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# Essays on Retirement

Midori Wakabayashi

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Dedication

To my late father,

Nobuo Wakabayashi

# Contents

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Chapter 1.

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# Introduction and Overview

Many individuals have considerable interest in issues of old-age income security because both public and private programs relating to old-age security are expected to undergo dramatic change in the coming years not only in Japan but also in many other countries. For example, in Japan, the rapid aging of the population will necessitate drastic reforms of her social security system including sizable benefit reductions, and 401(k)-type defined contribution company pension programs were introduced beginning in 2001 and are expected to partially or largely displace current defined benefit pension and lump-sum retirement payment programs. In such circumstances, individuals have to save urgently for life after retirement or forced to reduce their living expenses at their retirement, so many individuals feel uneasy about their future.

In this doctoral dissertation, I do empirical analysis focusing on the determinants of individual's behavior relevant to her retirement using Japanese micro data and examine whether individual behave in accordance with the life cycle hypothesis or not.

Each chapter consists as follows:

In Chapter 1, "Retirement Saving in Japan: With Emphasis on the Impact of Social Security and Retirement Payments," I apply Kazuo Sato's target wealth hypothesis to saving for life after retirement and analyze the impact of social security wealth, retirement payments, permanent income, and other factors on people's retirement saving using micro data from the "Survey of Social Security and Self Help," which was conducted in 1996 by the Japan Institute of Life Insurance. Our findings provide strong confirmation of the target wealth hypothesis and of the life cycle model and imply that the Japanese take account of their future social security benefits and retirement payments, their permanent income, etc., when saving for life after retirement.

In Chapter 2, "Annuitized Asset Adequacy in Japan: The Demand for Individual Pensions," I analyze the impact of social security wealth, retirement payments, and living expenses during retirement on people's retirement saving in general and individual pension holdings in particular using micro data from the 1996 "Survey on the Financial Asset Choice of Households," which was conducted in November 1996 by the Institute for Posts and Telecommunications Policy (IPTP) of what was then called the Ministry of Posts and Telecommunications of the Government of Japan. I confirm the existence of a replacement effect of social security on saving for all types of households and that on individual pensions for self-employed households only. My findings suggest that the social security assets of self-employed households are less than their optimal level of annuitized assets and that they would increase their demand for individual pensions if social security benefits were to be reduced.

In Chapter 3, "Consumption Discontinuity at Retirement in Japan," I examine the reasons why consumption changes at retirement using micro data from the same data source as Chapter 2. My results suggest that respondents decrease their consumption after retirement because both family size and work-related expenses decrease after retirement. Both of these reasons are consistent with the life cycle hypothesis.

# Chapter 1. Retirement Saving in Japan: With Emphasis on the Impact of Social Security and Retirement Payments

Midori Wakabayashi [1]

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# 1. INTRODUCTION

Nowadays, retirement security system programs such as social security and employer-provided pensions and lump-sum retirement payments play an important role providing old-age security. However, these programs are expected to undergo dramatic change in the coming years. For example, the rapid aging of the population will put severe strains on the public pension system. Moreover, 401(k)-type defined contribution company pension programs will be introduced beginning in 2001 and are expected to partially or largely displace current defined benefit pension and lump-sum retirement payment programs. Under such circumstances, we urgently need to improve our understanding of retirement saving and of the impact of social security and employer-provided pensions and lump-sum retirement payments on retirement saving.

In this paper, we apply Kazuo Sato's (1995) target wealth hypothesis to saving for life after retirement and analyze the impact of social security wealth, retirement payments, permanent income, and other factors on people's retirement saving using micro data from the 1996 "Survey of Social Security and Self Help (Kouteki-Hoshou to Jijo-Doryoku ni kansuru Ishiki-Chousa)," which were provided by the Japan Institute of Life Insurance (JILI) and the Information Center for Social Science Research on Japan, Institute of Social Science, University of Tokyo (SSJ Data Archive).

According to the life cycle hypothesis of Modigliani and Brumberg (1954), as extended by Feldstein (1974), people save for life after retirement, taking account of their own expectations concerning their living expenses after retirement, social security benefits, retirement payments, etc. In Japan, a large number of detailed studies have been conducted on the relationship between social security and saving since the 1980s (Tachibanaki and Sasaki (1985), Homma et al. (1987), Dekle (1990) etc.). For example, Dekle analyzed the impact of social security on household saving using micro data from the 1983 "Survey on the Living Behavior of the Aged (Rojin Ishiki Chousa)." He finds that the Japanese elderly are not dissaving and that social security does not appear to displace private tangible wealth in Japan. One of the most careful of these studies is Takayama et al. (1990), which uses micro data from the "National Survey of Family Income and Expenditure (Zenkoku Shouhi Jittai Chousa)," conducted by the Management and Coordination Agency of the Government of Japan. There is no information on the amount of future social security benefits in this survey, but the authors estimate the amount thereof and analyze the relationship between saving and social security benefits and confirm the existence of a replacement effect of social security and retirement payments on household saving. Two other relevant studies are Horioka and Okui (1999) and Horioka, Kouno, and Okui (2000). The former uses micro data from the "Comparative Survey of Savings in Japan and the United States," a binational household survey conducted in 1996 by the Institute for Posts and Telecommunications Policy of the Ministry of Posts and Telecommunications of the Government of Japan, to analyze the importance and determinants of retirement saving (not total saving) in the U.S. and Japan. They found that retirement saving is far more important quantitatively in the U.S. than it is in Japan, and that, in both the U.S. and Japan, retirement saving is influenced by some (but not all) of the factors identified by the extended life cycle model, especially expected living expenses during retirement. The latter does a similar analysis for Japan using micro data from the "Survey on the Financial Asset Choice of Households," a household survey conducted by the same entity.

This paper improves upon earlier studies in at least four ways[2]: first, the survey we used for our analysis focuses on retirement and collects information on living expenses during retirement, saving for retirement, etc., making it ideal for the purposes of our analysis. Second, we analyze the impact of social security and other factors on people's retirement saving, not their total saving. Most previous authors analyze people's total saving, but social security should affect primarily people's retirement saving, not

[2] The first three also apply to Horioka and Okui (1999) and Horioka, Kouno, and Okui (2000).

their total saving.[3] Third, whereas previous studies typically estimate future social security benefits from the provisions of the social security system and the individual's earnings history, we use information on the respondents' expectations concerning their future social security benefits because the estimated amounts do not necessarily approximate people's actual expectations and because data on earnings histories are not available in the case of Japan, as they are in the case of the U.S. (see, for example, Bernheim (1988)). Fourth, we examine the replacement effect not only of social security wealth but also of retirement payments on people's retirement saving.[4] A large number of detailed studies have been conducted on the relationship between social security and saving, but very little has been written on the relationship between retirement payments and saving due in large part to the unavailability of data on retirement payments in Japan. We believe that it is important to consider the impact of retirement

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[3] Some might argue that saving is not fungible and that it does not make sense to speak of saving for a specific motive, but I disagree for the following two reasons: first, household surveys consistently find that respondents are able to allocate their saving and wealth among specific motives (see, for example, Horioka and Watanabe (1997)). Second, in Japan, there are many types of saving accounts for specific motives such as housing purchase and retirement, and penalties are imposed if the funds are used for a different purpose.

[4] There are two types of retirement payment systems in Japan. One is a lump-sum retirement payment system (in Japanese, *taishokukin*), and the other is an employer-provided pension system (in Japanese, *kigyou nenkin*). In this paper, we refer collectively to lump-sum retirement payments and company pensions as "retirement payments." The proportion of companies with each type of retirement payment system is as follows:

| Types of system | Year | |
|---|---|---|
| | 1978 | 1997 |
| Only lump-sum retirement payments | 62.1 | 47.5 |
| Only corporate pensions | 16.4 | 20.3 |
| Both lump-sum retirement payments and corporate pensions | 21.5 | 32.2 |

Source: Survey of Retirement Allowance System and Payments, 1997 payments on saving for the following four reasons: first, retirement payments are one of the most important sources of income after retirement (in 1997, 88.9% of companies had a retirement payment system). Second, in the future, retirement payments will play an even more important role in providing old-age security because the rapid aging of the population has made people feel uneasy about their future social security benefits. Third, the proportion of companies with a company pension system has increased over time, and because company pensions are often portable, this has increased the importance of retirement payments as an income source during retirement. Fourth, the role played by retirement payments is different from that played by social security benefits. For example, homeowners often pay off their outstanding housing loans using their retirement payments. No information is available on the amount of retirement payments in the survey we used in our analysis, so we estimate the amount thereof from information on income at retirement and firm size.

To preview our main findings, we obtain strong confirmation of the target wealth hypothesis and of the life cycle model and find that the Japanese take account of their future social security benefits and retirement payments, their permanent income, etc., when saving for life after retirement.

This paper is organized as follows. In section 2 we discuss theoretical considerations, in section 3 we describe the data source, in section 4 we describe the variable definitions and calculation method, in section 5 we describe the estimation model and estimation method, in section 6 we present some descriptive statistics, in section 7 we present our estimation results, and section 8 concludes.

## 2. THEORETICAL CONSIDERATIONS

In this section, we introduce Sato's (1995) target wealth hypothesis (partial adjustment model), which provides a useful framework for analyzing retirement saving. Sato's contention is that people first determine their wealth target ($W^*$) and then save ($S^*$) so as to eliminate the gap between their wealth target and their current assets ($W_0$) by their target date (T). In particular, he assumes that households save a proportion $\alpha$ of the gap between W* and $W_0$ every year, where $\alpha = \frac{1}{T}$. Thus, $S^* = \alpha(W^* - W_0) = \frac{1}{T}(W^* - W_0)$. He uses data on gross financial assets and wealth targets from the "Public Opinion Survey on Savings and Consumption (Chochiku to Shouhi ni kansuru Seron-Chousa)," conducted by the Central Council for Savings Information (Chochiku-Kouhou-Chuou-Iinkai), to analyze whether W*, which is influenced by changes in the economic environment, has any impact on people's consumption and saving behavior.

In this paper, we apply this hypothesis to saving for life after retirement. We assume that people determine their wealth target for retirement primarily on the basis of their expectations concerning their social security benefits and retirement payments and that people engage in retirement saving (S*) in order to eliminate the gap between their wealth target for retirement (W*) and their current retirement assets ($W_0$). Thus, the speed of adjustment should equal $\alpha = \frac{1}{R - age}$, where $R$ = the retirement age and *age* = the respondent's current age, and thus should increase with age.

## 3. DATA

### 3.1 The Data Source

In this paper, we use micro data from the 1996 "Survey of Social Security and Self Help (Kouteki-Hoshou to Jijo-Doryoku ni kansuru Ishiki-Chousa)" which was conducted during the August 23--September 8, 1996 period, and provided by the Japan Institute of Life Insurance (JILI) and the Information Center for Social Science Research on Japan, Institute of Social Science, University of Tokyo (SSJ Data Archive). This survey collects information on living expenses during retirement, saving for retirement, etc., and tells us how each respondent envisions his/her life during retirement.

In this survey, a two-stage stratified random sample of 3,000 people aged 20 or older (from 200 points throughout Japan) was surveyed, resulting in 2,451 responses (a response rate of 81.7%).

## 4. VARIABLE DEFINITIONS AND CALCULATION METHOD

### 4.1 Questionnaire[5]

The survey we used for our analysis asks the following questions:[6]

a. "After you and your spouse retire, about how much will your living expenses be per month? Answer in current prices." (RLE: Living Expenses during Retirement per year)

b. "About how much do you save for life after retirement per month (not including social security contributions)?" (CRS: Current Retirement Saving per year)

c. "After you and your spouse retire, about how much do you plan to dissave per month in order to finance your living expenses? Answer in current prices." (DRS: Dissaving for Retirement per year)

d. "After you and your spouse retire, about how much will you receive in social security benefits per month?" (SS: expected Social Security benefits per year)

e. "About how much do you and your spouse spend per month?" (CLE: Current Living Expenses per year)

f. "About how much was your annual pre-tax income last year? " (Husband's CI: Husband's Current Income)

g. "About how much was the sum of your and your spouse's annual pre-tax income last year?" (CI: Current Household Income)

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[5] We converted categorical data to continuous variables by assigning to each respondent the midpoint of the bracket it selected (except that respondents selecting the lowest bracket were assigned a value equal to 0.8 times the upper bound of the lowest bracket and respondents selecting the highest bracket were assigned a value equal to 1.25 times the lower bound of the highest bracket.)

[6] We converted monthly amounts to annual amounts by multiplying by 12.

h. "Excuse us for being personal, but how much do you and your spouse have in financial assets (including bank deposits, postal savings, mutual funds, insurance, etc.)?" (FASST: Financial Assets)

The survey we used also collects information on the age, marital status, and occupation of the respondent and his or her spouse and on firm size for the respondent only.

### 4.2 Variable Definitions

#### 4.2.1 Conversion of Flow Data to Stock Data

Although the target wealth hypothesis is a hypothesis about stock variables, the survey we used in our analysis collects almost entirely flow data. We thus have to convert the flow data to stock data.[7]

a. Wealth Target for Retirement (WTR)

We calculate the wealth target for retirement (WTR=W*) (a stock) from the planned amount of dissaving during retirement (DRS) (a flow) as follows:

*WTR=DRS*RETSPAN*, where *RETSPAN* = retirement span (in years).[8]

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[7] We do not consider the interest rate because the cross-section variation in the wealth target for retirement (WTR) comes almost entirely from variation in dissaving for retirement (DRS).

[8] The survey we used does not collect any information on the expected age at retirement or on expected age at death so we assume that the expected retirement age is 60 for all respondents and obtain the expected age at death from the "18th Life Tables" (Information Department of the Minister's Secretariat of the Ministry of Health and Welfare). We use life expectancy at age 60 (20.28 years for males and 25.31 years for females) from this source and add 60 to it.

We define retirement span (RETSPAN) as follows: RETSPAN = max [the household head's expected age at death – his or her planned retirement age, the household head's spouse's expected age at death + (the household

b. Social Security Wealth (SSW)

We calculate social security wealth (SSW) (a stock) from expected social security benefits (SS) (a flow) as follows:

$$SSW=SS*RETSPAN$$

4.2.2 Permanent Income at Retirement (PIR)

Permanent income at retirement (PIR) (defined as permanent income at age 55-59) plays two roles in our analysis: first, it is used to calculate the amount of retirement payments (the amount of retirement payments is calculated as a multiple of PIR). Second, we divide the estimating equation through by PIR to alleviate the impact of heteroskedasticity.[9]

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head's age – the household head's spouse's age) – the household head's planned retirement age] (see Horioka and Okui (1999)).

We assumed that the expected retirement age is 60 for the following three reasons: first, the mandatory retirement age in Japan is 60. Second, there are those who continue working after the age of 60, but most of them have retired from permanent employee status and are earning much less than they did before retirement from permanent employee status. Third, in Japan, the employment rate decreases drastically after the age of 60. For example, according to the Annual Report on the Labour Force Survey, conducted by the Statistics Bureau, Management and Coordination Agency, in 1996, the employment rate of those aged 50-54 was 95.5%, that of those aged 55-59 was 92.1%, that of those aged 60-64 was 68.5%, and that of those aged 65 and over was 35.9%. Although this assumption causes an upward bias in the amount of WTR, there is no plausible alternative.

[9] With respect to the first role, the sample we use is salaried worker households, but with respect to the second role, we have to estimate PIR for all households (include self-employed households). We also divide the sample by the

Dicks-Mireaux and King (1982) point out that current earnings differ from permanent income because there exists an age-earnings profile over the life cycle and because there is a transitory component to current earnings. Hence, to calculate permanent income from current earnings, we must exclude the impact of these two factors. In this paper, we use Dicks-Mireaux and King's method to estimate PIR (see Appendix A).

### 4.3 The Estimation of Retirement Payments

There is no information on the expected amount of retirement payments in the survey we used in our analysis, so we estimate it from information on permanent income at retirement and firm size (see Appendix B for more details.)

### 4.4 Sample Selection

The sample we used in our analysis is as follows: first, we use only the subsample of male respondents because the survey we used collects information on firm size only for the respondent himself or herself (not on his/ her spouse). Second, we use the subsample of married respondents because we do not know whether or not single respondents will marry in the future and because, in the questions pertaining to saving for retirement, dissaving for retirement, expected social security benefits, etc., single respondents are asked to put down the amount for themselves only whereas married couples are asked to put down the total amount for husband and wife combined, meaning that the amounts are not comparable. Third, we

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occupation of the household head. A "salaried worker household" is a household whose head is a salaried worker working for a private company or for the government and a "self-employed household" is a household whose head is a self-employed worker. To circumvent the generated regressor problem, we also tried using CI instead of PIR but do not present the results here because the results based on CI were similar but worse than those based on PIR.

are interested in how individuals prepare for their future retirement so we confine the sample to households that have not yet retired.[10] Finally, we dropped all observations for which all of the necessary information is not available. Restricting the sample to male respondents reduces the number of observations from 2,451 to 1,219, restricting the sample to respondents who are married reduces the number of observations further to 996, restricting the sample to respondents who are not yet retired reduces the number of observations further to 650, and restricting the sample to respondents for whom all of the necessary information is available reduces the number of observations further to 237.

## 5. THE MODEL AND ESTIMATION METHOD

In this section, we describe the model and the estimation method used in our analysis.

### 5.1 Wealth Target Hypothesis for Retirement

#### 5.1.1 Wealth Target Equation for Retirement

We assume that people decide their wealth target for retirement (WTR) taking account of social security wealth (SSW), retirement payments (RP), homeownership status (HOUSE), and permanent income (PIR: a proxy for lifetime income).

Thus, the estimating equation we used is as follows:

$$WTR = a_1 * SSW + a_2 * RP + a_3 * HOUSE + a_4 * PIR + a_5 + u \tag{1}$$

If social security benefits and retirement payments are substitutes for one's own saving, then $a_1 < 0$,

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[10] We defined a household that has not yet retired as a household in which all of the following three conditions apply: first, the respondent is under 60 years old (see footnote 7). Second, neither the respondent nor his or her spouse is receiving social security benefits. Third, the respondent answers questions directed at those who are before retirement.

$a_2 < 0$ and if SSW and RP are perfectly substitutes for their wealth target for retirement, $a_1 = -1, a_2 = -1$. If homeowners do not plan to sell their homes even after retirement, we would expect their target wealth for retirement to be lower, ceteris paribus, than that of renter households because they do not have to pay rent after retirement. Thus, we would expect the coefficient of the homeownership dummy (HOUSE) to be negative ($a_3 < 0$). In addition, the higher permanent income is, the higher WTR should be, and thus we would expect that $a_4 > 0$.

Finally, homeowners often use their lump-sum retirement payments to pay off their outstanding housing loans, and we take account of this possibility by adding an interactive term RP*HOUSE. If the respondent uses all or part of his lump-sum retirement payment to pay off his outstanding housing loans, the amount he can apply toward living expenses during retirement will be that much less and thus his wealth target for retirement will be that much larger. Thus, the coefficient of RP*HOUSE should be positive. Moreover, if all homeowners have housing loans outstanding and use their entire lump-sum retirement payments to pay off their outstanding housing loans, the coefficient of RP*HOUSE should be 1.

In order to alleviate the problem of heteroskedasticity in the regression analysis, we divide the estimating equation through by PIR.

### 5.1.2 Partial Adjustment Equation for Retirement Saving

We assume that current retirement saving (CRS) depend on the gap between the wealth target for retirement (WTR) and financial assets (FASST).[11]

That is,

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[11] Due to data limitations, the financial asset variable that we use in our analysis is total financial assets, not financial assets earmarked for living expenses during retirement.

$$CRS = b * (WTR - FASST) + u \tag{2}$$

$b$ can be regarded as the speed of adjustment and should equal $b = \frac{1}{R - age}$, where $R$ = the retirement age and $age$ = the respondent's current age.

We also calculate the actual value of $\frac{1}{R - age}$ using the respondent's current age and test whether the coefficient b' equals 1.

$$CRS = b'*\left(\frac{1}{R - age} * (WTR - FASST)\right) + u \tag{3}$$

We allow for the possibility that retirement saving may depend not only on financial assets but also on real assets by adding a dummy variable for homeownership (HOUSE) to the equation. The sign of the coefficient of HOUSE can be either positive or negative. It will be negative if homeowner households use their own homes to finance their living expenses during retirement,[12] and it will be positive if non-homeowner households give preference to saving for housing purchase over that for retirement because they want to buy their own homes in the future.

Let us now take account of the fact that the survey we used collects information only on gross financial assets; net financial assets (net of liabilities) cannot be calculated because no information is collected on liabilities. Since the liabilities of the household sector are predominantly housing loans in the case of Japan, we deal with this problem by adding an interactive term FASST*HOUSE to the equation. If at least some homeowner households have housing loans outstanding and thus cannot use all of their financial assets to finance their living expenses during retirement, the coefficient of

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[12] There are two ways of using one's own home to finance one's living expenses during retirement. One way is to sell one's home, and the other way is to take out a "reverse mortgage." Under a reverse mortgage, the individual borrows using his/her home as collateral and the loan is repaid at death by transferring ownership of the home to the lender. Although this system is little known in Japan, it is well known in the U.S.

(FASST*HOUSE) will be positive. In this case, the gap between WTR and the portion of FASST that can be applied toward living expenses during retirement will be larger, and thus even if $b$ (the speed of adjustment) is the same, the flow of retirement saving will be larger.

We also divide (WTR-FASST) into WTR and FASST for equation (2) and (3) because we want to know what impact each component has on retirement saving and to test whether $b_1=b_2$ and $b_1'=b_2'=1$.

$$CRS = b_1 * WTR - b_2 * FASST + u \tag{4}$$

$$CRS = b_1'*\frac{1}{R-age}*WTR - b_2'*FASST + u \tag{5}$$

We also add the dummy variable HOUSE and an interactive term FASST*HOUSE to equations (4) and (5) for the same reasons as above.

Finally, we divide the estimating equations (2) to (5) through by permanent income at retirement (PIR) for the same reason as before.

5.1.3 Reduced Form Equation for Retirement Saving

We can obtain a reduced form equation by substituting equation (1) into equations (4) and (5) and use it to verify the replacement effect of social security and retirement payments on the retirement saving the respondent is currently doing.

That is,

$$CRS = c_1 * SSW + c_2 * RP + c_3 * PIR - c_4 * FASST + c_5 * HOUSE + c_6 + u \tag{6}$$

$$CRS = c_1'*\frac{1}{R-age}*SSW + c_2'*\frac{1}{R-age}*RP + c_3'*\frac{1}{R-age}*PIR - c_4'*\frac{1}{R-age}*FASST - c_5'*HOUSE + c_6 + u \tag{7}$$

As in sections 5.1.1 and 5.1.2, we also try adding other variables (RP*HOUSE, FASST*HOUSE) to equations (6) and (7).[13] The coefficients should be consistent with those in sections 5.1.1 and 5.1.2.

Finally, we divide the estimating equation through by permanent income at retirement (PIR) for the same reason as before.

5.2 The Estimation Method

We use a tobit model when the explanatory variable is CRS because there are some respondents who are not currently saving for retirement.[14]

The equations in sections 5.1.1 and 5.1.3 include RP (retirement payments). Retirement payments are paid only to salaried workers working for a private company or for the government and are not paid to self-employed workers. However, we include both salaried worker households and self-employed households in the sample in order to avoid sample selection bias and set the retirement payments of self-employed workers equal to zero.

## 6. DESCRIPTIVE STATISTICS

In Table I, we present descriptive statistics on the variables used in our analysis, broken down by the occupation of the household head. All flow variables are on an annual basis. The table refers to the 237 households used in our analysis -- 176 salaried worker households and 61 self-employed households. The average age of the husband is 46.3 for all households, 45.6 for salaried worker households, and 48.4

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[13] "Business income" is another major source of income after retirement, but we do not consider it here because we could not obtain any significant results.

