The Impact of Pension Reform on Households' Educational Investment*

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Abstract

This paper examines the impact of a policy of reducing pension on household investment in human capital. Among the primary sources of income for retirees, pensions and personal savings are paramount. In China, there exists a third income source for elderly individuals: intra-family financial support from their offspring. Hence, any alterations in pension policies could potentially impact the educational investments made by current employees in their children's future. This paper employs a difference-in-difference analysis to scrutinize the effects of China's 1997 urban pension reform on household behaviors concerning investments in human capital and savings. This reform notably decreased pensions for enterprise employees while leaving the pensions of public sector employees untouched. Empirical findings reveal that households anticipating lower pension benefits augment their investments in education by approximately 2%. Furthermore, a 10% reduction in the pension replacement rate corresponds to a 1.1% rise in households' investments in human capital. The study also extends its analysis to the 2015 pension reform, which aimed to reduce pensions for public sector employees without affecting enterprise employees. Nevertheless, due to the policy's 10-year transitional period, the empirical results suggest a moderate increase in human capital investments among corporate employee households. In circumstances where expected pension income is diminished, households seek to compensate through increased investments in the human capital development of the next generation.

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

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1 Introduction

Education plays an important role in the development of society, the family and the growth of the individual. East Asian countries attach particular importance to the education of their children. China is deeply influenced by Confucianism, which emphasizes education and also promotes filial piety to parents. In addition to cultural traditions, Chinese law also stipulates that children have the obligation to support their parents.[1] This also means that, on top of altruistic reasons, parents are motivated to invest in their children by the support their children will give them after their retirement.

In general, people have two 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 offspring. Thus, changes in retirement policy are likely to have an impact on households' investment in human capital and personal savings.

With the development of society, the problem of aging has increasingly become a hot topic. Many countries have formulated relevant pension policies to improve retirement protection. In the United States, the pension system is jointly supported by social security, enterprise annuities (401K) and individual retirement accounts (IRA), which plays the roles of the government, enterprises and individuals respectively, and achieves the effect of multi-level security. In recent years, China's demographic structure has shown continuous changes, and the trend of aging has become more and more obvious. As can be seen in Figure 1, the number of people aged 60 and over and 65 and over, and their share of the total population, have been rising over the past 20 years. In 2021, the proportion of people aged 60 and over has reached about 19%, and the proportion of people aged 65 and over has exceeded 14%. Considering that the retirement age in China is 60 for men, 55 for white-collar women and 50 for blue-collar women[2], the percentage of the population that is actually retired is likely to be even higher. The Chinese government has been introducing pension reforms since the 1990s to ensure the sustainability of pensions and expand pension coverage. Two of these reforms, in 1997, which reduced pensions for workers in

[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.

urban enterprises, and in 2015, which reduced pensions for public sector employees, have been more influential.

Using a difference-in-difference (DID) approach, this paper focuses on how lower pensions affect households' human capital investment and saving behavior in the context of China's pension reform. The exogenous shock of the 1997 pension reform led to differences in pension benefits between enterprise and public sectors.[3] The policy reduces the pensions of employees in enterprises, lowering the replacement rate[4] from an average of about 75% to about 57.5%. The pensions of public sector employees, on the other hand, have not been affected, and are still 70% to 90%, depending on the length of service.[5] Therefore, the selection of enterprise employees as the treatment group and employees of public sectors as the control group provides a natural experiment to study the causal effects of pension reduction. And, as a result of China's one-child policy in 1979, the number of children in Chinese families has decreased significantly.[6] This simplifies the fertility decision considerations in the analysis. In fact, the majority of households in the sample used in this paper have only one child in school.

This paper utilizes data from the China Household Income Project (CHIP) for 1995 and 2002 constituting the two periods before and after the 1997 policy to conduct the study. The two core outcome variables are investment in education and household savings. A DID regression by defining enterprise unit households as the treatment group and public unit households as the control group reveals that households in the treatment group, i.e., those expecting a lower pension, will invest 2% more of their own income in their children's education relative to the control group, and will increase their savings rate by about 6% compared to the control group. This paper further tests the robustness of the results by redefining the conditions for identifying the treatment group, as well as using a different sample selection and different control variable measures.

As a complementary study, this paper also applies the same DID analysis of the CHIP 1995 and 1999 survey data. The results show that the treatment group would have invested about 1.6% more of their

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

[4]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)

[5]Detailed policy descriptions and replacement rate formulas are written in section 3.1.

[6]China's population policy is described in section 3.2.

household income in education relative to the control group. This magnitude is slightly lower than in the baseline analysis, probably due to the short time the policy has been implemented.

This paper also examines the 2015 pension reform, using CHIP 2013 and 2018 survey data, which reduced the future pensions of public sector employees without affecting enterprise employees. The reform can be considered a "symmetry" of the 1997 reform. This is because the 2015 policy eliminated the difference between the pensions of enterprises and public sectors (i.e., the "Dual-pension" system) that resulted from the 1997 reform, which can also be called "Pension Merger". Here, the DID regression is conducted by defining the employees of public sectors as the treatment group and the employees of enterprises as the control group, and the results show that the treatment group puts about 1.8% more of the household income into education investment relative to the control group. But the result is not statistically significant. This may be due to the ten-year transition period, resulting in a more moderate response to the policy. This paper will continue the research on this topic after the ten-year transition period (i.e., 2025).

China's current pension formula is publicly available. To address this, this paper predicts individuals' wages and utilizes the pension calculation formula to further predict an individual's future pension as well as the pension replacement rate. The results show that there is a relatively large gap between the pre-policy and post-policy pension expectations of enterprise employees, and that most of the pensions of enterprise personnel after the implementation of the policy are concentrated in the range of 40% to 80%, with a mean value of 57.5%, which is much lower than the pre-policy replacement rate. The paper also uses the forecast results to examine the relationship between investment in education and the replacement rate. The regression results show that if the replacement rate for pensions is reduced by 10%, households tend to increase their household income by 1.1% to invest in education.

The last part of the article discusses the construction of an illustrative model. By solving the optimization problem of household investment constructed by the overlapping gerenations model (OLG), the paper finds that the partial derivative of the share of household investment in education with respect to the replacement rate is negative, which is consistent with the results of the empirical analysis.

In sum, family education investment decisions are influenced by pension expectations, and lower pensions lead to increased family education investment in search of higher future intra-family transfers.

The rest of this paper is organized as follows. Section 2 is the literature review, which summarizes the literature on the role of parents on the human capital accumulation of their children, the impact of social transfers on families' investment in their children's education, as well as the research on the reform of China's pension system. Section 3 introduces 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 4 describes the data used in the analysis of this paper and the empirical methodology: the difference-in-difference (DID) approach. Section 5 then discusses the DID empirical results, robustness checks, and a case study for expected pensions. Section 6 illustrates the modeling framework. Section 7 concludes the paper.

2 Literature Review

This paper closely relates to the literature explaining the impact of social transfers on families' investment in their children's education. Many literature argues that pension transfers increases children's human capital as when parents receive pension transfers, they 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, 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 contributes 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] shows that in China family support plays a prominent role in the well-being of the elderly 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. 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.

3 Institutional Background

This section focuses on the institutional background of this paper, including two important mandatory pension reforms in 1997 and 2015, as well as a summary of China's educational background and child policy changes.

3.1 Pension Policy

Table 1 summarizes the timeline of China's urban pension system reforms. The two most important reforms were the "Dual Pension Scheme" in 1997 and the "Pension Merger" in 2015. The former lowered the pensions of employees in enterprises, while the latter lowered the pensions of employees in public sectors. There were some non-mandatory policies between 1997 and 2015, such as the New Rural Pension Scheme (NRPS) introduced by the State Council in 2009, which provided a basic income for older people in rural areas. Further, in 2011, the Urban Residents Pension Scheme (URPS) was introduced with the aim of broadening minimum basic income protection to all older persons living in urban areas. As these two policies aim to expand pension coverage and are non-mandatory, they are beyond the scope of this paper.

