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Old Age Security: Impacts of Social Security Systems on Households' Fertility Decisions

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Abstract: The social security system is one of the biggest government public expenditures across countries with diverse influences on people's daily lives. In this study, longitudinal household survey data from the China Health and Retirement Longitudinal Study are used to examine the influence of social security systems on households' fertility decisions. Using the method of regression analysis, the impact of three types of social security systems are investigated: pensions, medical insurance, and reimbursements. It is found that social security systems significantly decrease the number of children per household. However, it does not affect households' gender preferences and fails to achieve gender balance as reflected in the more-than-average number of male children across time. These findings afford valuable insights for the government in formulating social security policies while concurrently addressing the decreasing fertility rate in recent years.

Keywords: Social Security System, Pension, Fertility Rate, Gender Inequality

1. Introduction

The social security system is one of the most significant public goods provided by central governments. It impacts the lives of not only people who benefit from it first-handed but also the lives of their descendants. It can come in various forms, including medical insurance, pensions, and reimbursement. Through the centuries, they become increasingly improved in China. For example, the number of urban residents with medical insurance increased 10 times its original in 6 years, starting with around 30 million in 2007 to 300 million in 2013. Also, in the 10 years period from 2011 to 2021, the coverage under reimbursements also increased, with now up to 70% of medical expenses being reimbursed.

This dramatic change in the social security system has impacted society in many different ways. One of the most mentioned impacts in the literature is the effect on households' fertility decisions. This is because the social security systems can function as direct substitutes for children to provide protection for the elders. Therefore, in this project, the effect of social security expansion on the number of children per household are also documented. In addition, its impacts on gender preferences in society are explored.

This impact can be linked to the rapid decline of the Total Fertility Rate (TFR) in China in the past few years. For example, the number of births per woman is 6.71 in China in 1950. This number dropped dramatically to 1.70 70 years later [1]. When the TFR drops below 2, the total population ages and shrinks, representing a lack of working-age population. This phenomenon has been listed as

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one of the biggest concerns on the tables of many central governments, and many actions and policies have been taken against it. For example, the Chinese government has abandoned the single-child policy in recent years. Thus, understanding how the social security systems affect the TFR can provide rich insights for future policy implications.

The effects of social security systems on household fertility decisions are not straightforward in the first place. On one hand, these aids bring more financial support for parents, making it more affordable to have children. On the other hand, this aid for individuals means less of a need for "old age security" motivations for childbearing [2]. These two channels could cause a conflicting outcome, complicating the effect of the social security system on TFR. Therefore, in this project, rigorous econometrics methods are used to study the impact of social security systems on households' fertility decisions in China. Understanding the relationship between social security systems and TFR can help policymakers to design policies that support families and promote sustainable population growth.

In this project, data is from the China Health and Retirement Longitudinal Study (CHARLS) from 2011 to 2018, which covers a representative sample of Chinese residents ages 45 or older and their spouses. Participants were selected from 150 counties or districts from 28 provinces using a four-staged, stratified, and cluster sampling method [3].

The advantage of using this data is that it covers both households' familial information and their social security status. Two sets of variables are constructed. The first set includes the number of children, the gender composition of children, and their time of birth. The second set of variables includes all the relevant household characteristics, including their social security status, such as their access to medical insurance, pension, reimbursement, and other important features, such as education, place of residence, and so on.

Equipped with all these variables, then two types of regressions are run to study the impact of having a social security system on households' overall fertility decisions. In the first set of analyses, the number of children on three sets of dummy variables are directly regressed, each representing one form of social security system. Especially, both the father's and mother's social security status are included to understand whether they have differential effects.

In addition, the percentage of male children is used as the dependent variable to study the impact of social security systems on households' gender preferences toward children. Most regression coefficients are insignificant, which seems to be consistent with the biological expectations. Since babies' genders are randomly selected, I would expect both numbers to be zero. However, when looking at the baseline, the percentage of males is more than 50%. This means that the average percentage of males is higher than in natural situations, which means that artificial gender selection still persists. Therefore, this shows that having social security systems, here being a form of old age security, would not affect people's gender preferences, which are more related to the traditional cultural norms where parents want to have male children to pass on the family line.

It is acknowledged that there can exist potential endogeneity problems. For example, urban households are both more likely to have better social security status and fewer children. The simple regression as above may only capture the fertility difference between urban and rural instead of the true effect of the social security system. Therefore, in the second analysis, these important household characteristics are included as the control variables.

This paper proceeds as follows. Section II conducts a literature review where previous studies are summarized. In Section III, the content and data are introduced. The summary statistics of households are presented included in the survey sample in Section IV. Section V focuses on documenting the trend of household's social security status in the past 20 years from the survey data. Section VI analyzes the effect of social security systems on a household's fertility decision, including the children number and gender preferences. Section VII presents conclusions.

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2. Literature Review

This paper responds to a large set of literature studying the effects of the social security system. Past studies have shown that social security systems can affect households' decisions in various aspects. For example, one of the most relevant studies is Shen et al [4], where they find that pension decreases the number of children by 8 percent. More importantly, this paper also discovered that pension influences the fertility rate of younger, well-educated, and high-income women more. Similar results have been found by Coeurdacier et al [5], where they analyze the effects of expanding social security on the number of children in China. There are additional studies analyzing the effect of social security on fertility in many other contexts, for example, Germany [6,7], Prussia [8], U.S. and Europe [2], and across-country analysis [9,10].