[14] We also tried estimating a robust regression model, but we do not present the results here because they were not significantly different.

for self-employed workers, and the average age of the spouse is 43.6 for all households, 42.9 for salaried worker households, and 45.5 for self-employed workers. The average age of husbands is higher than that of their wives in every occupation, and the average age of self-employed households is higher than that of salaried worker households (see Wakabayashi (2000) for a more detailed analysis of age). Our sample includes 180 homeowner households, 129 of which are salaried worker households and 51 of which are self-employed workers.[15]

First, we discuss the means for all households. While the average amount of current retirement saving (CRS) for all households is about 567,000 yen, the average amount of dissaving for retirement (DRS) is about 1,891,000 yen. DRS is about three times as large as CRS, which suggest that people are saving foresightedly in preparation for their life during retirement. The average amount of social security benefits (SS) is about 2,156,000 yen in flow terms and 60,429,000 yen in stock terms and the average amount of retirement payments (RP) is 13,414,000 yen for husband and wife combined. Although we estimate the amount of retirement payments from the respondent's permanent income at retirement and firm size, the estimated amount of retirement payments is broadly consistent with data from other sources. For example, the average retirement payment in 1997 was 19.26 million yen, according to the "Survey on Retirement Allowance System and Payments." Looking finally at current living expenses (CLE) and living expenses during retirement (RLE), the average amount of CLE is 3,637,000 yen and the average amount of RLE is 3,267,000 yen. If we compare the average amount of CLE in Table I to that from other sources, according to the Family Income and Expenditure Survey (FIES), conducted by the Statistics Bureau and Statistics Center, Management and Coordination Agency, the average living expenses of

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[15] We defined a "homeowner household" as a household whose home is in the name of the household head, the spouse of the head, or other family member and a "non-homeowner household" as a household that lives in rental housing, company housing, or government worker housing.

households with a head aged 59 or younger in 1996 was about 4,197,000 yen; according to the Survey on the Financial Asset Choice of Households (SFACH), conducted by the Institute for Posts and Telecommunications Policy of the Ministry of Posts and Telecommunications, the average amount of CLE of households in with a head aged 59 or younger in 1996 was 3,488,000 yen; and according to the National Accounts (NA), the average amount of CLE per household in 1996 was 6,583,000 yen (see Table II). While the amount of CLE in Table I is about 560,000 yen lower than that from the FIES and 2,946,000 yen lower than that from the NA[16], the difference between the figures in Table I and that from the SFACH is not so large. One reason why the amount of CLE in Table I is lower than that from the FIES is that the definition of living expenses in the survey we used does not include extraordinary expenses (such as medical expenses), as a result of which it is downward biased. As can be seen from Table I, the average amount of RLE is only about 90% of CLE.[17] This is perhaps because consumption needs are less during retirement; for example, retired individuals do not need to spend as much on business suits, etc. We would expect the sum of DRS and SS to fall short of RLE because RLE can be financed not only by DRS and SS but also by retirement payments, labor income, property income, etc., but in fact, the sum of DRS and SS is considerably larger than RLE, perhaps because the definition of living expenses during retirement in the survey we used in our analysis is narrower, not including such things as unforeseen expenses.

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[16] The amount of living expenses from the NA (macro data) is larger than that from household surveys because the definition of living expenses in NA is broader, including such things as imputed rent on owner-occupied housing.

[17] In the U.S., it is conventional wisdom that living expenses after retirement are about 85% of living expenses before retirement. According to the Family Income and Expenditure Survey, in 1996, the ratio of RLE to CLE was about 83% in Japan. In the survey we used in our analysis, this ratio is a little bit higher but not too out of line (see Table I).

Next, we discuss the means broken by the occupation of the household head. There are large differences in retirement savings (CRS, DRS) by the occupation of the household head. For example, the mean of CRS for salaried worker households is about 507,000 yen, while that for self-employed households is about 740,000 yen, a difference of about 233,000 yen. The retirement saving of self-employed households is much higher than that of salaried worker households for the following two reasons: one reason is that the social security benefits of self-employed workers are much lower than those of salaried workers (there is no earnings-related component in the case of self-employed workers), and the other reason is that retirement payments are paid only to salaried workers and not to self-employed workers. For these reasons, self-employed households are apparently more eager to save for life after retirement than salaried worker households.

Let us now look at the amount of the wealth target for retirement (WTR). The average amount of WTR for all households is about 53,036,000 yen, that for salaried worker households is about 50,146,000 yen, and that for self-employed worker households is about 61,376,000 yen. According to the SFACH, the average amount of WTR was 15,490,000 yen in 1996, and according to the Public Opinion Survey of Savings and Consumption (POSSC), conducted by the Central Council for Savings Information, the average wealth target for all purposes was 22,254,000 yen in 1996 (see Table II). This suggests that the amount of WTR in Table I is too high. We believe that the wealth target for retirement in Table I is much higher than that from the SFACH and the POSSC because it is calculated from flow data on dissaving during retirement (DRS) and because our assumption that the expected retirement age is 60 makes the retirement span (RETSPAN) longer than it is in actuality (see footnote 7).

Turning finally to asset data, the average amount of financial assets (FASST) for all households is about 9,153,000 yen, that for salaried worker households is about 8,770,000 yen, and that for self-employed households is about 10,256,000 yen. According to the POSSC, the average amount of FASST for all households in 1996 was 10,823,000 yen; according to the SFACH, the average amount of

FASST in 1996 was 10,988,000 yen; and according to the Family Saving Survey (FSS), conducted by the Statistics Bureau and Statistics Center, Management and Coordination Agency, the average amount of FASST in 1996 was 12,795,000 yen (see Table II). Thus, the amount of FASST in Table I is lower than that from the POSSC, SFASH, and FSS, but the difference is not so large considering how large the variance of FASST is (see Table I). We can also compare the average amount of FASST in Table I to that from macro data. For example, according to the NA, the average amount of FASST per household was 26,196,802 yen in 1996 (see Table II). Thus, the amount of FASST from household surveys is only about half of that from macro data. This is presumably due to underreporting by respondents in household surveys. There is a tendency for wealth data from household surveys to be downward biased in all countries (see, for example, Hayashi, Ando, and Ferris (1988) re Japan and Rossi and Shorrocks (2000) re the U.K.). Although self-employed households hold more financial assets than salaried worker house

holds, on average, the variance of self-employed households' financial assets is larger. The homeownership rate of self-employed households is also higher than that of salaried worker households, perhaps because many self-employed households use their homes for business purposes.

## 7. EMPIRICAL RESULTS

### 7.1 Wealth Target Equation for Retirement

In this section, we present our results concerning the determinants of the wealth target for retirement, focusing in particular on whether social security and retirement payments have a replacement effect on the wealth target for retirement. If people are rational, they should take account of social security wealth (SSW) and retirement payments (RP) when deciding their wealth target for retirement (WTR), and both SSW and RP should have a negative and significant impact on WTR.

Table III presents the estimation results, and we look first at the results concerning the replacement effect of SSW and RP on WTR. In the case of all households, SSW has a positive and significant impact on WTR, whereas RP has a negative and highly significant impact thereon. In the case of salaried worker households, SSW has a positive but not highly significant impact on WTR, whereas RP has a negative and generally significant impact thereon. We also compute t statistics, and could accept the coefficient of RP ($a_2$) equals -1 in all cases. The results for SSW are contrary to expectation but are often not highly significant, whereas the results for RP are highly significant in almost every case and confirm the existence of a replacement effect of retirement payments on the wealth target for retirement.

The coefficient of permanent income at retirement (PIR) is positive and significant in all four cases. This implies that the higher permanent income is, the higher WTR is, a plausible result.

Although the coefficients of the aforementioned variables are not sensitive to the inclusion of RP*HOUSE (equation (1)' in Table III), the coefficient of the homeownership dummy (HOUSE) is for both all households and salaried worker households. While the coefficient of HOUSE is not significant in the basic equation (equation (1) in Table III), it is negative and significant if RP*HOUSE is included (equation (1)' in Table III). The negative impact of HOUSE on WTR is presumably due to the fact that homeowner households do not need as much retirement saving as renter households because they do not need to pay rent. As for the coefficient of RP*HOUSE, it is positive and significant, which suggests that homeowner households apply at least part of their retirement payments toward housing loan repayments and thus that the replacement effect of RP on WTR is weaker for homeownership households than it is for renter households. In the case of salaried worker households, the coefficients of RP and RP*HOUSE are almost identical, which suggests that salaried worker homeowner households apply their entire retirement payments toward housing loan repayments and thus that the replacement effect of RP on WTR is non-existent in the case of such households.

7.2 Partial Adjustment Equation for Retirement Saving

In this section, we present our estimation results for the partial adjustment equation. As we discussed in section 2, if people behave in accordance with the target wealth hypothesis, they should engage in retirement saving in order to reduce the gap between their wealth target for retirement (WTR) and their retirement assets (here we use financial assets (FASST)). We test this model that the gap between the wealth target for retirement and retirement assets (WTR-FASST) has a positive and significant impact on the amount of retirement saving. In particular, the speed of adjustment should be the reciprocal of the time span between now and retirement and the speed of adjustment should be faster the closer the person is to retirement.

Tables IV and V present the estimation results, and we look first at the results concerning the speed of adjustment. In equation (2) in Table IV, the coefficient of (WTR-FASST) is always significant at the 1% level. The speed of adjustment for all households is 0.0088, while that for salaried worker households is 0.0080. The reason why these speeds of adjustment are slower is that the amount of WTR is much higher than in other household surveys (see page 16). Next, we calculate the actual value of $\frac{1}{\mathrm{R}-\mathrm{age}}$ and test whether the coefficient of $\frac{1}{\mathrm{R}-\mathrm{age}}*(\mathrm{WTR}-\mathrm{FASST})$ equals 1. In equation (3) in Table IV, the coefficient of this term is always significant at the 1% level both in the case of all households and in the case of salaried worker households but the magnitude of the coefficient is much smaller than expected.

In equations (4) and (5) in Table V, (WTR-FASST) is decomposed into WTR and FASST so that we can determine what impact WTR and FASST have individually on the amount of retirement saving. First, we look at the results for equations (4) and (4)' in Table V. According to our results, the coefficients of WTR and FASST are always significant at the 1% level, but the sign of the coefficient of FASST is contrary to expectation. When we add the interactive term FASST*HOUSE (equation (4)' in Table V), neither the coefficient of FASST nor that of FASST*HOUSE is significant, but since the coefficient of

FASST has the wrong sign, the fact that it becomes insignificant when FASST*HOUSE is added represents an improvement. Next, we look at the results for equations (5) and (5)' in Table V. The results are much better: the coefficient of $\frac{1}{\mathrm{R-age}}*\mathrm{WTR}$ is always positive and significant at the 1% level, as expected, and the coefficient of $\frac{1}{\mathrm{R-age}}*\mathrm{FASST}$ is negative though often not significant in almost all cases. When we add the dummy variable HOUSE and the interactive term FASST*HOUSE, the coefficient of FASST becomes negative and significant in the case of all households.

Finally, we compute F statistics for equations 4 and 5 in order to test the null hypotheses $b_1=b_2$ and $b_1'=b_2'=1$. Although in equations (4) and (4)' in Table V, the computed F statistics are so large that we could not accept the null hypothesis, in equations (5) and (5)' in Table V, we could accept the null hypothesis in all cases.

We look, finally, at the results for the dummy variable HOUSE and the interactive term FASST*HOUSE in equations (2)', (3)', (4)' and (5)' in Tables IV and V. We discuss the results for all equations collectively because the results do not differ significantly by equation or occupation except in the case of the interactive term FASST*HOUSE in equation (4)'. We first discuss the dummy variable HOUSE. If homeowner households use their own homes to finance their living expenses during retirement, their retirement saving should be less than that of non-homeowner households, but if non-homeowner households give preference to saving for housing purchase, their retirement saving should be less than that of homeowner households. In reality, the coefficient of HOUSE is positive and generally significant, suggesting that the latter effect is stronger than the former effect. This is plausible because, in Japan, most homeowner households do not use their own homes to finance their living expenses during retirement.

We next discuss the interactive term FASST*HOUSE. The survey we used in our analysis collects information only on gross financial assets; no information is collected on liabilities. Since the liabilities of homeowner households are predominantly housing loans, we take account of this problem by introducing the interactive term FASST*HOUSE. If homeowner households have at least some housing loans outstanding, they will not be able to finance as much of their living expenses during retirement using their financial assets as non-homeowner households, and thus we would expect the coefficient of FASST*HOUSE to be positive. According to our results, the coefficient of FASST*HOUSE is positive and strongly significant, as expected, except in equation (4)'.

7.3 Reduced Form Equation for Retirement Saving

In this section, we discuss our estimates of the reduced form equation obtained by substituting equation (1) into equations (4) and (5) and test for the replacement effect of social security wealth (SSW) and retirement payments (RP) on current retirement saving (CRS) using this reduced form equation.

Looking first at the results concerning the replacement effect of SSW and RP on CRS in equation (6) in table VI , the coefficient of RP is negative and significant, as expected, in the case of all households, but it is not significant in the case of salaried worker households, and the coefficient of SSW is not significant in the case of either all households or salaried worker households.

The coefficient of permanent income at retirement (PIR) is positive and significant in every case, as in the case of the wealth target equation (section 7.1).

Looking next at the coefficient of FASST, we found it to be consistently positive and significant, contrary to expectation, in the partial adjustment equation (section 7.2), but its coefficient is closer to expectation in the reduced form equation: it is generally positive, contrary to expectation, when FASST*HOUSE is not included (equation (6) in table VI), but it is significant only for all households. Moreover, it is negative, as expected, when FASST*HOUSE is included (equation (6-b) in table VI) although it is not significant.

We look next at the coefficients of HOUSE, RP*HOUSE and FASST*HOUSE. We discuss the results for all households and salaried worker households collectively because the results do not differ significantly by occupation. The coefficient of HOUSE is insignificant in equation (6) in table VI, but is closer to expectation when RP*HOUSE and FASST*HOUSE are included. Looking first at the coefficient of HOUSE when only RP*HOUSE is included (equation (6-a) in table VI), it is insignificant. Looking next at the coefficient of HOUSE when only FASST*HOUSE is included (equation (6-b) in table VI), it is negative and significant, as expected. Looking finally at the coefficient of HOUSE when both RP*HOUSE and FASST*HOUSE are included (equation (6-c) in table VI), it is negative, as expected, but not significant.

We look next at the coefficients of RP*HOUSE and FASST*HOUSE. Looking first at equations (6-a) and equation (6-b) in table VI, the coefficients of RP*HOUSE and FASST*HOUSE are positive, as expected, but not significant. Looking finally at the equation in which both RP*HOUSE and FASST*HOUSE are included (equation (6-c) in table VI), the coefficient of FASST*HOUSE is positive and significant, as expected, whereas the coefficient of RP*HOUSE is positive, as expected, but not significant. Thus, we find that homeowner households and renter households differ in how they prepare for life after retirement.

Next, we discuss our estimates of the reduced form equation obtained by substituting equation (1) into equation (5) and test for the replacement effects of $\frac{1}{\mathrm{R}-\mathrm{age}}*\mathrm{SSW}$ and $\frac{1}{\mathrm{R}-\mathrm{age}}*\mathrm{RP}$ on CRS using this reduced form equation that takes account of respondents' age (see table VI). We discuss the results for all equations collectively except in the case of the variable $\frac{1}{\mathrm{R}-\mathrm{age}}*\mathrm{FASST}$ and the dummy variable HOUSE because the results do not differ very much by equation or occupation. First, the replacement effects of neither $\frac{1}{\mathrm{R}-\mathrm{age}}*\mathrm{SSW}$ nor $\frac{1}{\mathrm{R}-\mathrm{age}}*\mathrm{RP}$ on CRS is significant in equations (7) to (7-c). Looking next at the coefficient of $\frac{1}{\mathrm{R}-\mathrm{age}}*\mathrm{FASST}$ in table VI, it is not significant in equations (7) and

(7-b), but it is negative and significant, as expected, in equations (7-b) and (7-c). We look finally at the coefficients of HOUSE and FASST*HOUSE. The coefficient of HOUSE is positive and significant in equations (7) and (7-a) as discussed in section 7-1, but it is not significant in equations (7-b) and (7-c). The coefficient of FASST*HOUSE is positive and significant, as expected, in all equations.[18] Thus, the coefficients of most of the variables in this reduced form equation that takes account of respondents' age are often not highly significant except for $\frac{1}{R-age}*FASST$ and FASST*HOUSE, but we consider it to be important to discuss this reduced form equation in this section because it allows us to test not only for the replacement effect of social security wealth and retirement payments on people's retirement saving but also for the speed of adjustment taking account of respondents' age.

Finally, the survey we used also asks about ideal retirement saving (IRS),[19] so we also analyzed the impact of social security wealth and retirement payments on IRS.[20] The results are much better when the dependent variable is IRS in both equations 6 and 7: for example, the coefficients of both SSW and RP are generally negative and significant, as expected, in equation 6, and the coefficients of both $\frac{1}{R-age}*SSW$ and $\frac{1}{R-age}*RP$ are also negative and significant, as expected, in the case of all households in equation 7, which implies that people ideally want to take account of their expectations concerning social security

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[18] Both the coefficient of $\frac{1}{R-age}*PIR$ and that of RP*HOUSE are generally insignificant in these reduced form equations.

[19] The survey we used in our analysis asks, "Ideally, about how much do you want to save for life after retirement per month (not including social security contributions)?" (IRS: Ideal Retirement Saving per year)

[20] We do not discuss the results based on IRS in detail because an anonymous referee felt that it is not a very meaningful concept.

benefits and retirement payments when saving for life after retirement. Our estimation results for the wealth target equation in section 7.1 showed evidence of a replacement effect of retirement payments, but not of social security, and thus our results for the reduced form equation are stronger than our results for the wealth target equation if ideal retirement saving is used.

## 8. CONCLUSION

In this paper, we applied Sato's (1995) target wealth hypothesis to saving for life after retirement and analyzed the impact of social security wealth, retirement payments, permanent income, and other factors on people's retirement saving using micro data from the 1996 "Survey of Social Security and Self Help (Kouteki-Hoshou to Jijo-Doryoku ni kansuru Ishiki-Chousa)."

Our target wealth hypothesis for retirement consists of two steps: in the first step, people decide their wealth target for retirement taking account of social security wealth, retirement payments, permanent income, etc. We found that the results for social security are often not highly significant but that the results for retirement payments are highly significant in almost every case and confirm the existence of a replacement effect of retirement payments on saving for retirement. In the second step, people who behave in accordance with the target wealth hypothesis engage in retirement saving in order to reduce the gap between their wealth target for retirement and their retirement assets. We tested this partial adjustment model and found, as expected, that the gap between the wealth target for retirement and retirement assets has a positive and significant impact on the amount of retirement saving and that the speed of adjustment is faster the closer the person is to retirement. Finally, we analyzed the replacement effect of social security wealth and retirement payments on current retirement saving using a reduced form equation derived from the first and second steps. We also found that the results for social security are often not highly significant but that the results for retirement payments are highly significant in almost every case. We also analyzed the replacement effect of social security wealth and retirement payments on ideal retirement saving and confirm the existence of a replacement effect of both social security benefits and retirement payments on saving for retirement. This implies that people take account of their expectations concerning both social security benefits and retirement payments when saving for life after retirement.

In addition, we analyzed the impact of permanent income on the wealth target for retirement and found that the higher permanent income is, the higher retirement saving is. Finally, our results suggest that homeowner households do not plan to sell their homes in order to finance their living expenses during retirement but rather that they plan to continue living in their own homes after retirement, thereby saving on rent.

Thus, we found evidence of a replacement effect of both social security benefits and retirement payments on saving for retirement. Previous studies have also found evidence of a replacement effect of social security benefits, but this study is one of the first to find a replacement effect of retirement payments, and we hope that our study will inspire further studies of this important relationship.

Our study has at least three defects: first, we used only information on respondents' firm size when estimating retirement payments, even though retirement payments also depend on educational attainment and seniority, because no information was available on the latter. Second, the sample we used in our analysis was quite small because we had to drop observations for which all of the necessary information was not available. Third, we did not consider the induced retirement effect of social security and retirement payments because we did not have information on respondents' planned retirement age.

## APPENDIX

A. The Estimation of Permanent Income at Retirement

We use Dicks-Mireaux and King's (1982) method in order to estimate permanent income at retirement

(PIR).[21]

A.1 Salaried Workers

In Japan, the earnings of salaried workers are based on age, firm size, education, etc. Thus, we calculate salaried workers' permanent income at retirement as follows: first, we regress the logarithm of current earnings on dummy variables pertaining to age and firm size[22]. Second, we assume that one-half of the residual from this regression is an unobservable individual-specific effect. Finally, we estimate permanent income at retirement (PIR) by calculating the fitted value from the earnings equation with the 55-59 age dummy substituted for the actual age dummy, adding the unobservable individual-specific effect to it, and taking the exponential of it.

A.2 Self-Employed Workers

The earnings of self-employed workers are not seniority based, unlike those of salaried workers. Thus, we calculate permanent income of self-employed workers as follows: first, we calculate the difference between the current earnings of each self-employed worker and the average earnings of all

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[21] We did not control for the "cohort effect" (Dicks-Mireaux and King (1982)) for the following two reasons: first, it is not unrealistic to assume that not only young workers but also old workers are capable of learning new technologies. Second, in the case of Japan, using historical data to estimate the cohort effect will lead to substantial biases because the high growth period is included.

[22] We use eight age groups (20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54 and 55-59) and five firm size groups (less than 30 employees, 30-299 employees, 300-999 employees, more than 1000 employees, and government workers.). There is no information on retirement payments in the case of firms with less than 30 employees in the "Survey on Retirement Allowance System and Payments." Thus, we regressed the multiple of retirement payments to regular monthly wages at retirement on firm size and used the predicted value from this regression.

self-employed workers. Then, we add half of that difference to the average earnings of all self-employed workers in order to obtain each self-employed worker's permanent income.

A.3 Spouses (Wives)

We take account of the spouse's income only if the spouse is working full-time because part-time earnings are likely to be regarded as transitory income.

First, we explain how we calculated the incomes of spouses who are salaried workers. We have no information on spouses' firm size, so we assume that their current earnings depend only on their age. We regress the logarithm of current earnings on age dummies and add half of the residual from that equation to the logarithm of each spouse's predicted earnings and take the exponential thereof in order to obtain her permanent income at retirement.

Also, we use the method described in A.2 to estimate spouses who are self-employed workers.

B. The Estimation of Retirement Payments

B.1 Salaried Workers

In Japan, the amount of the retirement payments of salaried workers is calculated as a multiple of their regular monthly income at retirement.[23] Hence, we use the estimation results for PIR in order to calculate

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[23] In Japan, annual income includes not only regular monthly income but also special income (especially seasonal bonuses). The amount of retirement payments is calculated as a multiple of regular monthly income at retirement.

The composition of annual income for private company workers and government workers is as follows:

Annual income = regular monthly income*12 + bonus + special income (private companies)

Annual income = regular monthly income*12 + family allowance + temporary allowance + end-of-the-year bonus + special end-of-the-year bonus + diligence allowance (government) it.

First, we explain how we estimated the retirement payments of salaried workers working for private companies. First, we converted permanent income at retirement (calculated as described in A.1) from a yearly basis to a monthly basis by using data on the ratio of regular monthly wages to annual income from the 1995 "Wage Census (Chingin-Census)" [24] conducted by the Policy Planning and Research Department, Minister's Secretariat, Ministry of Labour of the Government of Japan. We then estimate amount of retirement payments by multiplying our estimate of regular monthly wages by the multiple of retirement payments to regular monthly wages at retirement (by firm size [25]) taken from the "Survey on Retirement Allowance System and Payments."[26]

Next, we explain how we estimated the retirement payments of salaried workers working for the government. In the case of Japan, there is no information on the wages of government workers, unlike in the case of salaried workers working for private companies. Thus, we use the 1997 "Wage Manual for Government Workers (Koumuin-Kyuuyo-Binran)" to calculate the regular monthly wages of government workers from their annual income and to estimate the amount of their retirement payments from our estimate of their regular monthly wages at retirement.[27]

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[24] The survey we used in our analysis asks, "How much was your annual income last year (i.e., 1995)?" so we use the survey for 1995.

[25] There is no information on retirement payments in the case of firms with less than 30 employees in the "Survey on Retirement Allowance System and Payments." Thus, we regressed the multiple of retirement payments to regular monthly wages at retirement on firm size and used the predicted value from this regression.

[26] This survey is conducted only every three or four years, so we use the survey closest to the year to which our data pertain.

[27] There is information on the rates of government worker retirement allowances in the case of more than 25 years of

B.2 Self-Employed Workers

Retirement payments are paid only to salaried workers working for a private company or for the government and are not paid to self-employed workers. Thus, we assume that the retirement payments of self-employed workers are zero.

B.3 Spouses (Wives)

The "Survey on Retirement Allowance System and Payments" collects information only on males. Thus, we assumed that the male-female gap in retirement payments is the same as the male-female gap in wages, as given in the "Wage Census" when calculating the retirement payments of spouses working for private companies.

