social security reforms from changes in earnings profiles.

Second, the observed LFP, which forms the basis of our calculations of the weighted averages of incentive measures for each year, is also affected by existing programs. Although this bias cannot be completely disregarded, it is obviously smaller than it would have been if we used the actual wage profile of each cohort, which is more likely to be jointly determined with the actual LFP than the fixed wage profile.

3.3 Labor market outcomes

For labor market outcomes, we use data on labor force and employment from the *Labor Force Survey*, which provides annual data on labor force and employment for males and females separately from the year 1968. We focus on employees because the self-employed elderly are covered by the flat-rate NPI, and they seem to make different decisions on retirement compared to employees. However, the *Labor Force Survey* does not classify employees into private- and public-sector employees, of whom the latter are covered by Mutual Aid Insurance (MAI, *Kyosai Kumiai*). This empirical analysis is based on all employees because MAI programs and their reforms are similar to those of EPI and because MAI members account for less than 8 percent of the overall labor force.

In addition, we redefine the LFP rate in this analysis as the ratio of the sum of employees and the unemployed to the population excluding the self-employed and unpaid family workers, to concentrate on the retirement decisions of the employees. We refer to this redefined LFP rate as the employment-based LFP rate hereafter. This definition disregards the course of retirement from being employees in the main workplace to becoming self-employed or unpaid family workers.[13] However, this bias is far less serious than that stemming from the conventionally defined LFP rate,

[13] According to the *Survey on the Labor Participation of Older Workers* 2004 compiled by the Ministry of Health, Labour and Welfare, the gaps in the proportion of self-employed persons (including unpaid family workers) in the population aged 5559 and 6064 years were 1.3 and 0.5 percentage points for males and females, respectively, implying that the pathway to becoming self-employed is narrow.

which is affected by a structural shift from being self-employed and family workers to becoming employees.[14] Figure 1 compares the long-term trends of the conventionally defined, employment-based LFP rates for those aged between 55 and 69, over the past four decades. While these two LFP rates move in parallel, the gap has become smaller in recent years.

We also note that the *Labor Force Survey* provides data only for five-year age groups rather than for each age. Hence, we have to limit our analysis to three age groups (55-59, 60-64, and 65-69 years) and use the same LFP rates and corresponding $q_r(y)$ for those who are included in each age group. However, we can obtain annual population data by each age group from the *Population Estimates* provided by the Ministry of Internal Affairs and Communications. Therefore, we estimate the number of employees (individuals who are in the labor force, by our definition) and retired persons by multiplying the population by the employment-based LFP rates calculated from the *Labor Force Survey*. Then, we estimate $\gamma_r(y)$, the proportion of retired persons in each age group based on these figures.

4. Empirical results

4.1 Social security reforms and changing generosity

This section assesses changing generosity levels of social security programs and examines the relation between incentive measures and retirement. Table 2 shows the SSW and incentive measures for each retirement age in 1970, 1985, and 2005, all of which are based on the same wage profile of the typical person (born in 1935), expressed in inflation-adjusted 2005 prices. We choose the year 1985 because social security reforms changed direction in that year, as described in Table 1.

The following five points are noteworthy. First, we confirm that SSW was highest in 1985 for

[14] In fact, the share of employees in the total labor force aged 55-69 increased—for males and females, respectively—to 90.7 percent and 90.5 percent in 2007 from 68.7 percent and 54.2 percent in 1968.

both males and females. This is consistent with the history of social security reforms; the generosity of programs increased until the 1985 Reform and has been steadily decreasing since then. This pattern is more obvious for females than for males who enjoyed an increase in the Additional Pension benefit, which partly offset a reduction in the generosity of the main body of EPI benefits.

Second, over the 35 years the age for the maximum SSW was raised by just one year from 59 to 60 for males, whereas after 1985 it was raised by five years from 55 to 60 for females. This mainly reflects a difference in the shift of the eligibility age for the wage-proportional component between males and females; the eligibility age for females was 55 until 1985 and was gradually raised to 60, while it had already been raised from 59 to 60 in the early 1970s for males.

