Examining the Effects of Pension Reform on Families' Investment in Education - Evidence from China*

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Abstract

This study investigates how changes in pension policies affect households' investments in their children's education. In China, elderly individuals receive financial support from their children, in addition to pension benefits and personal savings. The researchers used a difference-in-differences (DID) analysis to compare the investment behavior of households with enterprise employees (who were affected by the 1997 pension reform) and public sector employees (who were not affected) on household investments in human capital and savings. The results showed that households expecting lower pension benefits increased their investments in education by around 2%. Additionally, a 10% decrease in the pension replacement rate corresponded to a 1.1% rise in households' investments in human capital. The study also looked at the 2015 pension reform, which aimed to reduce pensions for public sector employees, but the increase in education investment among these employees was not statistically significant, possibly due to the gradual 10-year transition period. The findings suggest that when pension income is expected to decrease, households invest more in their children's human capital development to compensate.

Key words: pension reform, investment in education, intra-family transfers, household savings

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1 Introduction

Education holds significant value as it contributes to the development of society, the family and the growth of the individual as a whole. East Asian countries attach particular importance to the education of their children. Education is also a way to invest in future income flows. China, in particular, places great emphasis on education, drawing inspiration from Confucianism, which highlights its importance and promotes filial piety towards parents. Moreover, Chinese law requires children to support their parents, both financially and emotionally, in their old age. [1] This legal obligation adds to the altruistic motivations for parents to invest in their children's education, ensuring that they will be well-equipped to provide for them in the future.

In general, people have two potential sources of income after retirement: private savings and pensions. In the case of China, where the law mandates obligations, older individuals may expect to have a third source of post-retirement income: support from their Children. This means that changes in retirement policies can have a significant impact on how households invest in human capital and personal savings.

Many countries have implemented pension policies to enhance retirement security. In the United States, the pension system is supported by social security, employer-provided 401K plans, and individual retirement accounts (IRA), providing multi-level security. China is aging even more rapidly than the U.S. In recent years, China's demographic structure has shown continuous changes, and is facing a more rapid aging population. As shown in Figure 1, the number and proportion of people aged 60 and over, and 65 and over, have increased significantly over the past 12 years, with approximately 19% of the population aged 60 or older and over 14% aged 65 or older in 2021. Considering the current retirement age in China (60 for men, 55 for white-collar women, and 50 for blue-collar women)[2], the actual percentage of retired population is likely to be higher. To ensure pension sustainability and expand coverage, the Chinese government has introduced reforms in 1997 and 2015, reducing pensions for urban enterprise workers and public sector employees, respectively. These reforms have had a significant impact.

[1] From Law of the People's Republic of China on the Protection of the Rights and Interests of the Elderly (2015 Amendment): "Supporters of the elderly shall fulfill the obligations of providing for the elderly economically, taking care of them in daily life and comforting them mentally, and attend to their special needs. Where the supporters do not fulfill their obligations of providing for the elderly, the elderly shall have the right to ask the supporters for payment of support and other rights. The supporters shall not ask the elderly to do any work beyond their ability."

[2] The current retirement age is mandatory. A proposal to delay the retirement age was put forward in 2021, but there are no detailed plans or programs to implement the policy at this time.

This study utilizes a difference-in-differences (DID) approach to examine the impact of reduced pensions on households' investment in human capital and savings behavior, using China's pension reform as a natural experiment. The 1997 pension reform resulted in a significant decrease in pension benefits for employees in enterprises, lowering the replacement rate[3] from an average of approximately 75% to about 57.5%. In contrast, public sector[4] employees' pensions remained unchanged, ranging from 70% to 90% depending on length of service[5]. By comparing enterprise employees (treatment group) and public sector employees (control group), the study aims to isolate the causal effects of pension reduction on household behavior. Additionally, China's one-child policy, implemented in 1979, has led to a significant decrease in the number of children in Chinese families[6], simplifying fertility decision considerations in the analysis. In fact, the majority of households in the sample have only one child in school.

This study uses data from the China Household Income Project (CHIP) for 1995 and 2002, which provides a before and after comparison of the 1997 policy. The study focuses on two main outcome variables: investment in education and household savings. By employing a difference-in-differences (DID) regression, the study finds that households expecting a lower pension (the treatment group) invest 2% more of their income in their children's education compared to the control group (public unit households). Additionally, the treatment group shows a 6% increase in savings rate compared to the control group. To ensure the robustness of the results, the study tests various assumptions and uses different sample selections and control variable measures.

This study also uses the CHIP1999 survey data to conduct a difference-in-differences (DID) analysis, examining the impact of the 1997 policy on education investment two years after its implementation. The results indicate that the treatment group would have invested approximately 1.6% more of their household income in education compared to the control group. This magnitude is slightly lower than the baseline analysis, likely due to the short time elapsed since the policy was introduced. This finding suggests that individuals had the ability to adapt quickly to the new policy and make changes in their

[3]In this paper, the term "replacement rate" refers to the percentage of an individual's annual employment income that is replaced by retirement income when they retire. It is calculated by the ratio of (gross income received in retirement) divided by (a pre-retirement gross income): Replacement Rate = Gross Income (retired) / Gross Income (pre-retirement)

[4]The public sector in this paper refers primarily to government agencies, schools and universities, and other non-profit sectors or institutions.

[5]Detailed policy descriptions and replacement rate formulas are written in Section 2.1.

[6]China's population policy is described in Section 2.2.

investment decisions.

This study also analyzes the 2015 pension reform, utilizing CHIP 2013 and 2018 survey data, which reduced the future pensions of public sector employees without impacting enterprise employees. The reform can be viewed as a "symmetry" of the 1997 reform, as it eliminated the difference between the pensions of enterprises and public sectors (i.e., the "Dual-pension" system) that was created by the 1997 policy, which can also be referred to as "Pension Merger". In this study, the DID regression is performed by defining public sector employees as the treatment group and enterprise employees as the control group, and the results indicate that the treatment group invests approximately 1.8% more of their household income in education compared to the control group. However, the result is not statistically significant, which may be attributed to the ten-year transition period, resulting in a more moderate response to the policy. This paper plans to continue researching this topic after the ten-year transition period (i.e., 2025).

China's current pension formula is publicly accessible, allowing this study to predict individuals' wages and calculate their future pension benefits and pension replacement rates using the formula. The results indicate a significant gap between the pre-policy and post-policy pension expectations of enterprise employees, with most pensions after the policy implementation concentrated between 40% and 80%, averaging 57.5%. This is notably lower than the pre-policy replacement rate. The study also explores the relationship between education investment and the replacement rate, finding that a 10% reduction in the replacement rate leads to a 1.1% increase in household income invested in education.

The article's final section focuses on developing an illustrative model to explore the relationship between pension expectations and family education investment decisions. By solving an optimization problem using the overlapping generations model (OLG), the paper demonstrates that the partial derivative of the share of household investment in education with respect to the replacement rate is negative. This result aligns with the empirical findings.

In summary, the study shows that family education investment decisions are influenced by pension expectations, with lower pensions leading to increased investment in education in pursuit of higher future intra-family transfers.

Literature Review

This paper contributes to the literature on the impact of social transfers on families' investment in their children's education, specifically in the context of China's pension reforms. Previous studies have shown that pension transfers can increase children's human capital as parents have more money to invest in their children's education and other activities that can improve their skills and knowledge. Ponczek [2011] shows that the 1991 Brazil pension reform with a substantial increase of pension amount had significant positive effects on schooling. de Carvalho Filho [2012] reaches similar results from Brazil pension reform and finds out that the effect if more significant for girls. Martinez [2004] finds positive effects of the a Bolivia's cash transfer pension program on household consumption and children's human capital. Edmonds [2006] documents large increases in schooling attendance when black South African families become eligible for fully anticipatable social pension income and provides with an explanation related to liquidity constraints perhaps because of schooling costs. However, However, some research has also found that parents are more likely to invest in their children's education and other forms of human capital if they know that their children will support them in their old age, which is consistent with the kinship story that family ties can provide incentives for parents to invest in their children because they know that this will pay off in the long run. Köthenbürger and Poutvaara [2006] proposes a theoretical framework to prove that reducing the social security contribution rate encourages investment in human capital. Some empirical research has found that parents are more likely to invest in their children's education and other forms of human capital if they know that their children will support them in their old age. In cultures where it is expected that children will support their elderly parents, family ties can provide incentives for parents to invest in their children because they know that this will pay off in the long run. Bau [2021] provides evidence that pension expansion decreases practices of kinship traditions to support old parents and investment in the education of children in Indonesia and Ghana. Herrmann et al. [2021] confirms the channel of children's support from a non-contributory pension scheme in Thailand by showing that older children benefit more from pension transfers.

This paper also adds to the literature studying children's human capital accumulation in China and its relationship with the impact of China's pension reforms. İmrohoroğlu and Zhao [2018] has shown that family support plays a prominent role in the well-being of the elderly in China and often substitutes

for the lack of government-provided old-age support systems. Fang and Feng [2018] provides a detailed overview of the current state of the Chinese pension system, as well as its development, its problems and some ideas for future reforms. Cai and Cheng [2015] reviews the history of China's pension system especially the 1997 pension reforms. Additionally, research has examined the effect of pension reform on life satisfaction, total education expenditure, and local public spending on education, as well as the impacts of the New Rural Pension Scheme (NRPS) on intergenerational wealth dependence and child investment. Abruquah et al. [2019] examines the effect of pension reform with its existing inequalities across demographic and social groups on the life satisfaction of retired urban residents. Mu and Du [2017] shows that a significant increase in the total education expenditure is found to be attributable to pension expansion with urban China data. Their finding is consistent with the kinship story that when social security is established to provide pensions to parents, their reliance upon children for future financial support decreases, and their need to save for retirement also falls. Yuan et al. [2018] uses both theoretical and empirical results to confirm that pension privatization is adversely associated with local public spending on education in China. In terms of 1997 pension reforms, Feng et al. [2011] and He et al. [2019] research on the its influences of on household savings and labor supply, respectively. Recently, many research papers examine the impacts of New Rural Pension Scheme (NRPS). You and Niño-Zarazúa [2019] shows that the NRPS strengthens intergenerational wealth dependence for the richest while penalizing the poorest by having a negative effect on their net worth. Shan and Park [2023] studies how access to public pensions affects old-age support and child investment in traditional societies and argues that impact on child investment significantly differs by child gender: while adult parents increase educational investment in sons, their investment in daughters appears to decrease.

Overall, this paper aims to provide a comprehensive analysis of the impact of China's pension reforms on families' investment in their children's education, taking into account the existing literature on social transfers, human capital accumulation, and pension reforms in China.

The remainder of this paper is structured as follows: Section 2 presents the institutional background, including two urban pension reforms in 1997 and 2015, as well as background information on China's education and fertility policies. Section 3 describes the data used in the analysis and the empirical methodology employed, specifically the difference-in-differences (DID) approach. Section 4 discusses the DID

empirical results, robustness checks, and a case study for expected pensions. Section 5 illustrates the modeling framework. Section 6 concludes the paper.

2 Institutional Background

This section provides an overview of the institutional context in which this study takes place, including two significant mandatory pension reforms implemented in 1997 and 2015, as well as a brief summary of China's educational background and changes in child policies.

2.1 Pension Policy

Table 1 provides an overview of the timeline of China's urban pension system reforms, including the significant "Dual Pension Scheme" in 1997 and the "Pension Merger" in 2015. The former reduced pensions for employees in enterprises, while the latter lowered pensions for employees in the public sector. Additionally, the New Rural Pension Scheme (NRPS) was introduced in 2009 to provide a basic income for older people in rural areas, and the Urban Residents Pension Scheme (URPS) was introduced in 2011 to expand pension coverage to all older persons living in urban areas. However, these non-mandatory policies are beyond the scope of this paper.

Since 1951, China has operated a pay-as-you-go (PAYGO) pension system for employees in the public sector and state-owned enterprises. The replacement rate after retirement is determined by the number of years worked, with a higher replacement rate for those who have worked longer (Table 2). In practice, the replacement rate is generally between 70% and 90%.

The pension insurance system has several key characteristics:

(1) **A single level**. The state is primarily responsible for post-retirement life, and pensions are the primary source of income for employees after retirement.

(2) **State guarantee**. Retired workers can receive their pensions from their former organizations, regardless of the organization's production and operation conditions.

(3) **Non-contributory**. Employees do not pay social insurance contributions, including pension insurance. Pensions are financed by transfers from government fiscal revenues for public sector employees

and by enterprises for state-owned enterprise employees.

(4) **Pay-as-you-go (PAYGO)**. Retirement formalities are handled in the original work unit, and the retirement salary is received in the original unit, but each work unit does not set up a pension insurance fund.[7]

The design of the system is highly welfare-oriented and not a social pension insurance system in the strict sense.

Since the reform and opening-up in 1978, marketization has had a significant impact on state-owned enterprises. The focus of the country's economic system reform shifted from rural to urban areas in the mid-1980s. The reform aimed to make enterprises self-managed, independently accountable, and self-sustaining economic entities. However, the age structure of employees varied among enterprises, with some having a large number and high rate of retired workers and others having very few retired workers, making the burden of pensions among enterprises different. To address this issue, some regions have begun to explore socialized pension insurance systems, coordinating pension costs among units to solve the problem of the unbalanced burden of retirement costs among state-owned enterprises and plan for the future pensions of workers in non-public enterprises.

In the early 1990s, the Chinese government proposed several goals, including establishing a multi-level pension insurance system, sharing pension insurance among the state, enterprises, and individuals, and implementing a combination of social coordination and individual accounts. Pilot policies have extended coverage from workers in state-owned enterprises to workers in other enterprises.

2.1.1 1997 Pension Reform: Dual Pension Scheme

In 1995, the State Council issued *Circular on Deepening the Reform of the Pensionary Insurance System for Workers and Staff Members in Enterprises*, further clarifying the model of the basic pension insurance system, which combined social coordination and individual accounts for workers and staff members in enterprises. However, pension benefits remained unchanged in most provinces until 1997. In 1997, the State Council promulgated *Decision on the Establishment of a Unified Basic Pension Insurance System for Enterprise Employees*, which clarified the model of pension insurance combining social coordination

[7] Only the National Federation of Trade Unions and trade unions at all levels withdrew transfers according to a certain rate, and after 1966 the transfers were also canceled

and individual accounts.

The structure of pensions after the 1997 reform is shown in Table 3. The reform did not affect the retired population (those who retired before 1997), and a transitional benefit was added for employees who joined the workforce prior to the 1997 reform to compensate for their inability to contribute before the reform. Both enterprises and employees were required to contribute to pension accounts. Enterprises contributed 20% to the basic benefit account, while employees contributed 8% to their individual benefit account.[8] More detailed formulas for the calculation of the three types of pensions are shown in Table 4.

The basic and transitional benefits are related to the average local wage and the individual's wage before retirement, and the basic benefit is proportional to the number of years contributed by the individual. There is an actuarial assumption for individuals, which is based on life expectancy. For example, a man who retires at the age of 60 will receive a monthly individual benefit that is the total amount in the account divided by 139 and can be taken for 139 months (i.e. until the age of 71.58). The balance in the personal pension account can be inherited through inheritance.

The new pension insurance system has several key features compared to the previous system, including:

(1) **Multi-level structure**. The system consists of three levels - basic pension insurance, occupational pension, and commercial pension insurance. The basic pension insurance only covers the basic living expenses of retirees.

(2) **Special partial accumulation system**. The employee basic pension insurance system combines social integration and individual accounts, using a mixed model that includes both pay-as-you-go and funded systems.

(3) **Contributory**. Both insured employees and their work units contribute to form the pension insurance fund, which is supplemented by the government when necessary.

(4) **Socialization**. The basic pension is organized and implemented by the government according to the law, and is managed by social insurance agencies with the cooperation of employers.

[8]The policy announced in 1997 indicated that corporations and individuals together contributed 11% to individual retirement accounts, with individuals contributing 8% and corporations 3%. This also means that enterprises contribute 17% to the basic benefit account. However, the reform in 2015 and the latest pension calculators all consider the individual account to be an 8% personal contribution. Therefore, this paper uses 8% when estimating pensions in Section 4.4.

