Personal Saving, Labor Force Participation and Social Security Retirement Benefits in Japan

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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 saving. The effect was a reduction of approximately 143 thousand yen per capita of 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 efect dominates the retirement effect. In addition, this study has identified a negative interdependency between the personal saving and labor retirement behaviors of the elderly; that is, an individual saves more befor retirement if he expects to stay a shorter time in the labor market, and vice versa.

I. Introduction

The effect of the Japanese social security retirement program, begun after World War II, on the behavioral pattern of high personal saving and the labor force participation of the elderly by a simultaneous

approach has not been empirically studied. Ever since its institution, the social security system has alleviated the financial problems of the elderly under changing economic and social conditions. One reason for this lack of attention is an excess or sufficient savings in the private sector in Japan as well as a relatively high labor force participation among the elderly in Japan compared to other industrialized nations. In contrast, in the United States where there are insufficient savings, this system has come under fire.

In the debate over social security and saving in the United States, the important issue continues to be whether social security retirement benefits increase or decrease personal saving. Despite an abundance of empirical studies on this issue, no conclusion has been reached upon. Inconsistent and different results stem from the choice of data, age groups and the scope of their studies.[1)]

In the United States an early and frequently cited study by Boskin (1977) sheds some light on the relation between social security and the retirement behavior of elderly workers. He stresses that social security retirement benefits influence the elderly to leave the job or to restrict market work, thereby reducing the labor supply 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) accept the hypothesis that social security retirement benefits delay the retirement of the elderly.[2)] Mathematical and theoretical analyses by Crawford and Lilien (1981) seem to support the statement of Blinder, Gordon and Wise (1980). Assuming uncertainty of lifespan, fairness of social security retirement benefits and perfect capital markets, the mathematical model by Crawford and Lilien reveals a tendency to delay retirement of the elderly who expect an increase in deferred social security retirement benefits. These results suggest that the effects of social security retirement benefits on personal saving and the retirement decisions of the elderly are still open to debate.

In Japan very few empirical studies concerning the effect of social security retirement benefits on personal saving and the retirement behavior of elderly workers have been done. Noguchi (1983) finds the effect of gross social security wealth on household net wealth to be negative, but significant in only one of social security wealth specifications. Other studies, for examples, Ishikawa and Ueda (1984), Ando, Yamashita and Murayama (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 saving, and upon the labor supply of the elderly in Japan under different demographic and socio-economic backgrounds using a simultaneous-equation model. The study also examines the interdependency between personal saving and labor force participation of the elderly (which explains retirement from the labor market) in relation to social security retirement benefits. The hypothesis to be tested states that personal saving over the life cycle is determined simultaneously with retirement decisions, as discussed and emphasized by King (1983), Thompson (1983) and Graham (1987). The development of a simultaneous-equation model of personal saving and labor force participation of the elderly will hopefully produce consistent estimates of the structural parameters. A lack of understanding of the behavioral patterns of the retirement decision and saving behavior, can lead to misleading policy implications. First, it helps us to understand implications of retirement policies.

Second, if social security retirement benefits reduce lifetime personal saving 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)]

The organization of the subsequent sections is as follows. Section II describes the analytical framework. The empirical results are presented in Section III. In Section IV we conclude by mentioning the potential importance of the personal saving, labor force participation of the elderly and social security wealth.

II. Analytical Framework

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. Retirement benefits of the Japanese Welfare Pension are indexed to the inflation rate. Contributions are generally required for a minimum of 20 years. The normal retirement age is 60 for men and 55 for women.[6)] 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.

A primary goal of the present paper is to study the effects of social security retirement benefits on personal saving for the postretirement period and on the labor force behavior of the elderly.[7)] 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.

Social security retirement benefits affect the life-cycle saving 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 saving 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 amount of saving and the social security retirement benefits each exert different influences on the quantity of a lifetime labor supply. In addition, the labor supply affects life-cycle saving. Consequently, a model should reflect not only the effects of social security retirement benefits upon the personal saving and labor force behavior of elderly, but also the interactions between the two behaviors. In a model, the omission of a labor force behavior variable from a saving behavior equation would cause the estimated coefficient on a social security wealth variable to be biased toward zero[8]. To demonstrate a simultaneity of personal saving and etirement, the study employs personal saving and labor force participation of the elderly as endogenous variables in a model of extended life cycle framework[9]. The specification of a simultaneous equation model is as foollows:

$$S_t = a_0 + a_1 SSW_t + a_2 LF60_t + a_3 YD_t + a_4 YD_{t-1} + a_5 ASSET1_t + a_6 ASSET2_t + a_7 UYD_t + a_8 RETAIN_t + a_9 GOVTSUR_t + u_t \quad \cdots\cdots(1)$$

$$LF60_t = b_0 + b_1 SSW_t + b_2 S_t + b_3 YD_t + b_4 YD_{t-1} + b_5 ASSET1_t + b_6 ASSET2_t + b_7 UYD_t + b_8 EDUCA_t + b_9 AGRICL_t + v_t \quad \cdots\cdots(2)$$

where the variables in the model are defined in Table 1 (the subscript "i" is omitted for brevity), and u_t and v_t are residual terms, assumed indepen-

Table 1. Definitions of Variables.