Third, SSA and PV show similar patterns for males and females across age groups. For males, both SSA and PV remain positive until SSW reaches its maximum at age 59 or 60, and then turn negative in each year. This implies that it was reasonable for males to retire at 59 or 60, judging from these incentive measures. For females, in 1970 and 1985, when the eligibility age for the wage-proportional component was fixed at 55, SSA and PV began with a negative value at that age. They turned positive at age 65, reflecting that they could receive the full benefit if they work after age 65, in 1970 and 1985. In 2005, however, the patterns of SSA and PV across ages became the same as those for males; they remained positive until age 60 and then turned negative because the benefit formula and eligibility were almost the same for males and females.

Fourth, the absolute values of SSA and PV for males were higher in 1985 than in 1970 and 2005, reflecting the fact that the benefit was highest in 1985. In 1985, individuals were encouraged to continue working until the age of 60 and to retire after 60, compared to the situation in 1970 and 2005. Hence, it is likely that the weighted average of SSA or PV tended to rise until 1985 and then fall, because the share of cohorts who faced higher positive values increased first and, subsequently, that of those who faced higher negative values increased.

Fifth and finally, OV, which is calculated using $g = 0.75$ and $k = 2.0$ for males and $g = 0.75$ and

$k = 3.0$ for females, monotonically declined with age for both males and females with the increase of their ages in 1970 and 2005. This is because the sum of utility from wage income and that from benefits—$V(r)$ in (3)—increased monotonically until age 69 because, in most cases, those aged 65 and older could obtain a full benefit even if they continued working. Hence, OV—which is defined as $V(69)–V(r)$ at age r—declined when age reached 69. An interesting revelation is that OV was lowest in 1985 for both males and females, and that it was rather low or zero for males beyond the age of 60. At first glance, this appears to be inconsistent with a long-term change in the benefits, which rose until 1985 and decreased afterwards. However, it is important to note that greater generosity implied greater benefits given up when postponing retirement. This effect was likely to be more than an offset by an increase of future benefit gains, and led to a reduction of OV.

Figure 2 depicts the long-term trends of SSW and incentive measures for those aged 55-69 years, and captures the changing overall generosity of social security programs. An inverse-U-shaped SSW curve confirms that generosity peaked in the mid-1980s for both males and females, and ascertains the change in the direction of social security reforms summarized in Table 2. The change was more remarkable for females than for males.

The OV curves also demonstrate almost the same U-shaped trends for both males and females. A downward slope of the OV curve corresponds to enhanced benefits, pointing to rising incentives to retire. However, OV has been on an upward trend due to reduced benefits for females since the mid-1980s, and somewhat later for males. An earlier turnaround of the curve for females is due to an increase in their eligibility age since the mid-1980s.

In contrast, the SSA and PV curves appear rather different for males and females. The SSA and PV curves for females are U-shaped; this is consistent with the SSW and OV curves. Before the mid-1980s, an increase in benefits with a fixed eligibility age tended to reduce the SSW; however, these trends changed in the mid-1980s, reflecting a gradual shift to the less generous programs. The PV curve for males has an inverse U-shape and shows a cyclical movement. As already suggested by Table 2, the increasing generosity of the programs tended to raise both the positive (before 60 years) and negative (after 60 years) values of SSA and PV, especially for males who received higher benefits than females. Hence, their averages across age groups did not move consistently with changes in the overall generosity of the social security programs, as shown by Figure 2. This suggests that regressions using SSA or PV may fail to precisely capture the relation between the LFP and the incentive measures for males.

4.2 Estimation method and regression results

Next, we examine how the LFP of the elderly has been affected by social security programs in terms of incentive measures.[15] The dependent variable is the employment-based LFP rate, which is defined as the share of employees in the population excluding the self-employed and family workers. This empirical analysis is based on 120 observations of males and females in the age groups 55-59, 60-64, and 65-69 years over a period of 40 years (1968 to 2007). The LFP rate, SSW, and three incentive measures are all aggregated for each age group.

