Fig.4 Proportions of direct taxes, health insurance contribution, and pension insurance contribution to earnings by earnings class (male average earnings = 100 %) : Individual Employee, 1999

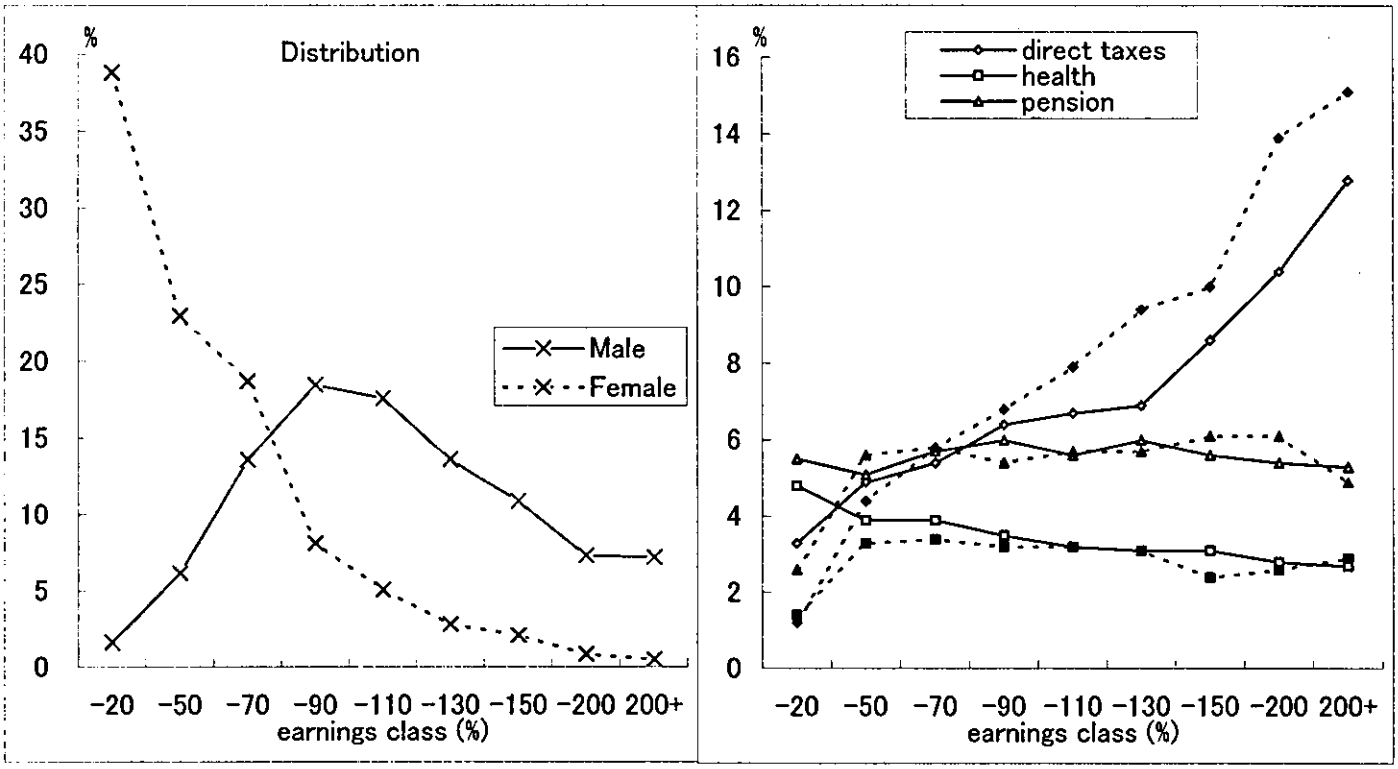
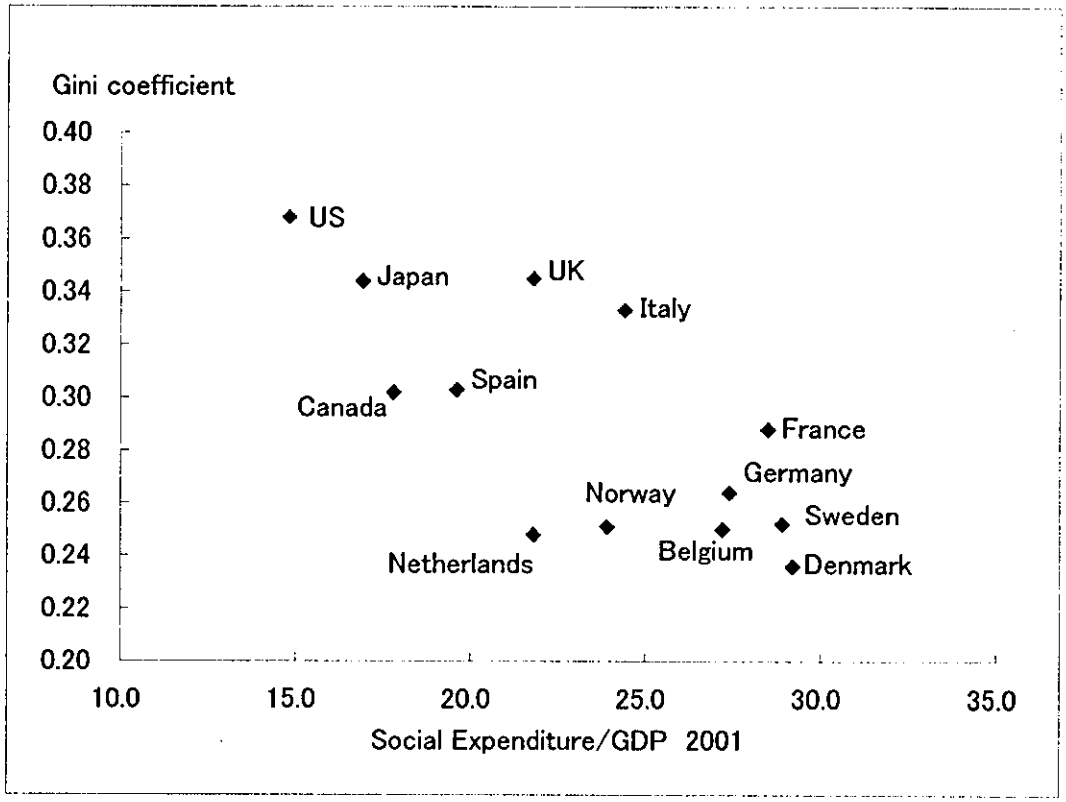


