『学習院大学　経済論集』第49巻　第4号（2013年1月）

Does Pessimism Over Pension Prospect Spur Excess Saving? — Evidence Concerning Close-to-retirement Households in Japan

Wataru Suzuki＊, Yanfei Zhou＊＊

1. Introduction

Pessimism over pension prospect is widely spread among Japanese nationals. A recent survey reveals that roughly 70% Japanese feel anxious about the reliability of the public pension system. Despite most Japanese anticipate a cut of pension benefit in the future, the anticipated range of cut varies notably from person to person. Some are extremely pessimistic about pension prospect, others less so. On average, Japanese nationals are much more pessimistic than policy makers. To cope with the future benefit cut, households is likely to spend less and accumulate wealth.

The elderly are major owners of Japan's huge household wealth. Elderly households whose head aged 60 or over, were estimated to hold a total of 358.8 trillion yen in net financial wealth in 2004, which is equal to nearly one year of Japan's GDP[1]. Elderly households own 51.4 percent of housing and land assets, and 78.6 percent of net financial wealth, despite that they account for only 37.4 percent of the overall households[2]. Contrary to the prediction of simple life-cycle model, most Japanese elderly households keep accumulating wealth even in the very late life stage. An average elderly household with workers' head saves nearly 10 percent of their disposable income each year.

Here, a simple question arises: do Japanese elderly households save excessively and accumulate too much wealth? Dekle (1990) believes that the answer is "yes". Using a 1983 Japanese household survey, Dekle (1990) finds an obvious absence of dissaving among Japanese elderly households, based on there being no significant differences in total wealth between different age groups for Japanese elderly

(Acknowledgements) The authors are very grateful to Robert Dekle, Charles Yuji Horioka and David S. Hong for their helpful comments.

＊） *Gakushuin University, Tokyo, Japan*

＊＊） *Japan Institute for Labour Policy and Training (JILPT), Tokyo, Japan*

1） The total gross financial wealth of Japanese households was estimated to be as much as 1,410.4 trillion yen in 2009 (Source: Bank of Japan "Statistics of Flow-of-Fund Account").

2） The number of 358.8 trillion yen and the percentages are computed by the authors basing on the statistics of Table 2.

households. A recent simulation study by Uemura (2008) suggests that Japanese elderly households have around 179 trillion yen of excessive savings, compared with the predicted amount based on a typical life-cycle model.

There are at least three potential reasons for elderly households to save excessively - (1) precautionary motive against lifespan uncertainties, (2) strategic motive that use wealth inheritance to entice attention from their children, and (3) bequest motive due to the altruism toward their children or to the perpetuation of family line and/or the family business. Among them, the precautionary motive is of special importance (Zhou 2003, Horioka 2002). If the insurance markets (i.e. annuity, medical care, disaster) function perfectly, the lifespan uncertainty will be reduced to nearly zero and elderly will have little need to hold excessive wealth for precaution. In fact, however, the insurance markets are imperfect. Particularly, when the anxiety toward the sustainability of the public pension system surges among Japanese households. As we will explain in Section 2, public pension uncertainty is very likely to be responsible for the precautionary savings and excessive wealth accumulation by elderly households. The essential question is as follows: how much precautionary saving results from public pension uncertainty? Answers to this puzzle will be critical for the evaluation of the Democratic Party's social security expansion policy and for the development of future growth strategies. Nevertheless, very few empirical studies have been conducted on this topic.

The present paper therefore uses a unique survey conducted by the Japan Institute for Labour Policy and Training (JILPT) in 2009 to tackle this problem. An important contribution of the JILPT survey is the provision of data on public pension uncertainty: the anticipated percentage change (APC) in public pension benefits with respect to the present benefit level, and the ideal amount (IA) of public pension for retirement. These data enable us to construct two indexes of public pension uncertainty: anticipated change rate in public pension benefits, and the expected change in the value of public pension benefits (APC×IA). Additionally, to assess precautionary savings motives more precisely, we limit our samples to people close to retirement for whom the labor income risk should be relatively small, following Lusardi (1997). Our estimates indicate that public pension uncertainty affects household wealth accumulation significantly, and that precautionary savings make up nearly 10 percent of net and 5 percent of gross financial wealth accumulation by close-to-retirement households.

2. Research Background and Literature Review

2.1 Background

(i) Households' surplus ratio remains high

The most recent Japanese net household saving rate (national accounting base) has slid to a historical low of 3.2 percent in 2006, from 11.4 percent in 1997. Along with population aging and capital depreciation, the net household saving rate may reach as low as zero or even become negative in the long run (NIRA 2008). Accordingly, perception of Japanese household saving behavior has changed notably. Horioka (2004) compares net household saving rates between Japan and 13 other OECD countries and finds that Japan has not had the highest saving rate since the mid 1980s. He thus concludes that Japan may no longer be regarded as the nation of enthusiastic savers it once was.

Table 1 Transition of Household Saving Rate in Japan (1996-2008) (%)

	96	97	98	99	00	01	02	03	04	05	06	07	08
National Accounting Index (SNA)	10.4	11.4	10.7	10	7.9	5.2	4.6	3.9	3.4	3.5	3.2		
Kakei Survey Index													
Workers' H. : all	28.0	28.0	28.7	28.5	27.9	27.9	27.0	25.9	25.7	25.3	27.5	26.9	26.6
Workers' H. : head aged 60 or over	21.8	22.4	22.5	21.0	18.4	19.6	14.5	12.8	10.5	8.5	9.0	11.1	9.0
Retiree's H.: head aged 65 or over	−6.0	−6.3	−6.1	−7.4	−8.8	−13.3	−17.5	−16.8	−23.2	−20.7	−21.2	−24.9	−25.5

Data Sources: Cabinet Office"Annual Report of National Accounting", MIC "Annual Report of Kakei Survey".
Note: (1) The Kakei Survey workers' H. data is about the two-or-more person households. (2) There exists huge gap between SNA index and Kakei Survey index (also named "suplus ratio"). The SNA index is computed using macrodata and is much lower than the Kakei Survey index largely because it (a) has included retired and unemployed households, and(b) has taken a control of capital depreciation and imputed house rent.

