1987

Social Security, Savings, and Labor Supply of the Elderly in Japan

Tetsuji Yamada
Graduate Center, City University of New York

INFORMATION TO USERS

While the most advanced technology has been used to photograph and reproduce this manuscript, the quality of the reproduction is heavily dependent upon the quality of the material submitted. For example:

- Manuscript pages may have indistinct print. In such cases, the best available copy has been filmed.
- Manuscripts may not always be complete. In such cases, a note will indicate that it is not possible to obtain missing pages.
- Copyrighted material may have been removed from the manuscript. In such cases, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, and charts) are photographed by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each oversize page is also filmed as one exposure and is available, for an additional charge, as a standard 35mm slide or as a 17"x 23" black and white photographic print.

Most photographs reproduce acceptably on positive microfilm or microfiche but lack the clarity on xerographic copies made from the microfilm. For an additional charge, 35mm slides of 6"x 9" black and white photographic prints are available for any photographs or illustrations that cannot be reproduced satisfactorily by xerography.

Yamada, Tetsuji

SOCIAL SECURITY, SAVINGS, AND LABOR SUPPLY OF THE ELDERLY IN JAPAN

City University of New York PH.D. 1987

SOCIAL SECURITY, SAVINGS, AND LABOR SUPPLY OF THE ELDERLY IN JAPAN

by

TETSUJI YAMADA

A dissertation submitted to the Graduate Faculty in Economics in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1987

This manuscript has been read and accepted for the Graduate Faculty in Economics of the City University of New York in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

[signature]

12/30/86
Date

Chairperson of Supervisory Committee

[signature]

12/30/86
Date

Executive Officer, Department of Economics

Professor Michael Grossman

Professor Harold Hochman

Professor Salih Naftci

Supervisory Committee

The City University of New York

ABSTRACT

SOCIAL SECURITY, SAVINGS, AND LABOR SUPPLY
OF THE ELDERLY IN JAPAN

by

Tetsuji Yamada

Adviser: Professor Michael Grossman

The study examines the controversial, inconsistent empirical results of the effect of social security on personal savings and analyzes the interdependency in the context of social security between the personal savings and laber supply behavior of elderly workers.

Very few studies in this field have been done, and it has not theoretically and empirically been accomplished yet in Japan. Time-series data are used for 1946-1982, and the methods of technique are ordinary least squares and a simultaneous-equation model in the life cycle framework.

The study finds that social security affects personal savings and that the benefit effect dominates the retirement effect concerning the hypothesized dual effects. The study also identifies an interdependency between personal savings and the labor force participation of the elderly in Japan.

To my father, Zenzo

To my mother, Kikue

To my late granfather Senmatsu

and

To my late grandmother Nami

ACKNOWLEDGEMENTS

The accomplishment of any difficult task requires not only perseverance but also the guidance and support of many individuals. I thank all the people associated with this thesis project and my studies here in the United States.

I am especially indebted to Professor Michael Grossman, who directed my work, and who was always available and willing to give advice and encouragement. His dedication to the trainning of economists is exemplary and this quality has touched not only his own students but all those in the Department of Economics.

I owe a special gratitude to Professor Harold Hochman, whose assistance and perspective through the years had a role in stimulating my attention to a broader investigation of ideas in economics. It was a great privilege to have Professor Harold Hochman as a member of my dissertation committee.

I would like to express my very sincere appreciation to Professor Salih Neftci who will have the painstaking job of reading my dissertation. I thank him for his valuable time.

In Professor Herbert Geyer I found an individual whose concern and continued encouragement made it possible for me to achieve my graduate work. I have learned a great deal from him.

I sincerely thank him for his patience, understanding and encouragement.

I especially want to thank my brother, Tadashi Yamada, who is also my best friend and colleague. I have exchanged ideas and thoughts with him. I hope to continue this treasured relationship with him for the rest of lives. I am also grateful to the following persons for their assistance. They helped me to accomplish my study in the United States.

Mr. Fujita Natsuji, Mrs. Fujita Misao,
Mr. Masuda Eiichi, Mrs. Masada Kazue,
Mr. Imura Isao, Mrs. Imura Satsue,
Mr. Yamada Tsuneo, Mrs. Yamada Masako,
Mrs. Yamada Nobuko, Mrs. Sugimoto Yoshie,
Mr. Uenoyama Masahiro, Mrs. Uenoyama Noriko,
Mr. Kinoshita Sakae, Mrs. Kinoshita Toshiko,
Mr. Iwai Tokuji, Mrs. Iwai Mayumi,
Mr. Yagi Haruo, Mr. Tsukamoto Yoshihiro,
Ms. Tanaka Kakuyo, Ms. Hayasaka Tomoe,
Professor Yokoyama Tatsuo,
Professor Takeuchi Yoshio,
Professor Elliot Zupnick.

Finally, I would like to thank my father, my mother, my late grandfather and my late grandmother for their patience, generosity and encouragement to pursue my study.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 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 private 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.

The pioneer study of the impact of social security benefits on personal savings was done by Feldstein (1974). On the basis of his estimated time-series results, expected social security benefits reduce personal savings by more than 30 percent. The study by Munnell (1974) also supports Feldstein's result.

Barro (1978) includes, in addition to the variables of Feldstein's model, new explanatory variables: government surplus and household durable goods. As for estimated coefficients, his alternatively specified social security variables are negative and statistically insignificant, while Feldstein's specification

of social security variables examined by Barro are positive, but statistically insignificant. Barro concludes that social security wealth or benefits do not really affect personal savings.

Darbey (1979) suggests that the reduction of personal savings is smaller than Feldstein and Munnell report. Leimer and Lesnoy (1982) state that the results differ not only under specification and construction of social security wealth variables, but also according to the period of estimation examined. Lesnoy and Leimer (1985) discuss econometric modeling, the interpretation of estimated coefficient and a sample of a particular period of historical observations related to an inclusion of true value. They conclude that the time-series data provide little statistical support for the proposition that social security has reduced personal savings in the United States.

An interesting study by Modigliani and Sterling (1983) does not exclusively deal with the United States but is an aggregate cross-country study of 21 OECD countries and takes an average of each country over the decade 1960-1970. Unlike other studies, except for that of Munnell (1974), Modigliani and Sterling, using a GLS technique in the life cycle framework, estimate not only direct benefit effect but also retirement effect. The results show that the small benefit and large retirement effects offset each other.[1] The net impact of social security retirement bene-

fits is close to zero. The study suggests that an increase in social security retirement benefits tends to reduce private per capita savings, but not as dramatic as shown in Feldstein's result.

There are other studies currently using microdata. Blinder, Gordon and Wise (1983) use an extensive cross-sectional data set beginning in 1969 and reinterviewing in 1979 (Longitudinal Retirement History Survey). They propose that there may be some displacement of private savings by social security retirement benefits within the life cycle framework. An increase of $1 in each social security wealth induces people to depress their financial wealth by 39 cents. This reasonable number is unfortunately unable to convince these researchers of the hypothesis of benefit effect because of a statistically insignificant estimated result.

Hamermesh (1984) applies microdata to a life cycle model. He uses his own constructed social security wealth variable, and his empirical study shows that small estimated coefficients compared to pension wealth variables reveal a statistically significant effect on consumption.

Williamson and Jones (1983) analyze a simulation of impact of social security upon life cycle behavior. They state that because of an increasing retirement period due to earlier re-

tirement and increasing life expectancy, the benefit effect of social security is offset by the retirement effect, although a pay-as-you-go social security system has a large impact on savings. Beach, Boadway and Gibbons (1984) use simulation methodology, taking U.S. annual national accounts data from 1929 through 1974 (excluding 1941-1946), to investgate the impact of direct social security wealth on private savings and capital accumulation. Their econometric technique is a non-liner FIML (a full-information maximum likelihood). The considerably small and statistically weak estimated results do not provide strong evidence for the impact of social security wealth on private savings.

The anticipation of the value of social security retirement benefits and an accumulation of compulsory savings for one's retirement period may have the effect of reducing voluntary private savings and of encouraging more consumption during the working period than would otherwise occur (Feldstein, 1974, 1982; Munnell, 1974; Blinder, Gordon and Wise 1983; Modigliani and Sterling, 1983; and Hamermesh, 1984). In the United States it may well be that lifetime-guaranteed social security retirement benefits will indeed affect voluntary private savings.

The recent development of a social security system in Japan could possibly stimulate an earlier retirement by older workers.

However, the ratio of personal savings to disposable income is remarkably high compared with that of the United States. The ratios were 18.7% in 1960, 18.2% in 1970, 19.2% in 1980, and 19.7% in 1981 in Japan, while those ratios in the United States have ranged historically between 5.0-8.5%. Why is the Japanese experience so different ? The historical evidence should be examined.

Concerning Japanese studies, an ambiguous argument by Takayama (1982) is that an increase in public pensions will reduce "private savings" only slightly. Public pensions are likely to increase total savings by increasing government capital formation through the partially funded system of a social security program. Noguchi (1983) shows that his estimated coefficients of Feldstein's algorithm (1974) of gross social security wealth measure are negative and that only one estimated coefficient in several equations is statistically significant. Another social security wealth measure, the value of past accumulated contributions of public pensions, reveals a substitution for the household net wealth. Two estimated coefficients in several equations show positive signs, however. Thus, Noguchi does not present any decisive conclusion concerning the effect social security has on savings.

In Japan the Welfare Pension is a partially funded system,

not a pay-as-you-go one. The Japanese system still provides for a demographic shift in the near future. This social security program (Welfare Pension) was introduced in 1942. The program has been in a process of development. The Welfare Pension, which is similar to the OASDI program in the United States, covers a majority of Japanese workers.[2] The tax rate of the Welfare Pension (social security tax rate) is at a flat rate of 10.6% on monthly earnings up to a taxable maximum of 410 thousand yen from the taxable minimum of 45 thousand yen for male workers. The rate is an 8.9% flat tax rate for females.[3] Half this rate is shared by the employer, as is true with the United States social security system.

Japanese Welfare Pension retirement benefits (social security retirement benefits) comprise the sum of three parts: (1) a fixed amount (2,050 yen) is multiplied by the length of tax payment (Welfare Pension tax) years of a worker, (2) the amount of relative earnings (average revalued earnings for past working years) is multiplied by 1/100 and by the length of the tax payment (Welfare Pension tax) years of a worker, and (3) a flat fixed 15,000 yen per month for a spouse[4] and fixed 5,000 yen per month for each eldest and second eldest dependents, as well as 2,000 yen for the remaining younger dependents.[5] In order to calculate the basic benefits of (1) and (2), the benefits are

indexed to the price level. Generally, the minimum years of contribution required by law is 20 years.

The normal retirement age is 60 for men and 55 for women.[6] Basically, retirement is a required condition. If a person between the ages of 60 and 64 has an earning income of less than 150 thousand yen a month, he (assuming that he is the main beneficiary) gets from 20% to 80% of his retired benefits, which are relative to his earning income. The scales of reduction are 20% for earnings of 45-92 thousand yen a month, 50% on earnings of 98-126 thousand yen and 80% on 134-150 thousnad yen. If his earnings exceed 150 thousand yen a month, however, a beneficiary does not get the retirement benefits. Over age 65 the picture changes somewhat. A beneficiary aged 65 or over with earnings less than 150 thousand yen is entitled to 100% of the social security retirement benefits, regardless of his other sources of non-labor income. If a beneficiary's earnings exceed 150 thousand, he will receive 80% of the retirement benefits.[7]

The receipts of the Welfare Pension tax (social security tax) are deposited in special Treasury accounts (Trust Fund Bureau) and are utilized through Treasury Investment and Loans. As of 1985 the accumulated pension fund was 27,983 billion yen.[8] The fund is used for housing, life environment improvement,

small enterprises, welfare culture, education, agriculture, forestry, fisheries, etc. The main purpose of these utilizations is to improve and stabilize living conditions. The proceeds of the fund are used for the administration costs of the social security program, which is also supported through the general accounts. The current surplus of Welfare Pension reserves would alleviate the growing burden of increased social security beneficiaries in the next decade as the demographic structure shifts.

In order to clarify the aforementioned inconsistent empirical results based upon the United States data and to explain the high saving ratios in Japan, it may be useful to apply previous researchers' consumer expenditure and saving functions to expanded functions for Japanese data (a time series data for the years 1946-1982). This study examines the influence of social security retirement benefits on personal savings and labor supply over the age of sixty under different demographic and socioeconomic backgrounds in the context of ordinary least squares and a simultaneous-equation model.

The empirical work of this study, by using Japanese time-series data, attempts to explain the impact of social security retirement benefits on personal savings and upon labor supply of the elderly in Japan. Such a study is necessary for predicting

behavioral patterns concerning savings and retirement and for guiding policy actions. The study will attempt as well to provide theoretical and empirical explanations of savings and labor supply behaviors.

The organization of the subsequent section is as follows. Chapter II reviews the previous studies. Chapter III describes the analytical framework, and theoretical arguments of a statistical model of savings and labor supply. Chapter IV reports the empirical results of previous researchers and a expanded life-cycle savings model by ordinary least squares. Chapter V analyzes the impact of social security retirement benefits on savings and on labor force participation of the elderly by a simultaneous-equation model. Chapter VI contains the summary and conclusion.

NOTE TO CHAPTER I

1 Benefit effect is defined as follows. Workers substitute social security retirement benefits for ordinary wealth in their portfolio of retirement assets. Thus, workers save less for retirement in anticipation of promised future social security retirement benefits. Retirement effect is defined as follows. Social security retirement benefits induce workers to retire earlier. Workers have to save over a short working life for a longer retirement period. Thus personal savings increase.

2 Another major social security retirement program is the National Pension for self-employed workers.

3 In 1986, the rates will be raised to 12.4% for a male worker and 11.3% for a female worker.

4 If a spouse has contributed to the National Pension program, she receives an additional benefit with some conditions.

5 Most of the elderly do not have dependent children at this age.

6 After 1986 the normal retirement age for females will become 60, with carefully graduated adjustments during this transition.

7 The sources are given by Mr. Tatsuro Matsue in Social Security Agency Japanese Government and in Shakai Hoken Techo ('83), pp.137-197.

8 White Paper of Welfare (1981), pp.387-394.

CHAPTER II

REVIEW OF THE PREVIOUS STUDIES

2.1 Social Security Retirement Benefits and Savings

The anticipated social security retirement benefits in old age are not only an important factor in household wealth, but also the major component of wealth in most retirement portfolios. With its compulsory government-directed savings program, the social security tax payment system produces future social security retirement benefits for retired workers during their retirement period and until death.

The most important study of the impact of social security benefits on personal savings was pioneered by Feldstein (1974). On the basis of his estimated time-series results, expected social security benefits reduce personal savings by more than 30%. The study by Munnell (1974) supports Feldstein's result. Barro (1978) however, shows that social security wealth or benefits do not really affect personal savings. Darby (1979) suggests that the reduction is smaller than Feldstein and Munnell report. Leimer and Lesnoy (1982) report that results will differ not

only under specification and construction of social security wealth variables but also according to the period of estimation examined. Again Feldstein (1982) estimates the original equation for the original sample period after correcting the programming error, and he confirms the original evidence of 1974.

In his pioneer study of social security retirement benefits, Feldstein (1974) adapts the life cycle model used by Ando and Modigliani (1963), and introduces the social security wealth (SSW) variable into his "consumption,C, function," as follows:

$$C = a_0 + a_1YD + a_2YD_{-1} + a_3RE + a_4U + a_5W + a_6SSW \quad \ldots\ldots 1.$$

YD is personal disposable income. He includes retained earnings (RE) to examine the impact of corporate savings on personal consumption. U is unemployment rate, and W is the value of the per capita net wealth. Feldstein uses an aggregate time-series data for the years 1929-1971, excluding the World War II years, 1941-1946. The method of estimation is ordinary least squares. His emphasis is that anticipated social security benefits reduce the amount of life cycle savings during the working years by providing income after the working period. His study assumes that the coefficient of SSW reflects both the benefit effect (asset-substitution effect) and the retirement

effect.[1]

The social security wealth variable (SSW) is the essence of Feldstein's analysis. Two definitions are employed. Gross social security wealth (SSWG) is the present value of the social security retirement benefits expected by the individual worker. The other is net social security retirement benefits (SSWN). SSWN is gross social security wealth minus the present value of the social security retirement tax expected by the individual workers. His major conclusion is that on the basis of his estimated time-series results, social security retirement benefits reduce personal savings by more than 30%.

Feldstein (1982) reexamines his original study(1974) with the correction of the social security wealth variable and concludes that the aggregate time-series evidence again provides a 38% reduction of potential total private savings in 1976.

The study by Munnell (1974) also concludes that social security retirement benefits reduce personal savings. Munnell has the following "saving,S, function":

$$S = a_0 + a_1 YD + a_2 YD.LF60 + a_3 U + a_4 W + a_5 SSCON \text{ or}$$

$$a\ SSW \quad \ldots\ldots 2.$$

Unlike Feldstein, Munnell employs disposable income (YD) times labor force participation of males aged 65 and over. YD.LF60[2]

explains the retirement effect in this study, after Munnell's (1974) model. U and W are unemployment rate and private net wealth per capita respectively. SSCON is social security contribution, which is the net total contribution to the OASDI program. Munnell uses the U.S. aggregate savings of a time series data 1929-1971 and concludes that social security contributions $(SSCON)^3$ have been responsible for a $47-$64 decrease in per capita savings and that the decline in labor force participation of the elderly affects an increase in per capita saving of $31 to $44. By using social security wealth (SSW, the same as Feldstein used) instead of SSCON, Munnell obtains similar results of the impact of both SSW and YD.LF6Ø on personal savings.

Feldstein's and Munnell's startling results are that social security retirement benefits depress personal savings. They both stress the existence of a large substitution of expected social security retirement benefits for private savings.

Barro's theoretical challenge (1978) does not support Feldstein's hypothesis of the positive effect of social security on consumption expenditure. He employs the alternative social security measure (SS) based on current benefit rates and current worker coverage under the social security system. His "consumption,C, function," is as follows:

$$C = a_0 + a_1 YD + a_2 YD + a_3 RE + a_4 SUR + a_5 U.YD + a_6 W + a_7 DUR + a_8 SS \text{ or } a\ SSW \quad \ldots\ldots 3.$$

His consumption expenditure function employs additional variables: government surplus (SUR) and stock of household durables excluding housing (DUR)[4]. Barro, as did Feldstein, includes current personal disposable income (YD) and lagged personal disposable income as proxy variables for a permanent income estimation. He maintains that unemployment rate times disposable income (U.YD) is more reasonable for measuring the deviation of income from its normal position than a linear form unemployment rate, U. Barro's empirical result is that SSW, as defined by Feldstein, is positive and insignificant, but his social security measure (SS) is negative with insignificance. His argument suggests that social security retirement benefits are not likely to have a substantial effect on personal savings.

Darby's major finding (1979) is employing the permanent-income consumption model, incorporating Feldstein's social security wealth variable and introducing a stock of real money balance as one of the explanatory variables.[5] The estimates depend upon the functional form and the time period used in the estimation. He reports the results of an extended consumer expenditure function based on Feldstein's and Barro's social

security wealth variables from 1929 to 1974. He states that the reduction of savings will be much smaller than the estimation by Feldstein.

Leimer and Lesnoy (1982) replicate Feldstein's social security variable and produce another social security wealth variable which is a different algorithm: constant ratio, current ratio, adaptive expectations, perfect foresight and actuarial projection. The estimated coefficients of social security wealth variables not only have small t-ratios, but also vary according to the period of estimation examined, which produces results contradicting Feldstein's. Although the results depend upon the choice of definition as to how social security wealth variables are formulated and what period of estimation is in cluded, Leimer and Lesnoy conclude that their results imply little or no effect on personal savings in the United States. Lesnoy and Leimer (1985) assert that the time-series data of the United States fail to support the hypothesis that social security reduces savings.

Very few empirical studies of the effect of social security retirement benefits on savings have been done in Japan. One reason for this lack of attention is an excess of or sufficient savings in the private sector in Japan as opposed to insufficient savings in the United States. As far as the author of

this study knows, the only empirical study on the Japanese case is a recent one by Noguchi (1983) which uses time-series data. There is no micro data study of the impact of social security retirement benefits on savings in Japan. There is a lack of theoretical and empirical development. As Noguchi (1983) mentions, it is extremely difficult for researchers to gain access to individual data.[6]

Takayama (1982) states that among the Japanese the motivation for saving is much more complex than simply for purposes of retirement. He identifies (1) a myopic saving attitude among the young generation for their retirement and (2) a serious saving attitude among those aged 50 and over for their retirement. He mentions that an increase in public pension will reduce private savings only slightly among the relatively young population in Japan. With little motivation for the retirement period, the total amount saved (in which Takayama includes government forced savings, namely government-funded social security tax contributions) will increase due to a rise in the tax contribution under the partially-funded Japanese system. This forced saving allows the government to increase government investment, which affects productivity and in turn results in raising total savings. Takayama's theoretical argument concludes that there have been no adverse effects of the social security tax upon

personal or private savings. It seems that he argues the current high savings from an aggregate point of view. As he mentions, we still need an empirical study of the impact of social security retirement benefits upon personal or private savings in Japan.

Shinohara (1983) poses two questions about a constantly and unusually high savings ratio and its upward trend in the savings ratios through the post-war period. The method of his analysis related to absolute and relative income hypotheses is mainly a descriptive one compiled by reading cross-section and time-series data. He gives several reasons for high savings: insufficiency of social security retirement benefits, bonus effect, asset effect, age composition, growth rate and national character. He emphasizes an increasing current income, a bonus payment and a lump sum retirement payment to influence savings. Using time-series data for 1963-1978, he found a statistically significant relationship between real savings and real disposable income. Shinohara favors an absolute income hypothesis to explain the high savings. Shinohara (1983) mentions the influence of social security retirement benefits on savings, but he does not empiricaly study its influence.

Noguchi (1983) examines the influence of the expected present value of public pensions, which correspond to Feldstein's

gross social security wealth measure (1974), as well as the influence of the value of past contributions accumulated to the present on household net wealth. He uses the data of the Family Saving Survey and the Family Income and Expenditure Survey for the period 1968 through 1980. The expected present values of public pensions are all negative, but not all of them are statistically significant. He suggests that it is difficult to conclude a perfect substitution between the expected present value of public pensions and net wealth among Japanese households. He states, however, that a substitution exists between the preretirement wealth accumulation and the accumulated contribution of public pensions.