We employ the ordinary least squares (OLS) method to estimate three regression models for SSA, PV, and OV (and for SSW, for reference), for males and females:

$$\begin{aligned}\text{Model 1}: LFP_{ya} &= \alpha + \beta IM_{ya} + \gamma_1 D6064_{ya} + \gamma_2 D6569_{ya} \\ &+ \sum_j \eta_j CV1_y^j + \sum_k \eta_k CV2_{ya}^k + \varepsilon_{ya}\end{aligned} \tag{9}$$

$$\begin{aligned}\text{Model 2}: LFP_{ya} &= \alpha + \beta IM_{ya} + \gamma_1 D6064_{ya} + \gamma_2 D6569_{ya} + \delta TIMETREND_y \\ &+ \sum_j \eta_j CV1_y^j + \sum_k \eta_k CV2_{ya}^k + \varepsilon_{ya}\end{aligned} \tag{10}$$

$$\text{Model 2}: \Delta LFP_{ya} = \alpha + \beta \Delta IM_{ya} + \sum_j \eta_j \Delta CV1_y^j + \sum_k \eta_k \Delta CV2_{ya}^k + \varepsilon_{ya} \tag{11}$$

Here, *LFP* is the employment-based LFP rate; *IM* is an incentive measure (SSA, PV, or OV); *CV*1 and *CV*2 are year-specific and year-and-age-specific control variables, respectively; *D*6064 and

[15] Oshio and Oishi (2004) is an early example of a study that applies incentive measures to Japanese micro-data.

D6569 are dummies for the age groups 60-64 and 65-69, respectively; *TIMETREND* is the time trend (1968 = 1); and ε is the error term. We include five control variables: (i) per capita real GDP, (ii) share of manufacturing in nominal GDP for *CV1*, (iii) share of firms with mandatory retirement age, (iv) life expectancy, and (v) share of college graduates for *CV2*.[16] Per capita real GDP is a proxy for the real wage rate and is used to adjust for cyclical movements of the LFP. The shares of manufacturing and of firms with a mandatory retirement age of 60 or above are used to capture structural changes in demand for the elderly labor force. Finally, life expectancy and share of college graduates are chosen to control for health conditions and educational background, respectively, of each age group. We also attempt to use SSW instead of incentive measures because we cannot rule out the possibility that the elderly take into account SSW itself rather than changes to it. In contrast to other incentive measures, it should be noted that the coefficient on SSW is expected to be negative.

Model 1 is the simplest version of the three models. We include two dummies of two age groups to distinguish the impact of the incentive measure from age-specific factors, especially considering that most Japanese firms set the mandatory retirement age at 60. Given that the retirement rate tends to rise with an increase of age, the coefficients of these dummy variables are expected to be negative. However, this type of model might result in spurious correlations. To control for trend as well as age-specific factors, we additionally consider two types of model: Model 2 adds the time trend and Model 3 considers a five-year difference for each variable.[17]

We recognize the limitations of our regression models based on aggregated data. For example, joint decisions on the LFP made by a husband and wife are disregarded because we cannot identify couples from the aggregated data. In addition, heterogeneity of ability and preference,

[16] Control variables (i) and (ii) are obtained from national accounts published by the Cabinet Office; (iii) is obtained from *Employment Management Surveys* (19802003) and *Employment Conditions Surveys* (20042007) compiled by the Ministry of Health, Labour and Welfare; (iv) is obtained from *Life Tables* compiled by the Ministry; and, (v) is calculated from *School Basic Surveys* by the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Education (1972).

[17] It should be noted that cohort-specific factors are not fully controlled by these models, even after calculating incentive measures based on the typical person.

which seems to be more significant in the elderly, is not taken into account in our analysis. These issues should be explicitly addressed if micro-data are available.

With respect to OV models, we must estimate the most appropriate values of k and g in (3). Ideally, we should estimate them using the maximum likelihood method; however, this is beyond our computational ability because the values of OV for all age groups in all years have to be calculated in response to every possible combination of k and g. Instead, we search for a combination that maximizes the goodness of fit of the model as well as the significance of the coefficient on OV, ranging between 0.5 and 4.0 (with an interval of 0.5) for k and between 0.5 and 1.0 (with an interval of 0.05) for g—that is, 88 combinations in total—for Models 1 to 3 and for each gender. We find the optimal combinations of $k = 2.0$ and $g = 0.75$ for males and $k = 3.0$ and $g = 0.75$ females for Models 1 to 3. We report the regression results using these combinations of k and g.

Table 3 summarizes the regression results of each model for both males and females. We focus on the coefficients of the incentive measures and do not report estimated coefficients of other variables.[18] Further, we observe three noteworthy findings.

First, all three incentive measures (SSA, PV, and OV) and SSW have significant coefficients with correct signs for females, but only OV and SSW have significant coefficients with correct signs for males in all models. The latter result suggests that for males, the weighted averages of SSA and PV over age groups are not good indicators of the overall incentives to postpone retirement. This is already inferred from Figure 2, which shows that for males SSA and PV curves did not move consistently with the change in overall generosity of the social security programs.

