fiscal year 1999, and will probably keep increasing. The Japanese government will most likely be forced to reduce pension benefits again at the next round of pension reforms, due in 2004, when the current assumptions will have proved too optimistic.

It should be noted, however, that the typical approach to the financial liabilities often ignores the effect of policy changes on labor supply of elderly people. It is important to understand retirement incentive effects in order to assess the full impact of pension reforms on the financial liabilities of the systems. Those effects will be critical in Japan, since postwar baby-boomers will become eligible for public pension benefits in the next few years. The reform that raise labor supply among the elderly can improve the fiscal position of the social security system and other public sector, but the fiscal implications will depend much on the provisions of the system.

This paper aims to illustrate how social security reforms affect the financial balance sheet of retirement income systems through a change in retirement decisions by elderly workers. Section 2 provides a brief picture of retirement programs in Japan. Section 3 presents the base model used for analysis. Section 4 describes the simulation methodology and issues that arise to Japan. Section 5 presents tentative results and discusses their policy implications. Section 6 concludes.

2. Institutional background

2-1 Public pension plans

The principal program for private sector employees in Japan is the *Kosei-Nenkin-Hoken* (KNH), which covers about 85 percent of all employees. Government employees, private school teachers, and employees in agriculture/forestry/fishing organizations are covered by special programs provided by *Kyosai-Kumiai* (mutual aid associations), but those programs have almost the same structure as the KNH. Thus our analysis of public pensions in this paper mainly focuses on the KNH, and treats *Kyosai-Kumiai* members as KNH members.

The KNH operate a two-tier system. One pays flat-rate Basic Pension (*Kiso Nenkin*) benefits, which are applied to all residents: not only employees but also the self-employed and unpaid family workers. Full Basic Pension benefits paid to those with 40-year contributions are about 67,000 yen per month. The other pays earnings-related benefits, which are only for private and public employees. Those benefits are calculated as the "career average monthly earnings" * the number of contribution years * the accrual rate (which differs by birth year). Both benefits are inflation-indexed every year in terms of consumer prices, and adjusted for wage growth every five years[2].

The "normal" eligibility age for full KNH benefits – both flat-rate and earnings-related components – had been 65 years old until 1999, but one could get full benefits at age 60 if he/she retired and stopped working at that age. Since 2000, however, the eligibility age for the flat-rate benefits is to be raised by one year every three years. And since 2013, the eligibility age for the earnings-related benefits will also be raised by one year every three years. These two steps of increasing the eligibility age have been called for by the 1994 and 2000 Reforms. If they are implemented as scheduled, men who were born in 1961 and later and women who were born in 1966 and later will receive no pension benefits until age 65.

It should be also noted that a KNH recipient, who keeps working during ages 60 and 64, can receive reduced KNH benefits subject to an earnings test. This scheme, which is called as the *Zaishoku* Pension, is roughly equivalent to the "early" retirement system in many other OECD countries. If monthly earnings are below 220,000 yen, pension benefits are reduced by 20 percent. If they are above 220,000 yen, the marginal tax rate is 50 percent. For high-salaried elderly workers who earn more than 370,000 yen a month, the marginal tax rate is 100 percent. One has to pay KNH contributions as long as he/she keeps working, although he/she can expect an increase in future pension benefits.

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[2] This wage indexation was abolished in the 2000 Pension Reform. The current system has the price indexation only.

Contributions are based on the employee's monthly standard earnings and shared equally by the employee and employer. The total contribution rate for the KNH Pension — covering both the flat-rate and earnings-related components — is currently 17.35 percent, meaning that an employee and employer contribute 8.675 percent each. A female employee pays premiums at the same contribution rate, while a dependent housewife does not need to contribute.

2-2 Other income support

Unemployment insurance adds temporary income support to retired employees. In many cases, an individual who reaches age 60 leaves the firm where he/she has been working, and starts to receive KNH benefits. At the same time, it is normal to apply for UI benefits when quitting one's previous job, regardless of one's wish to find a new job. UI benefits for those of age 60 to 64 replace 50-80 percent of wage earnings at age 60 for 300 days at most. Thus, there are many cases where the total replacement rate – adding KNH and UI benefits together – is effectively more than 100 percent of income at the first retirement age, probably reducing the incentive to work. Under a new law effective as of April 1998, however, an individual cannot receive UI and KNH benefits at the same time; as long as one is receiving UI benefits, one has to postpone receipt of KNH benefits.

