Fukino Project

Discussion Paper Series

No.009

Public Pension and Household Saving: Evidence from urban China

Jin Feng
Department of Economics, Fudan University

Lixin He
Department of Economics, Fudan University

Hiroshi Sato
Graduate School of Economics, Hitotsubashi University

February 2009

Fukino Research Project
Hitotsubashi University
2-1 Naka, Kunitachi, Tokyo, 186-8601 Japan

Public Pension and Household Saving: Evidence from urban China *

Jin Feng

Department of Economics, Fudan University

Lixin He

Department of Economics, Fudan University

Hiroshi Sato

Graduate School of Economics, Hitotsubashi University

Abstract: We relate household saving to pension reform, to explain the high household saving rates in urban China from a new perspective. We use the exogenous – policy induced - variation in pension wealth to explicitly estimate the impact of pension wealth on household saving, and obtain a significant offset effect of pension wealth on household saving. Our estimations show that pension reform boosted the household saving rate in 1999 by about 6 percentage points for cohort aged 25-29 and by about 3 percentage points for cohort aged 50-59. Our results also indicate that declining pension wealth reduces expenditure on education and health more than on other consumption items.

Keywords: pension reform, pension wealth, household saving rate, urban China

JEL classifications: E21, H55, P43

* Jin Feng: Department of Economics, Fudan University, 600 Guoquan Rd, Shanghai, 200433 China Fudan University, Shanghai 200433, China. E-mail: jfeng@fudan.edu.cn. Lixin He: Department of Economics, Fudan University, 600 Guoquan Rd, Shanghai, 200433 China. E-mail: srvnlx@gmail.com. Hiroshi Sato: Graduate School of Economics, Hitotsubashi University, Tokyo 186-8601, Japan. E-mail: satohrs@econ.hit-u.ac.jp. We are grateful to Xiaoyuan Dong, Chunyu Ho, Iikka Korhonen, Ming Lu, Yan Shen, Zheng Song, Yaohui Zhao and participants in the fifth CWE international workshop on empirical research using micro data and participants in the seminar of Bofit, Bank of Finland for their valuable comments. We gratefully acknowledge financial support for the CHIP 1995 and 1999 surveys provided mainly by the Ford Foundation and partly by the Masayoshi Ohira Memorial Foundation, the UK Department for International Development (DFID), the CCK Foundation, the George Webb Medley Fund, and Hitotsubashi University. Jin Feng is grateful to financial support from Ministry of Education, China (Project No. 05JA790020) and Institute for Economies in Transition, Bank of Finland. Lixin He and Hiroshi Sato also gratefully acknowledge financial support from the Japan Society for the Promotion of Science (Postdoctoral Fellowship for Foreign Researchers No.18.06312, Grants-in-Aid for Scientific Research No. 18203018), and the Global COE Program "Research Unit for Statistical and Empirical Analysis in Social Sciences", Hitotsubashi University. Financial support from Fukino Research Project, Hitotsubashi University, for preparing Englsih manuscript is also gratefully acknowledged.

1. Introduction

China's household saving rates climbed continuously during the mid-1990s. Based on official statistics, the urban household saving ratio increased from 17% in 1995 to 20% in 2000 and to 23% in 2004.[1] At the same time, China's public pension system for urban employees has been in the process of reform. The most important pension reform began in 1995, first in several provinces and eventually across the country. At the end of 1997, the State Council (1997, Document 26) officially implemented the new policy and unified the parameters of the system. The reform has been aimed a multi-pillar system. Besides the Pay-as-you go (PAYG) pillar, individual accounts were established. However, the total replacement ratio declined. The combined target replacement ratio of the first and the second pillars is 58.5%, down from 75% in the pre-reform period. Transition arrangements are available to even out the losses of those workers who did not have individual accounts before the reform. Although it has often been conjectured that pension reform would affect household saving, the relationship between rising household saving rates and declining pension benefits requires further exploration.[2]

Numerous studies have attempted to explain household saving rates in China. One recent study is by Horioka and Wan (2007), which investigated saving rates of urban, rural and all households in 1995-2004 using provincial data from the China household survey. They find the significant determinants to be the lagged saving rate, income growth rate, real interest rate, inflation rate, and (in one case) demographic structure. Modigliani and Cao (2004) use time series data from 1953 to 2000 and find that long-term economic growth and demographic structure are the two main factors

[1] This is calculated from household survey data as the difference between disposable income and consumption expenditure divided by disposable income. The data is from China's statistics yearbook.

[2] The other effect of pension reform on aggregate household saving is that growth of pension distribution in the 1990s would have had a negative impact on the incentive to save for old age, as inferred by Modigliani and Cao (2004). But the extension of the pension system occurred at a slow pace. Contributors as a percentage of urban employees was 44% in 1992 and 45% in 2002 (Yuan and Feng, 2005).

contributing to the high household saving rate. More comprehensive explanations for China's high household saving have been given in an earlier paper by Karry (2000), focusing more on saving behavior in a period of comprehensive urban economic reform. He uses the panel of provincial saving data before 1995. According to his estimations, none of the variables future income growth, future income uncertainty and dependency ratio is significant for urban areas in 1978-1983 and 1984-1989. Using household level data for 1995 to 2005, Chamon and Prasad (2008) find evidence suggesting that precautionary motives and the rising private burden of social expenditures on health, education and housing, have driven the increase in household saving rates. Meng (2003) uses micro data to test the permanent income and precautionary saving hypotheses for urban China. The results indicate that urban households in China have strong precautionary saving motives. However, there are no existing studies that explicitly consider factors such as the social insurance program and old-age pensions.

On the other hand, the relationship between pension wealth and household saving is inconclusive in the literature. The life-cycle model predicts that an increase in future pension wealth will be offset by a decline in individuals' saving. But in a general set-up more applicable to developing countries like China, both the sign and size of the incentive from future pension entitlements for savings requires more careful investigation. First, if current generations feel altruistic towards their offspring, who will be financing the current payouts, expending social security system may increase private saving to compensate for higher future contributions (Barro, 1978). Second, credit market imperfections reduce the importance of the life cycle motive for saving, as borrowing constraints limit the extent to which social security crowds out private savings (Diamond-Hausman, 1984; Dicks Mireaux-King, 1984).Third, limited economic and financial literacy may hinder an individual's assessment of pension wealth, which may limit the extent of the offset between pension and non-pension wealth (Bernheim, 1994). Therefore, predicting the impact of changes in pension wealth on private saving is an empirical issue.

There are only a few empirical studies on this topic as regards developing countries. Empirical results from developed countries have shown great variability over time and across countries. One reason for the inconclusive results is that the variation in pension benefits is not exogenous. Several studies have treated pension reform as an exogenous variation of pension wealth and have found a substantial offset effect in certain periods of the life cycle. For example, Attansio and Brugiavini (2003) and Bottai, et al.(2006) study the variation in pension wealth induced by a substantial legislative change in Italy in 1992, and Attanasio and Rohwedder (2003) treat major UK pension reforms as natural experiments.

In this paper we attempt to explain household saving behavior in China from a new perspective, treating the pension reform of 1995-1997 as the source of exogenous variation in pension wealth. Our data are from the China Household Income Project (CHIP) 1995 and 1999 surveys, which include enough information to allow us to compute pension wealth at the individual level. [3] Using micro data, it is possible to take account of the effects of pension reform on household saving of various cohorts. For a younger cohort, a decline in future pension benefits has less effect on saving, because younger people have more time to absorb the change before retirement. We consider explicitly this life cycle effect by allocating the present discounted value of pension benefits to each period of life and estimating the effects on saving. Micro data yield a variety of measures of household saving. To examine the effect of pension wealth on human capital investment, we measure household savings both including and excluding investment on human capital (expenditure on education and health).

