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The impact of social security on income, poverty, and health of the elderly in Japan

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The impact of social security on income, poverty, and health of the elderly in Japan[*]

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Abstract

We investigate the impact of social security benefits on the income, poverty, and health of the elderly in Japan during the past two decades, based on cross-sectional data from Surveys on Income Redistribution. We find that social security programs have significantly improved the well-being of the elderly, at least in terms of household income, as well as relative and absolute poverty rates. However, our empirical results suggest that social security benefits are not fully translated into disposable income of the elderly, and that additional sources of variations—gender and sector (public pension group)—significantly affect the evolution of elderly income and poverty.

Key words

social security benefits, health-care benefits, elderly well-being

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1. Introduction

Population aging puts substantial pressures on social security programs in Japan. The latest projections released by the National Institute of Population and Social Security Research in 2002 report that the share of those aged 60 years and above is expected to rise from 17.4 percent in 2000 to 28.0 percent in 2025 and 33.1 percent in 2050. At the same time, the total fertility rate is projected to recover only to 1.39 by 2050 from 1.29 in 2003. These projections have raised uncertainty about the financial sustainability of the current social security programs, which depend heavily on contributions by future generations.

The projected demographic changes will surely motivate Japan to carry out fundamental reforms of the social security system. Indeed, the Japanese government launched the 2004 Pension Reform, which aimed to establish an upper ceiling on the payroll contribution rate of 18.3 percent, a 5-percentage point increase from the current level, and hold down total pension benefits within total contributions and government subsidies in the long-run. Unlike previous ones, the latest reform introduced macroeconomic indexation to automatically adjust benefits in response to demographic and macroeconomic changes.

While it is desirable to raise the financial sustainability of social security schemes, the impact of policy changes on the well-being of the elderly should be of serious concern. In fact, according to the Basic Survey of the National Life, public pension benefits accounted for nearly 70 percent of the total income of the elderly in 2002. This implies that any change in social security benefits could have substantial effects on their standard of living. Indeed, many studies, including those of Yashiro and Oshio (1999) and Oshio and Oishi (2003), reveal that social security benefits might significantly affect the economic behavior of the elderly.

Moreover, there have been warning signals recently of widening income inequalities among the elderly, as stressed by Yamada and Casey (2002). To be sure, income transfers from the young to the elderly, via public pension and other social security schemes, contribute to a reduction in income inequalities among the elderly by raising their mean income. The earnings-related component of public pension benefits, however, is likely to keep the income inequality basically intact from young to old age groups. Also, substantial differences in pension benefits between employed and self-employed workers lead to a gap in the household income of the elderly. Moreover, lower progressivity of income taxes for the elderly, due to various tax and income deductions, appears to fail to sufficiently redistribute income among the elderly. Given an increasing share of the elderly of the total population due to population-aging, Japan is likely to move toward a more unequal society.

In this paper, we aim to empirically investigate the relationship between social security benefits and well-being outcome—in particular, income, poverty, and health status—of the elderly in Japan, based on cross-sectional data from Surveys on Income Redistribution, which are compiled by the Ministry of Health, Labour and Welfare. The data cover the period from 1980 to 1998, during which there were some major pension reforms—most notably the 1986 Pension Reform, which basically established the current scheme—as well as substantial changes in macroeconomic performance (the *bubble* expansion in the late 1980s and the subsequent long recession throughout the 1990s). We focus on variations across birth cohorts as well as within the same cohort in social security entitlements over the past two decades. More specifically, we examine income, relative and absolute poverty, and health status of the elderly, along with the evolution of social security generosity, and assess how social security programs have affected these measures.

The remainder of the paper is constructed as follows. First, section II briefly presents the institutional background of the social security programs for the elderly in Japan. Section III describes our data source. Section IV discusses our empirical methodology for identifying the impact of the social security program on income, poverty, and health across cohorts and within the same cohort. Section V presents a descriptive analysis of the long-term trends of well-being variables of the elderly, and compares them to those of the young. Section VI summarizes regression results on the relationship between social security benefits and well-being outcome of the elderly. Finally, Section VII concludes with the policy implications of our empirical findings and topics for future research.

II. Institutional background

In this paper, we concentrate on the Japanese public pension scheme, which consists of three components. The first is the National Pension Insurance (NPI: *Kokumin Nenkin*) for self-employed workers, farmers, and other non-employed workers. The second is the Employees' Pension Insurance (EPI: *Kosei Nenkin*) for employed workers in the private sector. And, the third is the Mutual Aid Insurance (MAI: *Kyosai Nenkin*) for employed workers in the public sector. The NPI has only a flat benefit, while the EPI and MAI have both flat and earnings-related benefits. Since the 1986 Pension Reform, all beneficiaries in these three programs have received a common, flat-rate benefit, which is called the Basic Pension benefit. Accordingly, the flat components of EPI and MAI, as well as the NPI benefits, are all the same under the current scheme.

For the NPI, the eligibility age for the full benefits is 65. More than one-fourth of the insured, however, start to receive actuarially reduced benefits between the ages of 60 and 64 years, probably because the average household income of self-employed workers is relatively low in general. An actuarial addition to the benefits is also available for those who are aged between 65 and 70 years, but few apply for it. Under the current program, eligibility to receive NPI benefits requires a minimum of 25 years of contributions, and eligibility to receive full benefits (currently 66,000 yen) requires 40 years of contributions. The benefits are price-indexed to reflect changes in the CPI in the previous calendar year.

The EPI is the main body of the Japanese public pension programs. The benefits consist of a flat component (Basic Pension benefits) as the first tier and an earnings-related component as the second tier. In principle, the eligibility age for the flat component was 65, but there had been a special legal provision allowing employees to receive full benefits from age 60. Since 2001, however, its eligibility age has been raised by one year for every three years, and it will eventually be raised to 65 in 2013.

The earning-related component of the EPI benefits is calculated by multiplying the career average monthly income (CAMI) by a certain accrual rate, which depends on the birth year. The CAMI is calculated over a worker's entire period of coverage, adjusted by increases in average wage rate. The eligibility age for earnings-related benefits is currently 60. Both flat and earnings-related benefits are CPI-indexed. Upon reaching age 60, an individual who has not fully retired is entitled to receive reduced pension benefits with an earnings test under the *Zaishoku* pension program. In addition, non-working dependent wives of EPI beneficiaries are eligible to receive Basic Pension benefits without any contributions. Therefore, an elderly couple whose husband is an EPI beneficiary can receive earning-related benefits (of the husband) and two flat components (of both the husband and his wife).

The EPI contributions, which are paid equally by employee and employer, had been based on monthly earnings. Contributions began to be deducted from semi-annual bonuses in 1995, and the contribution base was shifted completely from monthly earnings to annual earnings including bonuses in 2003.

We focus on the NPI and EPI programs in our empirical analysis, and treat MAI pensioners as if they were EPI members, because the benefits structure is almost the same under these programs, and because our survey data do not distinguish between two types of pension for retired employees. In addition to these public pension programs, there are medical and long-term care programs for the elderly. Medical care schemes for the elderly, excluding an individual's own payments, which cover 10 percent of the total cost, are financed 30 percent by subsidies from the central and local governments and 70 percent by transfers from medical care insurance programs for the workers[1].

Our strategy is to use the impacts of institutional changes to the NPI and EPI programs over time on the income, poverty, and health of the elderly. The government has conducting a major pension reform about every five years over the past couple of decades, and the underlying policy direction until recent reforms has been to raise benefits levels in line with the underling growth of per-capita labor income. In the case of the EPI, the government has explicitly or implicitly aimed to keep the replacement rate, which is the ratio of average benefits to average wage income of current workers, at around 60 percent. The government also has kept raising flat NPL benefits in line with the nationwide trend of average consumption expenditure.

In turn, increasing benefits have required a steady rise in contributions: the EPI contribution rate rose from 10.6 percent in 1980 to 17.35 percent in 1996 on a monthly earnings (excluding bonuses) basis, and the NPI flat-rate contribution per month rose from 3,770 yen in 1980 to 13,300 yen in 1998. Also, the 1986 Pension Reform called for an increase in the eligibility age of the EPI earnings-related benefits for female employees from the previous 55 to 60 by 2000.

III. Data sources

1. Survey on Income Redistribution

[1] Long-term care insurance, introduced in April 2000, aims to provide those aged 65 years and above with nursing care. The benefits are financed by contributions from the young (40-64 years old) on top of the medical care contributions, flat-rate contributions from the elderly (60 and over), and subsidies from the central and local governments. Our analysis does not assess the impact of the medical care program on the well-being of the elderly, or long-term care, which is too new to be reflected in our survey data, which cover the period 1980-1998.

Our analysis is based mostly on cross-sectional data from the Survey on Income Redistribution (SIR), compiled by the MHLW every three years. Unlike other household surveys, this survey primarily aims at measuring income distribution and the effects of redistribution policies. We use micro-data from seven SIRs released in 1981, 1984, 1987, 1990, 1993, 1996, and 1999, whose income data come from the previous year. The sample sizes range between 7,165 (in 1984) and 8,856 (in 1990). This survey provides rich variables of household income and social security measures including public pensions, medical care, and family allowances.

