample excludes counties having no insurants. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4 Access to Pension and Living Dependency of the Elderly

	Dependent Variable: Living Rely on Family Support (=1, yes)								
	Total			Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Specification I									
Pension	-0.1527***	-0.3810***	-0.3695***	-0.1334***	-0.3783***	-0.3756***	-0.1508***	-0.3647***	-0.3045***
	(0.010)	(0.012)	(0.013)	(0.010)	(0.015)	(0.017)	(0.018)	(0.018)	(0.021)
Presence of sons	0.0085	0.0354***	0.0278***	-0.0072	0.0235***	0.0173***	0.0340**	0.0481***	0.0408***
	(0.009)	(0.005)	(0.005)	(0.011)	(0.007)	(0.006)	(0.014)	(0.008)	(0.007)
Number of children	0.0186***	0.0045***	0.0056***	0.0169***	0.0038***	0.0050***	0.0116***	0.0049***	0.0054***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Average probability									
Observations	45910	45910	45910	23567	23567	23567	22343	22343	22343
R-squared	0.008	0.789	0.820	0.008	0.738	0.787	0.005	0.815	0.853
Panel B: Specification II									
Pension	-0.1513***	-0.3815***	-0.3700***	-0.1312***	-0.3784***	-0.3758***	-0.1505***	-0.3656***	-0.3057***
	(0.010)	(0.012)	(0.013)	(0.010)	(0.015)	(0.017)	(0.018)	(0.018)	(0.021)
Number of sons	0.0282***	0.0096***	0.0098***	0.0275***	0.0083***	0.0082***	0.0200***	0.0110***	0.0113***
	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.003)	(0.001)	(0.002)
Number of daughters	0.0124***	0.0040***	0.0052***	0.0088***	0.0027**	0.0044***	0.0085***	0.0048***	0.0049***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
Average probability									
Observations	45910	45910	45910	23567	23567	23567	22343	22343	22343
R-squared	0.008	0.789	0.820	0.009	0.738	0.787	0.005	0.814	0.853
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
County dummy	No	No	Yes	No	No	Yes	No	No	Yes

Source: China's 1% Population Sample Survey: *Rural subsample & aged 60-64.*

Notes: Controls included age, age squared, education level, ethnicity, log(Income), log(Household Income) and log(House Value). Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 5 Access to New Rural Pension and Choice of Old-age Support

What do you think you can rely on for old-age support	Total		Available		Not Available		Enrolled		Not Enrolled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Total										
Children	10,240	81.01	5,971	78.19	4,269	85.31	2,672	78.08	7,520	82.13
Savings	535	4.23	343	4.49	192	3.84	161	4.7	370	4.04
Pension or retirement salary	1,034	8.18	808	10.58	226	4.52	430	12.57	598	6.53
Commerical pension insurance	51	0.4	17	0.22	34	0.68	4	0.12	47	0.51
Other	781	6.18	498	6.52	283	5.66	155	4.53	621	6.78
Male										
Children	4628	78.11	2,670	75.25	1958	82.37	1,207	76.54	3403	78.65
Savings	286	4.83	176	4.96	110	4.63	81	5.14	204	4.71
Pension or retirement salary	558	9.42	432	12.18	126	5.3	213	13.51	344	7.95
Commerical pension insurance	32	0.54	11	0.31	21	0.88	3	0.19	29	0.67
Other	421	7.11	259	7.3	162	6.82	73	4.63	347	8.02
Female										
Children	5,603	83.58	3,293	80.73	2,310	88	1,461	79.4	4,112	85.28
Savings	247	3.68	166	4.07	81	3.09	80	4.35	164	3.4
Pension or retirement salary	475	7.09	375	9.19	100	3.81	216	11.74	254	5.27
Commerical pension insurance	19	0.28	6	0.15	13	0.5	1	0.05	18	0.37
Other	360	5.37	239	5.86	121	4.61	82	4.46	274	5.68

Source: CHARSL, 2011

Notes: Sample is restricted to rural residents. Available and Not Available are defined as whether the respondent can enroll NRPP if he/she wants.