Another income support that potentially interacts with public pension programs is the wage subsidy to elderly workers (referred to as the WS below). This program was introduced in 1994 as a part of the public employment insurance scheme to replace the aforementioned UI benefits. The WS, which is equivalent to 25 percent of the current wage, is provided to an employee – subject to a certain wage ceiling – on condition that he/she is 60-64 years old and his/her wage earnings are less than 85 percent lower than his/her pre-retirement wage at age 60.

This WS program is independent from the public pension scheme, but its economic implications are similar to those of the Zaishoku Pension. Both programs are applicable to the same age group (aged 60-64) and subject to

certain earnings criteria. The WS can be treated as a "negative" premium in calculating social security incentives. The WS equivalent to 25 percent of wage earnings well exceeds the employee's share of KNH contributions (8.675 percent). The combination of the WS and pension premium thus would add to an individual's net pension wealth, although it may not be enough to offset the negative effect from postponing receipt of pension benefits.

2-3 2000 Pension Reform

The 2000 Reform incorporated measures to lower contributions paid by future generations, making it inevitable that the eligibility conditions and benefit system would become less generous than scheduled in the 1994 Pension Reform. In particular, the 2000 Reform called for:

- a 5% reduction in earnings-related benefits,
- a gradual increase in the eligible age of the earnings-related benefits to 65 from 60 since 2013 (in addition to the already-scheduled increase of the eligibility age to 65 from 60 during 2000 and 2013 called for by the 1995 Pension Reform),
- abolishing the wage indexation for pension benefits,
- applying an earnings test for KNH benefits to high-salaried workers who are 65 years old and above, and
- a rise in the ratio of the subsidy from the central government to one-half from the current one-third of Basic Pension benefits (without referring to any specific tax reform).

If these proposals are implemented as scheduled, the final contribution rate for KNH will be eventually pushed up to 25.2 percent (from the current 17.35 percent) in contrast to the previously scheduled 34.5 percent. And the pension fund, which amount to 144 trillion yen at the end of fiscal 1999, will not be exhausted over the next fifty decades and more.

However, the risk that this 2000 Reform fails to raise sustainability of the overall social security scheme is high, because the Reform depends on the seemingly optimistic estimations of population growth and rosy macroeconomic forecasts. Indeed, several simulations conducted by private

think-thanks and researchers show that the pension fund is likely to turn into a deficit by 2050, with more realistic assumptions about fertility rates, interest rates, and inflation rates[3].

3. Base Model

3-1 Data Source

Our analysis is based on the *Survey on Labor Market Participation of Older Persons*, which was conducted in October 1996 and published in December 1997 by the then Ministry of Labor. The survey covers men and women of aged 55 to 69 who were employees, company executives, self-employed, and not working. Our analysis centers on those who used be employees at age 55 and had been working until 1996. The size of the sample we use for analysis is 4,088 out of 21,219 in the survey.

The major problem is that the data from this survey are cross-sectional and not longitudinal. What we know from the survey is an individual's age, current working status, wage income, pension benefits, and so on at the survey date. The survey asks each individual what kind of firm (industry and size) he/she was working for at 55, whether and when he/she would face mandatory retirement, and when he/she wanted to retire (if working at the time of the survey). However, any other longitudinal information, including wage profiles and the actual date of retirement, is not available: what we know from the survey is just whether an individual was retired or still working in the survey year of 1996. Moreover, data on an individual's background, such as education, and family situation, are limited.

The most important quantitative information available from the survey relates to an individual's current wage earnings and his/her social security and other benefits, on which our incentive calculations are based. It is, however, difficult to capture the diversity of incentives in employer-based pension policies, and information about lump-sum retirement benefits is not

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[3] See Seisaku Koso Forum (2001), "Towards the Pension Reform," for example.

available. Moreover, answers about the category and amount of benefits seem at times to be unreliable, probably due to inaccurate and/or limited knowledge among respondents about social security programs. We estimate the "theoretical" value of social security benefits based on projected wage profiles, and make some adjustment if the discrepancy between "theoretical" and "actual" figures is too large to be ignored.