Moreover, we adjust the original data as follows. First, we express all data in real 2001 yen using a series of the overall Consumer Price Index (released by the Statistics Bureau). Second, we scale all income and social security measures by an equivalence scale to account for household size: counting the first adult as one, each subsequent adult as 0.7, and each child younger than 15 years as 0.5. The old SIRs (1981 and 1984 surveys), however, do not report the ages of family members other than the household head, so we count any other family members as 0.7 in the 1981 and 1983 surveys. Third, we choose age 60 as the threshold age, because an individual can claim at least partial NPI or EPI benefits, and also because most employees retire from their primary jobs even if they enter the secondary job market.

Another issue in the empirical analysis is the relevant unit: whether a household (which means all individuals sharing the same living quarters) or a family (which means an elderly person, his/her spouse, and any dependent children). We use the household as the unit in this paper, mainly because the household is the primary unit reported in the SIR. However, the possibility cannot be ruled out that the estimation results are sensitive to the choice of household or family unit. In fact, Ohtake (1991) and Iwamoto and Fukui (2002) report that the higher the parents' income is, the more they are likely to live separately with their parents. If that is the case, a reduction in social security benefits could reduce the proportion of the elderly who live independently, with the negative impacts on their standard of living underestimated.

2. Income, poverty, and health

We construct two types of household size-adjusted income data: after-tax total household income and social security benefits. Total household income is defined as the sum of salaries, self-employed income, farm income, dividends, interests, rents, and private transfer receipts plus in-cash benefits such as public pension, unemployment benefits, and family allowances minus family taxes paid. In-kind benefits such as medical care are excluded, and taxes are the sum of income/property taxes and social security contributions (not including consumption tax and other indirect taxes). Social security benefits include all public pension benefits—NPI, EPI, and MAI benefits—and are expressed in pre-tax terms. Social security benefits other than public pension benefits—such as unemployment benefits and family allowances—are excluded from social security benefits in this paper (but they are included in total household income)[2].

We also construct measures of relative and absolute income poverty. We set a poverty line at 40 percent of the median non-elderly household income for each year, and define *relative* income poverty as the share of the elderly with income below this poverty line for each age group[3]. We also set a poverty line at 40 percent of median non-elderly household income in a base year (1980) upwardly adjusted for CPI inflation between the base and current years. And, we define *absolute* income poverty as the share of the elderly with income below this poverty line for each age group. Relative and absolute poverty rates can help us to examine how social security improves the living standards of households with relatively low incomes, and reduces income inequality among the elderly.

The impact of social security on the elderly's health is also of interest. The SIR does not contain self-reported health status, but instead reports medical care benefits that are imputed

[2] The correlation coefficient between public pension benefits and public pension plus other benefits is 0.974 in our whole dataset, suggesting that other benefits have no significant impact on the overall estimation results.

[3] The OECD and European Union use an official poverty line equal to 50 percent and 60 percent of the median income. In this paper, we set the poverty line for the elderly equal to 40 percent of the median non-elderly household income, considering that the median income is somewhat lower among the elderly than younger people.

from reported answers about health care receipts and hospitalization. We tentatively interpret higher medical care benefits as an indicator of poorer health status of the respondent. However, we have to bear in mind that medical care benefits reflect the generosity of medical care policy as well as medical care costs, which are affected by technological progress, and that demand for health care depends heavily on household income.

IV. Methodology

1. Basic empirical strategy

In this section we explain the empirical strategy for gauging the extent to which social security benefits, or their statutory changes, affect income, poverty, and health of the elderly. The strategy we apply here is basically in line with what the NBER International Social Security Project proposes for analyzing the impact of social security on elderly well-being (for example, see Engelhardt and Gruber (2005) as a case study for the United States).

First, we collapse all of the micro-data on income, poverty and health—except for relative and absolute poverty, which we calculate using original micro-data—and benefits into age-by-year cells, taking their mean values in each cell. The conventional way of assessing the impact of social security on income, poverty, and health might be to regress those measures on actual benefits, which are answered by the respondents in the survey (controlling for year, age, and other factors). This methodology is not free from simultaneous estimation bias, however, in addition to reporting errors in the survey-based data, observed outcome (total household income, poverty, etc.) and observed benefits are most likely determined by the same factors. We want to focus solely on variations in benefits that arise from institutional changes and are exogenous to the outcomes.

To avoid this bias, we construct simulated benefits that are exogenous to the outcomes.

Ideally, we would take the same person, put him/her in every single cohort, and then compute his/her benefits to make any benefits variations observed over time or across cohorts entirely due to statutory changes in social security programs. In reality, however, there are two types of factor that may actually differ across cohorts and affect benefits. The first type comprises factors that are largely exogenous to social security programs, but are potentially important determinants of income, poverty, and health. Earnings profiles are the most important example of this type. The second type comprises factors that are likely to be endogenous to social security programs. Ages of persons initially claiming social security benefits belong to this type. To assess the impact of social security programs on the well-being of the elderly, we should hold the first type of factor constant. An open question, however, is whether we should hold the second type constant, because those factors are part of the effect caused by legal changes.

Thus, we take three approaches to assess the robustness of any estimation results. First, we regress income, poverty, and health on the actual reported social security benefits. Then, the regression equation is expressed as

$$W_{at} = \alpha B_{at}^{A} + \sum_{a} \beta_{1a} AGE_{a} + \sum_{t} \beta_{2t} YEAR_{t} + u_{at},$$

where a and t index single year of age and calendar year, respectively, and W denotes the cell mean of income, poverty, or health outcome, B^A is the cell mean of actual reported social security benefits, AGE and $YEAR$ are age and year dummies, respectively, and u is an error term.

In the second approach, we base the flow of benefits amount on a given earnings history of a certain cohort to hold the first type of factor constant, but to allow the second type of factor to vary. We refer to it as a mixed simulation approach in this sense. Specifically, we use partially simulated benefits, B^{PS}, instead of actual reported benefits, B^{A}, in the above equation. Partially simulated benefits here incorporate the cohort-specific actual claiming ages by calculating the benefits for each retirement age and then weighting claiming-age-specific benefits by the distribution of claiming ages for that cohort.

Take the cohort born in year c (that is, aged a in year $c+a$) as an example, and call this cohort c. Let Pr (R_{ac}) be the probability that cohort c initially claims social security benefits at age a (in year $c+a$), and denote the earnings profile of the base cohort as $\bar{y}$. In addition, assume that cohort c has the earnings profile $\bar{y}$ (same as base cohort), and denote the benefits this cohort can initially claim at age k as B_{kc} ($\bar{y}$). Then, the expected benefits cohort c receives at age a, which is denoted by B_{ac}^{PS} , is expressed as

$$B_{ac}^{PS} = \sum_{k=a_0}^{a} \Pr\left(R_{kc}\right) B_{kc}\left(\bar{y}\right),$$

where we assume that the cohort keeps receiving the same amount of benefits from the initial claim[4] and denote the first age at which the cohort can claim benefits as a_0. Because cohort c is aged a in year $c+a$, B_{ac}^{PS} can be easily put into an age-by-year cell and used as an explanatory variable instead of B_{ac}^{A} .

Thirdly, we consider a pure simulation approach, in which we hold both the first and second types constant, because the timing of retirement and income, poverty and health of the elderly are correlated. We use the earnings profile of the base cohort in the same way as the case of a mixed simulation approach, but we use the retirement patterns of the base cohort when weighting the initially claimed benefits. That is, fully-simulated benefits, B_{ac}^{FS} , are given by

$$B_{ac}^{FS} = \sum_{k=a_0}^{a} \Pr(\bar{R}_k) B_{kc}(\bar{y}),$$

where $\Pr\left(\bar{R}_k\right)$ is the probability that the base cohort initially claims benefits at age k.

In sum, we estimate three regression equations:

$$\left.\begin{aligned} W_{at} &= \alpha B_{at}^{A} + \sum_{a} \beta_{1a} AGE_a + \sum_{t} \beta_{2t} YEAR_t + u_{at}, \\ W_{at} &= \alpha B_{at}^{PS} + \sum_{a} \beta_{1a} AGE_a + \sum_{t} \beta_{2t} YEAR_t + u_{at}, \\ W_{at} &= \alpha B_{at}^{FS} + \sum_{a} \beta_{1a} AGE_a + \sum_{t} \beta_{2t} YEAR_t + u_{at}. \end{aligned}\right\} (*)$$

We hereafter refer to this type of model as Model I, with which we aim to identify the impact of social security programs on income, poverty, and health from variations across cohorts by

[4] In practice, we have to consider the price indexation: the benefits are adjusted by CPI inflation from the age of the initial claim.

controlling age and year effects.