Since 1951, China has practiced a pay-as-you-go (PAYGO) pension system covering employees of public sectors and state-owned enterprises. The replacement rate was determined by the number of years worked (Table 2). From Table 2, we can learn that the longer the working years, the higher the replacement rate after retirement. For employees with less than 10 years of service, the replacement rate after retirement is only 50%. In practice, however, very few people have less than 10 years of service. So it can be assumed that the replacement rate is generally between 70% and 90%.

The pension insurance system was characterized by the following:

(1) **A single level**. According to the design of the system at that time, the state was mainly responsible for the post-retirement life of wage earners, and thus pensions were almost the only source of income for employees after retirement, with no occupational annuities, commercial pension insurance or other programs.

(2) **State guarantee**. After retirement, all workers can receive their pensions (also known as "retire-

ment pay") from their former organizations, although the production and operation conditions of each organization, especially enterprises, vary greatly.

(3) **Non-contributory**. At that time, the state practiced a low-wage system in accordance with the principle of high accumulation and low consumption, and as a result, employees did not pay any social insurance contributions, including pension insurance. The pensions of retired employees from public sectors were mainly financed by transfers from government fiscal revenues, while the pensions of retirees from state-owned enterprises were funded by the enterprises. In essence, of course, whether paid directly by the enterprise or through financial transfers, pensions come from the fruits of the current labor of active employees.

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

It can be seen from this that the design of the system is highly welfare-oriented and is not a social pension insurance system in the strict sense of the term.

Since the reform and opening-up in 1978, marketization had a big impact on state-owned enterprises. In the mid-1980s, the focus of the country's economic system reform shifted from rural to urban areas. The orientation of the reform was to make enterprises into self-managed, independently accountable and self-sustaining economic entities. However, the age structure of employees varied among enterprises, with some enterprises having a large number and high rate of retired workers and others having very few retired workers, thus making the burden of pensions among enterprises different, to the extent that it affected the profit and loss of enterprises, and some old enterprises could not afford to pay huge amounts of pensions, thus making it urgent to set up a socialized coordination mechanism to equalize the burden of pensions of various enterprises. Against this background, some regions have begun to explore socialized pension insurance systems. They have made a very important start by coordinating the pension costs of their units, firstly in an attempt to solve the problem of the unbalanced burden of retirement costs among State-owned enterprises, and secondly in order to plan for the future pensions of the workers in the gradually emerging non-public enterprises.

[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

Around the early 1990s, the Chinese Government put forward a series of proposals, including, the goal of establishing a multi-level pension insurance system, the sharing of pension insurance among the State, enterprises and individuals, and the implementation of a combination of social coordination and individual accounts. At the same time, some pilot policies have extended coverage from workers in State-owned enterprises to workers in other enterprises.

3.1.1 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 combining social co-ordination and individual accounts. The 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 and individual accounts for enterprise employees.

The structure of pensions after the 1997 reform is shown in Table 3. The reform does not affect the retired population (those who retired before 1997), and a transitional benefit has been added for employees who joined the workforce prior to the 1997 reform to compensate for their inability to contribute prior to the reform. Both enterprises and employees are required to contribute to pension accounts. Enterprises contribute 20% to the basic benefit account and employees contribute 8% to their individual benefit account.[8] More detailed formulas for the calculation of the three types of pensions are shown in Table 4. Both the basic and transitional benefits are related to the average local wage as well as to the individual's wage before retirement, and the basic benefit is proportional to the number of years contributed by the individual. There exists an actuarial assumption for individual, 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.

[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 5.4.

Compared with the previous system, the new system has the following characteristics:

(1) **Multi-level**. The pension insurance system consists of three levels: basic pension insurance, occupational pension and commercial pension insurance. Among them, the basic pension insurance only undertakes the responsibility of protecting the basic livelihood of retirees.

(2) **Special partial accumulation system**. Employee basic pension insurance system to implement a combination of social integration and individual account mode, the system of pay-as-you-go and the fund system combined with a mixed model.

(3) **Contributory**. The insured employees and their work units jointly contribute to form the pension insurance fund, which is financed by the treasury when the fund is insufficient.

(4) **Socialization**. Clarify that basic pension is organized and implemented by the government in accordance with the law, and that it is handled by social insurance agencies with the cooperation of employers.

3.1.2 2015 Pension Reform: Pension Merger

The 1997 system resulted in a relatively large difference in pensions between employees of enterprise units and those of public sectors. In 2015, the State Council issued the *Decision on the Reform of the Pension Insurance System for Staff of Institutions and Agencies*, clarifying that the basic pension insurance system for employees combining social coordination and individual accounts was to be implemented uniformly for employees in public sectors as well as for those working in enterprises.

This decision means that the “Dual Pension Scheme” has been formally abolished, thus realizing the "Pension Merger". After the implementation of the policy, employers and employees of institutions will have to start contributing in the same way as enterprises. The reformed pension system and the formula for calculating pensions are the same as in Tables 3 and 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 sum, after the 2015 reform, the pension benefits of employees of public sectors have a tendency to converge with those of enterprises. The "merger" will not take place until October 2024 onwards.

3.2 Educational Background and Child Policy

China's education system

Since 1986, China has practiced nine-year compulsory education, consisting of six years of elementary school and three years of middle school. Figure 2 illustrates the general process of education in China. After graduating from middle school, students take a high school entrance exam and are streamed. Figure 3 is about the annual enrollment numbers at each level of education, which shows that about half of the middle school students do not enter high school. These students usually go to vocational high schools to learn skills. High school graduates, on the other hand, undergo a college entrance examination, and in recent years, about half of the students have been able to enter college. And those students who do not get into college usually go to vocational colleges (or 2-year short-cycle colleges).

Since most families in China aim to send their children to college, they will place more emphasis on investing in education before college entrance exam. Moreover, tuition fees for vocational high schools, vocational colleges, and colleges/universities are relatively fixed and are publicly available that are not subject to changes in people's willingness to invest on education. And even if college students seek to improve themselves and participate in extracurricular training courses (e.g., language courses such as TOEFL and GRE, etc.), they generally pay for them out of the living expenses given by their parents, and those expenses may not be classfied as household education expenditures. There may be some measurement error. In the main analysis in Section 5, the sample is limited to 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 changed relatively significantly over the 40 years since the 1980s, and the timeline of some of these policies overlaps with pension reform, which may affect the analysis in this paper. The timeline of major policy reforms 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. At that time, 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 5.2 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). Iin 2013, the policy was further liberalized so that couples could have two children if one of them was an only child. And by the end of 2015, the universal two-child policy was launched. All couples (especially if both spouses have siblings) can have two children. The two child policy reforms of 2013 and 2015 are relatively close in time to the 2015 pension reform. In Section 5.3, this paper regresses each of these three types of households separately to mitigate internal differences due to population policy.

4 Data and Empirical Strategy

This section discusses the data used in the empirical analysis of this paper: the Chinese Household Income Project and its sample attrition, the difference-in-difference analysis framework, and some descriptive statistical results derived from the sample data.

[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.

4.1 Data

The dataset used for empirical analysis in this paper is the China Household Income Project (CHIP). This data is led by the China Institute of Income Distribution, in collaboration with the National Bureau of Statistics (NBS), and is part of the research project on incomes and inequality in China.

The CHIP is a repeated cross-sectional survey, covering rural household, urban household 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 5.2.5).

In terms of sample selection, this paper concentrates on urban households where the head or spouse is of working age (22 to 60) and has children who are attending school. The main discussion in the analysis of this paper is about households where the head or spouse is eligible for a pension. In the robustness tests in Section 5.2, the paper will relax some of the restrictions. Also, this paper removes samples that do not make sense, such as cases where the age difference between parent and child is too small (less than 12 years old), or where the child is older than the parent.

