NBER WORKING PAPER SERIES

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Working Paper No. 2661

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 1988

NBER Working Paper #2661
July 1988

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ABSTRACT

Using Japanese annual time series data covering the period from 1946 to 1982, this paper shows that social security wealth depresses personal savings. The effect was a reduction of approximately 143 thousand yen per capita wealth in real terms from 1970 to 1980. However, declining labor force participation of the elderly (i.e., earlier retirement), stimulates personal saving by an estimated 12 thousand yen over the same period. The study found that the benefit effect dominates the retirement effect. In addition, this study has identified a negative interdependency between the personal savings and labor retirement behaviors of the elderly; that is, an individual saves more before retirement if he expects to stay a shorter time in the labor market, and vice versa.

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The Effects of Japanese Social Security Retirement Benefits on Personal Savings and Elderly Labor Force Behavior

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I. Introduction

Ever since its institution, the social security system has alleviated the financial problems of the elderly under changing economic and social conditions. Recently, in the United States, this system has come under fire. The main thrust of this attack is twofold: (1) that personal savings decline as compulsory public savings, such as social security retirement benefits, increase and (2) that social security retirement benefits have created a trend towards earlier retirement.

In the debate over social security and savings in the United States, the pivotal issue continues to be whether social security retirement benefits increase or decrease personal savings. Despite an abundance of empirical studies on this issue, no conclusion has been agreed upon.[1]

Boskin's (1977) pioneering study of the effect of social security retirement benefits on the retirement decision concludes that social security retirement benefits influence the elderly to leave their jobs early or to restrict their market work, thereby reducing the labor supply

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*We are indebted to Michael Grossman, Koichi Hamada, Yoshio Higuchi, Charlotte Muller, Takatoshi Ito, Kazuo Sato, Hugh Patrick, and Frank Chaloupka for their helpful comments on preliminary drafts of this paper. The opinions expressed in this paper, as well as any errors, are mine. The original paper was presented at the Japan Economic Seminar at Harvard University, Cambridge, April 1987.

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[1]Feldstein (1974; 1982), Feldstein and Pellechio (1979), Munnell (1974), and Darby (1979) find a significant negative effect of social security retirement benefits on personal savings, whereas Barro (1978), Blinder, Gordon and Wise (1983), Leimer and Lesnoy (1982), Lesnoy and Leimer (1985) and Modigliani and Sterling (1983) find it to be insignificant.

of the elderly (see Pellechio 1979, Burtless and Moffitt 1984 and 1985, Hurd and Boskin 1984, Mitchell and Fields 1984, and Burtless 1986, which support this induced retirement effect). In contrast, Blinder, Gordon and Wise (1980) do not reject the hypothesis that social security retirement benefits delay the retirement of the elderly.[2]

These results suggest that the effects of social security retirement benefits on personal savings and the retirement decisions of the elderly are still open to debate. This paper examines the effects of social security on personal savings and labor force participation of elderly men. This sort of application is useful for several reasons. First, it helps us to understand implications of retirement policies. Secondly, if social security retirement benefits reduce lifetime personal savings and lower the labor supply of the elderly, capital formation and aggregate labor supply are reduced and, hence, aggregate output is lowered (Burtless and Moffitt 1984). Finally, a quantitative evaluation of the effects of social security retirement benefits on personal saving behavior and labor force participation of the elderly rests on empirical studies.[3]

Very few such studies have been done in Japan. Noguchi (1983) finds the effect of gross social security wealth on household net wealth to be negative, but significant in only one of many specifications. Other studies, for examples, Ishikawa and Ueda (1984), Ando, Yamashita and Murayama

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[2]Burkhauser and Turner (1978; 1982b) come to a similar conclusion as to the effect of social security on the market work behavior of prime-age males.

[3]Burtless (1986) also emphasizes the influence of the timing of changes in social security retirement benefits on lifetime labor supply and savings, but the estimation of this type of model depends on development of much better data than that currently available.

(1986), and Dekle (1986), examine the saving behavior of Japanese households, but totally ignore the influence of social security retirement benefits. Some other studies, such as those of Takayama (1982) and Ito (1983), inquire about the relationship between social security retirement benefits and the retirement behavior of elderly men: the former is a theoretical paper, presenting little empirical evidence on the impact of social security retirement benefits on retirement decisions; the latter, although empirical, does not use an econometric multivariate analysis. Consequently, neither of the studies supplies a good estimate of quantitative effects.