2.1.2 2015 Pension Reform: Pension Merger

The 1997 pension system created a significant disparity in retirement benefits between employees in the public sector and those in urban enterprises. In 2015, the State Council issued the *Decision on the Reform of the Pension Insurance System for Staff of Institutions and Agencies*, to reform the pension insurance system for institutional staff, introducing a uniform basic pension insurance system that combines social coordination and individual accounts for all employees, regardless of their sector. This decision effectively abolished the "Dual Pension Scheme" and implemented the "Pension Merger".

Under the reformed system, employers and employees of public sectors will contribute to pension funds in the same way as enterprises. The formula for calculating pensions remains the same as in Table 3 and Table 4. However, a 10-year transition period was established at the time of implementation. In short, the 2015 reform does not affect those who have already retired. However, for those who started working before September 2014 and will before September 2024, pensions are accounted for according to the old and new methods. If the new method of accounting treatment is lower than the old method of treatment standard, the treatment standard of the old method will be issued according to the old method of treatment standard, to maintain the treatment is not lowered; if the new method is higher than the old method of treatment standard, the first year of retirement (October 1, 2014 to December 31, 2015) issued 10% of the excess, the second year of retirement (January 1, 2016 to December 31, 2016) issued 20%, and so on, to 100% of the excess for those retiring in the last year of the transition period (January 1, 2024 to September 30, 2024). Those who retire after the end of the transition period will be subject to the new scheme.

In summary, the 2015 reform aims to align pension benefits for public sector employees with those of enterprise employees. The "merger" will not be fully implemented until October 2024.

2.2 Educational Background and Child Policy

China's education system

Since 1986, China has practiced nine-year compulsory education lasts for nine years, consisting of six years of elementary school and three years of middle school. The education system is illustrated in

Figure 2. After middle school, students take a high school entrance exam and are streamed. Figure 3 shows the annual enrollment numbers at each level of education, indicating that approximately half of middle school students do not continue to high school. These students often attend vocational high schools to acquire practical skills. High school graduates undergo a college entrance examination, and in recent years, around half have been able to enroll in college. The others usually attend vocational colleges (or 2-year short-cycle colleges).

Since most Chinese families prioritize sending their children to college, they tend to invest more in education before the college entrance exam. Additionally, tuition fees for vocational high schools, vocational colleges, and colleges/universities are fixed and publicly available, not subject to changes in people's willingness to invest in education. Although college students may seek to enhance their skills by participating in extracurricular training courses (e.g., language courses such as TOEFL and GRE), they generally pay for these expenses out of their living allowances from their parents, which may not be considered household education expenditures. There could be some measurement error. The main analysis in Section 4 focuses on households with children in preschool, elementary, middle, and high school. However, this assumption is relaxed in the robustness tests.

Child Policy

China's population policies have undergone significant changes over the past 40 years, with some reforms overlapping with pension reform. The timeline of major policy changes is summarized in Figure 4.

In the early 1970s, the Chinese Government began to promote the idea of having fewer children, and in 1973 it put forward the policy of "late, sparse, fewer". It advocated delaying the first birth, increasing the spacing between births, and having fewer children. However, the policy was not mandatory. In 1979, the Chinese Government formally implemented a strict one-child policy. With the exception of multiple births and some special cases,[9] all couples could have only one child. This paper finishes a robustness test in Section 4.2 by excluding all households whose children were born before one-child policy.

From 1984 to 2011, the policy was gradually relaxed on a province-by-province basis for couples in which both spouses were only children (neither having siblings). In 2013, the policy was further

[9]Exceptions include: the first child is a non-genetically disabled child who cannot grow into the workforce; remarried couples have only one child in total; rural couple with only one daughter; minorities.

liberalized to allow couples to have two children if one of them was an only child. By the end of 2015, the universal two-child policy was introduced, allowing all couples, regardless of their family background (especially if both spouses have siblings), to have two children. These reforms, particularly the 2013 and 2015 changes, are relatively close in time to the 2015 pension reform. To account for internal differences due to population policy, this paper conducts separate regressions for each of the three types of households (i.e., those with one child, those with two children, and those with three or more children) in Section 4.3.

3 Data and Empirical Strategy

This section presents the empirical data utilized in the study, specifically the Chinese Household Income Project (CHIP), and describes the sample attrition that occurred. Additionally, it outlines the difference-in-differences analysis framework employed in the study and provides some descriptive statistical results derived from the sample data.

3.1 Data

The empirical analysis in this paper utilizes the China Household Income Project (CHIP) dataset, which is a repeated cross-sectional survey conducted by the China Institute of Income Distribution in collaboration with the National Bureau of Statistics (NBS). The CHIP survey covers rural households, urban households and rural-to-urban migrant populations. CHIP investigates respondents' demographic information, personal work and income status, information on family members, and information on household income, expenditures, and wealth. For rural households, the survey also covers the assets and liabilities of the farm household, sale and consumption of products, and purchase of means of agricultural production. A total of eight waves of data are currently available: CHIP1988, CHIP1995, CHIP1999 (urban), CHIP2002, CHIP2007, CHIP2008, CHIP2013 and CHIP2018. Of these, CHIP1999 was a pilot survey in which only urban households in six provinces were interviewed. The 2007 and 2008 surveys were part of the larger RUMiC (Rural-Urban Migrants in China) survey project, and the sampling methodology and sample structure were relatively different from the other years, especially the selection of provinces.

This paper focuses on two pension reforms for urban residents in 1997 and 2015. Therefore, CHIP1995

and CHIP2002 are selected as pre-reform and post-reform, respectively, to study the impact of the 1997 pension reform on urban household' education investment and savings. And the two waves of CHIP2013 and CHIP2018 are used to study the impact of the 2015 Pension Merger on urban residents. Also, CHIP1999 is used as a comparison with 1995 as a robustness test to add to the picture (the results are summarized in Section 4.2.5).

In terms of sample selection, this paper concentrates on urban households with working-age heads or spouses (22-60 years old) who have school-age children. The main analysis concentrates on households where the head or spouse is eligible for a pension. Some restrictions are relaxed in the robustness tests, and samples with implausible data, such as small age differences between parents and children (less than 12 years old) or children older than their parents, are removed.

The paper focuses on two explanatory variables: household investment in children's education and household savings. Household investment in children's education is measured in two dimensions: quantity and ratio to household income. The total education expenditure in the household income questionnaire is selected as the explanatory variable, and the breakdown of educational expenditures includes tuition fees, book expenditures, and other costs. The share of education in household income is determined by using the ratio of total education investment to total household income.

Household savings are derived from total household income minus household expenditure, and the savings rate is the ratio of savings to total household income. The paper also examines the impact of multi-child families on educational expenditures, as most families in the data sample have only one child who is a student. For families with two or more student children, the paper selects the average educational spending per child as the explanatory variable.[10] In the individual questionnaire, CHIP surveyed each household member's personal income sources throughout the year, including wage income for active workers, and pension and support income for retirees. In the household questionnaire, CHIP investigates the assets of the household, including financial assets, fixed assets, durable consumer goods, etc., as well as household debts, and a breakdown of the consumption expenditures of the entire household, including daily expenditures, education expenditures, alimony expenditures, etc.

[10]Price levels are derived from Chinese Consumer Price Index (CPI) data in the World Bank database: https://data.worldbank.org/indicator/FP.CPI.TOTL?locations=CN. Using 2010 as the base year (CPI = 100), the CPI for 1995 was 74.08, for 1999 it was 80.69, for 2002 it was 80.96, for 2013 it was 111.16, and for 2018 it was 121.56.

Since only total educational inputs were recorded in the household finance questionnaire, multi-child families did not distinguish educational expenditures for each child. However, most families in the data sample have only one student.[11] Section 4.1 examines families with one student. For families with 2 or more student children, the paper selects the average educational spending per child as the explanatory variable and reports the results of the robustness check in Section 4.2.2. The paper also focuses on the cost of preschool, elementary, middle school, and high school education, as tuition fees for vocational high school, vocational college, or university education in China are relatively fixed and publicly available. Self-improvement expenses for college students, such as TOEFL training, are generally noted from the living expenses given by parents and are more difficult to measure.

3.2 Difference-in-differences (DID) Approach

In the context of China's pension reform in 1997, employees in urban areas who worked for enterprises faced a decrease in their future pension income, whereas public sector employees were not affected. In contrast, the 2015 reform led to a reduction in pension benefits for public sector employees, while enterprise employees saw no change in their pension. By comparing households affected by the policy (treatment group) to those not affected (control group), a difference-in-differences approach can be used to evaluate the impact of the policy.

$$Y = \beta_0 + \beta_1 D_{treat} + \beta_2 D_{policy} + \beta_3 D_{treat} \times D_{policy} + \gamma X + \varepsilon \tag{1}$$

The outcome variable Y represents the household's investment in the child's education and household savings, both measured as a proportion of household income and amount of spending, respectively. The treatment group is defined using a dummy variable D_{treat} that takes the value of 1 when the household belongs to the treatment group and 0 when it is the control group. In the 1997 reform, households working in enterprises are the treatment group. In the 2015 reform, households working in the public sector are in the treatment group. The treatment group is defined in three different dimensions: the head of the household is affected by the policy, the head or spouse is affected by the policy, and the head and spouse

[11] In total, 90% of the families in the cleaned dataset had only one child who was a student.

are affected by the policy.

The variable D_{policy} measures whether the year is a post-policy year, taking the value of 1 for observations in 2002 for the 1997 reform and in 2018 for the 2015 reform. The interaction term $D_{treat} \times D_{policy}$ captures the differential trends in the outcome variables between the treatment and control groups, with its coefficient β_3 being the focus of the paper.

The control variables X include demographic information, years of education, and work-related variables of the head and spouse, as well as the gender, age, and educational stage of the children. Household economic measures such as household income and household financial assets are also included. Descriptive statistics for all variables are presented in Table 5 and Table 6.

The modeling configuration assumes that there are no unaccounted variables that might affect the outcomes of both the treatment and control groups before and after the pension reform. Therefore, any differences in trends between the two groups are attributed to the effects of the pension reform. However, the enterprise reform, which resulted in significant layoffs of enterprise employees in the late 1990s, raises a concern about the composition of the treatment group. The treatment group in the dataset consists exclusively of survivors of the enterprise reform following the 1997 pension reform. To address this issue, Section 4.2 proposes a new definition of the treatment group that includes households in which the head is currently working in an enterprise, households in which the head is currently unemployed and the reason for unemployment is layoffs or business bankruptcy, and households in which the head's last job was in an enterprise. This new definition aims to mitigate the concern that the treatment group may not accurately represent the population affected by the pension reform.

3.3 Summary Statistics

Table 2 presents descriptive statistics for the samples from CHIP 1995 and CHIP 2002, broken down by work sector of the head of the household. The table shows means and standard deviations for four outcome variables: education expenditure as a share of total income, investment in education, savings rate, and savings. One notable feature of the data is that the mean value of savings is negative in both 1995 and 2002. This suggests that many households faced financial deficits and had to use past savings to supplement their spending in those years.

The table also includes means and standard deviations for several control variables, including demographic characteristics of the head and spouse, such as gender, age, ethnicity, and CPC membership, as well as variables related to the household's economic situation, such as household income and household assets. Among the control variables, adding "head" to the name of the variable means that it is a control variable related to the head of the household, adding "spouse" to the name of the variable means that it is a control variable related to the spouse, and adding "child" to the name of the variable means that it is a control variable related to the child. The main control variables include the gender of head, age, ethnicity, CPC membership, years of education, manager and technical position of the head or spouse, and the child's gender, age and current stage of schooling: whether he/she is an elementary school student, middle school student, or high school student (preschool is used as the base group). The last two variables are household economic related variables in thousands. Asset finance represents the household's total financial assets, including fixed-term saving accounts, checking accounts, stocks, bonds, treasury bills, lending, production funds for family production/operations, and investments in enterprises or other business activities other than stocks and bonds. Household income represents the total household income for the year.

In terms of the control variables, the table shows that the means of most variables are relatively close across the two years. However, there are some differences in the proportions of certain variables, such as CPC membership, managerial positions, and technical positions. For example, the proportion of CPC members is higher in the public sector than in the enterprise sector, regardless of the year. Similarly, the proportion of managerial positions is higher in the enterprise sector than in the public sector, while the proportion of technical positions is lower in the enterprise sector than in the public sector.

Overall, the data suggest that household income and household assets have increased dramatically over time, reflecting the growth of the economy. However, the negative mean value of savings suggests that many households still face financial challenges and may be relying on past savings to make ends meet.

Table 6 presents descriptive statistics for the samples of CHIP2013 and CHIP2018, with variable definitions consistent with Table 5. Like Table 5, the means of most control variables are relatively similar, but differences in binary variables such as CPC membership, managerial positions, and technical

positions are notable. Household income and household financial assets have increased significantly from 2013 to 2018, indicating societal development.

Figure 5 displays a histogram of support expenditures of children to parents as a share of the child's total household income for the CHIP1995 and CHIP2002 samples. The distribution of support expenditure ratios is similar in both years, with most households contributing a small portion (around 5%) of their expenditure to support their parents.

Figure 6 shows the mean pensions of retirees grouped by age in the CHIP 1995 and CHIP 2002 individual data, with confidence intervals of plus or minus one standard deviation from the mean. The pension amounts have been inflation-adjusted to 2010 price levels. The figure reveals that, after the policy implementation, pensions in both the public sector and the enterprise sector have increased, but the gap between the two has grown. For most age groups of retirees, the difference between the two means is more than one standard deviation, indicating a widening gap between public and enterprise sector pensions.

4 Empirical Results

This section presents the empirical analysis's main results. Section 4.1 uses a DID approach with CHIP1995 and CHIP2002 to examine the 1997 reform's impact on reducing pensions for enterprise employees, studying its effect on household investment in education and savings. Section 4.2 performs several robustness checks on Section 4.1's findings. Section 4.3 analyzes the 2015 "Pension Merger" policy's impact on public sector employees' pensions, examining its effect on household education investment and savings. Section 4.4 conducts a case study to further explore the relationship between substitution rates and household investment in education by projecting future wages and pensions.

4.1 Educational Investment and Household Saving: 1997 Pension Reform

The CHIP1995 and CHIP2002 datasets contain samples from 11 and 12 provinces, respectively. 11 of which are identical, with province 50[12] appearing only in 2002. However, to ensure consistency in the

[12]In China, each province is assigned a unique two-digit numeric code. The CHIP data utilizes this same code system to identify provinces, ensuring consistency across all years of the survey.

sample structure and to facilitate comparison across years, the regression sample in Section 4 is limited to the 11 provinces that are common to both datasets. This allows for a repeated cross-sectional analysis of the impact of the pension reform on household investment in education and savings. The results of the all-province regressions are presented in Table 23 and Table 24 in Appendix A.1.

The analytical framework of this section is built upon Equation (1), which is used to examine the impact of the 1997 pension reform on household investment in education and savings. In this context, employees of enterprises serve as the treatment group, while employees of public sectors act as the control group. As such, Equation (1) can be rewritten as:

$$Y = \beta_0 + \beta_1 D_{ent} + \beta_2 D_{2002} + \beta_3 D_{ent} \times D_{2002} + \gamma X + \varepsilon \tag{2}$$

where Y is the explanatory variable that includes educational spending, household savings, and their ratios to household income. β_0 is the intercept. The binary variable, D_{ent}, identifies whether the household is employed in the enterprise sector or not. Three different dimensions are used to define the treatment group: the head of the household works in the enterprise, the head or spouse works in the enterprise, and both the head and spouse work in the enterprise. β_1 is the coefficient of dummary variable D_{ent}. D_{2002} is the binary variable showing the policy treatment. β_3 is the coefficient for the interaction term. The control variables X, include personal information of the head of household and spouse, the education level of the children, and the economic status of the household, measured by self-reported household financial assets. When the outcome variable is a ratio, the control variable for household assets is the quartile of household financial assets, while when the outcome variable is an amount, the control variables representing household economic status are the amount of household financial assets as well as the amount of household income.

By estimating the coefficients of the treatment and dummy variables, the equation allows us to assess the effect of the pension reform on household investment in education and savings, while controlling for other factors that may influence these decisions.