The male-female gap in wages and retirement payments is smaller in the case of government workers than it is in the case of private company workers. Thus, we used the same method as in the case of household heads to calculate the retirement payments of spouses who work for the government (see B.1).

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service in the "Law of the Government Official Retirement Allowances, article 5." This article states: "In the case of 35 to 45 years of service, the retirement payment will equal 62.7 times regular monthly income at retirement."

## REFERENCES

Bernheim, B. Douglas (1988). Social security benefits: An empirical study of expectations and Realizations, *in* "Issues in Contemporary Retirement" (R. Ricardo-Campbell, E. Lazear, Eds.), pp. 312-350, Hoover Institution Press, Palo Alto.

Dicks-Mireaux, L-D. L., and King, M.A. (1984). Portfolio composition and pension wealth: An Econometric study, *in* "Financial Aspects of the United States Pension System" (Z. Bodie, and J.B. Shoven, Eds.), pp. 399-435, A National Bureau of Economic Research Project Report, The University of Chicago Press, Chicago/London.

Dekle, R. (1990). Do the Japanese elderly reduce their total wealth? A new look with different data (communication), *J. Japan and Int. Econ.* **4**, 309-317.

Feldstein, M. (1974). Social security, induced retirement, and aggregate capital accumulation, *J. Pilit. Econ.* **82**, 905-926.

Hayashi, F., Ando, A. and Ferris, R. (1988). Life cycle and bequest savings: A study of Japanese and U.S. households based on data from the 1984 NSFIE and the 1983 Survey of Consumer Finances, *J. Japan and Int. Econ.* **2**, 450-91.

Homma, M., Atoda, N., Iwamoto, Y., and Ohtake, F. (1987). Nenkin: Kourei-ka shakai to nenkin-seido {Social security: An aging society and the social security system}, *in* "Nihon Keizai no Makuro-Bunseki {Macro Analysis of the Japanese Economy}" (K.Hamada, A.Horiuchi, and M.Kuroda, Eds.), pp. 149-175, Tokyo Daigaku Shuppan-kai, Tokyo.

Horioka, C. Y., and Watanabe, W. (1997). Why do people save? A Micro-analysis of motives for household saving in Japan, *Econ. J.* **107**, 537-552.

Horioka, C. Y., and Okui, M. (1999). A U.S.-Japan comparison of the importance and determinants of retirement saving, *Econ. Letters,* **65**, 365-371.

Horioka, C. Y., Kouno, T., and Okui, M. (2000). Retirement saving and retirement behavior in Japan, mimeograph, Institute of Social and Economic Research, Osaka University.

King, M. A., and Dicks-Mireaux, L.-D. L. (1982). Asset holding and the life-cycle, *Econ. J.* **92**, 247-267.

Kotlikoff, L. J. (1979). Testing the theory of social security and life cycle accumulation, *Amer. Econ. Rev.* **69**, 388-436.

Modigliani, F., and Brumberg, R.E. (1954). Utility analysis and the consumption function: An Interpretation of cross-section data, *in* "Post Keynesian Economics" (K.K.Kurihara, Ed.), pp. 388-436. Rutgers University Press, New Brunswick.

Rossi, M., and Shorrocks, A. (2000). Personal wealth holdings in Britain: Reconciling the evidence from household surveys and individual estate records, University of Essex, mimeo.

Sato, K. (1995). Mokuhyou-shisan-kasetsu to Nihon no kakei-chochiku {The Target wealth hypothesis and household saving in Japan}, *Nihon Keizai Kenkyuu* 30, 25-50.

Takayama, N., Funaoka F., Ohtake, F., Arita (Uno), F., Ueno, H., and Kubo, K. (1990). Jinteki-shisan no suikei to kouteki-nenkin no sai-bunpai-kouka {The Estimation of human capital and the redistribution effect of social security wealth}, *Keizai Kenkyuu* 118, 1-72.

Takayama, N., Funaoka F., Ohtake, F., Arita (Uno), F., Ueno, H., and Kubo, K. (1990). Kakei no chochiku to shuurou nado ni kansuru keizai-bunseki – Kouteki-nenkin tono kankei ni shouten wo atete {Economic analysis of household saving, employment, etc. – With emphasis on the impact of social security}, *Keizai Kenkyuu* 121, 1-81.

Tachibanaki, T., and Sasaki M. (1985). Kouteki-nenkin-seido ga sedai-betsu-chochikuritsu to shisan-keisei ni ataeru eikyou {The Impact of social security system on the saving rate and asset formation}, *Kikan Shakai Hoshou Kenkyu* 21, 59-71.

Wakabayashi, M. (2000). Rougo-seikatsu no keizai-bunseki –Rougo-chochiku to kouteki-nenkin, taishoku-kin tono daitai-kankei– {Economic analysis of retirement saving – With emphasis on the impact of social security and retirement payments– }, master's thesis, Osaka University.

## DATA SOURCES

Chochiku Kouhou Chuuou Iinkai (The Central Council for Savings Information, Secretariat: Public Relations Department, Bank of Japan) (1996). "Chochiku to Shouhi ni kansuru Seron Chousa" (Public Opinion Survey of Savings and Consumption), 1996 edition, Tokyo.

Jichi-shou (The Ministry of Home Affairs, Government of Japan) (1998). "Juumin-Kihon-Daichou ni motozuku Zenkoku Jinkou Setaisuu Hyou" (All Japan Population and Households Table by Basic Register Inhabitants), 1996 edition, Tokyo.

Kyuuyo-kankei Hourei Kenkyuukai (Study Group on Salary-related Laws and Ordinances), "Koumu-in Kyuuyo Binran" {Government Worker Salary Handbook}, Zaidan-houjin Ookura Zaimu Kyoukai, 1999 edition, Tokyo.

Roudou-shou Daijin Kanbou Seisaku Chousa-bu (Policy Planning and Research Department, Minister's Secretariat, Ministry of Labour of the Government of Japan), (1998). "Taishoku-kin-seido Shikyuu-Jittai-Chousa-Houkoku" {Survey on Retirement Allowance System and Payments}, 1997 edition, Tokyo.

Roudou-shou Daijin Kanbou Seisaku Chousa-bu (Policy Planning and Research Department, Minister's Secretariat, Ministry of Labour of the Government of Japan), (1996). "Chingin-Sensasu" (Wage Census), Roudou Hourei Kyokai, 1995 edition, Tokyo.

Soumu-chou Toukei-kyoku (Statistics Bureau, Management and Coordination Agency, Government of Japan) (1997). "Roudou-Ryoku Chousa Nenpou" (Annual Report on the Labour Force Survey), 1996 edition, Tokyo.

Soumu-chou Toukei-kyoku (Statistics Bureau, Management and Coordination Agency, Government of Japan), (1997). "Chochiku Doukou Chousa Houkoku" (Family Saving Survey), 1996 edition,Tokyo.

Soumu-chou Toukei-kyoku Toukei-sentâ (Statistics Bureau & Statistics Center, Management and

Coordination Agency, Government of Japan) (1997). "Kakei Chousa" (Family Saving Survey), 1996 edition, Tokyo.

Yuusei-shou Yuusei Kenkyuu sho (the Institute for Posts and Telecommunications Policy of the Ministry of Posts and Telecommunications of the Government of Japan) (1998). "Kakei ni okeru Kinyuu Shisan Sentaku ni kansuru Chousa" (Survey on the Financial Asset Choice of Households), 1996 edition,Tokyo.

TABLEI I

Descriptive Statistics (Means and Standard Deviations)[a]

| | All Households | Salaried Worker Households | Self-employed Households |
|---|---|---|---|
| Number of observations | 237 | 176 | 61 |
| Husband's Age | 46.333 | 45.625 | 48.377 |
| | (8.245) | (8.296) | (7.806) |
| Spouse's Age | 43.591 | 42.938 | 45.475 |
| | (8.385) | (8.339) | (8.298) |
| Number of homeowners | 180 | 129 | 51 |
| Homeownership ratio | 0.759 | 0.733 | 0.836 |
| Variables (millions of yen) | | | |
| ***CRS*** | 0.567 | 0.507 | 0.740 |
| current retirement saving | (0.510) | (0.453) | (0.618) |
| ***DRS*** | 1.891 | 1.794 | 2.171 |
| dissaving for retirement | (1.137) | (1.110) | (1.175) |
| ***WTR*** | 53.036 | 50.146 | 61.376 |
| wealth target for retirement | (32.882) | (32.040) | (34.109) |
| ***FASST*** | 9.153 | 8.770 | 10.256 |
| financial assets | (10.104) | (9.699) | (11.206) |
| ***WTR-FASST*** | 43.884 | 41.375 | 51.120 |
| | (32.178) | (32.204) | (31.242) |
| ***SS*** | 2.156 | 2.352 | 1.591 |
| social security benefits | (1.007) | (0.890) | (1.113) |
| ***SSW*** | 60.429 | 65.900 | 44.645 |
| social security wealth | (29.743) | (26.945) | (31.951) |
| ***RP*** | 13.414 | 17.864 | 0.573 |
| retirement payments | (10.424) | (8.259) | (1.648) |
| ***Husband's RP*** | 12.714 | 17.120 | 0.000 |
| | (10.381) | (8.334) | (0.000) |
| ***Spouse's RP*** | 0.700 | 0.744 | 0.573 |
| | (1.735) | (1.767) | (1.648) |
| ***CI*** | 7.346 | 7.476 | 6.971 |
| current income | (3.679) | (3.417) | (4.355) |
| ***Husband's CI*** | 6.481 | 6.751 | 5.702 |
| | (3.552) | (3.314) | (4.094) |
| ***PIR*** | 7.359 | 7.579 | 6.726 |
| permanent income at retirement | (2.108) | (1.951) | (2.413) |
| ***Husband's PIR*** | 6.790 | 7.172 | 5.688 |
| | (2.068) | (1.940) | (2.047) |
| ***Spouse's PIR*** | 0.569 | 0.406 | 1.038 |
| | (1.081) | (0.873) | (1.438) |
| ***RLE*** | 3.267 | 3.252 | 3.309 |
| living expenses during retirement | (1.087) | (1.057) | (1.179) |
| ***CLE*** | 3.637 | 3.587 | 3.781 |
| current living expenses | (1.457) | (1.400) | (1.613) |
| (years) | | | |
| ***RETSPAN*** | 28.073 | 28.020 | 28.228 |
| retirement span | (3.451) | (3.353) | (3.744) |

*Source:* The 1996 "Survey of Social Security and Self Help (Kouteki-Hoshou to Jijo-Doryoku ni kansuru Ishiki-Chousa).[a]

[a] All variables refer to couples (except where indicated). All of the flow variables are on a yearly basis. Standard deviations are in parentheses.

TABLE II

A Comparison of Key Variables with Other Household Surveys[a]

| | Survey of Social Security and Self Help | Family Income and Expenditure Survey (FIES) | Public Opinion Survey of Saving and Consumption (POSSC) | Survey on the Financial Asset Choice of Households (SFACH) | Family Saving Survey (FSS) | National Accounts (NA) |
|---|---|---|---|---|---|---|
| The average age of the household head | | | | | | |
| All Ages | | 51.4 | 52.2 | 50.2 | 52.0 | |
| Households with a head aged 59 or younger | 46.3 | 44.5 | 43.8 | 43.5 | 44.5 | |
| Households with a head aged 59 or younger (millions of yen) | | | | | | |
| ***CLE*** current living expenses | 3.637 | 4.197 | | 3.488 | | 6.583 |
| ***WTR*** wealth target for retirement | 53.036 | | 22.254 | 15.490 | | |
| ***FASST*** financial assets | 9.153 | | 10.823 | 10.988 | 12.795 | 26.197 |

[a] All figures pertain to 1996. The figures for *CLE, WTR,* and *FASST* refer to households with a head aged 59 or younger (except in the case of National Accounts data, in which case they refer to households of all ages).

We divide NA data by 44,830,960, the number of households as given in "All Japan Population and Households Table by the Basic Register Inhabitants" (Ministry of Home Affairs).

TABLE III

Wealth Target Equation for Retirement [a]

Dependent variable: WTR (wealth target for retirement)

| | All Households (237 observations) | | Salaried Worker Households (176 observations) | |
|---|---|---|---|---|
| Explanatory variables | (1) | (1)' | (1) | (1)' |
| ***SSW*** | 0.19578 *** | 0.18998 *** | 0.13077 | 0.14796 * |
| social security wealth | (0.06949) | (0.06899) | (0.08394) | (0.08326) |
| ***RP*** | -1.21714 *** | -2.31319 *** | -0.47911 | -2.44606 ** |
| retirement payments | (0.28889) | (0.58030) | (0.55019) | (1.01667) |
| ***HOUSE*** | -0.8415 | -3.49074 ** | -0.31880 | -6.34611 ** |
| homeownership dummy | (0.67261) | (1.39022) | (0.72601) | (2.72880) |
| ***PIR*** | 8.15627 *** | 10.71230 *** | 6.83861 *** | 11.73010 *** |
| permanent income at retirement | (1.53180) | (1.92200) | (2.42096) | (3.20699) |
| ***intercept*** | 216.10840 | 32.70259 | -17.33026 | -198.60110 |
| | (758.96100) | (757.67040) | (1016.43200) | (1007.17600) |
| ***RP*HOUSE*** | | 1.35187 ** | | 2.52192 ** |
| | | (0.62236) | | (1.10163) |
| Adjusted R-squared | 0.10250 | 0.11660 | 0.00300 | 0.02710 |
| Root-MSE | 4.32170 | 4.28750 | 4.15790 | 4.10730 |

[a] In order to alleviate the problem of heteroskedasticity, we divided the estimating equation through by PIR.
Standard errors are in parentheses.

Level of significance ***1%
**5%
*10%

Regression model $WTR=a_1*SSW+a_2*RP+a_3*HOUSE+a_4*PIR+a_5+u$ (1)

$WTR=a_1*SSW+a_2*RP+a_3*HOUSE+a_4*PIR+a_5+a_6*(RP*HOUSE)+u$ (1)'

TABLE IV
Partial Adjustment Equation for Retirement Saving (with WTR - FASST) [a]

Dependent variable: CRS (current saving for retirement)

| | All Households (237 observations) | | Salaried Worker Households (176 observations) | |
|---|---|---|---|---|
| Explanatory variables | (2) | (2)' | (2) | (2)' |
| ***WTR-FASST*** | 0.00875 *** | 0.00575 *** | 0.00803 *** | 0.00538 *** |
| | (0.00065) | (0.00078) | (0.00074) | (0.00090) |
| ***HOUSE*** | | 0.01698 * | | 0.01717 * |
| homeownership dummy | | (0.00911) | | (0.00987) |
| ***FASST*HOUSE*** | | 0.02088 *** | | 0.01718 *** |
| | | (0.00422) | | (0.00486) |
| Sigma | 0.07751 | 0.06751 | 0.06911 | 0.06127 |
| | (0.00368) | (0.00322) | (0.00381) | (0.00338) |

Dependent variable: CRS (current saving for retirement)

| | All Households (237 observations) | | Salaried Worker Households (176 observations) | |
|---|---|---|---|---|
| Explanatory variables | (3) | (3)' | (3) | (3)' |
| ***(1/(R-age))*(WTR-FASST)*** | 0.02893 *** | 0.01205 *** | 0.03453 *** | 0.01714 *** |
| | (0.00351) | (0.00319) | (0.00450) | (0.00430) |
| ***HOUSE*** | | 0.04795 *** | | 0.04044 *** |
| homeownership dummy | | (0.00823) | | (0.00886) |
| ***FASST*HOUSE*** | | 0.01518 *** | | 0.01137 ** |
| | | (0.00456) | | (0.00505) |
| Sigma | 0.09185 | 0.07312 | 0.07797 | 0.06481 |
| | (0.00434) | (0.00348) | (0.00427) | (0.00357) |

[a] We used tobit because there were 13/237 censored observations in the case of all households and 9/176 censored observation in the case of salaried worker households.
In order to alleviate the problem of heteroskedasticity, we divided the estimating equation through by PIR.
Standard errors are in parentheses.

Level of significance
***1%
**5%
*10%

Regression model

$CRS=b*(WTR\text{-}FASST)+u$ (2)

$CRS=b*(WTR\text{-}FASST)+b_3*HOUSE+b_4*(FASST*HOUSE)+u$ (2)'

$CRS=b'*(1/(R\text{-}age))*(WTR\text{-}FASST)+u$ (3)

$CRS=b'*(1/(R\text{-}age))*(WTR\text{-}FASST)+b_3*HOUSE+b_4*(FASST*HOUSE)+u$ (3)'

TABLE V

Partial Adjustment Equation for Retirement Saving (with WTR and FASST entered separately) [a]

Dependent variable: CRS (current saving for retirement)

| | All Households (237 observations) | | Salaried Worker Households (176 observations) | |
|---|---|---|---|---|
| Explanatory variables | (4) | (4)' | (4) | (4)' |
| ***WTR*** wealth target for retirement | 0.00632 *** (0.00065) | 0.00519 *** (0.00081) | 0.00602 *** (0.00073) | 0.00481 *** (0.00092) |
| ***FASST*** financial assets | 0.01742 *** (0.00337) | 0.00916 (0.00641) | 0.01514 *** (0.00367) | 0.00977 (0.00703) |
| ***HOUSE*** homeownership dummy | | 0.02095 ** (0.00914) | | 0.02101 ** (0.00987) |
| ***FASST*HOUSE*** | | 0.00614 (0.00754) | | 0.00201 (0.00847) |
| Sigma | 0.06829 (0.00326) | 0.06661 (0.00318) | 0.06165 (0.00340) | 0.06032 (0.00333) |

Dependent variable: CRS (current saving for retirement)

| | All Households (237 observations) | | Salaried Worker Households (176 observations) | |
|---|---|---|---|---|
| Explanatory variables | (5) | (5)' | (5) | (5)' |
| ***(1/(R-age))*WTR*** | 0.02405 *** (0.00435) | 0.01497 *** (0.00374) | 0.02931 *** (0.00503) | 0.01770 *** (0.00468) |
| ***(1/(R-age))*FASST*** | 0.00028 (0.01598) | -0.03346 ** (0.01485) | -0.00295 (0.01518) | -0.02139 (0.01489) |
| ***HOUSE*** homeownership dummy | | 0.04472 *** (0.00849) | | 0.03980 *** (0.00912) |
| ***FASST*HOUSE*** | | 0.01956 *** (0.00543) | | 0.01234 ** (0.00602) |
| Sigma | 0.09104 (0.00431) | 0.07282 (0.00347) | 0.07677 (0.00421) | 0.06480 (0.00357) |

[a] We used tobit because there were 13/237 censored observations in the case of all households and 9/176 censored observation in the case of salaried worker households.

In order to alleviate the problem of heteroskedasticity, we divided the estimating equation through by PIR.

Standard errors are in parentheses.

Level of significance ***1%
**5%
*10%

Regression model

$CRS=b_1*WTR-b_2*FASST+u$ (4)

$CRS=b_1*WTR-b_2*FASST+b_3*HOUSE+b_4*(FASST*HOUSE)+u$ (4)'

$CRS=b_1'*(1/(R-age))*WTR-b_2'*(1/(R-age))*FASST+u$ (5)

$CRS=b_1'*(1/(R-age))*WTR-b_2'*(1/(R-age))*FASST+b_3*HOUSE+b_4*(FASST*HOUSE)+u$ (5)'

TABLE VI
Reduced Form Equation for Retirement Saving [a]

Dependent variable: CRS (current saving for retirement)

| | All Households (237 observations) | | | | Salaried Worker Households (176 observations) | | | |
|---|---|---|---|---|---|---|---|---|
| Explanatory variables | (6) | (6-a) | (6-b) | (6-c) | (6) | (6-a) | (6-b) | (6-c) |
| ***SSW*** | 0.00138 | 0.00138 | 0.0009 | 0.0009 | 0.00042 | 0.00049 | 0.0002 | 0.0003 |
| social security wealth | (0.00108) | (0.00108) | (0.0011) | (0.0011) | (0.00121) | (0.00121) | (0.0012) | (0.0012) |
| ***RP*** | -0.01554 *** | -0.01568 * | -0.0146 *** | -0.0150 * | -0.00988 | -0.02148 | -0.0078 | -0.0135 |
| retirement payments | (0.00448) | (0.00896) | (0.0044) | (0.0088) | (0.00779) | (0.01461) | (0.0077) | (0.0148) |
| ***PIR*** | 0.09692 *** | 0.09725 *** | 0.1158 *** | 0.1168 *** | 0.07550 ** | 0.10369 ** | 0.0891 ** | 0.1023 ** |
| permanent income at retirement | (0.02456) | (0.03037) | (0.0253) | (0.0309) | (0.03478) | (0.04591) | (0.0347) | (0.0453) |
| ***FASST*** | 0.00942 ** | 0.00942 ** | -0.0084 | -0.0084 | 0.00600 | 0.00651 | -0.0118 | -0.0108 |
| financial assets | (0.00373) | (0.00373) | (0.0078) | (0.0078) | (0.00412) | (0.00415) | (0.0085) | (0.0088) |
| ***HOUSE*** | 0.00080 | 0.00046 | -0.0234 * | -0.0245 | -0.00070 | -0.03635 | -0.0229 * | -0.0394 |
| homeownership dummy | (0.01029) | (0.02142) | (0.0138) | (0.0232) | (0.01028) | (0.03938) | (0.0138) | (0.0389) |
| ***intercept*** | -12.28365 | -12.30654 | -11.1932 | -11.2632 | 2.22622 | 1.45378 | 1.8751 | 1.5150 |
| | (11.82688) | (11.89277) | (11.6616) | (11.7258) | (14.53436) | (14.52165) | (14.2986) | (14.3124) |
| ***RP*HOUSE*** | | 0.00018 | | 0.0005 | | 0.01490 | | 0.0073 |
| | | (0.00961) | | (0.0095) | | (0.01590) | | (0.0160) |
| ***FASST*HOUSE*** | | | 0.0229 ** | 0.0229 ** | | | 0.0229 ** | 0.0219 ** |
| | | | (0.0089) | (0.0089) | | | (0.0097) | (0.0099) |
| Adjusted R-squared | -0.04300 | -0.04300 | -0.0553 | -0.0553 | -0.01180 | -0.01370 | -0.0241 | -0.0245 |
| Sigma | 0.06577 | 0.06577 | 0.0648 | 0.0648 | 0.05850 | 0.05835 | 0.0575 | 0.0575 |
| | (0.00314) | (0.00314) | (0.0031) | (0.0031) | (0.0032) | (0.0032) | (0.0032) | (0.0032) |

TABLE VI (Continued)

Dependent variable: CRS (current saving for retirement)

| | All Households (237 observations) | | | | Salaried Worker Households (176 observations) | | | |
|---|---|---|---|---|---|---|---|---|
| Explanatory variables | (7) | (7-a) | (7-b) | (7-c) | (7) | (7-a) | (7-b) | (7-c) |
| ***(1/(R-age))*SSW*** | 0.00182 | 0.00280 | -0.00319 | -0.00221 | -0.00331 | -0.00436 | -0.00789 | -0.00923 |
| social security wealth | (0.00513) | (0.00510) | (0.00507) | (0.00507) | (0.00670) | (0.00689) | (0.00676) | (0.00695) |
| ***(1/(R-age))*RP*** | -0.01162 | 0.01554 | -0.00685 | 0.01438 | -0.01728 | -0.03885 | -0.02583 | -0.05211 |
| retirement payments | (0.01831) | (0.02258) | (0.01764) | (0.02178) | (0.04191) | (0.05377) | (0.04113) | (0.05280) |
| ***(1/(R-age))*PIR*** | 0.01267 | -0.04354 | 0.15133 * | 0.10139 | 0.11768 | 0.17389 | 0.25790 | 0.32796 * |
| permanent income at retirement | (0.07726) | (0.08141) | (0.08091) | (0.08593) | (0.15225) | (0.17568) | (0.15719) | (0.18016) |
| ***(1/(R-age))*FASST*** | 0.01438 | 0.01489 | -0.04521 ** | -0.04240 * | 0.00085 | 0.00127 | -0.04422 * | -0.04430 * |
| financial assets | (0.01776) | (0.01759) | (0.02192) | (0.02185) | (0.01953) | (0.01950) | (0.02497) | (0.02492) |
| ***HOUSE*** | 0.02485 *** | 0.04615 *** | -0.00643 | 0.01163 | 0.01012 | -0.00557 | -0.00941 | -0.02871 |
| homeownership dummy | (0.00963) | (0.01422) | (0.01174) | (0.01603) | (0.00953) | (0.02635) | (0.01163) | (0.02702) |
| ***intercept*** | 32.65416 *** | 31.62457 *** | 33.07947 *** | 32.25349 *** | 35.07975 *** | 35.89468 *** | 33.99640 *** | 34.97066 *** |
| | (5.71550) | (5.68461) | (5.49612) | (5.48418) | (5.72643) | (5.85721) | (5.61853) | (5.73853) |
| ***RP*HOUSE*** | | -0.01183 ** | | -0.00934 | | 0.00661 | | 0.00803 |
| | | (0.00586) | | (0.0057) | | (0.01036) | | (0.01015) |
| ***FASST*HOUSE*** | | | 0.02447 *** | 0.02348 *** | | | 0.01744 *** | 0.01767 *** |
| | | | (0.00563) | (0.00563) | | | (0.00621) | (0.00620) |
| Sigma | 0.07011 | 0.06945 | 0.06743 | 0.06699 | 0.05960 | 0.05951 | 0.05834 | 0.05821 |
| | (0.00335) | (0.00332) | (0.00322) | (0.00320) | (0.00330) | (0.00329) | (0.00322) | (0.00322) |

[a] We used tobit because there were 13/237 censored observations in the case of all households and 9/176 censored observation in the case of salaried worker households.