However, in examining the saving behavior of each household, we get a different image. The gross saving rate (also named "surplus ratio") of the workers' households has been as high as 25–30 percent in the 2000s (see Table 1). Even retirement-age households, with heads-of-household aged 60 or over, save nearly 10 percent of their disposable income each year. Meanwhile, Japanese households' wealth accumulation remains among the highest of OECD countries. According to OECD statistics for 2006, the ratio of household net financial wealth to disposable income is 403.7 percent in Japan, which is notably higher than in the US (309.1 percent), Britain (291.3 percent), Germany (198.3 percent), and other OECD countries.

Hence, a simple question arises: do Japanese households save excessively and accumulate too much wealth? Dekle (1990) believes the answer is yes, at least for elderly households. Using a 1983 Japanese household survey, Dekle (1990) finds an obvious absence of dissaving among Japanese elderly households, based on there being no significant differences in total wealth between different age groups for Japanese elderly households. A recent simulation study by Uemura (2008) suggests that Japanese elderly households have around 179 trillion yen of excessive savings, compared with the predicted amount based on a typical life-cycle model. Japanese households were estimated to hold a total of 456.9 trillion yen in net financial wealth in 2004, which is equal to nearly one year of GDP[3)] in Japan (see Table 2). Elderly households, however, are the major holders of this huge stock of financial wealth: households with heads-of-household aged 60 or over own 78.6 percent of the total net financial wealth, while their population share is only 37.4 percent.

(ii) Public pension uncertainty surges

Recently, increasing concern about the sustainability of the public pension system has made this a more important uncertainty factor for Japanese households. According to the Social Security Survey conducted by the Japan Institute of Life Insurance (Seimei Hoken Bunka Center) in 2007, 69.2 percent

3) The total gross financial wealth of Japanese households was estimated to be as much as 1,410.4 trillion yen in 2009 (Source: Bank of Japan "Statistics of Flow-of-Fund Account").

Table 2　Wealth accumulation by age of the household head (2006 unit: 10 thousand Yen)

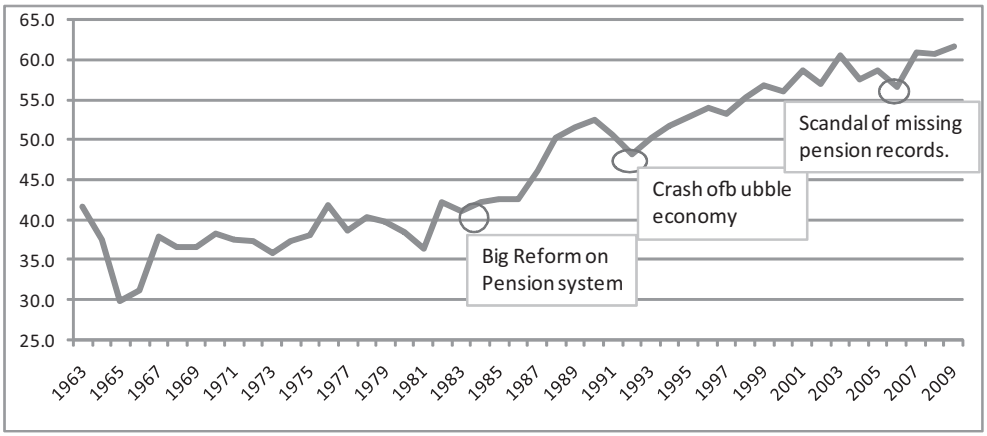
	Number of Households (A)		Net wealth (B)	Net financial wealth (C)	Housing& land assets	Other fixed assets	Annual income	Wealth/ income	share of total net wealth	share of total net financial wealth
15−29	5,271,641	(10.7%)	817	−8	679	146	469	1.7	2.3%	−0.1%
30−39	7,714,522	(15.7%)	1,459	−212	1,514	158	597	2.4	6.1%	−3.6%
40−49	7,570,791	(15.4%)	2,712	148	2,393	171	777	3.5	11.2%	2.5%
50−59	10,161,606	(20.7%)	4,160	1,020	2,955	186	878	4.7	23.0%	22.7%
60−69	9,034,720	(18.4%)	5,556	1,884	3,499	173	624	8.9	27.3%	37.3%
70 and over	9,309,250	(19.0%)	5,961	2,026	3,817	117	542	11.0	30.1%	41.3%
Total	49,062,530	(100.0%)	3,900	950	2,786	164	696	5.6	100.0%	100.0%

Source: Bureau of Statistics, MIC "National Census 2005", "National Survey of Family Income and Expenditure".
Note: The shares are computed by authors. Share of total wealth=(Bi*Ai) / Σi(Bi*Ai)

of respondents feel somewhat anxious about life in retirement because they believe that the public pension cannot provide a reliable retirement income, which is 10.2 percentage points higher than the 1998 survey. Accordingly, the saving motive for living expenses during old age (namely "retirement saving") seems to be stronger.

A long-lasting annual survey by the Central Council for Financial Services Information shows that the saving motive for living expenses during old age has been sharply gaining weight since 1985, the year that Japan enacted significant reforms of its public pension system. Figure 1 shows the proportion of respondents that admitted having a saving motive for living expenses during old age. The retirement saving motive fluctuated around 30–40 percent before 1985; it then rose steadily thereafter, with an accelerated speed after the crash of the bubble economy in 1992 and after the scandal of the missing pension records in 2007. In 2009, 61.6 percent of Japanese reported that they were saving for retirement,

Figure1　Historical trend of saving motive for living expenses during old age (percent)



Source: the Central Council for Financial Services Information (Kinyu Koho Chuo Iinkai) (ed.) "Kakei no Kinyu Kodou ni Kansuru Seron Chosa" (Public Opinion Survey on Household Financial Choices), time series statistics from 1963 to 2009.

almost a 20-percentage-point increase from 42.5 percent in 1985.