3-2 Cohorts in focus

To estimate the impact of pension reforms on retirement decisions and assess its financial implications, we limit our sample to those who were working at age 55. We use "multiple birth cohorts": that is, fifteen birth cohorts of ages 55-69 in survey year 1996. This is because the sample size of a single birth cohort is very small (around 400). Individuals who are older than age 55 in 1996 are "de-aged" back to age 55 by being given the projected earnings history (which is discussed in the next section) and other characteristics they had at age 55 (which is known from the survey).

Two things should be mentioned about spousal issues. First is how to obtain spousal information, which is needed to calculate family social security wealth (SSW) and other incentives to retire. Matching can be completely made if a spouse is 55-69 years old, since she or he is included in the sample and her or his information is available from the survey[4]. If a spouse's age is below 55 or above 69, however, we cannot know anything about her or him. We exclude the latter type of individual – whose ages tend to be close to 55 or 69 in most cases – from the sample. We believe that this adjustment has no substantial impact on the results, because we "de-age" the observations aged 56 years and over back to age 55 and the average age difference between husbands and wives are in accordance with the national

[4] The question sheets of the survey are sent to randomly-selected households which have at least one household member aged between 55 and 69, and everyone aged between 55 and 69 in the surveyed households is requested to fill in the sheet and send it back to the office. Thus, for example, in the case of a couple of a husband aged 65 and his wife 63, both are included in the survey, whereas in the case of a husband 55 and his wife 53 only the husband is included. We exclude the latter type of couples from the sample.

average.

The second is how to avoid spousal double counting. If both a husband and his wife are included in the sample cohort, we would have their SSW twice in the sum. We will solve this problem by including only men and single women in the analysis and incorporating all benefits received by married women (both from their own work and their husbands') in the calculations for the husbands[5].

The sample, after adjustment, consists of 8,101 people – 3,489 couples, 548 single male workers and 575 single female workers

3-3 Earnings Projections

Backward and forward projections of wage earnings are required to analyze the impact of social security incentives on retirement decisions. With limited longitudinal information, our projections of the age-earnings profiles depend largely on the cross-sectional data. Also, we use information from the *Wage Census* to complement reported individual characteristics observed in the survey. To summarize our methodology, we use: (1) current wage earnings as a benchmark, (2) average age-wage profiles obtained from the Survey for the ages 55-69, and (3) cohort-specific age-earnings profiles in backward projections starting the age 55 and below obtained from the Wage Census.

For earnings projections for the ages 55-69, we rely on average wage growth rates observed from the survey because cohort-specific information is not available. To calculate average wage growth, we regress the logarithm of monthly earnings (for males and females, separately) on an individual's age, experience of mandatory retirement, job categories, firm size at the employee's age of 55, whether a private or public employee at 55, and residential areas. All independent variables are dummies.

Based on this regression, we create each sample's earnings profile for the ages 55-69 using the reported current wage earnings as a benchmark. The wage growth rate is thus set to be the same for each individual: it is

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[5] We also exclude women whose husbands seem to have been dead.

calculated by taking the difference in parameters on the two subsequent age dummies. The timing of mandatory retirement, which is in most cases 60 years old, is important in projecting the earnings profile. We assume that one will face mandatory retirement at 60, regardless of their will to go to secondary labor markets.

To construct earnings histories before age 55, we use age-earnings data from the Wage Census, which is conducted and published every year by the Ministry of Health, Labor, and Welfare. The Wage Census provides average age-wage profiles by industry, firm size and educational background. We project wage earnings backwards using estimated earnings at 55 as a benchmark and the cohort-specific wage curve.

Based on those earnings projections, we compute SSW (Social Security Wealth) and two kinds of incentive measures: PV (Peak Value) and OP (Option Value) at each age for each individual. The technical problem here is how to deal with multiple retirement income programs: KNH, UI, and Zaishoku benefits. In the previous study, we captured the role of multiple retirement programs by creating weighted average incentive measures that incorporated all possible pathways to retirement. We cannot allocate workers across multiple programs based on these weights, since benefits are linked to their wage profiles. Instead, we use the weights to compute the weighted average of each program's benefits.