The regression results of Equation (2) are presented in Table 7 and Table 8, using data from families with one student and examining the child's educational level across preschool, elementary school, middle school, and high school. The explanatory variables in Table 7 are education-income ratio and investment

in education. And the explanatory variables in Table 8 are savings rate as well as savings. The treatment group is identified using three different dimensions:

- Column (1) and column (4): Households where the head works in an enterprise unit are considered the treatment group.
- Column (2) and column (5): A broader definition of the treatment group is used, including households where either the head or the spouse works in an enterprise, or in other words, households are identified as the control group only when neither the head nor the spouse works in an enterprise.
- Column (3) and column (6): A narrower scope is used to identify the treatment group, with both the head of household and the spouse working in the enterprise.

As can be seen in column (1) of Table 7, households with the head working in an enterprise increase their share of education expenditures in household income by about 2.1 percentage points compared to households with a head working in the public sector. This suggests that households may increase their spending on education in response to the expectation of a reduced pension. The results are similar for narrow calibers (column 3). However, in the second column, when the definition of the treatment group is relaxed (i.e., spouse working in firms but head working in the public sector is counted in the treatment group), the coefficient on the interaction term is relatively small (about 1.2%). This may be due to the generally greater influence of the head of the household on the household economy or on household decisions. For households in which the head works in the public sector and the spouse works in an enterprise, the head's expectations remain stable even if the spouse's future pension declines. The policy shock may not be as strong for such households. Thus the differences between the treatment and control groups are not as pronounced as under the other two definitions.

Before the 1997 policy (in 1995), the difference between the two types of households in terms of expenditure on investment in education as a share of household income was insignificant, but after the implementation of the policy, the share of education investment increases over time for both types of households, while it increases by about 2.1 percentage points more for workers in enterprises relative to workers in public sectors. As for the absolute amount spent on education, after controlling for variables such as household income and household assets, enterprise employees would increase more of their

spending on education compared with public sectore employees (columns 4 and 6), but the difference is not statistically significant.

Table 8 shows the impact of policy on savings. The first and third columns show that the difference between the savings rates of the two types of households was not significant in 1995, whereas after the policy was implemented, on average, the savings rate of workers in enterprises increased by about 6 to 7 percentage points relative to that of workers in institutions. Also, enterprise workers save relatively more (columns (4) and (6)), but the coefficients of the interation term are not significant. Similar to the analysis of investment in education, there is no significant difference between enterprise and public employees in the regression results under the broad-banded definition (column (2) and (5)). It is possible that policy shocks to spouses may not have a strong effect on households.

Overall, the results suggest that the 1997 pension reform had a positive impact on household investment in education and savings, especially for households with the head working in an enterprise.

For the analyses in Section 4.2, the treatment group is defined as the head working in an enterprise. Therefore columns (1) and (4) of Table 7 and Table 8 were chosen as the benchmark of comparison for the robustness checks.

4.2 Robustness

The first part of this section discusses the use of DID identification to account for the potential impact of layoffs on enterprise workers by expanding the definition of the treatment group. The second part of this section explores the various sample choices used in the study. In Section 4.1, the sample consists of families with only one child in school, and the educational levels of children are limited to preschool, elementary school, middle school, and high school. In contrast, Section 4.2.2 examines all levels of education for single-student families, restricts the sample to children born in 1980 or later (i.e., after the introduction of the one-child policy), and discusses educational expenditures in multi-child families. Section 4.2.3 discusses the different measures of family finances, while Section 4.2.4 evaluates the impact of the initial implementation of the policy on households by comparing the CHIP1999 pilot survey with the CHIP1995 survey.

4.2.1 Identification

In Section 4.1, the treatment and control groups are defined based on the current work status of the head of household. However, as discussed in Section 3.2, the 1997 pension reforms had different impacts on employees of enterprise units and employees of institutions, and the enterprise reforms of the 1990s resulted in layoffs of enterprise employees. In contrast, permanent employees of public organizations have "iron rice bowl" jobs (or secure jobs) with no risk of unemployment, which means that current employees of enterprises can be considered "survivors". To address this issue, this section modifies the identification conditions for the treatment group and adds additional restrictions.

The CHIP dataset asked participants about their work status at their last job, including reasons for leaving and basic information about the workplace. Therefore, this section defines a broader condition by considering as a treatment group those households where the head of the household is currently unemployed due to layoff or firm bankruptcy (i.e., a separation that was not caused by the person's own subjective reasons), or where the head's last job was in an enterprise, regardless of their current work status. This expanded definition increases the sample size from 5054 to 5382. Additionally, the paper excludes samples where the head did not start working before the policy implementation in 1997, based on the broad definition of the treatment group. The regression results are presented in Table 9 and Table 10, with the explanatory variables in Table 9 being education-related, and the explanatory variable in Table 10 being savings.

The outcome variables in columns (1) to (3) of Table 9 represent the percentage of household income invested in education, while the outcome variables in columns (4) to (6) represent the actual amount of money invested in education. Columns (1) and (4) of Table 9 are the benchmark results from column (1) and (4) in Table 7, and the treatment group is defined as the head working in an enterprise, while the treatment group in columns (2) and (5) is defined as households where the head works in an enterprise or has been affected by the layoff or bankruptcy, or has a last job was in an enterprise. The sample in columns (3) and (6) is further restricted to those who joined the workforce after 1997.

As shown in Table 9, the coefficients under the wide definition are generally similar to the baseline results, except for a slight increase in the magnitude of the coefficient of the interaction term in column (3). This suggests that those who joined the workforce after the policy did not experience the policy

shock firsthand and did not feel as strongly about expected pension reductions. After excluding this part of the sample, the remaining treatment group invested a little more in education relative to the control group.

Table 10 displays the regression results for the savings rate and savings amounts of employees in enterprises and public sector employees after the policy was introduced. The structure of it is similar to that of Table 9, with columns (1) - (3) showing the regression results for the savings rate and columns (4) - (6) showing the regression results for savings. Columns (1) and (4) are benchmark results, consistent with Table 8. The table shows that the interaction term coefficients are relatively similar across different definitions of the treatment group, indicating that the policy had a consistent effect on the savings behavior of employees in enterprises. Specifically, the results suggest that the savings rate of employees in enterprises was 6% higher than that of public sector employees, on average, after the policy was introduced. Additionally, the amount of savings for the treatment group is higher by about 1,400 RMB per year, although the result is not statistically significant.

4.2.2 Different Sample Selection

The previous baseline regression in 5.1 focused on households with a child in school and only considered regressions where the child was in preschool, elementary school, middle school, or high school. This section expands the sample scope and presents the results of the regressions on education and savings in Table 11 and Table 12, respectively. Table 11 presents the results of the regressions on education and Table 12 presents the results of the regressions on savings. The tables provide a comprehensive overview of the impact of the policy on education and savings outcomes for households with children in different stages of education.

Table 11 presents the results of regressions on education expenditures and savings for households with children in different stages of education. Columns (1) through (4) show the regression results for the share of education expenditures, while columns (5) through (8) display the results for education expenditures. The baseline results are shown in columns (1) and (5), which are the same as columns (1) and (4) of Table 7, respectively.

Columns (2), (3), (6), and (7) focus on households with only one child who is a student. How-

ever, columns (2) and (6) include vocational high school, vocational college, and university education in addition to basic education. Columns (3) and (7) use households with children in basic education but impose additional restrictions on the sample. China's strict one-child policy since 1979 affects household fertility decisions as well as other aspects. The regressions exclude samples with children born before the one-child policy (before 1980), which means that the regression sample includes families with children younger than 16 years old in CHIP1995 and families with children younger than 22 years old in CHIP2002. Since students in high school and below are all under 22 in the sample, the restriction is of little significance for the latter.

The regression results in columns (2) and (3) are similar to the baseline results in column (1), indicating that households in the treatment group still invest about 2% more of their household income in their children's education relative to the control group.

Columns (4) and (8) of Table 11 expand the scope of the analysis by considering the entire sample and calculating the average educational spending per child and this average educational spending as a share of household income as the outcome variable. The regression results in column (4) show that the treatment group's average investment per child as a share of household income increases by 1.7 percent more compared to the control group, which is slightly smaller than the 2.1 percent increase in the baseline results.

Table 12 presents the results of regressions on savings rates and savings amounts for different stages of education of children. The baseline regression results are shown in columns (1) and (4), while columns (2) and (5) present the results for all stages of education. The coefficient on the interaction term in the sample that includes vocational education and college education is lower, at 3.4%, and not significant, possibly due to the fact that families with older parents have different saving behaviors. The treatment group saves about 691 RMB more than the control group, but the coefficient is not significant.

Columns (3) and (6) restrict families with children born in 1980 and later, and the results show that for households more strongly affected by the one-child policy, enterprise households save, on average, 5.4% more of their household income than households in the public sector, which is less than the baseline of 6.2%. This may be due to the fact that the one-child policy has changed fertility attitudes and decision-making, and in households with only one child, there is no need to save for more children, and pension

policies do not affect household savings to the same extent.

4.2.3 Different Ways to Measure Household Assets

In the regressions presented in Section 4.1, the total value of household financial assets is utilized as a proxy variable for household assets. Quartiles of household financial assets are selected as control variables in regressions where education-income ratio and savings rate are explanatory variables, while the amount of household financial assets is controlled in regressions where investment in education and savings are outcome variables. In order to test the robustness of the results, other measures of household assets are considered in this section. The regression results are displayed in Table 13 and Table 14, where Table 13 shows the outcome variables related to education, while Table 14 presents the outcome variables related to savings.

In addition to the benchmark regressions, the study also examines three alternative measures of household assets:

Total household assets. This measure includes the total value of household financial assets, durable consumer goods, the market value of owned productive fixed assets, the market value of owned housing, and the estimated market value of other assets. The corresponding regression results are presented in columns (2) and (6) of Table 13 and Table 14.

Household net assets. This measure is calculated by subtracting total household liabilities from total household assets. The corresponding regression results are shown in columns (3) and (7) of Table 13 and Table 14.

Total household liquid assets. This measure includes only highly liquid and liquidable assets, such as fixed-term saving accounts, checking accounts, stocks, bonds, and treasury bills, in the household's financial assets. It excludes lending, production funds for family production/operations, and investments in enterprises or other business activities other than stocks and bonds. The corresponding regression results are presented in columns (4) and (8) of Table 13 and Table 14.

The results of the benchmark regressions in columns (1) and (5) of Table 13 and Table 14 are similar to the findings in columns (1) and (4) of Table 7 and Table 8, respectively. Specifically, the coefficients on the interaction terms are approximately 2.1% in columns (1) through (4) of Table 13 and around 6%

in columns (1) through (4) of Table 14. These findings support the conclusion that the treatment group invests and saves more in education relative to the control group, but the difference is not statistically significant.

In columns (5) through (8) of Table 13 and Table 14, the coefficients on the interaction terms are all positive but not significant, indicating that while the treatment group invests and saves more on education relative to the control group, the difference is not statistically significant. This suggests that the impact of the treatment on education spending and saving is not strong enough to be detected by the regression analysis.

Overall, the results of the regressions provide additional evidence that the treatment group invests and saves more in education relative to the control group, but the difference is not statistically significant. This supports the conclusion that the treatment has a positive effect on education outcomes, but further research is needed to confirm this finding.

Furthermore, given that household financial status can influence household spending decisions, this study splits the sample into four groups based on the stock of household financial assets and performs DID regressions for each group separately to examine the pre-policy responses of households with varying levels of wealth. The findings are presented in Table 15.

The first column of Table 15 mirrors the benchmark regression in the first column of Table 7, while columns (2) through (5) display the results of segmenting the sample into four groups based on the order of household financial assets. The first group has the lowest household financial assets, and the fourth group has the highest. The interaction term coefficients reveal that the retirement policy has a weaker impact on the poorest and richest groups, with coefficients of 0.012 and 0.013, respectively, which are not statistically significant. The policy's effect is more pronounced for the middle two groups, particularly the second group, suggesting a potential wealth effect that may also need to be considered in assessing the policy's impact.

4.2.4 Comparison of 1995 and 1999

In order to further investigate the impact of the 1997 pension reform, this section compares the CHIP data from 1999 and 1995. Since the samples are not identical, this section uses balanced mixed cross-section

data, which includes data from the six provinces that are common to both samples. The regression results for the unbalanced sample are presented in Table 25 and Table 26 in Appendix A.1. The regression equation is shown in Equation (3).

$$Y = \beta_0 + \beta_1 D_{ent} + \beta_2 D_{1999} + \beta_3 D_{ent} \times D_{1999} + \gamma X + \varepsilon \tag{3}$$

where the explanatory variable Y and control variable X have the same meanings as in Section 4.1. D_{1999} is a binary variable indicating the year, taking 1 when the year is 1999, and 0 when it is 1995. The treatment group is defined as households where the head works for an enterprise, and for robustness testing, the study also adopts a wider definition of the treatment group, which includes households where the head is currently working in an enterprise, or is currently unemployed and the reason for unemployment is layoff or firm bankruptcy, as well as households where the head's last job was in a firm regardless of their current job status. The sample is limited to families with only one child in school and the child's education level is preschool, elementary, middle school, or college. The regression results for education-related outcomes are presented in Table 16, while the saving-related results are in Table 17.

In Table 16 and Table 17, the treatment group is defined as households where the head of the household is currently employed in an enterprise, as indicated by columns (1) and (3). In contrast, columns (2) and (4) use a broader definition of the treatment group, which includes households where the head is currently working in an enterprise, or is currently unemployed and the reason for unemployment is layoff or firm bankruptcy, as well as households where the head's last job was in a firm regardless of their current job status.

As shown in Table 16, the treatment group allocates approximately 1.6% more of their household income towards their children's education compared to the control group, which is less than the 2% observed in the benchmark regression. This could be due to some households reacting slower than others, resulting in a less pronounced effect. However, the difference in spending between the treatment and control groups is not statistically significant. Additionally, columns (3) and (4) reveal that the control group would have spent around 560 RMB more on their children's education in 1999 than in 1995, while the treatment group spends approximately 137 RMB more than the control group, but the coefficient is not statistically significant.

Interestingly, Table 17 shows that the coefficients on the interaction terms in columns (1) and (2) are negative, while the coefficients on the year dummy D_{1999} are positive. This suggests that households' overall savings rate increased in 1999 compared to 1995, but enterprise households, which make up the treatment group, saved about 6% less of their household income than the control group. This finding contrasts with the results in Table 8 of Section 4.1. The difference in savings behavior between enterprise and public sector households may be attributed to the macro environment, specifically the period of severe corporate layoffs from 1998 to 2000, which affected enterprise households' saving behavior. The shock of lower future pensions, coupled with layoffs and uncertainty about future expectations, may have led to a savings behavior that deviates from that of public sector households.

4.3 "Pension Merger": 2015 Pension Reform

Similar to Section 4.1, CHIP2013 surveyed 14 provinces, while CHIP2018 surveyed 15 provinces, with province 15 appearing only in 2018. Therefore the sample used for the regressions in section 4.3 comes from the 14 provinces, and the results of the all-province regressions are in Table 27 and Table 28 in Appendix A.1.

This section takes a similar strategy as Section 4.1, comparing the three different dimensions of the definition of treatment groups. The treatment group in this section is defined as public sector employees, as the target population of the 2015 reform is public sector employees who are allowed to start paying pension contributions and receive lower future pensions. The regression model used in this section is as follows:

$$Y = \beta_0 + \beta_1 D_{pub} + \beta_2 D_{2018} + \beta_3 D_{pub} \times D_{2018} + \gamma X + \varepsilon \tag{4}$$

The model includes an explanatory variable (Y) that captures educational spending, household savings, and their ratios to household income. The binary variable (D_{pub}) identifies whether the household works for the public sector or not. Three different dimensions are used in this section to define whether the household belongs to the treatment group: (1) the head of the household works in the public sector, (2) the head or spouse works in the public sector, and (3) both the head and spouse work in the public sec-

tor. The model also includes control variables (X) such as personal information of the head of household and spouse, education level of the children, and household economic status measured by self-reported household financial assets. When the outcome variable is a ratio, the control variable for household assets is the quartile of household financial assets, while when the outcome variable is an amount, the control variables representing household economic status are the amount of household financial assets as well as the amount of household income.