This paper is organized as follows. In Section 2 we present a brief introduction to Chinese pension reform and its impact on the pension wealth of different cohorts. In Section 3 we explain the theoretical model and deal with econometric issues. In Section 4, we describe the data set and how the valid sample of households is obtained. In the appendix, we explain the method of

[3] For details of the sampling framework and sampling method of the CHIP 1995 and 1999 surveys, see Riskin, Zhao, and Li (2001), Li and Sato (2006), and Gustafsson, Li, and Sicular (2008).

computing pension wealth and report on and compare pension wealth among the sample households. In Section 5, we present the main results and compare them with results of other studies. Section 6 concludes the paper.

2. China's Pension Reform and its Impacts on Pension Wealth

In China, the public pension scheme is available for urban employees. Before the mid-1990s the arrangements were the same for public sector employees and those in enterprises.[4] The first formal public pension system was established in 1951 and covered only public sector employees and workers in state-owned enterprises. This PAYG system based on enterprises covered about 75%-90% of a worker's wage. In addition, enterprises provided housing, medical care and social security to their workers. In the 1980s the unfunded employer-sponsored pension became unsustainable during the move toward a market economy. Many of the old industries lacked the resources needed to finance pensions. Older enterprises burdened with large social security obligations could not compete with new enterprises with young workers. Moreover, an enterprise-based pension system lowers worker mobility. In 1986 the state council encouraged pension pooling at the municipal level on the pay-as-you go basis. During the 1980s and the first half of the 1990s, there was a series of reforms in pension system, including enlarging the pooling base from county to municipal level and extending coverage from state-owned enterprises to other enterprises. However, the PAYG system characterized by generous retirement benefits remained unchanged until 1995. During 1995-1997, the pension reform was directed at a multi-pillar system with a declining replacement ratio.

The most recent framework for pension reform was established in July 1997. The new system has three pillars: a pooling account to redistribute to all beneficiaries, compulsory individual accounts, and voluntary supplementary pensions provided via commercial insurance. The first pillar

[4] Public sector here refers to institutions and state organs that are mainly financed by fiscal spending, such as government sector, education sector, health sector etc.

imposes a payroll tax of 17% (paid by employers) to ensure that employees who have worked more than 15 years have a replacement ratio of 20%. The second pillar (paid jointly by employers and employees) establishes an individual account for each employee. The contribution rate for this is 11% of an individual's wage, of which the employer contributes 3%. After retirement, the employee gets a monthly benefit from this account amounting to the accumulated value divided by 120. The combined target replacement ratio of the first and second pillars is 58.5%. [5] The mandatory retirement age is 60 for males and 55 for females.

The reform of the late-1990s reduced the replacement ratio of pensions for enterprise workers, particularly younger workers. According to the reform framework, those who had retired before 1997 (old workers) remained in the original PAYG system, those who entered the labor market in or after 1997 (new workers) came under the new three-pillar pension system, and those who started work before 1997 and retired or will retire after 1997 (middle workers) were covered by a transitional plan.[6] During that period, the public pension for employees in the public sector remained unchanged. Table 1 summarizes the key features of the pension system for enterprise workers before and after reform.

Although there was a reduction in the replacement ratio in the 1997 reform, the transitional arrangement was adopted to compensate for the losses of workers who did not have individual accounts and hence had no accumulation in the account before the reform. Thus the transitional arrangement left pension entitlements affected less for workers who were on the verge of retirement while greatly affecting younger workers. However, the reform affected pensions of so-called middle man. For younger workers who entered the labor market in 1997, there was no effect.

[5] This is based on the assumption that life expectancy is 70 and the rate of growth of real wages equals the real interest rate. If one contributes to the system for 35 years, the individual account could provide a 38.5% replacement rate. The two pillars have a combined replacement rate of 58.5%.

[6] The transitional arrangements vary across provinces, but there is a basic rule for the transition benefit: benefit in transition= indexed avg monthly income * adjustment coefficient * number of years without individual account.

Pension wealth is defined as the present discounted value of future benefits, and net pension wealth is the net value after deducting the present discounted value of future contributions. The reform rules imply that workers of different age groups were affected in different ways in terms of pension wealth. We compute pension wealth from the 1999 survey used in this paper according to the policy before and after the reform. Details about the computation of pension wealth are explained in the appendix. Figure 1 compares average pension wealth at each age before and after reform for males aged 25–59 and for females aged 25–54. The figure shows that pension wealth declined for workers of all ages after the reform, and the younger the worker, the sharper the decline in pension wealth. For example, for 25-year-old males, net pension wealth declined by 53.59% on average, whereas for males aged 55, net pension wealth declined by 29.42% on average. For females aged 25 and 40, net pension wealth declined by 65.45% and 42.87%, respectively.

(Insert Figure 1 here)

It is noteworthy that the number of workers in enterprises contributing to the public pension system was about 45% of total urban employees during 1995-2000. Employees in the public sector accounted for 11% of total urban employees. During the same period, there has been no development of the private pension scheme in China.[7] Up to 2000, the total of private pensions was RMB19 billion, which was about 8% of revenue flowing into the public pension fund in 2000. The number of workers covered by the private pension scheme is 5.6 million, i.e. about 5% of those covered by public pensions. So we do not take account of private pension in this paper.[8]

3. Theoretical Framework and Empirical Specification

A. The Model

Since one of the motivations of this paper is to explain the saving behavior in china after the mid-1990s, we consider the relationship between public pension wealth and household saving rate

[7] Calculations based on China statistic yearbook, 2005.
[8] Data are from China Labor statistic yearbook, 2006

instead of that between pension wealth and other financial wealth. This approach is similar to Attansio and Brugiavini (2003). Public pension wealth is measured by the present discounted value of future entitlements, and we adjust it to an annual scale comparable to annual household savings. We use a life-cycle model in which a household at time period i chooses current and future consumption to maximize lifetime utility, subject to a lifetime budget constraint, which includes current household assets, future earnings and future pension benefits. [9] Given a logarithmic utility function, the household solves the following problem:

$$\max \sum_{t=i}^{T} \beta^{t-i} \log C_t \tag{1}$$

$$s.t. \quad \sum_{t=i}^{T} \frac{C_t}{(1+r)^{t-i}} = \sum_{t=i}^{TR-1} \frac{E_t}{(1+r)^{t-i}} + \sum_{t=TR}^{T} \frac{P_t}{(1+r)^{t-i}} + A_i \tag{2}$$

where t indexes age or time, C_t is consumption in each period, β is the time preference rate, r is the real interest rate, E_t is real cash earnings in each period, P_t is real pension benefits during the period after retirement, A_i is the household's initial assets at time i, T is life span, and TR is retirement age. Maximization of (1) implies the determination of initial consumption (equation (3)) and consumption growth in each period after time i (equation (4)). The consumption in each period depends on the present value of total compensation, including future earnings and pensions.

$$C_t = (\beta(1+r))^{t-i} C_i \tag{3}$$

$$C_i = \frac{1-\beta}{1-\beta^{T-i+1}} [\sum_{t=i}^{TR-1} \frac{E_t}{(1+r)^{t-i}} + \sum_{t=TR}^{T} \frac{P_t}{(1+r)^{t-i}} + A_i] \tag{4}$$

The household saving plan for age t' is given by equation (5), where $FE_{t'}$ is the present discounted value of future earnings at age t' and $FP_{t'}$ is the present discounted value of pension benefits at age t'. $A_{t'}$ is the present value of past earnings and initial assets at age t'. Equation (5)

[9] We use a simple model to get a clear relationship between pension wealth and household saving behavior in life cycle. In this model, we don't explicitly consider other motivations for saving and uncertainty of income and life expectancy.