3-4 Model estimates

In this section, we describe the empirical framework for regression analysis on the impact of social security on retirement. However, we first have to estimate each sample's previous working/retirement status, since our survey tells us only whether each sample is retired or not in the survey year of 1996. Hence, we first explain how to build up the "quasi-longitudinal" data; then we address the reduced form models of retirement decisions.

To estimate models for incentive measures we select from the survey the individuals who were working at age 55 *and* are expected to have kept working until 1995, one year before the survey year. We apply the probit models to them to explain their

retirement decisions in 1996: whether to keep working or to retire.[8] The main problem of our analysis is that we cannot exactly identify those who were working in 1995, due to a lack of longitudinal information. Hence, we first assume that those who were working in 1996 were working in 1995, too. And for those who were already retired, we only use those whose age of retirement can be identified from their reported answers about mandatory retirement and subsequent job experience. Thus, 2,629 men and 1,075 women out of the total sample are estimated to have been working in 1995 – whose statistical characteristics are summarized in **Table 1.**

For baseline simulations, we compute the projected work and retirement trajectory for our cohorts under the pre-2000 Reform scheme, using the two models with PV and OP. We use models that have all controls for earnings, demographics, and sectors. Each model includes SSW. For ages, we have two types of methodologies; "S1" includes linear ages and "S3" incorporates age dummies. Earnings controls consist of projected earnings for next year, average lifetime earnings, and the squares of each. Other controls include property income, dummies for health conditions, new occupational dummies, dummies for four categories of firm size at age 55, and eight dummies of residential areas.

Tables 2a and 2b summarize estimation results for men and women, respectively. For men, the coefficient on PV is negative and significant in both cases of S1 and S3, while we find negative and significant impact of OP on retirement only in the case of S1. For women, the coefficient on PV is negative and significant in both cases of S1 and S3, while it is insignificant in OP models. For both men and women, supporting intuition about income and substitution effects, average lifetime earnings tend to increase disincentive to work, while projected earnings tend to decrease it. The coefficient on SSW is positive in all cases, although insignificant in some cases, suggesting the existence of the "wealth effect" of SSW on retirement; a reduced SSW is expected to encourage people to keep working.

3-4 Predicted probabilities of retirement and pension reform

We can predict a probability of retirement at each age beyond 55, based on

the above-mentioned models and projected earnings. We first compute baseline hazard rates, assuming no policy change from the pre-2000 Reform schemes. Then we consider the three policy changes, the last of which is specific to Japan:

- The "Plus 3 Years" reform calls for a three-year increase in the ages of early and normal retirement age. In Japan, this means shifting the ERA to 63 from 60 and the NRA to 68 from 65.
- The "Common" reform calls for a common system with the ERA of 60, the NRA of 65, a benefit equal to 60% of average real lifetime earnings, a 6% per year actuarial adjustment, and the survivor benefit equal to 100% of her spouse's benefit[6].
- The "JP 2000" reform calls for the NRA of 65 with no ERA, and a 5% reduction in earning-related benefits, reflecting the final stage implied by the most recent pension reform in 2000.

For all of these three reforms, we consider two methodologies of S1 and S3 to check the sensitivity of the results to the treatment of age in the estimated models. We perform these simulations by taking the estimated retirement model, plugging in new incentive measures and possibly new retirement ages in place of the existing ones, and estimating for each individual a new probability of retirement. Also it should be remembered that the Japanese system already has the ERA of 60 and the NRA of 65, and that the JP 2000 reform calls for no benefit at all by age 65[7].

4. Simulation methodology

4-1 Methodology

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[6] In Japan, a widow can receive the maximum of (a) three-fourth of her husband's worker benefit, (b) full of her own benefit, and (c) a half of her husband's worker benefit and a half of her own worker benefit, in addition to her Basic Pension benefit. (a) is chosen in most cases, since women's wage income is much lower than men's, and women work shorter years than men. A widower cannot receive the survivor benefit.

[7] Disability pension benefits are available, but they are strictly targeted to accidentally handicapped people and not used for transitory income support until the normal eligibility age.