(iii) How can public pension uncertainty depress household consumption?

Japan's public pension system is a two-tiered system in which the first tier (namely, the "basic pension") is common for all nationals while the second tier is divided into three parts according to the occupation of the insurees: the Employees' Pension System to which private salaried workers belong, the Mutual Aid Association Pension System to which government workers belong, and the National Pension System[4] to which the self-employed and all others belong. All of these public pension systems are essentially operated on a pay-as-you-go basis. Thus, in a society in which fertility is declining and the population is aging, it becomes necessary to raise the contribution rate or cut the benefits of pensioners in order to keep a balanced budget.

Japan's population is known to be aging at its fastest rate in human history (Horioka et al. 2007). In 2008, the ratio of the productive-age (15–64 years) population to the elderly (65 and over) population reached 33.6 percent, which implies that it takes three productive-age people to support one elderly person. This ratio is projected to reach 50.2 percent in 2023 and 85.7 percent at the age peak of 2072. Besides this rapid aging process, the stagnation of economic growth in the past two decades has worsened the fiscal situation of the public pension system.

Because of the significant political power of the elderly population, until the 1994 reform, the public pension budget was balanced mainly by increasing the contribution rate. The benefits of pensioners were protected, and few retirees felt any anxiety over their pension benefits. Raising the contribution rate repeatedly as a budget balancing mechanism, of course, imposed heavy burdens on working households and resulted in further distrust of the public pension system among young generations. Accordingly, the number of dropouts and premium defaulters within the National Pension System has increased sharply since the 1990s (Suzuki and Zhou 2010). In 2008, the default rate for the national pension premium reached as high as 37.9 percent.

In the 1994 pension reform (and reforms thereafter), the Japanese government had no choice but to begin cutting the benefits of pensioners step by step. Firstly, in the 1994 reform, the eligible age for the basic pension benefit was postponed from 60 to 65 years in a phased manner. Then in the 1999 reform, the eligible age for the second-tier benefit was changed from 60 to 65 in a phased manner. The 1999 reform reduced pensioner benefits by 20 percent in incremental steps. The 2004 reform introduced a new system named "Macro Economic Slide" (MES), whereby the benefit amount of pensioners was lowered automatically along with the declining birth rate and the increasing longevity of the elderly[5]. According to simulations by the Japanese government, no further benefit reductions or eligible age postponing will be necessary until 2023 if the MES functions well. However, because the peak of population aging will

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4) The maximum benefit level for the "basic pension" is 66,000 yen per month. Pensioners belonging to the National Pension System are eligible for the "basic pension" only, while pensioners belonging to the other two systems are eligible for a second-tier benefit proportional to his/her total earnings for their working lifetime.

5) The public pension system was regulated by law to be reformed once every five years, based on forecasts of the future financial situation of the system. After the introduction of MES in 2004, however, this "once every five years reform" is regarded as unnecessary, and it was deleted from law.

occur in 2075, the risk of further cuts in pension benefits will be very high over the longer term.

In summary, for most Japanese households, including the close-to-retirement households, public pension uncertainty arises from not only the existing MES but also the unavoidable future reforms. As Horioka (1990) warned, uncertainty in the future provisions of the Japanese public pension system will cause Japanese households to discount future benefits heavily and to save excessively.

2.2 Literature review

The idea that people engage in saving as protection against income risk represents an important innovation in the life-cycle permanent-income hypothesis in explaining excessive household saving and wealth accumulation. Many empirical studies have been performed to evaluate the importance and magnitude of precautionary saving, but so far the findings are inconclusive. As Lusardi (1997) stresses, one of the major problems of empirical work is how to construct an exogenous direct index of income risk. Some studies (e.g. Skinner 1998) use occupation as a proxy for income risk, but this is criticized for selectivity bias, because people may choose occupations depending upon their degree of risk aversion. Other studies (e.g. Guiso et al. 1992; Lusardi 1997, 1998) utilize households' expectations about the probability of unemployment or nominal earnings changes as a proxy for income risk. These studies may suffer from measurement error, because the self-reported earnings variance refers to one-period-ahead forecasts of income and cannot be interpreted as a measure of lifetime earnings variance. Other studies using income variance within homogeneous groups (e.g. Dardanoni 1991; Carroll and Samwick 1998) as a proxy for income risk. However, this measure of income risk is not appropriate unless the income variability of households within each group is homogenous enough and the income variance varies significantly across different groups.

As a whole, empirical studies that use occupation or subject earnings variance as a proxy for income risk find little evidence in favor of the precautionary saving model. For example, Skinner (1998) compares the saving rates across different occupations and finds that people in riskier occupations, such as farmers or the self-employed, are in fact saving less than are people in professions with less income variability. Guiso et al. (1992) and Lusardi (1997) both employ households' expected nominal earnings changes as a measure of income risk from the 1989 Italian SHIW. They find that precautionary savings explain only 2–2.8 percent of total wealth accumulation. Additionally, Lusardi (1998) constructs an income risk index by using information about the subjective probability of job loss from the Health and Retirement Survey. He then finds that although precautionary saving has a role in explaining excessive saving and wealth accumulation by people close to retirement, it explains only a small part (2–4.5 percent of net financial wealth) of total wealth accumulation.

On the other hand, empirical studies using the variance of the income of homogeneous groups as a measure of income risk have in general obtained results supportive of the precautionary saving model. For instance, Carroll and Samwick (1998) divide the Panel.