This study examines the influence of social security retirement benefits on the personal savings and labor force participation of elderly men in Japan. The hypothesis to be tested is that personal savings over the life cycle are determined simultaneously with retirement decisions, as discussed and emphasized by King (1983) and Thompson (1983). Using three different social security retirement wealth measures, the analysis is based on Japanese annual time series data over the period from 1946 to 1982.

The organization of the subsequent sections is as follows. Section II contains a brief review of the social security system in Japan. Section III describes the theoretical model. The empirical results are presented in Section IV and conclusions in Section V.

II. A Brief Review of the Welfare Pension, Savings and Labor Force Participation of Elderly

The social security program (Welfare Pension) in Japan was introduced in 1942 and covers a majority of Japanese workers. It is a partially funded system, not a pay-as-you-go system.[4] Under the Welfare Pension a flat tax rate of 10.6% is applied to monthly labor earnings up to a maximum of 410 thousand yen, the minimum being 45 thousand yen for male workers. The rate is 8.9% for females.[5] Half of the social security tax rate is paid by the employer, as in the U.S.

The receipts of the Welfare Pension tax (social security tax) are deposited in special treasury accounts (Trust Fund Bureaus) and the fund is managed by the Treasury Investment and Loans Division. As of 1985, the accumulated pension fund was 27,983 billion yen. For the purpose of improving living conditions, the fund is used for housing, living environment improvements, small enterprises, culture, education, agriculture, forestry, fisheries, etc. The proceeds of the interest payments are used for a part of administrative costs of the social security program.

Retirement benefits of the Japanese Welfare Pension (social security retirement benefits, or SSRB) are indexed to the inflation rate and generally require contributions for a minimum of 20 years. The normal retirement age is 60 for men and 55 for women.[6] The basic schedule of

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[4]Another social security retirement program is the National Pension for self-employed workers and housewives who are not in the paid labor force.

[5]After April, 1986, the rates were raised to 12.4 percent and 11.3 percent for male and female workers, respectively.

[6]After April, 1986, the normal retirement age for female workers was raised to sixty years old with gradual adjustments.

monthly social security retirement benefits for a typical individual "i" is given as follows (Japan, White Paper on Welfare 1983):

$$SSRB_i = 2{,}050_{yen} \times T\{T=20 \text{ if } T_i \leq 20;\ T=T_i \text{ if } 20 < T_i < 35;$$

$$\text{and } T=35 \text{ if } T_i \geq 35\} + [(\sum_{t=1}^{12Ti} w_{it}/12\ T_i)$$

$$\times (1/100) \times T_i], \quad \ldots\ (1)$$

where T_i = number of preretirement working years, and $W_{i,t}$ = monthly labor earnings at time t. The amount of monthly social security retirement benefits is reduced according to the amount of an individual's monthly labor earnings as shown in Table 1.[7]

[Table 1 should be here]

The ratio of social security retirement benefits to disposable income per capita in real terms was only about 50%, on average, during the 10 years 1972-1982. The replacement rates of a social security, old-age, pension for a single worker in Japan were 26% in 1969, 37% in 1975 and 54% in 1980. The relatively low replacement rates in Japan compared to the United States seems to have some relation to Japanese saving behavior. The ratio of personal savings to disposable income in real per capita terms was about 20% on the average during the 10 years 1972-1982. This ratio is remarkably high compared to the ratio (about 5%, on average) in the United States.

In 1953 the ratio of personal savings to disposable income suddenly declined from 17.6% in 1952 to 11.2% in 1953, and the low ratio continued

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[7]A typical retired male with zero working hours a month received 136 thousand yen per month in 1983, based on the condition that he, with spouse present, had worked for 30 years. The replacement rate, proxied by the ratio of social security retirement benefits to personal disposable income

until 1958. Then the ratio of personal savings to disposable income increased to 16.7% in 1959 from 13.5% in 1958.