The goal of our simulation is to estimate the impact of pension reforms on older workers' net fiscal contributions to retirement income finances. Such reforms will have two effects: (1) an automatic effect on fiscal contributions by changing contributions and benefits for a given work history, and (2) an additional effect through labor supply responses to the reform. We will estimate the fiscal implications of both these effects, using the retirement model. It should be noted, however, that the result will be an estimate of the steady-state impact of the reforms, with the transitory pass neglected for simplicity.

The steps that we take are summarized in what follows. First, we project each worker's wage earnings forward (based on the predicted wage function) and backward (based on the Wage Census), as well as his/her SSW and incentive measures at each age.

Second, we get his/her estimated probability of exit at each age, by multiplying incentive measures (and other time-independent variables augmented for the current age and year) by the estimated coefficients in the probit functions and plug through the normal distribution. We also explicitly account for the probability of dying at age from the official mortality tables, to know whether he/she remains in the labor force, retires, or dies.

Third, we calculate net SSW at each age to those exiting the labor force to retirement and those exiting it to death, corresponding to the social security system that is applied to them. For couples, we average the SSW values over all of the wife states. Net SSW is calculated for the entire family SS payroll taxes and other taxes at each age paid by both spouses.

Fourth, we get the expected net SSW to those exiting the labor force at each age, by multiplying the probabilities of going to retirement and to death by net SSW associated with these states.

Finally, we add the expected net SSW across all potential states to calculate the average SSW that the individual is expected to receive under a given social security scheme. From the government's viewpoint, this average SSW means the net payment to the individual who leaves labor force. And the difference of its level between the baseline case and alternative reform

scenarios quantitatively shows the financial implications of the reforms.

Furthermore, we separate out the fiscal effects of the reforms that arise automatically due to changes in program rules and those that arise due to labor supply responses. We call the former as the "mechanical" effect and the latter as the "fiscal implications of the behavioral effect." We compute the mechanical effect by simulating out the paths of taxes and benefits without assuming any change in retirement behavior: that is, taking the baseline path of exiting the labor market and applying this path the new taxes/benefits structure. We then get the fiscal implications of the behavioral effect as the difference between the total effect and this mechanical effect.

4-2 Issues that arise to Japan

This methodology is largely applicable to Japan, but there are some minor issues that arise to Japan.

First, a wife's choice to keep working and retire does not substantially affect the family SSW when her husband has been dead, although her choice affects SS taxes and other taxes. A widow will receive the maximum of her own pension benefit and survivor benefit, but the latter is usually higher than the former (see footnote 5). Thus, the loop for averaging the (gross) SSW values over the wife states in the case of "exit to death" of her husband can be simplified to calculate just the discounted value of the survivor benefit in most (but not all) cases.

Second, we have to ignore the survivor pension benefit for dependent children for simplicity. We have little information about an individual's family members, and survivor pension benefits for dependent children are generally strict especially if they are older than 18 years old. We also ignore the possibility of divorce after age 55.

Finally, the risk is that we may overestimate the impact on older workers' labor supply in Japan, since there are limited chances to get full-time job after age 60. Most of policy incentives to stimulate working could be induced to firms rather than older workers through a reduction in wage. Our methodology assumes that additional labor supply, which is

stimulated by pension reforms, can be smoothly realized.

5. Simulation results

5-1 Main results

Table 3a shows the PDV of benefits, of SS taxes, and all other taxes, and net PDV of benefits net of all taxes for the Plus 3 Years, the Common, and the JP 2000 reforms in comparison with the base case. For each, the effect of the reform is broken down into the mechanical effect and the fiscal implications of the behavioral effect. The calculations are done using PV and OV models and methodologies S1 and S3 – four types of combination. The numbers are reported in thousand yen per worker.