My paper contributes to the existing literature research in four ways. First, consistent results with past studies are provided, with social security having negative impacts on the fertility rate. I extend the previous study by focusing on households in developing countries and comparing rural and urban households. Second, a detailed analysis of the household's fertility decision in various aspects is conducted, both across time and across household characteristics. Third, while previous papers mostly consider one type of social security system, this paper provides a more comprehensive picture by comparing the relative importance of three different tools in the social security system. Finally, this paper enriches our understanding of fertility decisions by analyzing the effect of social security systems on households' gender preferences.

3. Context and Data

This project focus on three widely-seen tools in the social security system: pension, reimbursement, and medical insurance. First, the pension system was first launched in 1986, which relied mainly on a collective commune. In 2009, the Chinese government initiated a new pension system that was heavily subsidized by the central government and increases the coverage of rural residents to 326.4 million in 2011. Second, there has been a long history of reform in medical insurance and reimbursement since the 1950s. For the urban medical insurance system, the central government launched a pilot in 2007, The number of urban residents with medical insurance increases from around 30 million in 2007 to 300 million in 2013. On the rural side, there was a pilot in 2003. The number of participants increased from 700 million in 2007 to 800 million in 2013. During this period, the percentage of medical expenses that can be reimbursed has also been increasing steadily. From 2011 to 2021, the reimbursement standard has increased from 200 RMB per person to 580 RMB per person. In 2021, around 70% of medical expenses can be reimbursed.

This analysis utilizes the China Health and Retirement Longitudinal Study (CHARLS) from 2011 to 2018, funded by Peking University (China), World Bank, and National Institute on Aging. This survey is based on a high-quality nationally representative sample of Chinese residents ages 45 or older and their spouses. Participants were selected from 150 counties or districts from 28 provinces using a four-staged, stratified, and cluster sampling method [3]. This survey consists of the social, economic, and health circumstances of Chinese residents, starting from 2011, a biennial survey. There are elaborate questions that focus on social security including but not limited to medical insurance, medical aids, and government aids that help with this study. The survey in 2018 will be my foremost focus for this analysis. Besides the periodic core survey waves, a special life history wave was directed in 2014, which provides specific information on the social security of the participants – including but not limited to medical insurance and welfare in works. Table 1 provides the summary of the statistics that I use for this study from both the 2014 and the 2018 survey.

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Table 1: Summary Statistics

Variable	Obs	Mean	Std.Dey	Min	Max
Number of Children	20733	2.86	1.65	0	16
Gender (Male=1)	19816	0.47	0.50	0	1
Education Category	19816	3.45	1.94	1	11
Residence(Urban =1)	19816	0.40	0.49	0	
Age	19813	61.87	10.39	18	119
Reimburse	16,943	0.22	0.42	0	
Pension	16,947	0.21	0.41	0	1
Year with Medical Insurance	18404	2005.02	9.70	1900	2014

Notes: This table uses data from both 2014 and 2018 survey. I winsorize the observations at 5% and 95%.

4. Descriptive Statistics

4.1. Fertility decision within the family

It is started by describing household fertility decisions. First, it focus on the number of children per household. Figure 1 shows the distribution of households with at least a certain number of children among all samples in 2018. The line starts at 100% and decreases as the number of children increases since the percentage of households with at least zero number of children is mechanically 100%. The figure also shows that around 50% of households in China have at least 3 children in 2018. Most households (70%) have 2 to 5 children.

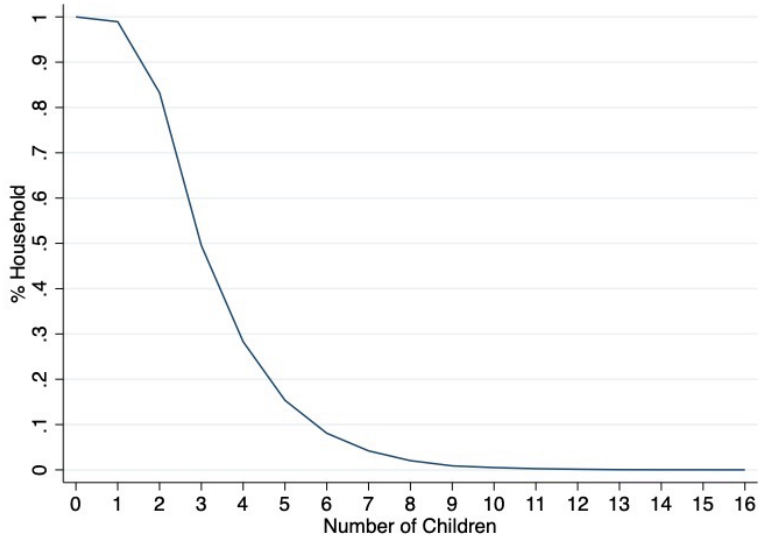

Figure 1: The Distribution of Households with at Least *N* Number of Children

Notes: This figure includes all households from the CHARLS survey from 2011-2018.The X-axis is the total number of children within in each household in the 2018 survey. The Y-axis is the percentage of household with at least certain number of children among all sample of households. The line starts at 100%, since the percentage of households with at least zero number of children is mechanically 100%.

Nextly, it turns to the gender composition within the household. Figure 2 calculates the percentage of males for every child-rank based on age within households. Children are firstly ranked based on their year of birth within their family and then calculate the percentage of male individuals for each group. First, we can observe that the average of male children percentage is greater than 50%. From

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a biological perspective, there should be a 50-50 distribution of children's gender. Thus, this tendency of a more-than-average number of children indicates a strong preference for boys. In addition, the figure shows that as the children's rank increases, the percentage of males also increases. This indicates that as households are having more children, they have an even stronger preference for boys than girls. This outcome may be driven by the abandonment of female new-born [11].