2. Calculating simulated benefits

To apply the basic empirical strategy described above to Japanese data, we have to consider two additional issues. The first is which cohort we should choose as the base cohort for simulations. While the actual cohort we use is not critical for simulations, we choose the 1926 cohort, which was aged 54 in 1980 (the first survey year) and aged 72 in 1998 (the last survey year). This cohort appears as the elderly during almost the entire period under study, and it faced the 1986 Pension Reform at the EPI eligibility age of 60. In addition to this base cohort, we focus on cohorts born from 1906 to 1943 for the descriptive analysis of time-series trends. For the regression analysis, we limit the samples to cohorts born from 1911 to 1943, considering the limited sample size of the year-by-age cell for the old and young cohort.

The second issue is how to construct the simulated benefits, which are the core of the regression analysis. The simulated benefits are constructed mainly from two factors: the first is the probability of retirement at each age for each cohort, and the second is the benefits to be claimed. The Annual Report of the Social Insurance Agency is the key data source for both factors. The Report shows the number of those who initially claimed benefits at different ages in each year for both EPI and NPI. In the case of EPI, the initial claim for benefits starts at age 55 and ends almost completely by age 74. By dividing the number of those who claim benefits at each age by the cumulative number of those up to age 74, we get the retirement pattern for each cohort (ignoring the mortality rate for simplicity). We apply the same method to the case of NPI, in which the age of the initial claim is limited to between 60 and 70[5]. Using these observed rates, we form a cohort-, gender-, and sector-specific set of probabilities for retirement that sum to one. Not surprisingly, the probability of retirement peaks at age 60 for EPI and 65 for NPI, both of

[5] In the case of the NPI, eligibility to claim the benefits is not equivalent to retirement, because the NPI members are self-employed workers, farmers, and other non-employed workers.

which are the normal eligibility ages for public pension programs. For example, 44.3 percent of male EPI members retired at age 60, and 62.3 percent of male NPI members retired at age 65 in the 1926 cohort.

The next task is to estimate benefits received by a synthetic person who has the same earnings history as the 1926 cohort, based only on legislative variations in the structure of benefits. In the case of EPI, a plausible method is to construct a mean earnings history for the 1926 cohort and calculate the benefits based on it with the benefits formula. Due to a lack of individual histories of wage earnings, however, we cannot directly apply this method. Instead, we use the following approach, which is indirect but is probably the most plausible approach given the limited information available from published data:

(1) First, we collect the mean value of initially claimed EPI benefits at each age from each year's Annual Report of the Social Insurance Agency. This reflects both the benefits formula that was effective in each year and the mean earnings histories of new beneficiaries.

(2) Second, we get the mean value of career average monthly income (CAMI) of EPI beneficiaries who initially claim benefits from the Annual Report. It is reasonable to assume that the mean CAMI reflects the mean earnings histories of the initial beneficiaries. Unfortunately, the Report only gives the average value of the CAMI across initially claiming ages in each year. We assume for simplicity that the reported mean CAMI roughly corresponds to the mean earnings history of the cohort that was aged 60 in the survey year, because the timing of initially claimed benefits is heavily concentrated on that age in the EPI.[6]

(3) Third, for each cohort, we calculate the ratio of initially claimed benefits at each age to the average CAMI (obtained in (2)), and interpret a set of these ratios as the EPI benefits law

[6] For example, if the average CAMI was 400,000 yen across ages of initial benefits claimed in 1990, we interpret this amount as the average CAMI for the 1930 cohort, which was aged 60 in that year. Of course, the CAMI differs at a different age of initial benefits claim even for the same cohort. But, we ignore it for simplicity and because of limited information about wage profiles.

applied to that cohort.[7]

(4) Finally, we put the 1926 cohort in each single cohort and compute its simulated benefits at each age by multiplying the average CAMI of the 1926 cohort by the benefits/CAMI ratio of each single cohort. We can roughly interpret this procedure as applying the EPI benefits law, which was actually applied to each cohort to the 1926 cohort.

In the case of the NPI, we can apply a simpler methodology, because the NPI benefits are flat and not related to earnings history. Hence, when we put the 1926 cohort in each single cohort, we roughly assume that that cohort would get the actual benefits (in 2001 price) reported by each single cohort. We believe that this is the most reliable method given the limited information available from the Annual Report, even though it ignores differences in the period of contributions across cohorts.

3. Additional sources of variations

Our basic equations (*) for Model I aim to identify the impact of social security programs on income, poverty, and health solely from variations across cohorts, by controlling for both age and year effects. This age-year cell approach, however, is likely to fail to exploit of important variations in benefits across groups within age-year cells. These within age-year cell variations can help identify the effects of benefits changes, and there are at least two candidates for the sources of variations: that is, sector and gender.

As discussed in the previous sections, benefits laws and retirement patterns differ for EPI/MAI and NPI beneficiaries. An EPI/MAI beneficiary used to be an employed worker, whereas an NPI beneficiary used to be a self-employed worker in most cases. Because the SIR

[7] For example, assume that we find that the average CAMI was 375,000 yen in 1990 and that the average benefits initially claimed was 187,500 yen at 60 in 1990 and 191,250 yen at 61 in 1991 (in 2001 price). Then, we assume that the average CAMI for the 1930 cohort was 375,000 yen (as explained in (2)), and we take 0.5 (=187,500/375,000) and 0.51 (=191,250/375,000) as the ratios to convert the CAMI to the benefits at age 60 and age 61, respectively, applied to the 1930 cohort by the EPI benefits law which was effective at that time.

asks the elderly about type of public pension benefit, we can identify the sector to which each household head belongs. However, two things should be noted here. First, the SIR only distinguishes the beneficiaries of NPI and those of the pension programs for employees, therefore, it cannot distinguish EPI (for retired employees in the private sector) and MAI beneficiaries (for retired employees in the public sector). We treat all beneficiaries of the public pension programs for employees as EPI beneficiaries, because EPI and MAI benefits have many things in common. Second, some elderly receive both EPI and NPI benefits in the SIR dataset, and we categorize them into EPI beneficiaries for simplicity. As a result, in our empirical analysis EPI beneficiaries are those who receive any EPI benefits, whether or not they receive NPI benefits. And, NPI beneficiaries are those who receive NPI benefits only, meaning that they have no experience working as private or public sector employees[8].

Another source of variations to be considered is gender. Several factors make a difference between the benefits received by men and women. In the case of EPI, females tend to receive substantially smaller benefits than males due to a shorter period of coverage and lower wage earnings; in fact, the average benefits and CAMI was 44 percent and 45 percent lower, respectively, for women than for men in 2001. In addition, the eligibility age for female employees, which had been 55 (compared to 60 for male workers) until 1988, was gradually raised to 60 until 2001, so younger females started to receive EPI at a later age. Moreover, the share of female beneficiaries is much higher in the NPI than in the EPI (73 percent versus 31 percent in 2001), largely because of women's limited opportunities to work as full-time employees. Reflecting a long-term uptrend of women's labor participation, however, there has been a shift among female beneficiaries from NPI to EPI over the past two decades.

In what follows, we collapse all of the micro-data into age-by-year-by-sector-by-gender

[8] Strictly, it is desirable to further control whether a spouse is alive or dead, because survivors' benefits differ substantially between the NPI and EPI/MAI beneficiaries (see Yamada and Casey (2002)). This effect seems to be reflected in the crossing terms of sector and gender (see below) dummies in our estimation equations.

cells taking their mean values in each cell, and then estimate models with sector and gender variations. The age of households head ranges from 55 to 75. Table 1 reports the basic statistics for main variables. We notice first that there are substantial gaps in household income and poverty rates among gender-sector cohorts. Household income is highest for households whose head is a male EPI beneficiary, while it is the lowest for households whose head is a female NPI beneficiary. The share of households under the poverty line is highest for households whose head is a male NPI beneficiary, followed by those whose head is a female NPI beneficiary. In other words, EPI participants enjoy higher income with a lower share of the poor while NPI participants suffer from lower income with a higher portion of the poor. The gaps in social security benefits are even larger than household income levels. On the other hand, expenditures on health, which are used as a proxy for health status, have smaller variations among the cohorts.

4. Models with variations

In addition to estimating the basic models (*), we include sets of dummies to control the two variations and estimate three versions of these models.

The first model, referred to as Model II hereafter, controls just first level fixed effects using age, year, sector, and gender dummies. We estimate models in the form:

$$W_{atsg} = \alpha B_{atsg} + \sum_a \beta_{1a} AGE_a + \sum_t \beta_{2t} YEAR_t + \beta_3 SECTOR + \beta_4 GENDER + u_{atsg},$$

where income, poverty, or health outcome, *W*, and social security benefits, *B*, are collapsed into the age (a)–year (y)-sector (s)-gender (g) cells, *SECTOR* dummy takes the value of one (zero) if the cell corresponds to EPI (NPI) beneficiaries, and *GENDER* dummy takes one (zero) if the cell corresponds to female (male) elderly. We estimate this equation by putting actual benefits (B^A), partially simulated benefits (B^{PS}), and fully simulated benefits (B^{FS}) alternatively into *B*.