Ishikawa and Ueda (1984) extensively examine Japanese household saving behavior by using cross section and time-series data. They concentrate on the bonus effect upon savings, hypothesize a habit-buffer income, and refute the permanent income/life cycle hypothesis. However, they do not examine the influence of social security on savings. They conclude that the bonus income has a large positive influence on Japanese savings behavior.[7]

Thus, the effect of social security retirement benefits on savings is still open to question both in the United States and Japan.

2.2 Social Security Retirement Benefits and Labor Supply

From the life-cycle, labor-supply hypothesis point of view, accumulated total wealth in one period affect labor supply in another period. Thus, anticipated social security retirement benefits in one period influence labor supply in another period, and vice versa.

In an early study Michael Boskin (1977) analyzed the effect of social security on retirement by extracting from the Panel Study of Income Dynamics data for 131 households headed by white married males aged 61 through 65 for the five years of survey. Incorporating the income-leisure choice theory, his results suggest that income-guaranteed social security retirement benefits clearly reduce the expected number of work years by more than 2 years in the 61-70 age interval. The acceptance of social security retirement benefits induces the elderly to leave the job or to restrict market work and thereby to reduce the labor supply. He also reveals that the high implicit tax rate on earnings has an enormous influence on the retirement decision of the elderly.

Pellechio (1979) estimates the impact of his constructed social security wealth variable: the actuarial present value of future benefits discounted at the market interest rate on the

retirement behavior for three age groups: 60-61, 62-64 and 65-70. An increase in social security wealth from $35 thousand to $55 thousand raises the probability of retirement by 0.22 relative to a 0.78 retirement rate (age group 65-70) and by 0.15 relative to a 0.41 retirement rate (age group 62-64), while the estimated coefficient is small and insignificant labor supply.

among the age group 60-61. However, calcuations based on the Longitudinal Retirement History Survey by Blinder, Gordon and Wise (1980) provide that the earning test for social security does not discourage work effort for the worker aged 62-64. The reason they suggest is due to a recouping of deferred benefits for the worker aged 62-64. Mathematical and theoretical analyses by Crawford and Lilien (1981) seem to support the statement of Blinder, Gordon and Wise (1980). Under the assumption: uncertainty of lifespan, fairness of social security retirement benefits, and perfect capital market, the mathematical model by Crawford and Lilien tends to delay retirement of the elderly who expect an increase in deferred social security retirement benefits.

Burkhauser and Turner (1982 b) reexamine their previous study (1978) after correcting the social security wealth variable in which Leimer and Lesnoy (1982) identify an error in the

is a time-series analysis to examine the effect of social security on the market work behavior of prime-age males. They reconfirm the results that social security raises the work week 2-3 hours in this age group. The result implies that if the earning test affects the labor supply of the elderly, social security retirement benefits induce the prime-age worker to work more hours during the unconstrained period in the life-cycle labor supply.

The main purpose of the study by Hamermesh (1984) is to examine the jointness of leisure-consumption behavior of the elderly under life cycle framework. He constructs a leisure variable and does not specify the work status of the elderly, using the Retirement History Survey data for 1969, 1973 and 1975. The inverse relationship between leisure (negative sign) and goods consumtion (positive sign) variables with estimated coefficients on the social security wealth variable suggests that social security wealth affects positively on work effort of the elderly.

Hanoch and Honig (1983), using data in a sample from the Retirement History Survey (RHS) for the year 1969-1975, look at various influential factors on retirement and preretirement behavior of white males and unmarried females aged 58-69. They use Primary Insurance Amount (PIA) as the potential social security income to examine the effect of social security retirement benefits on the labor force participation of the elderly. The

use Primary Insurance Amount (PIA) as the potential social security income to examine the effect of social security retirement benefits on the labor force participation of the elderly. The estimated coefficients of the social security variable for both sexes indicate an incentive to retire among the elderly. Their study (1985), using RHS for the years 1967-1973, explicitly deals with transitional behavior among non-retired, partially retired and fully retired white married males aged 62-67. The estimated logit coefficients of Primary Insurance Amount (PIA) show a positive sign on the probability of non-retired full-time work, and a negative sign on the probability of the partially retired (part-time work) and fully retired elderly.

Hurd and Boskin (1984) find a cause for the decline in labor force participation of elderly workers in the early 1970s. The cause is explained by the large increase in social security retirement benefits. They state, however, that the effect of social security on the retirement of the elderly is not yet sufficiently advanced to explain thoroughly the larger picture using the available specific data and theory. The more precise and explicit study by Mitchell and Fields (1984) provides evidence for a social security effect encouraging retirement. They use unique data compiled on 8,700 workers covered by 10 different pension plans: surveyed in 1978, and concentrate thoroughly

on when and why the workers retire and what is the nature of the workers' pension plans. The estimated logit coefficients reveal that an increase of social security benefits and pensions induces earlier retirement.

As far as Japanese studies are concerned, Takayama (1982) states that the social security system is unlikely to affect many employment decisions because of the scarcity of job opportunities for the elderly in Japan (though Takayama's is not an empirical study). He maintains that the impact of social security retirement benefits on the elderly's retirement decision is smaller than that of the job market situation of the elderly.

Ito (1983) explicitely identifies the relationship between the retirement process of elderly men and social security retirement benefits. His analytical method, Automatic Interactive Detector (AID) is applied to survey data.[8] He examines the influential factors on the transition from a main lifetime job to a second job before complete retirement. Most of the elderly men attempt to get a job again while receiving social security retirement benefits. His analysis finds that their incentive of work effort (without completely withdrawing from the labor market) is largely affected by the amount of social security retirement benefits. He states that as social security retirement benefits increase, the elderly men are not eager to find jobs

during their retirement period because of the availability of both social security retirement benefits and unemployment insurance benefits. They tend to stay in the labor market until their unemployment benefits expire, and only then will they compromise on the conditions and wages of a new job.

NOTES TO CHAPTER II

1 Benefit effect is defined as follows. Workers substitute social security retirement benefits for ordinary wealth in their portfolio of retirement assets. Thus workers save less for retirement in anticipation of promised future social security retirement benefits. Retirement effect is defined as follows. Social security retirement benefits induce workers to retire earlier. Workers have to save over a short working life for a longer retirement period, thus, personal savings increase.

2 Since a mandatory retirement age implicitly exists at the age of 55 or 60 under the Japanese life-time empployment 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 of receiving social security retirement benefits is sixty in Japan.

3 In Munnell (1974) social security contributions represent the net total contributions to the OASI Trust Fund in the United States.

4 The data of stock of household durables is not available from 1946. The data for expenditure of durable goods present a proxy variable for stock of household durables from 1946 to 1982. The data are in the Japanese Economic Planning Agency's White paper of National Income," 1960 and "National Economic Calculation," 1965-1983.

5 A permanent income variable by Darby (1979) is estimated as a weighted average of past income by the exponentially declining weight method.

6 We wait for the availability of individual data for further insight into the retirement behavior of the elderly in Japan. Obtaining micro-based data is extremely difficult unless a researcher is affiliated with the Japanese government agencies.

7 Bonus income is a non-regular income. Most of Japanese firms distribute bonus payments to their employees twice a year: August and December.

8 Basically the method of Automatic Interaction Detector (AID) is that samples are successively divided into two parts by a significant explanatory variable of a factor.

CHAPTER III

ANALYTICAL FRAMEWORK

3.1 The Impact of Social Security Retirement Benefits on Personal Savings

Most retired Japanese benefit from the social security retirement system after the age of sixty, as was discussed in Chapter I. In Japan the Welfare Pension was instituted in 1942, and the National Pension in 1961. (Both programs comprise the social security retirement benefits.) However, in spite of the completion of income-guaranteed retirement benefits, the ratio of personal savings to personal disposable income has been surprisingly and continuously high (regarded by many as insufficient for their needs), approximately 19% on the average since 1961. In particular, the ratios averaged above 21% during the highly inflationary period between 1973 and 1978. The question arises whether or not social security retirement benefits discourage personal savings.

In the debate over social security and savings, ambiguous theoretical and empirical conclusions by Feldstein (1974), Munnell (1974), Barro (1978), Darby (1979), and Feldstein and

Pellechio (1979)[1] have been advanced as to whether social security retirement benefits tend to increase or decrease personal savings under the pressure of changing retirement experiences (Leimer and Lesnoy, 1982; Feldstein, 1982; Blinder, Gordon, and Wise, 1983; Modigliani and Sterling, 1983; Hamermesh, 1984; and Lesnoy and Leimer, 1985.

But everyone seems to agree that personal savings will be reduced by the availability of expected future social security retirement benefits providing income for the consumption of the retirement period, i.e., the "benefit effect", and that personal savings will be increased by inducing earlier retirement caused by expected future social security retirement benefits. The earlier retirement means a longer period of retirement for a given life span, and this requires an accumulation of savings during the working period, i.e., the "retirement effect."

Thus, the net effect of social security retirement benefits on personal savings depends upon the relative strength of these offsetting effects. If the benefit effect is stronger than the retirement effect, personal savings will be reduced. On the other hand, if the retirement effect is stronger than the benefit effect, personal savings will be increased. Leimer and Lesnoy (1982), however, doubt that social security retirement benefits induce an increase in savings in the United States.

The significant progress in the Japanese social security retirement program since the Second World War has not yet clearly revealed its influence on the behavioral pattern of personal savings (Takayama, 1982; Noguchi, 1983; and Shinohara, 1983).

Under the Japanese lifetime employment system, a mandatory retirement age implicitly exists at the age of 55 or 60, although employees who desire to continue can remain at their jobs on condition that their wages are lower compared to their wages before the age of 55 or 60 (Osaka, 1982; and Takayama, 1982). However, individuals have come to expect prolonged retirement years due to a significant rise in the Japanese lifespan. This expectation, since it forces individuals to contemplate the amount of their own future social security retirement benefits for the retirement period, is based upon the fact that a gradual increase in expected retirement years is an important factor in a lifetime allocation of savings plan (Modigliani and Sterling, 1983; and Modigliani, 1986). Hamermesh (1984) finds that annual real consumption spending is lower amoung people with long life expectancy. One can safely say that the strong stimulation on the behavior of saving patterns during the last four decades has been the result of this visible increase in the life span of the Japanese (see TABLE 2).

3.2 Theoretical Model and Function

Motivations for saving come from several sources. There are the life cycle purpose, the precautionary purpose, and the speculative purpose. It is possible that motivations are interchangeable within the range of lifetime planned savings. With these diverse motives, one might find any substitution effect of social security wealth in any component of savings. Although the motivations of saving consist of several types, the life cycle hypothesis provides a suitable framework for arguing the effect of social security on personal savings (Feldstein, 1974; Darby, 1979; Blinder, Gordon and Wise, 1983; King, 1983; Modigliani and Sterling, 1983; Williamson and Jones, 1983; and Hamermesh, 1984).

The analysis expands the previously tested models within the framework of the life cycle model to a more general framework comprising the idea of life cycle savings, which hopefully will indicate the importance of the extended traditional model by relating the age of retirement to economic circumstances. Munnell (1974), and Modigliani and Sterling (1983) explicitly observe benefit and retirement effects. In this study we use personal savings as a dependent variable.

The form of the savings equation in the main analysis is as

follows:

$$S = a_0 + a_1 YD + a_2 YD + a_3 RE + a_4 SUR + a_5 U.YD + a_6 W + a_7 LF60 + a_8 SSW \text{ or } a\ SS \text{ or } a\ SSCON \quad ..... \quad 4,$$

where S is personal savings, YD is personal disposable income, RE is retained earnings, SUR is government surplus, U.YD is the product of unemployment rate (U) and disposable income (YD), W is per capita net wealth, and LF60 is labor force participation of males age 60 and over. SSWs (SSWG and SSWN) or SS or SSCON is social security wealth. The model will assume that individuals are forward- and backward-looking rational planners because of the inclusion of lagged variables. TABLE 1 reports the definitions of the variables.

Since the relation between social security contributions by taxation and by benefits during a retirement period is not a one-to-one relationship, social security taxes do not directly or accurately measure social security retirement benefits as wealth in the future. A measure of social security retirement benefits should consider the future consumption behavior for the retirement period.

The social security wealth variable (SSW) introduced by Feldstein (1974) and Munnell (1974) reflects survival probabilities and the present discounted value of future receipts as

wealth. It also takes into account not only the current social security tax but also the present discounted value of all future social security taxes. If individuals behave myopically, anticipated social security tax and benefits do not affect their current behavior (Williamson and Jones, 1983). Therefore, it seems legitimate to assume that the SSW is the amount of benefits which individuals can expect to receive in the retirement period as accumulated wealth which has been saved in the working period (Feldstein, 1974). However, as Leimer and Lesnoy (1982), and Lesnoy and Leimer (1985) point out, the construction of a social security wealth variable should reflect change in life expectancy, age structure, population, real income, interest rate, social security retirement benefits, social security retirement tax, and change in the benefit-income ratio during their observed periods. The present study takes into account the suggestions of Leimer and Lesnoy (1982), and Lesnoy and Leimer (1985).

Our social security wealth variable (SSCON) will represent another aspect showing how current social security tax contributions affect behavioral patterns of personal savings. The social security wealth variable (SS) will reflect how current social security retirement benefits affect behavioral patterns of personal savings.

In this study social security effects are measured by four variables:

(1) gross social security wealth (SSWG)[2], as constructed by Feldstein,

(2) net social security wealth (SSWN)[3], as constructed by Feldstein,

(3) social security tax contributions (SSCON)[4] paid by an employee and an employer, as defined by Mannell,

(4) social security (SS)[5] constructed by Barro.

The present analysis uses and compares various social security wealth measures: Feldstein's and Munnell's definition of social security wealth (SSW), Munnell's other definition (SSCON) and Barro's definition (SS). It is possible that results may differ under a different specification of social security wealth measure.

It is common to relate consumption to permanent income by using a distributed lag on past income. Therefore, it is reasonable to employ the lagged disposable income in the extended life cycle saving model (Barro, 1978; Darby, 1979; and Leimer and Lesnoy, 1982).[6] Even though the 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 posi-

tive impact on current personal savings.

Retained earnings are business savings in the private sector and proxies for current and future capital gains. They are treated as exogenous with respect to the personal savings decision because there are separate incentives governing the behavior of houshold and corporate sectors (Auerbach, 1982). Looking at retained earnings another way, we might find that retained earnings imply a substitution for personal savings (Modigliani and Sterling, 1983). They would negatively influence personal savings.

The government surplus has an indirect effect on personal savings through an increase in future disposable income by a reduction in future taxation, and through an increase in future real disposable income by a lowering of future price levels which are positively associated with government spending. As for a direct effect, the surplus is in excess of the government revenue, which consists of taxes, minus total government spending on goods, services and transfer payments or, more specifically, income tax collection minus payment of government spending and government transfers. This direct effect on personal savings is inversely associated with government surplus. Because government surplus is associated with taxes. The net effect depends upon the relative sizes of the direct and indirect effects.

The product of U and YD (U.YD) is included in the savings function to adjust for the cyclical variation of personal savings and for the deviation of income from the normal position (Barro, 1978). The unemployment rate would respond positively to consumer spending if future income positively related to the unemployment rate as a prediction of future income and if unemployment benefits also affected consumer spending through income redistribution, which is below permanent income (Ando and Modigliani, 1963; and Barro, 1978).[7] Thus, U.YD would negatively affect personal savings. From another point of view, U.YD would also have a negative influence on personal savings in order to maintain the level of consumption or the standard of living.

Workers build up wealth in the form of real assets such as housing, financial assets (stocks and bonds) and various types of insurance during the working period in order to provide for consumption in old age. Blinder, Gordon and Wise (1983), using the Longitudinal Retirement History Survey, estimate the strict form of the life cycle model. They conclude that a bequest motive increasing with the number of children on wealth accumulation is a weak one for wealth accumulation, i.e., statistically insignificant in the United States. The life cycle theory holds that accumulated wealth is drawn down to zero during retirement by consumption. King (1983) presents King and Dicks-

Mireaux's study (1982) describing a hump-shaped assets pattern of a life cycle model by using collective data from the Survey of Consumer Finances in Canada. The authors estimate permanent income for each household and construct the average value of the ratio of asset-holdings to permanent income. They confirm the hump-shaped assets pattern which decline after retirement. Household or personal wealth is emphasized by Ando and Modigliani (1963) and Modigliani (1966) in their theoretical and empirical analyses of the life cycle model. The direct positive effect of wealth on consumer spending means a direct negative effect effect on savings.

Disposable personal income, retained earnings and government surplus would measure the current flow of resources available to the private sector for consumer expenditure and savings. Above these income measures, unemployment rate and wealth would capture life cycle savings, permanent income and transitory income (Barrow, 1978; and Darby, 1979). Boskin and Kotlikoff (1985) also point out that the strict life cycle model is not enough to explain The United States's saving behavior. Therefore this study expands the life cycle model by employing additional explanatory variables.

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 do not include a variable which explicitly measures the retirement effect of social security retirement benefits (Leimer and Lesnoy, 1982). SSW and SS alone measure both effects, but do not allow for the separate estimation of each one. An additional variable is needed to explain the retirement effect.[8]

If the labor supply is given during the life cycle period, the introduction of a social security program will reduce personal savings, but cannot increase it. Under the life cycle hypothesis, if the combination of social security retirement tax and social security retirement benefits do not have an income effect (a given labor supply in the life cycle period means no change in budget constraints), personal savings will be reduced, with an increase in social security retirement benefits, yet leaving enough consumption for the retirement period (Modigliani and Sterling, 1983).

Current social security retirement benefits affect the length of retirement years by strongly encouraging the retirement age of sixty in Japan. However, not necessarily all the workers will withdraw from the labor market at age sixty. The probablity of retirement at age sixty and over will be indicated by a labor force participation rate age of sixty and over under the normal distribution of reservation wages and market wages (Ben-Porath,

1973), both of which can differ among individuals. Even if individuals have identical tastes, individuals will have different market wages. The reservation wage of people over sixty affects the retirement patterns of the current working force. Social security retirement benefits reduce the cost of an unemployed individual whose age is sixty and over, as well as that of the individual not in the labor market. Thus, social security retirement benefits induce an increase in the individual's reservation wage. The increase in the reservation wage of people sixty and over will lead to an increase in the minimum acceptance wage, while employers will lower the offered wage under a lifetime employment system with mandatory retirement due to the seniority wage structure in Japan. The above reasoning would lead the elderly to withdraw from the labor market.

If we assume the labor supply to be endogenous after the starting age of receiving social security retirement benefits, the social security program will reduce the labor supply of those aged people who are induced into earlier retirement, but not vice versa. The arguments, however, suggest that there now exists room to consider the ever increasing Japanese lifespan, which has increased conspicuously since the 1940s. The increase in expected lifespan as formulated undoubtedly has influence on an individual life-cycle saving plan.

For the above-mentioned reasons, the probability of an individual over sixty finding an acceptable job will become smaller. The lower the probability, the lower the finding of acceptable jobs, and this will lead to a withdrawal from the labor market. The planned retirement age and the expected length of retirement years have an influence on the individual's savings plan (Feldstein and Pellechio, 1979: Modigliani and Sterling, 1983; and Hamermesh 1984). Therefore, LF6Ø would reveal the retirement effect.

3.3 The Impact of Social Security Retirement Benefits on Savings and on the Labor Force Participation of the Elderly

The rapid progress of technology and the significant increase in married women's labor force participation in Japan has forced a change in the composition of the labor force during the last 30 years. As a result of this change, if they continue to stay in the labor market, a high structural unemployment rate among the elderly may be expected, rather than frictional and cyclical unemployment. However, rapid progress in Japanese social security programs has had the effect of discouraging elderly workers from remaining in the labor market when they become eligible for social security benefits. The literature in this field reveals social security to be one of the major stimulants in the recent rise in earlier retirements (Boskin, 1977; Pellechio, 1979; Burkhauser and Turner, 1982a; Hurd and Boskin, 1984; and Mitchell and Fields, 1984), but this field has not been studied theoretically and empirically in Japan.

Social security retirement benefits increase the reservation wages for the elderly who are eligible for the benefits. Conversely, potential employers tend to lower offered wages to the elderly due to the fact that there exist relatively high unemployment rates among them and that labor productivity on their part tends to decline. Consequently, the probability of the

elderly's finding acceptable jobs will become lower, and the duration of searching for jobs will be longer. These circumstances created by social security retirement benefits lead the elderly to withdraw from the labor market. (In addition, the increase in the average lifespan, as shown in columns 5 and 6 of TABLE 2, also prolongs their retirement years.)

Workers subsitute social security retirement benefits for wealth in their portfolios of accumulated assets for the retirement period. Thus, workers who expect future social security retirement benefits would save less for consumption during their retirement period (benefit effect). In addition, the amount of savings during the working period depends upon the individual's expected retirement age, level of consumption, and number of retirement years. These latter factors directly affect the propensity to save during the working period. Accumulated savings and social security retirement benefits in turn exert influence on the retirement decision. Social security retirement benefits may induce earlier retirement, which results in a prolonged retirement period that may possibly cause an increase in savings during the working period (retirement effect). Modigliani and Sterling (1983) estimate benefit and retirement effects by using data on a cross-section of countries and taking an average over the period 1960-1970, though the model is not a

strictly simultaneous one. From the above reasons, it is possible to deduce that there surely exists interdependency between personal savings and the labor supply of the elderly (King, 1983; Thompson, 1983; Hamermesh, 1984). Social security tax and social security retirement benefits are, however, exogenous in the system, and they are controlled by government policy, namely by legislation.

Column 2 of TABLE 2 shows the ratio of personal savings to disposable income since 1946. Columns 3 and 4 show the labor force participation of males and females age 60 and over. 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 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 age 60 and over increased to 73.5% in 1953 from 68.5% in 1952. The high labor force participation rate lasted until 1958. Then the participation rate declined to 69.9% in 1959 from 74.3% in 1958. A similar phenomenon can be seen for the female labor force participation rates beteen 1953 and 1958 (column 4). The relatively high female labor force participation lasted until 1961. The ratios of personal savings to disposable income has been relatively high: 18.9% on the average since 1960. The labor

force participation rates for both sexes had been gradually declining since 1960. Therefore, there seems to be some negative relationship between the ratio of personal savings to disposable income and labor force participation age 60 and over. The overall labor force participation of the elderly, however, has slightly declined about 10% for males and 4% for females since 1946.