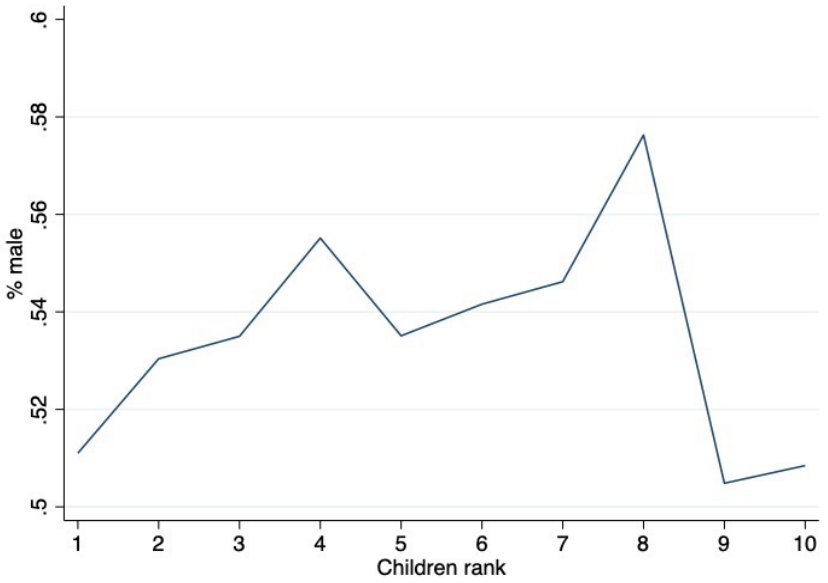

Figure 2: The Percentage of Male by the Rank of Children

Note: This figure includes all households with at least one child from the CHARLS survey from 2011-2018. The X-axis is the rank of children based on their year of birth within their family. The Y-axis is the percentage of male individuals for each specific rank.

However, when calculating the percentage of male children per household, which is figure 3, it is observed that the percentage of males decreases as households have more children. This result seems surprising in the first place but it is actually aligned with my previous finding. This pattern is driven by that households keep on giving birth to the next child if they have no male children. This can be seen more clearly in figure 4, where the probability of having a next child condition on previous children's gender composition is calculated. It shows that on average, the probability of having a next child is higher when the current child is female. For example, the probability is all above 50% in figure 4-(b), but not in figure 4-(a). In addition, this probability is even higher than 65% when households have zero male children.

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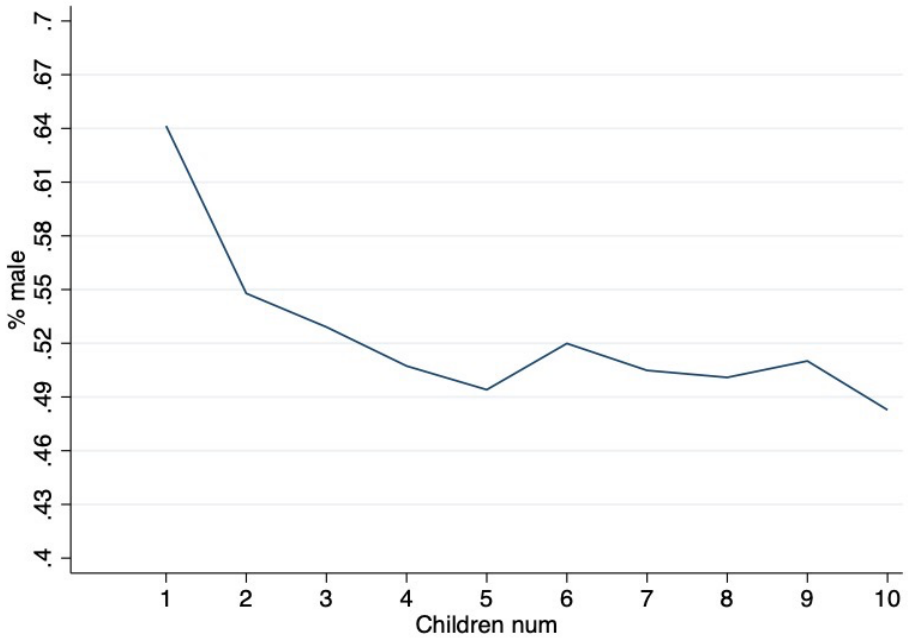

Figure 3: The Percentage of Male for Household with each Children Number

Note: this figure includes all household with at least one child from the CHARLS survey from 2011-2018. The X-axis is the number of children in the household, while the Y-axis is the average percentage of male for each household's children with the responding number.