The sample selection for this section is similar to Section 4.1, with households having only one student and children in high school education or below being retained. Additionally, households that retire before 2025 are excluded from the 2018 sample to ensure that the sample only includes households that are affected by the ten-year transition period.

The regression results of Equation (4) are presented in Table 18 and Table 19. Like Table 7 and Table 8, the tables display the coefficients for the interaction terms between the policy year dummy and the various dimensions of the treatment group. In Table 18, the coefficients on the interaction terms in columns (1) - (3) are positive, with the coefficient on the interaction term in column (1), which represents the treatment group defined as the head of household working in the public sector, being 1.8%. This is similar in magnitude to the variables in Section 4.1, but the coefficients are not significant. This may be due to the fact that 2018 is still in the middle of the ten-year transition period, and the policy shock to the treatment group is not yet particularly pronounced.

Table 19 shows that the coefficient on the interaction term is positive but not significant under the definition of the three dimensions of the treatment group. This suggests that institutional workers increase their savings rate relative to corporate workers, but the effect is not significant, possibly due to the ten-year transition period. The study will continue to monitor related data in this area and provide additional analysis of the impact of the pension merger policy on public employees after 2025.

Two-child Policy: Regression by household category

From Section 2.2 about China's population policy, it can be seen that the 2015 universal two-child policy affects families where neither spouse is an only child. The 2013 policy, on the other hand, affects families where one of the spouses is not an only child. To address this, this section examines the impact of China's

population policy on household savings rates, using a DID regression of Equation (4) for three categories of households based on the sibling status of the couple: both spouses are only children, one of the spouses is an only child, and neither of the spouses is an only child. The treatment group consists of households where the head works in the public sector. The sample attrition is the same as in Table 18 and Table 19, which includes households with one child at school, and the child is at pre-school, elementary, middle, or high school level. The results are presented in Table 20 and Table 21.

In Table 20 and Table 21, columns (1) and (4) are for families in which both spouses are only children, while columns (2) and (5) are for families in which only one of the spouses is an only child, and columns (3) and (6) are for families in which both spouses are not only children. However, the tables show an imbalance in the number of observations across the three categories, with approximately 6.57 of observations in the first category, 14.8 in the second, and 78.64 in the third. This disparity may affect the accuracy of the analysis.

In Table 20, columns (1) through (3), the investment in education expenditure for public sector households shows an increase relative to enterprise households, increasing by about 5% for both only children households and by about 6.8% for one only child households. However, this difference is not statistically significant. In contrast, columns (2) and (3) of Table 21 reveal that public sector households have higher savings rates compared to enterprise households in the one only child and no only child family categories. This suggests that these households may be saving in advance for future fertility decisions.

4.4 Case Study: Pension Prediction

This section uses individual data from from CHIP 1995, CHIP 1999, and CHIP 2002 to forecast future earnings of individuals. This prediction enables the application of the formulas presented in Table 2 and Table 4 to estimate future pensions and assess the impact of the 1997 pension reform on expected pensions.

The first step in the analysis is to predict future wages. This is done by using individual-level data such as age, gender, ethnicity, education, years of work experience, province, and job-related variables (e.g. industry, job title) as control variables in a regression model. The explanatory variable is the logarithm of wages, which is inflation-adjusted using the World Bank's CPI data for China. The meanings of the

variables and the regression results are presented in Table 29 in Appendix A.2. To account for clustering and heteroskedasticity, standard errors are calculated at the county level and are robust to both clustering and heteroskedasticity.

The next step is to calculate each individual's wage for every year from 1997 (or the first year of employment for those who started later than 1997) until retirement, while holding all control variables except age and years of employment constant. The wages are estimated using real wages for 1999 and 2002.

In the third step, the number of working years until retirement is calculated, and the pre-policy replacement rate and the pre-policy pension for the first year of retirement are determined using the formulas in Table 2. The pre-policy pension for the first year of retirement is calculated by multiplying the pre-policy replacement rate by the estimated salary for the year prior to retirement, which was determined in step two.

Step 4 then estimates the post-policy pension and replacement rate for enterprise workers in 1999 and 2002 using Table 4. W_A in Table 4 is calculated from the predicted wage in the second step. For example, for an individual who retires at the end of 2008, the predicted wage for 2008 is chosen as the pre-retirement wage. W_A is calculated by the average of the predict wages in the individual's province in 2007. From this, the basic benefit and the transitional benefit for the first year of retirement can be calculated. The individual pension account benefit is calculated by summing up all the predicted wages from 1998 until retirement, multiplying them by 8%, and ignoring interest on pension accounts.[13] The individual account benefit for the first year of retirement is determined by dividing this total by the pension actuarial month and multiplying by 12. Finally, the post-policy pensions are calculated by summing up the basic benefit, transitional benefit, and individual account benefit for the first year of retirement of employees in enterprises in 1999 and 2002, and thus the post-policy replacement rate.

The number of years a retiree will receive a pension can be estimated by subtracting the retirement age from life expectancy. Assuming pensions are adjusted annually for inflation only, the total pension over an individual's lifetime can be calculated by multiplying the number of years of receipt by the first-year pension amount. Life expectancy is sourced from the 2005 Chinese life expectancy data in the World

[13] Interest on pension accounts is ignored here. Since all amounts are inflation-adjusted, it is assumed here that the real interest rate on pension accounts is zero and that the amounts are only inflation-adjusted.

Bank database.[14]

Figure 7 shows the total lifetime pension amount that a sample of enterprise employees can expect to receive, broken down by age and gender, in 1999 and 2002. The dashed line represents the counterfactual pension estimate, or the total pension that employees would have received if the 1997 policy reform had not been implemented, while the solid line represents the pension expectation as affected by the policy. The graph shows that the policy has led to a significant reduction in the expected pension amount for both men and women. For example, a 40-year-old female employee in 1999 would have expected to receive a total pension of 150,000 RMB without the policy, but this amount was reduced to 75,000 RMB after the policy was implemented, a decrease of more than half. On average, men receive their pensions for a shorter period of time than women, but their later retirement age means they have longer working years, which suggests that men's and women's total pensions were expected to be roughly equal before the policy. However, after the policy was implemented, men's pensions were expected to be slightly lower than women's.

Figure 8 displays a histogram of the expected replacement rates for employees in enterprises from surveys conducted in 1999 and 2002. The vertical axis represents the density of the data, and the blue curve represents the kernel density estimate. The policy has caused a significant shift in the distribution of replacement rates, with the majority of workers now expecting a rate between 40 and 80 percent, with an average of approximately 57.5 percent. This is in contrast to the pre-policy replacement rate, which was typically above 70 percent.

This section concludes with a regression analysis that examines the relationship between the proportion of a household's investment in education and various factors, including the replacement rate of the head of the household, demographic information, and financial assets. The regression equation is as follows:

$$h_{it} = \alpha + \beta \cdot p_{it} + \gamma_1 X_{it} + \gamma_2 D_t + \gamma_3 D_{ent,it} + \gamma_4 D_t \times D_{ent,it} + \varepsilon_{it}$$

where h_{it} represents the proportion of the household's investment in education in year t, p_{it} represents

[14] According to the World Bank, in 2005, the life expectancy in China was 71.619 years for men and 76.819 years for women. This means that men can receive a pension for around 11.619 years, while women white-collar workers can receive a pension for approximately 21.819 years, and women blue-collar workers can receive a pension for about 26.819 years.

the predicted future replacement rate of the head of the household in year t, X_{it} represents control variables such as demographic information and financial assets, D_t represents year dummy variables, and D_{ent} is a dummy variable indicating whether the head of the household is working in an enterprise. Province fixed effects are controlled, and robust standard errors are clustered at the county level. The results of the regression analysis are presented in Table 22.

Table 22 presents the results of three regression analyses:

- Column (1) displays the results of regressing the entire sample for the three years 1995, 1999, and 2000.
- Column (2) shows the results of regressing only the 1995 and 2002 samples.
- Column (3) presents the results of selecting only balanced provinces (i.e., the six provinces surveyed jointly by CHIP1995, CHIP1999, and CHIP2002).

The regression analysis reveals that the coefficient for the replacement rate is approximately 0.11. This implies that for every 1% decline in the replacement rate, households tend to allocate 0.11% more of their income towards education. In other words, a 10% decrease in the expected replacement rate leads to a 1.1% increase in education investment. Given the observed decline in the replacement rate for enterprise households, from approximately 75% to 57.5%, households are found to invest around 2% more of their income in education. This finding aligns with the results discussed in Section 4.1.

5 Model

This section examines the issue of intergenerational optimization for households using the OLG model, taking into account the impact of the one-child policy in China. The policy has significantly limited the ability of households to make decisions about having children, particularly after the 1980s. To maintain a simple and illustrative model, we focus on the aspects of household savings and fertility decisions, while acknowledging their importance in the decision-making process.

5.1 Settings

The model makes several assumptions about households, including that they are homogeneous and go through three distinct stages of life: studying, working, and retirement. For households in generation t, the studying stage is characterized by receiving financial support from their parents (generation $t-1$) to pursue education and develop their own human capital. During the working stage, households in generation t support their retired parents (generation $t-1$) and raise and educate their own children (generation $t+1$). Finally, in the retirement stage, households in generation t receive a pension and support from their children in generation $t+1$.

The studying stage can be viewed as a period of human capital accumulation, during which households do not make decisions, do not derive utility from consumption, and receive educational support from their parents for capital accumulation. According to Bercker, Murphy, and Tamura (1990), the formula for intergenerational accumulation of human capital can be expressed as follows:

$$H_{t+1} = A(\bar{H} + H_t)^{\beta} h_t \tag{5}$$

where the human capital of a household in generation $t+1$, H_{t+1}, is equal to the product of three factors: A, the sum of the initial endowment $\bar{H}$ and the human capital of the parental generation H_t, raised to the power of β, and the investment in education from generation t to generation $t+1$, h_t. In other words, the human capital of the next generation is a function of the current generation's human capital, the initial endowment, and the investment in education. The coefficient A measures the productivity of investments, while $0 < \beta < 1$ represents the effect of scale on the accumulation of human capital.

During the working stage, households in generation t derive utility from consumption, $C_{w,t}$, and earn wages that are a linear function of their capital accumulation, $\bar{H} + H_t$. The base wage, $\bar{H}$, can be seen as the wage that the offspring can earn in the future based on the fact that the parents are not actively investing in their education, but rather relying entirely on public education in society. Household expenditures at this stage include social security payments, education expenditures for the next generation, and

support expenditures for the previous generation. The constraints for this phase can be written as:

$$C_{w,t} \leq (1 - \lambda_t - h_t - \phi)(\bar{H} + H_t) \tag{6}$$

where λ_t represents the income tax rate, h_t is the investment in education for the offspring as a share of household income, and ϕ stands for the support expenditure to the parents as a share of household income. The existence of the support expenditure can be considered as public information since it is mandated by Chinese law.

During the retirement phase, households in generation t derive utility from consumption $C_{r,t}$. The two main sources of income at this stage are pensions and intra-family transfers from offspring (generation $t+1$). The pension replacement rate, p_t, affects the first source of income, which is the product of wages and the replacement rate. The second source of income, intra-family transfers, is represented by the term $(\bar{H} + H_{t+1})\phi$, where ϕ is the proportion of support paid by generation $t+1$ to their parents (generation t) as a percentage of their wages. This term can be interpreted as the minimum standard of support set by law. The retirement stage constraint can be written as:

$$C_{r,t} \leq (\bar{H} + H_t)p_t + (\bar{H} + H_{t+1})\phi \tag{7}$$

The model simplifies the consideration of fertility and private savings, making education expenditure the only decision variable. Households pay for their children's education during the working years and receive returns during retirement through intra-family transfers.

5.2 Household Optimization Problem

According to the analysis in section 5.1, households derive utility from consumption at work, $C_{w,t}$, and in retirement, $C_{r,t}$. Taking into account the change in the time value of money that exists in both periods, the optimization problem for generation t households can be summarized as:

$$\max_{h_t} U = \log C_{w,t} + \delta \log C_{r,t}$$

subject to

$$C_{w,t} \leq (1-\lambda_t - h_t - \phi)(\bar{H}+H_t)$$

$$C_{r,t} \leq (\bar{H}+H_t)p_t + [\bar{H}+A(\bar{H}+H_t)^{\beta}h_t]\phi$$

The optimal level of educational investment, h_t, can be found by solving the above problem, and it is found to be:

$$h_t = -\frac{(\bar{H}+H_t)^{1-\beta}}{A\phi(1+\delta)} \cdot p_t + \frac{\delta}{1+\delta}(1-\lambda_t-\phi) - \frac{\bar{H}}{A(1+\delta)(\bar{H}+H_t)^{\beta}} \tag{8}$$

By taking a partial derivative of h_t with respect to p_t, we can find that there is an inverse relationship between the substitution rate and family investment in education

$$\frac{\partial h_t}{\partial p_t} = -\frac{(\bar{H}+H_t)^{1-\beta}}{A\phi(1+\delta)} < 0$$

The two pension reforms of 1997 and 2015 lead to lower expected pensions for the target population, which in turn seeks more intra-family transfers in the future by increasing investment in education.

Using the replacement rates estimated in section 4.4, we can create a scatter plot of the proportion of investment in education and the replacement rate, with a fitted line (see Figure 9). The slope of this fitted line is around 0.11, as derived from section 4.4.

6 Conclusion

This paper examines the impact of changes in pension expectations on household investment in human capital and savings. The 1997 pension reform in China reduced the future pensions of employees in enterprises, providing a natural experiment for studying the relationship between pension expectations and household behavior. The paper uses a difference-in-differences (DID) approach, comparing employees in enterprises (the treatment group) to public sector employees (the control group), to estimate the impact of the reform on household investment in education and savings.

The empirical analysis of CHIP1995 and CHIP2002 reveals that enterprise employees invested 2% more of their income in their children's education compared to public sector employees, and their household savings rate was 6% higher. These results suggest that households expecting a decline in future pensions invest more in their children and increase their personal savings to supplement their expected future income. The results are robust to various sensitivity checks, including redefining the treatment group, changing sample attrition, and using different measures of household assets. The paper's findings, however, indicate that households with varying levels of wealth respond differently to policy, with the middle two groups, particularly the second group, being more sensitive to policy changes. In contrast, the policy's impact is not significant for the poorest and richest groups.

In the regressions for CHIP 1995 and CHIP 1999, the treatment group invested about 1.6 percent more than employees in public sectors, probably because 1999 was a short time after the policy was implemented and the effect was not as pronounced as in 2002. The difference is that the saving rate of the treatment group (i.e., enterprise employees) declined in 1999 compared to the control group. This may be due to the general macro environment.

Additionally, the paper examines the "Pension Merger" reform in 2015, which reduced the pensions of workers in public sectors without affecting enterprise workers. Using a DID model to regress CHIP2013 and CHIP2018, the results show that public sector employees invested 1.8% more of their income in education compared to enterprise workers, but this result is not statistically significant. This may be due to the fact that 2018 is still in the ten-year transition period for the 2015 pension reform, and the policy shock is not yet significant.

The paper also predicts individuals' future earnings and estimates their future pensions using the pension formula. The results show that there is a substantial decline in the expected future pensions of enterprise workers after the policy, with an estimated average replacement rate of 57.5%, which is much lower than the pre-policy pension income. Furthermore, a regression of the education spending ratio on the predicted replacement rate shows that the ratio of households' education spending to their income increases by 1.1% for every 10% drop in the replacement rate.

Finally, the paper uses a simplified modeling framework based on the generational optimization problem of the OLG model to illustrate the results. The optimal solution shows a negative linear relationship

between households' optimal human capital investment and the replacement rate, consistent with the empirical findings. When the replacement rate of the household decreases, the proportion of investment in education increases.

In conclusion, this paper provides evidence that changes in pension expectations have a significant impact on household investment in human capital and savings. Households expecting a decline in future pensions invest more in their children and increase their personal savings to supplement their expected future income. The results are robust to various sensitivity checks and are consistent with the predictions of a simple modeling framework.