Fig. 5 International comparison



Social Security and Well-being of the Elderly in Japan*

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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 reports that the share of those aged 60 and above is expected to rise from 17.4% in 2000 to 28.0% in 2025 and 33.1% 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. Those projections have raised uncertainty about financial sustainability of the current social security programs, which depend heavily on contributions by future generations.

The projected demographic changes surely motivate Japan to carry out a fundamental reform of the social security system. Indeed, the Japanese government launched the 2004 Pension Reform, which aimed to establish an upper ceiling of the payroll contribution rate to 18.3%, a 5 % points increase from the current level, and hold down total pension benefits within total contributions and government subsidies in the long-run. Unlike the previous ones, the latest reform introduced the "macroeconomic" indexation so as to automatically adjust the benefits in response to demographic and macroeconomic changes. Medical and long-term nursing care programs also face a substantial deterioration in their financial positions and those difficulties have stimulated policy debates on increased contributions as well as reduced benefits. Their major reforms are scheduled over the next couple of years.

While it is desirable to raise financial sustainability of the social security schemes, the impact of policy changes on well-being of the elderly should be of serious concern. In fact, according to the Basic Survey of the National Life, public pension benefits account for nearly 70% of total income for the elderly in 2002. It implies that any change in social security benefits could have substantial effects on their standard of living and well-being. Many studies have revealed, however, that social security benefits may change the economic behaviors of the

elderly. Most of all, a series of empirical analyses of Yashiro and Oshio (1999), Oshio and Oishi (2003) (2004), which have been initiated by the NBER's international project on social security, find that the elderly tend to substantially adjust their labor supply to changes in public pension programs. Also, it has been of great interest whether more social security benefits could reduce precautionary savings, since the savings rate is expected to decline over the next decades. In fact, Shmizutani (2005) argues that the long-term care system, which was newly introduced in April, 2000, at least partly contributed to a reduction in the household saving rate in the most recent years.