The second model (Model III) also controls for second level fixed effects except for the cross term of age and year dummies, so we estimate:

$$
\begin{aligned}
W_{atsg} = \alpha B_{atsg} &+ \sum\nolimits_a \beta_{1a} AGE_a + \sum\nolimits_t \beta_{2t} YEAR_t + \beta_3 SECTOR + \beta_4 GENDER \\
&+ \sum\nolimits_a \beta_{5a} AGE_a * SECTOR + \sum\nolimits_a \beta_{6a} AGE_a * GENDER \\
&+ \sum\nolimits_t \beta_{7t} YEAR_t * SECTOR + \sum\nolimits_a \beta_{8t} YEAR_t * GENDER \\
&+ \beta_9 SECTOR * GENDER + u_{atsg} .
\end{aligned}
$$

The second level fixed effects are likely to be relevant in several ways. For example, the eligibility age for full benefits differs between EPI and NPI; female employees tend to start receiving benefits earlier than male employees; and EPI eligibility age for female employees has been gradually raised in recent years.

The third model (Model IV) controls all second level fixed effects including cross terms of age and year dummies, so we estimate:

$$
\begin{aligned}
W_{atsg} = \alpha B_{atsg} &+ \sum\nolimits_a \beta_{1a} AGE_a + \sum\nolimits_t \beta_{2t} YEAR_t + \beta_3 SECTOR + \beta_4 GENDER \\
&+ \sum\nolimits_a \beta_{5a} AGE_a * SECTOR + \sum\nolimits_a \beta_{6a} AGE_a * GENDER \\
&+ \sum\nolimits_t \beta_{7t} YEAR_t * SECTOR + \sum\nolimits_t \beta_{8t} YEAR_t * GENDER \\
&+ \beta_9 SECTOR * GENDER + \sum\nolimits_a \beta_{10at} AGE_a * YEAR_t + u_{atsg} ,
\end{aligned}
$$

where there is no more pure cohort variation. It is interesting to see how the impact of social security benefits differs among the three specifications.

V. Evidence

1. Time series evidence

Figures 1-4 show the time series evolution of the well-being measures we assess in this paper; that is, household income, poverty rates, and health care spending. In each figure, we compare the data for the young and the elderly to distinguish economy-wide trends and impacts of social security benefits. Also, we index the data, setting the starting value as 100 to assess the relative performance of income, poverty, and health of the elderly. The following key facts are observed from the figures.

(1) Figure 1 shows the evolution of after-tax, equivalized household income during 1980 and 1998. Average income rose steadily until the mid-1990s for the elderly, followed by a small fall reflecting the stagnant economy. Also, the income of the elderly did not increase as much as that of the young over the 1990s. A long-term downtrend of labor force participation among the elderly[9] more than offset the impact of an increase in social security benefits, at least partly leading to the underperformance of the elderly's income growth. Moreover, growth of social security benefits have been decelerating over the past two decades as discussed later.

(2) Figures 2 and 3 show time series movements of poverty rates based on equivalized, after-tax household income. Figure 2 measures relative poverty, which is defined as the share of the elderly and young living below the 40 percent of the median income of the young in each survey year. Relative poverty shows a remarkable uptrend for both the elderly and young (except for a temporary drop in 1986).[10] The parallel movements suggest that widening inequality is attributable to some economy-wide factors, and that social security benefits fail to redistribute income among the elderly sufficiently to reduce inequality. Figure 3 indicates the evolution of absolute poverty, which is defined as the share of the elderly and young living below the 40 percent of the median income of the young in 1980. This figure reflects the combination of the results shown in Figures 1 and 2, and indicates that an uptrend of household income has more than offset the upward momentum of income inequality for both the elderly and young.

(3) Figure 4 examines the time-series evolution of average health care benefits. There is a widening gap between rising benefits for the elderly and relatively stable benefits for the

9 According to the Labor Force Survey, the labor force participation rate for those aged 60 and above declined to 32.9 percent in 1998 from 35.0 percent in 1980.

10 This is consistent with a rise in the Gini coefficient for the economy as a whole, as reported by the MHLW based on the SIRs. The Gini coefficient for (not equivalized) after-tax income rose from 0.332 in 1980 to 0.381 in 1998.

young. This is not necessarily evidence of a relative deterioration in the health status of the elderly. An increasing share of the very old (aged 70 years and above) probably adds to average health care benefits among the elderly.

2. Simulated benefits

Next, we present our simulated benefits. Figure 5 depicts partially and fully simulated social security benefits measures, along with the actual benefits in each survey year. For the simulated benefits, we first calculate values (in 2001 prices) for EPI and NPI, and males and females at each age, based on the earnings history of the 1926 cohort, and then get their weighted average in each calendar year. As can be seen from this chart, they showed a steady increase during the 1980s and leveled off thereafter. This probably reflects a slowdown in the increasing generosity of the benefits formula in EPI; in fact, along with a rise in the average period of contributions, the MHLW lowered the actuarial rate for earnings-related benefits to hold down the growth of total benefits. In addition, both types of simulated benefits have been moving almost in parallel to actual benefits, while they have been higher than the latter, probably because our base cohort is relatively young among the cohorts that appear in the survey and its higher wage profile makes the simulated benefits relatively high.

Figure 6 shows the time series evolution of the social security benefits initially claimed at ages 60, 62, and 65 by year of birth for the 1926 cohort median male earnings history[11]. The top three curves are for the EPI, while the bottom three are for the NPI. In the case of the EPI, benefits growth has been decelerating, and even turned negative for the younger generations, reflecting less generosity incorporated into recent pension reforms. In comparison, there were some small jumps in NPI benefits, which were caused by increases in flat benefits in recent pension reforms. In addition, this figure demonstrates a wide gap in benefits levels between EPI

[11] We can also present a women's version of Figure 1, which shows almost the same pattern of evolution as seen in the case of men.

and NPI, making the sector one of key sources of variations.

VI. Regression results

In this section we discuss regression results, the core of our empirical analysis. Table 2 summarizes our regression results. The 12 columns across the table are four models for each of the three types of benefits; that is, actual, partially simulated, and fully simulated benefits. We run these regressions using four different outcome variables, which appear in the row of the table. Each result reported in the table is the coefficient on the benefits in each regression. For the purpose of exposition, the parameter estimates associated with the other explanatory variables—age, year, sector, gender, and sector dummies—are not shown in the table but are available upon request.

First, the top part of the table summarizes the results of Models I-IV for income, poverty, and health. The first row, which starts with Actual benefits, focuses on actual benefits received. The first set (top-left four cells) of results is blank, because the dependent variable and benefit variables are identical. In the second and third panels, we run regressions of actual benefits on partially and fully simulated benefits. This forms an implicit first stage for transforming our simulated benefits calculation into an effect on actual benefits received. By comparing the remaining rows to this row, we can form an implicit IV calculation of the impact of each yen of social security benefits on well-being outcome variables.

Using Model I, we find that each estimated 100 yen of partially simulated benefits leads to 36.5 yen more of actual social security benefits. This result is very close to that in the case of fully simulated benefits (37.0 yen). However, Models II-IV, which control both gender and sector, fail to report plausible or consistent results: Model II shows a very small impact of simulated benefits on actual ones, and Models III and IV imply that simulated benefits *reduce* actual benefits.

These results suggest that the specifications of Models II-IV are incorrect, meaning that the estimated impacts of simulated benefits on well-being outcomes in the models are irrelevant. A key plausible reason is that there is some multicolinearity between benefits and sector dummies as well as between benefits and gender dummies. In fact, the EPI has both flat and earning-related components, whereas the NPI has only the flat component, making the levels of the two benefits quite different. Also, gender appears to significantly affect the level of benefits, because female retirees receive much less benefits on average than males as discussed above. Therefore, we additionally estimate alternative versions for Models III-IV, by including only one of the gender and sector dummies, and we get significant coefficients for actual benefits with all models when we include gender dummies only[12]. We denote these modified models as Models II'-IV', and report their regression results at the bottom of the table (with the results of Models I replicated from the top for comparison)[13]. As can be seen, the impact of simulated benefits on actual benefits is 0.427-0.477, which is somewhat larger than in the case of Model I. In what follows, we focus our discussions on the bottom part of the table, which shows the results using Models II'-IV' as well as Model I.

We first assess the impact of simulated benefits on total household income, looking at the row that starts with Total household income. We find significant and positive effects on household income in all models, and also values in a relatively narrow range. This confirms that the development of benefits generosity actually led to increased disposable income for the retired population. We should note, however, that 100 yen of extra benefits adds to household income by only 20-30 yen. To correctly assess this coefficient, we have to normalize it by the effects of simulated benefits on actual benefits, which are reported in the first row. By

[12] We fail to get significant and positive coefficients when we include sector dummies only. Results are available upon request. This result indicates a strong relationship between the benefit and sector, as implied in Figure 6.

[13] We do not report the coefficients on the gender dummy (female=1) to save space, but we find that they are consistently negative and significant.

calculating the ratio between these two effects, we find that 47-80 percent of social security benefits is translated into total income.