shows that pension wealth has the same effect on consumption or saving as future earnings and other wealth in a setting where retirement is the motivation for. Moreover, it also shows that there is a crowding out effect of pension wealth on household saving rate in each period. A permanent reduction in pension wealth implies an increase in the saving rate. The relationship depends on the size of the change of pension wealth: the greater the decline in pension wealth, the greater the change in saving rate.

$$\frac{E_{t'}-C_{t'}}{E_{t'}}=1-\frac{(1-\beta)\beta^{t'-i}}{1-\beta^{T-i+1}}[FE_{t'}/E_{t'}+FP_{t'}/E_{t'}+A_{t'}/E_{t'}] \tag{5}$$

Where

$$FE_{t'}=\sum_{t=t'}^{TR-1}\frac{E_t}{(1+r)^{t-t'}},\cdots FP_{t'}=\sum_{t=TR}^{T}\frac{P_t}{(1+r)^{t-t'}},\cdots A_{t'}=(\sum_{t=i}^{t'}\frac{E_t}{(1+r)^{t-i}}+A_i)(1+r)^{t'-i}$$

Equation (5) determines saving behavior when the household can anticipate future wealth at age i. When the household experiences an unexpected change in pension wealth or future earnings at age t', it will re-optimize its saving behavior, taking account of the changed pension wealth and future earnings. Now we have $t'=i$. Equation (5) becomes:

$$\frac{E_{t'}-C_{t'}}{E_{t'}}=1-\frac{(1-\beta)}{1-\beta^{T-t'+1}}[FE_{t'}/E_{t'}+FP_{t'}/E_{t'}+A_{t'}/E_{t'}] \tag{6}$$

Where $FE_{t'}$, $FP_{t'}$ are the same as in equation (5) and $A_{t'}$ in equation (6) denotes household assets at age t'.

There is an adjustment factor in equation (5) and equation (6), i.e. $\frac{(1-\beta)\beta^{t'-i}}{1-\beta^{T-i+1}}$ and $\frac{1-\beta}{1-\beta^{T-t'+1}}$. This is a means of allocating present discounted value of all kinds of wealth to all future periods from the age at which a remaining-life plan is made. The adjusted pension wealth then can be treated as part of the household's permanent income. If the adjustment is ignored, we get an

underestimation of the effect. [10] The adjustment factor gives the effect of a shock on a household at age t'. A younger household experiences a smaller effect of a given change in present value of pension wealth than does an older household. The intuition for this result is that younger households have a longer horizon over which to smooth consumption and absorb unexpected changes. Therefore we adjust the present value of pension wealth, explicitly taking the life-cycle effect into consideration. If we assume a household does not experience a reform, we apply the adjustment factor in equation (5). If the household is observed in the year immediately after reform, we apply equation (6).[11] For the same reason, these factors are also used to adjust the present value of future earnings.

To get a better understanding of the effect we are estimating, it is necessary to compare it with the offset effect between pension wealth and other wealth estimated in many other papers (e.g., Dicks-Mireaux and King, 1984; Gale, 1998). We relate the change in private wealth to adjusted pension wealth instead of private wealth to pension wealth. If we assume the marginal effect of pension wealth on saving rate lasts in each period of time, this effect amounts to the offset effects estimated in other papers.

B. Empirical Specification

Following the logic of the model, we use the household saving rate as the dependent variable in regression. In the theoretical model, pension wealth is indistinguishable from future earnings, but in reality future earnings are more liquid than pension wealth, while pension wealth accrues over the retirement period with a more determined pattern than future earnings. Therefore, it is reasonable that we allow different effects for them in the regression. We could include both as

[10] The idea of adjustment is similar to that of Gale (1998). However, the adjustment factor is different from that in relating private wealth to pension wealth proposed by Gale (1998). He stressed that the offset effect of pension wealth is increasing with the years household has been in the pension system: the longer a household in the system, the larger the effect of pension wealth.

[11] This adjustment is also used in Attanasio and Rohwedder (2003), but what our use is a little different from theirs. They treat the period after retirement as just one period, while we consider it to be the number of periods as the years from retirement age to age of death.

explanatory variables, each divided by current household income. Alternatively, we use age, education and occupation to proxy future earnings and do not include the explicit future earnings in regression. We estimate the following equation:

$$SR_{it} = c + \sum \beta_n d_n + \gamma PW_{it} + X_{it}\delta + \theta_t + \varepsilon_{it} \quad (7)$$

where SR_{it} is saving rate of household i at time t, PW_{it} is the ratio of adjusted pension wealth to household income, the d_n are dummies for age of household head to capture other life-cycle effects, X_{it} is a vector that includes occupation of household head, education of household head, and household size. Besides pension reform, other benefits for enterprises such as housing, medical care and employment guarantee were gradually dismantled in the 1990s.[12] In public sector, there was a tendency to reduce employment and reduce government investment. Some sectors, such as health care, underwent a marketization process. All these reforms increase the uncertainty of future income and expenditure and may have significant impacts on urban household saving behavior. θ_t represents the time effect, capturing macroeconomic and other policy shocks during this period.

Our main interest is the offset effect γ, which is expected to be negative according to equations (5) and (6). We estimate equation (7) for households whose head works in the public sector and in enterprises separately, to avoid the possible selection problems when there are some unobservable factors determining one working in different sectors. But even though we split samples, OLS regression to estimate γ raises problems. First, because the calculation of pension wealth is based on projected (rather than actual) future earnings, which are unobserved, pension wealth will inevitably be measured with error. Second, assumptions must be made about parameters such as life expectancy, real interest rates, real wage growth, and time discount rates. These factors

[12] In year 1998, State Council issued a document to stop the housing benefits which lasted 40 years ("Circular on further reform on urban housing system and acceleration of the housing construction"). In year 1998 State Council started health insurance reform for urban employees ("Decision on the establishment of basic health insurance system for urban employees"). In year 1998, SOE reform required enterprises using 3 years to reduce the redundant employees through displacement and lay off.

bias the simple OLS estimate of γ. An additional bias arises if the unobservable individual and employer characteristics that influence household saving are related to the variables used to compute pension wealth. Thus, for unbiased estimates, we use instrumental variables (IVs). Because the pension system was reformed in enterprises in the mid-1990s, we take advantage of the fact that employees in enterprises experienced an associated exogenous change in pension wealth to generate IVs. Because the policy changes in this period differed for people of different ages and between provinces, we use interactions of the time dummies and the age dummies and interactions of the time dummies and the province dummies as IVs.

4. Data

The data were collected by Chinese Household Income Project (CHIP) of China Academy of Social Science. The data collection consisted of two distinct samples of urban and rural populations of China, selected from the larger samples drawn by the State Statistical Bureau (approximately 65,000 rural households and 35,000 urban households). The CHIP is based on a survey of 7998 rural households in 19 provinces and 6931 urban households in 11provinces. There are three waves available, for years 1988, 1995 and 2002, and there is a specific survey on urban households in 1999, which includes 5300 sample households in six of the 11 provinces.[13]. The 1999 survey focused more on unemployment, so we drop the additional samples of unemployment.

The purpose of the CHIP was to measure and estimate the distribution of personal income in both rural and urban areas of China. There are two parts in the data files: one where the individual is the unit of analysis and a second where the household is the unit of analysis. There is information on the individual's economic status such as, employment status, monthly wage and other sources of income, and demographic variables including gender, age and relationship to the household head.

[13] Six provinces - Beijing, Liaoning, Jiangsu, Henan, Sichuan and Gansu - are in 1995, 1999 and 2002 survey. Shanxi, Anhui, Hubei, Guangdong, Yunnan are included only in the 1995 and 2002 surveys.