In Japan the question is whether personal savings accumulated during the working period substitute for social security retirement benefits for consumption in the retirement period or whether social security retirement benefits substitute for personal savings for consumption in the retirement period. If the former is true, the primary source of consumption during the retirement period is personal savings accumulated during the working period, and thus saving rate will be high. If the latter is true, the primary purpose of social security benefits is to replace income during the retirement period, and therefore the saving rate will be low.

TABLE 3 shows the source of income of elderly couple households where the wife is age 60 and over. In both rural and urban areas Japanese elderly couples rely heavily upon earning income, non-earning income and other sources before the age of 65, although they are eligible to receive social security

retirement benefits. They get 50% of their income from social security retirement benefits around the age of 70. Elderly couples over 75 in rural areas depend more upon social security retirement benefits as compared to those of urban areas. The urban aged couples receive about half their income from social security retirement benefits after the age of 70. TABLE 3 shows that the major source of consumption during the retirement period is not social security retirement benefits. Retirement benefits barely cover the needs of the elderly.

The effect of the significant progress in the Japanese social security retirement program since World War Two has not yet been intensively and empirically studied concerning its influence on the behavioral pattern of high personal savings and the labor force participation of the elderly. The empirical study of the influence of social security on household savings by Noguchi (1983) is one of the few studies in this field. An empirical and theoretical study of the effect of social security on retirement behavior was made by Ito (1983) recently. Ito explicitly and precisely applies the Automatic Interaction Detector[9] to examine the elderly's retirement decision affected by social security retirement benefits and unemployment insurance benefits.

In the debate over social security and savings in the United States, theoretical and empirical conclusions by Feldstein

(1974), Munnell (1974), Barro (1978), Darby (1979), and Feldstein and Pellechio (1979) have been advanced as to whether social security retirement benefits tend to increase or decrease personal savings under the pressure of changing retirement experience (Feldstein, 1982; Leimer and Lesnoy, 1982; Blinder, Gordon and Wise, 1983; King, 1983; Modigliani and Sterling, 1983; Hamermesh, 1984; and Lesnoy and Leimer, 1985).

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 the increase in social security retirement benefits, along with the rapid growth of the social security system in the United States, induces the decline of labor force participation of the elderly, namely,] earlier retirement. The time-series analysis by Burkhauser and Turner (1978 and 1982 b) suggest a negative relationship. Blinder, Gordon and Wise (1980) and Hamermesh (1984), however, maintain that social security retirement benefits tend to delay the retirement of the elderly because of a recouping of deferred social security retirement benefits. Hurd and Boskin (1984), and Mitchell and Fields (1984) identify induced retirement by social security. The study by Mitchell and Fields (1984) especially concentrates on workers covered by ten pension plans which include social secu-

rity retirement benefits. A recent study by Honig and Hanoch (1985) tries to explain a transitional state from the main lifetime job to partial retirement and then to complete retirement. It is this writer's opinion that all these inconsistent and different results stem from the specific choice of data, age group, and limitations on the scope of the studies as applied to the elderly.

Despite the fact that life-cycle savings and labor supply behavior are mutually determined, there is little agreement of the effect of social security retirement benefits on labor supply behavior and savings behavior (Thompson, 1983). King (1983) discusses thoroughly, from a theoretical point of view, the mutual determination of consumption and labor supply and the non-separability and separability of consumption and leisure.

A lack of understanding of the behavioral patterns of the labor supply decision (namely, retirement decision) and life-cycle saving behavior can lead to misleading policy implications. Therefore, this study will examine the interdependency between personal savings and the labor force participation of the elderly (which explains retirement from the labor market) and social security retirement benefits. The development of a simultaneous-equation model of personal savings and labor force participation of the elderly will hopefully produce consistent

estimates of the structural parameters.

3.4 Theoretical Model and Function

Social security retirement benefits have two basic elements which affect life-cycle labor supply and life-cycle saving decisions. Since personal savings and labor supply decisions are interrelated, a model should reflect the effect of social security retirement benefits upon personal savings and the labor supply of the elderly.[10]

In a labor supply function, the effect of social security retirement benefits depends upon how workers perceive and adjust their behavioral responses in personal life cycle plans to both current tax payments and expected future benefits under the social security program. In this respect, a life cycle approach offers a more suitable analytic method (Pellechio, 1979), as opposed to an attempt to estimate whether or not the effect of a social security tax discourages labor force supply, which involves the slope of a labor supply curve.

The motivations of lifetime planned savings are interchangeable among the life-cycle purpose, the precautionary purpose and the speculative purpose. The expected value of social security retirement benefits, current social security tax contribution, and current social security retirement benefits on personal savings depend upon how individuals formulate the costs

and benefits and how they adjust costs and benefits to their lifetime planned savings.

In this study social security effects upon both the labor supply behavior of the elderly and personal savings are measured by four variables:

(1) gross social security wealth (SSWG), as constructed by Feldstein,

(2) net social security wealth (SSWN), as constructed by Feldstein,

(3) social security tax contribution (SSCON) paid by an employee and an employer, as defined by Mannell, and

(4) social security (SS), as constructed by Barro.[11]

The present analysis uses and compares the following various social security wealth measures: Feldstein's and Munnell's definitions of social security wealth (SSW), Munnell's other definition (SSCON) and Barro's definition (SS). It may be possible that results will vary under a different specification of social security wealth measure by using a time series data for the years 1946-1982.

The mathematical specification of a simultaneous equation model is as follows:

$$LF60 = a_0 + a_1 S + a_2 YD + a_3 YD + a_4 WREESTA + a_5 WLIQUID + a_6 UMALE.YD + a_7 AGRI + a_8 ED + a_9 SSWG \text{ or a SSWN or a SSCON or a SS} \quad .....5,$$

$$S = a_0 + a_1 LF60 + a_2 YD + a_3 YD + a_4 WREESTA + a_5 WLIQUID + a_6 UMALE.YD + a_7 RE + a_8 SUR + a_9 SSWG \text{ or a SSWN or a SSCON or a SS} \quad .....6,$$

with the variables in the equations being defined in TABLE 1.

Most researchers agree that the life-cycle model approach will explain the impact of permanent income upon individual savings. Boskin and Kotlikoff (1985) also suggest that an expanded or a modified life cycle model is more efficient for explaining savings behavior than a restricted one. The current and lagged disposable incomes are legitimate to be proxy variables of permanent income (Barro, 1978). They show the magnitude of impact of lifetime earnings on the retirement decision.

In the life cycle model the role of bequests in savings has been emphasized. The effect of bequested savings on the next generation, however, has been underemphasized. In the case of Japan, physical assets, such as housing, reflect a bequest motive as a national characteristic. The Japanese are strongly motivated to own a house and to pass it on to the future generation, and the long mortgages have an impact upon the retirement deci-

sion. The motivation for holding other assets, such as stocks, bonds, trusts and insurance, is precautionary. Unlike non-liquid assets, such as expected social security retirement benefits for the retirement period, liquid assets may have a different magnitude for the labor force participation of the elderly, i.e., the retirement decision.

Every individual will have different reservation wages affecting his retirement decision (Ben-Porath, 1973). Under the social security program individuals age sixty and over would raise the minimum acceptance wages, and this could reduce the cost of being unemployed. Takayama (1982) mentions that under a mandatory retirement system, employers will probably offer lower wages than the elderly worker's acceptance wages (namely reservation wages). Thus, the widening gap between the elderly worker's offer and the employer's offer causes the elderly to leave the labor market when the unemployment is high. This is because social security retirement benefits would reduce the opportunity cost of being unemployed. The total labor force participation rate for those age sixty and over is 67% at the sample mean, and this greatly affects the work effort due to a decline in market wages. The result is a complete withdrawal from the labor market, with the effect of the unemployment rate upon the labor force participation rate of those

60 and over being negative.

The decline of the agricultural sector due to the changing industrial structure since the 1940s affects the retirement behavior of the elderly. Industrial development induces them to enter the labor market. It provides an expansion of job opportunities, as well as nonpecuniary benefits, such as being able to socialize with other people and avoiding the psychological strain at home usually following retirement (Shapiro and Shaw, 1983). A variable (AGRI) would reveal how the change in industrial structure influences the labor supply of the elderly, i.e., retirement decision behavior.

Human capital can be defined in terms of quality of education, working experience, quality of health, a higher ability, etc. The quality of education (ED) reflects human capital and influences the elderly in their decision to withdraw from the labor market. An increase in the quality of education induces people to work more hours during the year and thus add further years of participation in the life cycle (Hanoch and Honig, 1983; and Modigliani, 1986). A higher education not only widens the choice of job opportunity, but can also influence the retirement plan by making possible a new type employment before withdrawing completely from the labor market.

The life-cycle saving plan is influenced by the following

factors: physical assets, liquid assets, unemployment rate, retained earnings and central government surplus, in addition to the life-cycle labor supply decision and the permanent income of individuals (namely, life time earnings).

Workers build up wealth in the form of physical assets, like housing, and liquid assets, such as stocks, bonds, trusts and insurance. In particular, the amount of liquid assets held by households has more than tripled in Japan since 1975. Lesnoy and Leimer (1985) bring out the ambiguity of the effect of social security retirement benefits because workers have other motives for saving, e.g., providing for contingencies by leaving a bequest in addition to retirement purpose. Motives for saving diversify total personal savings. Modiglini (1986) points out that the consideration of bequest motives in the life cycle framework is consistent, although during the retirement period assets decline and reach zero in the basic life cycle hypothesis. Hence, wealth is specified by two categories. One is physical assets (WREESTA) - housing - and the other is liquid assets (WLIQUID) - stocks, bonds, trusts and insurance. This specification will give an insight into the behavioral pattern of wealth accumulation.

Japanese housing conditions are still inadequate, and people want to own a house within their lifetime (Takayama, 1982;

Shinohara, 1983). This desire stems from a basically agricultural, national characteristic which historically has influenced the behavior of holding physical assets. In Japan physical assets, such as housing, are usually held for life and for the purpose of bequests in the life cycle framework rather than for the speculative purpose of wealth accumulation, as often occurs in the United States. This bequest purpose of obtaining one's own house seems to stimulate personal savings.

More recently in Japan liquid assets have been creating additional wealth as a form of savings. It seems that the lower- and middle-income classes are stimulated and motivated to enter the liquid assets market formerly targeted exclusively for the higher income class, as well as for corporations preferring to deploy their holdings in more speculative investment. However, the newly created market utilized by lower- and middle-income Japanese brings about a savings expansion associated with life cycle and precautional purposes.

As for the effect of unemployment on personal savings, the unemployment of a main wage earner reveals a clear influence on his life-cycle savings plan. The cyclical variation of unemployment and the resultant concern over the deviation of income from the normal position will make people anxious about future prospects, and thus motivate them to increase life cycle sav-

ings. The unemployment rate would also respond positively to consumer spending if future income positively related to the unemployment rate as a prediction of future income.[12] The product of the male unemployment rate and disposable income (UMALE.YD) reveals its possible effect.

For their employees Japanese business firms accumulate retirement pensions and transfer them to retained earnings, which are tax deductible. Noguchi (1985) intensively discusses the effects of tax-free reserves related to retirement payment for Japanese business firms. Although there are separate incentives for the saving attitudes between households and business firms (Auerbach 1982), under the Japanese tax system retained earnings imply a substitution for personal savings. An increase in retained earnings implies an increase in retirement pensions in business firms and thereby affects the behavioral patterns of workers' savings.

Boskin and Kotlikoff (1985) argue that government purchases will influence the private sector. In this case, the private sector means net national product, NNP, minus government purchases, G. Therefore, NNP minus G equals consumption in the private sector plus net private domestic investment. An increase in government surplus will ultimately decrease government purchases, which must be financed by the private sector. Assuming

the net private domestic investment, I, equals private savings, an increase in the government surplus will induce a rise in private consumer expenditure and/or private domestic investment. One would expect that savings in the private sector or personal savings would eventually rise.

The theoretical arguments of other viewpoints should be considered, too. Government surplus has an indirect effect on personal savings by increasing future disposable income through future taxation and future real disposable income by lower future price levels which are positively associated with government spending. As for a direct effect, the surplus is in excess of the government revenue - which consists of taxes, minus total government spending on goods, services and transfer payment - or, more specifically, income tax collection minus the payments of government spending and government transfer. This direct effect on personal savings is inversely associated with government surplus. The net effect is determined by the sum of these indirect and direct effects upon personal savings. For the above reasons, the central government surplus will have an ambiguous effect on personal savings.

3.5 Data

In Japan the social security retirement benefits program was instituted in 1942. The chaotic period during the Second World War, 1941-1945, is excluded since Darby(1979), Leimer and Lesnoy (1982), and Lesnoy and Leimer (1985) state the sensitivity of the period of estimation to the estimated regression of the US results. This study employs time-series data for the years 1946 to 1982 in Japan. All variables are in real per capita value except for LF.60, U, U.YD, UNMALE.YD, AGRI and ED in TABLE 1. King (1983) states that an advantage of using time-series data is that "it would enable the variation of real interest rates over time to be exploited," assuming individuals face the same real interest rate. Time-series data avoid the absence of variations in interest rates in cross-section data which deal with regions and individuals at a single point in time.

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.

Consumption

Consumption (1946-1982): "White Paper of National Income," 1930-1960, and "National Economic Calculation," 1951-1983, Economic Planning Agency.

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.

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.

Durable Goods
Purchase of durbale goods (1946-1982): "White Paper of National Income," 1930-1960, and "National Economic Calculation," 1951-1983, Japanese Economic Planning Agency.

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.

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.

NOTES TO CHAPTER III

1 The study by Feldstein and Pellechio (1979) uses household net wealth as a dependent variable instead of consumption or savings. The data used in their research is the Federal Reserve Board's Survey of Financial Characteristics of Consumers conducted in 1963.

2 The calculation of SSWs, gross social security wealth (SSWG) and net social security wealth (SSWN) variables are based on Feldstein (1974) and Munnell (1974). There are some modifications of calculation. The rate of benefits and social security tax payments per capita in relation to disposable income is changed each year by using the current rate. Life expectation is based on current male life expectancies. The rate of interest is a current yield level of ten years long term bond.

3 Net social security wealth (SSWN) equals gross social security wealth (SSWG) minus the present value of social security taxes.

4 SSCON represents the per person contributions (old-age, survivors and disability insurance under the Welfare Pension program divided by CPI). Munnell examines the impact of this social security wealth measure on personal savings in her study (1974).

5 SS is based on the study by Barro (1978). SS is benefits payments per recipient in old-age, survivors and disability insurance programs under the Welfare Pension program, divided by CPI, times the ratio of the number of workers with earnings taxable by social security to the total labor force.

6 A permanent income variable by Darby (1979) is estimated as a weighted average of past income by the exponentially declining weight method.

7 One simple model is

$C = \alpha_0 + \alpha_1 Y_p$ ..... 1, where C is consumption and Y_p is perment income.

$Y = Y_p + Y_t$ ..... 2, where Y_t is transitory income and Y is measured income.

From equqtions 1 and 2,

$C = \alpha_0 + \alpha_1 Y - \alpha_1 Y_t$ ..... 3.

Suppose $Y_t = \beta_0 + \beta_1 U$ ..... 4, where U is unemployment rate and $\beta_1 < \emptyset$.

Therefore, from equqtions 3 and 4 we get

$C = \alpha_0 + \alpha_1 Y - \alpha_1 \beta_1 U$ ..... 5, where $- \alpha_1 \beta_1 > \emptyset$.

With Y fixed, an increase in U means that Y_p rises and Y_t falls.

8 The insignificant and/or weak effects in other studies are due to failure to hold labor force participation (LF) constant. Munnell employs LF with income. She assumes that savings is a function of income and is indirectly a function of retirement years which affect a length of working years, namely, earnings. Munnell uses LF65 (labor force participation rate of age 65 and older), with income as a proxy variable to measure retirement pattern.

To be specific consider the following variables model:

$S = \alpha_0 + \alpha_1 SSW + \alpha_2 LF$ 1,

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

If we omit LF, the estimate is

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

From equation 1,

$\Sigma S.SSW / \Sigma SSW^2 = \alpha_1 + \alpha_2 \Sigma LF.SSW / \Sigma SSW^2$ ..... 3.

From equation 2, we get

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

Based on the omitted variable formula we have

$\hat{\alpha}_1^* = \alpha_1 + \alpha_2 b$ 5,

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

If magnitudes of α_1 and $\alpha_2 b$ are equal, both offset each other. $\hat{\alpha}_1^* \cong \emptyset$. $\hat{\alpha}_1^*$ tends to bias toward zero, if LF is omitted from the savings fanction.

9 Basically the method of Automatic Interaction Detector (AID) is that samples are successively divided into two parts by a significant explanatory variable of a factor.

10 See FOOTNOTE 8 to estimate a precise effect of social security retirement benefits.

11 The same social security wealth variables - SSWG, SSWN, SSCON and SS - are used in this simultaneous equation model as before. See FOOTNOTES 2, 3, 4 and 5.

12 See FOOTNOTE 7 for a reason of negative relationship between personal savings and unemployment.

TABLE 1

Definitions of Variables

Variable Name	Definition
S	real per capita personal savings in 1,000 yen.
LF.60	labor force participation rate of males age 60 and over.
SSWG	real per capita gross social security wealth, in 1,000 yen, based on OASDI program, as defined by Feldstein and Munnell. There are some modifications of calculation. The rate of benefits and social security tax payments per capita in relation to disposable income is changed each year by using the current rate. Life expectation is based on current male life expectancies.
SSWN	real per capita net social security wealth, in 1,000 yen, based on OASDI program as defined by Feldstein and Munnell. Net social security wealth (SSWN) equals gross social security wealth (SSWG) minus the present value of social security taxes.
SSCON	real per person contributions, in 1,000 yen (OASDI program: old-age, survivors and disability insurance under the Welfare Pension program), of workers with earnings taxable by social security as defined by Munnell.
SS	real social security benefits (OASDI program: old-age, survivors and disability insurance under the Welfare Pension program) per recipient in 1,000 yen, multiplied by the ratio of the number of workers with earnings taxable by social security to the total labor force, as defined by Barro (1978).
YD	real per capita personal disposable income in 1,000 yen.

(continued on next page)

TABLE 1 (continued)

Definitions of Variables

Variable Name	Definition
WREESTA	real per capita expense of personal residential construction in 1,000 yen in the private sector at the beginning of the year.
WLIQUID	real per capita net liquidity wealth: stocks, bonds, trusts and life insurance in 1,000 yen, at the beginning of the year.
U	unemployment rate in the total labor force.
U.YD	the product of unemployment rate and real per capita personal disposable income.
UMALE.YD	the product of male unemployment rate and real per capita personal disposable income.
RE	real per capita corporate retained earnings in 1,000 yen.
SUR	real per capita surplus of the central government sector in 1,000 yen in equations 4 and 6.
AGRI	the ratio of the number of workers in the agricultural sector to the total labor force.
ED	the ratio of the number of graduates from koto-sennon gakko (in Japan, equivalent to junior college), junior college, senior college and university graduates to junior high school graduates who complete the nine-year compulsory education in Japan.
W	real per capita net wealth, in 1,000 yen, at the the beginning of the year, excluding durable assets in equation 4.

TABLE 2

Year	Ratio of Personal Savings to Disposable Income	Labor Force Participation aged 60 and over (male)	(female)	Lifespan (male)	(female)
	%	%	%	year	year
1946	24.9	68.6	31.7	42.6	51.1
1947	-46.6	69.3	32.4	50.1	54.0
1948	-47.2	69.0	29.4	55.6	59.4
1949	-19.9	74.3	36.3	56.2	59.8
1950	12.5	64.4	30.2	59.5	62.9
1951	18.9	66.0	31.2	59.6	63.0
1952	17.6	68.5	30.7	61.9	65.5
1953	11.2	73.5	36.4	61.9	65.7
1954	10.4	72.9	38.0	63.4	67.7
1955	12.4	75.0	39.3	63.9	68.4
1956	13.3	74.1	37.8	63.6	67.5
1957	14.2	73.8	37.4	63.2	67.6
1958	13.5	74.3	36.3	65.0	69.6
1959	16.7	69.9	34.3	65.2	69.9
1960	18.7	70.9	34.3	65.4	70.3
1961	20.9	71.4	35.3	66.0	70.8
1962	18.3	72.1	31.4	66.2	71.2
1963	18.3	69.4	31.1	67.2	72.3
1964	18.4	69.3	31.5	67.7	72.9
1965	15.8	69.6	30.7	67.7	72.9
1966	15.1	69.3	31.1	68.4	73.6
1967	15.6	68.2	31.2	68.9	74.2
1968	16.7	67.0	29.2	69.1	74.3
1969	17.3	66.8	28.8	69.2	74.7
1970	18.2	65.5	28.5	69.3	74.7
1971	17.9	64.7	27.6	70.2	75.6
1972	18.2	63.6	26.5	70.5	75.9
1973	20.9	64.0	27.6	70.7	76.0
1974	23.7	63.0	26.8	71.2	76.3
1975	22.1	61.9	26.7	71.7	76.9
1976	22.4	61.6	26.2	72.2	77.4
1977	21.0	60.4	26.4	72.7	78.0
1978	20.6	60.0	27.1	73.0	78.3
1979	18.7	59.1	27.1	73.5	78.9
1980	19.2	59.4	27.2	73.4	78.8
1981	19.7	58.8	27.1	73.8	79.1
1982	17.7	57.4	27.3	74.2	79.7

Source: "Family Income and Expenditure Survey," 1951-1983, Statistics Bureau of Prime Minister's Office. "National Income Calculation," 1965-1983, Economic Planning Agency. "Annual Economic Statistics," 1966-1983, Bank of Japan. "Labor Survey," 1951-1983, Statistics Bureau of Prime Minister's Office. "Life Table," 1950-1983, Japanese Insurance Organization.