In order to alleviate the problem of heteroskedasticity, we divided the estimating equation through by PIR.

Standard errors are in parentheses.

Level of significance: ***1%
**5%
*10%

Regression models

$CRS=c_1*SSW+c_2*RP+c_3*PIR-c_4*FASST+c_5*HOUSE+c_6+u$ (6)

$CRS=c_1*SSW+c_2*RP+c_3*PIR-c_4*FASST+c_5*HOUSE+c_6+c_7*(RP*HOUSE)+u$ (6-a)

$CRS=c_1*SSW+c_2*RP+c_3*PIR-c_4*FASST+c_5*HOUSE+c_6+c_8*(FASST*HOUSE)+u$ (6-b)

$CRS=c_1*SSW+c_2*RP+c_3*PIR-c_4*FASST+c_5*HOUSE+c_6+c_7*(RP*HOUSE)+c_8*(FASST*HOUSE)+u$ (6-c)

$CRS=c_1'*(1/(R-age))*SSW+c_2'*(1/(R-age))*RP+c_3'*(1/(R-age))*PIR-c_4'*(1/(R-age))*FASST+c_5*HOUSE+c_6+u$ (7)

$CRS=c_1'*(1/(R-age))*SSW+c_2'*(1/(R-age))*RP+c_3'*(1/(R-age))*PIR-c_4'*(1/(R-age))*FASST+c_5*HOUSE+c_6+c_7*RP*HOUSE+u$ (7-a)

$CRS=c_1'*(1/(R-age))*SSW+c_2'*(1/(R-age))*RP+c_3'*(1/(R-age))*PIR-c_4'*(1/(R-age))*FASST+c_5*HOUSE+c_6+c_8*FASST*HOUSE+u$ (7-b)

$CRS=c_1'*(1/(R-age))*SSW+c_2'*(1/(R-age))*RP+c_3'*(1/(R-age))*PIR-c_4'*(1/(R-age))*FASST+c_5*HOUSE+c_6+c_7*RP*HOUSE+c_8*FASST+HOUSE+u$ (7-c)

# Chapter 2. Annuitized Asset Adequacy in Japan: The Demand for Individual Pensions

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# 1 Introduction

One of the main sources of income for financing living expenses after retirement is pensions. Although most people think of social security (public pensions) when they hear the word "pensions," there are other important pension systems such as employer-provided pensions (which are provided by one's employer—for example, private companies or the government) and individual pensions (which are provided by insurance companies). There are big differences among the systems: for example, participation in social security and employer-provided pension systems is compulsory and people have little or no choice about the amount of coverage, whereas participation in individual pension systems is voluntary and the individual can choose the amount of coverage. Since the rapid aging of Japan's population will necessitate drastic reforms of her social security system including sizable benefit reductions, individual pensions have begun playing a more important role as a means of providing retirement security. For example, according to the "Survey of Life Security (in Japanese, *Seikatsu Hoshou ni Kansuru Chousa*)," which was conducted by the Japan Institute of Life Insurance (in Japanese, *Seimei Hoken Bunka Sentaa*), the enrollment rate in individual pensions in Japan has increased by more than 10 percentage points during the past decade, reaching 22.5% in 2001.[1] Under such circumstances, it is more important than ever before to pay attention to the relationship between social security and individual pensions.

In this paper, I analyze the impact of social security wealth, retirement payments, and living expenses during retirement on people's retirement saving in general and individual pension holdings in particular using micro data from the 1996 "Survey of the Financial Asset Choice of Households (SFACH; in Japanese, *Kakei ni okeru Kin'yuu-Shisan-Sentaku ni kansuru Chousa*)," which was conducted in November 1996 by the Institute for Posts and Telecommunications Policy (IPTP) of what was then called the Ministry of Posts and Telecommunications of the Government of Japan.

The contributions of this paper are as follows; first, my paper is one of the first to analyze the impact of social security on individual pensions in order to make inferences about the extent to which households are

[1] Indeed, some individuals who feel uneasy about their future social security benefits refuse to enroll in public pensions (called "pension hollowing") and enroll instead in individual pensions (see Suzuki and Zhou (2000)). In Japan, the Ministry of Health, Labour and Welfare is worried about this problem and has proposed that people who refuse to enroll in public pensions and enroll instead in individual pensions should not be allowed to claim the tax deduction for individual pension contributions. See the August 25, 2000, issue of the Nihon-Keizai-Shimbun for more details.

overannuitized. As Bernheim (1991) points out, individuals would purchase individual pensions if their social security assets were less than the optimal level of their annuitized assets (i.e., if they were underannuitized), whereas they would purchase life insurance if their social security assets exceeded the optimal level of their annuitized assets (i.e., if they were overannuitized). A large number of careful studies (for example, Ohtake (1990), Chuma and Asano (1993), Chuma (1994), Iwamoto and Koie (1996b), Brown (1999), Komamura et al. (2000), and Suzuki (2001)) have been conducted on the relationship between social security and life insurance, but few have been conducted on the relationship between social security and individual pensions in spite of its importance; Asano (1998, 2001) is a rare exception. I feel that it is better to infer the degree to which households are overannuitized by analyzing the impact of social security on individual pensions for the following two reasons: first, the rapid aging of Japan's population is putting severe strains on the public pension system and has necessitated reductions in social security benefits. For example, the 1994 reforms stipulated a gradual increase in the age at which the basic pension is paid from 60 to 65, while the 1999 reforms stipulated a 5% reduction in benefits as well as a gradual increase in the age at which the earnings-related component of the benefits of salaried workers is paid from 60 to 65. Such reductions in social security benefits has increased the likelihood that Japanese households are underannuitized and increased the potential role for individual pensions. Second, life insurance is held not only for the purpose of offsetting excess social security benefits but also for the purpose of protecting the human capital of the primary breadwinner, as Brown (1999) points out. This may cause a spurious relationship between social security and life insurance, and thus it is difficult to make inferences about the degree to which households are overannuitized by looking at the impact of social security on the demand for life insurance. Brown (1999) and Suzuki (2001) restricted the sample to elderly respondents in order to avoid this problem, whereas I can avoid this problem by analyzing the impact of social security on individual pension demand because individual pensions are held only for the purpose of covering the deficiency of social security benefits.

Second, my paper is much more general than Asano (1998, 2001), the only previous analysis of this topic that uses Japanese data.[2] Asano analyzed the impact of social security not only on the demand for life insurance but also on the demand for individual pensions using the 1990 and 1994 data from the "Nikkei-

[2]Bernheim (1991) analyzed the relationship between social security and the demand for individual pensions using U.S. data, but I do not introduce his analysis here because Asano and I restricted our samples to individuals who have not yet retired, whereas Bernheim restricted his sample to retirement-age individuals, meaning that the analyses are not comparable.

Needs RADAR Survey on Financial Behavior (RADAR)," conducted by the Data Bank Bureau of Nihon Keizai Shimbun Inc., and finds that social security has a negative and significant impact on the demand for individual pensions, whereas the impact of social security on the demand for life insurance differs significantly by respondents' age. Although Asano made an important contribution by shedding light on the extent to which households are overannuitized, my paper is more general in the following respects: first, whereas Asano analyzed the impact only of social security on the demand for individual pensions, I analyze the impact not only of social security but also of living expenses during retirement and retirement payments (which are a important source of retirement income for salaried workers) on the demand for individual pensions. Second, whereas Asano uses only information on the number of children as a proxy for bequest motives, I use direct information on whether or not respondents have a bequest motive, plan to receive financial support or nursing care from their children or plan to live with their children, and the coefficients of some of these variables are highly significant. Third, whereas Asano analyzes the impact of social security only on the demand for individual pensions, I analyze the impact of social security (and other variables) not only on the demand for individual pensions but also on the wealth target for retirement. Fourth, whereas Asano presents results only for the full sample, I present results for the full sample as well as for the subsamples of salaried workers and self-employed workers and obtain dramatically different results for the two occupational groups.

To preview my main findings, I find evidence of a replacement effect of social security benefits on retirement saving for all types of households, and on individual pensions for self-employed households only (not for salaried worker households). This suggests that the social security assets of self-employed households are less than the optimal level of their annuitized assets, and that they would increase their demand for individual pensions if social security benefits were to be reduced.

This paper is organized as follows. In Section 2 I discuss theoretical considerations, in Section 3 I describe the estimation model, in Section 4 I describe the data source, variable definitions, sample selection, and estimation method, in Section 5 I present some descriptive statistics, in Section 6 I present my estimation results, and Section 7 concludes.

# 2 Theoretical Considerations and Previous Research

## 2.1 Theoretical Considerations

In this section, I introduce an optimal retirement portfolio choice model (a two-period overlapping generations model) based on Bernheim's (1991) model in order to explain the impact of social security on individual pensions and life insurance theoretically and then survey some previous studies. As discussed in the introduction, participation in social security is compulsory, and individuals cannot choose whether or not to participate or the amount of their coverage. Thus, individuals must purchase individual pensions or life insurance in order to adjust the total level of their annuitized assets; individuals can increase their holdings of annuitized assets by purchasing individual pensions, whereas they can decrease them by purchasing life insurance. I explain these relationships by using this theoretical model.

Consider an economy in which there are only two types of assets — annuitized assets ($AA \geq 0$; such as social security, employer-provided pensions, individual pensions, etc.) and bequeathable assets ($BA \geq 0$; such as financial assets, real assets, etc.). The individual decides how to allocate his/her wealth $W$ between annuitized assets and bequeathable assets in the first period as follows:

$$W = \textit{annuitized assets}(AA) + \textit{bequeathable assets}(BA)\ . \tag{1}$$

One dollar invested in annuitized assets yields a rate of return $\alpha$ $(= (1+\alpha'))$ only if the individual survives in the second period, whereas bequeathable assets yield a rate of return $\beta$ $(= (1+\beta'))$ whether or not he/she survives. The return on annuitized assets ($\alpha'$) is larger than that on bequeathable assets ($\beta'$) because the return on annuitized assets includes a mortality premium.

I can describe the individual's budget constraint in the second period as follows:

$$\begin{cases} C = \alpha AA + \beta BA & \textit{if the individual survives,} \\ B = \beta BA & \textit{otherwise.} \end{cases} \tag{2}$$

Figures 1 and 2 depict the bequest-consumption plane in the second period. The horizontal axis (the *B-axis*) measures the bequest he/she will leave if he/she dies, whereas the vertical axis (the *C-axis*) measures how much he/she will consume if he/she survives. If the individual decides to hold all of his/her wealth in bequeathable assets (that is, $AA$=0, $BA$=$W$), his/her wealth in the second period will be point $B^*$, whereas if he/she decides to hold all of his/her wealth in annuitized assets (that is, $AA=W$, $BA=0$), his/her wealth in the second period will be point $C^*$. The line $C= -\frac{\alpha-\beta}{\beta}B + \alpha W$, which goes through points $B^*$ and $C^*$, indicates all feasible combinations of bequests and consumption in the second period. I consider the following two cases: the case in which the individual has no bequest motive and the case in which the individual has a bequest motive.[3]

First, I consider the case in which the individual has no bequest motive (case 1; see Figure 1). The indifference curves are horizontal in case 1 because the individual derives utility only from his/her own consumption. I consider the following four cases: (i) neither individual pensions nor social security exist; (ii) only individual pensions exist; (iii) only social security exists; and (iv) both individual pensions and social security exist. In case (i), the individual cannot hold annuitized assets so he/she will hold all of his/her wealth in the form of bequeathable assets (that is, $AA=0$, $BA=W$), and his/her utility level will be $U_1''$ in Figure 1 ($B^*$ in Figure 1) In this case, the individual will generally end up leaving unintended bequests ($B= \beta W$). In case (ii), an individual who wishes to maximize his/her utility will hold all of his/her wealth in the form of annuities by purchasing individual pensions (that is, $AA=W$, $BA=0$); doing so will increase the individual's utility level from $U_1''$ to $U_1$ in Figure 1 ($C^*$ in Figure 1). In this case, the individual will not leave any unintended bequests at all. I turn next to case (iii), in which the government operates a compulsory social security system and collects $ss$ in social security contributions. If the rate of return on social security is the same as that on individual pensions, the budget constraint curve will not kink, and the individual's wealth in the second period will be $C = \alpha ss+\beta(W\text{-}ss)$ if he/she survives and $B= \beta(W\text{-}ss)$ otherwise ($D$ in Figure 1). If the government does not have information on the individual's optimal level of annuities or has this information but does not take it into account when setting benefit levels, the individual's utility level ($U_1'$) will generally be higher than in case (i) ($U_1''$) but lower than in case (ii) ($U_1$) because the individual will generally not leave as much in unintended bequests as in case (i) but will leave at least some unintended bequests, unlike in case (ii), because he/she does not have control over his/her level of annuitized assets, as a result of which his/her level of annuitized wealth will generally be suboptimal. I turn finally to case (iv) in which the government operates a social security system and collects $ss$ in social security contributions *and* individual have access to a private pension market. In this case, he/she will purchase individual pensions in

[3] In this paper, I presuppose a funded social security system, as done by Bernheim (1991). I also could have considered a pay-as-you-go system (PAYG) (see Yamada et al. (2001) for more details).

the amount of $(W\text{-}ss)$ in order to cover the deficiency of social security, and this will allow him/her to attain utility level $U_1$ in Figure 1 ($C^*$ in Figure 1). As in case (ii), the individual will not leave any unintended bequests at all.[4]

Second, I consider the case in which the individual has a bequest motive (case 2; see Figure 2). The individual derives utility both from his/her own consumption and from the utility of his/her children. If I assume that the utility function is quasi-concave, the indifference curves are as shown in Figure 2. I consider the same four cases as above. In case (i), the individual cannot hold annuitized assets, as discussed above, so he/she will hold only bequeathable assets and his/her utility level will be $U_2^{'''}$ in Figure 2 ($B^*$ in Figure 2). In case (ii), an individual who wishes to maximize his/her utility should achieve the optimal proportions of annuitized assets and bequeathable assets by purchasing individual pensions; doing so will increase the individual's utility level from $U_2^{'''}$ to $U_2$ in Figure 2 ($E$ in Figure 2). I turn next to case (iii), in which the government operates a compulsory social security program. In the bequest motive case, I have to consider the following two cases: the case in which the government collects $ss'$ in social security contributions (less than the individual's optimal level of annuitized assets (case (a)) and the case in which the government collects $ss''$ in social security contributions (more than the individual's optimal level of annuitized assets (case (b)). In case (a), the individual's wealth in the second period will be $C = \alpha ss' + \beta(W\text{-}ss')$ if he/she survives and $B = \beta(W\text{-}ss')$ otherwise ($F$ in Figure 2), and his/her level of utility ($U_2'$) will be lower than in the case in which individual pensions exist ($U_2$). In case (b), the individual's wealth in the second period will be $C = \alpha ss'' + \beta(W\text{-}ss'')$ if he/she survives and $B = \beta(W\text{-}ss'')$ otherwise ($G$ in Figure 2), and his/her level of utility ($U_2''$) will again be lower than in the case in which individual pensions exist ($U_2$). That is, in case (iii), the individual's utility level ($U_2', U_2''$) will generally be higher than in case (i) ($U_2^{'''}$) but lower than in case (ii) ($U_2$). Finally, I consider case (iv). If the government operates a compulsory social security

[4]Readers might feel that individual pensions are superior to social security and that there is no need for a social security system, but there might be market failure in the case of individual pensions — for example, adverse selection and moral hazard: since insurance companies do not have information on the life expectancy of insurees other than their sex and age, they have no choice but to set uniform rates for all insurees and thus individual pensions will be less than actuarially fair for unhealthy people and only healthy people will enroll (adverse selection). Moreover, if participation in individual pensions is not compulsory, low income earners will not purchase individual pensions and will instead rely on social welfare to finance their living expenses during retirement (moral hazard) (see Hatta and Oguchi (2001) for more details). I do not consider these issues here for the sake of the simplicity.

system but the level of social security contributions is $ss'$, which is less than the individual's optimal level of annuitized assets (case (a)), *and* the individual has access to individual pensions, he/she will purchase individual pensions in the amount of $(W\text{-}ss')\text{-}BA^*$ in order to cover the deficiency of social security; doing so will allow him/her to attain utility level $U_2$ in Figure 2. If the level of social security contributions is $ss''$, which is less than the individual's optimal level of annuitized assets (case (b)), the individual would like to sell individual pensions in the amount of $BA^*\text{-}(W\text{-}ss'')$ but has no individual pensions to sell. Instead, the individual will choose to eliminate the overannuitization of his/her wealth caused by excessively high social security contributions using an alternative method, such as purchasing life insurance (assuming he/she has access to life insurance), which will also allow him/her to attain utility level $U_2$ in Figure 2 ($E$ in Figure 2).[5]

Thus, the individual will purchase individual pensions if the amount of his/her social security assets is less than his/her optimal level of annuitized assets and purchase life insurance if the amount of social security assets is more than his/her optimal level of annuitized assets.[6]

## 2.2 Previous Research

Virtually all of the previous research in both the U.S. and Japan has focused on case 2-(iv)-(b). In other words, it has assumed that individuals have a strong bequest motive, that both social security and individual pensions are available, and that social security benefits exceed their optimal level (i.e., that individuals are overannuitized). If these assumptions are valid, social security should have a positive impact on the demand for life insurance, and thus studies of this type regress life insurance holdings on social security benefits. In

[5] Bernheim (1991) treated life insurance as identical to conventional assets and referred to them collectively as a bequeathable assets, but strictly speaking, this is not correct because life insurance is paid to individuals only if they die, whereas conventional assets are available whether or not the individual dies (see Yamada et al. (2001) for more details).

[6] In this theoretical model, I assume for the sake of simplicity that individuals never hold both individual pensions and life insurance because I assume that life insurance is held only for the purpose of offsetting excess social security benefits. This is an extreme assumption because life insurance is also held for a different purpose, as I explained in the introduction. As the matter of fact, the percentage of individuals who hold both individual pensions and life insurance, that of those who hold only the former, that of those who hold only the latter, and that of those who hold neither are 32.54 %, 0.48%, 60.33%, and 6.65%, in the sample I use in my analysis (421 observations), and 30.25%, 1.36%, 54.10%, and 14.29%, respectively, in the full sample excluding non-response observations (3233 observations).

the seminal study, Bernheim (1991) finds that social security benefits have a positive and significant impact on life insurance holdings and concludes that individuals are overannuitized and that the government should decrease social security benefits. By contrast, Brown (1999) finds that there is no relationship between social security benefits and life insurance holdings and concludes that individuals are not seeking to "undo" social security for bequest reasons. Many studies have been conducted on the relationship between social security and life insurance in Japan as well (see the introduction). For example, Iwamoto and Koie (1996b) conduct such an analysis using data from the 1994 RADAR and find that social security has a positive and significant impact on the demand for life insurance, which supports Bernheim's results, but that the magnitude of this effect is much smaller than expected. They also confirm the existence of a replacement effect of survivor pensions (a component of social security wealth) on the demand for life insurance. Suzuki (2001) analyzes the relationship between social security and life insurance using the SFACH (the same survey I use in my analysis) and finds that social security benefits significantly increase life insurance holdings only in the case of elderly individuals who belong to the Employees' Pension, which is consistent with Bernheim's results for all households. Thus, there is no agreement on whether or not the individuals are overannuitized in the U.S. and Japan.

In this paper, I consider the case in which the government operates a compulsory social security system but the level of contributions/benefits is less than the individual's demand for annuitized assets (corresponds to cases 1-(iv) and (2)-((iv)-(a)). In this case, the impact of social security on individual pensions should be *negative* and significant. As discussed in the introduction, the only previous studies that consider this case are Bernheim (1991) and Asano (1998, 2001).

# 3 The Estimation Model

In this section, I describe the estimation model which is based on theoretical model in Section 2.

## 3.1 Wealth Target Equation for Retirement

In the theoretical model in section 2, I assumed for the sake of simplicity that the individual's wealth is exogenous, but according to the life cycle hypothesis of Modigliani and Brumburg (1954), as extended by

Feldstein (1974), people save for life after retirement taking account of their expectations concerning their living expenses during retirement, social security benefits, retirement payments, etc. If individuals behave in accordance with this hypothesis, they will decide their wealth target for retirement ($WTR$) taking account of living expenses during retirement ($RLE$), social security wealth ($SSW$), and retirement payments ($RP$).

Thus, the estimating equation I used is as follows:

$$WTR = a_1 RLE + a_2 SSW + a_3 RP + a_4 + u \tag{3}$$

The higher living expenses during retirement are, the higher $WTR$ should be, and thus I would expect that $a_1 > 0$. If social security benefits and retirement payments are substitutes for one's own saving, $a_2 < 0$ and $a_3 < 0$, and if $SSW$ and $RP$ are perfect substitutes for one's own saving, $a_2 = -1$ and $a_3 = -1$.

In addition, people's behaviors during retirement have an impact on their wealth target for retirement, so I add the following dummy variables: $BEQ$ (a dummy variable that equals one for those who have a bequest motive and zero otherwise), $FS$ (a dummy variable that equals one for those who plan to receive financial support from their child or children and zero otherwise), $NC$ (a dummy variable that equals one for those who plan to receive nursing care from their child or children and zero otherwise), $COHBT$ (a dummy variable that equals one for those who plan to live with their child or children and zero otherwise) to this equation.[7] Also, there is a relationship between people's health condition and their wealth target

[7] I use the following question in order to analyze the relationship between the wealth target for retirement and bequests.

How do you feel about leaving a bequest (including inter vivos transfers) to your children?

1. I am planning to leave a bequest (including inter vivos transfers) no matter what.

2. I am planning to leave a bequest (including inter vivos transfers) only if my children provide care during my old age.

3. I am planning to leave a bequest (including inter vivos transfers) only if my children carry on the family line or the family business.

4. I am not planning to make special efforts to leave a bequest but will leave whatever happens to be left over.

5. It is not necessary to leave a bequest (including inter vivos transfers).

I tried adding three groups of dummy variables regarding bequests. First, I define the variable $BEQ$ that equals one for those who have a bequest motive (those who choose options 1, 2, or 3) and zero otherwise. Second, I tried adding $BEQ$ as well as another dummy variable that equals one for those who are planning to make special efforts to leave a bequest but will leave whatever happens to be left over (option 4) and zero otherwise. Third, I tried adding four dummy variables corresponding to each of the four options. I present the results only for $BEQ$ here because none of the coefficients of the other dummy variables for retirement, so I add the dummy variable $SICK$ (a dummy variable that equals one for those who are in poor health and zero otherwise) to this equation.[8]

$$\text{WTR}=\text{a}_1 RLE + a_2 SSW + a_3 RP + a_4 BEQ + a_5 FS$$
$$+a_6 NC + a_7 COHBT + a_8 SICK + a_9 + u \tag{4}$$

If individuals have a bequest motive, they need to set aside some wealth for this purpose and therefore may not be able to save up as much for retirement purposes. Thus, I would expect that $a_4 < 0$. If individuals plan to receive financial support or nursing care from one's children or to live with their children, they will decrease their wealth target for retirement because they require fewer resources of their own during retirement. Thus, I would expect that $a_5$, $a_6$, $a_7 < 0$. The sign of the coefficient of $SICK$ is ambiguous. If individuals who are in poor health believe that they will die earlier than those who are in good health, they will save less for retirement than healthy individuals ($a_8 < 0$), whereas if individuals who are in poor health believe that their medical, nursing care, and other expenses during retirement will be higher than those who are in good health, they save will more for retirement than healthy individuals ($a_8 > 0$).[9]

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were significantly different from zero.