The explanatory variables in this paper are household investment in children's education and household savings. Both categories are measured in two separate dimensions: i.e., quantity and ratio to house-

hold income. 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.

In this paper, the total income of the family members is summed up to calculate the total household income, and the total education expenditure in the household income questionnaire is selected as the explanatory variable. The breakdown of educational expenditures includes tuition fees, book expenditures, and again tow costs, etc. 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. The savings rate is the ratio of savings to total household income. All income or expense amounts are adjusted to the 2010 price level.[10]

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 5.1 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 5.2.2. As described in section 3.2, the 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 (e.g., TOEFL training) are generally noted from the living expenses given by parents and are more difficult to measure. Section 5.1 therefore focuses on the cost of preschool, elementary, middle school, and high school education.

[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.

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

4.2 Difference-in-difference (DID) Approach

In the context of China's pension reform in 1997, enterprise employees in urban areas faced the shock of lower future pension income, but public sector employees were unaffected. While in 2015 reform, public sector employees were reduced, and the pension for enterprises employees were unchanged. Therefore, a difference-in-difference approach can be constructed by considering households affected by the policy as the treatment group, and unaffected households as the control group.

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

The outcome variable Y represents the household's investment in the child's education as well as household savings. Both are measured as a proportion of household income and amount of spending, respectively. D_{treat} is a dummy variable for the treatment group. It 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 Section 5 through 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 are affected by the policy. D_{policy} is a measure of whether the year is a post-policy year. For the 1997 reform, Dpolicy takes the value of 1 for observations in 2002, while for the 2015 reform, it takes the value of 1 for observations in 2018. $D_{treat} \times D_{policy}$ is the interaction term. Its coefficient β_3 is the focus of this paper, which captures the differential trends in the outcome variables between the treatment and control groups. X represents the control variables, including 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 (household income and household financial assets) are also included. Descriptive statistics for all variables are in Tables 5 and 6.

The fundamental premise underlying this modeling configuration rests on the absence of unaccounted variables that might disproportionately influence the outcomes of both the treatment and control groups both before and after the pension reform. Consequently, any discrepancies in trends between these groups are solely attributed to the effects of the pension reform itself. A particular concern arises with the enter-

prise reform, which resulted in substantial layoffs of enterprise employees in the late 1990s. This event altered the composition of the treatment group, which, in the dataset, exclusively comprises survivors of enterprise reform following the 1997 pension reform. To mitigate this concern, Section 5.2 discusses a new definition of the treatment group: 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.

4.3 Summary Statistics

Table 2 presents descriptive statistics for the samples from CHIP 1995 and CHIP 2002 by work sector of the head of the household. The four outcome variables are education expenditure as a share of total income, investment in education, savings rate and saving. Interestingly, the mean value of savings was negative in 1995 and 2002. This means that many households faced deficits and needed to use past savings to supplement their spending in that year. 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. The means of most of the control variables are relatively close. The three dummy variables of CPC members, managers, and skilled positions are relatively different. In general, the public sector, especially the government sector, has requirements for CPC membership, so the proportion of party members in the public sector is higher than in the enterprise sector regardless of the year. Career paths, on the other hand, are different in the enterprises and the public sector, which

explains the difference in the proportion of managerial positions as well as the proportion of technical positions. It can also be seen that as the economy grows (over time), household income and household assets have risen dramatically.

Descriptive statistics for the samples of CHIP2013 and CHIP2018 are in Table 6. The variable definitions are the same as in Table 5. Similar to Table 5, the means of most of the control variables are relatively similar. In contrast, the differences of the binary variables of CPC members, whether they are managers, and whether they work in technical positions are relatively large. And with the development of the society, both household income and household financial assets have increased in 2018 compared with that in 2013.

Figure 5 presents a histogram of the support expenditures of child to parents as a share of child's total household income for the CHIP1995 and CHIP2002 samples. It can be seen that the structure of support expenditure ratio is relatively similar in both years. The value of most households' expenditures on their parents accounted for a very small portion of their own household income. On average, each household contributes 5% of its expenditure to support its parents.

Figure 6 reports the mean pensions of retirees grouped by age in the CHIP 1995 and CHIP 2002 individual data. where the black lines indicate confidence intervals of plus or minus one standard deviation from the mean. The amounts of the pensions have been inflation-adjusted to 2010 price levels. It can be seen that, following the implementation of the policy, although there has been an increase in pensions in both the public sector and the enterprise sector, there is a tendency for the gap between the two to increase. For most age groups of retirees, the difference between the two means is more than one standard deviation.

5 Empirical Results

The main part of this section presents the results of the empirical analysis. Section 5.1 examines the impact of the 1997 reform that reduced the pensions of employees in enterprises on household investment in education and savings, using DID approach with CHIP1995 and CHIP2002. Section 5.2 shows robustness checks of section 5.1. Section 3 studies the impact of the 2015 "Pension Merger" policy that reduced

pensions for employees in public sectors on household education investment and savings. Section 5.4 is a case study that further anticipates the relationship between substitution rates and household investment in education by projecting future wages and pensions.

5.1 Educational Investment and Household Saving: 1997 Pension Reform

Participants for CHIP1995 came from 11 provinces, while CHIP2002 contains a sample of 12 provinces, 11 of which are identical, with province 50[12] appearing only in 2002. Given that the survey data is a repeated cross-section and to ensure consistency in the sample structure, the regression sample in Section 5 is restricted to the 11 provinces that are present in both years. The results of the all-province regressions are presented in Table 22 and Table 23 in Appendix A.1.

The analytical framework of this section is developed based on Equation (1). In the context of the 1997 pension reform, employees of enterprises were the treatment group and employees of public sectors were the control group. Thus Equation (1) can be written 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. D_{ent} is the binary variable that identifies whether the household works for the enterprise or not. Three different dimensions are used in this section to define whether the household belongs to 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. X contains the control variables listed in Table 5, including the personal information of the head of household and spouse, the education level of the children, and the economic status of the household. Here household economic status is measured by self-reported household financial assets. When the outcome variable is a ratio (i.e., education expenditure as a percentage of household income and saving rate), the control variable for household assets is the quartile of household financial assets, while when the outcome variable is an amount (i.e., education spending and saving), the control variables representing household economic

[12]Each province in China has a two-digit numeric code. The CHIP data also uses this code system when recording provinces, and it is consistent across all years.

status are the amount of household financial assets as well as the amount of household income.

The regression results of Equation (2) are demonstrated in Tables 7 and 8. The samples used here are families with only one student and the child's educational level of 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. For each explanatory variable, this section identifies the treatment group using three different dimensions. In Tables 7 and 8, column (1) and (4) present the regression results for households whose head works in a enterprise unit as the treatment group, column (2) and (5) represent a broader definition of the treatment group: 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 enterprise. Column (3) and (6) represent a narrower scope: the treatment group is identified when both the head of household and the spouse work in the enterprise.

As can be seen in column (1) of Table 7, households with the head working in enterprise increase the share of education expenditures in household income by about 2.1 percentage points relative to households with a head working in the public sector. This implies that households will increase the share of their income devoted to education when faced with the expectation of a reduction in their pensions. 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.

For the analyses in Sections 5.2, the treatment group is defined as the head working in an enterprise. Therefore columns (1) and (4) of Tables 7 and 8 were chosen as the baseline of comparison for the robustness checks.

5.2 Robustness

This section is going to discuss the robustness tests. The first part of this section is a discussion on DID identification, controlling for the effect of possible layoffs on enterprise workers by giving a broader definition of the treatment group. The second part of this section deals with the different sample choices. In section 5.1, the sample used for the study is families with only one child in school, as well as educational levels of children are preschool, elementary school, middle school, and high school. Section 5.2.2, on the other hand, discusses all levels of education for single-student families, restricts the sample to children born in 1980, i.e., after the introduction of the one-child policy, as well as discusses educational spendings in multi-child families. Section 5.2.3 discusses the different measures of family finances. Section 5.2.4 examines the impact of the initial implementation of the policy on households by comparing CHIP1999 pilot survey with CHIP1995.