Urban households reported income from all sources, all types and values of food subsidies received, and total debt. Information was also gathered on household accommodations and living conditions. Households reported on all their expenditures.

When projecting the future earnings, we used samples from years 1995, 1999 and 2002. We used data from 1995 and 1999 as pre-reform and post-reform periods respectively, to estimate the effect of pension wealth on household saving. The sample we used includes households in which the head is aged between 25 and 59 if the head is a male, or aged between 25 and 54 if the head is a female. Moreover, we limit the sample households to those in which the head is covered by the public pension system, which means the head is a permanent staff member of an enterprise or in public sector or the head is a long-term contract worker. We exclude those households whose head is a temporary worker or short-term contract worker or employed without contact or self-employed. Households in which the head is retired or older than retirement age are excluded, to avoid issues involving the saving behavior of the elderly. Households in which there are adults other than head and spouse are also excluded because these families are in situations that are hard to estimate. We also drop households whose head enters into the labor market after the pension reform. Therefore the sample consists of 3150 households in 1995 and 1511 households in 1999, among which there are 2196 households in 1995 and 1083 households in 1999 with heads working in enterprises. Table 2 reports the sample characteristics.

A. Changes in Pension Wealth

We compute pension wealth at the individual level using the applicable policy rules (see appendix). Despite the complexity of these calculations, the value of pension wealth could not be precisely measured. Just as others have pointed out (e.g., Feldstein, 1974; Attanasio and Brugiavini, 2003), the precise pension wealth is not required in the sense that the pension wealth could reflect the magnitude of the decline during these periods rather than the actual levels of pension wealth.

Table 3 reports averages of net pension wealth for households in different employment groups and cohorts in the sample, and we compare those for 1995 and 1999. There is a substantial decline in households whose head is working in enterprises and a substantial increase in households whose head is working in the public sector in each cohort. The outcome may be due to pension reform for enterprises or to different household incomes in the 1995 and 1999 samples. So we further compute the ratio of pension wealth to current household income and changes therein during the two periods of time. There is obvious evidence of how reform affects households working in enterprises and different cohorts. For households whose head is in enterprises, this ratio declined by 26.61% on average, whereas for the younger cohorts the decline was much greater. For households whose head works in the public sector, few changes were found in this ratio, and the average change is 0.61%.

B. Changes of Household Saving

Household saving is measured as household disposable income minus household consumption in the same year as a percentage of disposable income. We use two measures for household consumption. The first one includes expenditure on education and health care, which can be viewed as investment in human capital. We also measure consumption exclusive of expenditures on education and health care, so that the effect of pension wealth on household's human capital investment can be compared with the effect on other consumption.

SR1 = (household disposable income – total consumption) ÷ household disposable income

SR2 = (household disposable income – consumption excluding education and health care) ÷ household disposable income

Table 4 reports average saving rates of households in different sectors and cohorts. There is an obvious increase in saving rates for all households over the period 1995 to 1999, and the changes in households in the public sector are as great as those in households in enterprises. For example, SR1 in both sectors rose by 5 percentage points on average, SR2 in both sectors rose by 9 percentage

points on average. Average saving rates of the youngest households increased most in both sectors. Therefore, a simple comparison between households of two employment groups does not yield clear evidence of an effect of pension wealth on household saving. We move on to estimating the degree of offset effect of pension wealth based on equation (7).

5. Results

With pension wealth for each household in the sample, we use the adjustment factor in equation (5) to adjust pension wealth and future earnings of those households in the public sector and those households in enterprises in 1995 and we use the adjustment factor in equation (6) to adjust pension wealth and future earnings of households in enterprises in 1999. [14] Due to the fact that workers in enterprises and public sector were faced different stages of reform, the coefficients of the explanatory variables may differ. Therefore, we estimate equation (7) on samples of households in enterprises and in the public sector separately. Robust standard errors are used to correct heteroscedasticity in the disturbance term.

Tables 5 and 6 present OLS estimation results for enterprise and public sector samples respectively. The key coefficient of interest is the effect of pension wealth on household saving. Results for both adjusted and unadjusted pension wealth are reported. The coefficient of unadjusted pension wealth relative to income is much smaller, although it is negative in all the regressions. This outcome is due to a mixture of variation in pension wealth and variation of current position in the life cycle. For households in enterprises, the coefficients of adjusted pension wealth relative to income are -0.257 when the dependent variable is SR1 and -0.217 for SR2, and statistically different from zero at less than the 1% level. The results indicate that an increase in pension wealth

[14] In order to compute the adjustment factors, we will make specific assumptions about the rate of discounting the future, the life expectancy of each age. We assume the discount rate is 4% and initial age is 25 in following regressions. Data of life expectancy at each age is from World Bank life table of China in 2003.

of RMB100 will reduce saving by RMB25.7or RMB21.7. The coefficient of the time dummy is about 0.20 and statistically significant, which shows that there was an overall increase in household saving rate during this period of time because of economic and social change. Similar results were obtained for households in the public sector, and the offset effect of pension wealth is even larger. It is reasonable that people in the public sector rely more on public pensions after retirement and hence pension wealth would have a larger offset effect on private saving. We also explicitly estimate the effect of future earnings. There is a significantly negative effect of future relative income in enterprises, but this effect is not significant in the public sector. This difference further implies that households in the public sector depend less on future earnings for consumption after retirement. It is noteworthy that the time effect is about 0.10 for households in the public sector, which indicates that macro shocks have caused greater increases in saving rates of households in enterprises than in the public sector.

The OLS results might be biased because of the measurement issues and unobservable factors mentioned in section 3. Since pension reform in enterprises provided us with an exogenous source of variation for pension wealth, we can perform instrumental variable estimation for sample households and remove the bias from the estimates. When using IV technique, we only use those samples where the household head works in enterprises. We use as instruments the interaction between the time dummy and six age group dummies and the interaction between the time dummy and six provincial dummies. The validity of these instruments rests on the fact that pension wealth changes exogenously for employees of different ages and in different regions as between the two periods of time. It also depends on the assumption that employees in enterprises did not switch to public sector jobs because of pension reform. This is a reasonable assumption in view of the fact that it is very difficult to switch from enterprise to public sector jobs after economic reform. There is no exogenous variation in reform-induced pension wealth of households in the public sector; however, the interaction term for the time dummy and a dummy indicating enterprise cannot be

used as an IV, because other reforms occurred during the same periods of time that were different for the two employment sectors. Hence, we apply IV estimation only to sample households in enterprises.

To assess the quality of the instruments, we check the rank condition regressing pension wealth on the full set of instruments and testing the null that the coefficients of the instruments are jointly equal to zero. The F-test rejects this null at the 1% level. The results from IV estimation are reported in table 7. When we exclude future earnings, we assume that their effect is captured by age dummies, occupation dummies and the time dummy. The coefficients of adjusted pension wealth relative to income vary little according to whether future earnings are included or excluded.[15] But the coefficients and the significance of the age dummies vary substantially. They are not significant when future earnings are excluded, which implies that the life-cycle effect of saving behavior is partly due to differences in future earnings relative to current income in different stages of life. We check the sensitivity of the results to changes in the real interest rate and discount rate used in computing adjusted pension wealth. A reduction in the discount rate yields a slightly larger effect of pension wealth.

The IV regressions indicate smaller effects of pension wealth than in the OLS regressions: -0.18 for SR1 and -0.12 for SR2. The larger effect for SR1 means that pension wealth has a greater influence on investment in human capital than on consumption. When pension wealth declines, households reduce their expenditures on education and health for children in most cases by more than their other expenditures. On the other hand, if pension wealth increases, households will increase consumption, with a further increase in human capital investment.