Tables and Graphs

Table 1: 1997 Reform of the Pension System in China

Year	Pension Plan	Targeted Group	Pension Amount
1951	PAYGO	Public sector employees and workers in state-owned enterprises	High
1995~1997	Pension reform was directed at introducing a multipillar system with a declining replacement rate		
1997	Dual Pension Schemes	Employees in enterprises	Middle
2015	Pension Merger	Public sector employees	Middle

Notes: This table provides an overview of China's significant pension policies and reforms. The 1997 "Dual Pension Scheme" reform reduced the future pensions of employees in enterprises, thereby ending the PAYGO system for enterprises and creating disparities in pensions between the public and private sectors. The 2015 "Pension Merger" reform equalized pensions in the public sector to the level of those in enterprises.

Table 2: Pre-Reform Pension Replacement Rate

Years of Work	Replacement Rate
35 years or more	90%
30~34 years	85%
20~29 years	80%
10~19 years	70%
Less than 10 years	50%

Notes: The table illustrates the criteria used to calculate replacement rates before the 1997 reform. The pre-policy replacement rate is determined solely by the length of service.

Table 3: Contributions and benefits before and after 1997 reform (for enterprise workers)

		Pre-reform	Post-reform		
			New worker	Middle worker	Retiree
Benefits		70%-90% of wage before retirement	Basic benefit + individual account benefit	Basic benefit + individual account benefit + transitional benefit	Same as pre-reform
Contribution	Employer	Varying across regions, up to 3%	20% of total wage		-
	Employee	No contribution from employees	4% payroll tax in 1997, increased gradually to 8%		

Notes: This table presents a comparison of the pension benefits and contribution status of employees in enterprises before and after the 1997 reform. The reform did not impact retired employees. Middle workers, who began their careers pre-1997 but retired post-1997, are shown separately. New workers, who joined the workforce after the reform, are also included. The table demonstrates that, following the reform, both employers and employees are required to contribute to pensions. Conversely, employees' pension benefits have decreased compared to the pre-reform pension. Middle workers, who had not contributed to a pension account before the reform, received a transitional benefit to offset this. The specific formula for each benefit is displayed in Table 4.

Table 4: Post-Reform Pension Formula

Basic Benefit	$W_A(1+i)\times 0.5\times n\times 1\%$
Individual Account Benefit	accumulated value of individual account (8% contribution) divided by **months**
Transitional Benefit	$W_A\times i\times$ (Years of work before policy) $\times 1.2\%$

Notes: This table shows the formula for calculating pensions. The parameters are as follows:
W_A: Average monthly salary of employees on duty in the province in the previous year at the time of retirement

i: average contributory wage index $= \begin{cases} 0.6, & \frac{\text{wage}}{W_A} \leq 0.6 \\ \frac{\text{wage}}{W_A}, & 0.6 < \frac{\text{wage}}{W_A} \leq 3 \\ 3, & \frac{\text{wage}}{W_A} > 3 \end{cases}$

n: Years of Contribution
months: Number of months of pension accrual. 139 months for retirement at age 60, 170 months for retirement at age 55, and 195 months for retirement at age 50.

Table 5: Summary Statistics (1995 & 2002)

Variable	Enterprise				Public			
	1995		2002		1995		2002	
	mean	sd	mean	sd	mean	sd	mean	sd
Outcome Variables								
$\frac{\text{Education Spending}}{\text{Household Income}}$	0.056	0.075	0.105	0.118	0.057	0.141	0.084	0.103
Education Spending	978.427	1566.887	2495.206	3747.107	1073.612	2183.392	2723.989	3753.516
Saving Rate	-0.146	0.436	-0.107	0.667	-0.146	0.458	-0.168	0.712
Saving	-2118.378	8547.977	-3968.181	25165.343	-2159.516	9680.639	-5672.169	26869.969
Control Variables								
Female head	0.350	0.477	0.329	0.470	0.333	0.472	0.354	0.478
Age head	38.816	5.881	40.44	5.113	37.951	6.731	40.144	5.293
Minority head	0.037	0.189	0.034	0.181	0.034	0.182	0.050	0.218
CPC member head	0.232	0.422	0.286	0.452	0.414	0.493	0.439	0.497
Educyear head	10.258	2.827	11.176	2.762	11.995	3.116	12.808	2.854
Manager head	0.105	0.307	0.107	0.309	0.215	0.411	0.198	0.399
Tech head	0.491	0.500	0.510	0.500	0.397	0.489	0.421	0.494
Age spouse	38.065	5.814	39.838	5.148	37.070	6.602	39.495	5.295
Minority spouse	0.035	0.184	0.028	0.164	0.045	0.207	0.051	0.221
CPC member spouse	0.152	0.359	0.206	0.404	0.240	0.427	0.270	0.444
Educyear spouse	9.944	2.874	10.988	2.814	10.970	3.248	11.982	3.080
Manager spouse	0.081	0.273	0.095	0.294	0.137	0.344	0.138	0.345
Tech spouse	0.407	0.491	0.344	0.475	0.406	0.491	0.377	0.485
Female child	0.482	0.500	0.491	0.500	0.476	0.5	0.470	0.499
Age child	10.751	4.339	12.844	4.009	9.769	4.889	12.462	3.998
Elementary school	0.389	0.488	0.404	0.491	0.334	0.472	0.439	0.497
Middle School	0.271	0.444	0.277	0.448	0.212	0.409	0.266	0.442
High school	0.134	0.341	0.273	0.446	0.145	0.353	0.241	0.428
Asset finance (K)	14.252	20.808	46.632	63.212	14.915	19.548	60.522	177.054
Household income (K)	17.983	9.405	28.725	18.126	19.631	10.552	34.315	20.029
Number of Observations	2079		1124		1074		777	

Notes: This table presents summary statistics for the CHIP 1995 and CHIP 2002 samples, broken down by year and work sector. The table includes means, standard deviations, and the number of observations for each variable. The outcome variables include households' education investment as a share of total income, total education investment, household savings rate, and household savings. The control variables include information on the head of the household, spouse, and children, as well as the economic status of the household. The table also includes variables for gender (female = 1), age, ethnic minority status (minority = 1), Communist Party of China (CPC) membership (CPC member = 1), years of schooling (Educyear), managerial status (Manager = 1), technical position status (Tech = 1), elementary school status (Elementary school = 1), middle school status (Middle school = 1), and high school status (High school = 1). Additionally, the table includes variables for total financial assets (Asset finance) and total household income, both in thousands of RMB.

Table 6: Summary Statistics (2013 & 2018)

Variable	Enterprise				Public			
	2013		2018		2013		2018	
	mean	sd	mean	sd	mean	sd	mean	sd
Outcome Variables								
$\frac{\text{Education Spending}}{\text{Household Income}}$	0.158	0.351	0.093	0.184	0.114	0.104	0.080	0.157
Education Spending	8088.107	9412.749	7314.844	10814.467	9023.426	10394.124	8218.276	11474.077
Saving Rate	0.235	0.409	0.187	0.535	0.154	2.389	0.285	0.386
Saving	23914.083	33105.048	30985.015	56585.707	30290.675	59571.434	46576.984	62849.825
Control Variables								
Female head	0.212	0.409	0.266	0.442	0.231	0.422	0.327	0.470
Age head	41.287	5.207	41.643	6.118	40.756	4.783	41.290	5.484
Minority head	0.033	0.180	0.031	0.174	0.045	0.208	0.064	0.246
CPC member head	0.197	0.398	0.160	0.367	0.597	0.491	0.576	0.495
Educyear head	11.883	3.050	11.711	3.295	13.992	2.590	14.468	2.532
Manager head	0.042	0.200	0.076	0.264	0.080	0.271	0.142	0.350
Tech head	0.126	0.332	0.207	0.406	0.095	0.294	0.349	0.477
Age spouse	40.152	5.232	40.776	6.414	39.721	4.646	40.426	5.630
Minority spouse	0.038	0.190	0.049	0.215	0.050	0.219	0.067	0.250
CPC member spouse	0.126	0.332	0.107	0.309	0.276	0.448	0.316	0.466
Educyear spouse	11.669	3.168	11.487	3.323	13.167	2.758	13.761	2.947
Manager spouse	0.038	0.190	0.046	0.210	0.037	0.189	0.064	0.246
Tech spouse	0.066	0.248	0.134	0.340	0.090	0.287	0.346	0.476
Female child	0.483	0.500	0.412	0.492	0.432	0.496	0.464	0.499
Age child	12.389	4.093	12.226	4.167	12.374	4.161	11.938	4.497
Elementary school	0.448	0.498	0.437	0.496	0.432	0.496	0.375	0.485
Middle School	0.254	0.436	0.241	0.428	0.247	0.432	0.225	0.418
High school	0.208	0.406	0.221	0.415	0.231	0.422	0.257	0.438
Asset finance (K)	80.686	115.392	103.874	163.467	101.597	125.601	125.610	156.400
Household income (K)	70.684	46.866	100.859	83.503	82.337	91.441	135.504	210.257
Number of Observations	717		1152		377		373	

Notes: This table provides summary statistics for the CHIP 2013 and CHIP 2018 samples, with data divided into sub-samples based on year and work sector. The table includes means, standard deviations, and the number of observations for each variable. The outcome variables include households' education investment as a share of total income, total education investment, household savings rate, and household savings. The control variables include information on the head of the household, spouse, and children, as well as the economic status of the household. The table also includes variables for gender (female = 1), age, ethnic minority status (minority = 1), Communist Party of China (CPC) membership (CPC member = 1), years of schooling (Educyear), managerial status (Manager = 1), technical position status (Tech = 1), elementary school status (Elementary school = 1), middle school status (Middle school = 1), and high school status (High school = 1). Additionally, the table includes variables for total financial assets (Asset finance) and total household income, both in thousands of RMB.

Table 7: DID estimates (1995 & 2002): Education Spending

Variables	Education Spending (Ratio)			Education Spending		
	(1) Head	(2) Head/Spouse	(3) Head&Spouse	(4) Head	(5) Head/Spouse	(6) Head&Spouse
D_{ent}	-0.003	0.004	-0.002	30.216	159.987**	45.370
	(0.002)	(0.003)	(0.002)	(51.001)	(63.668)	(42.575)
D_{2002}	0.020***	0.025***	0.021***	760.634***	823.547***	742.731***
	(0.005)	(0.005)	(0.005)	(152.822)	(140.222)	(173.652)
$D_{ent} \times D_{2002}$	0.021***	0.012**	0.020***	38.587	-40.789	113.405
	(0.005)	(0.005)	(0.005)	(139.467)	(139.572)	(177.353)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	5,054	5,301	4,289	5,054	5,301	4,289
R-squared	0.082	0.085	0.076	0.189	0.191	0.196

Notes: This table shows the effect of the 1997 pension reform on education spending using DID regression in Equation (2). Households in CHIP1995 and CHIP2002 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is education expenditure as a share of total income, and the explanatory variable in columns (4) through (6) is education expenditure. The treatment group definition for columns (1) and (4) is households where the head of the household works in enterprise. The treatment group definition for columns (2) and (5) is households where the head or spouse works in enterprise. The treatment group definition for columns (3) and (6) is households where both the head and spouse work in enterprise. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: DID estimates (1995 & 2002): Saving

Variables	Saving Rate			Saving		
	(1) Head	(2) Head/Spouse	(3) Head & Spouse	(4) Head	(5) Head/Spouse	(6) Head & Spouse
D_{ent}	-0.004	-0.002	-0.003	-379.261	-492.467	-308.430
	(0.016)	(0.018)	(0.013)	(388.008)	(401.939)	(310.838)
D_{2002}	0.000	0.037	-0.005	-1,687.593	-143.793	-2,190.089
	(0.035)	(0.038)	(0.038)	(1,114.509)	(1,105.963)	(1,336.973)
$D_{ent} \times D_{2002}$	0.062*	-0.009	0.071**	1,392.803	-889.436	1,982.078
	(0.033)	(0.035)	(0.031)	(1,187.806)	(1,096.289)	(1,231.435)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	5,054	5,301	4,289	5,054	5,301	4,289
R-squared	0.013	0.011	0.018	0.021	0.021	0.027

Notes: This table shows the effect of the 1997 pension reform on saving using DID regression in Equation (2). Households in CHIP1995 and CHIP2002 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is saving rate, and the explanatory variable in columns (4) through (6) is saving. The treatment group definition for columns (1) and (4) is households where the head of the household works in enterprise. The treatment group definition for columns (2) and (5) is households where the head or spouse works in enterprise. The treatment group definition for columns (3) and (6) is households where both the head and spouse work in enterprise. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Robustness: Identification (Education)

Variables	Education Spending (Ratio)			Education Spending		
	(1) Benchmark	(2) Wide Definition	(3) Work Pre-Policy	(4) Benchmark	(5) Wide Definition	(6) Work Pre-Policy
D_{ent}	-0.003	-0.003	-0.002	30.216	39.492	34.828
	(0.002)	(0.002)	(0.002)	(51.001)	(46.746)	(51.417)
D_{2002}	0.020***	0.021***	0.017***	760.634***	758.364***	714.609***
	(0.005)	(0.005)	(0.005)	(152.822)	(145.363)	(161.804)
$D_{ent} \times D_{2002}$	0.021***	0.022***	0.025***	38.587	38.556	98.734
	(0.005)	(0.004)	(0.004)	(139.467)	(138.289)	(152.656)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	5,054	5,382	5,062	5,054	5,382	5,062
R-squared	0.082	0.091	0.084	0.189	0.191	0.189

Notes: This table shows robustness checks of the effect of the 1997 pension reform on educational investment using DID regression in Equation (2). Households in CHIP1995 and CHIP2002 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is education spending as a percentage of household income, and the explanatory variable in columns (4) through (6) is education spending. The treatment group definition for columns (1) and (4) is households where the head of the household works in enterprise, and is the same as columns (1) and (4) in Table 7, respectively. The treatment group definition for columns (2), (3), (5) and (6) is households where the head works in enterprise, or the head is currently unemployed because of layoff or bankruptcy, or the head's last job was in an enterprise. Columns (3) and (6) exclude households where the head started working after 1997. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Robustness: Identification (Saving)

Variables	Saving Rate			Saving		
	(1) Benchmark	(2) Wide Definition	(3) Work Pre-Policy	(4) Benchmark	(5) Wide Definition	(6) Work Pre-Policy
D_{ent}	-0.004	-0.003	-0.004	-379.261	-376.682	-382.085
	(0.016)	(0.017)	(0.016)	(388.008)	(377.688)	(387.141)
D_{2002}	0.000	-0.020	0.001	-1,687.593	-1,789.321*	-1,747.001
	(0.035)	(0.037)	(0.036)	(1,114.509)	(1,044.499)	(1,149.961)
$D_{ent} \times D_{2002}$	0.062*	0.063*	0.060*	1,392.803	1,400.015	1,444.239
	(0.033)	(0.034)	(0.033)	(1,187.806)	(1,134.619)	(1,208.945)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	5,054	5,382	5,062	5,054	5,382	5,062
R-squared	0.013	0.011	0.013	0.021	0.020	0.021

Notes: This table shows robustness checks of the effect of the 1997 pension reform on saving using DID regression in Equation (2). Households in CHIP1995 and CHIP2002 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is saving rate, and the explanatory variable in columns (4) through (6) is saving. The treatment group definition for columns (1) and (4) is households where the head of the household works in enterprise, and is the same as columns (1) and (4) in Table 8, respectively. The treatment group definition for columns (2), (3), (5) and (6) is households where the head works in enterprise, or the head is currently unemployed because of layoff or bankruptcy, or the head's last job was in an enterprise. Columns (3) and (6) exclude households where the head started working after 1997. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Robustness: Different Sample Selection (Education)