(a) When this child is male

(b) When this child is female

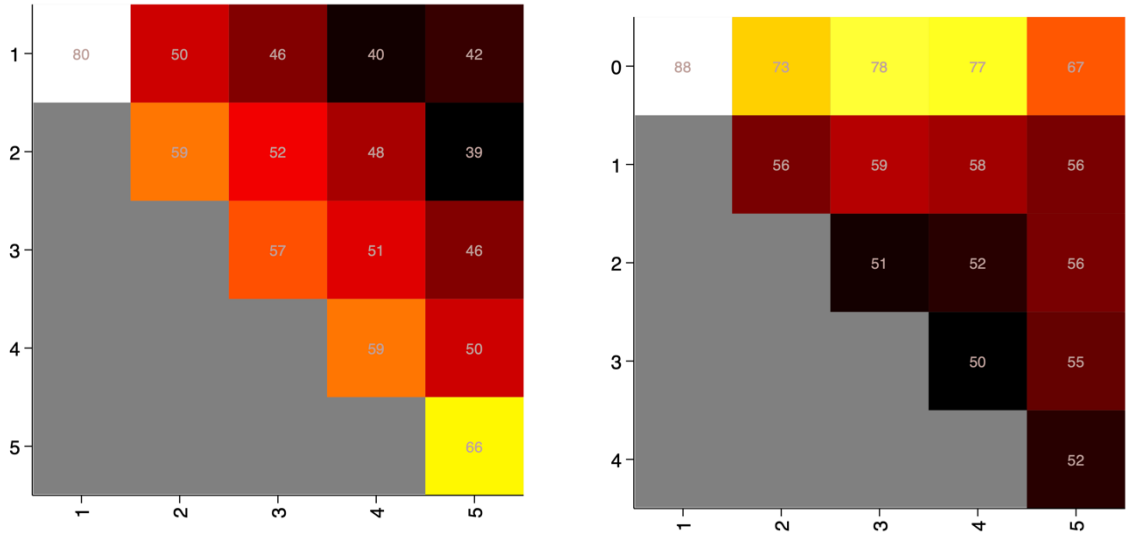

Figure 4: Percentage of Household Having a Next Child.

Note: This figure includes all households from the CHARLS survey from 2011-2018. The X-axis is the number of male children. The Y-axis is the total number of children. Colors and numbers in each cell represent the percentage of households having a next child. The first subfigure computes the percentage when the current child is male, while the second subfigure computes the percentage when the current child is female.

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4.2. How parents' characteristics affect fertility decision

Having seen households' fertility decisions on average, in this section, it further explores how households' characteristics affect their fertility decisions. As shown in figure 5, there is a trend of younger households giving birth to fewer children. Since it only keeps households with parents older than 40 years old, this result is less likely to be purely driven by age mechanically. Though there can be various factors contributing to this trend, in this project I focus on social security's influence on it.

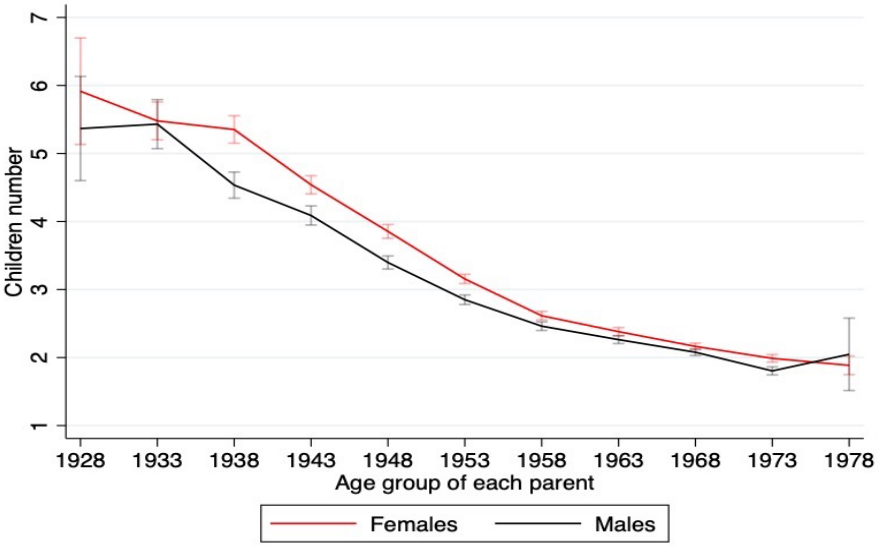

Figure 5: Children Number Relative to Parent's Age Group.

Note: This figure includes all households from the CHARLS survey from 2011-2018. The X-axis is the birth year of parents divided by age groups (5 years gap per group). The Y-axis is the average children number for each household.

There are also other important household characteristics that affect households' fertility decisions. For example, figure 6 demonstrates two trends. First, households with higher education tend to have fewer children. Second, a female's education level would have more impact on the number of children she had. Among people with a high school degree or higher, females have about 0.4 fewer children than males, which is significant at a 1% level. Figure 7 compares the number of children in urban versus rural households. It shows a clear pattern that urban households on average have 2.48 children, while rural households have significantly more children with an average equaling 3.06.

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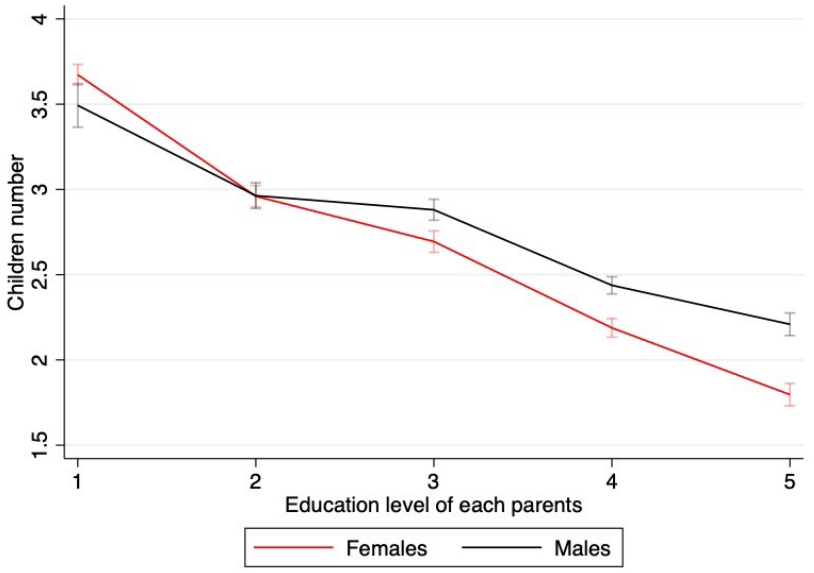