Second, we observe the same pattern of the significance of coefficients of incentive measures even after controlling for trend measures (except for male SSA) in Models 2 and 3. In addition,

[18] The complete regression results are available from the authors upon request. In general, the signs of the estimated coefficients tend to be (+) for age dummies, (-) for time trend, (+) for per capita real GDP, (+) for the share of manufacturing, (-) for the share of firms with mandatory retirement, and (+) for the share of college graduates, which are all consistent with the prediction. Meanwhile, the sign of life expectancy is indeterminate.

the sizes of the coefficients are not significantly different among the three models, indicating the robustness of the estimation results.

Third, it is noteworthy that the coefficients on SSW are significant and negative for both males and females in all models and that the goodness-of-fit is not worse than that in cases using incentive measures, suggesting that the elderly may be concerned about the current SSW to almost the same extent as they are concerned about future changes to it.

The estimation results in this study should be interpreted cautiously for two reasons. First, we did not fully control for the impact of mandatory retirement on the retirement decisions of the elderly, although we did include the share of firms engaging in mandatory retirement practice as a control variable in the regression models. Mandatory retirement is also closely related to the public pension programs in Japan. The mandatory retirement age has been raised in line with an increase of the eligibility age for public pension benefits, making it difficult to distinguish between the effects of these changes. Second, we did not explicitly consider the demand side of the labor market for the elderly. The LFP of the elderly is affected not only by the elderly's incentives to work but also by firms' incentives to hire them. It is likely that a change of incentive measures at least partly results in a change of wages, especially if there is not strong demand for full-time workers beyond the mandatory retirement age.

5. Policy simulations

This section presents counter-historical simulations to estimate the extent to which a series of social security reforms affected the labor supply of the elderly since 1985. First, we explore the effects on SSW and incentive measures had the government not implemented major social security reforms. For example, to understand the impact of the 1985 Reform and subsequent reforms, we construct all the parameters in the social security programs, including benefit multiplier, premium rates, and eligibility ages fixed in 1984, and construct the paths that SSW and the incentive measures would have taken since 1985 without any reform. In the same manner, we can construct the paths without reforms since the 1989 Reform, which followed the 1985 Reform. It is also reasonable to roughly interpret the difference between these simulated paths as the impact of the 1985 Reform. We can repeat the same experiments to capture the impact of each reform.

Figure 3 illustrates the results of these counter-historical simulations in terms of SSW for males and females. For example, the curve labeled "Without reform since 1985" depicts the path SSW would have taken if social security reform stopped just before the 1985 Reform. In this case, SSW for males would have continued to increase and would have leveled off in the early 2000s, as all the cohorts would have adopted the scheme that was applied just before the 1985 Reform. A series of reforms since 1985 led the SSW curve to peak in the mid-1980s and then slope downward. The decline continued with all subsequent reforms; however, the impact of the 1985 Reform has been larger than that of any other reform.

The impact of social security reforms is also clearly observed in the case of females. The impact differs from that for males in that SSW continued to decline before rising again and stabilizing in the early 2000s when there were no reforms since 1985. This is because the flat-rate component, which accounted for more in total benefits for females than for males, decreased in real terms since the late 1970s, thus holding the former's total benefit down. Nevertheless, the figure confirms that the generosity of social security reforms has been steadily decreasing since 1985.

Based on these observations, we confirm a substantial reduction in the overall generosity of social security programs over the past two decades. Indeed, in the absence of the 1985 Reform and subsequent reforms, the average SSW for ages 55-69 (evaluated at 2005 prices) would have been 2.68 million for males and 1.88 million for females in 2007, which are 45.4 percent and 81.9 percent higher than the actual levels (1.84 million and 1.03 million), respectively. In the same manner, we can construct the path each incentive measure would have taken in the absence of social security reforms. Figure 4 shows how the OV has been affected by the reforms. Had there been no reform since 1985, OV would have kept declining until the late 1990s for males and remained for a longer period at a low level for females.

Further, we estimate the impact of social security reforms on the LFP of the elderly. One reasonable way is to compute LFP rates by substituting the values of incentive measures obtained from each simulation as well as the values of covariates into (10) or (11) and using the estimated coefficients reported in Table 3. We focus on the OV results, which are most reasonable and consistent between males and females. Table 4 presents the simulation results, which are based on estimation results obtained from the three models. The top and bottom panels are based on OV and SSW results, respectively.