This table indicates that the financial implications depend on the type of reform, while their extent relies much on the combination of PV/OV and S1/S3. Main facts are summarized as follows. The Plus 3 Years reform makes the negative total effect in all cases, confirming that it will save the net benefit payments by 13.3-18.5%. The Common reform, in sharp contrast, shows the positive total effect in all cases, suggesting that it is not efficient in improving the financial position of Japan's pension system. This is probably because the scheme incorporated by the Common reform is very close to the current scheme; among others, the ERA and NRA are already 60 and 65 years old, respectively. The JP 2000 reform is more effective in saving net benefits than the other two forms, reducing the net benefit by 24.4-35.2%, mainly because it does not allow any pension benefits until age 65 and incorporates a 5% reduction of earnings-related benefits.

It is interesting to divide the impact into the mechanical effect and the fiscal implications of the behavioral effect. In the cases of the Plus 3 Years and JP 2000 reforms, most of the financial effect can be attributed to the mechanical effect; the fiscal implications of the behavioral effect are relatively small and even positive in some models. This probably reflects the actuarial fairness of the current scheme, especially for the earnings-related

component[8]. Postponed retirement increases SS payroll taxes, but at the same time it increase SS benefits, suggesting that the net effect is attributable mostly to an increase in other (income) taxes. However, a change in other tax collections is also limited, since the wage level is low for the older workers. Thus the proposed reforms center on the eligibility conditions and benefit payment scheme, and the impact on tax collections is indirect and limited.

Those results also depend much on the model specifications and estimation methodologies. OV tends to produce a more reduction in net benefits than SV, and S3 tends to produce a more reduction in them than S1. Accordingly, the estimated impact is the biggest for the combination of OV and S3, while it is the smallest for the combination of SV and S1.

Table 3b shows the results in terms of a share of nominal GDP to assess the magnitude of the impact for the whole economy and enable comparisons across countries. Our sample consists of only private sector employees, who are mostly *KNH* members. Public sector employees are covered by *Kyosai-Kumiai*, which has almost the same structure as *KNH* but independent. And self-employed workers receive only Basic Pension benefits and pay the flat-rate contributions. Thus, we scale up the results for private sector employees, estimating what percentage of people aged 55 are covered by *KNH*. In the cases of the Plus 3 years and JP 2000 reforms, the size of the total impact of reforms is in the range between 0.3% and 0.7% of nominal GDP, which is not substantial but cannot be neglected.

3-2 Interpreting the results

Figures 1-3 are useful in interpreting the simulation results. **Figures 1a-c** compare the retirement probabilities by age in the base case and under each reform. **Figure 2** show the net SSW by age of labor force exit in the base case and under each reform. **Figures 3a-c** indicate the fiscal implications of

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[8] In addition, older workers receive WS, a subsidy equivalent to 25% of wage income. While this scheme has net been widely used so far.

behavioral effect by age of labor force exit.

As seen in Figure 1a, the Plus 3 Years reform postpones the retirement age in S3 models, shifting the peak of the hazard rate to 63-64 from the current 60-61. But the efficacy of this reform depends much on how to incorporate ages in model estimations. Figure 1b shows that the Common reform does not produce any clear shift in the age pattern of retirement except for a reduction in the probability of retirement around age 60. This result is consistent with the finding from Table 3a that shows limited efficacy of the Common reform in saving net benefits. In addition, Figure 1c finds that the JP 2000 reform leads to almost the same results as the Plus 3 Year, with a clear postponement of retirement in method S3.

Figures 2 indicate how each reform changes the age pattern of net SSW at age of labor force exit to retirement. The Plus 3 Years and JP 2000 reforms reduce net SSW at each age, encouraging people to work through the wealth effect. But it should be noted that net SSW is relatively close to its current level around the NRA of 60. By contrast, the Common reform increases net SSW after age 60, consistent with the result in Table 3a that shows that reform increases bet pension benefits.

Finally, Figures 3a-c are helpful in understanding why the fiscal implications of the behavioral effect as a whole tend to be smaller than the mechanical effect. Take the cases of the Plus 3 Years reform under method S3 in Figure 3a as an example. The fiscal implications of the behavioral effect are negative at age 60 and 61, suggesting that the reform will encourage people to keep working at those ages. However, the fiscal implications turn positive after those ages reflecting people's postponed retirement and mostly offset the negative effect. After age 65, the figures show no substantial impact, presumably because labor supply of those older people is insensitive to pension reforms. Method S1 produces the same age pattern of the fiscal implications, but the size of impact is much smaller than in the case of model S3.