[15] The regression outcomes varied little with or without household assets. We exclude this variable from the final result. Household assets include total financial assets, estimated present market value of durable goods, estimated present market value of self-owned productive fixed assets, estimated present market value of privately-owned houses, plus estimated present market value of other assets.

We also allow for the possibility that the effect of pension wealth on household saving changes over the life cycle. We split the sample into age groups that may be expected to differ in this respect. One group consists of household whose head is younger than 40, the other includes all the other households in enterprises. Results of IV regressions for these two groups are presented in table 8. The effects of pension wealth for younger households are very small and insignificant, while the effects for older households are -0.44 (SR1) and -0.37 (SR2). This suggests that there might be liquidity constraints for younger households, or that the motive for saving in the younger ages is not mainly for retirement. According to Chamon and Prasad (2008), the main purpose of saving by young households is related to housing and education. It is hard to get reliable results by using an interaction term for pension wealth and age groups because of the validity of instruments. It is hard to identify the result as being age-related or a cohort effect. We present this result to compare with research in other countries, which report age-effects. Attanasio and Rohwedder (2003) find a substantial offset progressively increasing from 0.5 for people aged 32-42 up to 0.7 for those aged 54-64. For younger workers, the effect was negligible. An age-dependent schedule is found also for Italian micro-data (Attanasio and Brugiavini, 2003), in which there is a U-shaped pattern: pension wealth is found to be a good substitute for middle-age people.

We compare our results with others. Feldstein (1974) uses time series aggregate data to verify the substitution relationship between social security wealth and personal saving in the US, the social security wealth depresses personal saving by 30-50 percent. Micro-data evidence found in King and Dicks-Mireau (1982) pointed to a 25 cent decrease in Canadian household financial wealth following a 1-dollar increase in pension wealth. 20 percent or less offset was found based on US micro-data by Diamond and Hausman (1984) and Hubbard (1986). But some studies suggest there is no offset of pension on private saving (e.g. Kotlikoff, 1979; Venti and Wise, 1990; Aso and He, 2001). Gale (1998) corrects the bias in previous studies and finds larger offset effects: -0.66 for households with saving incentive accounts (households with less liquidity constrain), -0.68 for

households with higher education (households with lower income risk), -0.37 for households with lower education. Using Italian micro-data, Attanasio and Brugiavini (2003) obtain an estimate of an average effect of -0.35 for Italy and even larger effects in some cases. Bottazzi, et al.(2006) obtain an average effect of -0.65 for Italy. Compared with more recent results, the offset effect of pension wealth in China seems to be relatively small. There are many reasons for this finding. Besides the common reasons such as liquidity constraints and the precautionary and bequest saving motives, uncertainty as to future pension benefits also plays a role. For example, the misuse of the funds in the supposedly funded individual accounts, which remain notional, and the weak performance of financial markets raise doubt about the value of individual accounts (Yuan and Feng, 2005).

To get a sense of the magnitudes of the effect of pension reform on household saving, we compute pension wealth for samples in enterprises in 1999 applying policy rules before and after reform respectively and present changes of adjusted pension wealth relative to income for households due to the reform. Then we use the offset effect obtained to estimate the changing of household saving caused by pension reform. According to our estimation, the household saving rate increases by 2.78 percentage points for cohort aged 50-59 in year 1999 and by 6.31 for cohort aged 25-29 in 1999. This provides one explanation for the largest increase in household saving rates among the youngest households in our sample. More information is presented in table 9.

6. Conclusions

We explain the high household saving rates in China from a new perspective. During 1995-1999, there was a substantial pension reform for enterprise employees in China. We use the variation in pension wealth caused by policy to estimate the impact of pension wealth on household saving explicitly. We use two sets of cross-section data, one for 1995 (before reform) and one for 1999 (after reform). We compute the discounted present value of pension benefits at the individual level using the applicable policy rules, and we adjust pension wealth for different positions the

household life cycle. There was an obvious decline in pension wealth for households in enterprises and very little change for households in the public sector. In contrast, household saving in both employment groups increased during 1995-1999. Econometric results indicate significant offset effects of pension wealth in both groups. We take advantage of pension reform to create instrumental variables to remove the bias caused by measurement errors and unobservable factors, and obtain an offset effect of -0.18. Our estimations show that pension reform caused the household saving rate to increase by about 6 percentage points for cohorts aged 25-29 in 1999 and about 3 percentage points for cohorts aged 50-59. Almost 50% of enterprise employees are covered by pension scheme, and it is possible that pension reform that reduced the replacement ratio contributed to the observed increase in aggregate household saving rates.

However, relative to other countries, the effect of pension wealth is smaller in China. There may be a number of reasons for this. Our results also show that there is a greater effect on human capital investment. Other things being equal, declining pension wealth reduces expenditure more on education and health than on other consumption. In a process of population aging, cutting down pension benefits is a general tendency. However, human capital investment is related to productivity and is crucial for development. Thus more government investment in human capital is needed at the same time.

Because of sample limitations, in this paper we cannot measure the effect of providing pension benefits to those who were not covered by a pension scheme. In a country where the pension scheme is still being extended to cover more and more people, this is an important issue for future consideration.

Appendix: Estimating Future Earnings and Pension Wealth

To estimate pension wealth, it is necessary to project gross earnings from an individual's current age to his or her retirement age. To project future gross earnings, we used observations on individuals from 20–59 years of age and information on wage income for 1995, 1999, and 2002. We set up an econometric specification to obtain age–earnings profiles for different individuals and predicted annual gross earnings for each individual. To incorporate the cohort effect on wage growth, we used an assumed average wage growth rate. The variables controlled for in the wage equation were age, education, occupation, employment sector, and regional dummies. A detail description of the estimation methodology is given by He(2007).

Based on individuals' gross earnings in the year before their retirement, we computed the first year's pension benefit based on the rules applying to employees in different sectors. In 1995, the same policy applied to employees in the public sector and in enterprises. Monthly pension income represents a particular proportion of wage income at retirement (Table 1 reports the replacement ratios). To obtain the total pension benefit, we then computed the benefit for subsequent years by using the first year's pension benefit and the growth rate of average income.

Pension wealth is defined as the present value of expected pension income from retirement age to the expected age at death. We estimated both gross pension wealth and net pension wealth. The latter is obtained by subtracting from gross pension wealth the expected value of the future contributions paid by a worker from his or her current age until retirement.

For 1995, both gross pension wealth and net pension wealth for individual i aged a is:

$$LPold_i = \sum_{t=TR}^{T} \{ \hat{E}_{(i,TR-1)} \times \kappa \times (1+g_t)^{(t-TR)} / (1+r_t)^{(t-a)} \} \qquad \text{(A1)}$$

where $LPold_i$ is the present value of pension wealth, $\hat{E}_{(i,TR-1)}$ is projected earnings in the year before retirement, κ is the replacement ratio, T is life expectancy at the current age, TR is the retirement age (60 for males and 55 for females), g_t is the rate of growth of regional average wages when individual i is at age t, and r_t is the real interest rate.

For 1999, pension wealth is calculated based on the new policy rules, which differed between employees in the public sector and those in enterprises. For those working in the public sector, equation (A1) applies. For employees of enterprises and for 'middle workers' (those subject to the transitional pension arrangements), we use the rules in Table 1 to compute gross pension wealth based on each of the two pillars.

$LTBB_i$ is current basic pension wealth for individual i of age a, which is:

$$LTBB_i = \sum_{t=TR}^{T} \{\overline{E}_{m(i,t-1)} \times 0.2(1+g)^{(t-R)} / (1+r)^{(t-a)}\} \tag{A2}$$

where $\overline{E}_{m(i,t-1)}$ is the regional average wage at age $t-1$. (Other symbols have the same meanings as before.)