Variables	Education Spending (Ratio)				Education Spending			
	(1) Benchmark	(2) All Edu. Level	(3) Born after 1980	(4) Average Spending	(5) Benchmark	(6) All Edu. Level	(7) Born after 1980	(8) Average Spending
D_{ent}	-0.003	0.001	-0.003	0.001	30.216	88.496	26.344	71.949
	(0.002)	(0.003)	(0.002)	(0.002)	(51.001)	(58.897)	(55.555)	(52.878)
D_{2002}	0.020***	0.023***	0.012**	0.028***	760.634***	810.124***	555.213***	833.721***
	(0.005)	(0.006)	(0.006)	(0.005)	(152.822)	(172.464)	(154.488)	(163.604)
$D_{ent} \times D_{2002}$	0.021***	0.020***	0.022***	0.017***	38.587	57.434	45.297	58.484
	(0.005)	(0.005)	(0.005)	(0.004)	(139.467)	(146.844)	(137.600)	(129.264)
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y
Obs	5,054	5,732	4,627	6,617	5,054	5,732	4,627	6,617
R-squared	0.082	0.095	0.094	0.072	0.189	0.222	0.201	0.196

Notes: This table shows robustness checks of the effect of the 1997 pension reform on educational investment using DID regression in Equation (2). Households in CHIP1995 and CHIP2002 are retained. The explanatory variable in columns (1) through (4) is education spending as a percentage of household income, and the explanatory variable in columns (5) through (8) is education spending. The treatment group in this table is households where the head of the household works in enterprise. Columns (1) and (5) are benchmark results, and are the same as columns (1) and (4) in Table 7, respectively. Columns (2) and (6) retain households with one child at school and include all education stage of the child. Columns (3) and (7) excludes households with children born before one-child policy. Columns (4) and (8) study all households and select the average education spending (ratio) per child as the outcome variable. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Robustness: Different Sample Selection (Saving)

Variables	Saving Rate			Saving		
	(1) Benchmark	(2) All Educational Level	(3) Born after 1980	(4) Benchmark	(5) All Educational Level	(6) Born after 1980
D_{ent}	-0.004	-0.005	-0.002	-379.261	-252.427	-271.419
	(0.016)	(0.016)	(0.015)	(388.008)	(376.502)	(348.178)
D_{2002}	0.000	0.010	0.002	-1,687.593	-1,327.606	-1,800.757
	(0.035)	(0.033)	(0.039)	(1,114.509)	(1,088.617)	(1,157.417)
$D_{ent} \times D_{2002}$	0.062*	0.034	0.054*	1,392.803	691.348	1,294.147
	(0.033)	(0.031)	(0.032)	(1,187.806)	(1,098.552)	(1,166.549)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	5,054	5,838	4,713	5,054	5,732	4,627
R-squared	0.013	0.014	0.010	0.021	0.022	0.020

Notes: This table shows robustness checks of the effect of the 1997 pension reform on saving using DID regression in Equation (2). Households in CHIP1995 and CHIP2002 are retained. The explanatory variable in columns (1) through (3) is saving rate, and the explanatory variable in columns (4) through (6) is saving. The treatment group in this table is households where the head of the household works in enterprise. Columns (1) and (4) are benchmark results, and are the same as columns (1) and (4) in Table 7, respectively. Columns (2) and (5) retain households with one child at school and include all education stage of the child. Columns (3) and (6) excludes households with children born before one-child policy. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Robustness: Different Measures of Household Asset

Variables	Education Spending (Ratio)				Education Spending			
	(1) Benchmark	(2) Total Asset	(3) Net Asset	(4) Liquid Asset	(5) Benchmark	(6) Total Asset	(7) Net Asset	(8) Liquid Asset
D_{ent}	-0.003	-0.003	-0.003	-0.003	30.216	29.536	28.863	30.989
	(0.002)	(0.002)	(0.002)	(0.002)	(51.001)	(51.026)	(50.798)	(50.245)
D_{2002}	0.020***	0.022***	0.021***	0.022***	760.634***	727.549***	715.804***	748.625***
	(0.005)	(0.006)	(0.006)	(0.005)	(152.822)	(150.157)	(149.501)	(151.499)
$D_{ent} \times D_{2002}$	0.021***	0.021***	0.021***	0.021***	38.587	46.136	50.074	39.832
	(0.005)	(0.005)	(0.005)	(0.005)	(139.467)	(139.412)	(139.237)	(139.579)
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y
Obs	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054
R-squared	0.082	0.083	0.082	0.082	0.189	0.190	0.190	0.190

Notes: This table shows robustness checks of the effect of the 1997 pension reform on educational investment using DID regression in Equation (2). Households in CHIP1995 and CHIP2002 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (4) is education spending as a percentage of household income, and the explanatory variable in columns (5) through (8) is education spending. The treatment group in this table is households where the head of the household works in enterprise. Columns (1) and (5) are benchmark results, and are the same as columns (1) and (4) in Table 7, respectively, and the financial asset is used as a proxy variable for the household economy. Columns (2) and (6) uses total asset as a proxy of household economy. Columns (3) and (7) uses net asset. Columns (4) and (8) uses liquid asset. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Robustness: Different Measures of Household Asset

Variables	Saving Rate				Saving			
	(1) Benchmark	(2) Total Asset	(3) Net Asset	(4) Liquid Asset	(5) Benchmark	(6) Total Asset	(7) Net Asset	(8) Liquid Asset
D_{ent}	-0.004	-0.002	-0.002	-0.002	-379.261	-361.344	-372.122	-368.712
	(0.016)	(0.017)	(0.016)	(0.016)	(388.008)	(391.392)	(388.010)	(389.637)
D_{2002}	0.000	0.008	-0.003	-0.019	-1,687.593	-1,121.827	-1,536.892	-1,776.591
	(0.035)	(0.038)	(0.039)	(0.034)	(1,114.509)	(1,061.671)	(1,073.263)	(1,114.062)
$D_{ent} \times D_{2002}$	0.062*	0.056*	0.058*	0.064*	1,392.803	1,245.089	1,346.445	1,393.121
	(0.033)	(0.033)	(0.033)	(0.032)	(1,187.806)	(1,168.128)	(1,177.428)	(1,190.553)
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y	Y	Y
Obs	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054
R-squared	0.013	0.014	0.014	0.016	0.021	0.022	0.021	0.022

Notes: This table shows robustness checks of the effect of the 1997 pension reform on saving using DID regression in Equation (2). Households in CHIP1995 and CHIP2002 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (4) is saving rate, and the explanatory variable in columns (5) through (8) is saving. The treatment group in this table is households where the head of the household works in enterprise. Columns (1) and (5) are benchmark results, and are the same as columns (1) and (4) in Table 7, respectively, and the financial asset is used as a proxy variable for the household economy. Columns (2) and (6) uses total asset as a proxy of household economy. Columns (3) and (7) uses net asset. Columns (4) and (8) uses liquid asset. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Robustness: Subgroup Regressions Based on Wealth Level

Variables	Education - Income Ratio				
	(1) Benchmark	(2) Tier 1	(3) Tier 2	(4) Tier 3	(5) Tier 4
D_{ent}	-0.003	0.006	-0.008*	-0.010**	0.004
	(0.002)	(0.009)	(0.004)	(0.004)	(0.006)
D_{2002}	0.020***	0.031***	0.008	0.027***	0.014
	(0.005)	(0.011)	(0.010)	(0.009)	(0.009)
$D_{ent} \times D_{2002}$	0.021***	0.012	0.038***	0.025**	0.013
	(0.005)	(0.012)	(0.010)	(0.009)	(0.012)
Control Variables	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y
Obs	5,054	1263	1264	1263	1264
R-squared	0.082	0.132	0.063	0.137	0.110

Notes: This table shows robustness checks of the effect of the 1997 pension reform on saving using DID regression in Equation (2). Households in CHIP1995 and CHIP2002 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable is education-income ratio. The treatment group in this table is households where the head of the household works in enterprise. Columns (1) is the benchmark result, and are the same as columns (1) in Table 7. Tiers 1 through 4 represent four classifications of household wealth levels from low to high. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 16: Robustness: DID Estimates 1995&1999 on Education Spending

Variables	Education Spending (Ratio)		Education Spending	
	(1) Head	(2) Wide Definition	(3) Head	(4) Wide Definition
D_{ent}	-0.010**	-0.010**	-157.267**	-159.101**
	(0.004)	(0.004)	(58.910)	(58.760)
D_{1999}	0.010	0.011	560.772***	567.845***
	(0.011)	(0.011)	(186.104)	(186.893)
$D_{ent} \times D_{1999}$	0.016*	0.017*	136.649	105.257
	(0.009)	(0.009)	(186.851)	(190.856)
Control Variables	Y	Y	Y	Y
Province FE	Y	Y	Y	Y
Obs	2,967	3,040	2,967	3,040
R-squared	0.042	0.043	0.107	0.108

Notes: This table shows robustness checks of the effect of the 1997 pension reform on educational investment using DID regression in Equation (3). Households in CHIP1995 and CHIP1999 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) and (2) is education spending as a percentage of household income, and the explanatory variable in columns (3) and (4) is education spending. The treatment group definition for columns (1) and (3) is household where the head works in enterprise. The treatment group definition for columns (2) and (4) is households where the head works in enterprise, or the head is currently unemployed because of layoff or bankruptcy, or the head's last job was in an enterprise. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 17: Robustness: DID Estimates 1995&1999 on Saving

Variables	Saving Rate		Saving	
	(1) Head	(2) Wide Definition	(3) Head	(4) Wide Definition
D_{ent}	0.025	0.025	294.867	291.494
	(0.030)	(0.030)	(568.810)	(567.550)
D_{1999}	0.194***	0.191***	1,642.950*	1,614.930*
	(0.043)	(0.044)	(839.057)	(843.037)
$D_{ent} \times D_{1999}$	-0.060	-0.069*	14.323	105.387
	(0.039)	(0.039)	(755.611)	(750.764)
Control Variables	Y	Y	Y	Y
Province FE	Y	Y	Y	Y
Obs	2,967	3,040	2,967	3,040
R-squared	0.034	0.033	0.067	0.067

Notes: This table shows robustness checks of the effect of the 1997 pension reform on saving using DID regression in Equation (3). Households in CHIP1995 and CHIP1999 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) and (2) is saving rate, and the explanatory variable in columns (3) and (4) is saving. The treatment group definition for columns (1) and (3) is household where the head works in enterprise. The treatment group definition for columns (2) and (4) is households where the head works in enterprise, or the head is currently unemployed because of layoff or bankruptcy, or the head's last job was in an enterprise. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 18: DID estimates (2013&2018): Education Spending

Variables	Education Spending (Ratio)			Education Spending		
	(1) Head	(2) Head/Spouse	(3) Head&Spouse	(4) Head	(5) Head/Spouse	(6) Head&Spouse
D_{pub}	-0.052***	-0.053***	-0.027**	269.515	787.914	-787.512
	(0.014)	(0.016)	(0.012)	(830.923)	(809.747)	(1,055.704)
D_{2018}	-0.066***	-0.076***	-0.051***	-1,098.594**	-1,047.912*	-1,645.496**
	(0.012)	(0.014)	(0.010)	(556.230)	(566.528)	(751.889)
$D_{pub} \times D_{2018}$	0.018	0.029	0.016	-2,460.591**	-2,475.885**	-1,993.222
	(0.018)	(0.019)	(0.016)	(1,110.421)	(1,085.282)	(1,390.088)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	2,604	2,866	2,074	2,209	2,439	1,741
R-squared	0.046	0.049	0.053	0.159	0.150	0.146

Notes: This table shows the effect of the 2015 pension reform on education spending using DID regression in Equation (4). Households in CHIP2013 and CHIP2018 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is education expenditure as a share of total income, and the explanatory variable in columns (4) through (6) is education expenditure. The treatment group definition for columns (1) and (4) is households where the head of the household works in public sector. The treatment group definition for columns (2) and (5) is households where the head or spouse works in public sector. The treatment group definition for columns (3) and (6) is households where both the head and spouse work in public sector. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 19: DID estimates (2013&2018): Saving

Variables	Saving Rate			Saving		
	(1) Head	(2) Head/Spouse	(3) Head&Spouse	(4) Head	(5) Head/Spouse	(6) Head&Spouse
D_{pub}	-0.099	-0.077	-0.201	-921.403	-149.884	2,467.235
	(0.116)	(0.088)	(0.211)	(2,495.554)	(2,352.642)	(2,825.581)
D_{2018}	-0.048**	-0.054**	-0.057**	-6,719.381***	-7,606.795***	-6,097.719**
	(0.022)	(0.021)	(0.026)	(1,889.665)	(1,871.405)	(2,375.230)
$D_{pub} \times D_{2018}$	0.127	0.122	0.289	1,804.991	3,627.994	4,782.311
	(0.101)	(0.083)	(0.186)	(3,772.079)	(3,230.852)	(5,059.669)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	2,604	2,866	2,074	2,209	2,439	1,741
R-squared	0.011	0.010	0.015	0.548	0.584	0.520

Notes: This table shows the effect of the 2015 pension reform on saving using DID regression in Equation (4). Households in CHIP2013 and CHIP2018 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is saving rate, and the explanatory variable in columns (4) through (6) is saving. The treatment group definition for columns (1) and (4) is households where the head of the household works in public sector. The treatment group definition for columns (2) and (5) is households where the head or spouse works in public sector. The treatment group definition for columns (3) and (6) is households where both the head and spouse work in public sector. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 20: DID estimates (2013-2018) by Household Type: Education Spending

Variables	Education Spending (Ratio)			Education Spending		
	(1) Both Only Children	(2) One Only Child	(3) No Only Child	(4) Both Only Children	(5) One Only Child	(6) No Only Child
D_{pub}	-0.086	-0.042	-0.050***	-5,894.690	2,070.116	632.982
	(0.097)	(0.029)	(0.016)	(4,409.723)	(2,973.178)	(869.378)
D_{2018}	-0.092	-0.043**	-0.066***	-6,083.352***	-1,896.458	-444.359
	(0.061)	(0.017)	(0.014)	(2,288.287)	(1,308.236)	(621.575)
$D_{pub} \times D_{2018}$	0.050	0.068	0.011	4,761.539	-3,151.546	-2,712.040**
	(0.111)	(0.043)	(0.019)	(4,924.705)	(3,171.220)	(1,208.821)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	171	385	2,047	143	325	1,740
R-squared	0.269	0.175	0.051	0.480	0.294	0.135

Notes: This table shows the effect of the 2015 pension reform on education spending using DID regression in Equation (4) by different household category. Households in CHIP2013 and CHIP2018 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is education expenditure as a share of total income, and the explanatory variable in columns (4) through (6) is education expenditure. The treatment group definition for this table is households where the head of the household works in public sector. Columns (1) and (4) report results of households where both the couples are the only children. Columns (2) and (5) report results of households where one of the couples is the only child. Columns (3) and (6) report results of households where both the couples have siblings. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 21: DID estimates (2013-2018) by Household Type: Household Saving

Variables	Saving Rate			Saving		
	(1) Both Only Children	(2) One Only Child	(3) No Only Child	(4) Both Only Children	(5) One Only Child	(6) No Only Child
D_{pub}	0.031	-0.048	-0.127	-631.072	-5,854.863	-1,448.760
	(0.091)	(0.060)	(0.145)	(13,946.577)	(7,455.680)	(2,762.599)
D_{2018}	0.000	-0.128**	-0.034	-3,489.619	-15,094.484**	-6,462.053***
	(0.064)	(0.062)	(0.025)	(8,438.439)	(5,909.204)	(1,787.197)
$D_{pub} \times D_{2018}$	-0.012	0.165	0.145	-17,783.739	9,704.550	3,811.737
	(0.099)	(0.105)	(0.126)	(14,726.834)	(10,632.909)	(4,218.454)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	171	385	2,047	143	325	1,740
R-squared	0.163	0.135	0.014	0.633	0.587	0.564