Study of Income Dynamics sample into 26 groups according to the occupation, industry, and education of the head-of-household, with the variance and log of the income within each group employed as proxies for income uncertainty. As a result, they find that wealth and uncertainty are positively related, and that precautionary savings account for 45 percent of total net worth and 32 percent

of very-liquid assets for households with heads-of-household aged younger than 50 years. Using cross-section data for Britain, Dardanoni (1991) estimates income variances by grouping the sample into dozens of groups with respect to the industry, economic position, and skill level of the head-of-household. His estimates indicate that more than 60 percent of savings arise as a precaution against future risk. Furthermore, Kazarosian (1997) decomposes individual-specific income uncertainty into permanent and transitory components using National Longitudinal Survey He finds that the impact of uncertainty on the ratio of wealth to permanent income is highly significant, and that a doubling of uncertainty increases the ratio of wealth to permanent income by 29 percent.

Empirical studies of Japanese precautionary saving, although still limited, have become more common since the 2000s. Zhou (2003) improves upon the methodology of Dardanoni (1991) and applies it to Japanese household-level data. Specifically, she divides a representative Japanese sample into 56 homogeneous groups with respect to the education, age, and occupation of the head-of-household, and regards the income variances within each group as proxies for income risk for each household in that group. Zhou (2003) finds that precautionary saving represents 5.6 percent of the total savings of salaried-worker households and 64.3 percent of the total savings of farmers and self-employed households. Bessho and Tobita (2008) quote job loss rates and standard deviations of income by gender, age, education, and marital status from macro statistics, and then match this information with Japanese household-level data to obtain proxies for income uncertainty. They find that uncertainty is positively related to the wealth-to-income ratio, and that precautionary savings account for 6–15 percent of household net financial assets.

Many recent empirical studies shed light upon the effect of uncertainties in the social security system on household saving. The uncertainty of medical expenses, however, is one of the hottest topics. Using data from the 1989 Survey of Consumer Finances, Starr-McCluer (1996) finds that, contrary to expectations, insured households maintain a much higher level of wealth than comparable households without insurance. She concludes that savings and health insurance are related for reasons that have little to do with certainty and precautionary motives. In contrast, Chou et al. (2003) find supportive evidence for the hypothesis of precautionary saving for medical expenses uncertainty. Using a natural experiment associated with the 1995 introduction of the National Health Insurance program in Taiwan, they find that the program reduced Taiwanese households' savings by an average of 8.6–13.7 percent, with the largest effects for households with the least savings. Additionally, Palumbo (1999) uses a health-uncertainty model to predict household consumption expenditures, and his simulations imply that uncertain future out-of-pocket medical expenses reduce household annual consumption among elderly American couples by 7 percent.

There have been very few empirical studies of precautionary saving with respect to social security uncertainty in Japan, with the exception of Suzuki et al. (2008) and Murata (2003). Using Japanese micro data, Suzuki et al. (2008) examine whether the introduction of the Japanese Long-term Care Insurance System in 2000 has reduced households' precautionary saving or not. Contrary to their expectations, they find that households' gross financial assets remain constant or even slightly higher among elderly households. As Suzuki et al. (2008) admit in their paper, the uncertainty reduction effect of the Long-term Care Insurance System might be cancelled out by other social changes (e.g. a sharp

increase in public pension uncertainty, a rise in the unemployment rate, etc.).

On the other hand, Murata (2003) uses information about households' attitudes toward the public pension system[6] from a Japanese household survey to proxy public pension uncertainty. Although the final result is inconclusive, she finds supportive evidence for the precautionary saving model when limiting the sample to households where grown-up children do not coreside with their parents. That is, households besides coresidences with higher levels of anxiety toward the public pension system have a higher wealth-to-income ratio than comparable households that feel comfortable with the present pension system. Given that the average financial assets holdings of households with some anxiety about the pension system are 2.1 million yen higher than their counterparts', Murata (2003) suggests that precautionary saving because of public pension uncertainty could account for 1/4 to 1/3 of household financial wealth.

The present paper focuses on the impact of public pension uncertainty on household wealth accumulation, but it improves upon Murata's (2003) approach in the following ways. First, we use more specific and quantitative measures for public pension uncertainty instead of the abstract, four-choice dummy variable used in Murata (2003). Second, we limit our sample to people close to retirement, for whom labor income risk should be relatively small and public pension uncertainty should be relatively dominant, while Murata's sample is young households with members aged 27–37 years, for whom saving for child-rearing and housing are so prominent that it is difficult to save for public pension uncertainty. Third, we use econometric simulation techniques to estimate the precise magnitude of precautionary saving because of pension uncertainty instead of depending on descriptive statistics for approximate estimates.

3. Data and Empirical Model

3.1 Data

This study uses household data from the Survey on the Employment and Work Conditions of Elderly People (SEWCEP), a survey that was conducted by the Japan Institute for Labour Policy and Training in 2008. To ensure that the sample was representative of the Japanese population, the sample was selected from the Basic Residential Registers ("Jyumin Kihon Daicho"), based on a two-stage stratified sampling procedure. To improve the response rate, the questionnaires were distributed by surveyors instead of mailing. Surveyors distributed and explained the questionnaire to subjects in person, and several days later, the surveyors visited the subjects again to collect the questionnaires. Five thousand individuals aged between 55 and 69 years received the questionnaire throughout Japan, of whom 3,602 responded. The response rate was 72.0 percent.

Because of the necessity of estimating permanent income and the need to limit our sample to the close-to-retirement households, we used subjects (N=1,012) that met the following three conditions: (1) presently working and earning some labor income, (2) not yet receiving any public pension benefit, and

6) The variable is discontinuous and includes four choices: very comfortable, anxious about benefit cuts, anxious about the sustainability of the system, and no plan to rely on the system.