$LTPB_i$ is the present value of pension wealth from the individual account:

$$LTPB_i = \sum_{t=1}^{10} \{\sum_{s=a_1}^{TR-1} \hat{E}_{i(s)} \times (1+g)^{(s-a)} \times 0.11 \times (1+Ir)^{(TR-1-s)} / (1+r)^{(s-a)}\} \times \frac{1}{10} \times (\frac{1}{1+r})^{(t-1)} \tag{A3}$$

where Ir is the rate of investment return on the individual account and a_1 is the age at which the individual's account was established.[16]

$LTTB_i$ is the present value of transitional pension wealth:

$$LTTB_i = \sum_{t=TR}^{T} TB_{i(t)} (\frac{1}{1+r})^{(t-a)} \tag{A4}$$

[16] Referring to the investment rate reported in the "Social security fund for China" and the interest rate on five-year deposits, we assumed $Ir = 4\%$.

where the formula $TB_i = coefficient \times L_i \times \bar{E}_{m(i,TR-1)} \times Q_i$ is implied by the policy. This coefficient is 1.3% for most regions. L_i denotes work experience gained up to 1997, Q_i is the wage index of individual i, which is the individual wage relative to the regional average wage.

When computing net pension wealth for 1999, we took into consideration the contributions of employees (8% of their wage income, which is projected gross earnings for the previous year). We disregarded employer contributions (20% of the enterprise's average wage income) from the previous year. Thus, the present value of future contributions up to retirement age is a small proportion of gross pension wealth.

Accordingly, we define future earnings as the present value of gross earnings from the survey year to the year before retirement. The present value of gross earnings is:

$$LTW_i = \sum_{t=a_i}^{TR-1} \{[\hat{E}_{i(t)} \cdot (1+g_t)^{(t-a)}]/(1+r_t)^{(t-a)}\} \quad \text{(A5)}$$

where LTW_i is individual i's present value of future earnings in the period from age a to the retirement age, $\hat{E}_{i(t)}$ is the predicted gross earnings of individual i of t years of age, and a is the age in the survey year. (Other symbols have the same meanings as before.)

References

Aso, Yoshibumi., He, Lixin., 2001. Public Pensions and Household Wealth. *Keizai Kenkyuu* (The Economic Review) 52, 348–358 (in Japanese).

Attanasio, Orazio P., Brugiavini, Agar, 2003. Social Security and Households' Saving. *Quarterly Journal of Economics* 118, 1089–1119.

Attanasio, Orazio P., Rohwedder, Susann, 2003. Pension Wealth and Household Saving: Evidence from Pension Reforms in the United Kingdom. *The American Economic Review* 93(5), 1499–1521.

Bernheim, B. Douglas, 1994. Personal Saving, Information, and Economic Literacy: New Directions for Public Policy. In *Tax Policy and Economic Growth in the 1990s,* Washington: American Council Capital Formation.

Bottazzi, R., Jappelli, T., Padula, M., 2006. Retirement Expectations, Pension Reforms, and their Impact on Private Wealth Accumulation. *Journal of Public Economics* 90, 2187–2212.

Blinder, Alan S., Gordon, Roger H., Wise, Donald E., 1980. Reconsidering the Work Disincentive Effects of Social Security. *National Tax Journal* 33, 431–442.

Chamon, Macro, Prasad, Eswar, 2008. Why are saving rates of urban households in China rising. Working Paper No. WP/08/145. IMF.

Diamond, Peter A., Hausman, Jerry A., 1984. Individual Retirement and Savings Behavior. *Journal of Public Economics* 23, 81–114.

Dicks-Mireaux, Louis, King, Mervyn A., 1984. Pension Wealth and Household saving: Tests of Robustness. *Journal of Public Economics* 23, 115–139.

Feldstein, Martin S., 1974. Social Security, Induced Retirement and Aggregate Capital Formation. *Journal of Political Economy* 82(5), 905–926.

Gale, William G., 1998. The Effect of Pension on Household Wealth: A Reevaluation of Theory and Evidence. *Journal of Political Economy* 106, 706–723.

Gustafsson, Björn, Shi, Li, Sicular, Terry (eds.), 2008. *Inequality and Public Policy in China*, New York: Cambridge University Press.

He, Lixin, 2007. The distributional effects of public pension reform in urban China. *Jingji Yanjiu* (Economic Research Journal) 3, 70–80,91 (in Chinese).

Hubbard, R. Glenn., 1986. Pension Wealth and Individual Saving. *Journal of Money, Credit and Banking* 18(2), 167–178.

Horioka, C. Yuji, Wan, Junmin, 2007. The Determinants of Household Saving in China: A Dynamic Panel Analysis of Provincial Data. *Journal of Money, Credit and Banking* 39(8), 2077–2096.

King, Mervyn A., Dicks-Mireaux, Louis, 1982. Asset Holdings and the Life Cycle. *Economic Journal* 92, 247–267.

Kotlikoff, Laurence J., 1979. Testing the Theory of Social Security and Life Cycle Accumulation. *American Economic Review* 69, 396–410.

Karry, Aart., 2000. Household Saving in China. *World Bank Economic Reviews* 14(3), 545–570.

Li, Shi, Hiroshi, Sato (eds.), 2006. *Unemployment, Inequality and Poverty in Urban China*, London: Routledge.

Meng, Xin, 2002. Unemployment, Consumption Smoothing, and Precautionary Saving in Urban China. *Journal of Comparative Economics* 31, 465–485.

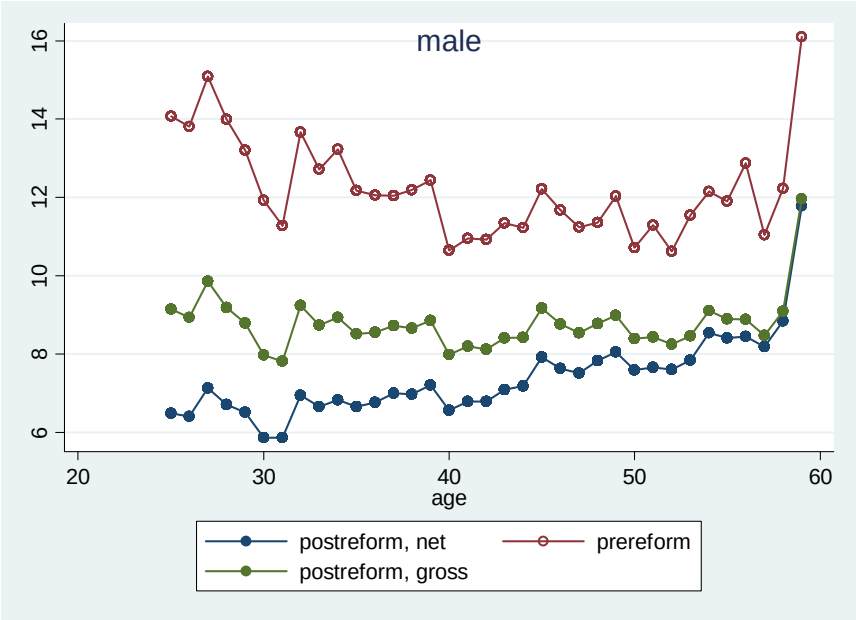
Modigliani, Franco, Cao, Shi Larry, 2004. The Chinese Saving Puzzle and the Life-Cycle Hypothesis. *Journal of Economic Literature* 42(1), 145–170.