Variable Name	Definition
S	real per capita personal saving, in 1,000 yen. (μ=100.159, σ=77.774)
LF60	labor force participation rate of males aged 60 and over. (μ=67.197, σ=5.085)
SSW	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. Net social security wealth (SSW) equals gross social security wealth (GSSW) minus present value of social security taxes (SSTAX). GSSW (μ=39180.7, σ=32764.1) SSW (μ=33048.2, σ=28014.4)
SST	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. (μ=49.685, σ=47.874)
YD	real per capita personal disposable income, in 1,000 yen. (μ=547.972, σ=350.412)
ASSET1	real per capita expense of personal residential construction, in 1,000 yen, in private sector, at the beginning of year. (μ=47.134, σ=39.466)
ASSET2	real per capita net liquidity wealth: stocks, bonds, trusts and life insurance, in 1,000 yen, at the beginning of year. (μ=35.376, σ=28.208)
ASSET	real per capita net wealth excluded durable assets in 1,000 yen at the beginning of year. (μ=126.919, σ=88.415)
UYD	the product of male unemployment rate and real per capita personal disposable income. (μ=947.708, σ=768.668)
RETAIN	real per capita corporate retained earnings, in 1,000 yen. (μ=25.179, σ=25.484)
GOVTSUR	real per capita surplus of the central government sector, in 1,000 yen. (μ=33.968, σ=26.482)
AGRICL	ratio of number of workers in agriculture and forestry to total labor force. (μ=25.691, σ=13.474)
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. (μ=15.000, σ=12.100)

Note: The sources are listed in Appendix 2. The symbols μ and σ denote mean and standard deviation, respectively.

dent, with zero means and constant variances.

The rationale for including the variables in the model is found in similar studies in the literature (Barro 1978, Burkhauser and Turner 1978 and 1982, Feldstein 1974, Leimer and Lesnoy 1982, Munnell 1974, and Noguchi 1983). Therefore, only the variables of interest are discussed. In the personal saving equation (equation 1), 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). Why is the labor force participation rate at age sixty and over one of the independent variables in the saving equation (1)? 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). Thus an additional variable is needed to explain the retirement effect. Munnell (1974) addresses the same question and introduces a new variable: a labor force participation of males aged 65 and over, for the U. S. study. Since a mandatory retirement age implicitly exists at the age between 55 and 60 under the Japanese lifetime employment system, according to the Ministry of Labor in 1980, most of the enterprises have a uniform retirement age between 55 and 60. Virtually four out of five business firms reemploy their own newly retired workers with lower wages and conditionally extend their retirement dates by up to several years. The starting age for receiving social security retirement benefits is sixty in Japan. Hence, this study includes the labor force participation rate of men ages 60 and over to capture the retirement effect as discussed in Munnell (1974). Furthermore, as argued in footnote 8, the omission of a LF60 variable from functioal form (1) would cause the estimated coefficient on the SSW variable to be biased towards zero. This happens if both estimated coefficients of LF60 and SSW are negative and if LF60 and SSW are negatively correlated.

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 saving if, given the value of current disposable income and other variables, the variable has a positive impact on current personal saving.

This study includes two different proxy measures of asset variables: ASSET1 includes physical assets (e.g., houses), which are less liquid than ASSET2 (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, ASSET1, will have a different impact on personal saving than ASSET2.

The product of U and YD (UYD) is included in the saving function to adjust for the cyclical variation in personal saving 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 saving. 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 saving. An increase in the government's budget surplus (GOVTSUR) has a positive influence on personal saving through an increase in future disposable income from the lowering of taxes and the price level (Barro, 1978). An increase in current government spending causes an increase in future taxes in order to finance a higher level of government spending. Individuals may reduce their own spending due to the anticipation of higher future taxes. Thus personal saving is inversely associated with government surplus. As a result the effect is ambiguous.