Coincidentally the labor force participation rate of males ages 60 and over increased to 73.5% in 1953 from 68.5% in 1952. The rate remained high until 1958, and then dropped from 74.3% in 1958 to 69.9% in 1959. The ratios of personal savings to disposable income have been relatively high: 18.9% on the average since 1960. The labor force participation rates had been gradually declining since 1960. Therefore, there seems to be some negative relationship between the ratio of personal savings to disposable income and the labor force participation of men ages 60 and over. The overall labor force participation of the elderly in Japan, however, declined by about 10 percentage points from 1946 through 1982.

A primary goal of the present paper is to study the effects of social security retirement benefits on personal savings in the preretirement period and the labor force behavior of the elderly.[8] Therefore, the paper focuses on the labor force participation rates of the elderly, ages 60 and over, rather than the labor supply, that is, hours of work. An advantage of using the labor force participation rate of the elderly is that one can view the outcome in this multivariate analysis as the probability of retirement for the elderly.

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per capita in real terms, was about 50 percent, on average, over the period from 1970 to 1982. This rate is low in comparison to the U.S. standard (Aldrich 1982) and may have encouraged the Japanese to maintain a high rate of personal savings.

[8]Japanese workers normally retire from their lifetime jobs at the age of 60, at which time they are entitled to receive social security retirement benefits (as of 1985). In this study, the period before the age of 60 is called the preretirement period and the period beginning at age 60 is called the postretirement period.

III. Theoretical Model

Social security retirement benefits affect the the life-cycle savings and labor supply decisions of an individual simultaneously. If the individual anticipates social security retirement benefits and saves less during the preretirement period, this is the benefit effect. If, however, he expects to retire earlier due to the anticipated benefits, he may increase his rate of savings during the preretirement period; this is the retirement effect. Which of the two effects will dominate is a testable hypothesis and is an empirical matter.

The social security wealth variable in the model can assume three alternative forms: gross social security wealth GSSW, net social security wealth NSSW, and social security tax contributions SSTC.

(1) Gross Social Security Wealth (GSSW) is defined as:

$$GSSW_{a,t} = \sum_{k \geq 60} A_{a,t} \times {}_{60|}L_{a} \times YD_{a,t} \times B_t^{60-a} \times {}_{k|}L_{60} \times B_t^{k-60} \quad , \ldots\ldots (2)$$

where $A_{a,t}$ = $(SSB_t / YD_{a,t})$,

B_t = $[(1+g_t)(1+p_t)]/(1+i_t)$,

SSB_t = social security retirement benefits per person at time t,

$YD_{a,t}$ = per capita disposable income of an individual of age a at time t,

${}_{60|}L_{a}$ = probability of an individual of age a to survive until age 60,

${}_{k|}L_{60}$ = probability of an individual of age 60 to survive at least to age k, k>60 ,

g_t = growth rate of per capita income at time t,

p_t = inflation rate at time t, and

i_t = rate at which an individual discounts his expected social security retirement benefits at time t.

In constructing the social security wealth variable, Leimer and Lesnoy (1982) and Lesnoy and Leimer (1985) suggest modifying the original social security wealth variable used by Feldstein (1974) and Munnell (1974). This study takes into account the suggestion by Leimer and Lesnoy (1982). For example, $A_{a,t}$, B_t, $L_{60|a}$, $L_{k|60}$, and $R_{a,t}$ are not constant in the analysis.

(2) Net Social Security Wealth (NSSW) is defined as:

$$NSSW_{a,t} = GSSW_{a,t} - SSTAX_{a,t} \quad \ldots\ldots (3)$$

where $NSSW_{a,t}$ = net social security wealth of an individual of age a at time t,

$$SSTAX_{a,t} = \sum_{j=a}^{59} R_{a,t} \times L_{j|a} \times YD_{a,t} \times [(1+g_t)/(1+i_t)]^{j-a} ,$$

$SSTAX_{a,t}$ = present value of social security tax per person of age a at time t,

$R_{a,t}$ = ratio of social security tax per covered worker of age a to per capita disposable income at time t, and

$L_{j|a}$ = probability of an individual of age a to survive until age j.

(3) Social Security Tax Contributions (SSTC) is defined as:

$$SSTC_{a,t} = OASDI_{a,t} / CPI_t , \ldots\ldots(4)$$

where $OASDI_{a,t}$ = contributions of an individual of age a at time t under the old-age, survivors and disability insurance of the Welfare Pension program, and

CPI_t = consumer price index at time t.