Moreover, there has been recently a warning signal of widening income inequality among the elderly, as stressed by Oshio (2005). To be sure, income transfer from the young to the elderly, via public pension and other social security schemes, contributes to a reduction in income inequality among the elderly by raising their mean income. The earnings-related component of the public pension benefits, however, is likely to keep income inequality basically intact from the young age to the old. Also, a substantial difference of the pension benefits between the employed and self-employed workers leads to a gap in household income of the elderly. Moreover, lower progressivity of income taxes for the elderly, due to various tax and income deductions, fails to sufficiently redistribute income among the elderly. Under an increasing share of the elderly in 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 of the elderly in Japan, based on the cross-sectional data from the Surveys on Income Redistribution, complied by the Ministry of Health, Labour and Welfare. The data covers the period from 1980 to 1998, during which there were some major pension reforms – especially 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 over the 1990s). We focus on the variation across birth cohorts as well as within the same cohort in social security entitlements over the past two decades. To be more specific, we examine measures of well-being based on 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 well-being of the elderly.

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 to identify the impact of the social security program on well-being across cohorts and within a same cohort. Section V presents a descriptive analysis on the long-term trends of well-being of the elderly and compares them with those of the young. Section VI summarizes the regression results on the relationship between social security benefits and well-being of the elderly. Finally, Section VII concludes with policy implications of our empirical findings and topics for the 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 the self-employed workers, farmers and other non-employed workers. The second is the Employees' Pension Insurance (EPI: *Kosei Nenkin*) for the employed workers in the private sector. And the third is the Mutual Aid Insurance (MAI: *Kyosai Nenkin*) for the 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 receive a common, flat-rate benefit, which is called the Basic Pension benefit.

Accordingly, the flat components of the EPI and MAI as well as the NPI benefit are all the same under the current scheme.

For the NPI, the eligibility age for the full benefit is 65. More then one-fourth of the insured, however, start to receive an actuarially reduced benefit during 60 and 64, probably because the average household income of self-employed workers is relatively low in general. An actuarial addition to the benefit is also available to those who are aged between 65 and 70, but only few people apply to it. Under the current program, the eligibility to receive the NPI benefit requires a minimum of 25 years of contribution, and the eligibility to receive the full benefit (currently 66,000 yen) requires 40 years of contribution. The benefit is 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 the flat component (the Basic Pension benefit) as the first tier and earnings-related component as the second. In principle, the eligibility age for the flat component was 65, but there had been a special legal provision allowing employees to receive the full benefit 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 be 65 in 2013. The phasing out for female workers will be delayed by five years starting in 2006.

The earning-related component of the EPI benefit 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 the workers' entire period of coverage, adjusted by an increase in the average wage rate. The eligibility age for the earnings-related benefit is currently 60, but the 2000 Pension reform called for a stepwise increase of it starting in 2013 by one year for every three years to 65 in 2025[1]. Both of the flat and earnings-related benefits are CPI-indexed. On reaching age 60, an individual who has not fully retired are entitled to receive a reduced pension

[1] Hence, there will be no EPI benefit at all until age 65 since 2025.

benefit with the earnings test under the *Zaishoku* pension program. In addition, non-working dependent wives of the EPI beneficiaries are eligible to receive the Basic Pension benefit without any contributions. Therefore, an elderly couple whose husband is an EPI beneficiary can receive the earning-related benefit (of the husband) and two flat components (of both the husband and his wife).

The EPI contributions, which are paid equally by an employee and employer, had been based on the monthly earnings. Contributions began to be deducted from semi-annual bonuses in 1995 and the contribution base was completely shifted from monthly earnings to annual earnings including bonuses in 2003. The current contribution rate is 13.934%, and it is scheduled to be raised to 18.3% by 2013.

We focus on the NPI and EPI programs in our empirical analysis, and treat MAI pensioners as if they were EPI members, because the benefit structure is almost same under those programs and because our survey data do not distinguish two types of pensions for retired employees. In addition to those 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 payment which covers 10% of the total cost, are financed 30% by subsidies from the central and local governments and 70% by transfers from medical care insurance programs for the workers. The long-term care insurance, introduced in April, 2000, aims to provide those aged 65 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 well-being of the elderly, or the long-term care, which is too new to be reflected in our survey data that covers the period of 1980-1998.