(3) head of the household[7]. We took the predicted labor income of the head-of-household from his/her income function as a proxy for his/her permanent income. (See Appendix I for details.)

The SEWCEP collected very detailed data on retirement plans, pension participation, household holdings of financial assets and debts, and consumption. Most interestingly, the SEWCEP provides unique information that can be used to construct proxies for public pension uncertainty.

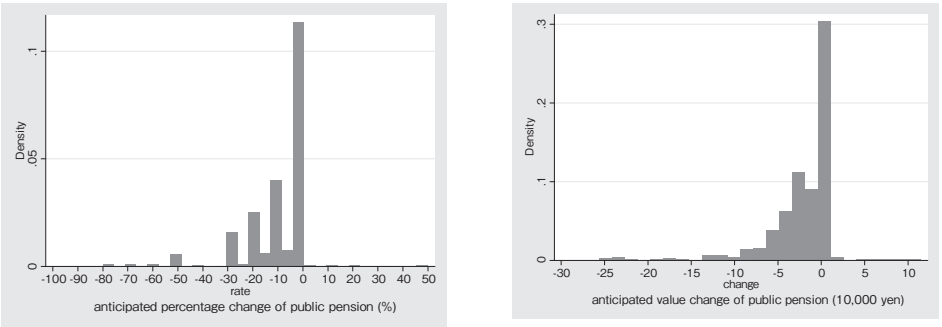
(i) Measuring public pension uncertainty

SEWCEP includes data on the anticipated percentage change (APC) in public pension benefits with respect to the present benefit level. The anticipated percentage change is determined in two steps: first, the respondents are asked to predict whether they think that their own public pension benefit will (a) rise, (b) drop, or (c) remain unchanged/unknown compared with the present benefit level[8]. Then, those who responded (a) or (b) are requested to provide the specific percentage (m percent) change that they expect. We take the APC as 0 percent for "(c) remain unchanged/unknown" cases, –m percent for "(b) drop" cases, and +m percent for "(a) rise" cases.

Our second candidate measure of public pension uncertainty is the anticipated value change (AVC) of the public pension, which equals APC multiplied by the ideal amount (IA) of the public pension for retirement. IA, however, is constructed by multiplying the ideal amount of living expenses in retirement by the ideal financing rate of the public pension benefit[9].

Figure 2 Distribution of anticipated pension change

(APC) (AVC)



The distribution of the anticipated change in the public pension in terms of both percentage change and value change is shown in Figure 2. Although nearly half of the respondents expect "remain

7) Because there is no direct information in the survey to determine whether a respondent is a head-of-household, we treat subjects that meet any of the following two conditions as a household head: (1) total income (including unearned income) of the respondent accounts for 50 percent or more of household income; (2) the biggest component of total income for the household is the respondent's labor income.

8) Reflecting the recent trend of pension reforms, only 1.4 percent of respondents expected a rise in pension benefits, and 43.8 percent of respondents expected a drop.

9) The ideal living expenses cover both the respondent and his/her spouse (if they have one).

unchanged/unknown", the percentage of respondents (43.8 percent) expecting a drop is much larger than those expecting a rise (1.4 percent). The average anticipated percentage change is –9.3 percent, and the average anticipated value change is –21.9 thousand yen (see Table 3). In comparison with the government's presently planned pension percentage change (–4.8 percent) and value change (–11.7 thousand yen)[10], households' anticipated decline in pension benefits is much larger. This huge gap between households' anticipation and the government's planning reflects the fact that households are discounting future pension benefits much more heavily than the government's planned level. This household pessimism toward public pensions is very likely to induce households to practice excessive saving and wealth accumulation.

(ii) Measuring wealth

Three measures of wealth are used in our empirical analysis. The first measure (gross financial assets) is defined as the sum of all savings account balances[11]. The second measure (net financial assets 1) is calculated by deducting all debts from gross financial assets. The third measure (net financial assets 2) is computed by deducting all debts, except housing mortgages, from gross financial assets. Because most households with a mortgage should possess a comparable or higher value of housing assets than average, the third measure sounds more reasonable as an index of households' net financial assets.

Because the wealth-to-income ratio has such a wide distribution, and outliers can significantly affect the estimates, we trimmed the distribution and excluded the top and bottom 2.5 percent. For the close-to-retirement households, the average wealth-to-income ratio is 163 percent according to the first measure, 50 percent according to the second measure, and 124 percent according to the third measure (see Table 3).

Because the SEWCEP contains no data on the specific values of housing assets or other real assets, we could not compute total household worth or net worth. As an alternative, we included an own-house dummy as an explanatory variable in our estimations, to control for the effect of real assets.

3.2 Empirical model

The theoretical predictions of the precautionary saving model can be summarized with reference to the following reduced-form equation, which has been employed by many empirical studies (e.g. Kazarosian 1997; Lusardi 1998; Murata 2003).

$$\frac{W_h}{Y_h^P} = a_0 AGE + a_1 U_h + X_h' \beta + \varepsilon_h \qquad (1)$$

In the above model, a_0, a_1, β are coefficients, and ε is a normally distributed disturbance term. Wealth divided by the permanent income (W/Y^P) of household h is a function of AGE, household characteristics (X) that reflect the preferences parameters, and uncertainty about future income (U). Uncertainty about future income, in this paper's context, is uncertainty about public pension benefits, because our sample is

10) Both are simulation values computed by the authors. See Appendix II for details of the simulation.

11) Because it is rare for Japanese household to hold bonds, stocks, and individual retirement annuities, saving accounts represent a major type of household financial assets.

limited to close-to-retirement households. A supportive condition of the precautionary saving model is that uncertainty is positively related to the wealth-to-income ratio. In our context, because the values of our uncertainty proxies are inversely proportional to the degree of uncertainty, the estimated coefficient should be negative ($\hat{a}_1<0$) if the precautionary saving model is true.