Two interpretations of this result are possible. First is that the social security benefits partly offset an increase in income of other sources. This crowding-out effect is consistent with the results of preceding empirical studies, including Yashiro and Oshio (1999), Oshio and Oishi (2003), which show a negative impact of the social security benefits on the incentives of the elderly to work. Second is that higher social security benefits have some negative impact on household-size-adjusted income through residential decisions. As implied by Ohtake (1991) and Iwamoto and Fukui (2002), higher social security benefits are more likely to make the elderly live separately with their adult children. This co-residence effect appears at least to partly offset the direct impact of the social security benefits on the disposable income of the elderly.

Next, we examine the impact on poverty rates. We find that social security benefits lower both relative and absolute poverty rates of the elderly in all models. Our estimates suggest that each 10,000 yen of simulated benefits leads to a decline in the elderly poverty rate of 0.09-0.12%. Normalizing by the relationship between simulated and actual benefits (that is, implicitly computing IV estimates) suggests that each 10,000 yen of benefits led to a 0.19-0.35 percent reduction in the poverty rate. During 1980 and 1998, benefits rose by about 390,000 yen, which is expected to have led to about a 10-13 percentage-point decline in relative poverty and a 7-10 percentage-point decline in absolute poverty. Over this time period, however, absolute income poverty rate only slightly declined from 10.9 percent to 10.5 percent (or 0.4 percentage points) for the elderly, while relative income poverty rate *rose* from 10.9 percent to 19.4 percent (or 8.5 percentage points). These results implies that there are some inequality-widening factors that offset a reduction in inequality caused by an increase in social security benefits, underscoring the above-mentioned view that there is no effective redistribution measures among the elderly in Japan.

Finally, we explore the impact on the health care benefits, which we take as a proxy of health status due to limited information from the SIR. Unfortunately, we find little consistent pattern of the social security benefits on the health care benefits. This implies that the health care benefits cannot tell precisely about health status of the elderly, since the health care benefits depends heavily on health care policies as well as demographic factors. Moreover, the social security benefits have two opposing effects on health care benefits; on the one hand, higher benefits may improve the elderly's health status and thus reduce their dependence on health care, and on the other hand, the income effect may raise their spending on it.

In addition to these regressions, we estimate explicit IV models, for which we regress the outcome variables (total household income and others) on actual social security benefits that are instrumented by simulated benefits. These IV estimations make it possible to understand the parameter estimates more straightforward and also provide a standard error for the estimated effect of benefits on income and other outcome variables. Table 3 presents the estimated coefficients on actual benefits, which are instrumented by simulated benefits, in each specification. The results in this table confirm that implicit IV discussions presented above are relevant. For example, in the case of total household income regressions with only gender controlled in Models II-IV (see the bottom part of the table), the estimated coefficients on instrumented actual benefits are in a range between 0.47 and 0.80, and also they are all quite significant. The table also confirms that benefits significantly reduce poverty rates, but not health care benefits.

VII. Conclusion

We have investigated the impacts of social security benefits on the income, poverty, and health of the elderly in Japan during the past two decades, based on cross-sectional data from

Surveys on Income Redistribution. We confirm that social security programs have significantly improved the well-being of the elderly, at least in terms of household income and poverty. However, four things should be noted when interpreting the estimation results.

First, the social security benefits are not fully translated into disposable income for the elderly. Accordingly, the income growth of the elderly has been lower than that of the young despite a long-term increase in benefits. Although we do not precisely understand the reason, we cannot rule out the case that the social security benefits crowd out other income, or that they reduce the incentive of the elderly to live with their adult children, both partly offsetting the direct impact of benefits on the disposable income of the elderly.

Second, our empirical results imply that additional sources of variation—gender and sector (public pension group)—significantly affect the evolution of income, poverty, and health of the elderly. The female elderly as well as the beneficiaries of the National Pension Insurance program face significantly lower income and high poverty rates than other groups. We thus have to explicitly take into account these sources of variations to precisely identify the effects of benefits changes.

Third, the impact of social security benefits probably differs between different income groups. Our empirical analysis focuses on the median earner, but it makes more sense to use simulations and regressions for different points in the income distribution. The impact of benefits on income, poverty, and health could be stronger for the low-income group than the high-income one.

Fourth, to assess the impact of social security on the well-being of the elderly more precisely, we need more evidence of the effects on well-being measures—consumption, consumption poverty, health status, and subjective assessment of happiness—which are not available in our dataset. Our tentative results regarding the impact on health-care spending, even if not an approximate proxy of health status, imply that the impact of social security programs is so complicated that it should be analyzed from as many viewpoints as possible.

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Table 1: Basic statistics of main variables

		Male NPI	Male EPI	Female NPI	Female EPI
Total Household Income (yen)	mean	2,142,782	2,579,644	1,677,275	2,052,416
	s.d.	603,768	712,350	593,960	972,265
Absolute income poverty (%)	mean	6.4	1.5	3.2	0.6
	s.d.	3.0	1.5	2.0	0.8
Relative income poverty (%)	mean	9.4	2.7	4.6	1.2
	s.d.	4.5	2.7	2.9	1.3
Actual social security benefits (yen)	mean	247,195	1,039,918	404,916	1,094,961
	s.d.	189,121	296,666	238,081	391,398
Partially-simulatied social security benefits (yen)	mean	236,682	1,751,298	214,842	896,636
	s.d.	189,255	1,069,784	163,433	481,315
Fully-simulatied social security benefits (yen)	mean	251,487	1,735,268	227,709	885,862
	s.d.	218,350	1,087,117	189,452	511,830
Health care benefits (yen)	mean	265,275	324,304	308,029	331,498
	s.d.	172,481	195,056	268,606	319,849