TABLE 3

Source of Income of Aged Couple Households with Wife aged 60 and over

RURAL

Household Age	Social Security (%)	Earning Income (%)	Non Earning Income (%)	Other (%)
under 60	7.237	86.582	1.159	4.589
60-64	26.768	68.766	1.273	3.054
65-69	37.598	57.180	1.156	4.075
70-74	49.809	42.008	1.532	6.651
75-79	57.204	29.217	2.273	11.306
80-84	61.732	19.462	2.921	15.885
85 and over	68.577	11.145	3.139	17.139

URBAN

Household Age	Social Security (%)	Earning Income (%)	Non Earning Income (%)	Other (%)
under 60	6.238	85.467	2.967	4.356
60-64	29.857	64.356	3.242	2.406
65-69	40.112	53.100	4.067	2.605
70-74	50.018	39.152	5.894	4.776
75-79	52.939	29.394	8.639	8.831
80-84	53.028	22.094	11.401	13.212
85 and over	54.612	16.151	13.593	15.186

Note: "Non Earning Income" is rent, interest, dividend and insurance. "Other" is welfare, remittance and other livelihood protection.
Source: "1980 Population Census of Japan," Office of the Prime Minister, Bureau of Statistics.

CHAPTER IV

THE IMPACT OF SOCIAL SECURITY ON PERSONAL SAVINGS IN JAPAN: EMPIRICAL RESULTS

4.1 The Results of Regressions: Feldstein, Munnell and Barro

In TABLE 1 two versions of Feldstein's consumption function model are estimated. One employs gross social security wealth (SSWG),[1] while the second employs net social security wealth (SSWN).[2] The signs of all coefficients are as expected, as are the signs of all coefficients for variables. The coefficients of SSWG and SSWN are only .0014 and .0016 respectively and are not statistically significant. TABLE 5 reports the definitions of the variables.

The point estimates of the income elasticities are .69 in the equation with SSWG and .70 with SSWN at the sample means. In the equation with SSWG and SSWN, the short-run marginal propensities to consume out of disposable income are both about .57, relatively larger in Japan than that reported by Feldstein (1974) for the United States (about.54).

The coefficients of retained earnings variables (RE) are stable and statistically significant at the 5% significant level. The

coefficients of unemployment rate (U) also are statistically significant. Both point estimates of the elasticities of consumption with respect to the unemployment rate are very small (Ø.Ø45). More explicitly the coefficients imply that a one-percentage-point increase in U would raise consumption by 13,ØØØ yen ($52) per person and 12,83Ø yen (about $51) per person in the equation with SSWG and SSWN, respectively.[3]

TABLE 2 shows three estimates of the Munnell model (equation 2 in II, "Review of the Previous Studies"). The signs of all coefficients in the first two equations with SSWG and SSWN have the proper signs, but none of the coefficients of independent variables are statistically significant. As for the last equation with SSCON[4], one would expect that the coefficients of YD.LF6Ø and SSCON would be negative. The adjusted R^2 in all the regressions are relatively low compared to those in Feldstein's study. In addition, the Durbin-Watson statistics are relatively low compared to the results of regressions from the models by Feldstein and Barro.

Estimates of Barro's model (equation 3 in II, "Review of the Previous Studies") are reported in TABLES 3-A and 3-B. TABLE 3-A includes the intercept, and TABLE 3-B excludes it. Barro (1978) points out that since the deletion of the intercept changes high standard errors of estimated coefficients to low standard

errors of estimated coefficients, the statistically insignificant intercept is deleted. The major change between TABLE 3-A and 3-B with the absence of intercept is that social security wealth variables (SSWG and SSWN) change the signs, namely positive in TABLE 3-A to negative in TABLE 3-B. None of the social security wealth variables are statistically significant.

The short-run marginal propensities to consume out of disposable income range between .59 and .64 with intercept and, .64 and .71 without intercept. These marginal propensities to consume are smaller in Japan than that reported for the United States by Barro in 1978 (about .8). These marginal propensities to consume in the model by Barro (in TABLES 3-A and 3-B) are larger than that of the model by Feldstein (in TABLE 3-A). The coefficient of retained earnings are stable and statistically significant in TABLES 3-A and 3-B, except for the column of 3-3 with SS in TABLE 3-B. The Durbin-Watson statistics become rather small in TABLE 3-B.

The variable of consumer expenditure includes nondurable and durable goods (excluding housing expenditure). Employing expenditure of durable goods as an independent variable may lead to a specification error, while involves the correlation of the consumer expenditure with shifts in the household expenditure of durable goods.

In this section, the models by Feldstein, Munnell and Barro were applied to examine the effect of social security retirement benefits on personal savings in Japan. The results do not provide a clear answer, perhaps because our analysis concentrates on the structure of previous researchers' models. Their theoretical frameworks remain useful tools, however. These previously-tested models are adaptable and allow us to expand into a new model. The analysis in the next section, with the expanded life-cycle savings model, may lead to better structural parameter estimates and help us understand the effect of social security retirement benefits on savings and retirement behavior in Japan.

4.2 The Results of an Expanded Life-Cycle Savings Model

What is of special interest about the regression results in TABLE 4 (equation 4 in III, "Analytical Framework")[6] is that the social security wealth variables are all negative and statistically significant, except for the SS variable. The signs of the other estimated coefficients for variables are as expected. The variables are defined in TABLE 5.

The marginal propensities to save with respect to SSWG, SSWN, and SSCON are -.0027, -.0030, and -.701, respectively. The point estimates of the corresponding elasticities of personal savings at the sample means are -1.06, -.99, and -.35, respectively. It seems that anticipated social security retirement benefits (represented by SSWG and SSWN) affect more personal savings than do social security tax contributions (represented by SSCON) in the long run. The relatively large estimated coefficient of marginal propensity to save with respect to SSCON (social security tax contribution) reflects that a raising of the tax directly lowers personal savings in the short run.

Marginal propensities to save with respect to LF60 are -1.588, -1.639, and -1.585 in the columns of SSWG, SSWN, and SSCON in TABLE 4, respectively. The point estimates of the corresponding elasticities of personal savings with respect to

LF60 are -1.065, -1.099, and -1.063 at the sample means, respectively. The estimated marginal propensities indicate that a one percentage point decline in LF60, i.e., earlier retirement, raises personal savings by approximately 1,600 yen per capita per year in real terms. Since the estimated elasticities are almost unitary, a 1% decrease in LF60, i.e., earlier retirement, will lead to a 1% increase in personal savings in Japan.

With respect to the net impact of both benefit and retirement effects, the estimated effects are evaluated using coefficients in TABLE 4, multiplied by a change in relevant variables between years of 1946 and 1982. The benefit effect dominates the retirement effect. This is because the anticipated social security retirement benefits (SSWG and SSWN) depress about 250 thousand yen real per capita, while earlier retirement (represented by LF60) causes an increase of about 18 thousand yen real per capita. Moreover, the SSWG and SSWN impacts of depressing personal savings by 255 thousand yen and 243 thousand yen respectively are more than twice as much as that of the social security tax contribution by 107 thousand yen (represented by SSCON).[7]

As for personal disposable income (YD), marginal propensities to save with respect to YD are .430 and .416 in the columns SSWG and SSWN in TABLE 4, respectively. Marginal propensities to consume with respect to YD are .565 in the equation with

SSWG and .571 in the equation with SSWN in TABLE 1. Marginal propensities to save with respect to YD in TABLE 4 are .224 in column SS and .154 in the column SSCON are too small to be 1 (=MPC + MPS) in the light of marginal propensities to consume in the column of SS in TABLE 3-A. The revised life-cycle savings model using either SSWG or SSWN as an independent variable seems more reliable and legitimate than the model using the variable SS.

Retained earnings (RE) has the expected negative effect. An increase in the retained earnings reduces personal savings because of a substitution between them (Modigliani and Sterling, 1983). There seems to exist separate incentives between personal savings and retained earnings. An increase of 1,000 yen retained earnings tends to depress personal savings from 300 to 400 yen. Referring to TABLE 1, 3-A and 3-B, an increase of 1,000 yen retained earnings (RE) will lead to an increase in personal consumption approximately from 300 to 360 yen. In TABLE 4, the point estimates of the elasticities on retained earnings range from -.10 to -.07, and a 1% increase in retained earnings will result in a .07% to a .1% decline in personal savings.

In TABLE 4 the marginal propensity to save out of the wealth variable is negative, statistically significant, and larger than the propensity to save out of the social security

wealth variable (SSWG, SSWN and SSCON). This difference may reflect the fact that wealth is held by individuals who consider the accumulation of wealth more important than expected social security benefits due to insufficiant social security retirement benefits in Japan. Shinohara (1983) suggests that the insufficient social security retirement benefits make people strive toward more savings for the retirement period. Hamermesh (1984), using sets of microdata on the United States, points out that the small, estimated coefficients of the marginal propensity to consume out of the social security wealth variable stem from an uncertainty of the future flow of social security retirement benefits.

4.3 Summary of an Expanded Life-Cycle Savings Model by Ordinary Least Squares

This study attempts to disentangle popular, irreconcilable arguments about the benefit and retirement effects of social security retirement benefits on personal savings within a framework of the life cycle model. The empirical evidence for a behavioral pattern of savings in Japan supports the hypothesis that social security retirement benefits depress personal savings. As for the usually hypothesized "dual effects" of social security retirement benefits, the benefit effect dominates the retirement effect in Japan.

Researchers define and construct their own variables of social security wealth according to their assumptions of how individuals form expectations of future social security retirement benefits. The previous researchers' conclusions, which are derived from different measures of the social security wealth variable, about the effects of the variable on personal savings lack consensus in the United States. Darby (1979) points out that the size of the impact of social security retirement benefits on personal savings depends mainly upon the time period used in the estimation and whether the unemployment rate is included in or excluded from the regression equation in the United States. Using Japanese data for the period 1946-1982, I find support for

the Feldstein's and Munnell's hypotheses that personal savings are affected by expected social security retirement benefits and current social security tax contributions rather than current social security retirement benefits.

The Japanese empirical evidence shows that the benefit effect is greater than the retirement effect. The results reveal the inverse relationship between personal savings and labor force participation. A high personal savings ratio, however, exists for the consumption of a prolonged retirement period in Japan. Although the high marginal propensity to save reveals different social norms and national characterastics toward saving in Japan and the United States, the Japanese high savings ratio is partially attributable to the insufficient social security retirement benefits, to the government tax policy[8] (which is related to the government surplus, the incentive of wealth accumulation to the household sector, and the tax deductable for retained earnings), and to the historically low unemployment rate. Even if social security retirement benefits reduce personal savings, the empirical results suggest that the effect on personal savings depends upon how important retirement savings, owing to the insufficiency and uncertainty of social security retirement benefits in the future, is relative to total life savings for the retirement period.

As a policy implication derived from historical Japanese experience, personal savings possibly could be raised or created by goverment policy: the replacement rates of social security retirement benefits, the tax rate on interest earnings from savings, and the length and amount of unemployment benefits. The Japanese high savings ratio has had a remarkable influence on private capital formation and consequently creates the growth of national output in the long run.

NOTES TO CHAPTER IV

1 The calculation of SSWs, gross social security wealth (SSWG), and net social security wealth (SSWN) variables are based upon Feldstein (1974) and Munnell (1974). There are some modifications of calculation. The rate of benefits and social security tax payments per capita in relation to disposable income is changed each year by using the current rate. Life expectancy is based on current male life expectancies. The rate of interest is a current yield level of 10 years long term bond.

2 Net social security wealth (SSWN) equals gross social security wealth (SSWG) minus the present value of social security taxes.

3 One simple model is

$C = \alpha_0 + \alpha_1 Y_p$ ..... 1, where C is consumption and Y_p is perment income.

$Y = Y_p + Y_t$ ..... 2, where Y_t is transitory income and Y is measured income.

From equqtions 1 and 2,

$C = \alpha_0 + \alpha_1 Y - \alpha_1 Y_t$ ..... 3.

Suppose $Y_t = \beta_0 + \beta_1 U$ ..... 4, where U is unemployment rate and $\beta_1 < 0$.

Therefore, from equqtions 3 and 4 we get

$C = \alpha_0 + \alpha_1 Y - \alpha_1 \beta_1 U$ ..... 5, where $-\alpha_1 \beta_1 > 0$.

With Y fixed, an increase in U means that Y_p rises and Y_t falls.

4 SSCON represents the per person contributions (old-age, survivors and disability insurance under the Welfare Pension program divided by CPI). Munnell examines the impact of this social security wealth measure on personal savings in her study (1974).

5 SS is based on the study by Barro (1978). SS is the benefit payments per recipient in old-age, survivors and disability insurance programs under the Welfare Pension program, divided by CPI, times the ratio of the number of workers with earnings taxable by social security to the total labor force.

6 Feldstein, and Lesnoy and Leimer state a multicollinearity problem. This study observes and takes into account covariances

between estimated parameters to have low covariance between estimated parameters. A high degree of collinearity will be associated with a relatively high (in absolute value) covariance between estimated parameters. See R.S. Pindyck and D.L. Rubinfeld, Econometric Models and Economic Forecasts, McGraw Hill, 1976, pp.60-71.

7 A method of calculation is adapted from Shapiro and Shaw (1983). The insignificant and/or weak effects in other studies are due to failure to hold labor force participation (LF) held constant. Munnell employs LF with income. She assumes that savings are a function of income and are indirectly a function of retirement years which affect a length of working years: namely earnings. Munnell uses LF65 (labor force participation rate of age 65 and older) with income as a proxy variable to measure retirement pattern.

To be specific consider the following variables model:

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

where S is personal savings, 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

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

From equation 1,

$$\Sigma S.SSW / \Sigma SSW^2 = \alpha_1 + \alpha_2 \Sigma\, LF.SSW / \Sigma\, SSW^2 \quad \ldots\ldots 3.$$

From equation 2, we get

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

Based on the omitted variable formula we have

$$\hat{\alpha}_1^* = \alpha_1 + \alpha_2 b \quad \ldots\ldots 5,$$

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

If magnitudes of α_1 and $\alpha_2 b$ are equal, both offset each other. $\hat{\alpha}_1^* \cong 0$. $\hat{\alpha}_1^*$ tends to bias toward zero, if LF is omitted from the savings fanction.

8 The policy is that the government does not impose taxes on the interest from savings in banks, postal savings, and national bonds. The upper limit of these amounts of savings and bonds is $12,500 each per person. This tax policy greatly stimulates the savings propensity amoung the Japanese, as of October 1984.

9 The Durbin-Watson test is not applicable to regression equations in which there is no constant term. See Jan Kmenta, Macmillan, 1986, pp.328-330.

TABLE 1

Consumer Expenditure Equation (Feldstein)

YD	YD_{-1}	RE	U	W	SSWG	SSWN	INTER	D.W.	SER	R^2
.565	.051	.353	13.00	.130	.0014	___	16.85	1.88*	9.29	.991
(3.95)	(.50)	(2.51)	(2.05)	(.78)	(1.44)	___	(1.07)			
.571	.051	.355	12.83	.131	___	.0016	16.88	1.88*	9.28	.990
(4.12)	(.50)	(2.52)	(2.02)	(.79)	___	(1.46)	(1.07)			

Note: INTER is the intercept. Asterisks for the Durbin-Watson statistics represent the acceptance of the null hypothesis after correction for serial correlation ** 2.5% level and * 5% level. SER is the standard error of the regression. R^2 is the adjusted R-squared. The parentheses below the coefficient estimates give t-statistics. For explanations of the symbols, see TABLE 5 (Definitions of Variables).

TABLE 2

Saving Equation (Munnell)

YD	YD.LF60	U	W	SSWG	SSWN	SSCON	INTER	D.W.	SER	R^2
.280	-.0002	-10.86	-.030	-.0005	___	___	-7.90	1.55	10.14	.800
(.94)	(-.07)	(-1.53)	(-.19)	(-.31)	___	___	(-.42)			
.284	-.0003	-10.80	-.031	___	-.0006	___	-8.01	1.55	10.14	.800
(.95)	(-.09)	(-1.53)	(-.19)	___	(-.32)	___	(-.43)			
.114	.0014	-11.69	-.013	___	___	.180	-3.12	1.49	10.10	.788
(.59)	(.53)	(-1.63)	(-.08)	___	___	(.57)	(-.19)			

Note: INTER is the intercept. Asterisks for the Durbin-Watson statistics represent the acceptance of the null hypothesis after correction for serial correlation ** 2.5% level and * 5% level. SER is the standard error of the regression. R^2 is the adjusted R-squared. The parentheses below the coefficient estimates give t-statistics. For explanations of the symbols, see TABLE 5 (Definitions of Variables).

TABLE 3-A

Consumption Expenditure Equation (Barro) with intercept

Independent Variable	3-1 with SSWG	3-2 with SSWN	3-3 with SS	3-4 without social security variable
YD	.596 (3.91)	.598 (3.99)	.641 (4.18)	.620 (4.52)
YD_{-1}	.052 (.44)	.052 (.44)	.050 (.42)	.059 (.51)
RE	.366 (2.35)	.365 (2.35)	.323 (1.87)	.350 (2.36)
U.YD	.031 (1.33)	.031 (1.30)	.036 (1.91)	.036 (1.93)
W	.163 (.85)	.162 (.85)	.135 (.67)	.156 (.83)
SUR	.085 (.30)	.085 (.30)	.129 (.51)	.133 (.53)
DUR	-.184 (-.21)	-.180 (-.21)	-.069 (-.08)	-.093 (-.11)
SSWG	.005E-1 (.39)	—— ——	—— ——	—— ——
SSWN	—— ——	.006E-1 (.39)	—— ——	—— ——
SS	—— ——	—— ——	-.037 (-.34)	—— ——
INTER	26.02 (1.50)	25.88 (1.52)	18.31 (1.64)	20.32 (2.16)
D.W.	1.91**	1.91**	1.89*	1.87*
SER	9.62	9.62	9.63	9.48
R^2	.991	.991	.991	.991

Note: INTER is the intercept. Asterisks for the Durbin-Watson statistics represent the acceptance of the null hypothesis after correction for serial correlation ** 2.5% level and * 5% level. SER is the standard error of the regression. R^2 is the adjusted R-squared. The parentheses below the coefficient estimates give t-statistics. For explanations of the symbols, see TABLE 5 (Definitions of Variables).

TABLE 3-B

Consumption Expenditure Equation (Barro) without intercept

Independent Variable	3-1 with SSWG	3-2 with SSWN	3-3 with SS	3-4 without social security variable
YD	.687 (4.78)	.682 (4.76)	.712 (4.68)	.647 (4.65)
YD_{-1}	.075 (.64)	.075 (.64)	.032 (.27)	.059 (.51)
RE	.315 (2.02)	.315 (2.01)	.257 (1.49)	.316 (2.05)
U.YD	.050 (2.51)	.051 (2.52)	.041 (2.05)	.042 (2.03)
W	.107 (.57)	.107 (.57)	.038 (.20)	.109 (.61)
SUR	.309 (1.31)	.311 (1.31)	.238 (.96)	.231 (.94)
DUR	-.083 (-.10)	-.097 (-.11)	-.273 (-.32)	-.236 (-.28)
SSWG	-.011E-1 (-1.39)	—— ——	—— ——	—— ——
SSWN	—— ——	-.012E-1 (-1.37)	—— ——	—— ——
SS	—— ——	—— ——	-.114 (-1.17)	—— ——
INTER	——	——	——	——
D.W.	1.78	1.78	1.87	1.83
SER	9.79	9.80	9.85	9.80
R^2	.997	.997	.997	.994

Note: INTER is the intercept. D.W. is the Durbin-Watson statistics, adjusted for the gap for the years 1946-1982.[9] SER is the standard error of the regression. R^2 is the adjusted R-squared. The parentheses below the coefficient estimates give t-statistics. For explanations of the symbols, see TABLE 5 (Definitions of Variables).

TABLE 4

Saving Equation (Expanded Life-Cycle Saving Model)

Independent variable	with SSWG	with SSWN	with SS	with SSCON
YD	.430 (3.34)	.416 (3.32)	.224 (1.83)	.154 (1.44)
YD_{-1}	.130 (1.08)	.133 (1.11)	.119 (.92)	.248 (2.07)
RE	-.414 (-3.57)	-.417 (-3.61)	-.279 (-1.84)	-.343 (-3.11)
SUR	.840 (3.27)	.861 (3.35)	.434 (1.21)	.795 (3.17)
U.YD	-.017 (-1.88)	-.016 (-1.67)	-.028 (-2.59)	-.005 (-.41)
W	-.572 (-2.48)	-.574 (-2.49)	-.440 (-1.82)	-.666 (-2.83)
LF60	-1.588 (-2.11)	-1.639 (-2.16)	-.916 (-1.20)	-1.585 (-2.01)
SSWG	-.027E-1 (-2.87)	—— ——	—— ——	—— ——
SSWN	—— ——	-.030E-1 (-2.92)	—— ——	—— ——
SS	—— ——	—— ——	-.312E-1 (-.26)	—— ——
SSCON	—— ——	—— ——	—— ——	-.701 (-2.65)
INTER	72.050 (1.41)	75.902 (1.47)	48.635 (.86)	91.542 (1.62)
D.W.	1.89*	1.89*	1.99**	1.93**
SER	8.66	8.64	9.19	9.01
R^2	.985	.985	.939	.986

Note: INTER is the intercept. Asterisks for the Durbin-Watson statistics represent the acceptance of the null hypothesis after correction for serial correlation ** 2.5% level and * 5% level. SER is the standard error of the regression. R^2 is the adjusted R-squared. The parentheses below the coefficient estimates give t-statistics. For explanations of the symbols, see TABLE 5 (Definitions of Variables).

TABLE 5

Definitions of Variables

Variable name	Definition
C	real per capita consumer expenditure in 1,000 yen.
S	real per capita personal savings in 1,000 yen.
SSWG	real per capita gross social security wealth, in 1,000 yen, based on OASDI program as defined by Feldstein and Munnell. There are some modifications of calculation. The rate of benefits and social security tax payments per capita in relation to disposable income is changed in each year by using the current rate. Life expectancy is based on current male life expectancies.
SSWN	real per capita net social security wealth, in 1,000 yen, based on OASDI program as defined by Feldstein and Munnell. Net social security wealth (SSWN) equals gross social security wealth (SSWG) minus the present value of social security taxes.
SSCON	real per person contributions, in 1,000 yen, (OASDI program: old-age, survivors and disability insurance under the Welfare Pension program), of workers with earnings taxable by social security as defined by Munnell.
SS	real social security benefits (OASDI program: old-age, survivors and disability insurance under the Welfare Pension program) per recipient in 1,000 yen, multiplied by the ratio of the number of workers with earnings taxable by social security to the total labor force, as defined by Barro (1978).
YD	real per capita personal disposable income in 1,000 yen.