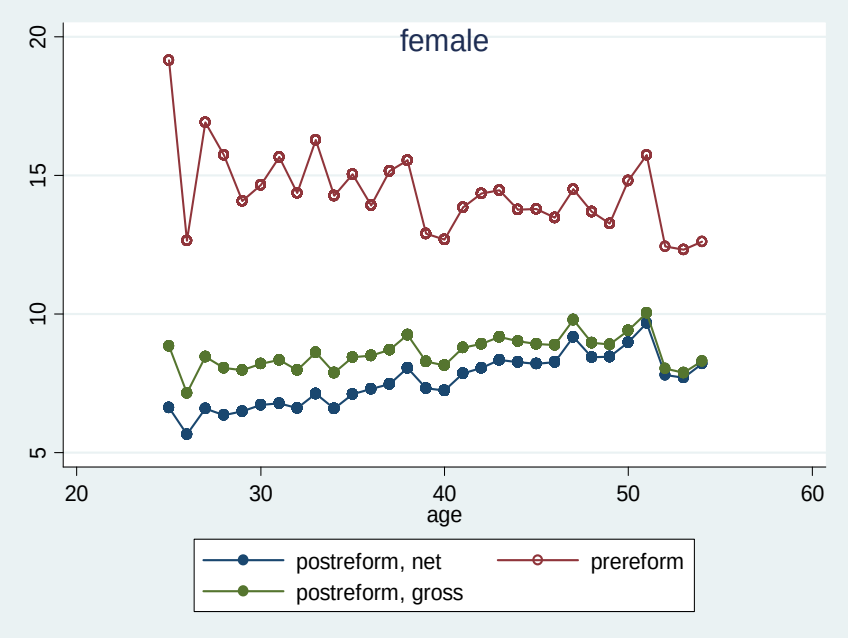
Riskin, Carl, Zhao Renwei, Shi, Li (eds.), 2001. *China's Retreat from Equality: Income Distribution and Economic Transition*, Armonk, New York: M. E. Sharpe.

Venti, Steven F., Wise, David A., 1990. Have IRAs Increased U.S. Saving? Evidence from Consumer Expenditure Surveys. *Quarterly Journal of Economics* 105, 661–698.

Yuan, Zhigang, Feng, Jin, 2005. Rethinking Pension Reform in China. *China and the World Economy* 13(2), 20–32.

Figure 1 Present value of pension benefits before and after reform





Note: computation method for pension wealth given in appendix. Data for computing pension wealth are from Chinese Household Income Project (CHIP), explained in the following section. The figures give pension wealth for indivdiduals working in enterprises in the 1999 survey.

Table 1 Contributions and benefits before and after reform (for enterprise workers)

	Pre-reform	Post-reform		
		new worker	middle worker	old worker
Benefits	75%-90% of wage before retirement	basic benefit (20% of regional avg wage last year) + individual account benefit (accumulated value of individual acct divided by 120)	basic benefit (same as for new worker) + individual account benefit (same as for new worker) + transitional benefit	same as in pre-reform
Contribution rate	employers contributed a certain percentage of total wage, varying across regions, up to 3% no contribution from employees	contribution of employers: 20% of total wage contribution of employees: 4% payroll tax in 1997, increased gradually to 8% contribution to individual acct: 11%		no contribution from employees
Indexation of pension	real wage growth rate	real wage growth rate		

Table 2 Characteristics of the sample

	Household head in enterprises		Household head in public sector	
	1995	1999	1995	1999
Age of household head %				
25–29	5.37	3.14	8.59	3.97
30–34	17.3	10.9	23.55	12.62
35–39	25.41	27.99	20.87	29.44
40–44	31.1	31.24	24.56	23.83
45–49	15.39	20.34	13.85	21.03
50–59	5.42	6.39	8.59	9.11
Education of head (years)	10.34	11.04	12.35	12.93
Gender of head (male, %)	64.00	61.84	66.85	67.06
Occupation of head (%)				
Professionals	20.13	36.14	21.17	38.79
Responsible person	9.88	22.27	11.53	22.43
Clerical/office staff	18.03	31.70	16.14	30.14
Manufacturing worker	47.50	8.23	43.29	6.07
Others	4.46	1.66	7.86	2.57
Household income (10 thousands)	1.56	1.77	1.69	2.23
Household size (numbers)	3.01	2.91	3.00	2.87
sample size	2196	954	1083	428

Table 3 Changes in pension wealth

	Present value of pension benefits (10 thousands)			Pension wealth, % of household income (%)		
Age and sector of household head	1995	1999	Changes (%)	1995	1999	Changes (%)
Enterprises	18.74	15.80	–15.68	13.22	9.71	–26.61
25–29	17.99	15.63	–13.14	18.41	10.96	–40.50
30–34	19.49	16.29	–16.41	15.56	9.47	–39.13
35–39	18.81	15.05	–19.98	13.51	9.80	–27.46
40–44	18.44	15.26	–17.25	12.08	9.73	–19.44
45–49	19.14	17.49	–8.63	11.39	9.60	–15.70
50–59	17.32	15.59	–9.99	11.07	9.29	–16.10
Public sector	24.80	34.10	37.49	16.31	16.21	0.61
25–29	26.50	37.32	40.85	22.03	21.12	–4.13
30–34	25.79	36.75	42.47	19.23	20.11	4.55
35–39	24.57	34.62	40.93	16.09	16.69	3.73
40–44	24.21	31.31	29.33	14.45	15.11	4.53
45–49	24.50	34.14	39.32	13.44	14.51	7.96
50–59	23.16	34.60	49.38	13.09	13.97	6.75

Note: The present value of pension benefits is the sum of that of the household head and spouse, as is household income. Pension wealth is measured in RMB10,000 in 1995 prices.

Table 4 Changes in household saving rates (Mean saving per mean income)

	SR1			SR2		
Age and sector of household head	1995	1999	Change (%-pts)	1995	1999	Change (%-pts)
Enterprises	0.13	0.18	5	0.21	0.30	9
25–29	0.04	0.19	15	0.11	0.27	16
30–34	0.12	0.19	7	0.18	0.28	10
35–39	0.14	0.19	5	0.20	0.29	9
40–44	0.13	0.18	5	0.22	0.30	10
45–49	0.16	0.17	1	0.26	0.33	7
50–59	0.15	0.18	3	0.23	0.29	6
Public sector	0.14	0.19	5	0.21	0.30	9
25–29	0.14	0.26	12	0.19	0.34	15
30–34	0.11	0.18	7	0.18	0.28	10
35–39	0.14	0.19	5	0.21	0.30	9
40–44	0.16	0.18	2	0.24	0.29	5
45–49	0.13	0.18	5	0.23	0.33	10
50–59	0.15	0.22	7	0.24	0.38	14

Table 5 OLS estimates for households with enterprise employment

	Adjusted pension wealth		Unadjusted pension wealth	
	SR1	SR2	SR1	SR2
Pension wealth ÷ household income	–0.257 (0.034)***	–0.217 (0.030)***	–0.014 (0.002)***	–0.012 (0.002)***
Future earnings ÷ household income	–0.119 (0.031)***	–0.120 (0.028)***	–0.007 (0.002)***	–0.007 (0.001)***
Year 1999	0.192 (0.020)***	0.227 (0.018)***	0.038 (0.015)*	0.085 (0.013) ***
Age dummies				
age 30–34	–0.095 (0.030)**	–0.088 (0.028)**	–0.058 (0.028)*	–0.053 (0.026)*
age 35–39	–0.163 (0.036)***	–0.148 (0.033)***	–0.108 (0.032)***	–0.097 (0.029)***
age 40–44	–0.224 (0.041)***	–0.183 (0.037)***	–0.171 (0.037)***	–0.134 (0.034)***
age 45–49	–0.247 (0.045)***	–0.182 (0.042)***	–0.201 (0.043)***	–0.139 (0.039)***
age 50–59	–0.275 (0.052)***	–0.234 (0.047)***	–0.239 (0.051)***	–0.199 (0.046)***
Gender	0.037 (0.011)***	0.029 (0.009)**	0.041 (0.011)***	0.032 (0.009)***
Education	0.003 (0.002)	0.003 (0.002)	0.004 (0.002)*	0.004 (0.002)*
Occupation				
professional	0.055 (0.023)*	0.045 (0.020)*	0.063 (0.023)**	0.052 (0.020)**
responsible person	0.040 (0.026)	0.037 (0.023)	0.047 (0.026)	0.042 (0.023)
clerical/office staff	0.008 (0.023)	0.005 (0.020)	0.016 (0.023)	0.012 (0.020)
manufacturing worker	0.039 (0.021)	0.03 (0.018)	0.041 (0.021)*	0.032 (0.018)
Household size	–0.011 (0.012)	0.002 (0.010)	–0.012 (0.011)	0.002 (0.010)
Provincial dummies	Yes	Yes	Yes	Yes
R-squared	9.55	13.27	12.39	16.44
Observations	3150	3150	3510	3510