In the general functional form for labor force participation (2), an increase in social security wealth (SSW or GSSW or SST) may induce earlier retirement, resulting in a prolonged retirement period. Consequently, the labor force participation of the elderly (LF60) declines. Higher personal saving (S) will also 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, and consequently influences the individual's retirement. The general argument is that investments in human capital increase the number of additional years of work. 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 (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 saving and labor force participation of the elderly[10]. In addition, the empirical results will shed light on the interdependency of Japanese personal saving and labor force behavior of the elderly.

III. Empirical Results

The data used to estimate the model are annual time series data covering the period of 1946 to 1982 shown in Appendix 2. The simultaneous equation model consists of an equation for personal saving and an equation for the retirement decisions of men ages 60 and over. Table 2 presents the results of ordinary least squares (OLS) and two-stage least squares estimates (TSLS) after correcting for serial correlation. The social

security wealth variable takes three alternative forms: gross social security wealth GSSW in models I and II, net social security wealth SSW in models I and III, and social security tax contributions SST in models I and IV. The alternative forms will show the sensitivity of the empirical results to the different specifications of the social security wealth variable. The construction of social security wealth variables is in Appendix 1. The study also investigates whether the estimates are sensitive to estimation by a simultaneous equation method versus a single equation method.

One of the robust results in the personal saving equations (the S columns) is that the social security wealth variables, GSSW, SSW and SST, are statistically significant and negative. Another striking result is that the estimated coefficients on the labor force pariticipation rate of men ages 60 and over, LF60, are negative and statistically significant in models I, II and III. On the other hand, in the labor force participation equations (the LF60 columns), the estimated coefficients on the personal saving variable are significantly negative in all models of TSLS. Therefore, simultaneity exists between personal saving and retirement decisions of the elderly. Feldstein (1980) and Graham (1987) show that TSLS coefficients differ very little from OLS estimates on saving equations. The regression results for the saving equations obtained from TSLS are nearly identical with those obtained from the corresponding OLS estimates. The discussion now focuses on the simultaneous equations to see the effects of social security wealth variables and other socioeconomic variables on saving and the labor force participation of the elderly.

Concerning the effect of social security wealth on personal saving, the marginal propensity to save with respect to GSSW, SSW and SST is -0.004 in model II, -0.005 in model III, and -0.979 in model IV, respectively. The point elasticities evaluated at the sample means are -1.56 (GSSW), -1.65 (SSW), and -0.49 (SST). In terms of elasticity, the magnitude of anticipated social security retirement benefits (GSSW and SSW) is substantially greater than that of current social security tax con-

Table 2. Regression Results of Saving, Labor Force Participation of the Elderly and Social Security Wealth.

	(OLS) Model I			(TSLS) Model II		(TSLS) Model III		(TSLS) Model IV	
Independent Variable	S (GSSW)	S (SSW)	S (SST)	S (GSSW)	LF 60	S (SSW)	LF 60	S (SST)	LF 60
Intercept	81.92 (1.56)	86.96 (1.66)	110.12* (2.09)	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	−0.003*** (−3.15)	——	——	−0.004*** (−4.82)	−0.005E-3 (−0.03)	——	——	——	——
SSW	——	−0.003*** (−3.28)	——	——	——	−0.005*** (−4.99)	−0.003E-3 (−0.02)	——	——
SST	——	——	−0.873*** (−3.59)	——	——	——	——	−0.979*** (−3.49)	0.085E-1 (0.19)
S	——	——	——	——	−0.039* (−1.73)	——	−0.039* (−1.75)	——	−0.040* (−1.79)
LF60	−1.77** (−2.31)	−1.847** (−2.41)	−1.865** (−2.56)	−2.031** (−2.23)	——	−2.172** (−2.40)	——	−1.539 (−1.51)	——
YD	0.460*** (3.44)	0.447*** (3.47)	0.150 (1.43)	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}	0.117 (0.93)	0.118 (0.94)	0.249** (2.10)	0.061 (0.55)	0.063*** (3.71)	0.065 (0.60)	0.063*** (3.75)	0.150 (1.19)	0.065*** (3.84)
ASSET1	——	——	——	0.733** (2.58)	0.246*** (3.75)	0.726** (2.60)	0.247*** (3.76)	0.407 (1.18)	0.259*** (3.58)
ASSET2	——	——	——	0.427 (1.66)	−0.018 (−0.46)	0.428 (1.69)	−0.017 (−0.45)	0.352 (1.20)	−0.017 (−0.43)
ASSET	−0.566** (−2.29)	−5.568** (−2.31)	−0.649** (−2.63)	——	——	——	——	——	——
UYD	−0.010 (−1.23)	−0.008 (−1.01)	−0.003 (−0.33)	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	−0.402*** (−3.37)	−0.409*** (−3.46)	−0.343*** (−3.26)	−0.481*** (−4.64)	——	−0.486*** (−4.76)	——	−0.399*** (−3.42)	——
GOVTSUR	−0.826*** (−3.12)	−0.858*** (−3.26)	−0.819*** (−3.39)	−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)
Durbin-Watson	1.87**	1.86**	1.94**	1.83**	2.12**	1.83**	2.11**	1.91**	2.12**
SER	8.95	8.90	9.01	8.74	1.44	8.67	1.44	9.61	1.44
Adjusted R^2	0.985	0.985	0.986	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 significance level and firpt-order serial correlation is corrected by Beach and McKinnon method. SER is the standard error of the regression.