(continued on next page)

TABLE 5 (continued)

Definitions of Variables

Variable name	Definition
RE	real per capita corporate retained earnings in 1,000 yen.
SUR	real per capita surplus, in 1,000 yen, of the total government sectors in TABLEs 3 and the central government sector in TABLE 4.
U	unemployment rate in the total labor force.
U.YD	the product of real per capita personal disposable income and unemployment rate.
LF.60	labor force participation rate of males aged 60 and over.
YD.LF60	the product of real per capita personal disposable income and labor force participation rate of males aged 60 and over.
W	real per capita net wealth in 1,000 yen, at the beginning of the year in TABLES 1, 2, 3-A and 3-B, and real per capita net wealth in 1,000 yen, at the beginning of the year excluded durable assets in TABLE 4.
DUR	real per capita household durable expenditure in 1,000 yen at the beginning of the year.

CHAPTER V

THE IMPACT OF SOCIAL SECURITY ON PERSONAL SAVINGS AND ON LABOR FORCE PARTICIPATION OF THE ELDERLY

5.1 Empirical Results

This chapter presents the results of a simultaneous-equation model estimated by two-stage least squares. One striking aspect of the results of TABLE 2-A by the method of two-stage least squares (equation 5 and 6 in Chapter III, "Analytical Framework") is that results seem to confirm the hypothesis that there have been two offseting factors: earlier retirement encourages personal savings (retirement effect), and social security retirement benefits discourage personal savings (benefit effect). Another surprising result is that an increase in personal savings induces an earlier retirement, whereby an individual plans or tries to save more in order to retire earlier. Thus, simultaneity and interdependency exist betweexipersonal savings and laboe force participation, i.e., the retirement indicator (represented by LF60). The variables are defined in TABLE 1.

Marginal propensities to save with respect to social security wealth variables are -.004, -.005 and -.979 in the columns SSWG[1]

and SSWN[2] in TABLE 2-A and SSCON[3] in TABLE 2-B, respectively. All are statistically significant. The point estimates of the corresponding elasticities of personal savings are -1.56, -1.65 and -.49 respectively at the sample means. The results suggest that the magnitude of anticipated social security retirement benefits (represented by SSWG or SSWN) is much greater than current social security tax contributions (SSCON). From 1961 to 1982, after the implementation of a social security retirement program, the absolute amount of impact on personal savings due to anticipated social security retirement benefits (SSWG or SSWN) was reduced by 314 thousand yen real per capita, while that of social security tax contributions (SSCON) was reduced by 134 thousand yen real per capita. In the past from 1970 to 1982, the estimated impact of SSWG or SSWN was approximately a 173 thousand yen reduction of personal savings, while that of SSCON was 97 thousand yen. A substantial reduction in personal savings due to social security retirement benefits is understood. In terms of a life-cycle savings approach individuals plan to save more with a view to long-range life aspect rather than a short range one.[4]

Marginal propensities to save with respect to LF60 are -2.031, -2.172 and -1.539 in the columns SSWG and SSWN in TABLE 2-A and SSCON in TABLE 2-B, respectively. The point estimates of the

corresponding elasticities of personal savings with respect to LF6Ø are -1.36, -1.46 and -.76 at the sample means. The elasticities of SSWG and SSWN are similar in magnitude. Earlier retirement requires individuals to save for the consumption of a long period of retirement. The estimated impact on personal savings by earlier retirement (represented by LF6Ø) was a 29 thousand yen real per capita increase in personal savings from 1961 to 1982, and 17 thousand yen from 197Ø to 1982. The absolute amount of upward impact of the earlier retirement effect was about one-tenth the anticipated social security retirement benefits effect (SSWG or SSWN) and one-fifth the social security tax contributions (SSCON).

Although the benefit effect was greater than the retirement effect, the ratio of social security retirement benefits to disposable income in real per capita was only about 5Ø% on the average during the past 1Ø years (1972-1982), as observed in TABLE 3 on column 3. Aldrich (1982) also reports that 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 198Ø. This insufficiency of social security retirement benefits probably induced the Japanese to save. The ratio of personal savings to disposable income in real per capita was about 2Ø% on the average during the past 1Ø years (1972-1982), as indi-

cated in TABLE 3 on column 2. This ratio is remarkably high compared to the ratio (about 5% on the average) in the United States.

TABLE 4 shows incomes of aged couples in both rural and urban areas. The social security program provides social security retirement benefits at the age of 60 and over in Japan; nevertheless, the main sources of incomes are earning, non earning and others at their early age of 60s. After the age of 75 the couple in a rural area relies more upon social security retirement benefits than do those couples in urban areas. The ratio of income from social security retirement benefits to totle incomes before age 74 is relatively similar for both rural and urban elderly couples. The relatively high, non-earning income of an aged couple in a urban area as compared to those in a rural area reveals that an urban couple accumulates assets for their retirement period.

Historical evidence of the replacement rates and the 1980 Population Census of Japan prove that the aged couple considers social security retirement benefits as less important than any other income in the early stage of the retirement period. Insufficient social security retirement benefits force individuals during the working period to save for the consumption of the retirement period.

Another major estimated impact is real disposable income. Shinohara (1983) emphasizes the importance of real disposable income. From 1970 to 1982 current and past real disposable incomes together contributed about 134 thousand yen real per capita personal savings, according to the calculation based on the results in TABLE 2-A under the SSWG column. Relatively high marginal propensities to save about .4 (in TABLE 2-A) may support the previous argument concerning high personal savings-income and low social security retirement benefits-disposable income ratios. We recognize that other explanatory variables -social norms and attitudinal behavior- are not included in this analysis.

Positively-estimated coefficients of physical assets, represented by WREESTA in TABLES 2-A and 2-B, show the stimulation of saving efforts for the purpose of obtaining one's own house, as well as the encouragement of work efforts to meet housing construction expenses. In Japan the owning of one's own house (physical assets) is motivated by the bequest purpose in life-cycle wealth accumlation (Darby, 1979; and Shinohara, 1983). Shinohara (1983) points out a strong community orientation between generations. It may tend to have a higher propensity to bequest than in other countries. The study by Blinder, Gordon and Wise (1983) find weak evidence for the bequest motive in

the case of the United States.

Estimated coefficients of retained earnings (RE) are negative and statistically significant in TABLES 2-A and 2-B and three explanations for this result are plausible. One is that business firms accumulate retirement pension allowances for their employees in Japan. The allowances are 40% tax deductible and transferable by the firms into retained earnings. These business savings are thus taken out of one's personal savings share in the private sector. Another reason is that increased retirement pensions undertaken by business firms for their workers tend to discourage workers from personal savings because of an increase in anticipated retirement pensions provided by the firm in the future. The last reason is that an increase in retained earnings is related to improving business prospects (Auerbach, 1982). This situation causes an increase in consumption and leads to a decrease in personal savings.

As for government surplus (SUR), estimated coefficients are statistically significant. The positively estimated coefficients (SUR) reflect the indirect effect upon personal savings. An increase in government surplus ultimately causes the private sector to increase savings, which means private investment, and future consumer expenditure. The empirical results support the theoretical arguments of Boskin and Kotlikoff (1985), which were

dicussed in 3.4 Theoretical Model and Function. The government surplus also has an indirect influence on personal savings through an increase in future disposable income by lowering future taxes and price level.

As for the factors' influence on the labor force participation of the elderly, estimated coefficients of savings (S) are all negative (-.039, -.039, -.040 and -.035 in the column SSWG and SSWN in TABLE 2-A, and SSCON and SS in TABLE 2-B respectively). As previously discussed, marginal propensities to save with respect to LF60 are all negative. The results reflect the interdependency between personal savings and labor force participation. The results infer that an increase in life-cycle savings affects the retirement decision of elderly workers. The results also imply that individuals try to save more during the working period under the condition of lifetime labor supply because of planned earlier retirement. Therefore, life-cycle savings and life-cycle labor supply are mutually determined (Thompson, 1983).

According to the estimated elasticities, a 1% increase in personal savings will lead to a range of between a .052 to a .060 percent decrease in the labor force participation of those age 60 and over at the sample means. Thus, the changes in personal savings have a slight decline in the labor force

participation of the elderly.

Statistically significant estimated coefficients of current real disposable income (YD) and lagged real disposable income (YD_{-1}), shown in the LF60 columns in TABLES 2-A and 2-B, present a life-cycle earning by labor supply. The point estimates of elasticities of labor force participation by the elderly (LF60) with respect to disposable income are -1.05 (YD) and .49 (YD_{-1}) at the sample means, in the LF60 columns with SSWG in TABLE 2-A. The negatively estimated sign by YD reflects income effect, which encourages elderly workers to choose leisure rather than work. The positively estimated sign by YD_{-1} reflects a substitutional effect, which is quite small. These variables are statistically significant in the LF60 columns.

Marginal effects of physical assets (WREESTA) on labor force participation of age 60 and over are .246, .247, .259 and .233 in the columns SSWG, SSWN, SSCON and SS in TABLEs 2-A and 2-B, respectively. The estimated coefficients are consistent and statistically significant. The bequest motive of owning a house has a strong influence, namely, a retirement decision, on the labor force participation of those 60 and over. The estimated marginal effects reveal that a 1,000 yen increase in holding physical assets, such as housing, raise the labor force participation of people 60 and over by approximately

.25 of a percentage point. The results suggest that the long mortgage payment possibly postpones withdrawal from the labor market.

Since World War II Japan has experienced an accelerating decline in the labor force from the agricultural sector and in her economic development. Statistically significant and estimated negative coefficients of AGRI in TABLES 2-A and 2-B reveal that industrial development provides an expansion of job opportunities. The negative effect of AGRI also infers nonpecuniary benefits from socializing with other people in the labor market (Shapiro and Shaw 1983).

The positive effect of the ED variable in the labor supply equation by the elderly (LF60) in TABLES 2-A and 2-B are statistically significant and stable. The effect of the ED variable operates in the expected direction (Boskin, 1977). An increase in the quality of education, which is associated with a rising opportunity cost, encourages individuals toward a longer working year or more participation in the labor market during the life cycle. An expanding choice of job opportunities, combined with a high quality of education, persuades the elderly not to withdraw completely from the labor market after retiring from the main lifetime job.

In Japan the influence of anticipated social security re-

tirement benefits (SSWG or SSWN) or social security retirement tax contributions (SSCON) on the labor supply of the elderly is negligible in this time-series study.

The results for the estimated labor supply suggest that the retirement decision (represented by LF6Ø) is mainly affected by life-cycle savings, life-cycle income, an incentive to obtain houses, a change in industrial structure (namely, the decline in the agricultural sector), and the quality of education.

5.2 Summary

The savings-income ratio in Japan remains quite high. One plausible reason for the relatively small impact of social security benefits upon personal savings is perhaps due to the fact that with the ever-increasing Japanese lifespan, social security retirement benefits are still too small to support the consumption for a long retirement period. The ambiguous improvement of the social security program and the uncertainty of future social security retirement benefits (Darby, 1979; and Hamermesh, 1984), and its insufficiency of benefits in Japan (Shinohara, 1983) will induce individuals to keep a substantially high savings-income ratio. In terms of social security retirement benefits the empirical study shows that the Japanese tend to save with a view toward a long-range life rather than a short-range one.

The empirical results of this study reveal that social security retirement benefits have a negative impact upon personal savings and that the labor force participation over the age of sixty is inversely related to personal savings. The usually hypothesized "dual effects" of social security retirement benefits exists. The benefit effect dominates the retirement effect in Japan. An empirical study by Burkhauser and Turner (1982 b)

suggests that the effect of social security on the elderly workers in the United States. The social security retirement benefits do not visibly affect labor force participation of the elderly in this time-series study in Japan, however. The results may stem from different social norms. The study explicitly identifies an interdependency between personal savings and the labor force participation of the elderly, namely, retirement-behavior pattern.

Although the benefit effect is greater than the retirement effect, a high personal saving ratio exists in Japan. This high saving ratio partly stems from obtaining a house in a life-cycle assets plan (Shinohara, 1983). Personal savings are related negatively to retained earnings, but positively to government surplus and to physical wealth accumulation.

The labor force participation of those over the age of sixty, i.e., the retirement decision, has been influenced since the 1940s by industrialization. The increase in the quality of education allows the elderly to remain longer in the labor market. The physical assets accumulation, motivated by bequest purposes, induces the individual to work longer in his lifetime.

Understanding the effect of social security retirement benefits upon personal savings and the labor supply of the elderly remains crucial in determining social and economic policies.

Savings by individuals are utilized by the financial market to purchase stocks, bonds and other financial assets, which, in turn, finance capital formation in the private sector. In the long run, the relatively high rate of personal savings would remarkably affect the rate of private capital stocks and consequently the growth of national income.

NOTES TO CHAPTER V

1 The calculation of SSWs: gross social security wealth (SSWG) and net social security wealth (SSWN) variables are based on Feldstein (1974) and Munnell (1974). There are some modifications of calculation. The rate of benefits and social security tax payments per capita in relation to disposable income is changed in each year by using the current rate. Life expectaion based on current male life expectancies. The rate of interest is a current yield level of 10 years long term bond.

2 Net social security wealth (SSWN) equals gross social security wealth (SSWG) minus the present value of social secu-

3 SSCON represents the per person contributions (old-age, survivors and disability insurance under the Welfare Pension program divided by CPI). Munnell examines the impact of this social security wealth measure on personal savings in her study (1974).

4 A method of calculation is adapted from Shapiro and Shaw (1983).

The insignificant and/or weak effects in other studies are due to failure to hold labor force participation (LF) held constant. Munnell employs LF with income. She assumes that savings are a function of income and are indirectly a function of retirement years which affect a length of working years: namely earnings. Munnell uses LF65 (labor force participation rate of age 65 and older) with income as a proxy variable to measure retirement pattern.

To be specific consider the following variables model:

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

where S is personal savings, 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

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

From equation 1,

$$\Sigma S.SSW / \Sigma SSW^2 = \alpha_1 + \alpha_2 \Sigma LF.SSW / \Sigma SSW^2 \quad \ldots\ldots 3.$$

From equation 2, we get

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

Based on the omitted variable formula we have

$\hat{\alpha}_1^* = \alpha_1 + \alpha_2 b$ 5,

where $\hat{\alpha}_1 < \emptyset$, $\alpha_2 < \emptyset$, $b < \emptyset$, and $\alpha_2 b > \emptyset$. b is the regression coefficient of LF on SSW ($LF = b_0 + bSSW$).

If magnitudes of α_1 and $\alpha_2 b$ are equal, both offset each other. $\hat{\alpha}_1^* \cong \emptyset$. $\hat{\alpha}_1^*$ tends to bias toward zero, if LF is omitted from the savings function.

TABLE 1

Definitions of Variables

Variable name	Definition
S	real per capita personal savings in 1,000 yen.
LF.60	labor force participation rate of males aged 60 and over.
SSWG	real per capita gross social security wealth, in 1,000 yen, based on OASDI program as defined by Feldstein and Munnell. There are some modifications of calculation. The rate of benefits and social security tax payments per capita in relation to disposable income is changed in each year by using the current rate. Life expectation based on current male life expectancies.
SSWN	real per capita net social security wealth, in 1,000 yen, based on OASDI program as defined by Feldstein and Munnell. Net social security wealth (SSWN) equals gross social security wealth (SSWG) minus the present value of social security taxes.
SSCON	real per person contributions, in 1,000 yen, (OASDI program: old-age, survivors and disability insurance under the Welfare Pension program), of workers with earnings taxable by social security as defined by Munnell.
SS	real social security benefits (OASDI program: old-age, survivors and disability insurance under the Welfare Pension program) per recipient in 1,000 yen, multiplied by the ratio of the number of workers with earnings taxable by social security to the total labor force, as defined by Barro (1978)'.
YD	real per capita personal disposable income in 1,000 yen.

(continued on next page)

TABLE 1 (continued)

Definitions of Variables

Variable name	Definition
WREESTA	real per capita expense of personal residential construction in 1,000 yen in private sector at the beginning of the year.
WLIQUID	real per capita net liquidty wealth: stocks, bonds, trusts and life insurance, in 1,000 yen, at the beginning of the year.
UMALE.YD	the product of male unemployment rate and real per capita personal disposable income.
RE	real per capita corporate retained earnings in 1,000 yen.
SUR	real per capita surplus of the central government sector in 1,000 yen.
AGRI	the ratio of the number of workers in agricultural sector to the total labor force.
ED	the ratio of the number of graduates from koto-semmon gakko (in Japan equivalent to junior college), junior college, senior college and university graduates to junior highschool graduates who complete the nine-year compulsory education in Japan.

TABLE 2-A

Saving and Labor Supply of the Elderly
(Expanded Life-Cycle Saving Model)

Independent variable	S with SSWG	LF60 with SSWG	S with SSWN	LF60 with SSWN
S	___	-.039	___	-.039
	___	(-1.73)	___	(-1.75)
LF60	-2.031	___	-2.172	___
	(-2.23)	___	(-2.40)	___
YD	.379	-.129	.359	-.129
	(2.57)	(-4.27)	(2.50)	(-4.37)
YD_{-1}	.061	.063	.065	.063
	(.55)	(3.71)	(.60)	(3.73)
WREESTA	.733	.246	.726	.247
	(2.58)	(3.75)	(2.60)	(3.76)
WLIQUID	.427	-.018	.428	-.017
	(1.66)	(-.46)	(1.69)	(-.45)
UMALE.YD	.007	-.003E-1	.010	-.003E-1
	(.88)	(-.18)	(1.16)	(-.18)
RE	-.481	___	-.486	___
	(-4.64)	___	(-4.76)	___
SUR	.570	___	.607	___
	(2.37)	___	(2.54)	___
AGRI	___	-.732	___	-.734
	___	(-6.12)	___	(-6.06)
ED	___	.312	___	.313
	___	(2.14)	___	(2.15)
SSWG	-.004	-.005E-3	___	___
	(-4.82)	(-.03)	___	___
SSWN	___	___	-.005	-.003E-3
	___	___	(-4.99)	(-.02)
INTER	103.547	112.682	113.545	112.789
	(1.69)	(14.66)	(1.86)	(14.58)
D.W.	1.83*	2.12*	1.83*	2.11*
SER	8.74	1.44	8.67	1.44
R^2	.993	.936	.993	.936

Note: INTER is the intercept. Asterisks for the Durbin-Watson statistics represent the acceptance of the null hypothesis after correction for serial correlation ** 2.5% level and * 5% level. SER is the standard error of the regression. R^2 is the adjusted R-squared. The parentheses below the coefficient estimates give t-statistics. For explanations of the symbols, see TABLE 5 (Definitions of Variables).

TABLE 2-B

Saving and Labor Supply of the Elderly
(Expanded Life-Cycle Saving Model)

Independent variable	S with SSCON	LF60 with SSCON	S with SS	LF60 with SS
S	___	-.040	___	-.035
	___	(-1.79)	___	(-1.52)
LF60	-1.539	___	-.280	___
	(-1.51)	___	(-.21)	___
YD	.046	-.134	.144	-.128
	(.31)	(-5.43)	(.71)	(-5.91)
YD_{-1}	.150	.065	.048	.058
	(1.19)	(3.84)	(.33)	(3.38)
WREESTA	.407	.259	.545	.233
	(1.18)	(3.58)	(.92)	(3.73)
WLIQUID	.352	-.017	-.264	-.014
	(1.20)	(-.43)	(-.77)	(-.36)
UMALE.YD	.016	-.005E-1	-.007	-.001
	(1.41)	(-.28)	(-.52)	(-.70)
RE	-.399	___	-.271	___
	(-3.42)	___	(-1.59)	___
SUR	.491	___	.154	___
	(1.77)	___	(.40)	___
AGRI	___	-.758	___	-.775
	___	(-6.18)	___	(-7.77)
ED	___	.314	___	.350
	___	(2.18)	___	(2.38)
SSCON	-.979	.085E-1	___	___
	(-3.49)	(.19)	___	___
SS	___	___	-.036	.013
	___	___	(-.27)	(.69)
INTER	95.688	114.311	9.697	115.092
	(1.32)	(15.80)	(.09)	(20.33)
D.W.	1.91**	2.12*	1.76	2.10**
SER	9.61	1.44	9.99	1.43
R^2	.989	.934	.981	.933

Note: INTER is the intercept. Asterisks for the Durbin-Watson statistics represent the acceptance of the null hypothesis after correction for serial correlation ** 2.5% level and * 5% level. SER is the standard error of the regression. R^2 is the adjusted R-squared. The parentheses below the coefficient estimates give t-statistics. For explanations of the symbols, see TABLE 5 (Definitions of Variables).

TABLE 3

Year	Ratio of Personal Savings to Disposable Income	Ratio of SSRB/YD per person	Ratio of SST/YD per person
	%	%	%
1946	24.9	14.9	7.4
1947	-46.6	7.2	5.0
1948	-47.2	35.2	5.4
1949	-19.9	45.4	7.8
1950	12.5	45.2	6.5
1951	18.9	44.1	5.5
1952	17.6	39.9	4.9
1953	11.2	35.8	3.9
1954	10.4	40.2	5.8
1955	12.4	37.1	5.8
1956	13.3	34.7	5.4
1957	14.2	31.3	5.0
1958	13.5	29.8	5.0
1959	16.7	27.3	4.4
1960	18.7	24.9	5.3
1961	20.9	21.8	5.2
1962	18.3	19.4	5.2
1963	18.3	17.3	4.8
1964	18.4	15.7	4.6
1965	15.8	33.0	7.1
1966	15.1	29.7	7.3
1967	15.6	26.4	6.9
1968	16.7	23.6	6.5
1969	17.3	33.6	6.7
1970	18.2	29.4	7.5
1971	17.9	29.3	7.8
1972	18.2	26.3	8.0
1973	20.9	47.9	8.2
1974	23.7	44.7	9.5
1975	22.1	48.8	9.7
1976	22.4	53.0	11.2
1977	21.0	53.2	12.5
1978	20.6	52.9	12.3
1979	18.7	51.8	12.1
1980	19.2	54.9	13.0
1981	19.7	55.9	14.5
1982	17.7	56.1	14.5

Source: "Family Income and Expenditure Survey," 1951-1983, Statistics Bureau of Prime Minister's Office. "National Income Calculation," 1965-1983, Economic Planning Agency. "Annual Economic Statistics," 1966-1983, Bank of Japan. "Social Insurance Agency Annual Report," 1965-1983, Social Insurance Agency Japanese Government.