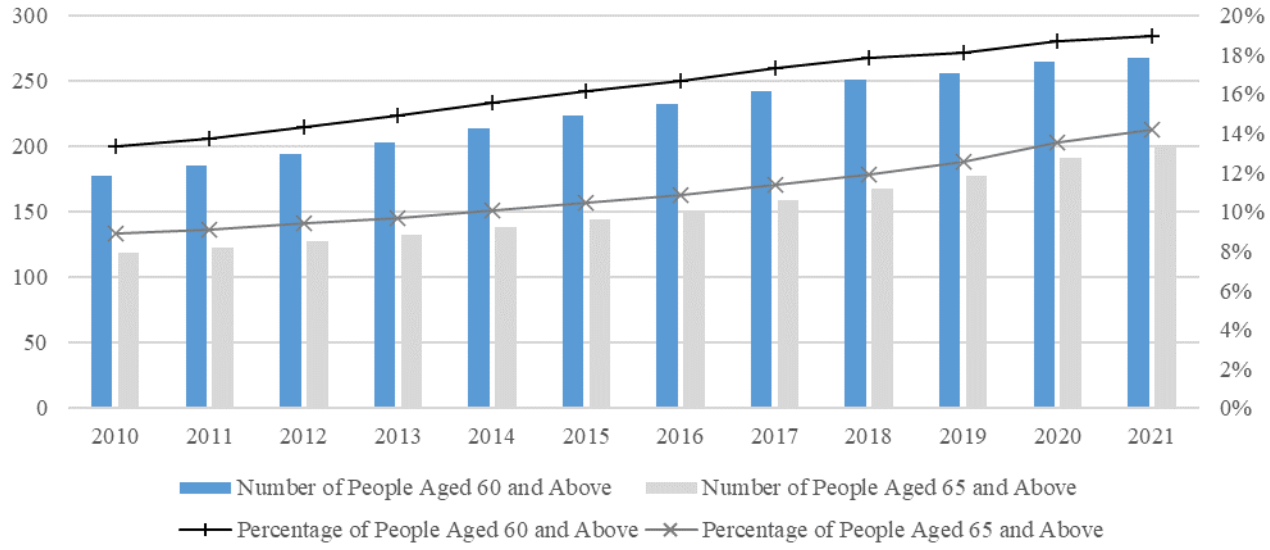
Notes: This table shows the effect of the 2015 pension reform on saving using DID regression in Equation (4) by different household category. Households in CHIP2013 and CHIP2018 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is saving rate, and the explanatory variable in columns (4) through (6) is education saving. The treatment group definition for this table is households where the head of the household works in public sector. Columns (1) and (4) report results of households where both the couples are the only children. Columns (2) and (5) report results of households where one of the couples is the only child. Columns (3) and (6) report results of households where both the couples have siblings. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 22: Pension Prediction

Variables	Education Spending (Ratio)		
	(1)	(2)	(3)
Replacement Rate	-0.108***	-0.121***	-0.098***
	(0.025)	(0.036)	(0.029)
D_{1999}	0.017***		0.021***
	(0.006)		(0.008)
D_{2002}	0.022***	0.022***	0.029***
	(0.005)	(0.005)	(0.008)
D_{ent}	0.001	0.002	0.004
	(0.002)	(0.002)	(0.004)
$D_{1999} \times D_{ent}$	-0.026***		-0.025**
	(0.010)		(0.010)
$D_{2002} \times D_{ent}$	-0.008	-0.012	-0.004
	(0.009)	(0.012)	(0.011)
Control Variables	Y	Y	Y
No. of Provinces	12	12	6
Province FE	Y	Y	Y
Obs	6,505	5,186	3,944
R-squared	0.061	0.069	0.061

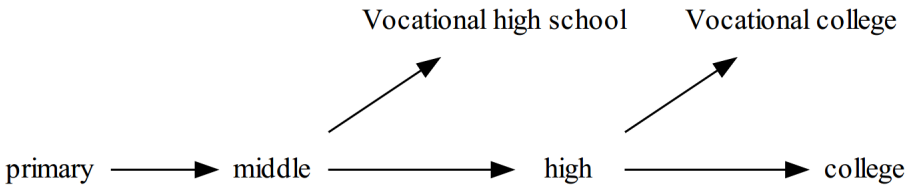
Notes: This table presents regressions of the education spending - income ratio on the predicted replacement rate. Column (1) includes all related households from CHIP1995, CHIP1999 and CHIP2002. Column (2) reports results from CHIP1995 and CHIP2002. Column (3) reports results from CHIP1995, CHIP1999 and CHIP2002 with the 6 balanced provinces. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure 1: Demographic Structure of China (2010 - 2021)



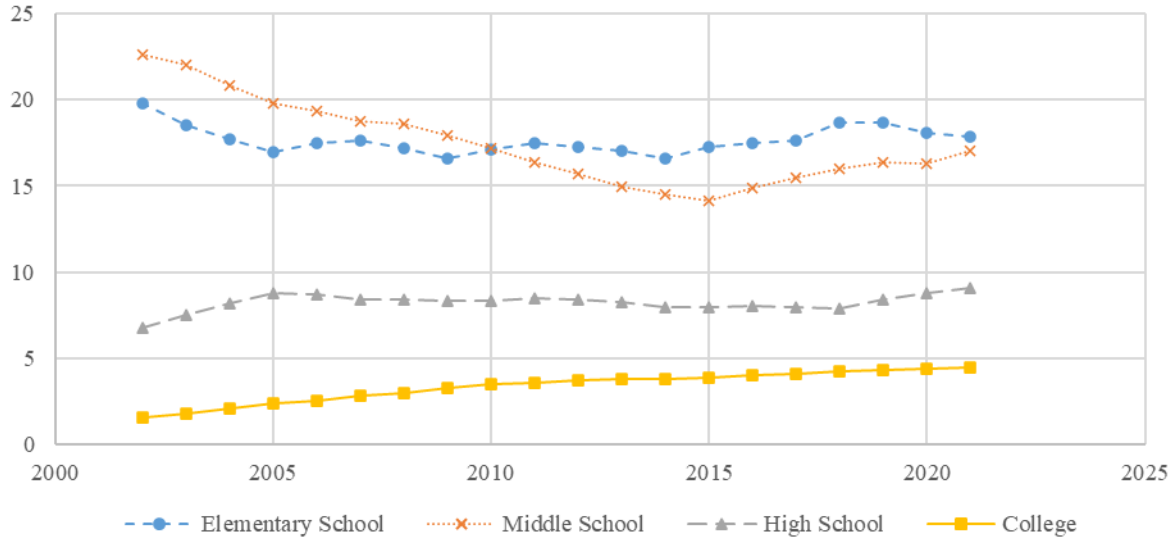
Notes: This graph shows the change in the number of elderly people and their share of the total population from 2010 to 2021. The left vertical axis is in millions.

Figure 2: China's Education Structure



Notes: This figure shows the stages of education in China.

Figure 3: Number of Entrants Per Year by Levels of Education (in millions)



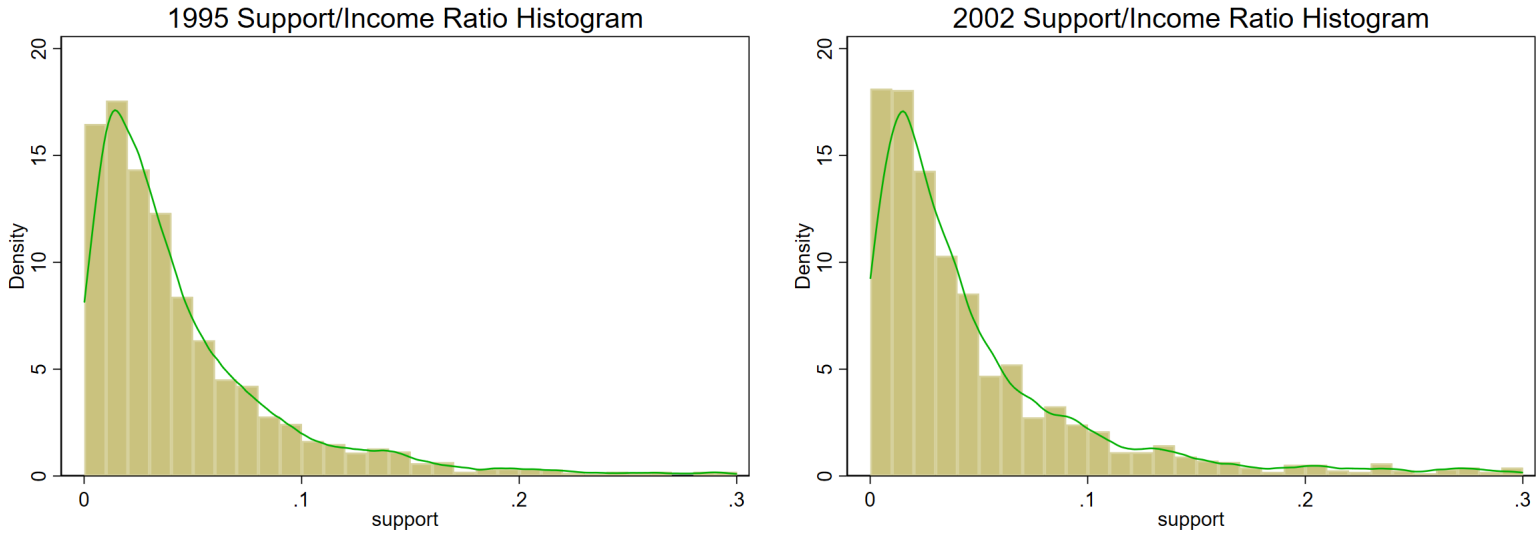
Notes: This figure shows the number of new students at each level of education for each year from 2002 to 2021. The vertical axis is in millions.

Figure 4: Child Policy Reform Timeline

July 1973	Beginning of birth control - "Late, Sparse, Few"
June 1979	One-child policy
Apr 1984	If both parents are only children, they can have two children (One province)
Nov 2011	If both parents are only children, they can have two children (All provinces)
Nov 2013	If one parent is an only child, they can have two children
Oct 2015	Two-child policy (universal)
May 2021	Three-child policy (universal)

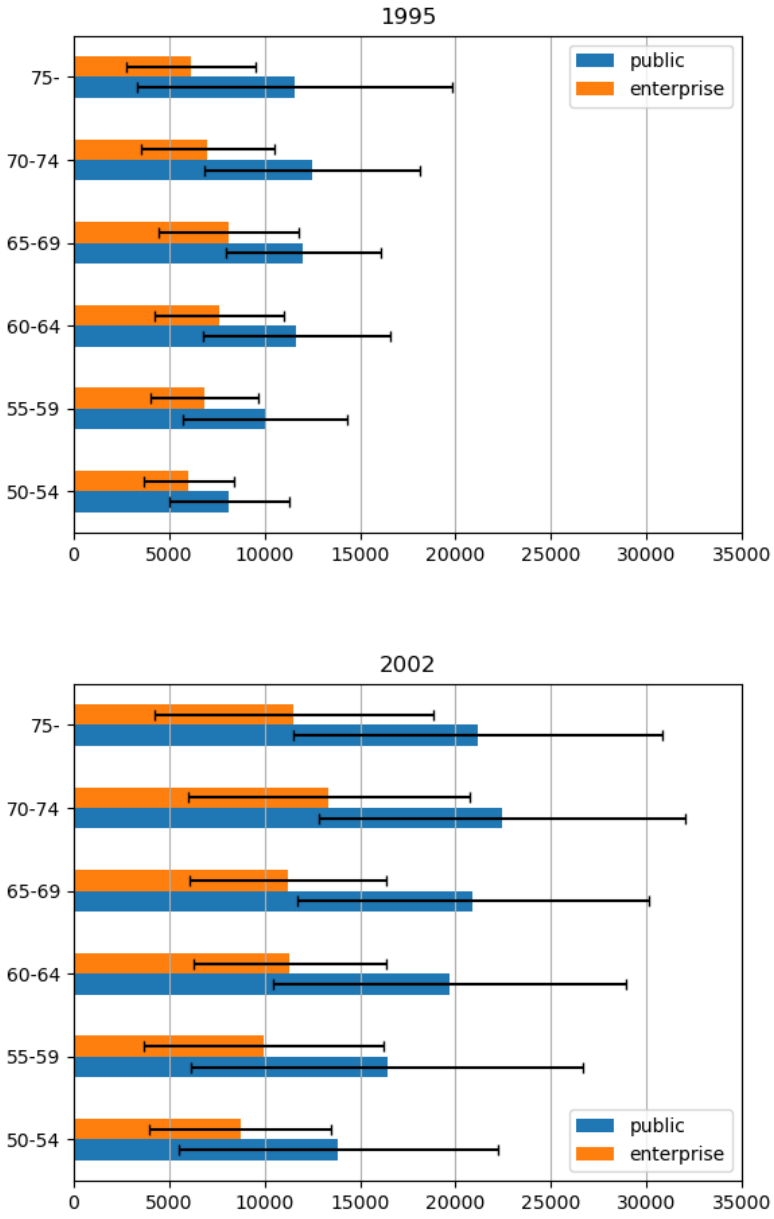
Notes: This figure shows the timeline of China's child policy.

Figure 5: Support of Children to Parents as a percentage of Children's Household Income



Notes: This figure shows the distribution of people's support to their parents as a ratio of their total household's income. Green curves present the kernel density.

Figure 6: Average Pension for Retirees by Age Group

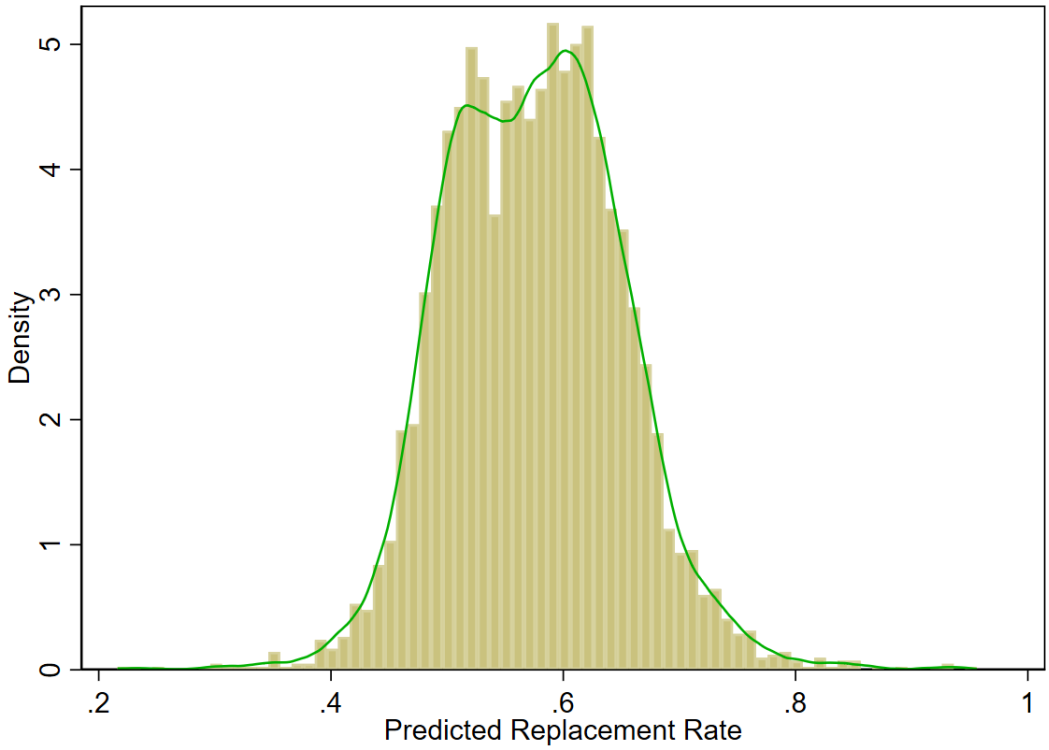


Notes: This figure shows the average pension for retirees by age group in the survey years 1995 and 2002 for different work sectors.