In the top panel, we observe that in Model 1, the male labor force aged 55-69 years would have been an average of 6.996 million per year during 1985 and 2007, in the absence of the 1985 Reform and subsequent reforms. Given that the baseline result is 7.082 million (which is close to the actual 7.093 million), these reforms since 1985, as a whole, increased the male labor force by 92 thousand per year—equivalent to 1.3 percent of the LFP that would have been realized had there been no reform since 1985. The impact is larger in Model 2 (1.9 percent) and smaller in Model 3 (0.7 percent). Table 4 also reports the results for females. The total impact for females is estimated to have been an average of 29 thousand (0.7 percent) in Model 1, 35 thousand (0.9 percent) in Model 2, and 26 thousand (0.6 percent) in Model 3 per year during 1985 and 2007; these figures are somewhat smaller than those for males.

The bottom panel shows that the SSW and LFP of the elderly relate reasonably to each other as in the cases of incentive measures. This result is reasonable given that SSW and OV moved rather symmetrically over the past 40 years, as shown in Figure 2. In fact, Table 4 states that the impact is somewhat greater than in the OV version for all models with both males and females, underscoring the fact that the impact of a series of social security reforms since 1985 on the LFP of the elderly is not negligible.

6. **Conclusion**

We examined how social security programs affect the LFP of the elderly in Japan. Using publicly available data, we constructed forward-looking incentive measures based on the concepts of SSW and related incentive measures. This empirical analysis covers a period of forty years (19682007) that has marked significant changes in social security programs. Further, we compare the impact of major social security programs in the past on the labor supply of the elderly in a consistent manner.

Our main findings are summarized as follows. First, our calculations concerning SSW and incentive measures reveal a substantial change in social security policy in the mid-1980s. Although the generosity of social security programs was increasing, the 1985 Reform reversed the trend and subsequent reforms featured a reduction of generosity.

Second, our regression analysis confirms that the LFP of the elderly is affected significantly by forward-looking incentive measures for inducing retirement. In particular, the option value model of Stock and Wise (1990a) appropriately explains the relation between social security and LFP for both the male and female elderly population. It should be noted, however, that we should be cautious when interpreting these results because our estimation models do not fully control for the effects of mandatory retirement practice and demand-side conditions.

Third, our counter-historical simulations show that social security reforms encourage the elderly to continue working and postpone retirement via reduced generosity and increase of eligibility age. The option value model estimates that the 1985 Reform and subsequent reforms increased the elderly labor force by 0.7–6.7 percent for males and by 0.6–2.2 percent for females during the past two decades, compared to the levels that would have been realized in the absence of a reform since 1985. The magnitude of the impact is not negligible given that Japan has already entered a phase of declining population growth.

This analysis can be extended in a variety of respects, provided micro-data with longitudinal information and family background are available. First, we can explicitly examine the impact of social security programs on multiple pathways to retirement (see Clark and Ogawa (1992)), which has been disregarded by many Japanese studies, including our analysis. Second, we can analyze the impact of social security reforms by taking into account simultaneous relations among LFP, benefit receipts, and living arrangements (see Raymo *et al.* (2004)). Third, we can compare social security programs with health status, financial support from children, and other factors in terms of the effects on retirement decisions of the elderly. Finally, we can also discuss the impact of the changes of the generosity of social security programs on the overall well-being of the elderly, which covers health, poverty, and other socioeconomic aspects as well as income itself.