[8]The number of respondents who have a bequest motive is 103 (34 self-employed households and 69 salaried worker households), that of those who plan to receive financial support from their child or children is 37 (15 self-employed households and 22 salaried worker households), that of those who plan to receive nursing care from their child or children is 20 (11 self-employed households and 9 salaried worker households), that of those who plan to live with their child or children is 81 (18 self-employed households and 63 salaried worker households), and that of those who are in poor health is 32 (10 self-employed households and 22 salaried worker households).

[9]I also added an interactive term RP*HOUSE (HOUSE is a dummy variable that equals one for those who own their own house and zero otherwise) to this equation because homeowners often use their lump-sum retirement payments to pay off their outstanding housing loans. If the respondent uses all or part of his/her lump-sum retirement payment to pay off his/her outstanding housing loans, the amount he/she can apply toward living expenses during retirement will be that much less and thus his/her wealth target for retirement will be that much larger. I do not present the results for RP*HOUSE here, but the coefficient of RP*HOUSE was positive and significant, as expected, when the full sample was used.

## 3.2 The Demand for Individual Pensions

As discussed in Section 2, if individual behave in accordance with the life cycle hypothesis, individuals should convert all of their assets into annuities as long as the marginal annuity pays a rate of return that is equal to or greater than that paid on conventional assets.[10]

Thus,

$$IP = b_1 WTR + b_2 \ + u \tag{5}$$

Theory implies that $b_1 = 1$ and $b_2 = 0$.

## 3.3 Reduced Form Equation for Individual Pension Demand

I can obtain a reduced form equation by substituting equation (3) into equation (4). Using this reduced form equation, not only can I analyze the relationship between social security, retirement payments, and individual pensions, I can also alleviate the simultaneously between wealth target for retirement and individual pensions.

As discussed in Section 2, if individuals behave in accordance with optimal portfolio choice theory and if retirement needs exceed the sum of social security wealth and retirement payments (case 1-(iv), and case 2-(iv)-(a) in Section 2.1), social security wealth and retirement payments should have a *negative* and significant impact on the demand for individual pensions.

That is,

[10]When one cancels an individual pension plan, one gets a lump-sum refund called a "cancellation refund," which can be regarded as the saving portion of the individual pension. For example, the amount of the cancellation refund in the case of individual pensions sold by Nippon Life Insurance Company (for those who enroll when they are between 40 and 60 years old) is 669,000 yen per one million yen if the individual cancels just before the expiration date of the contract. Previous studies have argued that I should exclude this cancellation refund from the value of the individual pension and use only the insurance portion. However, I did not control for this cancellation refund for the following two reasons: first, there is no information on the amount of the cancellation refund in the survey I used in my analysis. Second, if cancellation refunds do not differ significantly among insurance plans and insurance companies, taking account of the cancellation refund would merely entail reducing *IP* by the same proportionate amount for all respondents, and thus the estimation results would not be significantly affected.

$$IP = c_1 RLE + c_2 SSW + c_3 RP + c_4 + u, \tag{6}$$

where $c_1 = a_1 b_1 > 0$, $c_2 = a_2 b_1 < 0$, $c_3 = a_3 b_1 < 0$, and $c_4 = b_2 + a_4 b_1$.

I also add the dummy variables (*BEQ*, *FS*, *NC*, *COHBT*, *SICK*) that I used in Section 3.1 to this equation and expect the coefficients of all of these dummy variables to be negative.

$$\begin{aligned} \mathrm{IP} = {} & c_1 RLE + c_2 SSW + c_3 RP + c_4 BEQ + c_5 FS \\ & + c_6 NC + c_7 COHBT + c_8 SICK + c_9 + u \end{aligned} \tag{7}$$

# 4 The Data Source, Variable Definitions, Sample Selection, and Estimation Method

## 4.1 The Data Source

I use the micro data from the 1996 "Survey of the Financial Asset Choice of Households (SFACH) (in Japanese, *Kakei ni okeru Kin'yuu-Shisan-Sentaku ni kansuru Chousa*)" which was conducted in November 1996 by the Institute for Posts and Telecommunications Policy. This survey collects detailed information, including various information on retirement, individual pensions etc., making it ideal for the purposes of my analysis (see the introduction for more details).

In this survey, a stratified multistage random sample of 6,000 households with a head aged 20 or older from throughout Japan was surveyed by the drop-off, pick-up method, resulting in 3,695 responses (a response rate of 61.6 %).

## 4.2 Questionnaire

I use the following questions in order to analyze the estimation model which I introduced in Section 3.

1. "After the household head retires, about how much will your living expenses be per month?" (*MRLE*: Living Expenses during Retirement per month)

2. "After the household head retires, what portion of your monthly living expenses do you plan to finance using social security benefits? Indicate as a percentage of monthly living expenses during retirement." (*PSS*: Social Security Benefits Proportion)

3. "Are you enrolled in an individual pension? If so, about how much did you pay in premiums last year and what is the cumulative amount of past premiums?" (*IPL*: Last Year's Premiums; *IPC*: Cumulative Amount of Past Premiums)

4. "Are you saving for retirement? If so, about how much is your wealth target (financial assets) for retirement?" (*WTR*: Wealth Target for Retirement)

The survey also collects information on the age, annual income, marital status, educational background, planned retirement age, occupation, and firm size of the respondent and his or her spouse.

## 4.3 Variable Definitions

### 4.3.1 Conversion of Flow Data to Stock Data

As I introduced in Section 3, the estimation model which I analyze in my analysis needs stock data, whereas the survey I use collects almost entirely flow data. I thus have to convert the flow data to stock data.

**Living Expenses during Retirement (*RLE*)** I calculate the total amount of living expenses during retirement (*RLE*: a stock) from monthly living expenses during retirement (*MRLE* (question 1) : a flow) as follows:

$RLE = MRLE \times RETSPAN$, *where* $RETSPAN$ *=retirement span (in months).*[11]

[11] I use Horioka and Okui's (1999) method for estimating the retirement span. They defined retirement span (RETSPAN) as follows: RETSPAN = max [the household head's expected age at death − his planned retirement age, the spouse's expected age at death + (the household head's age − the spouse's age) − the household head's planned retirement age].

Note that the unit of analysis in the theoretical analysis in Section 2 is the individual whereas the unit of analysis in the empirical analysis is the household. The survey I use does not collect any information on the expected age at death so I use data on life expectancy at retirement from the "18th Life Tables" (Statistics and Information Department of the Minister's Secretariat of the Ministry of Health and Welfare) and add to it the respondent's planned retirement age.

**Social Security Wealth ($SSW$)** I calculate social security wealth ($SSW$: a stock) from the monthly living expenses during retirement ($MRLE$ (question 1) : a flow) and the expected social security benefit proportion ($PSS$: question 2) as follows:

$SSW = MRLE \times PSS \times RETSPAN.$

**Holdings of Individual Pensions ($IP$)** I calculate holdings of individual pensions ($IP$: a stock) from last year's premium ($IPL$ (question 3) : a flow) and the cumulative amount of past premiums ($IPL$ (question 3)) as follows:

$IP = IPL \times WRKSPAN + IPC$, *where* $WRKSPAN$*=working span (number of years from now until retirement).*

**The Estimation of Retirement Payments** There is no information on the expected amount thereof in the survey I used in my analysis, so I use Wakabayashi's (2001) method (based on that of Dicks-Mireaux and King's (1984)) in order to estimate retirement payments. In this paper, I use information not only on the firm size of respondents' employers but also on respondents' educational attainment whereas Wakabayashi (2001) used only information on the former.

## 4.4 Sample Selection

The sample I used in my analysis is as follows: first, I dropped observations for which the respondent's gender is not known. Second, I used only the subsample of married respondents because I do not know whether or not single respondents will marry in the future and because, in the questions pertaining to saving for retirement, expected social security benefits, etc., single respondents are asked to put down the amount for themselves only whereas married couples are asked to put down the total amount for the household head and spouse combined, meaning that the amounts are not comparable. Third, I am interested in how individuals prepare for their future retirement so I confine the sample to households that have not yet retired.[12] Finally, I dropped all observations for which all of the necessary information is not available. Restricting the sample

[12]I defined a household that has not yet retired as a household in which all of the following three conditions apply: first, the respondent's current age is equal to or smaller than his/her retirement age. Second, neither the respondent nor his or her spouse is receiving social security benefits. Third, the respondent answers questions directed at those who are before retirement.

to respondents who report their gender reduces the number of observations from 3,695 to 3,666, restricting the sample to respondents who are married reduces the number of observations further to 2,694, restricting the sample to respondents who are not yet retired reduces the number of observations further to 2,416 — 575 self-employed households, 1792 salaried worker households, and 49 other households,[13] and restricting the sample to respondents for whom all of the necessary information is available reduces the number of observations further to 421— 134 self-employed households and 287 salaried worker households.

I present estimation results for the full sample as well as for the subsample of self-employed households and that of salaried worker households. As discussed in the introduction, my paper is the first analysis of this topic to do so, and it is important because there are many differences by the occupation of the household head. For example, self-employed workers, farmers, etc., receive only a flat rate pension whereas salaried workers receive not only a flat rate component but also an earnings-related component, as a result of which the social security benefits of the former are much lower than those of the latter. In addition, retirement payments are paid to the latter but not to the former. Not surprisingly, therefore, many of my results (for example, those concerning the relationship between social security and individual pensions) differ significantly by the occupation of the household head, as discussed later in greater detail.

## 4.5 The Estimation Method

I use a Tobit model because there are 211 respondents (about 50%) who do not have a wealth target for retirement and 282 respondents (about 67%) who are not enrolled in an individual pension.[14]

Equations (3) and (5) include $RP$ (retirement payments). Retirement payments are paid only to salaried workers working for a private company or for the government and are not paid to self-employed workers. However, I include both salaried worker households and self-employed households in the sample in order to avoid sample selection bias and set the retirement payments of self-employed workers equal to zero.

[13] A "self-employed household" is a household whose household head is a farmer or self-employed worker, a "salaried worker household" is a household whose household head is a salaried worker working for a private company or for the government, and an "other household" is a household whose household head is a part-time worker, is not working, or does not report his/her household head's occupation.

[14] The proportions of "zero respondents" do not include respondents who did not indicate whether or not they have a wealth target for retirement nor whether or not they are enrolled in an individual pension because I limit my sample to observations for which all of the necessary information is available.

# 5 Descriptive Statistics

## 5.1 Occupational Differences

In this section, I present the main descriptive statistics broken down by the occupation of the household head and compare them with those of some well-known surveys in order to check the reliability thereof (see Tables I and II for more details).

Table I refers to the 421 households used in my analysis — 134 self-employed households and 287 salaried worker households.[15]

Looking first at the average length of the retirement span (*RETSPAN*), the average length is 23.0 years for self-employed households and 25.6 years for salaried worker households, and the length for self-employed households is 2.6 years shorter than that of salaried worker households. This is presumably because there is a mandatory retirement age system for salaried workers in most companies in Japan, whereas there is no such system for self-employed workers.

I look next at the average amount of current living expenses per month (*CLE*) and living expenses during retirement per month (*MRLE*). The average *MRLE* is about 285,000 yen for all categories of households and hardly differs by the occupation of the household head, whereas the average *CLE* is much higher for self-employed households than it is for salaried workers ( 340,200 yen vs. 305,100 yen). The average *CLE* in my survey is much lower than that in other data sources (see Table II), and one possible explanation is that the definition of living expenses is different: for example, the *CLE* used in my analysis does not include imputed rent on owner-occupied housing, as a result of which it is downward biased.

Let us now look at the average amount of social security benefits per month (*SS*) and retirement payments (*RP*). The average amount of *SS* for the household head and spouse combined is 103,400 yen for self-employed worker households and 144,000 yen for salaried worker households.[16] As can be seen from Table II, the

[15]The need to verify the reliability of the data is further heightened by the fact that I limit my analysis to observations for which all of the necessary information is available. Since this may cause sample selection bias, I check the reliability of the data in the appendix.

[16]In Japan, self-employed workers, farmers, those not working, and students are supposed to enroll in the National Pension system (in Japanese, *Kokumin Nenkin*) and receive only a flat rate pension, while salaried workers working for a private company belong to the Employees' Pension system (in Japanese, *Kousei Nenkin*) and salaried workers working for the government belong to the Mutual Aid Pension system (in Japanese, *Kyousai Nenkin*), receiving a flat rate pension — the Basic Pension

amount of $SS$ from my survey (future expected benefits; see Section 4.3) is much lower than that from the Summary of Social Security System (present benefits), and I believe that this difference is due to the following two reasons: first, social security benefits have been reduced in recent years and will be reduced further in the future and thus future expected benefits are presumably less than present benefits. Second, people may not plan to rely on social security because there is so much uncertainty about future benefit levels. Turning to $RP$, the average $RP$ for the household head and spouse combined is about 16,800,000 yen for salaried worker households, and as can be seen from Table II, this figure is broadly consistent with data from the Survey on Retirement Allowance System and Payments. In addition, the reason why the average amount of $RP$ for self-employed households is not zero is that the retirement payments of spouses who are working for a private company or for the government are included.

Finally, I look at the wealth target for retirement ($WTR$) and individual pension holdings ($IP$). Although differences by the occupation of the household head in the proportion of households with $WTR$ and $IP$ are not so large, differences in the average amounts thereof are very large. Looking first at $WTR$, the average $WTR$ is about 10,400,000 yen for self-employed worker households and 7,000,000 yen for salaried worker households. I believe that the average $WTR$ for self-employed households is much higher than that for salaried worker households for the following two reasons: first, the social security benefits of self-employed workers are much lower than those of salaried workers, and second, retirement payments are paid only to salaried workers and not to self-employed workers, as pointed out earlier. Looking next at $IP$, the enrollment rate in $IP$ is about 30% for all categories of households in my survey, but according to the SLC (Table II), it was 25.4% in 1996, which is about 5 percentage points lower than in my survey. In my analysis, I did not consider the possibility that there are some respondents who are currently not enrolled in individual pensions but who plan to enroll in the future, but I calculated the enrollment rate for individual pensions for ten-year age groups and found that the difference among age groups is not very large.[17] This suggests that there are relatively few people who enroll in an individual pension for the first time late in life. Looking finally at the

(in Japanese, *Kiso Nenkin*) — as well as an earnings-related component. Spouses of salaried workers are exempt from paying monthly contributions if their annual income is below a certain level (see Horioka (1999) for more details).

[17]The enrollment rates of those aged 20-29, 30-39, 40-49, and 50-59 are 29.17%, 29.47%, 33.12%, and 35.81%, respectively, in the sample I use in my analysis (421 observations), whereas they are 16.2%, 33.0%, 32.4%, and 31.9%, respectively, for the full sample (3695 observations).

average amount of *IP*, the average *IP* is 4,120,000 yen for self-employed households and 1,700,000 yen for salaried worker households. Thus, both *WTR* and *IP* are much higher for self-employed households than they are for salaried worker households. This is presumably because the magnitude of the deficiency in the annuitized assets of self-employed households is much larger than in the case of salaried workers.

## 5.2 Enrollment Differences

I next present descriptive statistics on the variables used in my analysis, broken down not only by the occupation of the household head but also by whether or not the household head is enrolled in an individual pension (*IP*), because I want to know whether the values of these variables (for example, living expenses during retirement) differ significantly by whether or not the individual is enrolled in an individual pension (see Table III for more details).

Looking first at *CLE* and *MRLE*, two interesting patterns emerge: first, the average *MRLE* of self-employed households is about 285,000 yen and hardly differs according to whether or not they are enrolled in an *IP*, whereas the average *MRLE* of salaried worker households who are enrolled in an *IP* is about 301,000 yen, which is 26,000 yen higher than that of those who are not enrolled in an *IP*. Second, if I compare the ratio of *MRLE* to *CLE* according to whether or not the household is enrolled in an *IP*, the impact of *IP* on this ratio differs by the occupation of the household head. In the case of self-employed households, the ratio of those who are enrolled in an *IP* is about 80% (=288,300/361,800), which is about 7 percentage points *lower* than that of those who are not enrolled in an *IP* (=283,600/328,600), whereas in the case of salaried worker households, the ratio of those who are enrolled in an *IP* is about 95% (=301,300/317,100), which is 3 percentage points ***higher*** than that of those who are not enrolled in an *IP* (=275,200/299,300). These findings suggest that self-employed households enroll in individual pensions in order to make up for the shortfall in their retirement income, whereas salaried worker households purchase individual pensions in order to make possible a higher standard of living during retirement.

Looking next at social security, the level of benefits differs by the occupation of the household head. In the case of self-employed households, the average *SS* of those who are enrolled in an *IP* is 95,800 yen, which is 11,600 yen *lower* than that of those who are not enrolled in an *IP*, whereas in the case of salaried worker households, the average *SS* of those who are enrolled in an *IP* is 159,100 yen, which is 22,300 yen *higher* than that of those who are not enrolled in an *IP*. Moreover, similar patterns can be observed in the case of the retirement payments. These results suggest that the deficiency in living expenses during retirement of self-employed households is caused by the deficiency in their annuitized assets (social security and retirement payments).

Looking finally at the amount of *WTR*, the wealth target for retirement, the average *WTR* of those who are enrolled in an *IP* is much higher than that of those who are not enrolled in an *IP* for all types of households. For example, the average *WTR* of self-employed households who are enrolled in an *IP* is 18,600,000 yen, which is about 3 times as high as that of those who are not enrolled in an *IP*. This is because respondents who are saving for retirement are more likely to enroll in an individual pension.

To summarize my findings based on descriptive statistics, I found that the reason why respondents enroll in individual pensions differs by the occupation of the household head. Salaried worker households enroll in individual pensions in order to make possible a higher standard of living during retirement, whereas self-employed households enroll in individual pensions in order to make up for the shortfall in their annuitized assets (social security and retirement payments).

# 6 Estimation Results

## 6.1 Wealth Target Equation for Retirement

In this section, I present my results concerning the determinants of the wealth target for retirement. As discussed in Section 3.1, if people behave in accordance with the life cycle hypothesis, they decide their wealth target for retirement taking account of living expenses during retirement, social security wealth, retirement payments, etc.

Table IV presents the results from estimating equations (3-a) and (3-b) using Tobit. Looking first at the results concerning the impact of *RLE* (living expenses during retirement) on *WTR* (wealth target for retirement), the coefficient of *RLE* is positive and significant in all three cases. This implies that the higher one's living expenses during retirement, the higher one's *WTR*, as expected, but the magnitude of the coefficient of *RLE* is significantly less than I expected (less than one) for all types of households.

Looking next at the replacement effect of *SSW* (social security wealth) and *RP* (retirement payments) on *WTR*, *SSW* has a negative and significant impact on *WTR*, as expected, in every case, but the coefficient of *RP* is generally positive and significant, contrary to expectation (see the conclusion for possible reason). As for the magnitude of the coefficient of *SSW*, the estimated coefficient is about -0.22 for all households, about -0.48 for self-employed households, and about -0.06 for salaried worker households and is significantly less than 1 in absolute value for all types of households, which implies that the extent to which increases in social security benefits are offset by declines in household saving is far from complete. I did a likelihood ratio test and found that the coefficients differ significantly by the occupation of the household head (the log likelihood ratio is 44.395 and 52.380, respectively, in equations (3-a) and (3-b)). In addition, the coefficients of the aforementioned variables are not sensitive to the inclusion of dummy variables (this result is the same as in the case of Section 6.3).

Finally, I discuss the coefficients of the dummy variables (*BEQ*, *FS*, *NC*, *COHBT*, *SICK*). The survey I use collects valuable information that is relevant to my analysis. For example, it collects direct information on whether or not respondents have a bequest motive and whether or not they plan to receive assistance (specifically, financial support or nursing care) from their child or children or plan to live with them, whereas previous studies (for example, Hurd (1989), Asano (1998, 2001)) use a child dummy (that equals one if the respondent has one or more children and zero otherwise) as a proxy thereof because they have no direct information on bequest motives or support from one's children. Although the coefficients of most of the dummy variables are not significantly different from zero, the coefficient of *COHBT* is negative and significant, as expected, in the case of all households and salaried worker households, meaning that those planning to live with their child/children require fewer resources of their own during retirement. In addition, the coefficient of *FS* is negative and marginally significant (its p-value is 0.111), as expected, in the case of self-employed households.

## 6.2 The Demand for Individual Pensions

In this section, I present my results concerning the demand for individual pensions. Individuals convert all of their retirement assets into annuities as long as the marginal annuity pays a rate of return that is equal to or greater than that paid on conventional assets.

Table V presents the estimation results. The coefficient of *WTR* (the wealth target for retirement) is positive and significant, as expected, in all three cases, but the magnitude of the coefficient is smaller than expected. I would expect the coefficient of $WTR$ to be 1, but the estimated coefficient is only about 0.4 for all households, about 0.5 for self-employed households, and about 0.2 for salaried worker households.

This suggests that people do not convert all of their assets into annuities but only a portion thereof. There are at least two reasons why people do not convert all of their assets into annuities: first, it could be that people do not convert all of their assets into annuities because of market imperfections (adverse selection) in private pension markets. Since insurance companies do not have information on the life expectancy of insurees, they have no choice but to set uniform rates for all insurees, and thus there is the possibility that only healthy people get a good deal from enrolling in individual pensions and that individual pensions are less than actuarially fair for unhealthy people. Second, it could be that people do not convert all of their assets into annuities because doing so reduces the usefulness of their assets (for example, it can no longer double as precautionary saving for unforeseen contingencies). Lastly, I speculate about the reason why the coefficient of $WTR$ is higher for self-employed households than it is for salaried worker households. The reason is that the annuitized assets of self-employed households are much more likely to be deficient than salaried worker households because the social security benefits of self-employed workers are much lower than those of salaried workers (there is no earnings-related component in the case of self-employed workers —see footnote 16) and because retirement payments are paid only to salaried workers and not to self-employed workers. In addition, the intercept in this model is generally negative and significant, contrary to expectation. As in Sections 6.1, I did a likelihood ratio test and found that the coefficients differ significantly by the occupation of the household head (the log likelihood ratio is 136.370 in equations (4)).

### 6.3 Reduced Form Equation for Individual Pension Demand

In this section, I discuss my estimates of the reduced form equation obtained by substituting equation (3-a) into equation (4-a) and test for the replacement effect of $SSW$ (social security wealth) and $RP$ (retirement payments) on $IP$ (individual pensions) using this reduced form equation. As discussed in cases 1-(iv) and 2-(iv)-(a) in Section 2, if people's annuitized assets (social security and retirement payments) are insufficient, they should purchase individual pensions in order to make up for the deficiency in their annuitized assets; that is, social security wealth and retirement payments should have a *negative* and significant impact on the demand for individual pensions.

Table VI presents the results from estimating equations (5-a) and (5-b) using Tobit, and looking first at the results concerning the impact of $RLE$ (living expenses during retirement) on $IP$, the coefficient of $RLE$ is positive and marginally significant, as expected, only in the case of all households, and the magnitude of this coefficient is significantly less than I expected (less than one). Looking next at the replacement effect of $SSW$ and $RP$, the coefficient of $SSW$ is negative and significant, as expected, only in the case of self-employed households and is not significant in the case of all households and salaried worker households. As for the magnitude of the coefficient of $SSW$ in the case of self-employed households, the estimated coefficient is about -0.63 and is *not* significantly different from its expected value of -1, which implies that increases in social security benefits are largely or fully offset by declines in individual pension holdings. The coefficient of $RP$ is generally positive, and sometimes significant, contrary to expectation (see Section 7 for possible reason). As in Sections 6.1 and 6.2, I also did a likelihood ratio test and found that the coefficients differ significantly by the occupation of the household head (the log likelihood ratio is 149.096 and 154.952, respectively, in equations (5-a) and (5-b)). This suggests the possibility that only self-employed households purchase individual pensions in order to make up for the deficiency in their annuitized assets and that salaried worker households are not deficient in their annuitized assets. It might even be the case that salaried worker households are overannuitized. Although the coefficients of most of the dummy variables are not significantly different from zero, the coefficient of $FS$ is negative and significant, as expected, in the case of all households.

# 7 Conclusion

In this paper, I analyzed the impact of social security wealth, retirement payments, and living expenses during retirement on people's retirement saving in general and individual pension holdings in particular using micro data from the 1996 "Survey of the Financial Asset Choice of Households," which was conducted in November 1996 by the Institute for Posts and Telecommunications Policy.