5.2.1 Identification

In the discussion in Section 5.1, the definitions of the treatment and control groups are based on the current work status of the head of household. However, as discussed in section 4.2, in addition to the different impacts of the 1997 pension reforms on employees of enterprise units and employees of institutions, the enterprise reforms of the 1990s brought about the problem of layoffs of enterprise employees. In contrast, permanent employees of public organizations can be considered as "iron rice bowl" jobs (or secure jobs) with no risk of unemployment. This also means that current employees of enterprises can be considered "survivors". To address this issue, this section redefines 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 and the reason for unemployment is layoff or firm bankruptcy (i.e., a separation that was not caused by the person's own subjective reasons), as well as those households where the head of the household's last job was in an enterprise regardless of his or her current work status. This wide definition extends the sample size from 5054 to 5382. In addition to this, considering that some of heads in CHIP2002 joined the workforce after the implement of the policy, i.e., after 1997, the paper further excludes the sample whose heads did not start working before the policy, based on the use of a broad definition of the treatment group. The regression results are presented in Tables 9 and 10. The explanatory variables in Table 9 are the two education-related variables, while the explanatory variable in Table 10 is savings.

The outcome variable in columns (1) - (3) is the percentage of household income invested in education, while the outcome variable in columns (4) - (6) is the 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. Columns (2) and (5), on the other hand, show the results under the wide definition. Columns (3) and (6) present results under the wide definition for the sample that joined the workforce after 1997. As can be seen in Table 9, the results of the coefficients under the wide definition are relatively similar to the baseline results, while the magnitude of the

coefficient of the interaction term increase a little bit in column (3). It can be assumed that those who joined the workforce after the policy did not experience the policy shock firsthand, and this group did not feel relatively 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.

The structure of Table 10 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. As can be seen from the results, the interaction term coefficients are relatively similar across the different caliber definitions of treatment groups. This means that after the policy was introduced, on average, the savings rate of employees in enterprises was 6% higher relative to public sector employees. The amount of savings for treatment group is also higher, by about 1,400 RMB per year, but the results are not significant.

5.2.2 Different Sample Selection

The baseline regression of 5.1 retains a household with a child in school and only discusses regressions where the child is in preschool, elementary school, middle school, and high school (i.e. the basic education stage). This section relaxes these sample restrictions, and the results are summarized in Tables 11 and 12. Table 11 presents the results of the regressions on education and Table 12 presents the results of the regressions on savings.

Columns (1) through (4) of Table 11 are regressions on the share of education expenditures, while columns (5) through (8) are regression results on education expenditures. Columns (1) and (5) are the same as columns (1) and (4) of table 7, respectively, and are the baseline results. Columns (2), (3), (6) and (7) also study households where only one child is a student. However, column (2) and (6) are not limited to the basic education level, but also takes vocational high school, vocational college and university education into account. Columns (3) and (7) also use households whose children are in basic education, but impose additional restrictions regarding the sample. China's strict one-child policy since 1979 affects household fertility decisions as well as other aspects. The regressions here exclude samples with children born before the one-child policy (before 1980). In other words, 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. But this restriction is of little significance for the latter, since students in high school and below are all under 22 in our sample. It can be seen that the regression results in column (2) and (3) are similar to the baseline results in column (1), and 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 relax the restriction that only one child in a household is attending school by taking the full sample into account and calculating the average educational spending per child and this average educational spending as a share of household income as the outcome variable. As can be seen from the regression results in column (4), the treatment group's average investment per child as a share of household income increases by 1.7 percent more relative to the control group, which is slightly smaller than the 2.1 percent increase in the baseline results.

In Table 12, columns (1) and (4) present the baseline regression results. Columns (2) and (5) present the results of the regressions for all stages of education of child. Relative to the 6% coefficient on the interaction term in the baseline savings rate regression results, the coefficient on the interaction term in the sample that includes vocational education and college education is somewhat lower, at 3.4% and not significant. This may be due to the fact that families with children in vocational, college or university education have, on average, older parents, and family saving behavior may differ from that of younger parents. Column (5) shows that the treatment group saves about 691 RMB more relative to the control group, but the coefficient is not significant. Columns (3) and (6) restrict families with children born in 1980 and later. The result of the regression in the third column show that for households more strongly affected by one-child policy, enterprise households save, on average, 5.4 % more of their household income than households in public sectors, which is less than the baseline of 6.2 %. This may be due to the fact that one-child policy has changed the fertility attitudes of households as well as their fertility decision-making. 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.

5.2.3 Different Ways to Measure Household Assets

In the regressions in Section 5.1, the total value of household financial assets is used 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 this section, other measures of household assets are considered for robustness testing. The regression results are displayed in Tables 13 and 14, where the outcome variables in Table 13 are education-related, while the outcome variables in Table 14 are savings-related variables.

In addition to the benchmark regressions, three asset measures are:

Total household assets. This contains 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 in columns (2) and (6) of Tables 13 and 14.

Household net assets. Derived from the total value of household assets minus total household liabilities. The corresponding regression results are in columns (3) and (7) of Tables 13 and 14.

Total household liquid assets. 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 does not include 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 in columns (4) and (8) of Tables 13 and 14.

Columns (1) and (5) of the two tables are benchmark regressions from columns (1) and (4) of Tables 7 and 8, respectively. As can be seen in columns (1) through (4) of Table 13, the coefficients on the interaction terms are essentially the same at about 2.1%. This also supports the conclusion of this paper in 5.1. In columns (1) through (4) of Table 14, the coefficients on the interaction terms are slightly different from the baseline, but they are all roughly around 6%. It can be assumed that the treatment group would have invested about 6% more of their household income in savings relative to the control group. In the analysis of education spending and saving in columns (5) through (8) of Tables 13 and 14, the coefficients on the interaction terms are all positive but not significant. This means that while on average the treatment group invests and saves more on education relative to the control group, it is not statistically significant.

5.2.4 Comparison of 1995 and 1999

Consider that 1999 is also a post-policy year and is closer to policy implementation, this section complements the study of the effects of the 1997 pension reform by comparing CHIP 1999 with CHIP 1995. Since only six of the provinces in which the CHIP1999 and CHIP1995 samples are located are the same, this section reports balanced mixed cross-section data, i.e., samples from the common six provinces are retained. The regression results for the unbalanced sample are in Tables 24 and 25 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 meanings of the explanatory variable Y as well as the control variable X are the same as in Section 5.1. 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 here is defined as households where the head works for the enterprise. Also for the sake of robustness testing, this section adopts as a comparison the wide definition of the treatment group in Section 5.2.1, i.e., the head is currently working in an enterprise, or the head is currently unemployed and the reason for the unemployment is layoff or firm bankruptcy, as well as the head's last job was in a firm regardless of his or her current job status. Sample choices are still limited to families with only one child in school and the child's education level of preschool, elementary, middle school, and college. The eduation-related results of the regressions are in Table 15. The saving-related results of the regression are in Table 16.

The definition of the treatment group in columns (1) and (3) of Table 15 and Table 16 is that the head of the household is currently working in a business, while columns (2) and (4) use a wide definition.

As can be seen in columns (1) and (2) in Table 15, the treatment group invests about 1.6% more of their household income in their children's education relative to the control group. Columns (3) and (4) show that, on average, control group households would have spent about 560 RMB more on their children's education in 1999 than in 1995. The treatment group spends about 137 RMB more on top of the 560 RMB than the control group, but the coefficient is not statistically significant.