Figure 6: Children Number Relative to Parents' Education

Note: This figure includes all households from the CHARLS survey from 2011-2018. The X-axis is education level of parents. (1: illiterate; 2: literate but no school; 3: elementary school or sishu; 4: middle school; 5: high school to doctoral). The Y axis represents the number of children.

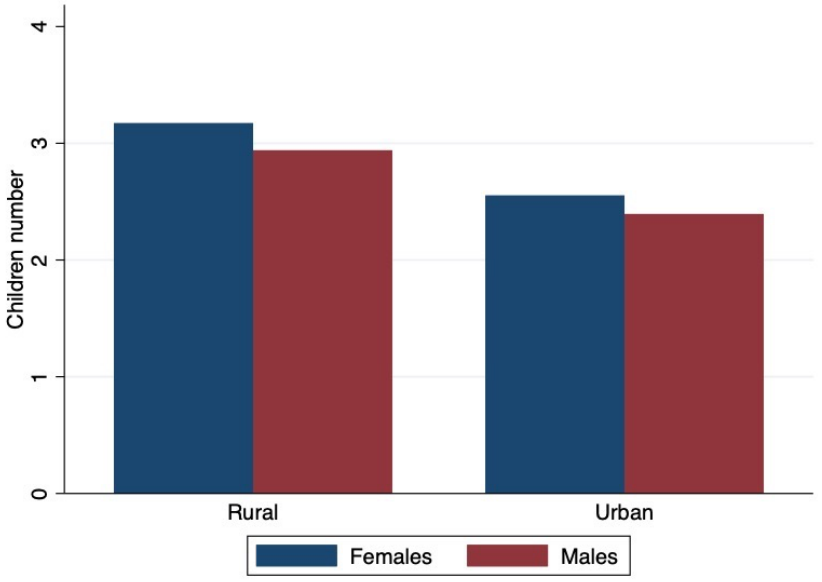

Figure 7: Children Number vs Parents' Residence

Note: This figure includes all households from the CHARLS survey from 2011-2018. The X-axis represents the place of residence for respondents. The Y-axis is the average children number for each respondent.

In addition to the number of children, the timing of giving birth is also analyzed. Figure 8 illustrates female respondents' birth year compared to the average age they obtain their first child. The numbers do not have a very distinct difference, where it can be seen that mothers born from 1928 to 1978 tend to give birth to their first child around ages 22-24. Therefore, social security systems may have an impact on the number of children born, but not the age female respondents have their first child.

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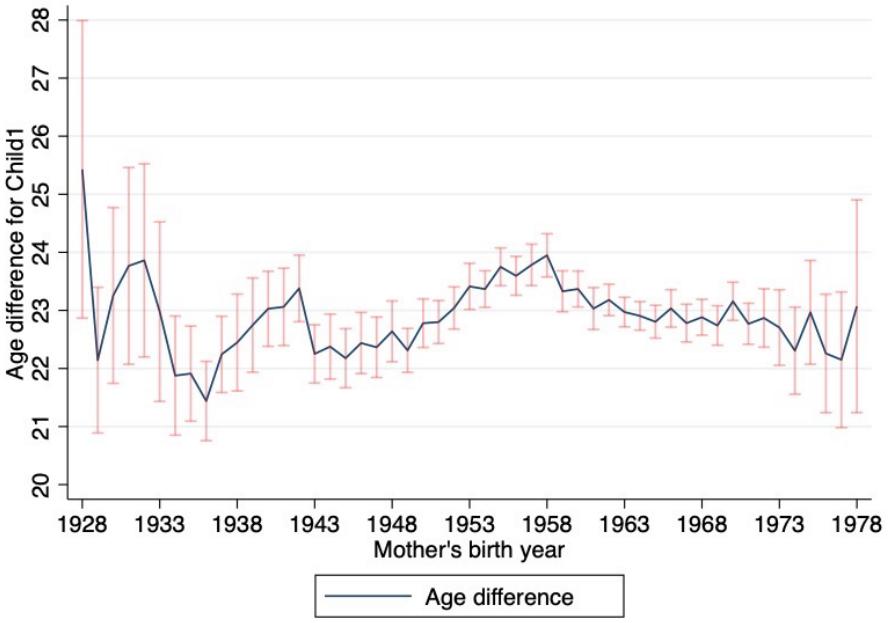

Figure 8: Mother's Birth Year and the Age She has Her First Child.

Note: This figure includes all households from the CHARLS survey from 2011-2018. The X-axis is the mother's birth year divided by age groups with a range difference of 5. The Y-axis is the age difference between the mother and her first child.

5. Social security system

This section analyzes the overall situation of the social security system in China, especially relating to their reforms in recent years. In addition, it explores how households' different social security statuses correlate with their characteristics.