I analyzed this relationship using a two-stage model: I assume that people decide their wealth target for retirement in the first stage taking account of living expenses during retirement, social security wealth, and retirement payments. I found that the results for retirement payments are often contrary to expectation, but that the results for social security are highly significant and confirm the existence of a replacement effect of social security on saving for retirement for all types of households. I assume that people decide how much of their retirement assets to convert into individual pensions in the second stage and found that people do not convert all of their retirement assets into annuities but only a portion thereof. Finally, I analyzed the replacement effect of social security wealth and retirement payments on individual pensions using a reduced form equation derived from the first and second stages. I found that the results for social security are highly significant in the case of self-employed households but insignificant in the case of salaried worker households.

Thus, I found evidence of a replacement effect of social security on individual pensions in the case of self-employed households only. This suggests that the social security assets of self-employed households are less than their optimal level of annuitized assets and that they would increase their demand for individual pensions if social security benefits were to be reduced. Conversely, my findings that a replacement effect of social security on individual pensions does not exist in the case of salaried worker households suggests that the annuitized assets of salaried worker households are not deficient and that such households may even be overannuitized. The descriptive statistics also supports these results. Suzuki (2000) found evidence of a replacement effect of social security on life insurance in the case of salaried worker households only, which is consistent with my results because it suggests that only salaried worker households are overannuitized.

There are at least three areas for further improvement in my paper. First, I used only information on respondents' firm size and educational attainment when estimating retirement payments, even though retirement payments also depend on seniority, etc., because no information was available on the latter. This might be the reason why I could not find a replacement effect of retirement payments on retirement savings and individual pensions. However, unfortunately this problem cannot be resolved unless a different data source is used. Second, I analyzed the impact of bequest motives and of financial support and/or care from one's children during retirement on one's wealth target for retirement and individual pensions, but I could not infer the motives for such intergenerational transfers. Horioka (2002) analyzes data for the U.S. and Japan and finds that both parents and children are selfish life cyclers in both countries and that bequests are either unintended or a quid pro quo for financial support and/or care during old age. Third, I assumed that individual pensions are perfect substitutes for social security, but in reality, there are many differences between the two: individual pensions are provided by private insurance companies that might go bankrupt whereas social security is provided by the government that will never go bankrupt. In addition, social security has an income redistribution function, whereas individual pensions do not (see footnote 4 for more details on the characteristics (disadvantages) of the individual pensions). I would like to relax this assumption in my future research.

# Appendix

In this section, I discuss the reliability of the data I use in my analysis because limiting my analysis to observations for which all of the necessary information is available may have caused sample selection bias. For example, respondents who answered all of the questions may have some unique characteristics, –e.g., they may have a greater tendency to behave rationally.

I first compare the descriptive statistics for the sample for which all of the necessary information is available to those for the full sample. Table I shows the descriptive statistics for the sample of married and non-retired respondents for which all of the necessary information is available, while Table VII shows the descriptive statistics for the sample of all married non-retired respondents (2367 households —575 self-employed households and 1792 salaried worker households). Although most of the descriptive statistics in Table I are not significantly different from those in Table VII, I should note the following three patterns: first, the average age of the self-employed households in Table VII is about three years older than that in Table I, whereas that of salaried worker households is not significantly different between Tables I and VII. This means that relatively old self-employed households are underrepresented in my analysis. Second, the difference between the mean values of *WTR* and *IP* in Table I and those in Table VII are large, whereas the levels of the ownership rates of *WTR* and *IP* are broadly consistent in most cases. For example, the average amounts of individual pension premiums paid during the last year in Table VII are smaller than those in Table I for all categories of households (the amounts in Table VII are 21 percent to 36 percent smaller than those in Table I). Third, I should mention differences in the non-response rate by variable. Although the non-response rates for most the variables are less than 40 percent, the non-response rate for *WTR* is high – more than 50 percent for all categories of households. This suggests that the question concerning *WTR*, which asks about the future wealth target for retirement, may be hard to answer for many respondents. In addition, the non-response rates for most variables are higher for self-employed households than they are for salaried worker households.

I look next at the characteristics of the non-response individuals for the following key variables: *MRLE*, *PSS*, and *WTR*. I calculated non-response rates for these variables by the annual income decile of the household head (Figure 3) and by the educational attainment of the household head (Figure 4). I should note the following three patterns: first, the non-response rate for *WTR* in Figures 3 and 4 is highest among the three variables except in the case of the second and third lowest annual income deciles of the household head. This is consistent with Tables I and VII. Second, the lower the annual income of the household head, the higher the non-response rates for *MRLE* and *PSS*, whereas there is little difference in the non-response rate for *WTR* by the annual income decile of the household head. I can also see that the lower the household head's educational attainment, the higher the non-response rate in almost every case. The only exception is that the non-response rate for *WTR* of college/graduate school graduates is slightly higher than that of junior college/technical college graduates. Third, the non-response rate of respondents who did *not* report the annual income or the educational attainment of the household head is much higher than that of those who *did* report it.

## References


Asano S. (1998). Kouteki-nenkin-seido to kojin-nenkin, seimei-hoken jyuyou —1990, 1994 nendo Nikkei RADAR de-ta no bunseki {Social security system and the demand for individual pensions and life insurance — An analysis using the Nikkei RADAR data for 1990 and 1994, *Nihon Keizai Kenkyu* **26**, 83-102.

Asano S. (2001). Social security system and the demand for individual pensions and life insurance — An analysis of Japanese Microdata, 1990 and 1994, *in* "Aging issues in the United States and Japan" (S. Ogura, T.Tachibanaki, and D.A.Wise Eds.), pp.105-133, A National Bureau of Economic Research, The University of Chicago Press, Chicago and London.

Bernheim, B. D. (1991). How strong are bequest motives? Evidence based on estimates of the demand for life insurance and annuities, *Journal of Political Economy* **99**, 899-927.

Brown, J. R. (1999). Are the elderly really over-annuitized? New evidence on life insurance and bequests, *NBER working paper series*, **No. 7193**.

Chuma, H. (1994). Intended bequest motives, savings and life insurance demand, *in* "Saving and bequests" (T. Tachibanaki, Ed.), pp. 15-38. The University of Michigan Press, Michigan.

Chuma, H. and S. Asano. (1993). "Isan douki to seimei hoken juyou {Bequest motives and the demand for life insurances}", *Keizai Kenkyu* **44**, 137-148.

Dicks-Mireaux, L.-D. L., and M. A. King (1984). Portfolio composition and pension wealth: An Econometric study, *in* "Financial aspects of the United States pension system" (Z. Bodie, and J. B. Shoven, Eds.), pp.399-435, A National Bureau of Economic Research project report, The University of Chicago Press, Chicago/London.

Feldstein, M. (1974). Social security, induced retirement, and aggregate capital accumulation, *Journal of Political Economy* **82**, 905-926.

Hatta, T. and N. Oguchi (1999). "Nenkin kaikaku ron — Tsumitate-houshiki ni ikou seyo {The theory of pension reform — Change into funded system}", Nihon Keizai Shimbun sha, Tokyo.

Hayashi, F. (2000). "Econometrics", Princeton University Press, New Jersey.

Horioka, C. Y. (2001). Japan's Public Pension System in the Twenty-first Century, *in* "Japan's New Economy: Continuity and Change in the Twenty-First Century" (M. Blomstrom, B. Gangnes, and S. L. Croix, Ed.), pp.99-119. Oxford University Press Inc., New York.

Horioka, C. Y. (2002). Are the Japanese Selfish, Altruistic, or Dynastic?, *Japanese Economic Review* **53**, 26-54.

Horioka, C. Y., T. Kouno, and M. Okui (2000). Retirement saving and retirement behavior in Japan, mimeograph, Institute of Social and Economic Research, Osaka University.

Horioka, C. Y., and M. Okui (1999). A U.S.-Japan comparison of the importance and determinants of retirement saving, *Economics Letters* **65**, 365-371.

Horioka, C. Y., and W. Watanabe (1997). Why do people save? A Micro-analysis of motives for household saving in Japan. *Economic Journal* **107**, 537-552.

Hurd, M. D. (1989). Savings of the elderly and desired bequests, *American Economic Review* **77**, 365-371.

Iwamoto, Y. and Y. Koie (1996a). Setai no izou-seikou no kettei youin {Factor's Determining the bequeathing tendency of households} *in* "Kourei-ka shakai no chochiku to isan, souzoku (Saving and Bequests in an aging society)" (N. Takayama, C.Y. Horioka, and K. Ohta Eds.), pp. 226-245, Nihon Hyouron sha, Tokyo.

Iwamoto, Y. and Y. Koie (1996b). Izou-kanou-shisan no chousei-koudou to seimei-hoken jyuyou {The adjustment behavior for bequeathable assets and the demand for life insurance} *in* "Koureika shakai no chochiku to isan, souzoku (Saving and Bequests in an aging society)" (N. Takayama, C.Y. Horioka, and K. Ohta Eds.), pp. 247-262, Nihon Hyouron sha, Tokyo.

King, M. A. and Dicks-Mireaux, L.-D. L. (1982). Asset holding and the life-cycle, *Economic Journal* **92**, 247-267.

Komamura, K., T. Shibuya, and F. Urata (2000). "Nenkin to kakei no keizai-bunseki {An economic analysis of pensions and households}", Touyou Keizai Shinpou sha, Tokyo.

Maddala, G.S. (1983). "Limited dependent and qualitative variables in econometrics", Cambridge University Press, Cambridge.

Modigliani, F., and R. E. Brumberg (1954). Utility analysis and the consumption function: An Interpretation of cross-section data, *in* "Post Keynesian Economics" (K. K. Kurihara, Ed.), pp. 388-436. Rutgers University Press, New Brunswick.

Nissei Kiso Kenkyuusho (2001). "Seimei hoken no chishiki —shinpan {Life insurance Information —New Edition", Nihon keizai shimbun sha, Tokyo.

Ohtake, F. (1990). Kouteki-nenkin-shisan to kakei no shisan-sentaku-koudou {Social security assets and households portfolio choice} *in* "Jinkou no koureika to chochiku, shisan-sentaku" (Chochiku keizai kenkyu senta- Ed.), pp. 99-131, Gyousei, Tokyo.

Suzuki, W. (2001). Kousei nenkin, Kyousai nenkin no kyuuhu suijun ha kajou ka? —Nenkin sousai moderu wo mochiita kenshou {Are the elderly over-annuitized in Japanese public pension system? An empirical analysis using an annuity offset model}, *Kikan Shakai Hoshou Kenkyu*, **37**, 183-195.

Suzuki, W. and Y. Zhou (2000). Kokumin nenkin mikanyuu sha no keizai bunseki {An economic analysis of the individuals who are not enrolled in the National Pension system}, *Nihon Keizai Kenkyu, 42*, 44-60.

Yaari, M. E. (1965). Uncertain lifetime, life insurance, and the theory of the consumer, *Review of Economic Studies* 32, 137-150.

Yamada, K., C. Y. Horioka, and M.Wakabayashi (2001). Comment on "How Strong Are Bequest

Motives? Evidence Based on Estimates of the Demand for Life Insurance and Annuities," mimeograph, Institute of Social and Economic Research, Osaka University.

Wakabayashi M. (2001). Retirement saving in Japan: with emphasis on the impact of social security and retirement payments, *Journal of the Japanese and International Economies* **15**, 131-159.

# Data Sources

Chochiku Kouhou Chuuou Iinkai (The Central Council for Savings Information, Secretariat: Public Relations Department, Bank of Japan) (1996). "Chochiku to shouhi ni kansuru seron chousa (Public opinion survey of savings and consumption)", 1996 edition, Tokyo.

Kousei-shou Daijin Kanbou Toukei Jouhou-bu (Statistics and Information Department of the Minister's Secretariat of the Ministry of Health and Welfare), "Dai 18 kai seimei hyou (18th Life Tables)", 1996 edition, Tokyo.

Kyuuyo-kankei Hourei Kenkyuukai (Study Group on Salary-related Laws and Ordinances), "Koumuin kyuuyo binran" {Public servant's salary handbook}, Zaidan-houjin Ookura Zaimu Kyoukai, 1999 edition, Tokyo.

Roudou-shou Daijin Kanbou Seisaku Chousa-bu (Policy Planning and Research Department, Minister's Secretariat, Ministry of Labour, Government of Japan), (1998). "Taishokukinseido shikyuu jittai chousa houkoku (Survey on retirement allowance system and payments)", 1997 edition, Tokyo.

Roudou-shou Daijin Kanbou Seisaku Chousa-bu (Policy Planning and Research Department, Minister's Secretariat, Ministry of Labour, Government of Japan), (1996). "Chingin sensasu (Wage census)", Roudou Hourei Kyokai, 1995 edition, Tokyo.

Seimei Hoken Bunka Sentaa (Japan Institute of Life Insurance). "Seimei-hoken fakuto bukku (Life insurance fact book)", 2000 edition, Tokyo.

Seimei Hoken Bunka Sentaa (Japan Institute of Life Insurance). "Seikatsu hosho ni kansuru chousa (Survey of life security)", 2001 edition, Tokyo.

Soumu-chou Toukei-kyoku (Statistics Bureau, Management and Coordination Agency, Government of Japan), (1997). "Chochiku doukou chousa houkoku" (Family saving survey), 1996 edition,Tokyo.

Soumu-chou Toukei-kyoku Toukei-senta (Statistics Bureau & Statistics Center, Management and Coordination Agency, Government of Japan) (1997). "Kakei chousa" (Family Income and Expenditure Survey), 1996 edition, Tokyo.

TABLE I
Descriptive Statistics (Means and Standard Deviations)[a]

| | All Households | Self-employed Households | Salaried Worker Households |
|---|---|---|---|
| Number of observations | 421 | 134 | 287 |
| Husband's Age | 45.029 | 45.873 | 44.634 |
| | (8.927) | (9.446) | (8.663) |
| Spouse's Age | 42.586 | 43.632 | 42.101 |
| | (8.693) | (9.161) | (8.439) |
| Number of homeowners | 281 | 87 | 194 |
| (years) | | | |
| *RETSPAN* | 24.737 | 22.962 | 25.566 |
| (retirement span) | (5.304) | (6.483) | (4.427) |
| *Variables* | | | |
| (millions of yen) | | | |
| *CLE* | 31.600 | 34.023 | 30.507 |
| current living expenses per month | (10.748) | (13.234) | (9.237) |
| *RLE* | 8451.405 | 7937.927 | 8691.147 |
| living expenses during retirement (stock) | (3214.325) | (3634.463) | (2974.675) |
| *MRLE* | 28.413 | 28.522 | 28.362 |
| living expenses during retirement per month | (8.760) | (9.112) | (8.606) |
| *SSW* | 3935.553 | 2891.318 | 4423.106 |
| social security wealth (stock) | (2338.424) | (2074.819) | (2297.588) |
| *SS* | 13.111 | 10.345 | 14.402 |
| social security benefits per month | (7.145) | (6.260) | (7.175) |
| *PSS* | 0.471 | 0.372 | 0.517 |
| proportion of the SS on MRLE | (0.219) | (0.197) | (0.214) |
| *RP* | 1153.444 | 32.806 | 1676.669 |
| retirement payments | (1090.435) | (132.793) | (935.328) |
| *Husband's RP* | 969.414 | 0.000 | 1422.032 |
| | (863.088) | (0.000) | (669.366) |
| *Spouse's RP* | 184.030 | 32.806 | 254.637 |
| | (442.009) | (132.793) | (512.828) |
| Number of respondents who are setting up *WTR* | 210 | 66 | 144 |
| Ownership ratio | 0.499 | 0.492 | 0.502 |
| *WTR* | 808.470 | 1043.134 | 698.906 |
| wealth target for retirement | (1585.520) | (2145.257) | (1230.328) |
| Number of respondents who are holding *IP* | 139 | 46 | 93 |
| Ownership ratio | 0.330 | 0.343 | 0.324 |
| *IP* | 247.067 | 412.090 | 170.017 |
| individual pension (stock) | (1442.002) | (2476.946) | (426.371) |
| *last year's premium of IP* | 14.297 | 25.858 | 8.899 |
| | (72.128) | (122.438) | (24.017) |
| *conventional total amount of IP* | 70.430 | 112.515 | 50.780 |
| | (172.891) | (247.547) | (119.087) |

[a] *Source:* The 1996 "Survey on the Financial Asset Choice of Households (SFACH)".
All variables refer to couples (except where indicated). Standard deviations are in parentheses.

**Table II: A Comparison of Key Variables with Other Household Surveys**

| | Survey of Financial Asset Choice of Households (SFACH) 1996 | Family Income and Expenditure Survey (FIES) 1994 | Public Opinion Survey of Saving and Consumption (POSSC) | Family Saving Survey (FSS) 1996 | Summary of the Social Security System (SSSS) 1996 | iurvey on Retirement Allowanc System and Payments (SRASP) 1997 | Survey of Life Insurance (SLC) 1996 |
|---|---|---|---|---|---|---|---|
| The average age of the household head | 45.0 | 44.5 | 43.8 | 44.5 | | | |
| (tens of thousands of yen) *CLE* current living expenses | 31.60 | 41.97 | | 35.58 | | | |
| *MRLE* living expenses during retirement per month | 28.41 | | | 29.328※ | | | |
| *SS* social security benefits per month | 13.11 | | | | | | |
| Self-employed households' *SS* (per couple) | 10.35 | | | | 9.20 | | |
| Salaried households' *SS* (per couple) | 14.40 | | | | 21.600※※ | | |
| Salaried household head's *RP* retirement payments | 1422.03 | | | | | 1926.00 | |
| *WTR* wealth target for retirement | 808.47 | | 2225.40 | | | | |
| *IP* enrollment rate in individual pensions (%) | 36.74 | | | | | | 25.40 |

The figure for all variables expect *MRLE* refer to households with a head aged 59 or younger.
※ The amount refers to households with a head aged 60 or older.
※※per household head and housewife combined.

TABLE III

Descriptive Statistics by Household Type and Individual Pension Status (Means and Standard Deviations)[a]

| | All Households | | Self-employed Households | | Salaried Worker Households | |
|---|---|---|---|---|---|---|
| | Holderes of individual pensions | Non-holders of individual pensions | Holderes of individual pensions | Non-holders of individual pensions | Holderes of individual pensions | Non-holders of individual pensions |
| Number of observations | 139 | 282 | 46 | 88 | 93 | 194 |
| Husband's Age | 45.70 | 44.70 | 48.48 | 44.51 | 44.32 | 44.78 |
| | (8.88) | (8.95) | (8.47) | (9.69) | (8.80) | (8.62) |
| Spouse's Age | 43.55 | 42.11 | 46.57 | 42.08 | 42.06 | 42.12 |
| | (8.75) | (8.64) | (8.42) | (9.20) | (8.57) | (8.40) |
| Number of homeowners | 102 | 179 | 36 | 51 | 66 | 128 |
| *Variables* | | | | | | |
| (years) | | | | | | |
| *RETSPAN* | 24.50 | 24.85 | 22.70 | 23.10 | 25.39 | 25.65 |
| retirement span | (4.98) | (5.46) | (6.21) | (6.65) | (3.99) | (4.63) |
| (ten thousands of yen) | | | | | | |
| *CLE* | 33.18 | 30.81 | 36.18 | 32.86 | 31.71 | 29.93 |
| current living expenses per month | (11.60) | (10.23) | (14.65) | (12.34) | (9.52) | (9.07) |
| *RLE* | 8722.82 | 8317.62 | 7856.58 | 7980.45 | 9151.28 | 8470.57 |
| living expenses during retirement (stock) | (3199.93) | (3218.64) | (3251.60) | (3836.60) | (3102.74) | (2893.55) |
| *MRLE* | 29.70 | 27.78 | 28.83 | 28.36 | 30.13 | 27.52 |
| living expenses during retirement per month | (9.13) | (8.52) | (9.09) | (9.17) | (9.17) | (8.21) |
| *SSW* | 4079.25 | 3864.72 | 2547.37 | 3071.11 | 4836.96 | 4224.71 |
| social security wealth (stock) | (2307.25) | (2354.48) | (1609.75) | (2268.36) | (2227.99) | (2309.61) |
| *SS* | 13.82 | 12.76 | 9.58 | 10.74 | 15.91 | 13.68 |
| social security benefits per month | (7.17) | (7.12) | (5.82) | (6.47) | (6.86) | (7.23) |
| *PSS* | 0.48 | 0.47 | 0.34 | 0.39 | 0.54 | 0.50 |
| proportion of the SS on the MRLE | (0.22) | (0.22) | (0.18) | (0.21) | (0.20) | (0.22) |
| *RP* | 1292.89 | 1084.71 | 26.22 | 36.25 | 1919.41 | 1560.30 |
| retirement payments | (1244.79) | (1000.95) | (104.93) | (145.70) | (1058.22) | (848.87) |
| *Husband's RP* | 1042.64 | 933.32 | 0.00 | 0.00 | 1558.35 | 1356.68 |
| | (940.84) | (821.42) | (0.00) | (0.00) | (717.89) | (636.42) |
| *Spouse's RP* | 250.25 | 151.39 | 26.22 | 36.25 | 361.06 | 203.62 |
| | (531.98) | (387.03) | (104.93) | (145.70) | (617.75) | (446.92) |
| Number of respondents who are setting up WTR | 92 | 118 | 32 | 34 | 60 | 84 |
| Ownership ratio | 0.66 | 0.42 | 0.70 | 0.39 | 0.65 | 0.43 |
| *WTR* | 1311.63 | 560.46 | 1862.61 | 614.77 | 1039.10 | 535.82 |
| wealth target for retirement | (2271.04) | (1018.59) | (3155.43) | (1159.62) | (1624.62) | (949.98) |
| *IP* | 748.31 | 0.00 | 1200.44 | 0.00 | 524.68 | 0.00 |
| individual pension (stock) | (2439.41) | (0.00) | (4143.15) | (0.00) | (614.03) | (0.00) |
| *last year's premium of IP* | 43.30 | 0.00 | 75.33 | 0.00 | 27.46 | 0.00 |
| | (120.70) | (0.00) | (201.24) | (0.00) | (35.75) | (0.00) |
| *total amount of IP* | 213.32 | 0.00 | 327.76 | 0.00 | 156.71 | 0.00 |
| | (245.50) | (0.00) | (330.15) | (0.00) | (165.25) | (0.00) |

[a] *Source:* The 1996 "Survey on the Financial Asset Choice of Households (SFACH)".
All variables refer to couples (except where indicated). Standard deviations are in parentheses.

**Table IV: Wealth Target Equation for Retirement**

**Dependent variable *WTR* (wealth target for retirement)**

| | All households | | Self-employed households | | Salaried worker households | |
|---|---|---|---|---|---|---|
| Explanatory variables | | | | | | |
| ***RLE*** | 0.17 *** | 0.17 *** | 0.29 *** | 0.28 ** | 0.083 * | 0.079 |
| living expenses during retirement | (0.05) | (0.05) | (0.11) | (0.11) | (0.05) | (0.05) |
| ***SSW*** | -0.22 *** | -0.22 *** | -0.48 ** | -0.51 ** | -0.063 * | -0.063 * |
| social security wealth | (0.07) | (0.07) | (0.20) | (0.20) | (0.03) | (0.03) |
| ***RP*** | 0.249 * | 0.265 ** | -4.18 | -4.32 | 0.58 *** | 0.59 *** |
| retirement payments | (0.13) | (0.13) | (3.00) | (3.11) | (0.14) | (0.14) |
| ***BEQ*** | | 152.758 | | 351.92 | | -87.29 |
| bequest motive dummy | | (326.17) | | (756.29) | | (302.18) |
| ***FS*** | | -384.21 | | -2486.17 | | 875.67 |
| financial support dummy | | (698.59) | | (1547.40) | | (708.93) |
| ***NC*** | | 605.21 | | 780.07 | | 721.76 |
| nursing care dummy | | (473.91) | | (1081.92) | | (450.84) |
| ***COHBT*** | | -627.64 * | | 373.84 | | -615.68 * |
| cohabitation dummy | | (359.84) | | (970.60) | | (316.82) |
| ***SICK*** | | -0.16 | | 534.97 | | -326.95 |
| sick dummy | | (520.36) | | (1215.80) | | (481.62) |
| ***intercept*** | -1153.78 *** | -1106.02 ** | -1235.50 | -1128.31 | -1533.49 *** | -1423.70 *** |
| | (402.92) | (431.65) | (803.76) | (909.53) | (429.66) | (442.97) |
| Log Likelihood | -2078.57 | -2076.04 | -671.27 | -669.36 | -1385.10 | -1380.49 |
| Number of Observations | 421 | 421 | 134 | 134 | 287 | 287 |
| Number of Zero Observations | 211 | 211 | 68 | 68 | 143 | 143 |

Regression model $WTR = a_1 RLE + a_2 SSW + a_3 RP + a_4 + u$ (3-a)

$WTR = a_1 RLE + a_2 SSW + a_3 RP + a_4 BEQ + a_5 FS + a_6 NC + a_7 COR + a_8 HLTH + a_9 + u$ (3-b)

The log likelihood ratio is 44.40 and 52.38, respectively, in equations (3-a) and (3-b)

The level of significance at 1% is ***, 5% is **, and 10% is *.