TABLE 4

Source of Income of Aged Couple Households with Wife aged 60 and over

RURAL

Household age	Social security (%)	Earning income (%)	Non earning income (%)	Other (%)
under 60	7.237	86.582	1.159	4.589
60-64	26.768	68.766	1.273	3.054
65-69	37.598	57.180	1.156	4.075
70-74	49.809	42.008	1.532	6.651
75-79	57.204	29.217	2.273	11.306
80-84	61.732	19.462	2.921	15.885
85 and over	68.577	11.145	3.139	17.139

URBAN

Household age	Social security (%)	Earning income (%)	Non earning income (%)	Other (%)
under 60	6.238	85.467	2.967	4.356
60-64	29.857	64.356	3.242	2.406
65-69	40.112	53.100	4.067	2.605
70-74	50.018	39.152	5.894	4.776
75-79	52.939	29.394	8.639	8.831
80-84	53.028	22.094	11.401	13.212
85 and over	54.612	16.151	13.593	15.186

Note: Non earning income is rent, interest, divindend and insurance. Other is welfare, remittance and other livelihood protection.
Source: "1980 Population Census of Japan," Office of the Prime Minister, Bureau of Statistics.

CHAPTER VI

SUMMARY

The pioneer study of the impact of social security benefits upon personal savings is done by Feldstein (1974). On the basis of his estimated time-series results, expected social security benefits reduce personal savings by more than 30%. The study by Munnell (1974) also supports Feldstein's conclusion.

Darbey (1979) suggests that the reduction of personal savings is smaller than Feldstein and Munnell report. Leimer and Lesnoy (1982) state that the results differ not only the under specification and construction of social security wealth variables but also according to the period of estimation examined. Barro (1978), though, shows that social security wealth or benefits do not really affect personal savings.

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. Blinder, Gordon and Wise (1980), and Hamermesh (1984), however, maintain that social security retirement benefits tend to delay the retirement of the elderly. Hurd and Boskin (1984), and Mitchell and Fields (1984) identify induced retirement by social security. Recent studies by Honig and Hanoch (1985) try to explain a transitional state from the main lifetime job to partial retirement and then to complete retirement.

Very few empirical studies concerning the effect of social security retirement benefits on savings and retirement behavior of elderly workers have been done, and in Japan study of this field has not theoretically and empirically been accomplished yet.

The recent development of a social security system in Japan could possibly stimulate an earlier retirement by elderly workers. However, the ratio of personal savings to disposable income is remarkably high compared with that of the United States. In Japan the ratios were 18.7% in 1960, 18.2% in 1970, 19.2% in 1980, and 19.7% in 1981, while those ratios in the United States were historically between 5.0% and 8.5%.

In order to clarify the aforementioned, inconsistent empirical results based on U.S. data, it is necessary and interesting to apply previous researchers' consumer expenditure and

saving functions and to expand those functions for Japanese data, a time-series data 1946-1982. Examined are influence of social security retirement benefits on personal savings and labor force participation over the age of sixty under different demographic and socio-economic backgrounds in the context of ordinary least squares and a simultaneous-equation model.

According to the empirical results of this study, the following conclusions are supported:

(1) Ther is an interdependency between personal savings and the labor force participation of the elderly.

(2) Social security retirement benefits clearly have a negative impact on personal savings, and the benefit effect is greater than the retirement effect.

(3) Personal savings are significantly related to labor force participation over the age of sixty, to private wealth, to retained earnings, and to government surplus.

(4) Unlike the United States, social security retirement benefits do not definitely affect labor force participation over the age of sixty in Japan.

(5) Labor force participation over the age of sixty is significantly affected by education and by the expense of personal residential construction, which is motivated by bequest motivations.

(6) The declining agriculture sector, because of the development of industrization, reflects the significantly negative effect on labor force participation over the age of sixty.

As for the usually hypothesized "dual effects" of social security retirement benefits, the benefit effect dominates the retirement effect in Japan. The empirical work of this study attempts to disentangle the previous inconsistent estimates on the impact of social security retirement benefits on personal savings and the labor supply behavior of the elderly. Such a study also assists both in predicting behavior patterns concerning savings and retirement and in guiding policy action.

SUPPLEMENT

ENVIRONMENT AND RETIREMENT DECISIONS OF THE ELDERLY WORKERS IN JAPAN

Introduction

The Japanese are presently experiencing a demographic shift of its labor force. This has triggered government action. At the request of the government, Japanese firms have recently begun to extend mandatory retirement beyond the traditional age of fifty-five. The Japanese government also requires business firms and institutions to achieve a legal employment quota by employing at least 6% of the elderly workers aged 55 and over among their total regular employees.[1] In 1980 the ratios of businesses with a mandatory retirement age system were 39.7% (at age 55 and less), 20.1% (56-59) and 39.7% (60 and over). The ratios changed to 35.5% (at age 55 and less), 18.2% (55-59) and 56.9% (60 and over) in 1982.[2] Despite the fear of some during the recession of the late 70s and early 80s, the gradual increase in the age of the labor force did not have a large, adverse impact on the Japanese economic performance under a seniority and lifetime employment structure (Osaka, 1982).

At present Japan, along with most other highly-developed countries, is becoming an "aging society" as a result of the aging of its labor force. Some economists maintain that job vacancies for the young will be created by encouraging elderly workers to leave the labor market and concomitantly by providing

them with social security retirement benefits. This is seen as an appropriate sharing of the nation's labor resources. Other economists are concerned that the number of retirees will exhaust the esonomy and place a heavy burden on the younger generations. There is a further concern: if older workers are able to continue working and are willing to work, is this not a matter of policy wasting a valuable economic asset ?

Under the changing socio-economic condition, the social social security system has alleviated the financial problems of the elderly since its implementation. Social security retirement benefits have created a trend toward earlier retirement in the United States, (Boskin, 1977; Pellechio, 1979; Burkhauser and Turner, 1982; Hurd and Boskin, 1984; and Mitchell and Fields, 1984). In Japan the Welfare Pension was instituted in 1942 and the National Pension in 1961[3] (both benefits comprise the program of social security retirement benefits). The system of social security retirement benefits was completed in 1961, though its program is still in progress. The recent development of a social security system in Japan could possibly stimulate an earlier retirement of older workers.

Takayama (1982) mentions that the social security earnings test by the program of Welfare Pension is unlikely to affect many retirement decisions, though his statement is not derived

from an empirical examination. His reasoning stems from a difficulty on the part of the elderly to find a satisfactory employment except for a substantially low wage compared to their pre-retirement wages in the Japanese labor market. His statement casts three questions. (1) How does the social security retirement benefits affect work effort? (2) How does the labor market situation of the elderly influence their retirement decision? (3) How does their wage rate affect their work incentive?

Ito (1983) analyzes the retirement process of elderly men and uses 1981 survey data compiled on males aged 55 and over in the Tokyo area. He points out that the decision to continue to stay in the labor market depends upon social security retirement benefits, unemployment benefits and total benefits. An increase in social security retirement benefits induce the elderly to prolong spells of unemployment and to linger in the labor market. They try to maximize both benefits and then are eager to find jobs when the unemployment insurance benefits expire. Ito finds that the availability of the period of unemployment insurance benefits affects the elderly's incentive to find a job. The reality is that the longer they stay without a job in the labor market, the lower their wages become.

In Japan a study in this field has not theoretically and empirically been accomplished yet. Understanding the elderly's

decision to retire is of critical importance. Its increasing segment of the labor force by demographic shifts is of great consequence. A detailed examination is required to understand the characteristics of the elderly in the labor market. Why and how do elderly workers retire, for example, and when do they retire ? This paper will explore such questions.

Method of Analysis

The probability of retirement by the elderly will be indicated by a labor force participation rate under the cumulative distribution of reservation and market wages (Ben-Porath, 1973). Even if individuals have identical reservation wages which reflect the marginal rates of return from economic activities, the individuals will have different degrees of the socio-economic and health (Rones, 1980) conditions that cause retirement.

The elderly aged 60 and over tend to raise their reservation wages due to eligibility for social security retirement benefits, which raises the opportunity cost of being in the labor market. On the contrary, potential employers offer lower wages to the elderly for their declining labor productivity and relatively high unemployment rate under the existing conditions. According to the Year Book of Labor Statistics (1982), age profiles for male earnings peaked in the age range 45-50 for regular employees and in the age range 50-54 for managerial and professional employees. Recently Honig and Hanoch (1985) explicitly discuss the declining wages of elderly workers, using the Retirement History Survey in the United States.

It will be realistic and theoretically consistent to assume that as the wage rate declines the elderly work a lesser number

of hours instead of zero working hours after the normal retirement age of 60 and/or a retirement age officially designated by firms. Although four out of five business firms either re-employ newly retired employees or conditionaly postpone their retirement year by up to several years after the officially specified retirement age in Japan (Osaka 1982), the White Paper of Labor (1983) shows that as age increases, the ratio of long working to total employed declines from 85.0% (in the age range 55-59), 71.0% (60-64) to 61.0% (65-69) and the ratio of short working to total employed rises from 14.7% (in the age range 55-59), 28.7% (60-64) to 38.7% (65-69) in 1980. A similar pattern is also seen in the study of the United States by Gustman and Steinmeier (1983), and Honig and Hanoch (1985). Thus, by involving full-time work, part-time work, unemployed and retired, and by separating three age groups: aged 60-64, 65-69, and 70 and over, we can clearly observe the transition to retirement of the elderly workers under different conditions of socio-economic interaction.

This analysis seeks to examine the effects of the socio-economic and health environment on elderly workers. Generally, it attempts to model the retirement behavior of the elderly workers. We observe retirement ages and how they react under the influence of socio-economic and health factors. The probabil-

ity of selecting one of the states in z will show a transition from a single state. There are four mutually exclusive options: full-time work, part-time work, unemployed or retired. The individual will make a certain choice according to given factors. The probability of choosing one state depends upon the attractiveness of retirement throughout the state and is specified as logistic proability function:

$$(1)\quad P_{j,z} = [\exp(a_{j,z} + \sum_{k=1}^{m} (b_{k,j,z} X_{k,j}))/(1+ \sum_{z} \exp(a_{j,z} + \sum_{k=1}^{m} (b_{k,j,z} X_{k,j})))],$$

where $k = 1,.....,m$ and $z = f, p, u$ and r.

$P_{j,z}$ is the probability that workers in age group j will change a state from one state in z to an alternative state, e.g., r (tired) in z. X_k, k=1,...,m, are explanatory factors, for workers in age group j. z can be f (full-time work), p (part-time work), u (unemployed) and r (retired). b is an unknown parameter to be estimated. b simply gives an effect of one unit rise in X on log adds ratio attached to the explanatory factors affecting a change in among states, especially retirement behavior.

The equation of the natural logarithm of the observed odds ratio is:

$$(2) \quad \ln(P_{j,f(z)} / P_{j,r(z)}) = a_{j,f(z)} + \sum_{k=1}^{m} (b_{k,j,f(z)} X_{k,j}),$$

where $k = 1,.....,m.$

$P_{j,f(z)}$ is the proportion of male full-time workers in age group j in the total male population of age group j. $P_{j,r(z)}$ is the proportion of the retired in age group j in the total male population of age group j. $P_{j,p(z)}$ (the proportion of male part-time workers in age group j), $P_{j,u(z)}$ (the proportion of male unemployed in age group j) and $P_{j,r(z)}$ (the proportion of the retired in age group j) will be substituted for $P_{j,f(z)}$. The dependent variable in this model is simply the logarithm of the odds of one of the states in z to state r.

The marginal effect is found by taking the partial derivative of equation (3) for each of the explanatory variables.

$$(3) \quad \partial P_{j,z} / \partial X_{k,z} = P_{j,z} [b_{k,z} - (\sum_{z} b_{k,z} * p_{j,z})],$$

where z = f, p, u and r. The equation of the marginal effect on the retired is

$$(4) \quad \partial P_{j,z=r} / \partial X_{k,z=r} = - \sum_{z} (\partial P_{j,z} / \partial X_{k,z}),$$

where $k = 1,.....,m$ and $z = f$, p and u.

The model will be estimated using a GLS technique to correct for heteroscedasticity. The logit equation is estimatied separately for three age groups: male workers aged 60-64, 65-69, and 70 and over. Because different groups may reveal different responses, (which this study wants to investigate), to socio-economic and health factors. Thus, weight in age group j is:

$$(5) \quad \text{weight}_{j,z} = [(\text{total male age group j}) * P_{j,z} * P_{j,r(z)}]^{1/2},$$

where $z = f$, p, and u.[4]

Empirical Estimates

This study's estimation is based principally on the Wage Census of 1980, and the 1980 Population Census of Japan[5], using the cross-sectional urban areas of the 47 prefectures in Japan[6].

Dependent variables are three status: full-time workers, part-time workers and the unemployed, and are classified according to age groups: 60-64, 65-69, and 70 and over.[7] These classifications will represent the changing retirement behavior as influenced by the internal and external environment. This is fundamentally a test of whether or not the estimated parameters for the three age groups are meaningfully different from one another.

This study employs the following explanatory factors: full-time male wages, part-time male wages[8], unemployment rate, social security retirement benefits, non-labor income, personal savings, educational levels, presence of spouse, family structure, tension and health variables.

An increase in full-time wages possibly discourages labor market participation among elderly workers. Although social security benefits are held constant, elderly workers implicitly adjust their working effort to the rule of social security retirement benefits. If an earning income is below 150 thousand

yen between ages 60 and 64, a worker gets a 20% to 80% deduction of social security retirement benefits according to his earnings. He is not entitled to receive these benefits if his earnings exceed 150 thousand yen. Over age 65, if his earning income exceeds 150 thousand yen, he will receive 80% of the benefits.[9] The elderly age 60 and over try to adjust both social security retirement benefits and wages in order to maxmize their total income under the constraint of the social security earnings test (Ito, 1983). Another reason is that with increasing age the income effect may dominate the substitution effect.

The retirement age is a transitional period characterized by quitting the main lifetime job and possibly entering a new type of employment before formal retirement. Potential employers often tend to lower wages to the elderly because of the fact that labor productivity on their part tends to decline due to declining physical and/or job related skill, resulting in shorter working hours and/or reduced job responsibilities. An increase in the part-time wage is likely to have significant influence on full-time and part-time workers.

Even though many companies have steadily increased the mandatory retirement to at least age 60, job opportunities of the elderly remain low. The effective demand/supply ratio of age 55 and over has been about 20% as compared to the general

average effective demand/supply ratio (about 70% on average in 1980). After the mandatory or normal retirement age, few jobs are available for elderly workers at prevailing preretirement wages (Takayama, 1982). Unless they accept substantial wage cuts, jobs are difficult to find. Consequently, they may choose to remain unemployed and to receive unemployment benefits or, if retired, social security retirement benefits (Ito, 1983).

Every individual has a different reservation wage which will affect his/her retirement decision (Ben-Porath, 1973). The availability of social security retirement benefits raises the minimum acceptance wage of individuals sixty and over. These guaranteed retirement benefits may also reduce the cost of being unemployed. Under the condition of a mandatory retirement system, employers will probably offer lower wages than the elderly worker's acceptance wages (namely, reservation wages). The widening gap between the elderly worker's offer and the employer's offer induces the elderly to leave the labor market or to withdraw from the main lifetime job when the unemployment rate is high. Therefore job opportunities among the elderly will dwindle during periods of higher or increasing unemployment rates (Rones, 1983).

Workers substitute social security retirement benefits for wealth in their portfolios of accumulated assets for the retire-

ment period. Boskin (1977), Pellechio (1979), Hurd and Boskin (1984), and Mitchell and Fields (1984) maintain that social security retirement benefits exert influence on the retirement decision and will induce earlier retirement. Blinder, Gordon and Wise (1980), and Hamermesh (1984), however, state the social security retirement benefits cause the elderly under age 65 to stay in the labor market longer because of an increase in deferred retirement benefits.

As for Japanese studies, Takayama (1982) asserts that the discouraged effect, due to lack of job opportunity, has a greater influence on the retirement decision of the elderly than the induced effect of social security retirement benefits. Ito (1983) reports that social security retirement benefits are one of the major factors which influence the retirement behavior of elderly workers.

TABLE 1 shows that the incomes of couples in their early 60s in both rural and urban areas come from earnings, non earnings, and other sources. The ratios of income from social security retirement benefits to total income before age 74 are relatively similar for both rural and urban older couples. The relatively high non-earning income for aging couples in urban areas compared to those of aging couples in rural areas reveals that urban older couples accumulate assets for their retirement

period. The older couples in rural areas rely more on social security retirement benefits than those in urban areas after the age of 75. The 1980 Population Census of Japan reflects the fact that aging couples consider social security retirement benefits less reliable than other income in the early stage of the retirement period.

Concerning non-labor income, the replacement rates were 48.8% in 1975, 52.9% in 1978, 54.9% in 1980, 55.9% in 1981 and 56.1% in 1982.[10] Insufficient social security retirement benefits for aging couples force individuals to accumulate wealth during the working period for consumption during the retirement period. Workers build up wealth in the form of real assets, such as housing, as well as financial assets (stocks and bonds) during the working period. Non-labor income presents a proxy variable for the wealth of workers. Unlike liquid assets such as personal savings, non-labor income may have a different impact on the retirement decision of the elderly.

If goods and leisure are complements in the production of commodities for the household, individuals with a large consumption of goods at one point in time in a cross-section framework will consume larger amounts of leisure, holding other things constant. In terms of jointness of leisure and goods consumption, the study by Hamermesh (1984) provides a theoret-

ical model by using microdata, and its results tell the complementarity of leisure and goods consumption in household production. This implicitly assumes we exclude the possibility that leisure is an inferior good. The study deals with household savings in a cross-section framework.

Motivation for saving comes in several varieties, which include the transaction, precautionary, speculative and bequest purposes. These savings are interchangeable. The amount of accumulated savings during the working period depends upon the individual's expected retirement age, level of consumption, and number of retirement years. Accumulated savings has an influence on the retirement decision.

For the above-mentioned reasons and keeping other things constant, it is logically possible to have a positive relationship between savings and labor force participation in a cross-section, but a negative relationship in a time-series framework, In other words, consumption and earnings are procyclical in a time-series. Hence, it will difficult to conclude that savings and labor force participation have an inverse relationship in a static and cross-section analysis.

The quality of education reflects the quality of human capital, and influences the elderly in the decision to withdraw from the labor market. An increase in productivity provides

people with an incentive to work more hours during the year, and add further years of participation (Hanoch and Honig, 1983) and a shorter retirement (Modigliani, 1986). An increase in the quality of education not only improves job market prospects through higher wages and better working conditions, but can also influence the retirement plan regarding the main lifetime job, by providing opportunities for and by widening accessibility to new types of employment before complete withdrawal from the labor market during the transitional period.

In addition to economic (namely, pecuniary return) influences, a changing social environment also affects the elderly worker's retirement decision. Why is this?

Marital status and family structure may elucidate the behavior of the labor force participation of elderly workers, (Burkhauser and Turner, 1982; Hanoch and Honig, 1983; Duggan, 1984; Gustman and Steinmeier, 1984). Family living arrangements are important for personal well-being, as they help the individual avoid isolation (Hughes and Gove, 1981).

Social pressure and tension are social environmental factors. Crime, noise, population density and heavy traffic due to urbanization cause tension to rise. A changing work environment involving new and unfamiliar technology causes stress in older workers. Stress is a major factor contributing to high

blood pressure, heart disease, stroke, and other physical ailments. Another category of workers exposed to stress are those who have chosen high-risk jobs for high pecuniary returns, and who tend to wear out faster than other workers (Frenkel, Priest and Ashford, 1980). Job stress has psychological as well as physical consequences. The monetary equivalant of the indirect utility cost is a shortening of economic activity in the lifetime. Social stress may lead to coping strategies defined by the use of alcohol and drugs, and this in turn may cause secondary family and health problems. In the long run social pressure and tension due to urbanization may have an adverse impact on lifetime working efforts. The working effort incentives of the elderly are influenced by these factors. Hence this study uses quantity of noise as a proxy of pressure and tension variables.

The role of health factors in the labor force participation of the elderly cannot be ignored. There are three types of health factors: institutional, environmental and taste factors. Institutional factors largely depend upon the government's budget allocations, which are based on costs and benefits. Health improvement affects the working efforts of the elderly (Rones, 1980; and Fuchs, 1984).

The main benefit of environmental regulation is to improve

human health. Individuals are often unaware of the ill effect on health by environmental pollution. A reduction in pollution decreases illness and lowers the risks posed to human life. Therefore an improved environment lengthens the working lifetime. There is a clear link between environmental pollution and the decision to retire for health reasons, whether it be high-level/ short-term environmental pollution, or low-level/ long-term pollution (Gerking and Schulze, 1981; and Cropper, 1981).

Lifestyle health habits such as cigarette smoking, alcoholic consumption, diet, and medical care consumption have an influence on health which clearly affects labor force participation (Wolfe, 1984). A lifestyle of risk-taking consumption patterns exists at various income levels (Rosen, 1981; and Hausman, Ostro and Wise, 1984). The rational consumer may act as a self regulator by consciously opting for healthy habits over unhealthy ones.[11]

Results

TABLES 2, 3 and 4 represent the results of the regression analysis for three age groups (60-64, 65-69, and 70 and over), showing different status of economic activity and using a logistic estimation model that contains findings on the economic factors previously discussed. Raw coefficients appear on the tables. The marginal effect is obtained from the application of equation 3 or 4. The variables are defined in the APPENDIX.