Table 6 Access to New Rural Pension and Choice of Old-age Support

	Dependent Variable: Rely on Children for Old-age Support (=1, yes)					
	Total	Male	Female	Total	Male	Female
Available (=1, yes)	-0.0752***	-0.0717***	-0.0783***			
	(0.007)	(0.011)	(0.009)			
Enrolled (=1, yes)				-0.0311***	-0.0284*	-0.0332**
				(0.010)	(0.015)	(0.013)
Sons	0.0412***	0.0450***	0.0348***	0.0440***	0.0407***	0.0436***
	(0.004)	(0.006)	(0.005)	(0.005)	(0.009)	(0.007)
Daughters	0.0168***	0.0211***	0.0102**	0.0129***	0.0143**	0.0084
	(0.003)	(0.005)	(0.004)	(0.005)	(0.007)	(0.006)
Age	-0.0014***	-0.0006	-0.0021***	-0.0011*	0.0006	-0.0025***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	0.0221***			0.0112		
	(0.008)			(0.011)		
Capable of reading & writing	-0.0305***	-0.0031	-0.0400***	-0.0280**	0.0029	-0.0334*
	(0.011)	(0.018)	(0.013)	(0.014)	(0.025)	(0.018)
Primary school	-0.0185*	0.0230	-0.0473***	-0.0242*	0.0396*	-0.0756***
	(0.010)	(0.017)	(0.014)	(0.014)	(0.023)	(0.020)
Middle school or above	-0.0359***	0.0068	-0.0680***	-0.0257*	0.0312	-0.0637***
	(0.011)	(0.018)	(0.015)	(0.015)	(0.025)	(0.022)
Divorce/Separated	-0.3817***	-0.4358***	-0.0276	-0.3848***	-0.4443***	0.0327
	(0.029)	(0.031)	(0.065)	(0.039)	(0.041)	(0.088)
Widowed	0.0686***	0.0398**	0.0899***	0.0689***	0.0276	0.0956***
	(0.011)	(0.020)	(0.013)	(0.015)	(0.029)	(0.017)
Migrates	-0.0511	-0.0083	-0.0840*	-0.0289	-0.0098	-0.0395
	(0.035)	(0.048)	(0.049)	(0.043)	(0.063)	(0.059)
Constant	0.8428***	0.7533***	0.9312***	0.7821***	0.6449***	0.8908***
	(0.029)	(0.045)	(0.035)	(0.039)	(0.062)	(0.046)
Observations	12587	6032	6555	7165	3378	3787
R-squared	0.049	0.066	0.030	0.041	0.061	0.028

Source: CHARLS, 2011

Notes: Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1. Sample is restricted to rural residents.

Table 7 Effects of Pension Program on Sex Ratio: *DID Estimation Results*

	Unadjusted				Mortality Rate Adjusted			
	Total		Restricted Sample		Total		Restricted Sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Experiment of Interest: Birth cohorts 1999 to 2005 or 1985 to 1991								
(Youngest cohort: 1999 to 2005)								
Specification I	-15.711***		-11.621**		-13.108***		-11.927***	
	(5.207)		(4.541)		(4.942)		(4.181)	
Specification II		-0.653***		-0.418**		-0.598***		-0.408**
		(0.235)		(0.210)		(0.198)		(0.189)
Observations	5273	5273	4856	4856	5270	5270	4854	4854
R-squared	0.549	0.549	0.534	0.533	0.554	0.555	0.541	0.540
Panel B: Control Experiment: Birth cohorts 1978 to 1991								
(Youngest cohort: 1985 to 1991)								
Specification I	2.113		-0.138		1.558		-0.784	
	(5.009)		(4.301)		(4.670)		(4.216)	
Specification II		0.123		0.066		0.005		-0.014
		(0.194)		(0.161)		(0.206)		(0.163)
Observations	5327	5327	4860	4860	5319	5319	4858	4858
R-squared	0.547	0.547	0.534	0.534	0.556	0.556	0.544	0.544

Source: China's 2005 1% Population Sample Survey: *Rural subsample.*

Notes: Restricted sample excluded counties in which the sampled population size is smaller than one hundred. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table A1 Pension Participation by Types of Work Unit

Type of Work Units	Participation Rate	Frequency
Governments and Institutions	0.331	955
State-owned Enterprises	0.301	365
Collective Enterprises	0.284	756
Private Enterprises	0.183	3331
Other types	0.053	5551
Individual Business	0.069	6869
Operators of Land Contract	0.020	123844
Not at Work	0.037	32162
Total	0.038	186487

Source: China's 2005 1% Population Sample Survey: *Rural subsample.*

Notes: Sample has been restricted by age, the total number of observations is corresponding to that in the fifth row of appendix Table 2.

Table A2 Sample Restriction

Data	Number Excluded	Number Remaining
Total		1801001
Restricted to household head or spouse of household head	890935	910066
Restricted to female aged from 50 to 65 and male whose spouse aged from 50 to 65	723509	186557
Excluded if information on number of children is missing	60	186497
Excluded if information on pension status is missing	10	186487
Excluded if work at governments and institutions and formal enterprises*	5407	181080

Notes: *Formal enterprises include state-owned enterprises, collective enterprises and private enterprises.