Standard errors are in parentheses.

**Table V: The Demand for Individual Pensions**

**Dependent variable *IP* (individual pensions)**

| | **All households** | **Self-employed households** | **Salaried worker households** |
|---|---|---|---|
| Explanatory variables | | | |
| ***WTR*** | 0.38 *** | 0.49 ** | 0.20 *** |
| wealth target for retirement | (0.09) | (0.20) | (0.05) |
| ***intercept*** | -2079.00 *** | -3408.94 *** | -597.14 *** |
| | (239.35) | (696.87) | (98.27) |
| Log Likelihood | -1412.87 | -488.40 | -856.29 |
| Number of Observations | 421 | 134 | 287 |
| Number of Zero Observatio | 282 | 88 | 194 |

Regression model $IP=b_1 WTR+b_2+u$

The log likelihood ratio is 136.37 in equations (4).
The level of significance at 1% is ***, 5% is **, and 10% is *.
Standard errors are in parentheses.

**Table VI : Reduced Form Equation for Individual Pension Demand**

**Dependent variable *IP* (individual pension holdings)**

| | **All households** | | **Self-employed households** | | **Salaried worker households** | |
|---|---|---|---|---|---|---|
| Explanatory variables | | | | | | |
| ***RLE*** | 0.10 * | 0.09 | 0.23 | 0.20 | 0.03 | 0.03 |
| living expenses during retirement | (0.06) | (0.06) | (0.17) | (0.18) | (0.03) | (0.03) |
| ***SSW*** | -0.11 | -0.11 | -0.63 * | -0.68 * | 0.00 | 0.01 |
| social security wealth | (0.09) | (0.09) | (0.33) | (0.35) | (0.03) | (0.03) |
| ***RP*** | 0.13 | 0.09 | -0.91 | -0.22 | 0.22 *** | 0.20 *** |
| retirement payments | (0.16) | (0.16) | (4.24) | (4.32) | (0.07) | (0.07) |
| ***BEQ*** | | -134.41 | | 671.37 | | -233.73 |
| bequest motive dummy | | (402.55) | | (1148.10) | | (163.95) |
| ***FS*** | | -2997.69 ** | | -4074.90 | | |
| financial support dummy | | 1373.56 | | 2785.53 | | |
| ***NC*** | | 372.72 | | -519.97 | | 263.64 |
| nursing care dummy | | (589.79) | | (1785.96) | | (235.05) |
| ***COHBT*** | | 171.54 | | 818.31 | | 127.96 |
| cohabitation dummy | | (421.99) | | (1485.16) | | (156.74) |
| ***SICK*** | | 394.63 | | 1223.30 | | 91.03 |
| sick dummy | | (617.87) | | (1777.90) | | (250.28) |
| ***intercept*** | -2343.49 *** | -2179.64 *** | -2828.00 ** | -2586.77 * | -1096.37 *** | -1063.22 *** |
| | (508.83) | (546.26) | (1283.98) | (1451.13) | (234.39) | (244.23) |
| Log Likelihood | -1423.97 | -1420.21 | -491.57 | -489.49 | -857.85 | -853.25 |
| Number of Observations | 421 | 421 | 134 | 134 | 287 | 287 |
| Number of Zero Observations | 282 | 282 | 88 | 88 | 194 | 194 |

Regression model $IP = c_1 RLE + c_2 SSW + c\, IP = c_1 {*} RLE + c_2 {*} SSW + c_3 {*} RP + c_4 + u$ (5-a)

$IP = c_1 RLE + c_2 SSW + c_3 RP + c_4 BEQ + c_5 FS + c_6 NC + c_7 COR + c_8 HLTH + c_9 + u$ (5-b)

The log likelihood ratio is 149.10 and 154.95, respectively, in equations (5-a) and (5-b).

The level of significance at 1% is ***, 5% is **, and 10% is *.

Standard errors are in parentheses.

I could not calculate the standard errors of FS in the case of salaried worker households because all salaried worker households who are enrolled in individual pensions do not plan to receive financial support from their chil

Table VII : Descriptive Statistics and non-response rate by Household Type [a]

| | All households (No. of Obs. 2367) | | Self-employed households (No. of Obs. 575) | | Salaried worker households (No. of Obs. 1792) | |
|---|---|---|---|---|---|---|
| | Means (Standard Deviations) | Number of non-response observation non-response rate | Means (Standard Deviations) | Number of non-response observation non-response rate | Means (Standard Deviations) | Number of non-response observations non-response rate |
| Household head's age | 45.692 | 1 | 49.106 | 0 | 44.596 | 1 |
| | (10.116) | 0.000 | (10.012) | 0.000 | (9.905) | 0.001 |
| Spouse's age | 42.982 | 16 | 46.379 | 7 | 41.900 | 9 |
| | (9.877) | 0.007 | (9.807) | 0.012 | (9.654) | 0.005 |
| *CLE* | 30.642 | 110 | 33.696 | 33 | 29.677 | 77 |
| current living expenses per month | (11.376) | 0.046 | (14.326) | 0.057 | (10.084) | 0.043 |
| *MRLE* | 28.234 | 511 | 28.826 | 150 | 28.058 | 361 |
| living expenses during retirement per month | (8.872) | 0.216 | (10.209) | 0.261 | (8.430) | 0.201 |
| *PSS* | 0.479 | 904 | 0.390 | 235 | 0.505 | 669 |
| proportion of the SS on the MRLE | (0.215) | 0.382 | (0.203) | 0.409 | (0.211) | 0.373 |
| Number of respondents who have *WTR* | 879 | 627 | 223 | 175 | 656 | 452 |
| Ownership ratio | 0.505 | 0.265 | 0.656 | 0.304 | 0.490 | 0.252 |
| *WTR* | 825.292 | 1166 | 1372.622 | 308 | 668.829 | 858 |
| | (3244.621) | 0.493 | (6356.690) | 0.536 | (1381.951) | 0.479 |
| Number of respondents who have *IP* | 780 | 244 | 203 | 65 | 577 | 179 |
| Ownership ratio | 0.367 | 0.103 | 0.398 | 0.113 | 0.358 | 0.100 |
| last year's *IP* premiums | 9.196 | 506 | 16.137 | 137 | 7.060 | 369 |
| | (43.590) | 0.214 | (76.069) | 0.238 | (26.224) | 0.206 |
| cumulative amount of past *IP* premiums | 51.361 | 556 | 80.720 | 150 | 42.359 | 406 |
| | (156.461) | 0.235 | (207.752) | 0.261 | (135.768) | 0.227 |

[a] *Source:* The 1996 "Survey on the Financial Asset Choice of Households (SFACH)."
All variables refer to couples (except where indicated). Standard deviations are in parentheses.
All variables are in units of tens of thousands of yen except where indicated.

Figure 1: Individual without a Bequest Motive

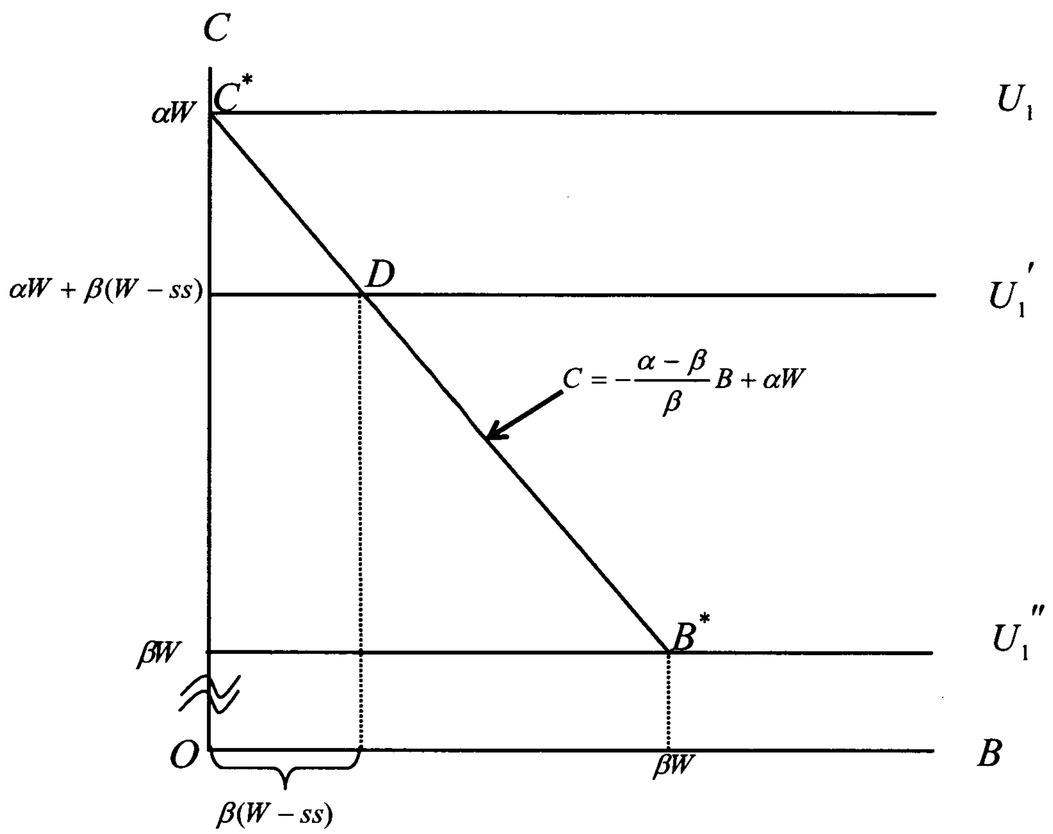
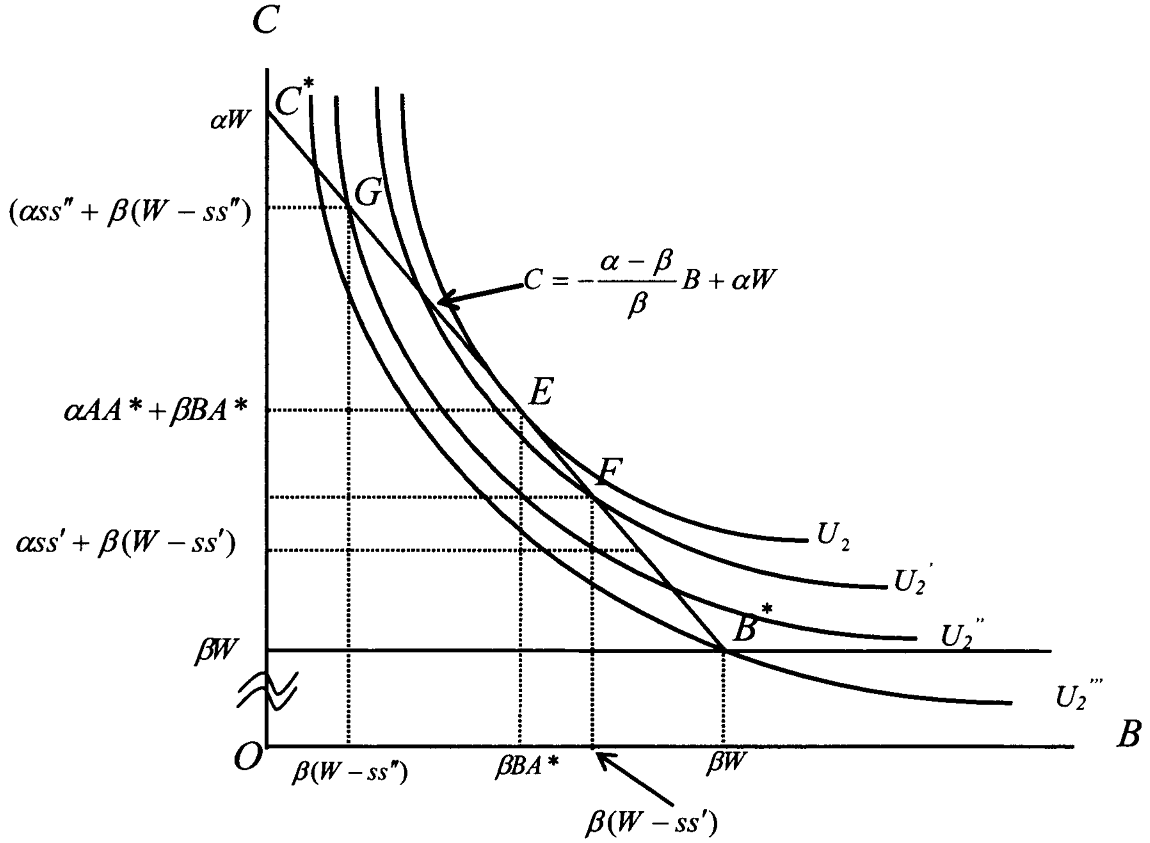


Figure 2: Individual with a Bequest Motive



# Chapter 3. Retirement Consumption Puzzle in Japan

Midori Wakabayashi*

Journal of Economic Literature Classification Numbers: D1, D12, D91, E21

Keywords: Consumption; Saving; Retirement; Discontinuity; Living expenses; Public pension; Social security; Retirement payments; Life cycle

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## INTRODUCTION

According to the simplest life cycle model, consumption should be smoothed throughout one's lifetime, and in particular, there should be no change in consumption after retirement, but most previous empirical studies have found that consumption is, in fact, lower after retirement than it is before retirement, and this is called the "retirement consumption puzzle."

There are at least four explanations for the decline in consumption after retirement, three of which are consistent with the life cycle model and one of which is not. First, it could be that consumption (living expenses) declines after retirement because parents cohabit with and support their child or children during their working years but that their child or children become financially independent and live separately from them after they retire. Second, it could be that consumption declines after retirement because working households incur work-related expenses whereas retired households do not. On the contrary, leisure-related expenses might change after retirement because retired households can spend more time on leisure than working households: leisure-related expenses will decline if consumption and leisure are substitutes, whereas they will increase if consumption and leisure are complements. Third, it could be that there are some individuals who are forced to decrease their consumption after retirement because they faced unexpected events before retirement, as a result of which they could not save a sufficient amount for retirement: for example, individuals might be forced to retire earlier than planned or individuals might learn of a decline in their expected retirement income just before retirement. Fourth, it could be that there are some individuals who are forced to decrease their consumption after retirement even though they did not experience any unexpected shocks. One example is individuals who did not save a sufficient amount for retirement because they are myopic or because they did not have sufficient will power.

Most previous studies (except Kotlikoff et al. (1982)) cannot fully explain why consumption after retirement is lower than that before retirement using the life cycle model. For example, Hamermesh (1984) analyzes the relationship between consumption and lifetime wealth using data from the 1973-75 Retirement History Survey and the 1972-73 Consumer Expenditure Survey (both of which are U.S. data) and obtains two interesting findings: first, the resources available to retirees are insufficient to allow them to sustain the level of real consumption enjoyed early in their retirement. Second, they respond to this insufficiency by reducing their real consumption as they get older. [1] Robb and Burbridge (1989) also analyze this relationship by respondents' occupation using data from the 1979-85 Canadian Family Expenditure Survey and find that, among Canadians, consumption at retirement falls more sharply for blue-collar workers than for white collar workers. This is inconsistent with the life cycle model because it is often said that white collar workers incur more work-related expenses during their working years than blue collar workers. Banks et al. (1998) examine whether individuals' consumption declines at retirement using data from the 1968-92 Family Expenditure Survey (British data). They find that consumption falls if the household head retires, so they control for labor-market participation (by comparing the consumption of retirees and that of the unemployed) and find that they can explain part, but not all, of this decline. Bernheim et al. (2001) analyze the relationship between accumulated wealth and the shape of the consumption profile using data from the 1978-90 Panel Study of Income Dynamics and the Consumer Expenditure Survey (CEX) (both U.S. data) and find that a pronounced discontinuity in consumption at retirement, with the size of the discontinuity negatively correlated with retirement savings and income

[1] Kotlikoff et al. (1982) examine how adequately people save for retirement using data from the 1969-73 Retirement History Survey. They find that there is currently no systematic problem of undersaving among the elderly population, and this is consistent with the life cycle model. On the other hand, this result is contrary to the result of Hamermesh even though they use the same data source. This is because they use different estimation models.

replacement rates. These findings are difficult to interpret in the context of the life cycle model but consistent with "rule of thumb," "mental accounting," or hyperbolic discounting theories of wealth accumulation. Miniaci et al. (2002) examine how the consumption of different goods varies with age and with retirement using data from the 1985-96 Italian Survey on Family Budgets (large repeated cross sections data set). They find that total non-durable consumption decreases at retirement, and this result is similar to those found in the U.S. and other developed countries. They control for family size because the proportion of extended families is very high in Italy, but the results do not change.

In this paper, I examine the reasons why individual's average consumption after retirement is lower than that before retirement using micro data from the 1996 "Survey of the Financial Asset Choice of Households (SFACH; in Japanese, Kakei ni Okeru Kin'yuu Shisan Sentaku ni kansuru Chousa)," which was conducted in November 1996 by the Institute for Posts and Telecommunications Policy (IPTP) of what was then called the Ministry of Posts and Telecommunications of the Government of Japan.

The contributions of this paper are as follows: first, my paper is the first to analyze the reasons why consumption after retirement is lower than that before retirement using Japanese data. Second, my analysis shows the virtues of using cross section data. As I discussed above, most previous studies analyze consumption changes after retirement using panel data. Although using panel data has the advantage of being able to observe "actual" consumption changes or "actual" income changes after retirement, there are at least two defects with such data:[2] first, it is not possible to distinguish between those who retired as planned and those who retired earlier than planned. Second, the amount of consumption *just* after retirement is

[2] Some previous studies (Banks et al (1998) and Bernheim et al. (2001)) tried to avoid this problem.

presumably much higher than the average amount of consumption after retirement because individuals who have just retired incur considerable extraordinary expenses, -- for example, taxes or the repayment of outstanding loans.[3] It is possible to circumvent the second problem by using a long span of panel data but such data are seldom available. On the other hand, the data I use in my analysis is from a cross section survey that collects a variety of data including detailed information on respondents' retirement plans -- for example, their planned retirement age, their planned living expenses during retirement, their expected social security benefits during retirement, etc. By analyzing these data on expectations, I can circumvent the aforementioned problems of not being able to distinguish between those retiring as planned and those retiring earlier than planned and of not being able to observe the average amount of consumption after retirement.[4]

My results suggest that average consumption after retirement is lower than that before retirement because both family size and work-related expenses decrease after retirement. Both of these reasons are consistent with the life cycle model. In addition, in almost every case, respondents smooth their consumption even if their income declines after retirement, and only individuals who are near retirement plan to respond to the decline in their income after retirement by reducing their consumption after retirement.

This paper organized as follows: in Section 2, I describe the data source, variable definitions and calculation method, in Section 3, I present some descriptive statistics, in Section 4, I present the estimation model and estimation method and present my estimation results, and Section 5

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[3] Bernheim et al. (2001) also point out that households with lower income replacement rates show much steeper declines in consumption at retirement than households with higher income replacement rates.

[4] When analyzing data on expectations, the problem of measurement error is critical, but I could not resolve this problem.

concludes.

## 2. Data

### 2.1 The Data Source

I use micro data from the 1996 "Survey of the Financial Asset Choice of Households (SFACH) (in Japanese, Kakei ni okeru Kin'yuu Shisan Sentaku ni kansuru Chousa)" which was conducted in November 1996 by the IPTP. This survey collects information not only on the respondent's current situation (for example, living expenses, saving, and financial and real assets per household, and age, annual income, marital status, educational background, planned retirement age, occupation, and firm size of the respondent and his or her spouse) but also on the respondent's expected situation during retirement (for example, expected living expenses during retirement and expected social security benefits). Thus, I can use the data from this survey as panel data even though the survey is a cross section survey (see the introduction for more details).

In this survey, a stratified multistage random sample of 6,000 households with a head aged 20 or older from throughout Japan was surveyed by the drop-off, pick-up method, resulting in 3,695 responses (a response rate of 61.6%).

### 2.2 Questionnaire

The SFACH asks the following questions about living expenses, income, social securiy benefits, and saving for retirement.

a. All respondents

a-1. "About how much do you and your spouse spend per month?" (CLE: Current Living Expenses per moth) a-2. "About how much was the sum of your and your spouse's annual pre-tax income last year?" (CI: Current Household Income per year)

b. Respondents who have not yet retired

b-1. "After the household head retires, about how much will your living expenses be per month?" (RLE: Living Expenses during Retirement per month)

b-2. "After the household head retires, what portion of your monthly living expenses do you expect to finance using social security benefits? Express as a percentage of monthly living expenses during retirement." (EPSS: Expected Social Security Benefit Proportion)

b-3. Are you saving for retirement? If so, about how much is your wealth target (financial assets) for retirement?" (WTR: Wealth Target for Retirement)

c. Respondents who have already retired

c-1. "About what portion of your monthly living expenses are you currently financing using social security benefits? " (APSS: Actual Social Security Benefit Proportion)

I also use information on the age, marital status, educational background, planned retirement age, occupation, and firm size of the respondent and his or her spouse.

2.3 Variable Definitions

a. Expected Social Security Benefits (ESS)

I calculate expected social security benefits per month from monthly living expenses during retirement (RLE; b-1) and the expected social security benefit proportion (EPSS; b-2) as follows:

$ESS = RLE \times EPSS$

b. Actual Social Security Benefits (ASS)

I calculate actual social security benefits per month from current living expenses per month (CLE; a-1) and the actual social security benefit proportion (APSS; c-1) as follows:

$ASS = CLE \times APSS$

c. Retirement Span (RETSPAN)

I calculate the retirement span (in years) from data on the planned retirement age of the household head from the survey I use and data on life expectancy by age and sex from the "18th Life Tables" (Statistics and Information Department of the Minister's Secretariat of the Ministry of Health and Welfare) using Horioka and Okui's (2001) method:

*RETSPAN = max [the household head's expected age at death – his or her planned retirement age, the household head's spouse's expected age at death + (the household head's age – the household head's spouse's age) – the household head's planned retirement age]*

d. Permanent Income at Retirement

Since there is no information on the amount of permanent income at retirement in the survey I use, I calculate permanent income at retirement from current earnings (CI) and information on the occupation, firm size, age, retirement age, and educational attainment of the household head and his spouse (see Dicks-Mireaux and King (1984) and Wakabayashi (2001)).

e. Retirement Payments

Retirement payments are one of the most important sources of income after retirement for salaried worker households, but there is no information thereon in the survey I use. I therefore estimate the amount of retirement payments using Wakabayashi's (2001) method.

f. Income after Retirement (RI)

It is often said that the main income sources for financing living expenses after retirement is social security and retirement payments, so I define annual income during retirement as follows:

$$RI = ESS \times 12 + \frac{RP}{RETSPAN}$$

g. Ratio of Consumption after Retirement to That before Retirement (RCONS)

I define the ratio of consumption after retirement to that before retirement is as follows:

$$RCONS = \frac{RLE}{CLE}$$

h. Ratio of Income after Retirement to That before Retirement (RINC)

I define the ratio of income after retirement to that before retirement is as follows:

$$RINC = \frac{RI}{CI}$$

2.4 Sample Selection

The sample I used in my analysis is as follows: First, I dropped observations for which the respondent's gender is not known. Second, I used only the subsample of married respondents because I do not know whether or not single respondents will marry in the future and because, in the questions pertaining to saving for retirement, expected social security benefits, etc., single respondents are asked to put down the amount for themselves only whereas married couples are asked to put down the total amount for the household head and spouse combined, meaning that the amounts are not comparable. Third, I confine the sample to households whose household head is 40 years old or older because households whose household head is under 40 years old may not yet have thought seriously about their future retirement. Finally, I dropped all observations for which all of the necessary information is not available. Restricting the sample to respondents who report their gender reduces the number of observations from 3,695 to 3,666, restricting the sample to respondents who are married reduces the number of observations further to 3,151, restricting the sample to respondents whose age is 40 or older reduces the number of observations further to 2,436, and restricting the sample to respondents for whom all of the necessary information is available reduces the number of observations further to 988--695 working households and 293 retired households.