Figure 3b shows that the Common reform fails to make any substantial behavioral effect, confirming again that it is effectively close to

the current system. Figure 3c shows that the JP 2000 reform makes a remarkable pattern of offsetting behavioral effects before and after age 65, since that reform does not allow no pension benefits until age 65.

Finally, Figure 4 summarizes the fiscal implications of reforms under the combinations of PV/OV and S1/S3. We again observe: 1) the Plus 3 Years and JP 2000 reforms can save net SSW but the Common reform cannot, and 2) the mechanical effect dominates the fiscal implications of the behavioral effect in all cases.

5-3 Distributional issues

The proposed pension reforms seem to have different effects on different income groups. For considering distributional issues, we divide the sample into quintiles according to real family average lifetime earnings and show how a change in net benefit is distributed by lifetime income group. For each quintile, we show two things: 1) the share of the net SSW that accrues to that quintile, and 2) the percent change in the net SSW from the base case.

The results are summarized in Tables 4a-d for each of the PV/OV and S1/S3 combinations. In the cases of the Plus 3 Year and JP 2000 reforms, which succeed in reducing overall net benefits, the lower quintiles reduce their shares of the net SSW and face a larger cut of their net benefits. In the case of the Common reform, which fails to save net benefits in total, the lower quintiles lose the more and the higher quintiles get the more. This result means that the proposed pension reforms are all. This result is consistent with Japan's current pension scheme in Japan. The *KNH* has two components of flat-rate basic benefit and earnings-related benefit, and the proposed increase in the eligibility age is biased toward to a reduction in the basic benefit component, which is relatively harmful to poor workers. To richer workers, on the other hand, the longer period of contributions incorporated by the reforms adds to earnings-related benefits, which partly or more than offset a reduction in the basic benefit.

6. Conclusions

Our analysis has several limitations. First, it is an analysis about the steady-state impacts on some specific cohorts, not about the transition to the new steady state. And the proposed pension reforms cannot be implemented immediately; they have to incorporate many adjustments for cohorts in transition. Second, it does not incorporate any general equilibrium effects that might occur. Finally, we neglect how firms will respond to an increase in labor supply of the elderly; they might reduce wage and absorb some of the impact from reforms.

However, our policy simulations strongly suggest that the proposed pension reforms can mitigate strong pressures on social security finances from aging. Especially, postponement of eligibility age, which is incorporated by the Plus 3 Years and JP 2000 reforms, can significantly reduce net SS payments mainly through the mechanical effect. The fiscal implications of the behavioral effect are relatively small, reflecting the actuarial fairness of the current system. Encouraging work in older age, by reforming incentive measures, should be one of the effective ways to help mitigate pressures on the government budget from aging.

Table 1: Summary Statistics for the Estimation Sample

Males sample size = 2,629

	Mean	Std. Dev.	Min	Max
Retired (Def.I)	0.132	0.339	0.000	1.000
SSW (billion yen)	32.748	9.412	6.100	74.558
SSA (billion yen)	-0.050	2.476	-7.212	6.130
Peak value (billion yen)	1.844	3.761	-7.212	13.319
Option value (billion yen)	63.417	43.952	1.125	396.407
Property income (10 thousands)	2.099	13.850	0.000	500.000
Health condition: not well	0.151	0.358	0.000	1.000
Health condition: bad or sick	0.035	0.183	0.000	1.000
Projected earnings (billion yen)	3.393	2.264	0.100	14.417
Average lifetime earnings (billion yen)	3.486	1.792	0.799	7.080
Square of PE	16.635	25.715	0.010	207.860
Square of ALE	15.359	14.765	0.639	50.126
Age	61.324	3.660	55.000	69.000
Lives with spouse	0.858	0.349	0.000	1.000