The amounts of savings and social security retirement benefits exert different influences on the quantity of lifetime labor supply. Conversely, labor supply affects life-cycle savings. Consequently, a model should reflect not only the effects of social security retirement benefits upon the personal savings and labor force behavior of elderly, but also the interactions between the two behaviors. The specification of our simultaneous equation model is as follows:

$$S_t = a_0+a_1SSW_t+a_2LF60_t+a_3YD_t+a_4YD_{t-1}+a_5WEALTH1_t+a_6WEALTH2_t+ a_7UYD_t+a_8RETAIN_t+a_9GOVTSUR_t+u_t, \quad \ldots\ldots \quad (5)$$

$$LF60_t = b_0+b_1SSW_t+b_2S_t+b_3YD_t+b_4YD_{t-1}+b_5WEALTH1_t+b_6WEALTH2_t+ b_7UYD_t+b_8EDUCA_t+b_9AGRICL_t+v_t, \quad \ldots\ldots \quad (6)$$

where the variables in the model are defined in Table 2 (the subscript "i" is omitted for brevity), and u_t and v_t are residual terms, assumed independent, with zero means and constant variances.[9]

[Table 2 should be here)

The rationale for including the variables in the model is found in similar studies in the literature (Barro 1978, Burkhauser and Turner 1978 and 1982b, Feldstein 1974, Leimer and Lesnoy 1982, Munnell 1974, and Noguchi 1983). Therefore, only the variables of interest are discussed. In the personal savings equation (equation 5), the coefficient of social security wealth reflects both the benefit and retirement effects, but does not allow for the separate estimation of each effect (Leimer and Lesnoy 1982). Hence, this study includes the labor force participation rate of

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[9]In the model, the omission of a LF60 variable from equation (5) would cause the estimated coefficient on the SSW variable to be biased towards zero. This happens if a_1 and a_2 are negative and if SSW and LF60 are negatively correlated.

men ages 60 and over to capture the retirement effect (see Munnell 1974).

It is common to relate consumption to permanent income by using a distributed lag on past income. Therefore, it is reasonable to employ lagged disposable income in the extended life cycle saving model (Barro, 1978; Darby, 1979; and Leimer and Lesnoy, 1982). Even though lagged disposable income does not affect the current flow of resources, it has a positive effect on personal savings if, given the value of current disposable income and other variables, the variable has a positive impact on current personal savings.

This study includes two different wealth variables: WEALTH1 includes physical assets (e.g., houses), which are less liquid than WEALTH2 (e.g., stocks, bonds, trusts and insurance). In Japan, physical assets are usually held through life for a bequest purpose rather than a speculative one (Sato 1987); therefore, illiquid wealth, WEALTH1, will have a different impact on personal savings than WEALTH2.

The product of U and YD (UYD) is included in the savings function to adjust for the cyclical variation in personal savings and for the deviation of income from the normal position (Barro, 1978). The deviation of income from its normal position, represented by UYD, will make the individual anxious about future prospects and hence motivate him to increase his personal savings. Japanese business firms accumulate retirement pension allowances for their employees. These allowances are 40 percent tax deductible and are transferable by firms into retained earnings (RETAIN). An increase in retirement pensions funded by firms tends to discourage individual personal savings. An increase in the government's budget surplus

(GOVTSUR) has a positive influence on personal savings through an increase in future disposable income from the lowering of taxes and the price level (Barro 1978).

In the labor force participation equation (equation 6), an increase in social security wealth (SSW) may induce earlier retirement, resulting in a prolonged retirement period. Consequently, the labor force participation of the elderly (LF60) declines. Why is the labor force participation rate at age sixty and over one of the independent variables? Barro's and Feldstein's interpretation of social security wealth measured in their models does not include a variable which explicitly measures the retirement effect of social security retirement benefits (Leimer and Lesnoy, 1982). SSW alone measures both effects, but does not allow for the separate estimation of each one. An additional variable is needed to explain the retirement effect.[10] Higher personal savings (S) will make it less necessary for the elderly in the postretirement period to stay in the labor market and earn for consumption.