Interestingly, in Table 16, the coefficients on the interaction terms in columns (1) and (2) are positive,

while the coefficients on the year dummy variable D_{1999} are positive. This implies that the overall savings rate of households was up in 1999 compared to 1995, yet enterprise households, i.e., the treatment group, saved about 6 percent less of their household income than the control group. This is the opposite of the findings in Table 8 in Section 5.1. Considering that 1998 to 2000 were the years of more severe corporate layoffs, the saving behavior of households may still be affected by the macro environment. Enterprise households not only faced the shock of lower future pensions, but also suffered from the wave of layoffs and uncertainty about future expectations. All these factors may lead to a savings behavior that is inconsistent with that of the more stable public sector households.

5.3 "Pension Merger": 2015 Pension Reform

Similar to Section 5.1, 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 5.3 comes from the 14 provinces, and the results of the all-province regressions are in Table 26 and Table 27 in Appendix A.1.

This section takes a similar strategy as Section 5.1, comparing the three different dimensions of the definition of treatment groups. Here the treatment group changes to public sector employees, since the target population of the 2015 reform is public sector employees, allowing them to start paying pension contributions and lowering their future pensions. The regression model for this section is as follows:

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

where Y is the explanatory variable that includes educational spending, household savings, and their ratios to household income. D_{pub} is the binary variable that 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: the head of the household works in the public sector, the head or spouse works in the public sector, and both the head and spouse work in the public sector. X contains the control variables listed in Table 6, including the personal information of the head of household and spouse, the education level of the children, and the economic status of the household. Here household economic

status is measured by self-reported household financial assets. When the outcome variable is a ratio (i.e., education expenditure as a percentage of household income and saving rate), the control variable for household assets is the quartile of household financial assets, while when the outcome variable is an amount (i.e., education spending and saving), the control variables representing household economic status are the amount of household financial assets as well as the amount of household income.

The sample is selected similarly to section 5.1, retaining households with only one student and with children in high school education and below. Given the ten-year transition period, this section also excludes from the 2018 sample households that retire before 2025.

The regression results of Equation (4) are in Table 17 and Table 18. The structure of Tables 17 and Table 18 is similar to that of Tables 7 and 8. From Table 17, the coefficients on the interaction terms in columns (1) - (3) are positive, with column (1) representing the treatment group defined as the head of household working in the public sector, and the coefficient on the interaction term in this column is 1.8%, which is close in magnitude to the variables in section 5.1, but the coefficients are not significant. This may be because 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.

As can be seen in Table 18, 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 perhaps due to the ten-year transition period, the effect is not significant. This study will keep track of related data in this area and will provide additional analysis of the impact of the pension merger policy on public employees after 2025.

Two-child Policy: Regression by household category

From the introduction to China's population policy in section 3.2, 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 divides households into three categories according to 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, and performs a DID regression of Equation (4) for each category. The treatment group in this section is defined as

households where the head works in a public sector. The sample attrition is the same as in Table 17 and Table 18, which keeps households with one child at school, and the child is at pre-school, elementary, middle, or high school level. The results are in Tables 19 and 20.

In Table 19 and Table 20, 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, as can be seen from Tables 19 and 20, the ratio of the number of observations in the three categories is roughly 6.57% : 14.8% : 78.64%. This creates a great imbalance between the number of families in the three categories.

In columns (1) through (3) of Table 19, the ratio of investment in education investment increased for public sector households relative to enterprise households, increasing by about 5 percent for both only children households and by about 6.8 percent for one only child households. However, this difference is not statistically significant. Whereas in columns (2) and (3) of Table 20, in one only child and no only child family categories, public sector households have increased their savings rates compared to enterprise households. This may imply that these two types of households have to save in advance for future fertility decisions.

5.4 Case Study: Pension Prediction

In this section, individual data from CHIP 1995, CHIP 1999, and CHIP 2002 will be used to predict an individual's future earnings so that the formulas outlined in Table 2 and Table 4 can be utilized to make projections of future pensions as well as changes in expected pensions influenced by the policies of the 1997 pension reform.

The first step is future wage prediction. In this paper, individual's age, gender, ethnicity, education, years of working experience, province, and job-related variables (e.g., industry, job title, etc.) are collected as control variables for the regression, the explanatory variable is the logarithm of wages,[13] and the meanings of the variables as well as the regression results are shown in Table 28 in Appendix A.2. Standard errors are clustered at the county level and are heteroskedasticity robust.

The next step is to estimate each individual's wage for all years from 1997 (or the first year of em-

[13] Wages are inflation-adjusted based on the World Bank's CPI data for China.

ployment for those who started later than 1997) to retirement, assuming that all control variables except age and years of employment are held constant. Of these, real wages were used for 1999 and 2002.

In the third step, the total 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 calculated using the formulas in Table 2. Here the first year of pre-policy pension is calculated by multiplying the pre-policy replacement rate by the estimated salary for the year before retirement in step 2.

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. As for the calculation of the individual pension account, this section calculates the total individual pension account benefit by summing up all the predicted wages of the individual from 1998 until retirement and multiplying them by 8 percent.[14] 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. Then post-policy pensions are calculated by summing up the basic benefit, the transitional benefit and the individual account benefit for the first year of retirement of employees in enterprises in 1999 and 2002, and thus the post-policy replacement rate.

On average, the number of years a retiree will receive a pension can be simply estimated by subtracting the age of retirement from life expectancy. If it is assumed that pensions are adjusted annually only for inflation and that factors such as real interest rates are not taken into account, the total pension over an individual's lifetime can be obtained by multiplying the total number of years of receipt by the pension in the first year of retirement. Life expectancy is obtained from the 2005 Chinese life expectancy in the World Bank database.[15]

Figure 7 illustrates the lifetime total pension amount that can be received by a sample of enterprise

[14]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.

[15]Life expectancy in China in 2005 was 71.619 years old for men and 76.819 years old for women. Thus men can receive a pension for approximately 11.619 years, women white-collar workers for 21.819 years, and women blue-collar workers for 26.819 years.

employees by age in 1999 and 2002. The horizontal axis of each subfigure represents the age of the individual in the year of the survey, and the vertical axis represents the average total pension of all individuals by that age. The dashed line represents the counterfactual pension estimate, i.e., the total pension that enterprise employees would have received in the absence of the 1997 policy reform, and the solid line represents the pension expectation as affected by the policy. As can be seen from the figure, the amount of pension expected to be received by both men and women after the impact of the policy has dropped considerably. For example, for a 40-year-old female employee in 1999, the expected pension was reduced from 150,000 RMB to 75,000 RMB in total, a reduction of more than half. On average, although men receive their pensions for a shorter period of time, men's later retirement age is also associated with longer working years than women's, and the combination of the two suggests that men's and women's total pensions were expected to be about the same before the policy, while men's were expected to have a slightly lower pension than women's after the policy.

Table 8 shows a histogram of expected replacement rates for employees in enterprise in 1999 and 2002 surveys, where the vertical axis represents density and the blue curve is the kernel density estimate. This means that after the policy, the replacement rate for workers in enterprises is roughly concentrated in the range of 40 to 80 percent, with an average of about 57.5 percent. There is a big difference from the pre-policy replacement rate which could be at least 70% or more.

This section concludes with a simple regression analysis. 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 i's investment in education in year t, p_{it} represents the replacement rate of the head of the household i in year t, and X_{it} represents control variables that include demographic information about the head of the household and the ratio of the household's financial assets to its total income in year t. D_t represents the year dummy variable(s), and D_{ent} is a dummy variable for whether or not 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 regression results are in Table 21.

Column (1) of Table 21 represents the results of regressing the entire sample for the three years

1995,1999, and 2000, column (2) represents the results of regressing only the 1995 and 2002 samples, and column (3) is the result of selecting only balanced provinces (i.e., the six provinces surveyed jointly by CHIP1995, CHIP1999, and CHIP2002).

The full-sample regression coefficient for the replacement rate is about 0.11. This means that when the replacement rate falls by 1 percent, on average households invest 0.11 % more of their income in education. In other words, households invest 1.1% more of their income in education when the expected replacement rate falls by 10%. In the context discussed in this paper, the average replacement rate for enterprise households falls from about 75% to 57.5%, a decline of about 17.5 percentage points, so that on average households invest about 2% more of their income in education. This is also consistent with the findings in section 5.1.