As King and Dicks-Mireaux (1982) note, when preferences are nonhomothetic, X may include permanent income[12]. Specifically, X is a vector of the following variables: gender, four-scaled educational attainment, four-scaled health condition, marital status, having a family member in need of nursing care or not, having double income or not, coresiding with parents or not, number of family members, children's status[13] and residence (five-scaled city size and 11 districts). Including children's status in the estimations enables us to test the hypothesis of a bequest motive. The descriptive statistics of the major variables are presented in Table 3.

4. Empirical Results

Table 4 presents the correlation coefficients between the wealth-to-income ratio and public pension uncertainty. No matter what measures are used, the correlation coefficients are all negative, just as the precautionary saving model predicts. However, the relationship between the wealth-to-income ratio and pension uncertainty seems to be quite weak with respect to the magnitude of the coefficients (less than –0.2).

When controlling for the other covariates, however, the estimation results show more supportive evidence for the precautionary saving model. Table 5 presents estimates of the wealth-to-income equation by using the APC as a proxy for uncertainty. Table 6, however, uses the alternative proxy, AVC. Both tables present estimation results when either gross financial assets, net financial assets 1, or net financial assets 2 are used as the measure of wealth.

In accordance with the precautionary saving model, the sign of pension uncertainty is negative and statistically significant in five of the six cases, indicating that when people feel greater uncertainty about the public pension, they will save more and accumulate more wealth.

Table 7 presents our estimate of the magnitude of precautionary saving for public pension uncertainty by calculating what our results imply about the share of precautionary wealth in total wealth accumulation. We can calculate the share of precautionary saving (λ) in total wealth (W) from a_1, the estimated coefficient of σ, as follows:

$$\lambda = \frac{\overline{W}^{P}}{\overline{W}} = \frac{\overline{W}^{P} / \overline{Y}^{PP}}{\overline{W} / \overline{Y}^{P}} = \frac{OD \times a_1}{\overline{W} / \overline{Y}^{P}}. \quad (2)$$

12) Some studies (e.g. Lusardi 1997; Bessho and Tobita 2008) assume homothetic preferences and use the log of W/Y^{P} as the dependent variable. In that case, all the observations with negative net wealth will be automatically excluded from the sample. Because negative net financial assets are quite common in real life, we use absolute value instead of the log value of W/Y^{P} as the dependent variable.

13) Children's status is defined as either one of the following three conditions: a) no child, b) all children independent, and c) not all children independent.

Table 3 Discriptive Statistics

Variables	Mean	Std. Dev.	Min	Max
Gross financial assets (10,000 yen)	583.64	1219.76	0	10000
Net financial assets 1 (10,000 yen)	218.83	1527.42	−10000	10000
Net financial assets 2 (10,000 yen)	494.84	1333.67	−4000	10000
Permanent income (10,000 yen)	402.47	234.88	55.4	1322.0
Annual total income (10,000 yen)	482.91	438.38	10.8	7300.0
Annual labor income (10,000 yen)	445.45	409.21	10.8	7300.0
Permanent income (10,000 yen)	402.47	234.88	55.4	1322.0
Gross financial assets / Permanent income	1.63	3.80	0.0	47.7
Net financial assets 1 / Permanent income	0.52	5.03	−34.0	47.7
Net financial assets 2 / Permanent income	1.24	3.93	−22.7	29.6
Anticipated percentage change in pension (%)	−9.30	14.70	−80.00	50.00
Anticipated value change in pension (10,000 yen)	−2.19	3.81	−25.63	10.00
Planned percentage change in pension by the government (%)	−4.83	1.17	−7.65	-3.04
Planned value change in pension by the government (10,000 yen)	−1.17	2.21	−25.32	0.00
Age	58.53	2.66	55	69
$Age^2/100$	34.33	3.17	30.25	47.61
Male	0.691	0.462	0	1
Junior high school	0.164	0.370	0	1
High school	0.471	0.499	0	1
Junior college	0.124	0.329	0	1
College or graduate school	0.238	0.426	0	1
Excellent health	0.081	0.273	0	1
Good health	0.688	0.464	0	1
Poor health	0.209	0.407	0	1
Very poor health	0.019	0.136	0	1
Family member in need of nursing care	0.178	0.383	0	1
Double income	0.424	0.494	0	1
Extended family	0.655	0.476	0	1
No children	0.097	0.296	0	1
All children independent	0.519	0.500	0	1
Not all children independent	0.384	0.487	0	1
Married	0.839	0.368	0	1
Number of family member	3.252	1.554	1	11
Own house	0.854	0.353	0	1

Notes: (1) Permanent income is predicted by using the estimation results of Appendix table. (2) Net financial assets 1= Gross financial assets- All debts; Net financial assets2=Gross financial assets-All debts except houseing mortgage.

Table 4 Correlation between subjectively expected pension change and wealth/income ratio

	Anticipated pension change (percentage)	Anticipated pension change (value)
Gross financial assets / Permanent income	−0.079	−0.104
Net financial assets 1 / Permanent income	−0.079	−0.139
Net financial assets 2 / Permanent income	−0.104	−0.123

Here, $\overline{W}^P$ is the average precautionary wealth accumulation against public pension uncertainty. *OD* is the over-discounting of future pension benefits, defined as the difference between households' anticipated percentage change (or value change) of the pension benefit and the government's planned percentage change (or value change). λ is predicted to be 9.87–9.91 percent when net financial assets 2 are

employed as the wealth index, which means that precautionary saving accounts for about 10 percent of the net financial assets of close-to-retirement households (see Table 7). λ is predicted to be 5.46–5.78 percent or 20.32–28.07 percent when either gross financial assets or net financial assets 1, respectively, are used as the index of wealth.