Education (EDUCA) widens the choice of job opportunities, by making new types of employment available to the elderly at the age of 60, after their lifetime jobs, and consequently influences the individual's retirement. Thus, a rise in EDUCA increases the years of labor force participation (Hanoch and Honig 1983; Modigliani 1986). An accelerating industrial development in Japan has provided the elderly with job opportunities, while the opportunity for employment in the agricultural sector

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[10]Since a mandatory retirement age implicitly exists at the age between 55 and 60 under the Japanese lifetime employment system, this study uses the labor force participation of males aged 60 and over. Munnell (1974) uses a labor force participation of males aged 65 and over for the U.S. study. The starting age for receiving social security retirement benefits

(AGRICL) has declined. AGRICL, therefore, will have a negative effect on LF60.

Finally, the simultaneous equation model provides estimates of the effects of social security wealth, separately, on personal savings and labor force participation of the elderly. In addition, the empirical results will shed light on the interdependency of lifetime personal saving and labor force behavior of the elderly.

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is sixty in Japan.

IV. Empirical Results

The data used to estimate the model are an annual time series covering the period from 1946 to 1982. The simultaneous equation model consists of an equation for personal savings and an equation for the retirement decisions of men ages 60 and over. Table 3 presents the second-stage results after correcting for serial correlation. The social security wealth variable takes three alternative forms: gross social security wealth GSSW in model I, net social security wealth NSSW in model II, and social security tax contributions SSTC in model III. The alternative forms will show the sensitivity of the empirical results to the different specifications of the social security wealth variable.

[Table 3 should be here]

One of the robust results in the personal savings equation (the S columns) is that the social security wealth variables, GSSW, NSSW, and SSTC, are statistically significant and negative. Another striking result is that the estimated coefficients on the labor force participation rate of men ages 60 and over, LF60, are negative and statistically significant in models I and II. On the other hand, in the labor force participation equation (the LF60 columns), the estimated coefficients on the personal savings variable are significantly negative in all models. Therefore, simultaneity exists between personal savings and retirement decisions of the elderly.

Concerning the effect of social security wealth on personal savings, the marginal propensity to save with respect to GSSW, NSSW, and SSTC is

-0.004 in model I, -0.005 in model II, and -0.979 in model III, respectively. The point elasticities evaluated at the sample means are -1.56 (GSSW), -1.65 (NSSW), and -0.49 (SSTC). In terms of elasticity, the magnitude of anticipated social security retirement benefits (GSSW and NSSW) is substantially greater than that of current social security tax contributions (SSTC): the first two elasticities are three times larger than the last one. Utilizing these estimated elasticities, the study examines the relative contributions of GSSW, NSSW, and SSTC to the recent Japanese personal savings experience for the period of 1970-1980. Personal savings per capita in real terms increased by 68 thousand yen from 140 thousand yen in 1970 to 208 thousand yen in 1980. The increase in GSSW and NSSW over the period resulted in approximately a 143 thousand yen reduction in personal savings per capita in real terms, while the increase in SSTC resulted in a 77 thousand yen reduction in personal savings.[11] Therefore, personal savings are depressed by approximately 68 percent due to the increase in GSSW and NSSW, ceteris paribus, while the reduction in savings due to the increase in SSTC is by approximately 53 percent.

The point elasticities of personal savings with respect to the labor force participation of elderly males, LF60, are -1.36 in model I, -1.46 in model II, and -0.76 in model III, at the sample means. A reduction in LF60, (i.e., earlier retirement), makes individuals in the preretirement period save more for consumption during a prolonged postretirement period. The estimated impact on personal savings of earlier retirement was about a 23

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[11]The method for this calculation is adapted from Shapiro and Shaw (1983). The estimated reductions in personal savings during the period from 1960 to 1980 were about 291 thousand yen due to the effects of GSSW (or NSSW) and about 118 thousand yen due to that of SSTC. In this period personal savings per capita in real terms increased by 143 thousand yen,

thousand yen increase in personal savings per capita in real terms from 1960 to 1980 and a 12 thousand yen increase from 1970 to 1980. Hence, during the two periods from 1960 to 1980 and from 1970 to 1980, the absolute amount of the upward impact of the retirement effect (LF60) on personal savings was about one-tenth of the amount of downward impact of the anticipated social security retirement benefits effect (GSSW and NSSW) and about one-fifth of the amount of downward impact of the social security ta contributions (SSTC). The benefit effect outweighs the retirement effect and the net effect consequently depresses personal savings.