6 Model

This section investigates the intergenerational optimization problem for households using the OLG model. Influenced by the one-child policy, the decision of Chinese households to have children after the 1980s is greatly restricted. To keep the model simple and illustrative, we abstract from households' savings and fertility decisions.

6.1 Settings

The model assumes that households are homogeneous and live through three stages: studying, working and retirement. For Generation t households, the studying stage is characterized by receiving financial support from parents (generation $t-1$) for education and completing the accumulation of their own human capital. The working stage involves supporting retired parents (generation $t-1$) and raising and supporting the education of children in the studying stage (generation $t+1$). The retirement stage involves receiving a pension and support from generation $t+1$.

The studying stage can be considered as a stage of human capital accumulation. In this stage, it is assumed that households do not make decisions, do not derive utility from consumption, and receive educational support from their parents for capital accumulation. Based on Bercker, Murphy and Tamura

(1990), the formula for intergenerational accumulation of human capital can be considered as follows:

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

where H_{t+1} represents the human capital of the household in generation $t+1$, and H_t represents the human capital of generation t, i.e., the parental generation of generation $t+1$. $\bar{H}$ represents the initial endowment, i.e., each generation is assigned a unit of $\bar{H}$ of productive skill. h_t represents the investment in education from generation t to generation $t+1$. The coefficient A measures the productivity of investments. $0 < \beta < 1$ measures the effect of scale on the accumulation of human capital.

Entering the working stage, generation t households derive utility from consumption $C_{w,t}$ in this stage and engage in work for wages. Wages are assumed to be a linear function of capital accumulation, i.e., $\bar{H} + H_t$. It follows from this assumption that $\bar{H}$ can also be understood as the base wage or bottom wage, i.e., the wage that the offspring can earn in the future based on the fact that the parents are not actively investing in the offspring's education at all, but rather relying entirely on public education in society. At this stage, household expenditures include social security payments, education expenditures for the next generation, and support expenditures for the previous generation (i.e., generation $t-1$). Therefore, 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 can be interpreted as the income tax rate. h_t is the investment in education for the offspring as a share of household income, which has the same meaning as h_t in Equation (5), and which will also determine the accumulation of human capital in the $t+1$ generation. ϕ, on the other hand, stands for the support expenditure to the parents as a share of household income. The existence of this expenditure can be considered as public information since the Chinese law imposes for the support obligation.

During the retirement phase, generation t households will derive utility from consumption $C_{r,t}$. Ignoring the factor of personal savings, there are two main sources of income at this point: pensions and intra-family transfers from offspring (generation $t+1$). Denoting the pension replacement rate by p_t, 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 first term $(\bar{H} + H_t)p_t$ of the above equation represents pension income during retirement and consists of the product of wages and the replacement rate. p_t is a replacement rate and is affected by exogenous pension policies. The second term $(\bar{H} + H_{t+1})\phi$ represents the support income from children, i.e., generation $t+1$ to generation t. ϕ can be understood as the proportion of support paid by generation $t+1$ to their parents (generation t) as a percentage of their wages, which is the same as ϕ in Equation (3). Here ϕ can be interpreted as the minimum standard of support set by law. And H_{t+1} can be derived from Equation (5).

In the above framework, the model simplifies the consideration of fertility as well as the private savings factor. Thus education expenditure is the only decision variable. Households pay for educational to their children during the working years and receive returns during retirement through intra-family transfers.

6.2 Household Optimization Problem

According to the analysis in section 6.1, 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 follows:

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

subject to

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

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

In the above optimization problem, it is assumed that only education investment h_t is the decision

variable and all other variables are exogenous. By solving the above problem, it can be concluded that the optimal level of educational investment is:

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

The result of the comparative static analysis can be obtained by applying a partial derivative to p_t in Equation (8):

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

From the above analysis, it can be learned that there is a certain inverse relationship between substitution rate and family investment in education. The two pension reforms of 1997 and 2015 therefore 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 5.4, this section makes a scatter plot of the proportion of investment in education and the replacement rate with a fitted line (see Figure 9). As can be derived from section 5.4, the slope of this fitted line is around 0.11.

7 Conclusion

This paper analyzes the impact of changes in pension expectations on household investment in human capital as well as household savings. The 1997 pension reform reduced the future pensions of employees in enterprises but did not affect public sector workers. Therefore, this paper utilizes a difference in difference (DID) approach and uses employees in enterprises as the treatment group and public sector employees as the control group to investigate the relationship.

The empirical analysis of CHIP1995 and CHIP2002 reveals that, on average, employees of enterprises will invest 2% more of their income in their children's education than employees of institutions. Also, the household savings rate would increase by about 6% more for enterprise employees than public sector employees. This implies that households expecting a decline in future pensions will invest more in their

children and increase their personal savings to supplement the expected decline in future income. The consistency of the results is also illustrated by robustness checks such as redefining the identification conditions for the treatment group, changing the sample attritions, and defining different measures of household assets.

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.

As a supplementary analysis, this paper also examines the "Pension Merger" reform in 2015. The reform reduced the pensions of workers in public sectors without affecting enterprise workers. This paper also applies a DID model to regress CHIP2013 and CHIP2018, and the results show that employees of public sectors will invest about 1.8% more of their income in education than employees of enterprise units, 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 very significant. This study will further discuss the impact of the 2015 pension reforms after the end of the ten-year transition period in 2025.

The final part of the empirical evidence uses CHIP1995, CHIP1999, and CHIP2002 to predict individuals' future earnings and the pension formula to estimate individuals' future pensions. In particular, enterprise workers in CHIP1999 and CHIP2002 are used to compare their (counterfactual) pre-policy pensions and post-policy pensions. The results show that there is a substantial decline in the expected future pensions of enterprise workers after the policy and the estimated average replacement rate is 57.5%, which is much lower than the pre-policy pension income. Finally, 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.

This paper concludes with a simplified modeling framework using the generational optimization problem of the OLG model to illustrate the results. The optimal solution shows that there is a negative linear relationship between households' optimal human capital investment and the replacement rate. When the

replacement rate of the household decreases, the proportion of investment in education increases. This is also consistent with the prediction of the empirical part.

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 summarizes China's major pension policies and reforms. the 1997 "Dual Pension Scheme" reduced the future pensions of employees in enterprises, ending the PAYGO system for enterprises that had been in place and and led to differences in pensions between enterprises and public sector. the 2015 "Pension Merger"reduced pensions in public sector to the same level as 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: This table shows the criteria for calculating replacement rates prior to the 1997 reform. The pre-policy replacement rate depends entirely on 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 shows a comparison of the pension benefits and contribution status of employees in enterprises before and after the 1997 reform. The reform did not affect retired employees. Middle workers are those who started working before 1997 but retired after 1997. New workers are those who joined the workforce after the 1997 reform. After the reform, on the one hand, both employers and employees are required to start contributing to pensions, and on the other hand, employees' pension benefits have declined compared to pre-reform pension. Since middle workers had not contributed to a pension account before the reform, a transitional benefit was added to them to compensate for this. The formula for each specific benefit is shown 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	

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	

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 Educational Level	(3) Born after 1980	(4) Average Spending	(5) Benchmark	(6) All Educational 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: 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 16: 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 17: 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 18: 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 19: 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 20: 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