Our strategy is to utilize impacts of institutional changes to the NPI and EPI programs over time on well-being of the elderly. The government has been 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 the benefit 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 the average benefits to the average wage income of the current workers, at around 60%. The government also has kept raising the flat NPL benefits in line with the nationwide trend of average consumption expenditures.

In turn, increasing benefits have required a steady rise in contributions; the EPI contribution rate rose from 10.6% in 1980 to 17.35% 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 benefit for female employees from the previous 55 to 60 by 2000.

III. Data sources

1. Survey on Income Redistribution

Our analysis is based mostly on the cross-sectional data from the Survey on Income Redistribution (SIR), complied 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, 83, 86, 89, 92, 95, and 98, whose income data come from the previous year. The sample sizes range between 7,165 (in 1983) and 8,856 (in 1989). This survey provides rich variables of household income and social security measures including public pensions, medical care, and family allowances. Unfortunately, the SIR does not provide any variable on consumption expenditures, health status, subjective assessment of well-being, or educational background. Hence, we concentrate on

household income and social security benefits. [We plan to use the micro data from another household survey, the Basic Survey of National Life, which contains the data on consumption expenditure, health status and subjective assessment of happiness, once they become available after the MHLW' permission.]

We construct the dataset to make the results as comparable as possible across well-being measures in Japan as well as across countries under study. First, we use 2001 euros everywhere in the analysis. We first express all yen-denominated data in real 2001 yen using a series of the overall Consumer Price Index (released by the Statistics Bureau), and then convert them into 2001 euros based on the yen-euro exchange rate in December, 2001 (reported by the Bank of Japan).

Second, we scale all income and social security measures by an OECD equivalence scale to account for the household size: counting the first adult as one, each subsequent adult as 0.7 and each child younger than 15 as 0.5. The old SIRs (1981 and 1984 surveys), however, do not report the ages of the family members other than the household head, but they provide information about coresidence with the elderly aged 60 or above. We count any family member whose age cannot be identified in the 1981 and 1983 surveys as 0.7.

Third, for descriptive analysis we define the elderly household as one in which there is at least one member aged 60 or above, and as the non-elderly otherwise. 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 might enter the secondary job market.

Another issue in empirical analysis is which we should use as the relevant unit, 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 a 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 a 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 a proportion of the elderly who live independently, making its negative impacts on their standard of living underestimated.

2. Income, poverty, and health

We construct two types of the 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 tax). 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 in 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% 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. We also set an absolute poverty line at 40% of the median non-elderly household income in a base year (1980) upward adjusted for CPI inflation between the base and current years.

The SIR does not contain self-reported health status, but instead reports medical care

[2] The coefficient of correlation 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.

benefits that are imputed from reported answers about health care receipts and hospitalization. We tentatively interpret a higher medical care benefit 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 and that demand for health care depends heavily on household income.

III. Methodology

1. Basic empirical strategy

In this section we explain the empirical strategy to gauge the extent to which social security benefits, or their statutory changes, affect well-being of the elderly. First, we collapse all of the micro data on well-being and benefits into age-by-year cells taking their mean values in each cell. A conventional way to assess the impact of social security on well-being might be to regress well-being 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, since 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 the variation in benefits that arise from institutional changes and exogenous to the outcomes.

To avoid this sort of 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, in order to make any benefit variation observed over time or across cohorts entirely due to statutory changes in social security programs. In reality, however, there are two types of factors which may actually differ across cohorts and affect benefits. The first type are factors which are largely exogenous to social security programs but are potentially

important determinants of well being. Earnings profiles are the most important example of this type. The second type are factors which are likely endogenous to social security programs. Ages of initially claiming social security benefits belong to this type. To assess the impact of social security programs on well-being of the elderly, we should hold the first type of factors constant. An open question, however, is whether we should hold the second type constant, since those factors are part of the effect caused by law changes.

Thus, we take three approaches to assess the robustness of any estimation results. First, we regress well-being outcome on the actual reported social security benefits. Then, the regression equation is expressed as

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

where a and t index single year of age and calendar year, respectively, and W denotes the cell mean of well-being outcomes, B^A is the cell mean of the 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 the benefit amount on a given earnings history of a certain cohort in order to hold the first type of factors constant but to allow the second type of factors to vary. We refer to it as a "mixed simulation" approach in this sense. Specifically, we use "partly-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 benefit for each retirement age and then weighting the claiming-age-specific benefits by the distribution of claiming ages for that cohort.