Figure 1: After-tax household income

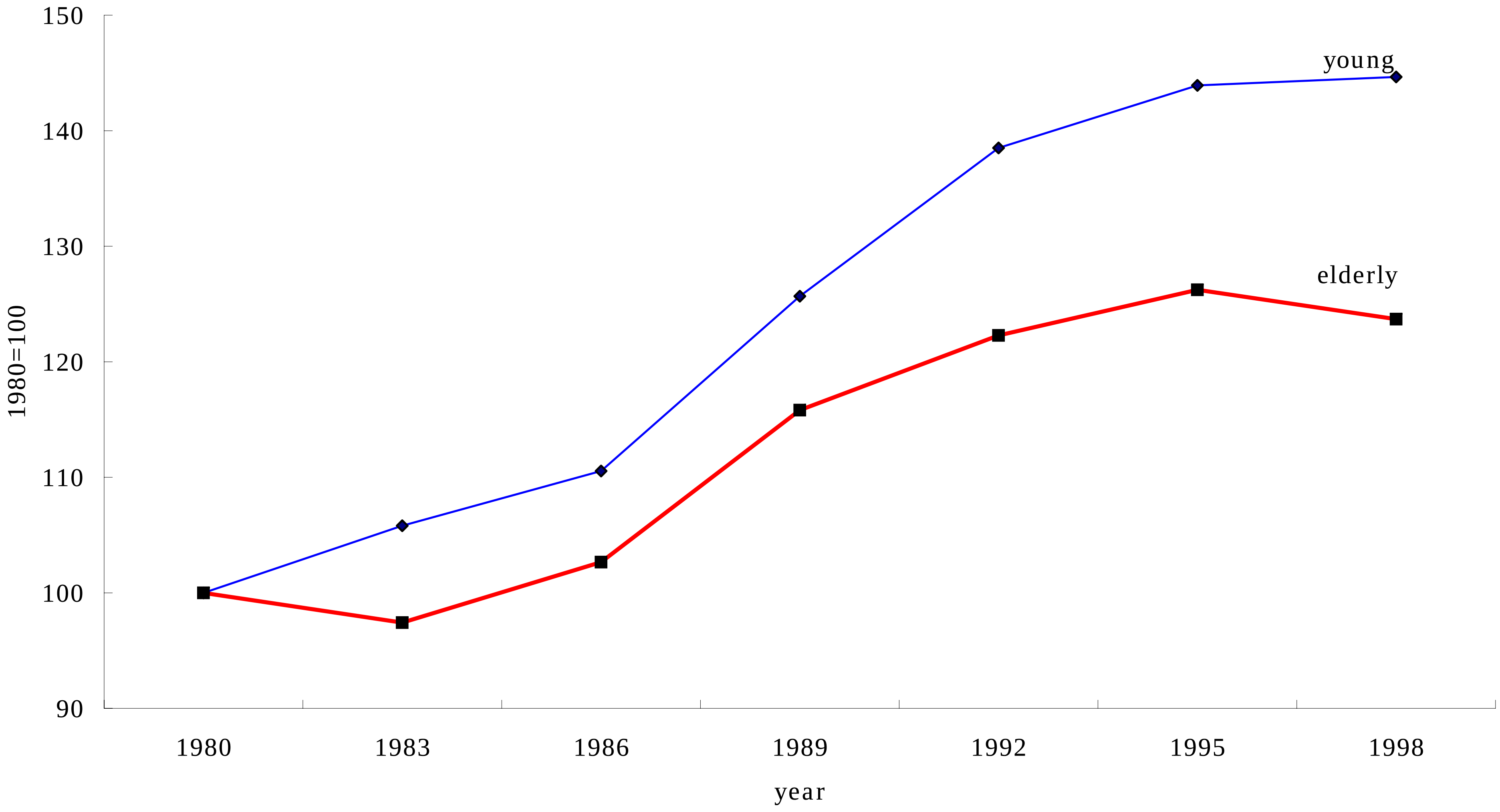

Figure 2: Relative income poverty

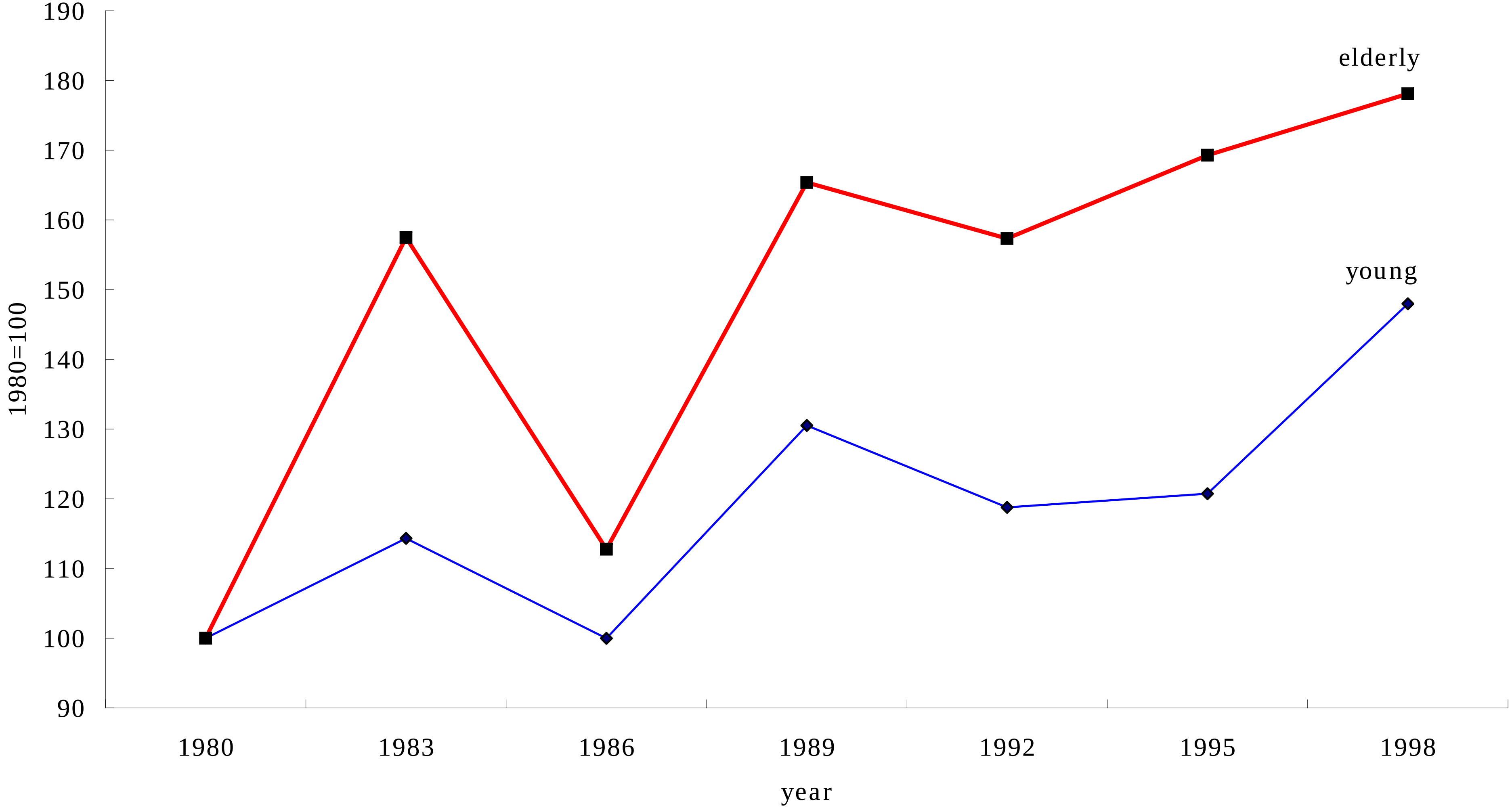

Figure 3: Absolute income poverty

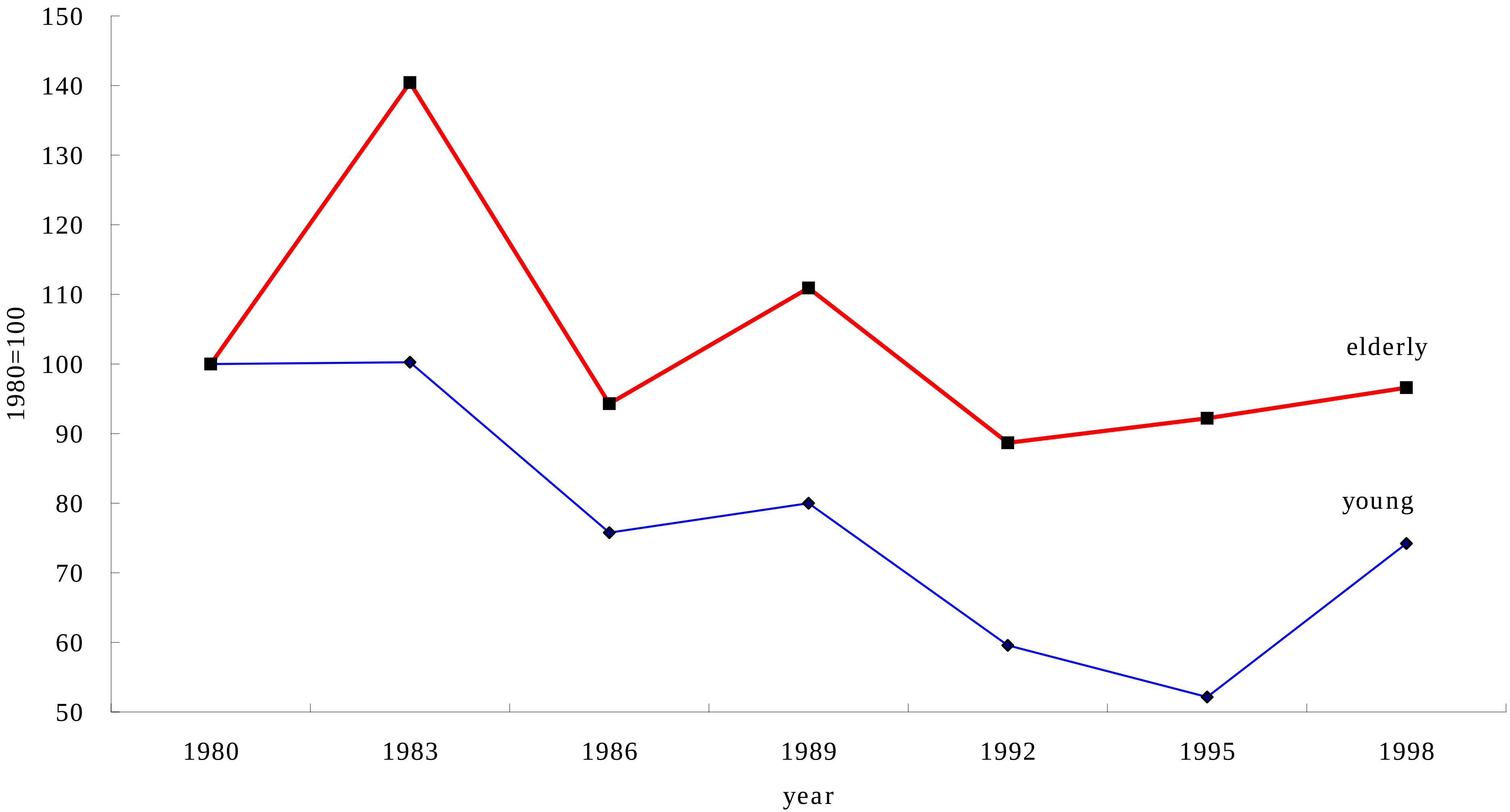

Figure 4: Health care benefits