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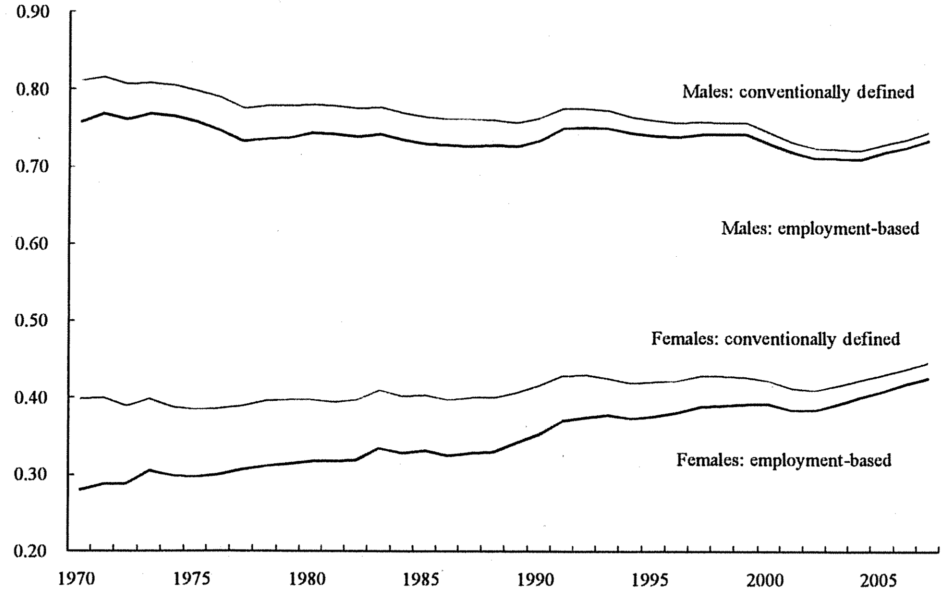
Table 1. Overview of key social security reforms in terms of benefits

Social security reform	Employees Pension Insurance			National Pension Insurance	
	Wage-proportional benefit	Flat-rate benefit (yen, annual) per year of contribution		Flat-rate benefit (annual, yen) per year of contribution	
	Benefit multiplier (/1000)	Nominal	2005 prices	Nominal	2005 prices
1954	5	24,000[a]	[127,292]	-	-
1959	6	24,000[a]	[127,620]	900/1,200[b]	[4,786/6,381]
1965	10	3,000	[11,835]	2,400	[9,468]
1969	10	4,800	[15,602]	3,840	[12,482]
1973	10	12,000	[29,630]	9,600	[23,704]
1976	10	19,800	[32,459]	15,600	[25,574]
1980	10	24,600	[31,990]	20,160	[26,203]
1985	7.5	15,000	[17,026]	15,000	[17,026]
1989	7.5	16,650	[18,237]	16,650	[18,237]
1994	7.5	19,500	[19,345]	19,500	[19,345]
2000	7.125	20,105	[19,672]	20,105	[19,672]
2004	7.125	20,105	[20,045]	20,105	[20,045]

(Note) a. Constant regardless of years of contributions. b. 900 yen for less than 20 years and 1,200 yen for 20 years or more.
Male EPI pensioners receive Additional Pension benefit for dependent spouses.

Figure 1. Labor force participation rates



(Source) Ministry of Internal Affairs and Communications, Labor Force Survey.

Table 2. SSW and incentive measures in 1970, 1990, and 2005

Males

Age	1970				1985				2005			
	SSW	SSA	PV	OV	SSW	SSA	PV	OV	SSW	SSA	PV	OV
55	13,544	430	2,197	4,275	22,163	711	3,630	3,280	16,947	323	1,712	3,765
56	13,974	511	1,766	3,620	22,874	718	2,919	2,581	17,271	333	1,389	3,135
57	14,485	625	1,255	2,972	23,592	726	2,200	1,904	17,604	343	1,056	2,526
58	15,110	630	630	2,324	24,318	733	1,474	1,248	17,947	352	713	1,938
59	15,740	-539	-539	1,698	25,052	741	741	614	18,299	361	361	1,369
60	15,202	-685	-685	1,094	25,793	-1,440	-1,440	0	18,660	-505	-505	820
61	14,516	-709	-709	944	24,353	-1,451	-1,451	0	18,155	-501	-501	665
62	13,807	-729	-729	812	22,902	-1,458	-1,458	10	17,654	-347	-347	522
63	13,078	-746	-746	697	21,444	-1,460	-1,460	38	17,306	-825	-825	494
64	12,332	-758	-758	597	19,984	-1,458	-1,458	77	16,481	-830	-830	475
65	11,573	-534	-534	513	18,526	-1,007	-1,007	127	15,652	-686	-686	466
66	11,039	-508	-508	375	17,519	-959	-959	98	14,966	-777	-777	325
67	10,531	-483	-483	245	16,560	-911	-911	71	14,189	-801	-801	215
68	10,048	-458	-458	121	15,650	-863	-863	46	13,388	-577	-577	122
69	9,590	-458	-458	0	14,786	-863	-863	0	12,811	-577	-577	0