Figure 7: Estimated Pension Wealth

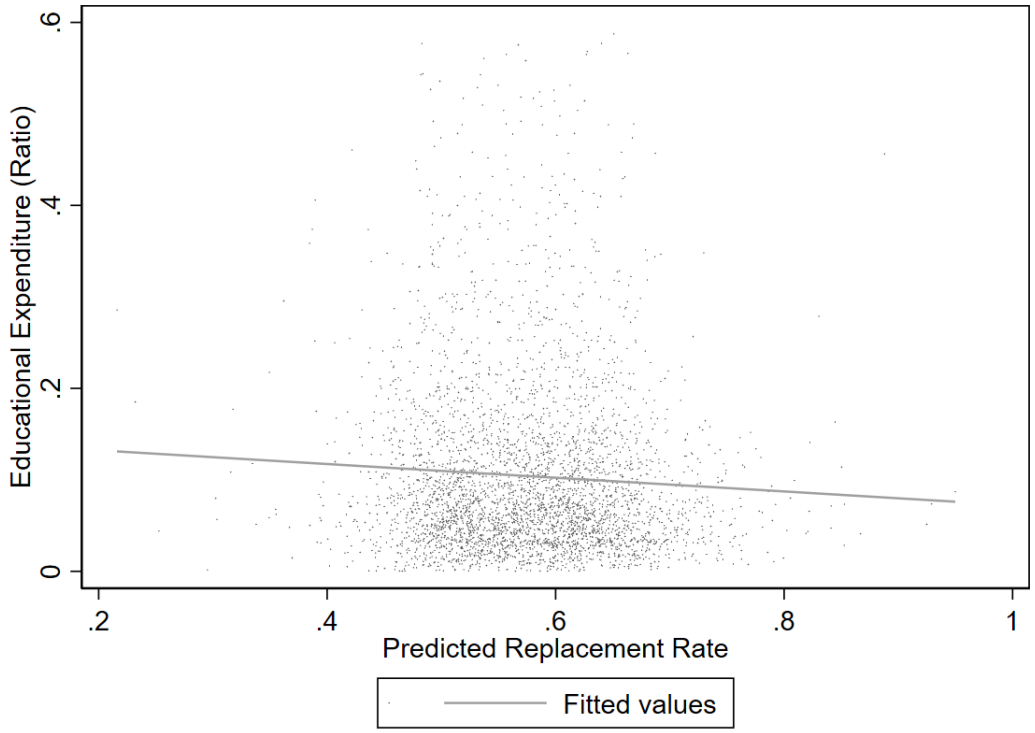
Notes. This figure shows the predicted post-policy and counterfactual pre-policy pensions for enterprise employees by year and gender.

Figure 8: Histogram of the Replacement Rate of Employees in Enterprise after the 1997 Reforms



Notes. This figure shows a histogram of predicted post-policy replacement rates for enterprise households. The green curve is the Kernel density

Figure 9: Linear Fit of Educational Investment (Ratio) to Predicted Replacement Rates



Notes. This figure shows a scatter plot of household education expenditure-income ratio as well as the predicted post-policy replacement rates of head who works in enterprises and its fitted line.

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Appendix

A.1. Regression Results for Unbalanced Provinces

Table 23: DID estimates (1995 & 2002): Education Spending (Unbalanced Provinces)

Variables	Education Spending (Ratio)			Education Spending		
	(1) Head	(2) Head/Spouse	(3) Head & Spouse	(4) Head	(5) Head/Spouse	(6) Head & Spouse
D_{ent}	-0.003	0.004	-0.002	29.040	156.575**	42.034
	(0.002)	(0.003)	(0.002)	(50.224)	(62.936)	(41.961)
D_{2002}	0.019***	0.024***	0.021***	754.048***	820.954***	742.520***
	(0.005)	(0.005)	(0.005)	(150.856)	(138.033)	(170.522)
$D_{ent} \times D_{2002}$	0.023***	0.013***	0.021***	54.258	-34.973	125.438
	(0.005)	(0.005)	(0.005)	(135.223)	(135.432)	(172.155)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	5,140	5,395	4,351	5,140	5,395	4,351
R-squared	0.085	0.088	0.077	0.191	0.193	0.197

Notes: This table shows the effect of the 1997 pension reform on education spending using DID regression in Equation (2). The meaning of the columns in this table is the same as in Table 7, except that this table includes unbalanced provinces, while Table 7 shows balanced provinces. Households in CHIP1995 and CHIP2002 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is education expenditure as a share of total income, and the explanatory variable in columns (4) through (6) is education expenditure. The treatment group definition for columns (1) and (4) is households where the head of the household works in enterprise. The treatment group definition for columns (2) and (5) is households where the head or spouse works in enterprise. The treatment group definition for columns (3) and (6) is households where both the head and spouse work in enterprise. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 24: DID estimates (1995 & 2002): Saving (Unbalanced Provinces)

Variables	Saving Rate			Saving		
	(1) Head	(2) Head/Spouse	(3) Head & Spouse	(4) Head	(5) Head/Spouse	(6) Head & Spouse
D_{ent}	-0.004	-0.002	-0.004	-394.408	-502.507	-308.430
	(0.016)	(0.018)	(0.013)	(382.838)	(406.594)	(310.838)
D_{2002}	0.005	0.041	-0.009	-1,605.276	-102.304	-2,190.089
	(0.035)	(0.038)	(0.038)	(1,099.128)	(1,093.233)	(1,336.973)
$D_{ent} \times D_{2002}$	0.055*	-0.013	0.079**	1,279.039	-934.686	1,982.078
	(0.033)	(0.035)	(0.030)	(1,156.909)	(1,076.960)	(1,231.435)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	5,140	5,395	4,351	5,140	5,395	4,351
R-squared	0.013	0.011	0.018	0.021	0.021	0.018

Notes: This table shows the effect of the 1997 pension reform on saving using DID regression in Equation (2). The meaning of the columns in this table is the same as in Table 8, except that this table includes unbalanced provinces, while Table 8 shows balanced provinces. Households in CHIP1995 and CHIP2002 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is saving rate, and the explanatory variable in columns (4) through (6) is saving. The treatment group definition for columns (1) and (4) is households where the head of the household works in enterprise. The treatment group definition for columns (2) and (5) is households where the head or spouse works in enterprise. The treatment group definition for columns (3) and (6) is households where both the head and spouse work in enterprise. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 25: Robustness: DID Estimates 1995&1999 on Education Spending (Unbalanced Provinces)

Variables	Education Spending (Ratio)		Education Spending	
	(1) Head	(2) Wide Definition	(3) Head	(4) Wide Definition
D_{ent}	-0.004	-0.004	-62.277	-63.668
	(0.003)	(0.003)	(40.415)	(40.617)
D_{1999}	0.013	0.013	574.166***	582.761***
	(0.010)	(0.010)	(170.101)	(170.752)
$D_{ent} \times D_{1999}$	0.012	0.013	76.572	45.214
	(0.007)	(0.008)	(175.150)	(178.628)
Control Variables	Y	Y	Y	Y
Province FE	Y	Y	Y	Y
Obs	4,391	4,464	4,391	4,464
R-squared	0.050	0.052	0.123	0.124

Notes: This table shows robustness checks of the effect of the 1997 pension reform on educational investment using DID regression in Equation (3). The meaning of the columns in this table is the same as in Table 16, except that this table includes unbalanced provinces, while Table 16 shows balanced provinces. Households in CHIP1995 and CHIP1999 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) and (2) is education spending as a percentage of household income, and the explanatory variable in columns (3) and (4) is education spending. The treatment group definition for columns (1) and (3) is household where the head works in enterprise. The treatment group definition for columns (2) and (4) is households where the head works in enterprise, or the head is currently unemployed because of layoff or bankruptcy, or the head's last job was in an enterprise. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 26: Robustness: DID Estimates 1995&1999 on Saving (Unbalanced Provinces)

Variables	Saving Rate		Saving	
	(1) Head	(2) Wide Definition	(3) Head	(4) Wide Definition
D_{ent}	-0.000	-0.000	0.336	2.758
	(0.017)	(0.017)	(328.411)	(328.977)
D_{1999}	0.182***	0.180***	1,592.592**	1,565.986*
	(0.036)	(0.037)	(762.402)	(767.502)
$D_{ent} \times D_{1999}$	-0.042	-0.053*	156.444	231.919
	(0.031)	(0.031)	(610.998)	(609.562)
Control Variables	Y	Y	Y	Y
Province FE	Y	Y	Y	Y
Obs	4,391	4,464	4,391	4,464
R-squared	0.030	0.029	0.074	0.074

Notes: This table shows robustness checks of the effect of the 1997 pension reform on saving using DID regression in Equation (3). The meaning of the columns in this table is the same as in Table 17, except that this table includes unbalanced provinces, while Table 17 shows balanced provinces. Households in CHIP1995 and CHIP1999 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) and (2) is saving rate, and the explanatory variable in columns (3) and (4) is saving. The treatment group definition for columns (1) and (3) is household where the head works in enterprise. The treatment group definition for columns (2) and (4) is households where the head works in enterprise, or the head is currently unemployed because of layoff or bankruptcy, or the head's last job was in an enterprise. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 27: DID estimates (2013&2018): Education Spending (Unbalanced Provinces)

Variables	Education Spending (Ratio)			Education Spending		
	(1) Head	(2) Head/Spouse	(3) Head&Spouse	(4) Head	(5) Head/Spouse	(6) Head&Spouse
D_{pub}	-0.053***	-0.054***	-0.028**	268.992	812.003	-742.749
	(0.014)	(0.016)	(0.012)	(827.326)	(809.977)	(1,049.812)
D_{2018}	-0.065***	-0.076***	-0.051***	-1,100.626**	-1,018.459*	-1,686.889**
	(0.012)	(0.015)	(0.010)	(557.114)	(565.053)	(751.254)
$D_{pub} \times D_{2018}$	0.018	0.027	0.015	-2,525.542**	-2,634.221**	-1,972.984
	(0.018)	(0.019)	(0.015)	(1,091.670)	(1,074.882)	(1,347.741)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	2,697	2,977	2,137	2,302	2,550	1,804
R-squared	0.047	0.050	0.053	0.159	0.150	0.146

Notes: This table shows the effect of the 2015 pension reform on education spending using DID regression in Equation (4). The meaning of the columns in this table is the same as in Table 18, except that this table includes unbalanced provinces, while Table 18 shows balanced provinces. Households in CHIP2013 and CHIP2018 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is education expenditure as a share of total income, and the explanatory variable in columns (4) through (6) is education expenditure. The treatment group definition for columns (1) and (4) is households where the head of the household works in public sector. The treatment group definition for columns (2) and (5) is households where the head or spouse works in public sector. The treatment group definition for columns (3) and (6) is households where both the head and spouse work in public sector. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 28: DID estimates (2013&2018): Saving (Unbalanced Provinces)

Variables	Saving Rate			Saving		
	(1) Head	(2) Head/Spouse	(3) Head&Spouse	(4) Head	(5) Head/Spouse	(6) Head&Spouse
D_{pub}	-0.099	-0.080	-0.199	-535.663	-120.400	2,837.487
	(0.116)	(0.089)	(0.210)	(2,519.840)	(2,384.154)	(2,828.334)
D_{2018}	-0.049**	-0.054**	-0.056**	-6,853.905***	-7,530.192***	-5,993.581**
	(0.021)	(0.021)	(0.026)	(1,877.671)	(1,855.314)	(2,363.221)
$D_{pub} \times D_{2018}$	0.134	0.129	0.286	2,493.917	3,826.338	4,784.548
	(0.102)	(0.082)	(0.189)	(3,654.990)	(3,157.162)	(4,840.194)
Control Variables	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Obs	2,697	2,977	2,137	2,302	2,550	1,804
R-squared	0.011	0.010	0.015	0.542	0.576	0.511

Notes: This table shows the effect of the 2015 pension reform on saving using DID regression in Equation (4). The meaning of the columns in this table is the same as in Table 19, except that this table includes unbalanced provinces, while Table 19 shows balanced provinces. Households in CHIP2013 and CHIP2018 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. The explanatory variable in columns (1) through (3) is saving rate, and the explanatory variable in columns (4) through (6) is saving. The treatment group definition for columns (1) and (4) is households where the head of the household works in public sector. The treatment group definition for columns (2) and (5) is households where the head or spouse works in public sector. The treatment group definition for columns (3) and (6) is households where both the head and spouse work in public sector. All regressions include control variables and control for province fixed effects, and robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.2. Wage Prediction

Table 29: Pension Prediction

Variables	Wage Prediction Model (log wage)	
	Variable Meaning	Coefficients
Obs		21,790
R-squared		0.443
Constant		7.634***
		(0.087)
age	Individual's age	0.068***
		(0.004)
age_sq	Square of age	-0.001***
		(0.000)
female	Gender (Female = 1, Male = 0)	-0.103***
		(0.007)
minor	Ethnicity (Minority = 1, Han = 0)	0.304***
		(0.010)
workyr	Years of working experience	0.013***
		(0.001)
Province dummy variables (province 11 is the base)		
pvc14	Province 14	-0.541***
		(0.020)
pvc21	Province 21	-0.356***
		(0.016)
pvc32	Province 32	-0.124***
		(0.016)
pvc34	Province 34	-0.470***
		(0.018)
pvc41	Province 41	-0.458***
		(0.017)
pvc42	Province 42	-0.393***
		(0.017)
pvc44	Province 44	0.230***
		(0.020)
pvc50	Province 50	-0.309***
		(0.027)
pvc51	Province 51	-0.352***
		(0.016)
pvc53	Province 53	-0.350***
		(0.017)
pvc62	Province 62	-0.469***
		(0.017)

Variables	Wage Prediction Model (log wage)	
	Variable Meaning	Coefficients
Occupation Category dummy variables (other is the base)		
jobtype1	Owner or manager of private or individual enterprise	0.120**
		(0.052)
jobtype2	Professional or technical worker	0.171***
		(0.018)
jobtype3	Head of institution	0.186***
		(0.023)
jobtype4	Division head in institution	0.190***
		(0.020)
jobtype5	Office worker	0.110***
		(0.018)
jobtype6	Skilled worker	0.113***
		(0.018)
jobtype7	Unskilled worker	-0.012
		(0.020)
Economic sector codes dummy (other is the base)		
jobcode1	Agr/forestry/animal husbandry/fishing/water conservancy	-0.006
	/mining and geological survey and prospecting	(0.039)
jobcode2	Manufacturing	-0.062*
		(0.035)
jobcode3	Construction	-0.016
		(0.039)
jobcode4	Transport/communications/posts/telecommunications/commerce	0.017
	/restaurants&catering/materials supply/warehousing	(0.035)
jobcode5	Real estate/public utilities/personal & consulting services	0.129***
		(0.037)
jobcode6	Health, physical culture and social welfare	0.110***
		(0.037)
jobcode7	Education, culture, arts and broadcasting	0.070*
		(0.036)
jobcode8	Scientific research and technical services	0.044
		(0.041)
jobcode9	Finance, insurance	0.190***
		(0.040)
jobcode10	Government and Party organs, social organizations	0.035
		(0.036)
Work unit dummy variables (other is the base)		
enterprise	An enterprise	0.106***
		(0.033)
gov	A government organization or institution	0.080**
		(0.033)

Variables	Wage Prediction Model (log wage)	
	Variable Meaning	Coefficients
Educational Level dummy variables (middle school is the base)		
educ_lv1	Below elementary school	-0.293***
		(0.108)
educ_lv2	Elementary school	-0.109***
		(0.023)
educ_lv4	High school	0.082***
		(0.010)
educ_lv5	Vocational high school	0.135***
		(0.012)
educ_lv6	Vocational college	0.228***
		(0.012)
educ_lv7	College or above	0.345***
		(0.015)
Ownership of the workplace dummy variables (other is the base)		
owner1	State-owned, at central or provincial level	-0.135***
		(0.015)
owner2	Local publicly-owned	-0.339***
		(0.015)
owner3	Urban collective	-0.514***
		(0.020)
owner4	Private enterprise, including partnership	-0.272***
		(0.054)
owner5	Self-employed business/individual enterprise	-0.249***
		(0.094)
owner6	Sino-foreign joint venture	0.055
		(0.039)
owner7	Foreign owned	0.303***
		(0.074)
owner8	State-controlled enterprises	-0.062**
		(0.030)
owner9	Other shareholding enterprises	-0.200***
		(0.025)
owner10	Township and village enterprise	-0.369**
		(0.160)
owner11	Individual rural ownership	-0.216
		(0.273)

Notes: This table presents the results of the regressions used to estimate individual wages, where the explanatory variable is the logarithm of wages. The meaning of the explanatory variables, regression coefficients and standard errors are shown in the table. Robust standard errors are clustered at the county level and are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$