Precaution against future public pension uncertainty may not be the sole incentive for excessive wealth accumulation. The elderly may also be holding excessive wealth for the bequest motive (Dekle 1990). The estimation results in Tables 5 and 6, however, provide little supportive evidence for the bequest motive hypothesis. Wealth holding by households is not changed significantly by the existence of children. Rather, households with economically independent children have a significantly lower wealth-to-income ratio in comparison with the households without children.

Estimates of household characteristics are in general consistent with intuition. For example, households headed by a female or a more highly educated individual, households that own their residences, and households with fewer family members have a relatively higher wealth-to-income ratio than their counterparts.

Table 5 Estimation results of ratio of financial assets to permanent income

	Gross FA/Yp		Net FA1/Yp		Net FA 2/Yp	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Permanent income (Yp)	−0.002	0.001 **	0.001	0.001	−0.001	0.001
Anticipated percentage change of pension	−0.020	0.012 *	−0.024	0.015	−0.028	0.013 **
Age	1.668	1.676	0.932	1.995	0.211	1.685
$Age^2/100$	−1.321	1.370	−0.701	1.633	−0.114	1.382
Male	−1.278	0.495 ***	−1.228	0.684 *	−1.172	0.547 **
High school	1.019	0.270 ***	0.970	0.573 *	0.883	0.334 ***
Junior college	1.935	0.825 **	2.065	1.177 *	0.979	0.737
College or graduate school	2.518	0.520 ***	2.249	0.709 ***	2.105	0.602 ***
Excellent health	1.622	0.909 *	0.788	0.986	1.289	0.953
Good health	1.155	0.588 **	0.303	0.752	0.713	0.617
Poor health	0.971	0.652	−0.068	0.868	0.441	0.705
Family member in need of nursing care	0.791	0.567	1.140	0.690 *	0.386	0.461
Double income	0.476	0.345	0.527	0.473	0.369	0.387
Extended family	−0.182	0.435	0.247	0.660	0.026	0.526
All children independent	−0.430	0.682	−0.998	0.846	−0.780	0.752
Not all children independent	−1.031	0.679	−2.031	0.880 **	−1.257	0.732 *
Married	0.349	0.462	1.324	0.780 *	0.530	0.536
Number of family members	−0.144	0.108	−0.666	0.262 **	−0.449	0.209 **
Own house	1.397	0.328 ***	0.397	0.417	1.471	0.370 ***
Constant	−51.2	51.1	−28.9	60.6	−6.1	51.0
Number of observations	619		586		576	
Adjusted R^2	0.1391		0.1187		0.1285	

Notes: (1) The estimation method is OLS with robust standard errors. (2) City size dummies and district dummies are included in the covariates but their coefficients are abbreviated to save space. (3) "***", "**", and "*" indicate that the coefficient is statistically significant at the 1, 5, and 10 percent level, respectively.

Table 6 Estimation results of ratio of financial assets to permanent income

	Gross FA/Yp		Net FA1/Yp		Net FA 2/Yp	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Permanent income (Yp)	−0.001	0.001 *	0.001	0.001	0.000	0.001
Anticipated value change of pension	−0.092	0.049 *	−0.142	0.062 **	−0.119	0.055 **
Age	1.540	1.841	1.498	2.287	0.366	2.187
$Age^2/100$	−1.145	1.529	−1.158	1.895	−0.154	1.822
Male	−1.668	0.554 ***	−1.410	0.789 *	−1.676	0.659 **
High school	1.083	0.341 ***	0.784	0.700	0.871	0.438 **
Junior college	1.392	0.700 **	0.953	1.229	0.941	0.929
College or graduate school	2.256	0.550 ***	1.754	0.791 **	1.814	0.661 ***
Excellent health	1.038	0.807	0.649	1.050	0.665	0.896
Good health	0.801	0.745	0.142	0.990	0.415	0.809
Poor health	0.516	0.769	−0.187	1.002	−0.151	0.856
Family member in need of nursing care	0.308	0.466	0.635	0.637	0.296	0.553
Double income	0.236	0.380	0.485	0.556	0.458	0.487
Extended family	−0.638	0.527	−0.352	0.809	−0.294	0.665
All children independent	−0.569	0.856	−1.045	1.063	−0.970	0.955
Not all children independent	−0.928	0.818	−1.596	1.061	−1.323	0.939
Married	0.452	0.586	1.544	0.983	0.750	0.676
Number of family member	−0.102	0.149	−0.735	0.332 **	−0.480	0.273 *
Own house	1.480	0.395 ***	0.388	0.525	1.468	0.441 ***
Constant	−47.7	55.0	−44.3	68.4	−11.7	65.3
Number of observations	458		444		437	
Adjusted R^2	0.1891		0.1591		0.1729	

Notes: (1) The estimation method is OLS with robust standard errors. (2) City size dummies and district dummies are included in the covariates but their coefficients are abbreviated to save space. (3) "***", "**", and "*" indicate that the coefficient is statistically significant at the 1, 5, and 10 percent level, respectively.

Table 7 Ratio of precautionary saving to close-to-retirement households' wealth

	Over-discounting of future pension benefit (OD)	Estimate of uncertainty (a1)	Precautionary component of W/YP	Average W/YP	Share of precautionary saving to W (Lambda)
W/Yp=Gross financial assets / Yp					
Pension uncertainty=APC	−4.465	−0.020	0.089	1.634	5.46%
Pension uncertainty=AVC	−1.027	−0.092	0.094	1.634	5.78%
W/Yp=Net financial assets 1 / Yp					
Pension uncertainty=APC	−4.465	−0.024	0.106	0.520	20.32% #
Pension uncertainty=AVC	−1.027	−0.142	0.146	0.520	28.07%
W/Yp=Net financial assets 2 /Yp					
Pension uncertainty=APC	−4.465	−0.028	0.123	1.240	9.91%
Pension uncertainty=AVC	−1.027	−0.119	0.122	1.240	9.87%

5. Concluding Remarks

Using a representative and unique Japanese elderly household survey, this paper investigated the impact of public pension uncertainty on wealth accumulation by close-to-retirement Japanese households. Households' anticipated percentage/value changes in pension and future public pension benefits with respect to the present benefit level were used to proxy pension uncertainty. Our principle econometric finding is that households' financial wealth holdings are positively and significantly related to public pension uncertainty for various measures of wealth and both uncertainty proxies.