One striking aspect of the result of TABLES 2 through 4 is that the variables of social security retirement benefits have statistically significant coefficients in the full time, part time and unemployed equations. The results of the social security retirement benefits variable reveal that the probability of retirement increases or labor force participation declines as social security retirement benefits are raised. Estimated elasticities of probability of retirement with respect to social security retirement benefits are -.40 (full time), -.01 (part time) and .15 (unemployed) in age group 60-64, -.39 (full time), -.02 (part time) and .07 (unemployed) in age group 65-69, and -.19 (full time), -.01 (part time) and .02 (unemployed) in age group 70 and over.[12] A 1 percent increase in social security retirement benefits will lead to approximately a .4% decrease in full-time labor force participation among the age groups 60-64

and 65-69. The impact is much smaller within age group 70 and over. The effects of social security retirement benefits on part-time workers of all age groups are smaller than that on full-time worers, indicating that the earnings test would be less effective on part-time workers. The positive signs of the unemployed on social security retirement benefits (SSRB) for all age groups in column 3 support the analysis by Ito (1983). The eligibility of both unemployment insurance benefits and social security retirement benefits provides some of the elderly with an incentive to maximize both their entitled benefits by staying in the labor market.

In the United States the literature in this field reveals social security to be one of the major stimulants in the recent rise for earlier retirement (Feldstein, 1974; Boskin, 1977; Pellechio, 1979; Bould, 1980; Hurd and Boskin, 1984; and Mitchell and Fields, 1984). However, there are counter arguments by Blinder, Gordon and Wise (1980), and Hamermesh (1984). Social security retirement benefits in Japan have clearly induced elderly workers to leave the labor market at the age of eligiblity for benefits.

Another surprising result is that an increase in the unemployment rate forces the elderly to leave the labor market in Japan. In TABLES 2 through 4, the probabilities of reducing

labor force participation among all age groups (60-64, 65-69, and 70 and over) of full-time and part-time workers are substantially higher due more to the discouragement effect than to an induced retirement effect resulting from social security retirement benefits. The results support the assumption by Takayama (1982) that retirement among older workers is a consequence of their having difficulty finding jobs. Bould (1980) reports the major role of unemployment in the United States as compelling workers to leave the labor market and to enter into early retirement. Rones (1983) also discusses the case of the early 1980s in the United States. In Japan, the marginal effects of unemployment on full-time work among all age groups are much greater than those of the part-time work. A one percentage point increase in the unemployment rate reduces the labor force participation of full-time work by 4.1 percentage points (age 60-64), 4.0 percentage points (65-69), and 3.0 percentage points (70 and over) and of part-time work by .01 percentage points (age 60-64), .08 percentage points (65-69), and .018 percentage points (70 and over).[13] Declining marginal effects of the unemployment rate on the unemployed are .98 percentage points (age 60-64), .46 percentage points (65-69) and .04 percentage points (70 and over). This declining rate is attributable to two causes. The elderly face the dilemma of discouragement while

searching for jobs and the stigma of unemployment. Dwindling job opportunities for the elderly during a period of increasing unemployment encourages them to exit the job market because of the eligiblity of social security retirement benefits.

In TABLE 2 of age group 60-64, the probability of full-time work will increase as full-time male wages rise and decrease while part-time male wages increase. An increase in full-time male wages tends to reduce the probability of part-time work and to raise the unemployed. The total marginal effect of full-time male wages on the retired is 8.3 percentage points which means that the retired among age group 60-64 tend to reenter the labor market as full-time male wages rise by 1,000 yen. The marginal effect of part-time male wages on the retired among age group 60-64 is positive, and the retired will be raised by 13.6 percentage points as part-time male wages rise by 1,000 yen. The results of the total marginal effects imply that workers among age group 60-64 are less sensitive to a reduction of social security retirement benefits (earnings test) by an increase in full-time wages than by an increase in part-time wages.

In TABLES 2, 3 and 4, part-time work (60-64), (65-69) and (70 and over) are positively affected by an increase in part-time male wages. However none of the coefficients are statistically significant. The probabilities of reducing unemployment

because of an increase in part-time male wages are relatively higher among all age groups -.705 (60-64), -.684 (65-69) and -.755 (70 and over), compared to those of full-time male wages. In column 1 of TABLES 3 and 4 the probability of full-time work of age groups 65-69 and 70 and over would decrease by a rise in full and part-time wages. Two reasons for the negative signs are probable. One is the effect of the earnings test, and the other is that the income effect of those age groups dominates the substitution effect as Hanoch and Honig (1983) discuss.

Generally, income is often considered an indicator of economic well-being. Hurd and Shoven (1982) examine the correlation between the income level of households and their wealth accumulation. They find an inaccuracy of the indicator of economic well-being measured by income and show stability of wealth distribution. In column 2 of TABLES 2, 3 and 4, we find that the logit coefficients of non-labor income (a proxy variable of wealth) are statistically significant and stable. An increase in non-labor income (economic well being) reduces the probability of part-time work.

Concerning the results of personal savings, at any given age in the time of a cross-section framework workers will consume less goods leisure and if they stay longer in the labor market. Considering the jointness of leisure and good consump-

tion, the positive logit coefficients reflect the complementary of leisure and goods consumption (Hamermesh, 1984) by the elderly workers. Discernible marginal effects are, however, somewhat small and range .ØØ1 and .ØØ9 percentage points as the balance of personal savings rises 1,ØØØ yen per person.[14]

The signs of logit coefficients on education are all compatible with theory as well as the earlier findings by Duggan (1984), and Honig and Hanoch (1985) as is the case in the United States. Among all age groups increased education tends to encourage the elderly to work longer regardless whether it is on a full-time or a part-time basis. Hence the probablity of labor force participation by the elderly rises. Negative coefficients of the unemployed in column 3 in all age groups are attributable to a higher level of education, which makes it easier for the unemployed elderly to find jobs; thus, the probability of unemployment lowers. However only the coefficient of part-time workers age 6Ø-64 is statistically significant.

The logit coefficients of presence of spouse in all age groups of full-time work are statistically significant at the one-percent level of significance. These positively high probabilities suggest that elderly men with wives are better integrated into their communities as workers and/or have financial responsibility for their spouses. Indeed, the total marginal

effects on the retired by equation 4 are negative and substantial: -1.ØØ (age 6Ø-64), -.73 (65-69) and -.73 (7Ø and over). A one percentage increase in the proportion of the population with the presence of a spouse raises the labor force participation of the elderly by .73 through 1.Ø percentage points. The results of an increase in labor force participation are congruent with the study by Gustman and Steinmeier (1984) as is the case in the United States.

The signs of logit coefficients on family structure are consistent through all age groups and their labor states. As for full-time work among all age groups, the coefficients on the family structure have negative signs. An increase in the number of elderly living with their children and grandchildren lower the probability of participation by the elderly as full-time workers in the labor market. The elderly living with a one or two generation family seem to have less financial responsibilities and tend to reduce economic activity as full-time workers in the labor market. The positively high probability of family structure in the second column (part time) among all age groups suggests that the family structure influences elderly workers to spend a considerable amount of time in the intermediate state as part-time workers before entering complete retirement.

As regards the tension variable, the results of its logit coefficients of the tension variable are compatible with this study's hypothesis. In general, an increase in tension decreases the probability of full-time and part-time work, as well as the number of unemployed, namely, the labor force partici-participation of the elderly. As for the unemployed in column 3, these probabilities, relatively high when compared to full time and part time, show a negatively increasing probability with age and imply that the number of unemployed elderly decreases as age rises. These marginal effects suggest that an increase in tension by a 1 percentage point change lowers unemployed by .34 percentage points (age 60-64), by .74 percentage points (65-69) and by .45 percentage points (70 and over). In column 1, an increase in tension decreases the probability of full-time work among all age groups. The marginal effects are -4.1 percentage points (age 60-64), -5.0 percentage points (65-69) and -3.5 percentage points (70 and over). The impact of tension on full-time workers in terms of marginal effect is much larger than on the unemployed. Moreover, the rise in tension compels the elderly to withdraw from the labor market, namely, into retirement. A one percentage point increase in tension raises the probability of retirement by 4.4 percentage points (age 60-64), 5.5 percentage points (65-69) and 3.9 percentage

points (70 and over). The results show that tension inversely influences the working effort and shortens the economic activity in the lifetime.

Poor health not only limits the amount of work (Hanoch and Honig, 1983) but can also cause loss of employment. The results of this study show how elderly workers respond if the predicted life expectancy (a proxy measure of health quality) rises. The logit coefficients of the life variable in column 1 in TABLEs 2, 3 and 4 mean that the probability of full-time work will increase as the predicted life expectancy rises. The results are congruent with the report of Honig and Hanoch (1985) that health limitations indicate an adverse influence on the work effort of the elderly. There are suggestive positive signs in column 3 of TABLES 2, 3 and 4 that the probability of unemployment would seem to rise, as a result of staying in the labor market as long as the health condition allows, although the logit coefficient is statistically significant in only one age group (60-64). Interestingly, the results of the marginal effect for the retired age are negative: -.132 (age 60-64), -.015 (65-69) and -.408 (70 and over). These negative signs are compatible with the findings by Gustman and Steinmeier (1984 and 1985) as is the case in the United States. As long as the health condition allow the elderly to have economic activity, they tend to work longer and/or reenter the labor market.

Conclusion

The major finding in this study of Japanese elderly workers is that their retirement decision is mainly determined by unemployment and social security retirement benefits. Discernible wage and health effects on the retirement decision of elderly workers are weak.

Rapid progress in social security programs has had the effect of discouraging elderly workers from staying in the labor market when they became eligible for social security retirement benefits. The qualitatively consistant results of this study suggest that the impact of social security retirement benefits on full-time workers among the age groups 60-64, 65-69, and 70 and over is much greater than that on part-time workers. The social security retirement benefits would, however, seem to increase the probability of the elderly unemployed in Japan.

One surprising and important result of unemployment is that the probability of a reduction of labor force participation among all age groups (60-64, 65-69, and 70 and over) of full-time workers is substantially higher. This is due to the discouragement effect. Moreover, the marginal effects of the unemployed on full-time workers among all age groups (ranging 3.0-4.1) are much greater than that of part-time workers (ranging .01 - .08).

These results suggest that unemployment insurance benefits and social secucurity retirement benefits tend to prolong the job search for those elderly eligible for both benefits.[15] The large exit from the labor market is attributable mainly to social security retirement benefits and dwindling job opportunities for the elderly.

An increase in part-time wages would decrease the probability of the elderly unemployed. Higher wages mean higher income, and an income effect would seem to dominate the age groups (65-69, and 70 and over) of full time workers. High and positive probability indicates that the elderly with spouses tend to have full-time work. The elderly living with a one or two generation family in the labor market seem to lower full-time work activity and to raise part-time work activity.

It would be inappropriate to conclude this study without emphasizing the tension and health influences on the retirement decision of elderly workers during the transitional period. The results confirm that an increase in tension has an adverse effect on working effort and shortens the economic activity of the elderly. An improvement of health quality raises the probability of full-time work by the elderly.

A popular proposal to expand job opportunities for the elderly as well as to reduce the current deficiency in social secu-

rity retirement funds is to raise the mandatory retirement age. If the high unemployment rate of those age 60 and over persists, the high rate will imply that the elderly are trying to stay in the labor market. An increase in job opportunities for workers by government initiative and/or supervision might be effective Another way to encourage individuals to remain in the labor market could be by a reduction of the social security tax for workers over sixty and/or an increase in the age of eligibility for social security retirement benefits.

We must learn to value and utilize the long-cultivated assets - their experience and their knowledge - of the elderly. This would be accomplished by expanding the opportunities of the elderly by helping them not to withdraw completely from the labor market when they become eligible for social security retirement benefits. This study examines the influence on retirement patterns among the different age groups of elderly workers in various work states. Changes in labor force participation among the elderly depend upon the complex interactions of various factors. To understand the labor market in Japan of the elderly and their economic activity, more studies of this type are required in order to predict the behavioral patterns which influence the decision of the elderly to retire. Only then can the proper socio-economic and health-related policy action be implemented.

NOTES

* I am indebted to Michael Grossman, Robin Carey, M. Anne Hill, Marjorie Honig and Tadashi Yamada for their helpful comments on the first draft of this paper. However, the views expressed in this study are the sole responsibility of the author. Earlier draft of this research was presented at Rutgers University (February 1986), and at the Eastern Economic Association 12th Annual Convention (April 1986).

1 White Paper of Labor, Showa 58 Nenban, 1983, p.69. Under this law, the ratio of the elderly workers (55 and over) has been gradually increased 5.8% in 1979, 6.2% in 1980, 6.6% in 1981 and 6.9% in 1982.

2 White Paper of Labor, Showa 58 Nenban, 1983, pp.66-70.

3 The National Pension is for self-employed workers.

4 See Yamada, Yamada and Chaloupka (1985) for a similar method.

5 We await the availability of individual data for further insight into the retirement behavior of individual elderly in Japan. Obtaining micro-based data is extremely difficult unless a researcher is affiliated with Japanese government agencies.

See the advantages in using grouped data as described by Cain and Dooley (1976), Link and Settle (1981), and Duggan (1984), and the disadvantages by Dooley (1982), and Greenlees and Zieschang (1984).

6 Japan is administratively divided into forty-seven prefectures, of which one carries the suffix To, one carries Do, two carry Fu and forty-three carry Ken. Each prefecture is further subdivided into Shi(city) and Gun(rural county). Gun is further subdivided into Cho(town) and Mura(village). This study of urban areas refers to Shis(cities) in Japan.

7 The definitions of full-time work, part-time work and the unemployed refer to the 1980 Population Census of Japan (pp.XI-XXI) and Year Book of Labor Statistics (pp.310-313). "'Employed' persons refer to all persons who did any work during the week before the census date for pay or profit, such as

wage, salary, allowance, business profit, etc, as well as persons who had a job or business but did not work at all during the week before the census date because of vacation, illness, bad weather, labor dispute or personal reasons." Major subdivisions of "employed" are "persons mainly working or mostly worked" and "persons secondarily working or working besides doing housework". There are no specification of working hours and weeks in terms of "person mainly working" and "persons secondarily working" in the 1980 Population Census of Japan and Year Book of Labor Statistics. This study refers to "persons mainly working" as full-time workers and "persons secondarily working" as part-time workers. The definition of the unemployed is that "'Unemployed' persons refer to those who had no job but were able to work and actually seeking a job during the week before the census date".

8 Full-time male wages are "scheduled cash earnings (contract cash earnings, excluding overtime allowance, which means the allowances paid for overtime work in working days, holiday work, night work, night or day watch)" divided by schedule hours (the number of hours actually worked between the starting and terminating hours of employment determined by work regulations of the establishment), deflated by cost-of-living in 1980.

There are no statistics for part-time male wages in Japan. However there are good statistics on part-time female wage rates. The study utilizes the data of part-time female wages from the Wage Census 1980. To estimate part-time male wages, part-time female real wage is first regressed on years of tenure by female part-time workers, a square of years of tenure by female part-time workers, and female education level (the ratio of the number of graduates from senior high school, junior college, koto-senmon gakko, senior college and university graduates, to junior high school graduates who complete the nine-year compulsory education), using generalized least-squares technique (GLS). Then, the estimated coefficients are applied to the relevant male variables to predict the part-time male wage rates. See Gustman and Steinmeir (1982) for the similar issue.

9 Unlike the United States, the elderly in Japan could formally start to receive social security retirement benefits at age 60 for men and 55 for women up till 1985. Those with a spouse present are entitled to receive an additional resource for the family (15 thousand yen a month from the Welfare Pension). Most of the elderly do not have dependent children at this age. In 1986, the age of entitlement will be raised

to age 65 for men and 60 for women, with carefully graduated adjustments until the year 2000.

10 Source: "Family Income and Expenditure Survey," 1951-1983, Statistics Bureau of Prime Minister's Office. "National Income Calculation," 1965-1983, Economic Planning Agency. "Annual Economic Statistics," 1966-1983, Bank of Japan. "Social Insurance Agency Annual Report," 1965-1983, Social Insurance Agency Japanese Government.

11 The predicted health variable is used employing a GLS method as follows:

lnLIFE = F(CARE, MISO, POLLUTION, INSPECTION, SANITATION, NUTRITION, CIGARETTE, EDUCATION).

LIFE is male life expectancy as a proxy measure of health quality. CARE is expenditure of medical care per household of 1,000 yen in cities in 1980. MISO is a Japanese salty paste, a typical daily diet per household of 100g in cities in 1980. POLLUTION is quantity of sulfurous acid gas ppm and suspended particulates mg/m^3 in urban areas in 1980. INSPECTION is inspective facilities of environment sanitation per 1,000 persons in 1980. SANITATION is inspective facilities of food sanitation per 1,000 persons in 1980. NUTRITION is total persons given nutrition guidance per 1,000 persons in 1980. CIGARETTE is expenditure of cigarette consumption per person aged 18 and over, of 1,000 yen deflated by cost-of-living in 1980. EDUCATION is the ratio of the number of graduates from senior high school, junior college, koto-senmon gakko, senior college and university graduates who complete the nine-year compulsary education in 1980.

See also related issues Liu (1979), Cropper (1981), Gerking and Schulze (1981), and Rosen (1981).

12 All elasticities are computed at the point of the means of each of the independent variables.

13 The marginal effect is obtained from the application of equation 3 or 4.

14 The results using lagged personal savings are also qualitatively consistent with this finding.

15 The stated period of unemployment insurance benefits is 300 days and in addition an extension is allowed from 60 days to a maximum 90 days under the condition.

TABLE 1

Source of Income of Older Couple Households with Wife Age 60 and over

RURAL

Household age	Social security (%)	Earning income (%)	Non earning income (%)	Other (%)
under 60	7.237	86.582	1.159	4.589
60-64	26.768	68.766	1.273	3.054
65-69	37.598	57.180	1.156	4.075
70-74	49.809	42.008	1.532	6.651
75-79	57.204	29.217	2.273	11.306
80-84	61.732	19.462	2.921	15.885
85 and over	68.577	11.145	3.139	17.139

URBAN

Household age	Social security (%)	Earning income (%)	Non earning income (%)	Other (%)
under 60	6.238	85.467	2.967	4.356
60-64	29.857	64.356	3.242	2.406
65-69	40.112	53.100	4.067	2.605
70-74	50.018	39.152	5.894	4.776
75-79	52.939	29.394	8.639	8.831
80-84	53.028	22.094	11.401	13.212
85 and over	54.612	16.151	13.593	15.186

Note: Non earning income is rent, interest, divindend and insurance. Other is welfare, remittance and other livelihood protection. Source: "1980 Population Census of Japan," Office of the Prime Minister, Bureau of Statistics.

TABLE 2

Labor Supply of the Elderly Workers
Age 60-64

Independent variable	ln(Pf/Pr) full time (60-64)	ln(Pp/Pr) part time (60-64)	ln(Pu/Pr) unemployed (60-64)
Full-time male wage(60-64)	0.506*	-0.941*	0.661**
	(0.29)	(0.53)	(0.34)
Part-time male wage(60-64)	-0.844**	0.152	-0.705
	(0.37)	(0.70)	(0.44)
Unemployment	-20.473***	-15.167***	-0.589
	(2.84)	(5.30)	(3.18)
SSRB	-1.567E-3***	-1.424E-3***	0.718E-3**
	(0.27E-3)	(0.50E-3)	(0.30E-3)
Non-labor income	1.619E-3***	-2.451E-3**	0.180E-3
	(0.57E-3)	(1.08E-3)	(0.63E-3)
Personal savings	0.108E-3	0.345E-3**	0.225E-3**
	(0.09E-3)	(0.16E-3)	(0.10E-3)
Education (60-64)	0.191	2.089**	-0.404
	(0.42)	(0.77)	(0.47)
Presence of spouse (60-64)	7.007***	-2.784	-2.453
	(1.45)	(3.13)	(1.66)
Family structure	-1.349**	2.889**	-1.219
	(0.63)	(1.07)	(0.75)
Tension	-0.264**	-0.142	-0.254*
	(0.11)	(0.19)	(0.13)
Life (ln)	2.854	-9.846	11.181**
	(3.92)	(7.31)	(4.34)
Intercept	-15.497	43.521	-48.037**
	(16.92)	(31.63)	(18.72)
F-statistic	28.08	12.19	12.52
R-squared	0.90	0.79	0.80

Standard Errors are in parenthese. Asterisks represent significant levels of logit coefficients as follows: *** 99% level, ** 95% level, and * 90% level for a two-tailed test. A (ln) next to a variable indicates the natural logarithm of the variable.

TABLE 3

Labor Supply of the Elderly Workers
Age 65-69

Independent variable	ln(Pf/Pr) full time (65-69)	ln(Pp/Pr) part time (65-59)	ln(Pu/Pr) unemployed (65-59)
Full-time male wage(65 and over)	-Ø.285 (Ø.28)	-Ø.151 (Ø.47)	-Ø.222 (Ø.36)
Part-time male wage(65 and over)	-Ø.218 (Ø.23)	Ø.282 (Ø.44)	-Ø.684** (Ø.28)
Unemployment	-16.67Ø*** (3.15)	-14.Ø32** (5.84)	1.211 (3.72)
SSRB	-1.354E-3*** (Ø.32E-3)	-1.5Ø9E-3** (Ø.57E-3)	Ø.64ØE-3* (Ø.37E-3)
Non-labor income	Ø.473E-3 (Ø.56E-3)	-Ø.16ØE-2 (Ø.1ØE-2)	1.463E-3** (Ø.62E-3)
Personal savings	Ø.254E-3*** (Ø.Ø9E-3)	Ø.423E-3** (Ø.16E-3)	Ø.248E-3** (Ø.11E-3)
Education (65 and over)	Ø.832 (Ø.56)	Ø.224 (1.Ø1)	-Ø.2Ø7 (Ø.66)
Presence of spouse (65-69)	3.12Ø*** (Ø.56)	3.892*** (Ø.9Ø)	2.819*** (Ø.65)
Family structure	-Ø.775 (Ø.65)	1.853* (1.Ø9)	-2.521*** (Ø.83)
Tension	-Ø.236* (Ø.12)	-Ø.Ø85 (Ø.2Ø)	-Ø.321** (Ø.15)
Life (ln)	Ø.Ø97 (4.24)	-6.387 (7.69)	5.342 (4.89)
Intercept	-1.1Ø3 (18.16)	22.217 (32.91)	-28.114 (2Ø.91)
F-statistic	22.78	14.16	15.38
R-squared	Ø.88	Ø.82	Ø.83

Standard Errors are in parenthese. Asterisks represent significant levels of logit coefficients as follows: *** 99% level, ** 95% level, and * 90% level for a two-tailed test. A (ln) next to a variable indicates the natural logarithm of the variable.