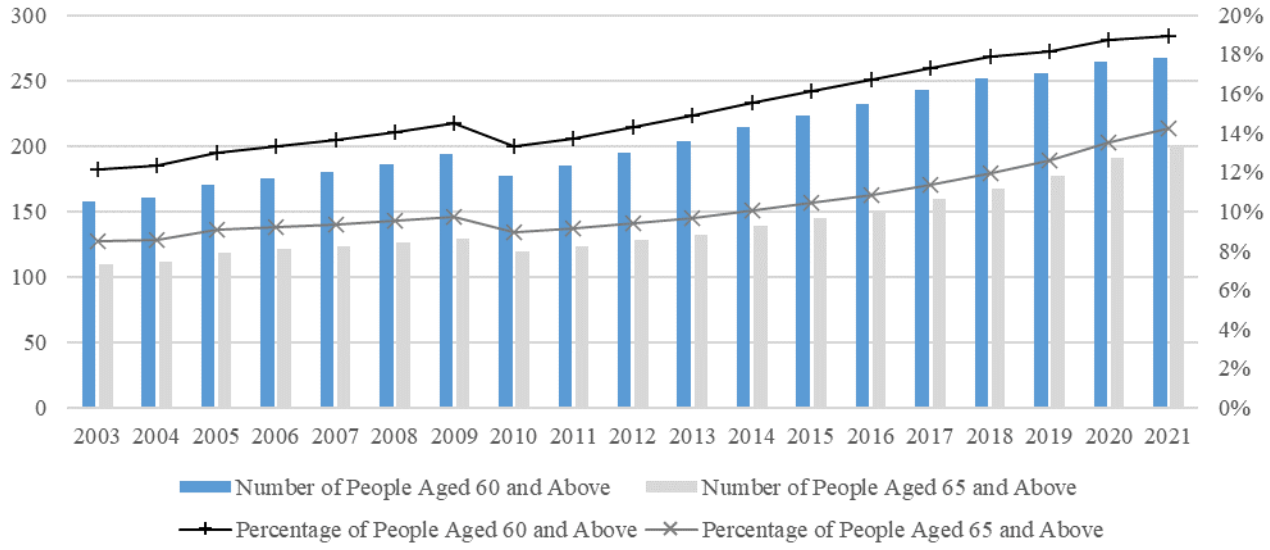
Notes: This table shows the effect of the 2015 pension reform on saving using DID regression in Equation (4) by different household category. Households in CHIP2013 and CHIP2018 with one child in school and whose child's educational level is preschool, elementary, middle or high school are retained. 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 21: 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

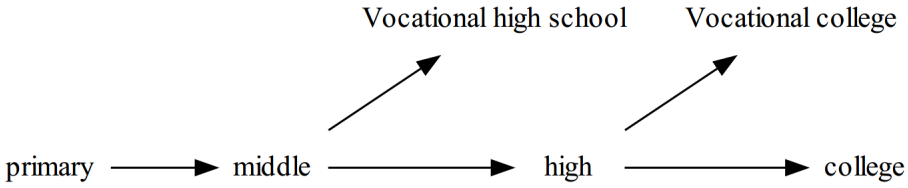
Notes: This table presents regressions of the education spending - income ratio on the predicted replacement rate. Column (1) includes all related households from CHIP1995, CHIP1999 and CHIP2002. Column (2) reports results from CHIP1995 and CHIP2002. Column (3) reports results from CHIP1995, CHIP1999 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 (2003 - 2021)



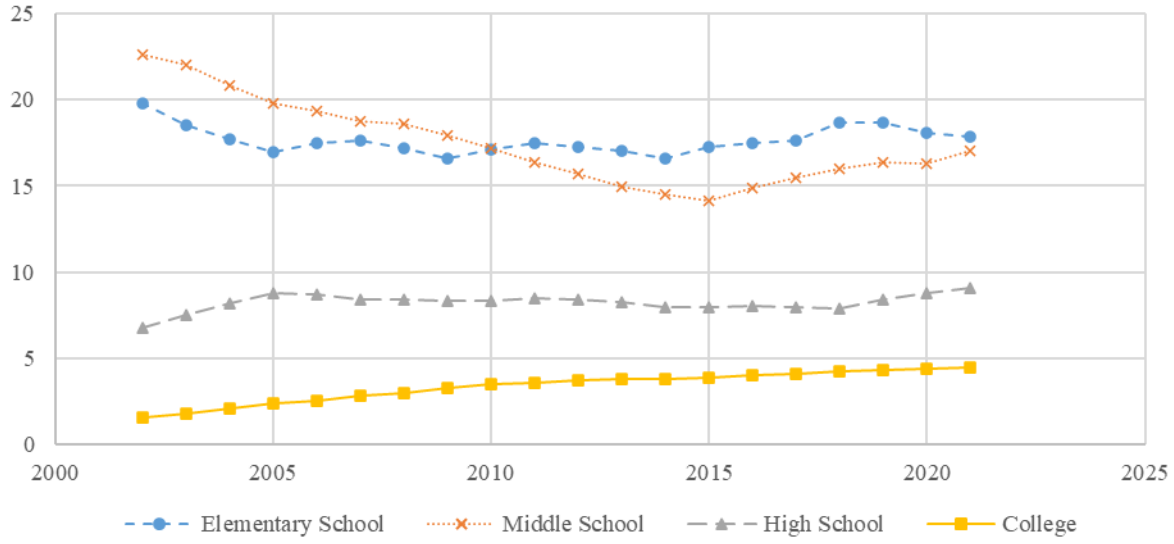
Notes: This graph shows the change in the number of elderly people and their share of the total population from 2002 to 2021. The left vertical axis is in millions.

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)



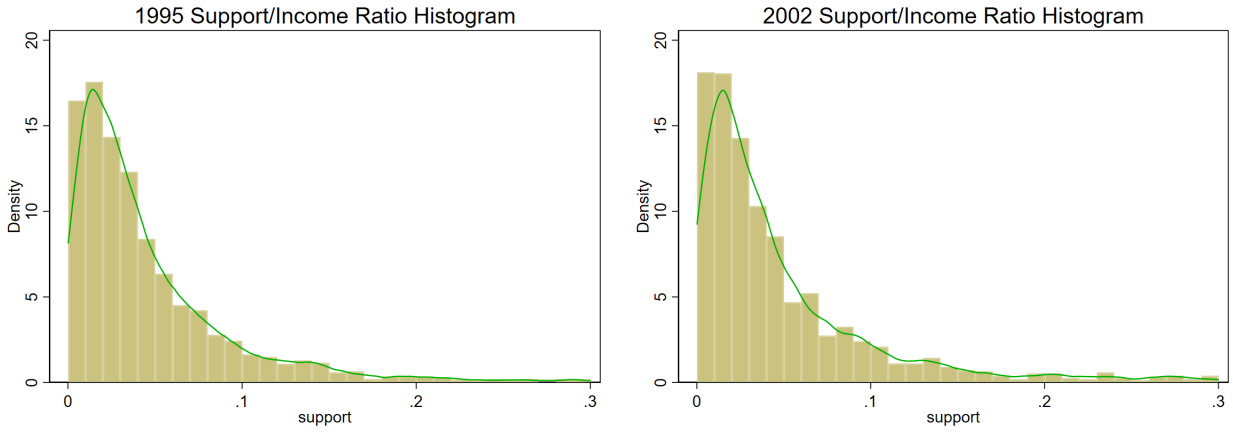
Notes: This figure shows the number of new students at each level of education for each year from 2002 to 2021. The vertical axis is in millions.