We also found that households discount future pension benefits much more heavily than the government's planned pension cut. We use this discrepancy as an index of households' over-discounting rate on future pension benefits and combine this information with the estimation result to predict the magnitude of precautionary saving. Our simulations suggest that approximately 10 percent of net financial assets and 5 percent of gross financial assets of the close-to-retirement households are held as a precaution against public pension uncertainty. Hence, our findings are in accordance with the precautionary saving model and provide supportive evidence for the hypothesis of excessive saving and wealth accumulation by elderly Japanese households.

How to alleviate the public pension uncertainty of elderly households effectively, however, remains an open question. Major possible reasons for public pension uncertainty include (a) nationals' distrustfulness toward the pension system management (e.g. missing pension records, poor management of the pension fund), (b) anxiety about the sustainability of the public pension system because of population aging, and (c) irrational panic and gossip because of nationals' lack of knowledge concerning the complicated public pension system and pension reforms. Therefore, effective strategies for easing pension uncertainty could be to provide a reliable, easy-to-understand reform plan to nationals and to improve the transparency and efficiency of the pension management system.

Although encouraging dissaving by elderly households or encouraging inter vivos transfers is a potentially efficient antirecession approach, there are some side-effects that we should consider. A large decline in elderly households' wealth holdings is likely to weaken the domestic affordability of government bonds and then drive up the long-term interest rate. A dramatic rise in the interest rate will not only have a negative impact on the economy by crowding out equipment investment of private companies but also drive up the interest rate burden of government debt. To avoid debt default, the government would have to print more money, which may cause hyperinflation, raise tax rates, which will be harmful to economic growth, or cut public spending, which is extremely painful and politically difficult. In sum, expecting elderly households to spend more to save the Japanese economy has limited effectiveness.

An important limitation of our approach is that the subjective proxies for public pension uncertainty we used may suffer from endogeneity. Because we could not control households' risk aversion and time preference rates because of lack of information, estimates of uncertainty may be upward biased if these two unobservable preference variables affect both households' subjective uncertainty perceptions and wealth accumulation.

Appendix I: Estimation of Permanent Income

We use the predicted labor income of the head-of-household from his/her income function as a proxy for his/her permanent income. This income function uses explanatory variables such as age, tenure, education, health condition, marriage status, occupation, industry, scale of workplace, size of city of residence, and district of residence. We also include the square of the person's age and tenure as explanatory variables to measure age or tenure based upon an inverted-U earning profile. A typical Mincerian wage function is employed, in which the dependent variable is the log of annual labor income. The estimation result is outlined in Table A.1.

Appendix Table
Estimation result of wage function

	Coef.	Std.Err.	
Age	0.098	0.245	
$Age^2/100$	−0.098	0.205	
Tenure	0.028	0.007	***
$Tenure^2/100$	−0.031	0.015	**
Male	0.527	0.060	***
High school	0.044	0.064	
Junior college	−0.009	0.087	
College or graduate school	0.235	0.079	***
Excellent health	0.025	0.161	
Good health	0.034	0.147	
Poor health	−0.107	0.152	
Married	0.052	0.059	
Constant	2.149	7.314	
Occupation dummies	Yes		
Industry dummies	Yes		
Scale of workplace dummies	Yes		
City size dummies	Yes		
District dummies	Yes		
Number of observations	727		
Adjusted R^2	0.5205		

Note: The dependent variable is log (annual labor income). The estimation method is OLS with robust standard errors . "***", "**", and "*" indicate that the coefficient is statistically significant at the 1, 5, and 10 percent level, respectively.

Appendix II: Simulation of the Government's Planned Pension Benefit Change

The government's planned pension benefit change is simulated by estimating the extent to which lifetime pension benefits will decline within the system of macroeconomic slide (MES) functions. We use the standard scenario used by the government in 2007, which assumed the following conditions[14].

Nominal wage increase rate per year (w): 2.1 percent

14) Source: MHLW Pension Bureau "A Simulation of Impact on Pension Finance by the 2004 Reform". URL: http://www.mhlw.go.jp/topics/nenkin/zaisei/zaisei/04/index.html

Inflation rate per year (π): 1.0 percent
Nominal interest rate (r): 3.2 percent
MES rate per year (k): 0.9 percent

Because it is planned that the MES be functioning between 2009 and 2023, we assume that pension benefits in other years are unchanged. Then for people aged 55 in the JILPT 2009 survey, for instance, the MES will be applicable after they reach 65 years of age (2019) and end when they reach 69 years of age (2023). For people aged 65, however, the applicable period will be the longest (14 years). The pension benefit for people aged 55, for instance, in 2023 (while MES applies) will be as follows (where the pension benefit of people aged 69 in 2009=100):

$$PB_{MES} = 100 \times \frac{(1 + w - \pi - k)^{(69-65)}}{(1 + r - \pi)^{(2023-2009)}}. \tag{3}$$

We assume that each person lives until age 85, and we sum up their lifetime public pension benefit and compare it with the level when MES is absent to obtain the percentage change in the government planned public pension. We then multiply this percentage with the ideal retirement pension benefit obtained in the survey to get the value change in the government planned public pension. These two variables are employed to estimate the ratio of precautionary saving to total household wealth.

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