TABLE 4

Labor Supply of the Elderly Workers
Age 70 and Over

Independent variable	ln(Pf/Pr) full time (70 and over)	ln(Pp/Pr) part time (70 and over)	ln(Pu/Pr) unemployed (70 and over)
Full-time male wage(65 and over)	-0.609** (0.24)	-0.613 (0.47)	0.017 (0.48)
Part-time male wage(65 and over)	-0.216 (0.21)	0.027 (0.44)	-0.755* (0.38)
Unemployment	-14.630*** (2.91)	-14.198** (6.11)	-1.367 (5.36)
SSRB	-0.797E-3** (0.30E-3)	-0.851E-3 (0.62E-3)	1.017E-3* (0.55E-3)
Non-labor income	0.297E-3 (0.46E-3)	-2.948E-3*** (0.95E-3)	1.413E-3* (0.79E-3)
Personal savings	0.398E-3*** (0.08E-3)	0.735E-3*** (0.16E-3)	0.534E-3*** (0.14E-3)
Education (65 and over)	0.210 (0.49)	0.888 (0.99)	-0.628 (0.93)
Presence of spouse(70 and over)	3.892*** (1.16)	-3.126 (2.48)	0.087 (2.02)
Family structure	-0.931 (0.59)	1.682 (1.14)	-4.633*** (1.21)
Tension	-0.176* (0.10)	-0.010 (0.19)	-0.407** (0.19)
Life (ln)	8.194** (3.84)	6.461 (8.40)	5.908 (6.91)
Intercept	-37.743** (16.38)	-28.401 (34.33)	-30.432 (29.44)
F-statistic	27.03	12.05	23.17
R-squared	0.90	0.79	0.88

Standard Errors are in parenthese. Asterisks represent significant levels of logit coefficients as follows: *** 99% level, ** 95% level, and * 90% level for a two-tailed test. A (ln) next to a variable indicates the natural logarithm of the variable.

APPENDIX

Variables in the Equation

Variables	Mean Values and (Standard Deviations) age group 60-64	age group 65-69	age group 70 and over
Full-time male Worker (Pf)	0.707 (0.050)	0.562 (0.056)	0.293 (0.046)
Part-time male Worker (Pp)	0.012 (0.004)	0.018 (0.006)	0.019 (0.006)
Unemployed (Pu)	0.070 (0.015)	0.043 (0.009)	0.013 (0.004)
Retired (Pr)	0.211 (0.040)	0.377 (0.055)	0.675 (0.049)
Full-time Male Wage	0.924 (0.117)	0.840 (0.090)	0.837 (0.090)
Part-time Male Wage	0.571 (0.063)	0.623 (0.079)	0.624 (0.079)
Unemployment	0.027 (0.007)	0.027 (0.007)	0.027 (0.007)
SSRB	1158.01 (63.093)	1157.56 (62.085)	1155.08 (62.962)
No-labor Income	196.088 (72.843)	196.986 (72.877)	196.262 (72.203)
Personal Savings	1752.95 (319.81)	1760.50 (318.33)	1765.83 (316.76)
Education	0.374 (0.094)	0.310 (0.081)	0.309 (0.080)
Presence of Spouse	0.921 (0.015)	0.897 (0.033)	0.756 (0.015)

Variables in the Equation

Variables	Mean Values and (Standard Deviations) age group 60-64	age group 65-69	age group 70 and over
Family Structure	0.150 (0.054)	0.150 (0.055)	0.151 (0.054)
Tension	0.007 (0.133)	0.006 (0.133)	0.007 (0.135)
Life	4.299 (0.004)	4.299 (0.004)	4.299 (0.004)

Full-time male worker (Pf) -- Proportion of full-time male workers aged 60-64, 65-69, and 70 and over in cities in 1980 for age groups 60-64, 65-69, and 70 and over respectively. See FOOTNOTE 7.

Part-time male worker (Pp) -- Proportion of part-time male workers aged 60-64, 65-69, and 70 and over in cities in 1980 for age groups 60-64, 65-69, and 70 and over respectively. See FOOTNOTE 7.

Unemployed (Pu) — Proportion of male unemployed aged 60-64, 65-69, and 70 and over in cities in 1980 for age groups 60-64, 65-69, and 70 and over respectively. See FOOTNOTE 7.

Retired (Pr) — Proportion of retired aged 60-64, 65-69, and 70 and over in cities in 1980 for age groups 60-64, 65-69, and 70 and over respectively. See FOOTNOTE 7.

Full-time male wage -- hourly full-time male wage aged 60-64, one thousand yen deflated by cost of living in 1980, for age group 60-64. Hourly full-time male wage aged 65 and over, one thousand yen deflated by cost of living in 1980 for age groups 65-69, and 70 and over. See FOOTNOTE 8.

Part-time male wage -- Hourly part-time male wage aged 60-64, one thousand yen deflated by cost of living in 1980 for age group 60-64. Hourly part-time male wage aged 65 and over, one thousand yen deflated by cost of living in 1980, for age groups 65-69, and 70 and over. See FOOTNOTE 8.

Unemployment -- Proportion of total labor force aged 15 and over, unemployed, in cities in 1980 for all age groups.

SSRB -- Average of annual social security retirement benefits for a retired person, in one thousand yen deflated by cost of living in 1980, for all age groups.

Non-labor income -- Non-labor income: interests, dividends, and rent, per person in houshold sector in one thousand yen deflated by cost of living in 1980 for all age groups.

Personal savings -- The balance of personal savings per person in one thousand yen deflated by cost of living in 1980 for all age groups.

Education -- Proportion of male aged 60-64 with at least a senior high school education in cities in 1980 for age group 60-64. Proportion of male aged 65 and over with at least a senior high school education in 1980 for age groups 65-69, and 70 and over.

Presence of spouse -- Proportion of male aged 60-64, 65-69, and 70 and over living with wife in cities in 1980 for age groups 60-64, 65-69, and 70 and over respectively.

Family structure -- Proportion of elderly family living with two or three generations together in cities in 1980.

Tension -- A percentage change in complaints received by windows for public nuisances (noise pollution) of local public bodies in 1980.

Life -- Predicted life expectancy as a proxy measure of health quality. See FOOTNOTE 11.

REFERENCE FOR SUPPLEMENT

Ben-Porath, Yoram, "Labor-Force Participation Rates and the Supply of Labor." Journal of Political Economy 81 (May/June 1973): 697-704.

Blinder, Alan S., Gordon, Roger H., and Wise, Donald E., "Reconsidering the Work Disincentive Effects of Social Security." National Tax Journal 33 (December 1980): 431-42.

Boskin, Michael, "Social Security and Retirement Decisions." Economic Inquary 15 (January 1977): 1-23.

Bould, Sally, "Unemployment as a Factor in Early Retirement Decisions." American Journal of Economics and Sociology 39 (April 1980): 113-36.

Burkhauser, Richard V., and Turner, John A., "Labor-Market Experience of the Almost Old and the Implications for Income Support." American Economic Review 72 (May 1982): 304-8.

Cain, Glen G. and Dooley, Martin D., "Estimation of A Model of Labor Supply, Fertility, and Wages of Married Women." Journal of Political Economy 84 (August 1976): 179-99.

Cropper, M.L., "Measuring the Benefits from Reduced Morbidity." American Economic Review 71 (May 1981): 235-40.

Dooley, Martin D., "Labor Supply and Fertility of Married Women: An Analysis with Grouped and Individual Data from the 1970 U.S. Census." Journal of Human Resources 17 (Fall 1982): 499-532.

Duggan, James E., "The Labor-Force Participation of Older Worker." Industrial and Labor Relations Review 37 (April 1984): 416-30.

Feldstein, Martin, "Social Security, Induced Retirement, and Aggregate Capital Accumulation." Journal of Political Economy 82 (September/October 1974): 905-26.

Frenkel, Richard L., Priest, W. Curtiss, and Ashford, Nicholas A., "Occupational Safety and Health: A Report on Worker Perceptions." Monthly Labor Review 103 (September 1980): 11-4.

Fuchs, Victor R., "Though Much is Taken--Reflections on Aging, Health, and Medical Care." Working Paper no.1269. Cambridge, Mass.: NBER, January 1984.

Gerking, Shelby and Schulze, William, "What Do We Know about Benefits of Reduced Mortality from Air Pollution Control ?" American Economic Review 71 (May 1981): 228-34.

Greenlees, John S. and Zieschang, Kimberly d., "Grouping Tests for Misspecification: An Application to Housing Demand." Journal of Business & Economic Statistics 2 (April 1984): 159-69.

Gustman, Alan L., and Steinmeier, Thomas L., "Partial Retirement and Wage Profiles of Older Workers." Working Paper no.1000. Cambridge, Mass.: NBER, October 1982.

_____, and Steinmeier, Thomas L., "Retirement Flows." Working Paper no.1069. Cambridge, Mass.: NBER, January 1983.

_____, and Steinmeier, Thomas L., "Partial Retirement and the Analysis of Retirement Behavior." Industrial and Labor Relations Review 37 (April 1984): 403-15.

_____, and Steinmeier, Thomas L., "A Disaggregated, Structural Analysis of Retirement by Race, Difficulty of Work and Health." Working Paper no.1585. Cambridge, Mass.: NBER, March 1985.

Hamermesh, Daniel, "Life-Cyle Effects on Consumption and Retirement." Journal of Labor Economics 2 (July 1984): 353-70.

Hanoch, Giora and Honig, Marjorie, "Retirement, Wages, and and Labor Supply of the Elderly." Journal of Labor Economics 1 (April 1983): 131-51.

Hausman, Jerry A., Ostro, Bart D. and Wise, David A., "Air Pollution & Lost Work." Working Paper no.1263. Cambridge, Mass.: NBER, January 1984.

Honig, Marjorie and Hanoch, Giora, "Partial Retirement as a Separate Mode of Retirement Behavior." Journal of Human Resources 20 (Winter 1985): 21-46.

Hughes, Michael, and Gove, Walter, "Living Alone, Social Integration, and Mental Health," American Journal of Sociology 87 (July 1981): 48-74.

Hurd, Michael D., and Boskin, Michael J., "The Effect of Social Security on Retirement in the Early 1970s," Quarterly Journal of Economics 99 (November 1984): 767-90.

_____, and Shoven, John B., "The Economic Status of the Elderly," Working Paper no.914. Cambridge, Mass.: NBER, June 1982.

Ito, Minoru, "Koreisha no Kyushoku Kodo to Nenkin Koyo Hoken," (in Japanese), Nippon Rodo Kyokai Zashi 288 (March/April 1983): 12-23.

Japan, Asahi Shinbun Sha, Minryoku 1982 and 1983 (in Japanese), Tokyo, 1982 and 1983.

_____, Department of Labor, Wage Census, Showa 55 Nenban (in Japanese), Tokyo, 1981.

_____, Department of Labor, White Paper of Labor, Showa 58 Nenban (in Japanese), Tokyo, 1983.

_____, Department of Labor, Year Book of Labor Statistics 1982, Tokyo, 1982.

_____, Office of the Prime Minister, Bureau of Statistics, 1980 Population Census of Japan, Tokyo, 1983.

_____, Statistics Bureau Prime Minister's Office, Annual Report on the Family Income and Expenditure Survey 1980, Tokyo, 1981.

_____, Statistics Bureau prime Minister's Office, Japan Statistical Yearbook 1982, Tokyo, 1982.

Link, Charles R., and Settle, Russell F., "A Simultaneous-Equation Model of Labor Supply, Fertility and Earnings of Married Women: The Case of Registered Nurses," Southern Economic Journal 47 (April 1981): 977-89.

Liu, Ben-Chieh, "The Costs of Air Quality Deterioration and Benefits of Air Pollution Control: Estimates of Mortality Costs for Two Pollutants in 40 U.S. Metropolitan Areas," American Journal of Economics and Sociology 38 (April 1979): 187-95.

Mitchell, Olivia S. and Fields, Gary S., "The Economics of Retirement Behavior," Journal of Labor Economics 2 (January 1984): 84-105.

Modigliani, Franco, "Life Cycle, Individual Thrift, and the Wealth of Nations," American Economic Review 76 (June 1986): 297-313.

Osaka Masako M., "How Japanese Firms Cope with Effects of an Aging Labor Force," Aging and Work 5 (1982): 23-30.

Pellechio, Anthony, "Social Security Financing and Retirement Behavior," American Economic Review 69 (May 1979): 284-7.

Rones, Philip L., "The Retirement Decision: A Question of Opportunity ?" Monthly Labor Review 103 (November 1980): 14-7.

_____, "The Labor Market Problems of Older Workers," Monthly Labor Review 106 (May 1983): 3-12.

Rosen, Sherwin, "Valuing Health Risk," American Economic Review 71 (May 1981): 241-45.

Takayama, Noriyuki, "Japan," In The World Crisis in Social Security, edited by Jean-Jacques Rosa. Paris, Fondation National d'Economie Politique, 1982.

Wolfe, Barbara L., "Measuring Disability and Health," Journal of Health Economics 3 (August 1984): 187-93.

Yamada, Tadashi, Yamada, Tetsuji, and Chaloupka, Frank, "A Multinominal Logistic Approach to the Labor Force Behavior of Japanese Married Women," Working Paper no.1783. Cambridge, Mass.: NBER, December 1985.

BIBLIOGRAPHY

Aldrich, Jonathan, "The Earnings Replacement Rate of Old-age Benefits in 12 Countries, 1969-80," Social Security Bulletin, November 1982, Vol.45, pp.3-11.

Ando, Albert and Modigliani, Franco, "The Life Cycle Hypothesis of Saving: Aggregate Implication and Tests," American Economic Review, March 1963, Vol.53, pp.55-84.

Auerbach, Alan, "Issues in the Measurement and Determinants of Business Savings," National Bureau of Economic Research, November 1982, Working Paper No.1024.

Barro, Robert, The Impact of Social Security on Private Saving: Evidence from the U.S. Time Series, Washington, D.C.: American Enterprise Institute, 1978.

Beach, Charles M., Boadway, Robin W., and Gibbons, Jack O., "Social Security and Aggregate Capital Accumulation Revisted: Dynamic Simultaneous Estimates in a Wealth-Generation Model," Economic Inquiry, January 1984, Vol.22, pp.68-79.

Beach, Charles M. and Mackinnon, James G., "A Maximum Likelihood Procedure for Regression with Autocorrelated Errors," Econometrica, January 1978, Vol.46, pp.51-8.

Ben-Porath, Yoram, "Labor-Force Participation Rates and the Supply of Labor," Journal of Political Economy, May/June 1973, Vol.81, pp.697-704.

Blinder, Alan S., Gordon, Roger H., and Wise, Donald E., "Reconsidering the Work Disincentive Effects of Social Security," National Tax Journal, December 1980, Vol.33, pp.431-42.

_____, Gordon, Roger H., and Wise, Donald E., "Social Security Bequests and the Life Cycle Theory of Savings: Cross Sectional Tests," In The Determinants of National Saving and Wealth, Eds.: Franco Modigliani and Richard Hemming, New York, St.Martin, 1983, pp.89-122.

Boskin, Michael, "Social Security and Retirement Decisions," Economic Inquiry, January 1977, Vol.15, pp.1-23.

_____, and Kotlikoff, Laurence J., "Public Debt and U.S. Saving: A New Test of the Neutrality Hypothesis," National Bureau of Economic Research, June 1985, Working Paper No.1646.

Burkhauser, Richard V., and Turner, John A., "A Time-Series Analysis on Social Security and its Effect on the Market Work of Men at Younger Ages," Journal of Political Economy, August 1978, Vol.86, pp.701-15.

_____, and Turner, John A., "Labor-Market Experience of the Almost Old and the Implications for Income Support," American Economic Review, May 1982, Vol.72, pp.304-8, (a).

_____, and Turner, John A., "Social Security, Preretirement Labor Supply, and Saving: A Confirmation and a Critique," Journal of Political Economy, June 1982, Vol.90, pp.643-6, (b).

Corman, Hope, Joyce, Theodore J., and Grossman, Michael, "Birth Outcome Production Function in the U.S.," National Bureau of Economic Research, November 1984, Working Paper No.1729.

Crawford, Vincent P., and Lilien, David M., "Social Security and the Retirement Decision," Quarterly Journal of Economics, August 1981, Vol.96, pp.505-29.

Daimon, Tokuhisa, Shakai Hoken Techo ('83), Tokyo, Kosei Shuppan, 1982.

Darby, Michael, The Effect of Social Security on Income and the Capital Stock, Washington, D.C.: American Enterprise Institute, 1979.

Feldstein, Martin, "Social Security, Induced Retirement, and Aggregate Capital Accumulation," Journal of Political Economy, September/October 1974, Vol.82, pp.905-26.

_____, "Social Security and Saving: The Extended Life Cycle Theory," American Economic Review, May 1976, Vol.66, pp.77-86.

_____, "Social Security and the Distribution of Wealth," Journal of American Statistical Association, December 1976, Vol 71, pp.800-7.

_____, "Social Security and Private Saving: Reply," Journal of Political Economy, June 1982, Vol.90, pp.630-42

Feldstein, Martin and Pellechio, Anthony, "Social Security and Household Wealth Accumulation: New Microeconometric Evidence," Review of Economics and Statistics, August 1979, Vol.61, pp.361-8.

Hamermesh, Daniel, "Life-Cyle Effects on Consumption and Retirement," Journal of Labor Economics, July 1984, Vol.2, pp.353-70.

Hanoch, Giora and Honig, Marjorie, "Retirement, Wages, and Labor Supply of the Elderly," Journal of Labor Economics, April 1983, Vol.1, pp.131-151.

Honig, Marjorie and Hanoch, Giora, "Partial Retirement as a Separate Mode of Retirement Behavior," Journal of Human Resources, Winter 1985, Vol.20, pp.21-46.

Hurd, Michael D., and Boskin, Michael J., "The Effect of Social Security on Retirement in the Early 1970s," Quarterly Journal of Economics, November 1984, Vol.99, pp.767-90.

Ibe, Hideo, "Nenkin to Koyou," (in Japanese), Nippon Rodo Kyokai Zashi, February 1983, Vol.287, pp.2-12.

Ishikawa, Tsuneo and Ueda, Kazuo, "The Bonus Payment System and Japanese Personal Savings," In The Economic Analysis of the Japanese Firm," Ed.: Masahiko Aoki, New York, North-Holland, 1984, pp.133-92.

Ito, Minoru, "Koreisha no Kyushoku Kodo to Nenkin Koyo Hoken," (in Japanese), Nippon Rodo Kyokai Zashi, March/April 1983, Vol.288, pp.12-23.

Japan. Department of Labor, White Paper of Labor, Showa 58 Nenban (in Japanese), Tokyo, 1983.

_____. Department of Welfare, White Paper of Welfare, Showa 56 Nenban (in Japanese), Tokyo, 1981.

King, Mervyn, "The Economics of Savings," National Bureau of Economic Research, December 1983, Working Paper No.1247.

Leimer, Dean and Lesnoy, Selig, "Social Security and Private Saving: New Time-Series Evidence," Journal of Political Economy, June 1982, Vol.90, pp.606-29.

Lesnoy, Selig and Leimer, Dean, "Social Seculity and Private Savings: Theory and Historical Evidence," Social Security Bulletin, January 1985, Vol.48, pp.14-30.

Mitchell, Olivia and Fields, Gary, "The Economics of Retirement Behavior," Journal of Labor Economics, January 1984, Vol.2, pp.84-105.

Modigliani, Franco, "The Life Cycle Hypothesis of Saving, the Demand for Wealth and the Supply of Capital," Social Research, Summer 1966, Vol.33, pp.160-217.

_____, "Life Cycle, Individual Thrift, and the Wealth of Nations," American Economic Review, June 1986, Vol.76, pp.297-313.

Modigliani, Franco and Sterling, Arlie, "Determination of Private Saving with Special Reference to the Role of Social Security - Cross-country Tests," In The Determinants of National Saving and Wealth, Eds.: Franco Modigliani and Richard Hemming, New York, St.Martin, 1983, pp.24-55.

Munnell, Alicia, "The Impact of Social Security on Personal Saving," National Tax Journal, December 1974, Vol.27, pp.553-67.

_____, The Future of Social Security, Washington, D.C., The Brookings Institution, 1977.

Noguchi, Yukio, "Problems of Public Pensions in Japan," Hitotsubashi Journal of Economics, June 1983, Vol.24, pp.43-68.

_____, "Tax Structure and Saving-Investment Balance," Hitotsubashi Journal of Economics, June 1985, Vol.26, pp.45-58.

Okazaki, Youichi, "Jinko Koreika to Rodo Mondai," (in Japanese), Nippon Rodo Kyokai Zashi, March/April 1983, Vol.288, pp.2-11.

Osaka, Masako, "How Japanese Firms Cope with Effects of an Aging Laboe Force on Industrial Productivity," Aging and Working, November 1982, Vol.5, pp.23-30.

Pellechio, Anthony, "Social Security Financing and Retirement Behavior," American Economic Review, May 1979, Vol.69, pp.284-7.

Shapiro, David and Shaw, Lois, "Growth in Labor Force Attachment of Married Women: Accounting for Changes in the 1970s," Southern Economic Journal, October 1983, Vol.50, pp.461-73.

Shinohara, Miyohei, "The Determination Post-War Saving Behaviour in Japan," In The Determinants of National Saving and Wealth, Eds.: Franco Modigliani and Richard Hemming, New York, St.Martin, 1983, pp.201-18.

Takayama, Noriyuki, "Japan," In The World Crisis in Social Security, Ed.: Jean-Jacques Rosa, Paris, Fondation National d'Economie Politique, 1982, pp.71-91.

Takayanagi, Hiroshi, Shakai Hosho Nenkan 1983 Nenban, Tokyo, Toyo Keizai Shinposha, 1983.

Thompson, Lawrence, "The Social Security Reform Debate," Journal of Economic Literature, December 1983, Vol.21, pp.1425-67.

Williamson, Samuel and Jones, Warren, "Computing the Impact of Social Security Using the Life Cycle Consumption Function," American Economic Review, December 1983, Vol.73, pp.1036-52.

Yamagoshi, Toku and Kimura, Fumikatsu, "Nenrei Betsu Rodoryoku to Rodo Shijo," (in Japanese), Nippon Rodo Kyokai Zashi, January 1983, Vol.286, pp.36-51.