Take the cohort which was born in year c (that is, is aged a in year $c+a$) as an example, and call this cohort as cohort c. Let Pr (R_{ac}) be the probability that cohort c initially claims the social security benefit 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 $\bar{y}$ (the same as the base cohort), and denote the benefit which this cohort can initially claim at age k as B_{kc} ($\bar{y}$). Then, the

expected benefit which cohort c receives at age a, which is denoted by B_{ac}^{PS}, is expressed as

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

where we assume that the cohort keeps receiving the same amount of the benefit since the initial claim[3] and denote the first age at which the cohort can claim the benefit as a_0. Since 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 the both the first and second types constant, since the timing of retirement and well-being of the elderly are correlated. We use the earnings profile of the base cohort as in the case of a mixed simulation approach, but we use the retirement patterns of the base cohort in weighting the initially claimed benefit. That is, "fully-simulated" benefits, B_{ac}^{FS}, is given by

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

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

In sum, we estimate three regression equations:

$$W_{at} = \alpha B_{at}^{A} + \sum_a \beta_{1a} AGE_a + \sum_t \beta_{2t} YEAR_t + u_{at},$$

$$W_{at} = \alpha B_{at}^{PS} + \sum_a \beta_{1a} AGE_a + \sum_t \beta_{2t} YEAR_t + u_{at},$$

$$W_{at} = \alpha B_{at}^{FS} + \sum_a \beta_{1a} AGE_a + \sum_t \beta_{2t} YEAR_t + u_{at}.$$

We hereafter refer to this type of model as Model I, with which we aim to identify the impact of the social security programs on well-being from variation across cohorts by controlling for age and year effects.

2. Calculation of simulated benefits

To apply the basic empirical strategy described above to the Japanese data, we have to consider additional two issues. The first is which cohort we should choose as the base cohort for

[3] In practice, we have to consider the price indexation: the benefit is adjusted by CPI inflation from the age of initial claim.

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 the cohorts which were born in 1906 to 1943 for the descriptive analysis of time-series trends. For the regression analysis, we limit the samples to cohorts born in 1911 to 1943 considering the limited sample size of year-by-age cell for the old and young cohort.

The second issue is how to construct the simulated benefits, which are the core for the regression analysis. The simulated benefits are constructed mainly by two factors: the first is the probability of retirement at each age for each cohort, and the second is the benefit to be claimed. The Annual Report of the Social Insurance Agency is the key data source for both of the two 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 of the benefit starts at age 55 and ends almost completely by age 74. By dividing the number of those who claim the benefit 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 between 60 and 70[4]. 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 the EPI and 65 for the NPI, both of which are the normal eligibility ages for the public pension programs. For example, 44.3% of male EPI members retired at age 60, and 62.3% of male NPI members retired at age 65 in the 1926 cohort.

The next task is to estimate the benefit received by a synthetic person which has the same earnings history as the 1926 cohort, based only on legislative variation in the structure of benefit.

[4] In the case of the NPI, the eligibility to claim the benefit is not equivalent to "retirement," since the NPI members are self-employed workers, farmers, and other no-employed workers.

In the case of the EPI, a plausible way is to construct a mean earnings history for the 1926 cohort and calculate the benefit based on it with the benefit formula. Due to lack of lack of individual histories of wage earnings in the past, however, we cannot directly apply this method. Instead, we use the following approach, which is indirect and but probably most plausible given limited information available from the published data:

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

(2) Second, we get the mean value of the career average monthly income (CAMI) of the EPI beneficiaries who initially claim the benefit 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 reports only the average value of the CAMI across initially claiming ages in each year. We suppose for simplicity that the reported mean CAMI roughly corresponds to the mean earnings history of the cohort which was aged 60 in the survey year, since the timing of initially claimed benefits heavily concentrates on that age in the EPI.[5]

(3) Third, for each cohort we calculate the ratio of the initially claimed benefit at each age to the average CAMI (which is obtained in (2)), and interpret a set of these ratios as the EPI benefit "law" which was applied to that cohort.[6]

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

[5] For example, if the average CAMI was 3,200 euros across ages of initial benefit claim 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 benefit claim even for the same cohort. But we ignore it for simplicity and because of limited information about wage profiles.