In LF60 equations, the estimated coefficients on the personal savings variable are significant and negative: -0.039, -0.039, and -0.040, in models I, II, and III, respectively, implying that an increase in personal savings induces earlier retirement, i.e., reduces labor force participation. As previously discussed, the marginal propensity to save with respect to LF60 is also observed to be significantly negative. These two results suggest a negative interdependency between the personal savings and labor force behaviors of the elderly. The point elasticities evaluated at the sample means indicate that a one percent increase in personal savings will lead to a reduction in the labor force participation rate of the elderly, i.e., earlier retirement, in the range 0.052 to 0.060 percent.

Most of the other variables are statistically significant and have the

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from 65 thousand yen in 1960 to 208 thousand yen in 1980. The estimated reductions obtained from Models I and II are invariant since the estimated coefficients on social security wealth variables are very insensitive to the specifications.

expected signs. The estimated positive coefficients on physical assets, WEALTH1, in both the personal savings and labor force participation equations indicate the stimulation of personal saving effort for the purpose of obtaining a house and the long mortgage payment which is likely to postpone an individual's retirement. The retained earnings variable, RETAIN, has a significantly negative impact on personal savings, suggesting that an increase in anticipated private retirement pensions provided by firm results in lower personal savings. The government surplus variable, GOVTSUR, has a significantly positive effect on personal savings.

In sum, social security retirement benefits have a negative effect on personal savings, i.e., the benefit effect, and declining labor force participation has a positive effect on personal savings, i.e., the retirement effect. The benefit effect dominates the retirement effect.[12]

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[12]Of equation (5) in section III, $dS_t / dSSW_t = a_1 + a_2 \times b_1$ where $b_1 = \partial LF60_t / \partial SSW_t$. Our result shows $a_1 > a_2 \times b_1$ in absolute value.

V. Conclusion

In the debate over social security and savings, the pivotal issue continues to be whether social security retirement benefits increase or decrease personal savings. Abundant studies fail to produce consistent results. Therefore, the effect of social security retirement benefits on personal savings is still open to question in the United States. This study adapted and applied the methodology used in U.S. studies to Japanese data; the social security system in Japan is relatively similar to that of the United States, but few empirical studies have been done.

Despite the fact that life-cycle saving and labor supply behaviors are mutually determined, studies of the effects of social security retirement benefits on personal savings and retirement decisions often ignore this interdependency. This study has examined the interdependency between the personal savings and labor force participation of elderly men in Japan.

Using Japanese annual time series data covering the period from 1946 to 1982, the study shows that social security wealth depresses personal savings: the effect was approximately a 143 thousand yen reduction per capita in real term from 1970 to 1980. However, the declining labor force participation, i.e., expected earlier retirement, stimulates personal savings, by an estimated 12 thousand yen increase over the same period. Examination of the estimates shows that the benefit effect dominates the retirement effect in Japan. In addition, the study has identified a negative interdependency between the personal savings and retirement behaviors of the elderly. That is, an individual saves more before retirement if he

expects to stay a shorter time in the labor market, and vice versa.

A lack of understanding of the behavioral patterns of personal saving and retirement of the elderly can lead to inappropriate policies. The econometric model estimated in this study is of course based on a number of maintained assumptions, and it would be useful to relax them in future research. Given more complete information, such as the timing of changes in social security rules, and data on private pensions, actual estimation of a model depends on development of much better data than that currently available. To advance the understanding of the socioeconomic activities of the elderly, more studies of this type are required in Japan.

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Table 1. Monthly Social Security Retirement Benefits in Yen (as of 1985)

Age	Monthly Labor Earnings	Monthly SSRB
60 - 64	$W_i \leq 45{,}000$	1 x SSRB (full amount)
	$45{,}000 < W_i \leq 92{,}000$	0.8 x SSRB
	$92{,}000 < W_i \leq 126{,}000$	0.5 x SSRB
	$126{,}000 < W_i \leq 150{,}000$	0.2 x SSRB
	$150{,}000 < W_i$	0 x SSRB
65 and +	$W_i \leq 150{,}000$	1 x SSRB (full amount)
	$150{,}000 < W_i$	0.8 x SSRB

Source: Social Insurance Handbook 1983 (1982), The Bureau of Social Insurance in Japan.