## 3. Descriptive Statistics

### 3.1 Descriptive Statistics

In Table I, I present and discuss descriptive statistics on the variables used in my analysis. The table refers to the 988 households used in our analysis--695 working households and 293 retired households. The average age of the household head is 50.0 for working households and 68.6 for retired households.

First, I discuss the mean of consumption (living expenses) before retirement (CLE (current living expenses)) and that after retirement (RLE (living expenses after retirement)). The average CLE of working households is about 33,3000 yen, the average CLE of retired households is about 261,000 yen, and the average RLE of working households is about 28,7000 yen. As I discussed in the introduction, I focus on at least four possible reasons why consumption after retirement might be lower than that before retirement. There are at least four reasons why consumption after retirement might be lower than that before retirement: first, it could be that consumption (living expenses) declines after retirement because parents cohabit with and support their child or children during their working years but that their child or children become financially independent and live separately from them after they retire. Second, it could be that consumption declines after retirement because working households incur work-related expenses whereas retired households do not. On the contrary, leisure-related expenses might change after retirement because retired households can spend more time on leisure than working households: leisure-related expenses will decline if consumption and leisure substitutes, whereas they will increase if consumption and leisure are complements. Third, it could be that there are some individuals who are forced to decrease their consumption after retirement because they faced unexpected events before retirement, as a result of which they could not save a sufficient amount for retirement: for example, individuals might be forced to retire earlier than planned or individuals might learn of a decline in their expected retirement income just before retirement. Fourth, it could be that there are some individuals who are forced to decrease their consumption after retirement even though they did not experience any unexpected shocks: one example is individuals who did not save a sufficient amount for retirement because they are myopic or because they did not have sufficient will power. In addition, since the data I use in my analysis is cross section data, it could be that the average amount of living expenses of working households (younger cohorts) is higher than that of retired households (older cohorts) because of a "cohort effect" (i.e., because the lifetime incomes of younger cohorts are higher than those of older cohorts). I interpret the results in the context of these five reasons.

First, the average CLE of working households is about 72,000 yen (22%) higher than that of retired households. This is a cross-section comparison, so all five of the reasons listed above apply. Second, the average RLE of working households is about 27,000 yen (10%) higher than the average CLE of retired households. The former figure is provided by worker households (younger cohorts) and indicates the "ideal expected" value of living expenses during retirement, whereas the latter is provided by retired households (older cohorts) and indicates the "actual" value thereof, and thus the difference between the two is attributable to the last two reasons. Third, the average CLE of working households is about 45,000 yen (16%) higher than the average RLE of working households. In this comparison, the two figures are provided by the same respondents, and thus the latter is lower than the former because respondents believe that they will need less living expenses during retirement than now. As a result, the difference between the two is attributable to the first three reasons.[5] I also calculated RCONS (the ratio of consumption after retirement to that before retirement calculated as RLE/CLE), and the ratio was 92%. As with previous studies, I observe some decline in consumption after retirement in the survey I use in my analysis.[6]

Next, I discuss the means of income both before and after retirement (CI (current household income per year), SS (social security benefits), and RP (retirement payments)). The average CI of working households is 8,200,000 yen per year for husband and wife combined,

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[5] I also calculated the means and standard deviations of consumption (CLE and RLE) for both the subsample of working households whose head plans to retire within particular years and that of retired households whose head has retired within a particular number of years (for example, ten, five, three, and two years), and three patterns emerged: first, the amount of CLE in the case of working households whose head plans to retire within two to five years is higher than the average amount of CLE, whereas that of households whose head plans to retire within less than two years is *lower* than the average thereof. Second, the amount of CLE in the case of retired households does not vary significantly by the number of years since retirement. Third, the closer one is to retirement, the higher is the amount of RLE.

[6] For example, Bernheim et al. (2001) calculated the change in (log) average consumption between the two years prior to retirement and the two years postretirement. The average change was -14%, whereas the median decline was -12%.

which is not too out of line because, according to the Family Income and Expenditure Survey, which is conducted by the Statistics Bureau and Statistics Center, Management and Coordination Agency, average household income was 7,430,000 yen in 1996. The main sources of income after retirement are social security benefits for all households and retirement payments for salaried worker households.[7] First, I discuss the means of the social security-related variables. As discussed earlier, the survey I use in my analysis does not collect direct information on social security benefits. The average EPSS (expected social security benefit proportion) of working households is 51%, whereas the average APSS (actual social security benefit proportion) of retired households is 74%: Thus, the former figure is a full 23 percentage points lower than the latter. In addition, the mean of ESS (expected social security benefits) for working households is 145,000 yen, which is about 45,000 yen lower than the means of ASS (actual social security benefits) for retired households. This is plausible results because the rapid aging of the population has made people feel uneasy about their future social security benefits, and individuals who have not yet retired know that they will not be able to rely on social security to finance their living expenses during retirement to the same extent as individuals who have already retired. On the other hand, the average amount of RP is 20,640,000 yen for salaried worker households whose household head is working for a private company or for the government (household head and wife combined). As I explained earlier, I estimate the amount of retirement payments from the respondent's permanent income at retirement, education, and

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[7] The survey I used in my analysis asks, "after the household head retires, with what kinds of income do you expect to finance your living expenses after retirement? Check all that apply." The answers are as follows: social security 79.1%, dissaving 45.2%, employment income during retirement 40.2%, insurance and private pensions 38.3%, and retirement payments and company pensions 30.7%.

firm size. The estimated amount of retirement payments is broadly consistent with data from other sources because, according to the Survey on Retirement Allowance System and Payments, which is conducted by the Policy Planning and Research Department, Minister's Secretariat, Ministry of Labor of the Government of Japan, the average amount of retirement payments in 1997 was about 19,260,000 yen. Finally, I introduce data on the ratio of income after retirement to that before retirement. The average RINC (the ratio of income after retirement to that before retirement) of salaried worker households is about 46%, which is much smaller than other sources. For example, according to the Summary of the Social Security System, which is conducted by the Social Insurance Agency, the income replacement rate (the ratio of social security benefits to income before retirement) was 62% in 1996 even though this figure does not include retirement payments.

### 3.2 Decline in family size after retirement

As I discussed in the last section, the average RLE of working households is about 46,000 yen lower than the average CLE of working households (287,000 yen vs. 333,000 yen), and this gap is attributable to the first two reasons (the decline in family size after retirement and the decrease in work-related expenses after retirement).[8] In this section, I focus on the former reason and adopt two methods: one method is to compare the RLE and CLE of only the subsample of respondents who do not have any children, and the other method is to compare RLE with CLE adjusted for family size using equivalence scales.

#### 3.2.1 Using the sample of respondents who do not have any children

[8] Unfortunately, I cannot focus on the latter reason because no information is available in the survey I used on the composition of consumption, even though previous studies do focus on this reason.

In Table 2, I present the average amounts of RLE and CLE for the sample of respondents who do not have any children. The number of households that do not have any children is 43. The average amount of RLE for respondents who do not have any children is 299,000 yen, and the average amount of CLE for these respondents is 271,000 yen. As I discussed earlier, the average CLE for working households is about 46,000 yen *higher* than the average RLE for working households, whereas the former is about 28,000 yen *lower* than the latter when I confine the sample to respondents who do not have any children. This means that households that do not have any children expect much *lower* future retirement expenses than households that have a child or children.

### 3.2.2 Using equivalence scales

The equivalence scale is the income required to preserve the prechild standard of living for all members of the postchild household, and there is a large number of detailed studies on the estimation of equivalence scales (for example, McClements (1977), Mutoh (1992), Suruga (1993), Phipps (1998), and Suruga et al. (2001)). Since the data I use in my analysis contain various information on the number of the children, I calculate adjusted CLE (ADJCLE) using the following method and compare this amount with RLE.

First, I calculate the number of children who are supported by respondents using the following information:

a. How many child or children do you have? (Put down the number of your children regardless of whether or not they are financially dependent and whether or not they live with you. If you do not have any children, please answer zero.
b. Where do your children who are already independent live? Please put down the number of children.

Answers

b.1. I cohabit with my children who are already independent and their number is (b.1).

b.2. I live separately from my children, but they live in the same city or town and their number is (b.2).

b.3. I live separately from my children, they live in a different city or town and their number is (b.3).

I define the number of children who are supported by respondents (*DepCHILD* ) as follows (see Table 3):[9]

$$DepCHILD = a-[\,(b.2)+(b.3)]$$

Second, I use Phipps's (1998) method to estimate the average amount of ADJCLE (adjusted CLE).[10]

Looking at RLE and ADJCLE (CLE which is adjusted by the equivalence scale) in Table 2, the average amount of ADJCLE is 274,000 yen, which become close to RLE (the value of RLE is 287,000 yen).

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[9] I regard children who cohabit with their parents but who are already independent as "dependent children" because parents often support even their independent children until they retire. According to the survey I use in my analysis, the average amount of CLE for respondents who cohabit with their children but those children is already independent is 340,000 yen per month and the average amount of RLE for these respondents is 279,000 yen; this pattern is consistent with my hypothesis.

[10] As can be seen from Table 3, Phipps calculates equivalence scales by using data from the 1978, 1982, 1986, and 1992 administrations of the Statistics Canada Family Expenditure Survey and confirm that the scale is not very different from other previous studies. Phipps calculated equivalence scales for two-parent household with 0-5 children, whereas, as seen from Table 4, the sample for the data set I use in my analysis includes a two-parent households, with six children. When I regress the equivalence scale calculated by Phipps on the number of children and calculate the fitted value from this equation for those with six children substituted for the actual number of the children, I obtain an equivalence scale of 1.693.

To summarize my findings in this section, I found that respondents' consumption declines after retirement because family size (the number of dependent children) declines. This is consistent with the life cycle model. I conduct a more rigorous econometric analysis in the next section.

## 4. Econometric Analysis

In this section, I describe the estimation model and estimation method I use in my analysis.

### 4.1. Estimation Model and Estimation Method

I use the following estimation model to test what variables affect consumption change at retirement $\left(RCONS = \frac{RLE}{CLE}\right)$;[11]

$$RCONS = a_1 * RINC + a_2 * RETSPAN + a_3 * DepCHILD + a_4 * SLFEMPLY + u$$

If individuals behave in accordance with the life cycle model, they should smooth their consumption throughout their lives, so $RINC$ ( $\left(= \frac{RI}{CI}\right)$ ) should not have any impact on $RCONS$. In addition, $RETSPAN$ (retirement span) should not have any impact on $RCONS$ because even if individuals expect their retirement span to be longer than usual (for example, because they plan to retire earlier than the mandatory retirement age), they should still smooth their consumption. Thus, both $a_1$ and $a_2$ should not be significant. If, however, individuals

[11] Previous studies use the similar estimation models. For example, Banks et al. (1998) regress the change in log nondurable expenditure on the number of adults' in excess of two, the real interest rate, the age of the head, the change in the logarithm of the survival probability, a dummy variable that equals one for those whose head is out of the labor market, and a dummy variable that equals one for those whose head is unemployed, whereas Bernheim et al. (2001) regress the change in log consumption on income replacement quartile, family size, marital status, a disability dummy, a female widower dummy, and a dummy variable for whether the household was working part-time for 3-4 years prior to full retirement.

are myopic, *RINC* and *RETSPAN* may have a significant (positive and negative, respectively) on *RCONS*. If the reason why consumption changes at retirement is that family size changes, the coefficient of *DepCHILD* (the number of children who are supported by respondents: see Section 3.2.2) should be negative ($a_3 < 0$). In addition, if individuals' work-related expenses differ by their occupation, the coefficient of *SLFEMPLY* (a dummy variable that equals one for those whose heads are self-employed workers and zero for those whose heads are salaried workers) should be significant.

In this analysis, the estimation method I use is OLS (Ordinary Least Squares) with robust standard errors.

4.2 . Estimation Results

In this section, I present my estimation results concerning the reasons why consumption changes at retirement. Table 5 presents the estimation results, and I look first at the results concerning the impact of *RCONS* and *RETSPAN* on *RINC*. In the case of all working households, I find that the coefficients of both *RCONS* and *RETSPAN* are not significant, as expected. This is consistent with the life cycle model.

The coefficient of *DepCHILD* is negative and significant, as expected. This result is consistent with the results of Section 3.3.2 and implies that the more children respondents support during their working years, the larger their consumption decline at retirement.[12]

I next discuss the coefficient of *SLFEMPLY*, which tests whether or not respondents'

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[12] I also tried using the total number of children (section 3.2.2 questionnaire (a)) and the other definition of dependent children (*DepCHILD2*, which excludes children who cohabit with their parents but who are already independent from the definition of *DepCHILD* in section 3.2.2--i.e., *DepCHILD2*=a-[(b.1)+(b.2)+(b.3)]) instead of *DepCHILD* but do not present these results here because they were not significantly different from those based on *DepCHILD*.

work-related expenses differ by occupation. The coefficient of *SLFEMPLY* is negative and significant which means that self-employed households decrease their consumption more after retirement than do salaried worker households, which in turn implies that self-employed workers incur more work-related expenses during their working years than salaried workers. A possible reason for this as follows: self-employed households may report a higher level of living expenses before retirement than do salaried worker households because it is difficult to distinguish between living expenses and work-related expenses in the case of self-employed households. According to the survey I use in my analysis, the average amount of current living expenses is 366,000 yen per month for self-employed households, whereas that for salaried worker households is 324,000 yen; this pattern is consistent with my hypothesis.

Finally, I present the estimation results for the subsample of working households whose head is 50 or older because those who are 50 or older are more likely to have thought seriously about their future retirement than those who are under 50.[13] Although the coefficients of most of the explanatory variables do not differ by the age of the household head, the coefficient of *RINC* does differ. It is not significant in the case of all working households, but it is positive and significant in the case of households whose head is 50 or older. This result suggests that, the older a person is, the greater is the extent to which he or she responds to a decline in his or her expected income after retirement by reducing his or her planned consumption after retirement. This is not surprising because there are some individuals who are forced to decrease their consumption after retirement. There are at least two reasons why some individuals are forced to decrease their consumption after retirement: first, the closer one is to retirement, the more difficult it is to increase one's wealth accumulation to make up for the decline in one's income after retirement,

[13] I also tried estimating this regression model for the subsample of working households whose head is under 50, but I do not present the results here because they were not significantly different from those for all working households.

and the more likely it is that one will have to reduce one's consumption after retirement. Second, it could be that the coefficient of RINC is more significant for the 50 and older subsample because the closer one is to retirement, the more likely it is that one will have thought seriously about one's retirement.[14]

## 5. Conclusion

In this paper, I examine the reasons why average consumption after retirement lower than that before retirement using micro data from the 1996 "Survey of the Financial Asset Choice of Households," which was conducted by the Institute for Posts and Telecommunications Policy (IPTP).

Whereas most previous studies analyze the consumption change after retirement using panel data, my analysis showed the virtues of using cross section data on when information on both respondents' current situation and future expectations are available.

My results suggest that respondents decrease their consumption after retirement because both family size and work-related expenses decrease after retirement. Both of these reasons are consistent with the life cycle model. In addition, in almost every case, while respondents smooth their consumption even if their income declines after retirement, and only individuals

[14] I also tried estimating this regression model for the subsample of working households whose head plans to retire within ten years (232 observations), five years (76 observations), three years (29 observations), and two years (21 observations). The estimation results are not significantly different from those for households whose head is 50 or older--the coefficient of RINC is positive and significant in almost all cases. Whereas the coefficient of RINC is 0.000 (0.001) in the full sample, its coefficient for those within ten years, five years, three years, and two years of retirement are 0.067 (0.033), 0.063 (0.017), 0.019 (0.018), and 0.033 (0.012), respectively (robust standard errors are in parentheses).

who are near retirement plan to respond to the decline in their income after retirement by reducing their consumption after retirement.

Turning finally to directions for further research, I plan to use data on saving to shed on light on whether consumption declines after retirement because people cannot save sufficiently for retirement.

## REFERENCES


Banks J., Blundell R. and Tanner S. (1998). Is there a retirement-savings puzzle?, *American Economic Review*, 89 (4), 769-88.

Bernheim B.D. (2001). What accounts for the variation in retirement wealth among U.S. households?, *American Economic Review*, 91(4), 822-857.

Feldstein, M. (1974). Social security, induced retirement, and aggregate capital accumulation, *Journal of Political Economies* 82, 905-926.

Hamermesh D.S. (1984). Consumption during retirement; the missing link in the life cycle, *Review of Economics and Statistics* 66(1) 1-7.

Horioka C.Y. and Okui M. (1999) A. U.S.-Japan comparison of the importance and determinants of retirement saving, *Economics Letters*, 65, 365-371.

Kotlikoff L.J, Spivak A, and Summers L.H., (1982) The adequacy of savings, *American Economic Review*, 72 (5), 1056-1069.

McClements, L.D. (1977). Equivalence scales for children, *Journal of Public Economics* 8 (2), 191-210.

Miniaci, R. Monfardini, C. and Weber, G. (2002). Is there a retirement consumption puzzle in Italy? *Mimeo*. University of Padua, Italy.

Mutoh, H. (1992). Nihon ni okeru kosodate kosuto to kodomo jyuyou, (Cost of a child rearing and the demand of a child), *Nihon Keizai Kenkyuu*, 22(2).

Phipps S.A. (1998). What is the income "cost of a child"? Exact equivalence scales for Canadian two-parent families, *Review of Economics and Statistics*, 80 (1), 157-164.

Robb, A.L. and Burbidge, J.B. (1989). Consumption, income and retirement. *Canadian Journal of Economics*, 22(3), 522-542.

Suruga, T. (1993). Estimation of equivalence scales using Japanese data, *Economics*

*Studies Quarterly*, 44 (2), 169-177.

Suruga, T., and Nishimoto, M., (2001). Touka shakudo to kodomono hiyou – Shouhi seikatsu ni kansuru paneru chousa wo shiyou shite. (Equivalence scale and the cost of a child – using Japanese Panel Survey of Consumers.) *Kikan Kakei-Keizai-Kenkyuu* 50, 25-31.

Venti, S. and Wise D.A. (1998). The cause of wealth dispersion at retirement: Choice or Chance? *American Economic Review*, 88(2) (Paper and Proceedings), 185-191.

Wakabayashi M. (2001) Retirement saving in Japan; with emphasis on the impact of social security and retirement payments, *Journal of the Japanese and International Economies* 15, 131-159.

Wakabayashi M. (2002) Annuity asset adequacy in Japan; the demand for individual pensions. *mimeo*, Osaka University.

**DATA SOURCES**

Kyuuyo-kankei Hourei Kenkyuukai (Study Group on Salary-related Laws and Ordinances), "Koumu-in Kyuuyo Binran" {Government Worker Salary Handbook}, Zaidan-houjin Ookura Zaimu Kyoukai, 1999 edition, Tokyo.

Kyuuyo-kankei Hourei Kenkyuukai (Study Group on Salary-related Laws and Ordinances), "Koumu-in Kyuuyo Binran" {Government Worker Salary Handbook}, Zaidan-houjin Ookura Zaimu Kyoukai, 1999 edition, Tokyo.

Roudou-shou Daijin Kanbou Seisaku Chousa-bu (Policy Planning and Research Department, Minister's Secretariat, Ministry of Labour of the Government of Japan), (1998). "Taishoku-kin-seido Shikyuu-Jittai-Chousa-Houkoku" {Survey on Retirement Allowance System and Payments}, 1997 edition, Tokyo.

Roudou-shou Daijin Kanbou Seisaku Chousa-bu (Policy Planning and Research Department, Minister's Secretariat, Ministry of Labour of the Government of Japan), (1996). "Chingin-Sensasu" (Wage Census), Roudou Hourei Kyokai, 1995 edition, Tokyo.

Shakai-hoken-chou (Social Insurance Agency, Ministry of Health, Labor, and Welfare of the Government of Japan), (1996). "Kouteki Nenkin Kanyuu Jyoukyou nado Chousa" ((Summary of the Social Security System), Internet Homepage.

Soumu-chou Toukei-kyoku Toukei-sentâ (Statistics Bureau & Statistics Center, Management and Coordination Agency, Government of Japan) (1997). "Kakei Chousa" (Family Income and Expenditure Survey), 1996 edition, Tokyo.

Table 1: Descriptive Statistics by Household Type (Means and Standard Deviations)[a]

| | Working Households | Retired Households |
|---|---|---|
| Number of observations | 695 | 293 |
| Household head's age | 49.90 | 68.62 |
| | (6.14) | (5.53) |
| Spouse's age | 46.77 | 64.67 |
| | (6.73) | (5.97) |
| *CLE* | 33.28 | 26.05 |
| current living expenses per month | (11.51) | (10.34) |
| *RLE* | 28.75 | - |
| living expenses during retirement per month | (8.80) | - |
| *PCONS* | 0.92 | - |
| ratio of consumption after retirement to that before retirement | (0.31) | - |
| *CI* | 820.25 | - |
| current income per year | (398.29) | - |
| *EPSS* | 0.51 | - |
| SS as a proportion of RLE | (0.21) | - |
| *ASS* | | 0.74 |
| SS as a proportion of CLE | | (0.23) |
| *ESS* | 14.49 | - |
| expected social security benefits | (7.07) | - |
| *APSS* | | 18.97 |
| actual social security benefits | | (9.09) |
| *RP* | 2064.00 | - |
| retirement payments | (1091.53) | - |
| *PINC* | 0.46 | - |
| ratio of income after retirement to that before retirement | (0.31) | - |

[a] *Source:* The 1996 "Survey on the Financial Asset Choice of Households (SFACH)."
All variables refer to couples (except where indicated). Standard deviations are in parentheses.
All variables are in units of tens of thousands of yen except where indicated.

Table 2: Descriptive Statistics after controlling for the number of children

| | Working Households (695) | subsample of respondents who do not have any children (43) | Working Households (695) ADJCLE (calculated using equivalence scales) |
|---|---|---|---|
| | Means (Standard Deviations) | Means (Standard Deviations) | Means (Standard Deviations) |
| *CLE (ADJCLE)* current living expenses per month | 33.282 (11.505) | 27.093 (8.076) | 29.849 (11.011) |
| *RLE* living expenses during retirement per month | 28.750 (8.801) | 29.884 (7.359) | - - |

[a] *Source:* The 1996 "Survey on the Financial Asset Choice of Households (SFACH)."
All variables refer to couples (except where indicated). Standard deviations are in parentheses.
All variables are in units of tens of thousands of yen except where indicated.

Table 3: Equivalence Scales Calculated by Phipps (1998)[a]

| Number of Children | Scale |
|---|---|
| 0 | 1.000 |
| 1 | 1.155 |
| 2 | 1.279 |
| 3 | 1.383 |
| 4 | 1.475 |
| 5 | 1.557 |

[a] Source: Survey of the Financial Asset Choice of Households

Table 4: Number of both children and dependent children

| Number of children (Section 3.2.2, a) | Distribution by Number of Children | Distribution by Number of Dependent Children |
|---|---|---|
| 0 | 43 | 112 |
| 1 | 84 | 182 |
| 2 | 378 | 279 |
| 3 | 160 | 108 |
| 4 | 25 | 10 |
| 5 | 3 | 2 |
| 6 | 1 | 2 |
| 9 | 1 | 0 |
| Total | 695 | 695 |

[a] Source: Survey of the Financial Asset Choice of Households

Table 5: Estimation Results for the Determinants of the Ratio of Consumption after Retirement to That before Retirement

| | All households | Aged 50 or older |
|---|---|---|
| Explanatory variables | | |
| ***RINC*** | 0.000 | 0.058 ** |
| ratio of income after retirement to that before retirement | (0.001) | (0.026) |
| ***RETSPAN*** | -0.003 | -0.001 |
| retirement span | (0.002) | (0.004) |
| ***DepCHILD*** | -0.043 ** | -0.049 *** |
| the number of children who are supported by respondents | (0.012) | (0.018) |
| ***SLFEMPLY*** | -0.068 *** | -0.063 * |
| self-employed household dummy | (0.029) | (0.036) |
| ***intercept*** | 1.080 *** | 0.983 *** |
| | (0.067) | (0.103) |
| R-squared | 0.031 | 0.040 |
| Number of Observations | 695 | 343 |

Regression model: $RCONS=a_1 RINC+a_2 RETSPAN+a_3 DepCHILD+a_4 SLFEMPLY+u$
Dependent variable: *RCONS* (the ratio of consumption after retirement to that before retirement)
The level of significance at 1% is ***, 5% is **, and 10% is *.
Standard errors are in parentheses.