It is started by analyzing the year people get their medical insurance. Figure 9 represents the percentage of people getting their first medical insurance each year. It has been increasing since 2001 and reached its peak in the year 2009 and decreases immensely after that. There is also a small peak in the year 2004 as at the end of the year 2003. This result is consistent with government reforms in the medical insurance sector as documented in section 3. Overall, it does not find significant differences between males and females, but there is still a higher rate for males at the beginning while the female percentage catches up after the peak of 2009.

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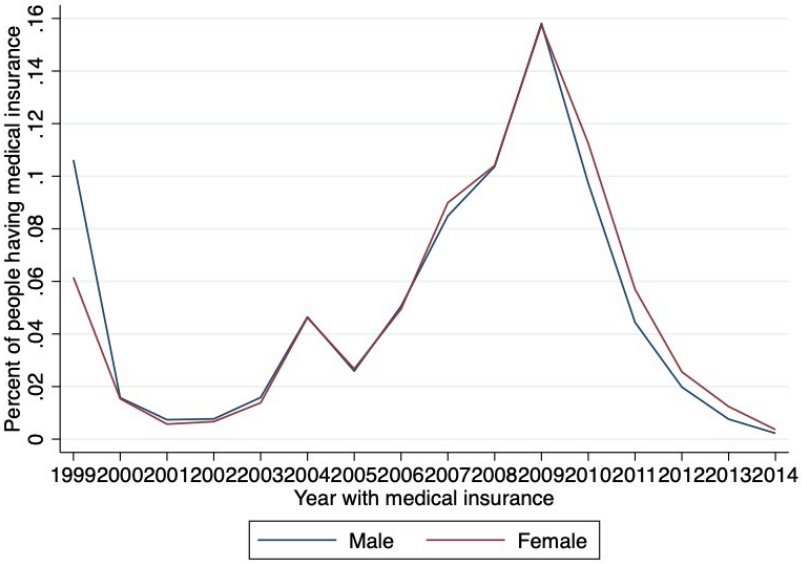

Figure 9: Percent of People Having Medical Insurance for Each Given Year.

Note: This figure includes all households from the CHARLS survey from 2011-2018. The X-axis is each year from 1999-2014 (1999 represents all households in 1999 and prior). The Y axis is the percentage of people getting medical insurance that given year.

Next, other social security systems are compared with household characteristics. Figure 10 shows how respondents' education level correlates with their pension status. As expected, it finds that the percentage of respondents with pension increases significantly with their education level. There is a very distinct difference between people that have high school and above education versus the rest. This might be driven by that higher education respondents are more likely to find formal jobs, which can provide pensions.

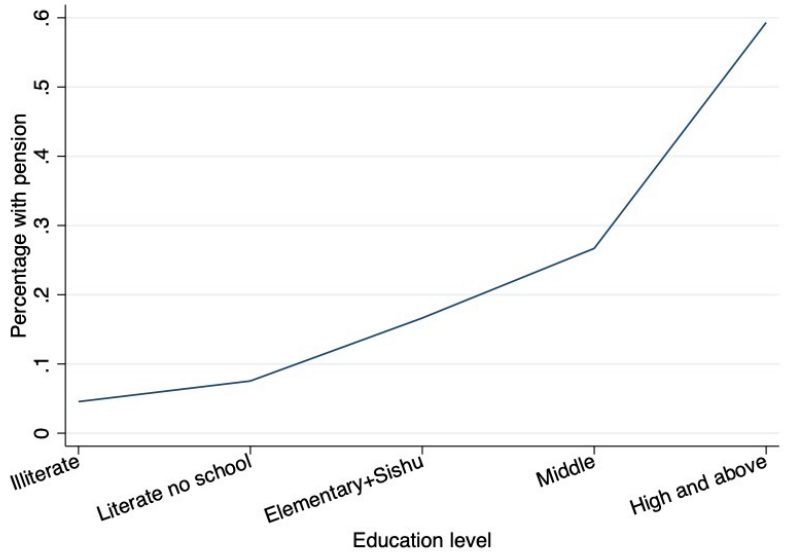

Figure 10: Respondents' Educational Level vs Percentage with Pension

Note: This figure includes all households from the CHARLS survey from 2011-2018. The X-axis is the education level of respondents. The Y-axis is the percentage of each category with pension.

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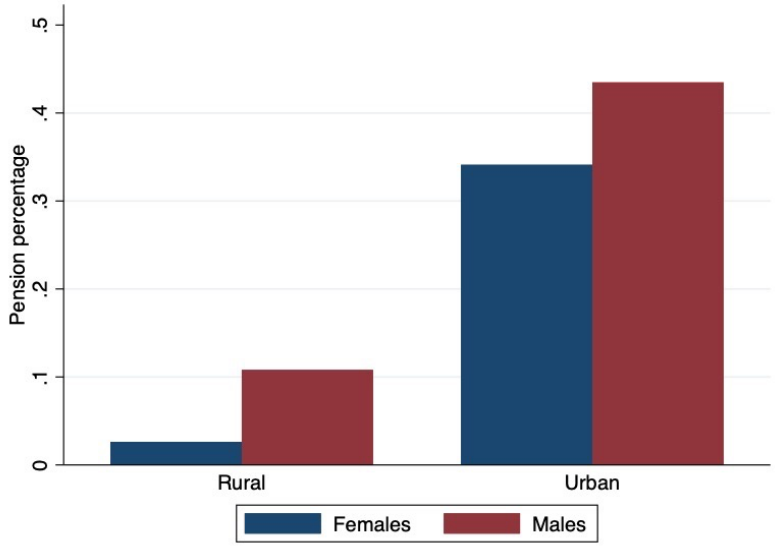

Figure 11: Parent's Place of Residence vs Percentage with Pension.