Note. W_i is individual monthly labor earnings, which include wages and payments in kind. Bonuses are also included if they are given four times or more a year. Total benefits are social security retirement benefits (SSRB) plus $15{,}000_{yen}$ x F (F=1 if spouse is alive; and F=0 otherwise) + 5,000 x N(N=min(N_i,2)) + $2{,}000_{yen}$ x (N_i-2) (if N_i>3, N_i=2 otherwise), where N_i is number of dependent children.

Table 2. Definitions of Variables

Variable Name	Definition
S	real per capita personal savings, in 1,000 yen.
LF60	labor force participation rate of males aged 60 and over.
GSSW	as defined by Feldstein and Munnell, real per capita gross social security wealth, in 1,000 yen, based on OASDI program (old-age, survivors and disability insurance under the Welfare Pension Program). There are some modifications for GSSW defined by Feldstein and Munnell. The ratio of benefits to disposable income and that of social security tax payment to disposable income, in per capita, are variable by using the current rates. Life expectation is variable based on current male life expectancy.
NSSW	as defined by Feldstein and Munnell, real per capita net social security wealth, in 1,000 yen, based on OASDI program. Net social security wealth (NSSW) equals gross social security wealth (GSSW) minus present value of social security taxes (SSTAX).
SSTC	as defined by Munnell, real social security tax contributions per person, in 1,000 yen, under OASDI program, of workers with earnings taxable by social security.
YD	real per capita personal disposable income, in 1,000 yen.
WEALTH1	real per capita expense of personal residential construction, in 1,000 yen, in private sector, at the beginning of year.
WEALTH2	real per capita net liquidity wealth: stocks, bonds, trusts and life insurance, in 1,000 yen, at the beginning of year.
UYD	the product of male unemployment rate and real per capita personal disposable income.
RETAIN	real per capita corporate retained earnings, in 1,000 yen.

(continued)

Table 2 (concluded)

Variable Name	Definition
GOVTSUR	real per capita surplus of the central government sector, in 1,000 yen.
AGRICL	ratio of the number of workers in agriculture and forestry to total labor force
EDUCA	ratio of the number of graduates from Kouto-senmon gakko (equivalent to junior college), junior college, senior college and university to people who completed at least the nine-year compulsory education of elementary school and junior high school.

Note: The sources are listed in Tables 4 and 4.1

Table 3. Regression Results of the Impact of Social Security on Personal Savings and Labor Retirement of the Elderly

Independent Variable	Model I		Model II		Model III	
	S	LF60	S	LF60	S	LF60
Intercept	103.55 (1.69)	112.68*** (14.66)	113.55* (1.86)	112.79*** (14.58)	95.69 (1.32)	114.31*** (15.80)
GSSW	-0.004*** (-4.82)	-0.005E-3 (-0.03)	---	---	---	---
NSSW	---	---	-0.005*** (-4.99)	-0.003E-3 (-0.02)	---	---
SSTC	---	---	---	---	-0.979*** (-3.49)	0.085E-1 (0.19)
S	---	-0.039* (-1.73)	---	-0.039* (-1.75)	---	-0.040* (-1.79)
LF60	-2.031** (-2.23)	---	-2.172** (-2.40)	---	-1.539 (-1.51)	---
YD	0.379** (2.57)	-0.129*** (-4.27)	0.359** (2.50)	-0.129*** (-4.37)	0.046 (0.31)	-0.134*** (-5.43)
YD_{-1}	0.061 (0.55)	0.063*** (3.71)	0.065 (0.60)	0.063*** (3.75)	0.150 (1.19)	0.065*** (3.84)
WEALTH1	0.733** (2.58)	0.246*** (3.75)	0.726** (2.60)	0.247*** (3.76)	0.407 (1.18)	0.259*** (3.58)
WEALTH2	0.427 (1.66)	-0.018 (-0.46)	0.428 (1.69)	-0.017 (-0.45)	0.352 (1.20)	-0.017 (-0.43)
UYD	0.007 (0.88)	-0.003E-1 (-0.18)	0.010 (1.16)	-0.003E-1 (-0.18)	0.016 (1.41)	-0.005E-1 (-0.28)
RETAIN	-0.481*** (-4.64)	---	-0.486*** (-4.76)	---	-0.399*** (-3.42)	---
GOVTSUR	0.570** (2.37)	---	0.607** (2.54)	---	0.491* (1.77)	---
AGRICL	---	-0.732*** (-6.12)	---	-0.734*** (-6.06)	---	-0.758*** (-6.18)
EDUCA	---	0.312** (2.14)	---	0.313** (2.15)	---	0.314** (2.18)