Females

Age	1970				1985				2005			
	SSW	SSA	PV	OV	SSW	SSA	PV	OV	SSW	SSA	PV	OV
55	11,709	-247	-247	3,210	21,890	-246	-246	2,757	9,355	456	2,302	3,243
56	11,462	-272	-272	2,744	21,644	-315	-315	2,185	9,811	458	1,846	2,743
57	11,190	-178	-178	2,292	21,329	-379	-379	1,629	10,270	460	1,388	2,256
58	11,012	-106	-106	1,817	20,950	-439	-439	1,086	10,730	463	927	1,783
59	10,907	-150	-150	1,323	20,511	-494	-494	556	11,193	465	465	1,321
60	10,756	-198	-198	842	20,017	-614	-614	39	11,657	-23	-23	872
61	10,558	-237	-237	673	19,403	-659	-659	9	11,635	-65	-65	765
62	10,321	-272	-272	527	18,744	-699	-699	0	11,570	-104	-104	677
63	10,049	-305	-305	401	18,045	-735	-735	0	11,466	-141	-141	606
64	9,744	-335	-335	295	17,310	-768	-768	0	11,325	-175	-175	550
65	9,409	188	707	207	16,542	246	928	0	11,150	-308	-308	510
66	9,597	180	520	152	16,788	237	682	0	10,842	-331	-331	358
67	9,777	173	339	99	17,025	227	445	0	10,511	-352	-352	223
68	9,951	166	166	49	17,252	218	218	0	10,159	-371	-371	104
69	10,117	166	166	0	17,470	218	218	0	9,788	-371	-371	0

(Notes) 1) This table summarizes SSW and incentive measures (evaluated at 2005 prices) which the typical person experienced at age 55 in each year under existing social security programs.

2) In SSA and PV calculations, we tentatively assume that their values at age 69 are the same as those at age 68 because we do not calculate SSW beyond 69.

3) In OV calculations, we we set k=2.0 and g=0.75 for males and k=3.0 and g=0.75 for females and tentatively assume that the indirect utility is maximized at age 69 because it keeps rising even beyond age 69.

4) The shadowed figures show the maximum SSW in each year.