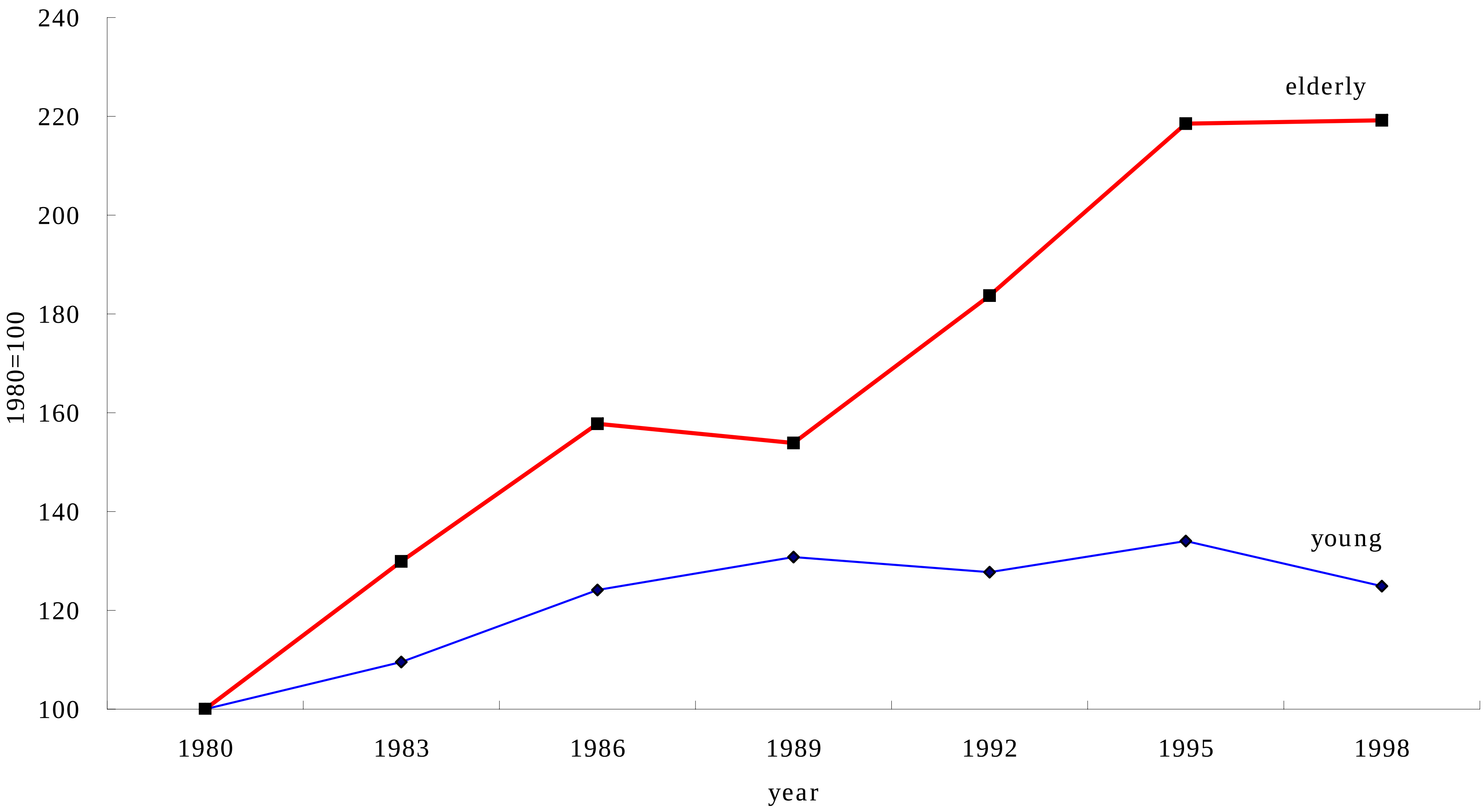

Figure 5: Average actual and simulated social security benefits

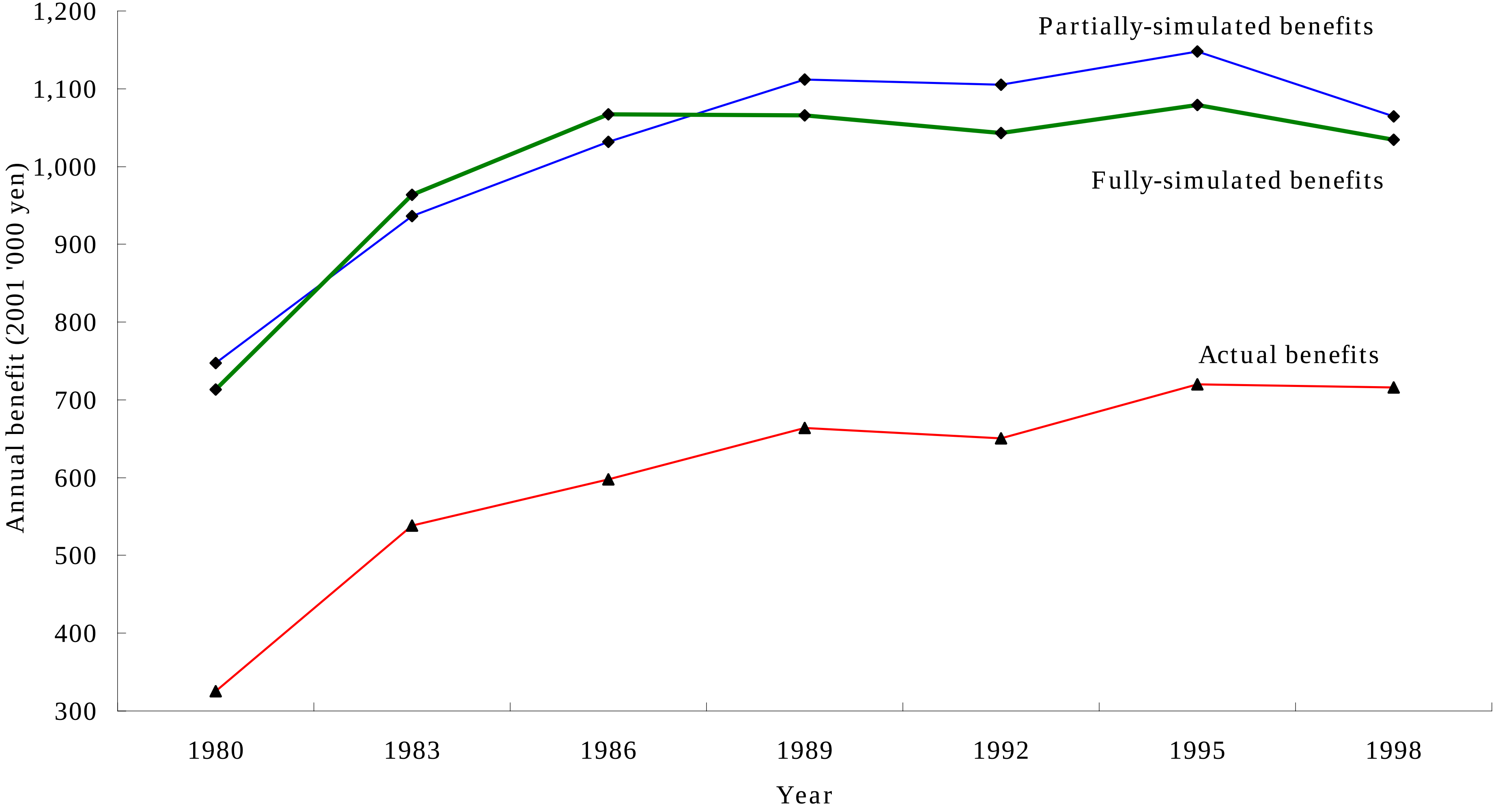

Figure 6: Average social security benefits initially claimed at different ages by year of birth for the 1926 cohort median male earnings history