(continued)

Table 3 (concluded)

Independent Variable	Model I		Model II		Model III	
	S	LF60	S	LF60	S	LF60
Durbin-Watson	1.83**	2.12**	1.83**	2.11**	1.91**	2.12**
SER	8.74	1.44	8.67	1.44	9.61	1.44
R^2	0.993	0.936	0.993	0.936	0.989	0.934

*** Significant at 1 percent. ** Significant at 5 percent. * Significant at 10 percent.
Note: t-statistics are in parentheses below the estimated coefficients. Asterisks for the Durbin-Watson statistic represent the acceptance of the null hypothesis after correction for serial correlation at 5 percent (or less) significance level. SER is the standard error of the regression.

Table 4. Sources of Data

Social Security

Social security retirement benefits (1944-1983): "Social Insurance Agency Annual Report," 1965-1983, Social Insurance Agency Japanese Government.
Social security tax (1944-1983): "Social Insurance Agency Annual Report," 1965-1983, Social Insurance Agency Japanese Government.

Savings

Savings (1946-1982): "Annual Economic Statistics," 1960-1983, Bank of Japan.
"White Paper of National Income," 1930-1960, and "National Economic Calculation," 1951-1983, Economic Planning Agency.

Labor Force Participation Rate

Labor force participation rate (1946-1982): "Labor Survey," 1948-1983, Statistics Bureau, Prime Minister's Office, and Department of Statistical Information in Ministry of Labor, and Department of Population Census in Prime Minister's Office.

Income

Personal income (1946-1982): "National Income Calculation," 1951-1983, Economic Planning Agency.
"White Paper of National Income," 1930-1960, Economic Planning Agency.
"Annual Economic Statistics," 1965, Bank of Japan.

Unemployment Rate

Unemployment rate (1946-1982): "Labor Survey," 1948-1983, Statistics Bureau, Prime Minister's Office, and Department of Statistical Information in Ministry of Labor.

Taxes

Income tax (1946-1982): "National Income Calculation," 1951-1983, Economic Planning Agency.
"White Paper of National Income," 1930-1960, Economic Planning Agency.
"Annual Economic Statistics," 1965, Bank of Japan.

Price Index

Consumer price index (1945-1982): "Annual Economic Statistics," 1960-1983, Bank of Japan, and Department of Statistical Consultation in Bank of Japan.
GNP deflator (1945-1983): "Annual Economic Statistics," 1960-1983 Bank of Japan, and Department of Statistical Consultation in Bank of Japan.

Table 4. Sources of Data (continued)

Population

Population (1945-1983): "Vital Statistics of Japan," 1960-1983, Ministry of Health and Welfare.

Life Expectancy

Life Expectancy (1945-1983): "Life Table," 1935-1983, Japanese Insurance Organization.

Interest Rate

Market and discount rates, and yield of 10 years long term bond (1940-1983): "Annual Economic Statistics," 1960-1983, Bank of Japan, and Department of Statistical Consultation in Bank of Japan.

Retained Earnings

Retained earnings (1946-1983): "Annual Economic Statistics," 1960-1983, Bank of Japan.
"White Paper of National Income," 1930-1960, and "National Economic Calculation," 1951-1983, Economic Planning Agency.

Government Surplus

Government surplus (1946-1983): "Annual Economic Statistics," 1960-1983, Bank of Japan.
"White Paper of National Income," 1930-1960, and "National Economic Calculation," 1951-1983, Economic Planning Agency.
Department of Survey in the Ministry of Finance.

Agriculture and Forestry

Labor Survey (1948-1983), Statistics Bureau, Prime Minister's Office.

Education

Education 1946-1982: "Educational Statistical Survey," 1980-1983, Department of Education.

Wealth, Physical Assets, and Liquidity Assets

"Annual Economic Statistics," 1960-1983, Bank of Japan.
"National Income Calculation," 1951-1983, Economic Planning Agency.
"Family Income and Expenditure Survey," 1951-1983, Statistics Bureau, Prime Minister's Office.