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)

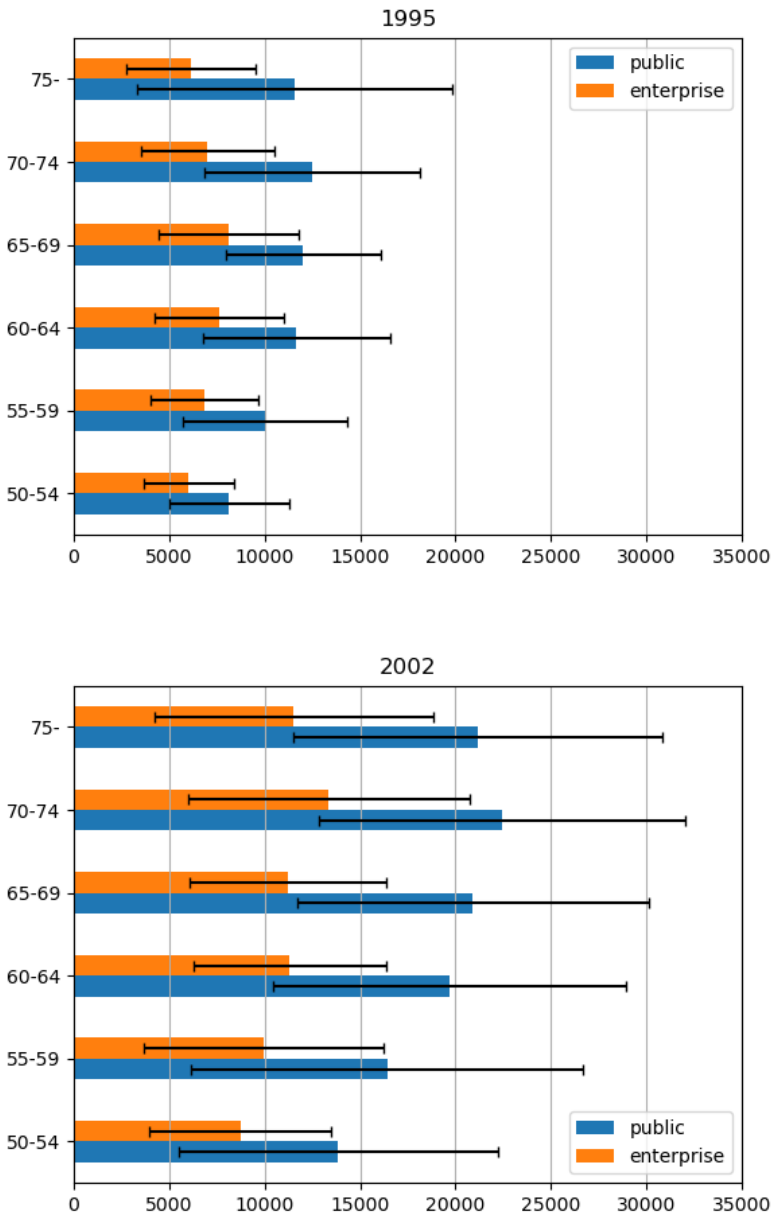
Notes: This figure shows the timeline of China's child policy.

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

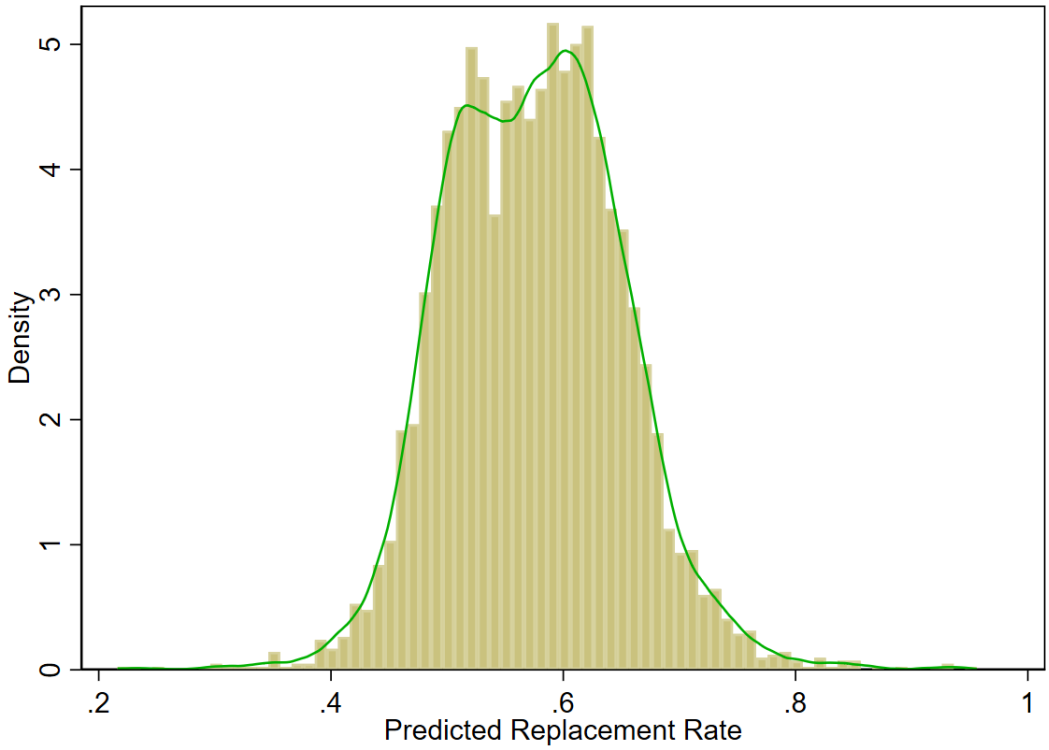


Notes: This figure shows the average pension for retirees by age group in the survey years 1995 and 2002 for different work sectors.

Figure 7: Estimated Pension Wealth

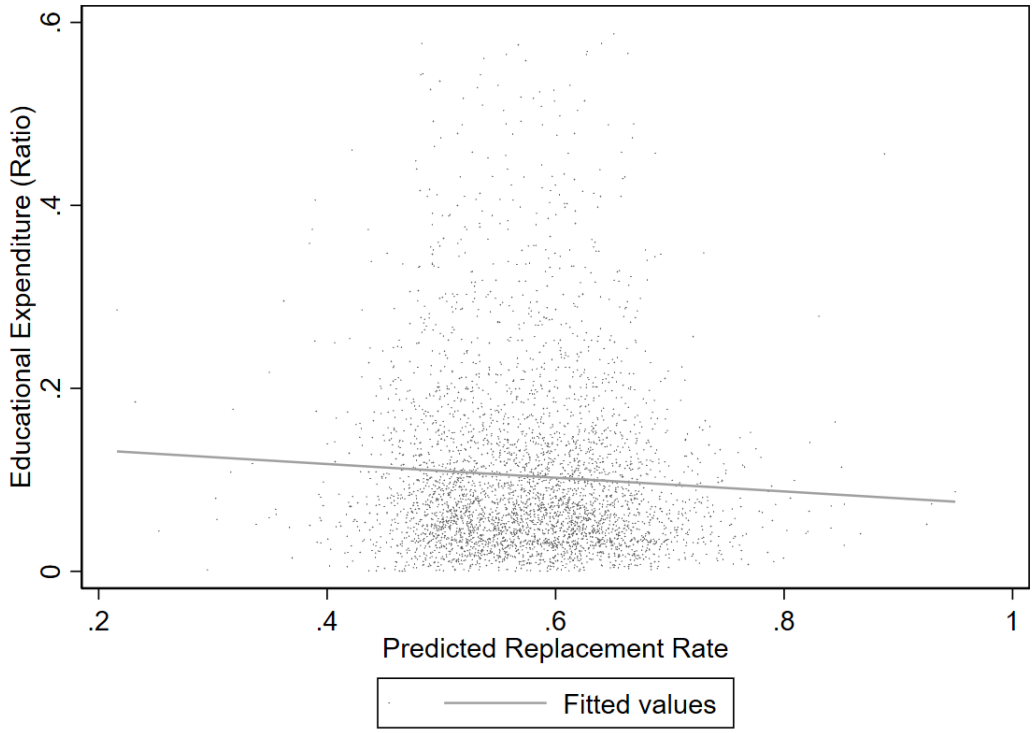
Notes. This figure shows the predicted post-policy and counterfactual pre-policy pensions for enterprise employees by year and gender.

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 22: 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 23: 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 24: 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 15, except that this table includes unbalanced provinces, while Table 15 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 25: 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 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 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 26: 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 17, except that this table includes unbalanced provinces, while Table 17 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 27: 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 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 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 28: 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
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)

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)