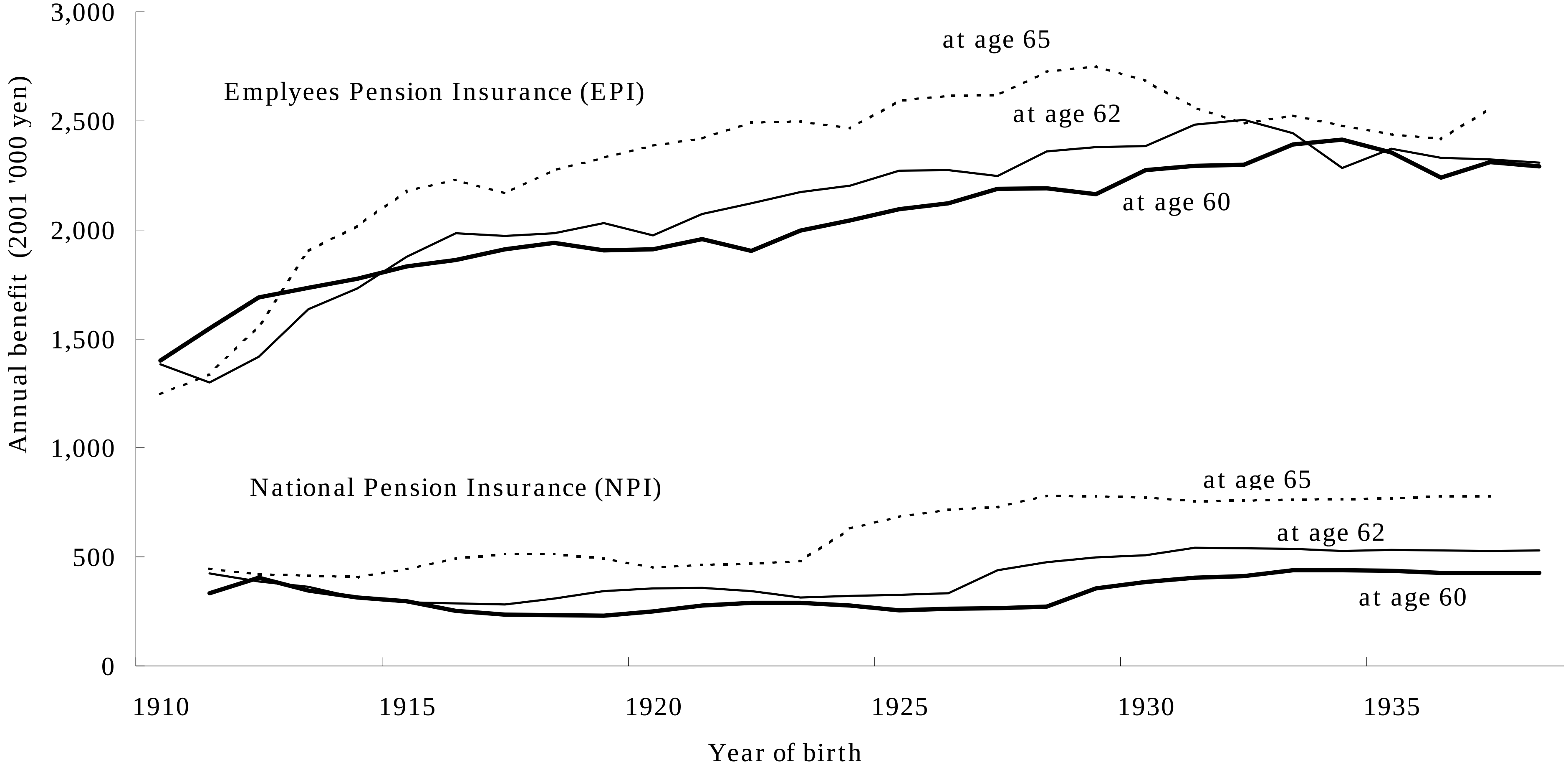

Table 2. Regression results

(1) Both gender and sector are contoled in Models II-IV.

Explanatory variable	Actual benefits				Partially-simulated benefits				Fully-simulated benefits			
Model	Model I	Model II	Model III	Model IV	Model I	Model II	Model III	Model IV	Model I	Model II	Model III	Model IV
Dependent variable:												
Actual social security benefits					0.365 ***	0.035 *	-0.108 **	-0.069	0.370 ***	0.035 *	-0.094 *	-0.077
					(0.019)	(0.020)	(0.049)	(0.047)	(0.020)	(0.020)	(0.054)	(0.051)
Total household income	0.382 ***	0.144	0.065	0.284 *	0.293 ***	-0.054	0.018	-0.023	0.295 ***	-0.067	-0.037	-0.049
	(0.066)	(0.126)	(0.138)	(0.167)	(0.039)	(0.060)	(0.155)	(0.162)	(0.039)	(0.061)	(0.171)	(0.176)
Relative income poverty	-0.189 ***	-0.151 ***	-0.120 ***	-0.178 ***	-0.125 ***	-0.054 ***	0.014	0.014	-0.128 ***	-0.055 ***	0.002	0.007
	(0.014)	(0.003)	(0.028)	(0.033)	(0.008)	(0.013)	(0.032)	(0.032)	(0.008)	(0.013)	(0.035)	(0.035)
Abslute income poverty	-0.148 ***	-0.107 ***	-0.099 ***	-0.118 ***	-0.092 ***	-0.033 ***	0.020	0.022	-0.094 ***	-0.036 ***	0.008	0.020
	(0.012)	(0.022)	(0.024)	(0.028)	(0.007)	(0.010)	(0.026)	(0.027)	(0.007)	(0.011)	(0.029)	(0.029)
Health care benefits	0.066 ***	0.088 *	0.114 **	0.037	-0.001	-0.038 *	-0.119 **	-0.117 **	-0.001	-0.037 *	-0.128 **	-0.132 **
	(0.022)	(0.047)	(0.052)	(0.062)	(0.013)	(0.022)	(0.057)	(0.059)	(0.014)	(0.022)	(0.063)	(0.064)

(2) Only gender is controled in Models II-IV.

Explanatory variable	Actual benefits				Partially-simulated benefits				Fully-simulated benefits			
Model	Model I	Model II'	Model III'	Model IV'	Model I	Model II'	Model III'	Model IV'	Model I	Model II'	Model III'	Model IV'
Dependent variable:												
Actual social security benefits					0.365 ***	0.427 ***	0.453 ***	0.472 ***	0.370 ***	0.435 ***	0.461 ***	0.477 ***
					(0.019)	(0.019)	(0.019)	(0.020)	(0.020)	(0.019)	(0.019)	(0.020)
Total household income	0.382 ***	0.455 ***	0.452 ***	0.516 ***	0.293 ***	0.205 ***	0.238 ***	0.237 ***	0.295 ***	0.204 ***	0.239 ***	0.238 ***
	(0.066)	(0.061)	(0.061)	(0.062)	(0.039)	(0.039)	(0.040)	(0.041)	(0.039)	(0.040)	(0.041)	(0.041)
Relative income poverty	-0.189 ***	-0.206 ***	-0.205 ***	-0.221 ***	-0.125 ***	-0.114 ***	-0.120 ***	-0.120 ***	-0.128 ***	-0.117 ***	-0.123 ***	-0.122 ***
	(0.014)	(0.013)	(0.013)	(0.013)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
Abslute income poverty	-0.148 ***	-0.160 ***	-0.159 ***	-0.167 ***	-0.092 ***	-0.085 ***	-0.089 ***	-0.089 ***	-0.094 ***	-0.088 ***	-0.092 ***	-0.091 ***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Health care benefits	0.066 ***	0.064 ***	0.064 ***	0.049 **	-0.001	0.005	0.012	0.017	-0.001	0.006	0.013	0.018
	(0.022)	(0.022)	(0.023)	(0.023)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)

(Note) The number of observations is 561. The numbers in the parentheses are standard errors. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Income poverty rates are multiplied by 10,000.
The parameter estimates associated with the other explanatory variables—age, year, sector, gender, and sector dummies—are not reported. The results for Model I are replicated in the bottom part for comparison.

Table 3. Regression results (IV)

(1) Both gender and sector are contoled in Models II-IV.

Instrument	Partially-simulated benefits				Fully-simulated benefits			
Model	Model I	Model II	Model III	Model IV	Model I	Model II	Model III	Model IV
Dependent variable:								
Total household income	0.801 ***	-1.523	-0.162	0.334	0.796 ***	-1.908	0.393	0.644
	(0.112)	(1.918)	(1.434)	(2.338)	(0.113)	(2.082)	(1.831)	(2.310)
Relative income poverty	-0.343 ***	-1.525 *	-0.125	-0.196	-0.346 ***	-1.577 *	-0.027	-0.086
	(0.025)	(0.851)	(0.285)	(0.449)	(0.025)	(0.900)	(0.367)	(0.445)
Abslute income poverty	-0.251 ***	-0.937 *	-0.184	-0.323	-0.254 ***	-1.021 *	-0.084	-0.258
	(0.020)	(0.551)	(0.239)	(0.402)	(0.020)	(0.607)	(0.301)	(0.381)
Health care benefits	-0.004	-1.070	1.103	1.695	-0.003	-1.048	1.357	1.721
	(0.036)	-(1.190)	(0.686)	(1.393)	(0.037)	(0.916)	(0.970)	(1.380)

(2) Only gender is controled in Models II-IV.

Instrument	Partially-simulated benefits				Fully-simulated benefits			
Model	Model I	Model II'	Model III'	Model IV'	Model I	Model II'	Model III'	Model IV'
Dependent variable:								
Total household income	0.801 ***	0.480 ***	0.527 ***	0.502 ***	0.796 ***	0.469 ***	0.518 ***	0.500 ***
	(0.112)	(0.089)	(0.087)	(0.083)	(0.113)	(0.090)	(0.087)	(0.084)
Relative income poverty	-0.343 ***	-0.268 ***	-0.265 ***	-0.255 ***	-0.346 ***	-0.269 ***	-0.266 ***	-0.256 ***
	(0.025)	(0.019)	(0.018)	(0.017)	(0.025)	(0.019)	(0.018)	(0.017)
Abslute income poverty	-0.251 ***	-0.199 ***	-0.196 ***	-0.190 ***	-0.254 ***	-0.202 ***	-0.199 ***	-0.191 ***
	(0.020)	(0.016)	(0.015)	(0.014)	(0.020)	(0.016)	(0.015)	(0.015)
Health care benefits	-0.004	0.012	0.027	0.036	-0.003	0.013	0.029	0.038
	(0.036)	(0.033)	(0.032)	(0.030)	(0.037)	(0.033)	(0.032)	(0.031)

(Note) The number of observations is 561. The numbers in the parentheses are standard errors. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Income poverty rates are multiplied by 10,000. Each equation includes actual benefits as the instrumented explanatory variable.

The parameter estimates associated with the other explanatory variables—age, year, sector, gender, and sector dummies—are not reported.

The results for Model I are replicated in the bottom part for comparison.

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2005-03	Seiichi INAGAKI	Projections of the Japanese Socioeconomic Structure Using a Microsimulation Model (INAHSIM)	October 2005