Note: This figure includes all households from the CHARLS survey from 2011-2018. The X-axis is the respondents place of residence. The Y-axis is the percentage of each category with pension.

There are other household characteristics that correlate with social security status aside from education level. Figure 11 compares the pension status between rural and urban households. Similarly, urban households are significantly more likely to have pensions. Males on average have higher pension rates. This is consistent with the trend that males are more likely to work outside the household, and there are more formal jobs in the cities. The percentage of people with medical reimbursement by their place of residence and gender is also calculated, shown in figure 12. The result is similar to figure 11 for similar reasons.

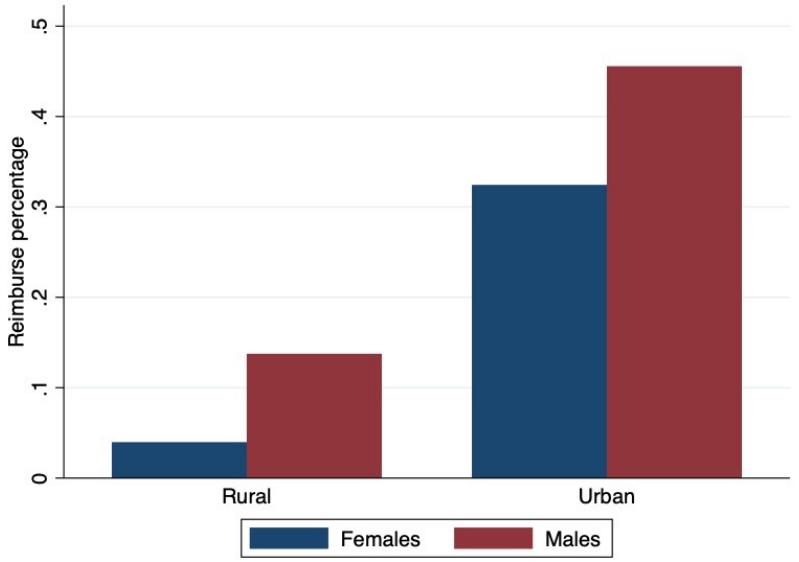

Figure 12: Parent's Place of Residence vs Percentage with Reimbursement.

Note: This figure includes all households from the CHARLS survey from 2011-2018. The X-axis is the respondents place of residence. The Y-axis is the percentage of each category with reimbursement.

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6. The effect of the social security system on fertility

This section represents the main analysis of this project, where the effect of social security systems on household fertility decisions is analyzed. Firstly a distinct analysis of each social security system is made and then the three are combined to make an overarching analysis.

Table 2: The Effect of Medical Reimbursement on Children Number and their Gender.

Dep.Var.	Number of Children			Percent of male children		
	All	Rural	Urban	All	Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)
Reimburse mother	-0.798**	-0.245	-0.703***	-0.0302**	0.0145	-0.0324
	(0.0681)	(0.152	(0.0789)	(0.0149)	(0.0294)	(0.0208)
Reimburse father	-0.271***	-0.102	-0.199***	-0.00206	0.0138	-0.0107
	(0.0552)	(0.0826)	(0.0742)	(0.0121)	(0.0160)	(0.0196)
Observations	4,821	2,877	1,944	4,821	2,877	1,944
R-squared	0.057	0.002	0.075	0.001	0.000	0.003
Sample Y Mean	2.845	3.119	2.438	0.546	0.553	0.537
SampleY SD	1.528	1.530	1.433	0.325	0.295	0.364

Note: This table reggresses the number of children and the percentage of male children in each household on two dummy variables,wether the mother or father has medical reimburse. Column 1 and 4 include all households,while column 2 and 5 include only rural households and column 3 and 6 with only urban households.
*** p<0.01,**p<0.05,*p<0.1

It is started with exploring the effect of reimbursement. Table 2 shows that both mothers' and fathers' reimbursement statuses decrease the number of children. More interestingly, this effect only exists among urban households and is more significant with mothers' reimbursement status. However, this can be correlated to mother education, which motivates me to include mother education as one of the control variables in the next robustness check section. On the other hand, it finds that on an aggregate level, when mothers have medical reimbursement, the percentage of male children decreases. However, the effect is not significant when I separate the sample by urban or rural status.

Table 3: The Effect of Medical Insurance on Children Number and their Gender.

Dep.Var.	Number of Children			Percent of male children		
	All	Rural	Urban	All	Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)
Insurance mother	-0.767***	-0.830***	-0.672***	0.000663	0.0199	-0.0163
	(0.0476)	(0.0709)	(0.0609)	(0.00958)	(0.0132)	(0.0148)
Insurance father	-0.658***	-0.614***	-0.512***	-0.00181	0.00163	0.00118
	(0.0494)	(0.0799)	(0.0633)	(0.00996)	(0.0149)	(0.0153)
Observations	11,582	6,163	4,251	11,458	6,158	4,247
R-squared	0.057	0.050	0.064	0.000	0.000	0.000
Sample Y Mean	2.892	3.147	2.544	0.547	0.554	0.538
Sample Y SD	1.649	1.633	1.516	0.322	0.297	0.356

Note: This table reggresses the number of children and the percentage of male children in each household on two dummy variables, wether the mother or father has medical insurance before 40 years old. Column 1 and 4 include all households,while column 2 and 5 include only rural households and column 3 and 6 with only urban households.
***p<0.01,**p<0.05,*p<0.1

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Table 4: The Effect of Pension on Children Number and their Gender.