tributions (SST): the first two elasticities are three times larger than the last one. Utilizing these estimated elasticities, the study examines the relative contributions of GSSW, SSW and SST to the recent Japanese personal saving experience for the period of 1970–1980. Personal saving 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 SSW over the period resulted in approximately a 143 thousand yen reduction in personal saving per capita in real terms, while the increase in SST resulted in a 77 thousand yen reduction in personal saving.[11)] Therefore, personal saving is depressed by approximately 68 percent due to the increase in GSSW and SSW, ceteris paribus, while the reduction in saving due to the increase in SST is by approximately 53 percent.

The point elasticities of personal saving with respect to the labor force participation of elderly males, LF60, are −1.36 in model II, −1.46 in model III, and −0.76 in model IV, 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 saving of earlier retirement was about a 23 thousand yen increase in personal sav-

ing 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 saving was about one-tenth of the amount of downward impact of the anticipated social security retirement benefits effect (GSSW and SSW) and about one-fifth of the amount of downward impact of the social security tax contributions (SST). The benefit effect outweighs the retirement effect and the net effect consequently depresses personal saving.

In LF60 equations, the estimated coefficients on the personal saving variable are significant and negative: -0.039, -0.039, and -0.040, in models II, III and IV, respectively, implying that an increase in personal saving 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 saving and labor force behaviors of the elderly. The point elasticities evaluated at the sample means indicate that a one percent increase in personal saving 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 expected signs. ASSET variable in Model I has the expected negative signs which indicate that an increase in net wealth would be accompanied by a decrease in personal saving. Therefore net wealth and personal saving are substitutes. The estimated positive coefficients on physical assets, ASSET1, in both the personal saving and labor force participation equations in Models II, III and IV 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 saving, suggesting that an increase in anticipated private retire-

ment pensions provided by a firm results in lower personal saving. The government surplus variable, GOVTSUR, has a significantly negative effect on personal saving and the signs are congruent with the study by Barrow (1978) in the U. S. A one thousand yen increase in the government surplus depresses personal saving by about seven hundred yen on average. Although the coefficients of GOVTSUR in Model I are larger than that of GOVTSUR in other models, the marginal effect of the government surplus on personal saving is significant.

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

IV. Conclusion

The results underscore the importance of the interdependency between personal saving and labor force participation of elderly and the effect of social security retirement benefits on both of these. Using Japanese annual time series data covering the period from 1946 to 1982, the study shows that social security wealth depresses personal saving: the effect was approximately a 143 thousand yen reduction per capita in real terms from 1970 to 1980. However, the declining labor force participation, i.e., expected earlier retirement, stimulates personal saving, by an estimated 12 thousand yen increase over the same period. Examination of the estimates reveals that the benefit effect dominates the retirement effect in Japan. In addition, the study has identified a negative interdependency between the personal saving 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. The finding provides suggestive, although far from definitive, explanations of relatively high

personal saving and a declining trend in elderly labor force participation, namely early retirement, in Japan. The role and effect of public policy are clearcut. First, the recently drastic reform of the social security system by extending the eligible age in 1986 may reflect the behavioral characteristics of elderly labor froce participation. As a result of the reform the elderly tend to stay longer in the labor market. The late retirement may cause a reduction of life-time saving, and consequently a reduction of capital formation and aggregate output. Second, the Japanese government has recently requested private fioms and other organizations to extend the mandatory retirement ages beyond the traditional age of fifty-five and has required firms and other institutions to hire more elderly workers. To raise the eligible age for the social security retirement benefits with a coordinated increase in the retirement age in the private sector will be a vital part of the retirement program in Japan.

The results, that a decrease in the labor force participation, namely early retirement, raises personal saving, call for additional research. A lack of understanding of the behavioral patterns of personal saving and retirement of the elderly can lead to inappropriate policies. 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 the development of 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.