Note: The reference group for age is 25–29; the reference group for occupation is ‘other’. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at less than 1%, 1%, and 5%, respectively.

Table 6 OLS estimates for households with public sector employment

	Adjusted pension wealth		Unadjusted pension wealth	
	SR1	SR2	SR1	SR2
Pension wealth ÷ household income	–0.441 (0.089)***	–0.361(0.080)***	–0.013 (0.003)***	–0.010 (0.002)***
Future earnings ÷ household income	0.001 (0.066)	–0.027 (0.060)	–0.006 (0.002)**	–0.006 (0.002)**
Year 1999	0.083 (0.018)***	0.134 (0.016)***	0.093 (0.018)***	0.143 (0.016)***
Age dummies				
age 30–34	–0.148 (0.035)***	–0.127(0.033)***	–0.096 (0.030)**	–0.077 (0.027)**
age 35–39	–0.229 (0.048)***	–0.205(0.046)***	–0.146 (0.037)***	–0.125 (0.034)***
age 40–44	–0.283 (0.056)***	–0.243(0.053)***	–0.191 (0.044)***	–0.154 (0.040)***
age 45–49	–0.349 (0.063)***	–0.269(0.059)***	–0.259 (0.053)***	–0.184 (0.048)***
age 50–59	–0.373 (0.069)***	–0.288(0.063)***	–0.288 (0.061)***	–0.209 (0.055)***
Gender	0.004 (0.016)	0.002 (0.014)	0.019 (0.016)	0.016 (0.014)
Education	0.006 (0.003)*	0.004 (0.002)	0.007 (0.003)**	0.005 (0.002)*
Occupation				
professional	0.018 (0.035)	–0.018 (0.029)	0.025 (0.035)	–0.013 (0.030)
responsible person	0.022 (0.036)	–0.008 (0.030)	0.030 (0.036)	–0.003 (0.031)
clerical/office staff	0.032 (0.035)	–0.008 (0.029)	0.038 (0.035)	–0.003 (0.030)
worker	0.011 (0.043)	–0.022 (0.037)	0.011 (0.043)	–0.023 (0.037)
Household size	–0.009 (0.016)	0.003 (0.013)	–0.006 (0.016)	0.005 (0.013)
Provincial dummies	Yes	Yes	Yes	Yes
R-squared	8.85	13.34	11.39	15.36
Observations	1510	1510	1510	1510

Note: The reference group for age is 25–29; the reference group for occupation is ‘other’. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at less than 1%, 1%, and 5%, respectively.

Table 7 IV estimates for households whose head works in an enterprise

	Excluding expected future earnings		Including expected future earnings	
	SR1	SR2	SR1	SR2
Pension wealth (adjusted) ÷ household income	–0.165 (0.057)**	–0.103 (0.051)*	–0.181 (0.056)**	–0.117 (0.049)*
Future earnings (adjusted) ÷ household income	–	–	–0.157(0.036)***	–0.170 (0.032)***
Year 1999	0.099 (0.017)***	0.129 (0.015)***	0.198 (0.018)***	0.235 (0.016)***
Age dummies				
age 30–34	–0.004 (0.028)	0.008 (0.025)	–0.099(0.028)***	–0.093 (0.025)***
age 35–39	–0.017 (0.033)	0.007 (0.029)	–0.169(0.032)***	–0.156 (0.028)***
age 40–44	–0.042 (0.036)	0.010 (0.031)	–0.234(0.036)***	–0.196 (0.032)***
age 45–49	–0.039 (0.038)	0.038 (0.034)	–0.261(0.041)***	–0.202 (0.036)***
age 50–59	–0.046 (0.043)	0.009 (0.038)	–0.294(0.047)***	–0.258 (0.042)***
Gender	0.022 (0.010)*	0.013 (0.009)	0.041 (0.011)***	0.034 (0.010)***
Education	0.002 (0.002)	0.002 (0.002)	0.003 (0.002)	0.003 (0.002)
Occupation				
professional	0.047 (0.023)*	0.037 (0.021)	0.056 (0.023)*	0.046 (0.020)*
responsible person	0.038(0.025)	0.033(0.023)	0.04(0.025)	0.036(0.022)
clerical/office staff	0.003(0.023)	0(0.020)	0.008(0.023)	0.005(0.020)
manufacturing worker	0.031(0.021)	0.022(0.019)	0.039(0.021)	0.03(0.019)
Household size	–0.011(0.011)	0.002(0.010)	–0.011(0.011)	0.003(0.009)
Provincial dummies	Yes	Yes	Yes	Yes
Number of IVs	10	10	10	10
F-test for instruments	F(33, 3116) = 125.14***		F(34, 3116) = 302.50***	
Adjusted R-squared	7.08	9.96	8.67	12.24
Observations	3150	3150	3150	3150

Note: The reference group for age is 25–29; the reference group for occupation is ‘other’. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at less than 1%, 1%, and 5%, respectively.

Table 8 Age-related effect (IV regression)

	Age of household head < 40		Age of household head > 40	
	SR1	SR2	SR1	SR2
Pension wealth (adjusted) ÷ household income	–0.040 (0.176)	–0.005 (0.163)	–0.440 (0.116)***	–0.373 (0.098)***
Future earnings (adjusted) ÷ household income	–0.178 (0.097)	–0.183 (0.090)	–0.189 (0.077)**	–0.198 (0.064)
Year 1999	0.201 (0.053)***	0.227 (0.053)***	0.306 (0.031)***	0.346 (0.025)***
Number of IVs	7	7	7	7
F-test for instruments	F(28, 1428) = 129.67***		F(28, 1664) = 187.32***	
Adjusted R-squared	8.91	10.50	9.17	14.07
Observations	1457	1457	1664	1664

Note: The regressions include future earnings. Other control variables are the same as those in Table 7.

Table 9 Estimated changes in household saving rates caused by pension reform

	Adjusted pension wealth ÷ household income			Change in savings rate (percentage points)	
Cohort	Pre-reform	Post-reform	Change	SR1	SR2
1	0.94	0.59	–0.35	6.31	4.21
2	0.84	0.52	–0.32	5.77	3.85
3	0.86	0.55	–0.30	5.43	3.62
4	0.84	0.57	–0.27	4.82	3.21
5	0.77	0.59	–0.18	3.31	2.21
6	0.76	0.61	–0.15	2.78	1.85

Note: Cohorts 1–6 refer to households with heads aged 25–29, 30–34, 35–39,40–44, 45–49, and 50–59, respectively, in 1999. We used the coefficient –0.18 to calculate the changes in SR1 for each cohort and used –0.12 to compute the change in SR2.