Dep.Var	Number of Children			Percent of male children		
	All	Rural	Urban	All	Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)
Pension mother	-1.015***	-0.725***	-0.864***	-0.0167	0.0493	-0.0222
	(0.0695)	(0.183)	(0.0786)	(0.0153)	(0.0355)	(0.0209)
Pension father	-0.161***	0.0513	-0.0778	0.00469	0.00779	0.0119
	(0.0575)	(0.0894)	(0.0749)	0.0127)	(0.0173)	(0.0199)
Observations	4,820	2,875	1,945	4,820	2,875	1,945
R-squared	0.071	0.006	0.091	0.000	0.001	0.001
Sample Y Mean	2.847	3.120	2.443	0.546	0.553	0.537
Sample Y SD	1.528	1.530	1.435	0.325	0.296	0.363

Note:This table reggresses the number of children and the percentage of male children in each household on two dummy variables,wether the mother or father has pension for at least one of their jobs.Column 1 and 4 include all households,while column 2 and 5 include only rural households and column 3 and 6 with only urban households.
***p<0.01,**p<0.05,*p<0.1

Similarly, in table 3 and 4, it shows that whether parents have insurance or pension after retirement have significant negative effects on the total number of children but not on the percentage of male children. The effects of both social security policies have similar magnitudes. Suggestively, urban households seem to care more about pensions while rural households seem to value medical insurance more.

Table 5: The Effect of All Social Security Systems on Children Number and their Gender.

	(1)	(2)	(3)	(4)
VARIABLES	children_num	children_num	percent_male	percent_male
Reimburse Mother	-0.0342	-0.158*	-0.0543**	-0.0511**
	-0.0942	-0.0809	-0.0211	-0.0212
Reimburse Father	-0.0313	-0.142**	-0.0221	-0.019
	-0.0725	-0.0625	-0.0162	-0.0164
Pension Mother	-0.673***	-0.413***	0.0226	0.0294
	0.097	-0.085	-0.0217	-0.0223
Pension Father	-0.0139	-0.208***	0.0167	0.0218
	-0.0747	-0.0655	-0.0167	-0.0172
Insurance Mother	-0.572***	0.159**	0.00143	-0.00324
	-0.0754	-0.0673	-0.0169	-0.0176
Insurance Father	-0.436***	-0.0512	0.0252	0.0242
	-0.0712	-0.0617	-0.0159	-0.0162
Control Variable	No	Yes	No	Yes
Observations	4,811	4,811	4,811	4,811
R-squared	0.102	0.345	0.003	0.003
Sample Y Mean	2.847	2.847	0.546	0.546
SampleY SD	1.529	1.529	0.325	0.325

Notes: This table regresses the number of children and percentage of male children in each household on six dummy independent variables and a set of control variables. The independent variables are the same as previous tables,which represents the social security status of either the mother or the father. In column 2 and 4,the control variables include education level, urban or rural status, and age group of both parents.
***p<0.01,**p<0.05,*p<0.1

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After documenting each system separately, in table 5, all three independent variables are added as well as the parent's education level, place of residence, and age group as control variables. This comparison helps measure the significance of each variable, control for the endogeneity of having social securities and points more vividly to the extent of influence each has toward the number of children born. Overall, it finds that as parents get social security, they give birth to fewer children since most of the coefficients are significantly negative. Comparing columns 1 and 2, it finds that the results are relatively stable for the control variables. Although the magnitudes change across the two columns, the directions of the coefficients stay the same.

More importantly, because all the independent variables here are dummy variables, it can directly compare the coefficient of which type of social security has the largest effect. As in table 5 column 2, whether the mother has a pension has the biggest impact on the number of children. This makes sense as there is this old saying in China that "raising a child is insurance for old age". Pension therefore can be a substitute for children to guarantee financial aid when people get older. However, in column 2, there is a positive coefficient in mother insurance, meaning that having medical insurance makes mothers more willing to give birth. This could be due to the feeling mothers get of being either safer or cheaper to give birth after having medical insurance. Also, this coefficient is not as significant as other coefficients, therefore can be a result of measurement errors.

In addition to the number of children, the effect of the social security system on gender composition is also analyzed. Column 3 and 4 in table 5 shows that social security does not increase or decrease the percentage of male children. The only significant number is whether mothers have medical reimbursement, which decreases the likelihood of having male children. Recall that in figure 2, it shows that the percentage of male children is higher than 50%. This implies that establishing a better social security system does not affect households' preferences for male children. It reveals that to achieve gender equality, much more effort is needed.

7. Discussions and Conclusions

In this paper, it shows that a household's social security status can significantly decrease the number of children per household. Among all factors, it is found that mother's pension is the most influential. It is shown that when mothers have pensions, it can decrease the number of children by 0.413. Noticeably, social security status has limited to no effects on a household's gender preferences, where I find that better social security status does help achieve a balanced gender ratio.

However, endogeneity is the biggest challenge in studying this topic, which might affect the results of this paper. To deal with this, robustness checks are conducted by adding the control variables such as parents' education level in the main analysis. It is acknowledged that there might still be some remaining factors that I have not included. Given the difficulty of randomizing households' social security systems, future research with richer data or any natural shocks could also enrich the findings in this field.

Findings from this project help both the public and the government evaluate the effect of social security systems. While it decreases the number of children by providing better safety nets for the elders, more efforts are needed to achieve gender equality.

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