Footnotes

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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 retire-

ment benefits on personal saving, 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. Cross-country test by Graham (1987) also found an insignificant impact of social security on private saving unlike Feldstein (1980)'s findings.

2) Burkhauser and Turner (1978; 1982) 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 saving in the United States, but the estimation of this type of model depends on development of much better data than that currently available in Japan.

4) Another social security retirement program is the National Pension for self-employed workers and housewives who are not in the paid labor force. The paper focuses on the Welfare Pension in this study.

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.

7) Japanese workers normally retire by the age of 60, at which time they are entitled to receive social security retirement benefits and the annuity value of the benefits does not change with the age of acceptance because of no provision of a delayed retirement credit (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.

8) To be specific consider the following variables model:

$$S=\alpha_0+\alpha_1 SSW+\alpha_2 LF \quad \cdots\cdots 1$$

where S is personal saving, SSW is social security retirement benefits and LF is labor force participation variables. $\alpha_1<0$, and $\alpha_2<0$.

If we omit LF, the estimate is

$$S=\hat{\alpha}_0+\hat{\alpha}_1 * SSW \quad \cdots\cdots 2.$$

From equation 1,

$$\sum S.\ SSW / \sum SSW^2=\alpha_1+\alpha_2 \sum LF.\ SSW / \sum SSW^2 \quad \cdots\cdots 3.$$

From enuation 2, we get

$$\sum S.\ SSW / \sum SSW^2=\hat{\alpha}_1 * \quad \cdots\cdots 4.$$

Based on the omitted variable formula we have

$\hat{\alpha_1}^* = \alpha_1 + \alpha_2 b$ ..... 5.

where $\alpha_1 < 0$, $\alpha_2 < 0$, $b < 0$, and $\alpha_2 b > 0$. b is the regression coefficient of LF on SSW ($LF = b_0 + b SSW$).

If magnitudes of α_1 and $\alpha_2 b$ are equal, both offset each other. $\hat{\alpha_1}^* \approx 0$. $\hat{\alpha_1}^*$ tends to bias toward zero, if LF is omitted from the saving function.

9) Graham (1987) conducts an interesting econometric test by using the labor froce participation rate of female as an endogeneous variable with two-stage least squares. He shows the statistically significant results. Feldstein (1980) argues that the labor force participation of the aged reduces the saving rate by 0.02 by emphasizing two-stage least square with asymptotic consistency.

10) The study utilizes two-stage least squares which provide a useful estimation procedure for obtaining the values of structural parameters in overidentified equations. The order condition for determining the identification status of the structural equations in the model is satisfied. However the results of the rank condition lead the structural equations to being overidentified. Kmenta intensively discusses the identification problem in *Elements of Econometrics* (1986) by Macmillan Publishing Company.

11) The method for this calculation is adapted from Shapiro and Shaw (1983). The estimated reductions in personal saving during the period from 1960 to 1980 were about 291 thosand yen are to the effects of GSSW or (SSW) and about 118 thousand yen due to that of SST. In this period personal saving per capita in real terms increased by 143 thousand yen, from 65 thousand yen in 1960 to 208 thousand yen in 1980. The estimated reductions obtained from Models II and III are invariant since the estimated coefficients on social security wealth variables are very insensitive to the specifications.

12) Of equation (1) in section II, $dS_t / dSSW_t = a_1 + a_2 \times b_1$ where $b_1 = \partial LF60_t / \partial SSW_t$. The result shows $a_1 > a_2 \times b_1$ in absolute value.

Appendix 1

The Construction of Sccial Security Wealth Variable

The social security wealth variable in the model can assume three alternative forms: gross social security wealth GSSW, net social security wealth SSW, and

social security tax contributions SST.

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

$$GSSW_{a,t}=\sum_{k\geq 60} A_{a,t}\times L_{60|a}\times YD_{a,t}\times B_t^{60-a}\times L_{k|60}\times B_t^{k-60} \quad \cdots\cdots(1)$$

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,

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

$L_{k|60}$ = probability of an indiviaual 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 weaith 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 Secrity Wealth (SSW) is defined as:

$$SSW_{a,t}=GSSW_{a,t}-SSTAX_{a,t} \quad \cdots\cdots(2)$$

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

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

$SSTAX_{a,t}$ = 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,

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

r = real interest rate at time t.

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

$$SST_{a,t}=OASDI_{a,t} / CPI_t \quad \cdots\cdots(3)$$

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.

Appendix 2

Sources of Data

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