Figure 2. Incentive measures averaged for ages 55-69

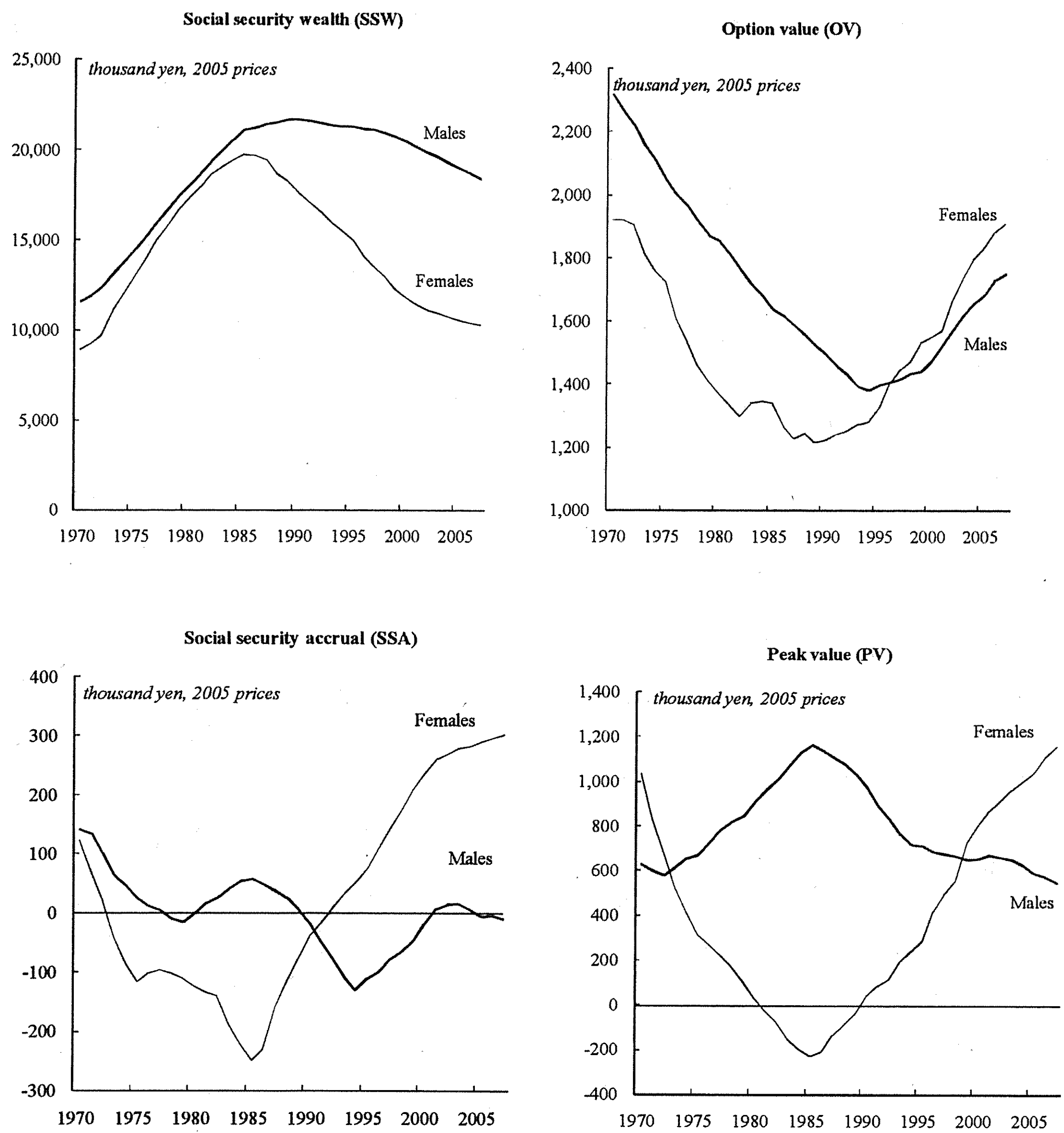


Table 3. Regression results

Incentive measure	Males Model 1 Levels without time trend	Males Model 2 Levels with time trend	Males Model 3 Five-year differences	Females Model 1 Levels without time trend	Females Model 2 Levels with time trend	Females Model 3 Five-year differences
SSA	*-0.0094*	*0.0091*	*-0.0683* **	0.0403 **	0.0352 **	0.0210 **
(S.E.)	(0.0233)	(0.0201)	(0.0244)	(0.0088)	(0.0074)	(0.0080)
Adj. R^2	0.9826	0.9884	0.2757	0.9828	0.9887	0.2685
PV	*-0.0301* **	*-0.0288* **	*-0.0384* **	0.0130 **	0.0128 **	0.0079 **
(S.E.)	(0.0082)	(0.0068)	(0.0071)	(0.0036)	(0.0030)	(0.0029)
Adj. R^2	0.9845	0.9891	0.3966	0.9817	0.9874	0.2745
OV	0.0361 **	0.0511 **	0.0522 **	0.0268 **	0.0330 **	0.0245 **
(S.E.)	(0.0157)	(0.0130)	(0.0130)	(0.0094)	(0.0077)	(0.0070)
Adj. R^2	0.9834	0.9889	0.3287	0.9809	0.9874	0.3044
SSW	-0.0072 **	-0.0079 **	-0.0072 **	-0.0015 *	-0.0016 **	-0.0015 **
(S.E.)	(0.0014)	(0.0011)	(0.0012)	(0.0006)	(0.0005)	(0.0005)
Adj. R^2	0.9859	0.9914	0.4219	0.9808	0.9868	0.2822
No. of observations	120	120	105	120	120	105

(Notes) 1) The dependent variable is the level of employee-based LFP rate in Models 1 and 2, and its five-year difference in Model 3.

2) When estimating OV, we set k = 2.0 and g = 0.75 for males and k = 3.0 and g = 0.75 for females.

3) All models include real GDP per capita, share of manufacturing, and share of firms that have mandatory retirement age, share of college graduates, and life expectancy for each age group as control variables. The complete regression results are available from the authors upon request.

4) The estimation period is 1968-2007 for Models 1 and 2 and 1973-2007 for Model 3.

5) Incentive measures are expressed in units of 1 million yen.

6) Coefficients that are inconsistent with the prediction and/or are insignificant at the 10-percent level are shown in italics.

7) Two asterisks indicate statistical significance at the 1% level and one asterisk for the 5% level.