[6] For example, suppose that we find that the average CAMI was 3,000 euros in 1990 and that the average benefit initially claimed was 1,500 euro at 60 in 1990 and 1,530 euro at 61 in 1991 (in 2002 price). Then, we assume that the average CAMI for the 1930 cohort was 3,000 euro (as explained in (2)), and we take as 0.5 (=1,500/3,000) and 0.51 (=1,530/3,000) 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 benefit law which was effective at that time.

which was actually applied to each cohort to the 1926 cohort.

In the case of the NPI, we can apply a simpler methodology, since the NPI benefit is flat and not related to the earnings history. Hence, when we put the 1926 cohort in each single cohort, we roughly suppose that that cohort would get the actual benefit (in 2002 price) which was reported by each single cohort. We believe that this is the most reliable method given limited information available from the Annual Report, even though it ignores differences in the period of contributions across cohorts.

3. Additional sources of variation

Our basic equations (1)-(3) for Model I aim to identify the impact of the social security programs on well-being solely from variation across cohorts, by controlling for both age and year effects. This "age-year cell" approach, however, is likely to fail to exploit some of important variations in benefits across groups within age-year cells. These within age-year cell variations can help identify the effect of benefit changes, and there are at least two candidates for the sources of variation: that is, the "sector" and "gender".

As discussed in the previous sections, benefit laws and retirement patterns are quite different between the EPI and NPI beneficiaries. An EPI beneficiary used to be an employed worker, whereas an NPI beneficiary used to be a self-employed worker in most cases[7]. Since the SIR asks the elderly about the type of public pension benefits, we can identify the sector to which each household head belongs. It should be noted, however, that since the SIR only distinguishes the beneficiaries of the NPI and of the pension programs for employees, 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 for simplicity, since EPI and MAI benefits have many things in

[7] Some elderly receive both the EPI and MPI benefits in our SIR dataset. We categorize them into EPI beneficiaries for simplicity.

common.

Another source of variation to be considered is gender. There several factors to make the difference between the benefits of men and women. In the case of the 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 benefit and CAMI was 44% and 45% 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 the 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% versus 31% in 2001), largely because of women's limited chances to work as a full-time employee. Reflecting to a long-term uptrend of women's labor participation, however, there has been a shift of female beneficiaries from the NPI to the EPI over the past two decades[8].

4. Models with variations

In addition to estimating the basic models (1)-(3), we collapse all the micro data on well-being and benefits into age-by-year-by-sector-by-gender cells taking their mean values in each cell, and then estimate models with sector and gender variations. In our dummy regression models, we would include sets of dummies to control for the two variations and estimate three versions of these models.

The first model, referred to as Model II hereafter, controls just for "first level" fixed effects using age, year, sector, and gender dummies, we estimate models of 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 the outcome of well being, W, and social security benefit, B, are collapsed into the age

[8] There seem to be other potential sources of variation, such as marital status and education, but the SIR has limited information about them. The survey tells whether the household head has a spouse or not, but it cannot distinguish widowed, divorced, or unmarried when he/she has no spouse. Nor does the Survey does distinguish usual and survivor pension benefits. No information about educational background is available at all.

(a)–year (y)-sector (s)-gender (g) cells, *SECTOR* dummy takes the value of one (zero) if the cell corresponds to the EPI (NPI) beneficiaries, and *GENDER* dummy takes one (zero) if the cell corresponds to the female (male) elderly. We estimate this equation by putting the actual benefit (B^A), the partly-simulated benefit (B^{PS}), and fully-simulated benefit (B^{FS}) alternatively into B.

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

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

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

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

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

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

V. Evidence

1. Time series evidence

Figures 1-4 show the time series evolution of well-being measures which 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 so as to distinguish the economy-wide trend and the impact of the social security benefits. Also, we index the data setting the starting value as 100 to assess the relative performance of well-being of the elderly. The following are key facts 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 both the young and the elderly, followed by a small fall thereafter reflecting the stagnant economy. More importantly, 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 of the elderly[9] more than offset the impact of an increase in social security benefits to the elderly, 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 the time series movements in 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% of the mean 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 the late 1980s).[10] The parallel movements suggest that widening inequality can be attributable to some economy-wide factors and that the social security benefits fail to redistribute income among the elderly sufficiently to reduce inequality. On the other hand, Figure 3 indicates the evolution of absolute poverty, which is

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