Females sample size = 1,075

	Mean	Std. Dev.	Min	Max
Retired (Def.I)	0.186	0.389	0.000	1.000
SSW (billion yen)	33.633	14.838	9.057	80.908
SSA (billion yen)	0.239	1.626	-6.512	6.185
Peak value (billion yen)	1.909	3.003	-6.512	12.761
Option value (billion yen)	106.208	66.216	1.218	442.930
Property income (10 thousands)	0.804	3.836	0.000	66.000
Health condition: not well	0.148	0.355	0.000	1.000
Health condition: bad or sick	0.032	0.175	0.000	1.000
Projected earnings (billion yen)	1.957	1.270	0.120	12.000
Average lifetime earnings (billion yen)	1.985	1.163	0.799	7.080
Square of PE	5.440	10.762	0.014	144.000
Square of ALE	5.292	7.928	0.639	50.126
Age	59.309	3.378	55.000	69.000
Lives with spouse	0.735	0.442	0.000	1.000

Table 2a: Retirement Probits-Males Sample

N=2,629

Model	PV, S1	PV, S3	OP, S1	OP, S3
SSW	0.002	0.005	0.036	0.006
	(0.006)	(0.007)	(0.007)	(0.009)
Incentive measure	-0.110	-0.083	-0.005	-0.001
	(0.012)	(0.034)	(0.002)	(0.002)
Property income	0.007	0.007	0.007	0.007
	(0.004)	(0.004)	(0.004)	(0.004)
Health condition: not well	0.280	0.293	0.282	0.304
	(0.088)	(0.090)	(0.087)	(0.091)
Health condition: bad or s	1.065	1.113	1.069	1.145
	(0.152)	(0.151)	(0.149)	(0.151)
Projected earnings	-0.320	-0.236	-0.977	-0.258
	(0.409)	(0.490)	(0.399)	(0.492)
Average lifetime earnings	0.858	0.803	1.326	0.825
	(0.390)	(0.454)	(0.397)	(0.457)
Square of PE	0.013	0.009	0.047	0.010
	(0.021)	(0.025)	(0.020)	(0.025)
Square of ALE	-0.101	-0.100	-0.126	-0.102
	(0.025)	(0.027)	(0.025)	(0.027)
Age	-0.019		-0.069	
	(0.019)		(0.021)	
Age55		0.516		0.540
		(0.365)		(0.359)
Age56		0.155		0.414
		(0.383)		(0.369)
Age57		-0.285		-0.097
		(0.411)		(0.401)
Age58		0.160		0.426
		(0.391)		(0.391)
Age59		0.348		1.320
		(0.568)		(0.393)
Age60		0.750		1.399
		(0.479)		(0.391)
Age61		-0.048		0.537
		(0.485)		(0.421)
Age62		0.323		0.830
		(0.476)		(0.424)
Age63		0.205		0.642
		(0.458)		(0.448)
Age64		0.663		1.018
		(0.431)		(0.422)
Age65		0.207		0.561
		(0.448)		(0.442)
Age66		0.103		0.487
		(0.501)		(0.484)
Age67		-0.287		0.131
		(0.524)		(0.485)
Age68		-0.161		0.292
		(0.546)		(0.539)
Pseudo R^2	0.177	0.210	0.136	0.207
Other controls	YES	YES	YES	YES

Notes: Other control variables are 9 occupational dummies, dummies for 4 categories of establishment size, and 8 regional dummies. The estimated parameters on these variables are not reported.
Figures in parentheses show robust standard errors.

Table 2b: Retirement Probits-Females Sample

N=1,075

Model	PV, S1	PV, S3	OP, S1	OP, S3
SSW	0.010	0.010	0.014	0.007
	(0.004)	(0.004)	(0.006)	(0.006)
Incentive measure	-0.137	-0.163	-0.001	0.001
	(0.026)	(0.067)	(0.002)	(0.002)
Property income	0.056	0.056	0.058	0.057
	(0.017)	(0.017)	(0.018)	(0.017)
Health condition: not well	0.138	0.194	0.152	0.209
	(0.132)	(0.134)	(0.130)	(0.135)
Health condition: bad or s	1.230	1.242	1.129	1.255
	(0.231)	(0.238)	(0.229)	(0.238)
Projected earnings	-0.288	-0.535	-0.794	-0.664
	(0.461)	(0.485)	(0.440)	(0.482)
Average lifetime earnings	0.330	0.626	0.766	0.618
	(0.536)	(0.539)	(0.536)	(0.540)
Square of PE	0.043	0.061	0.068	0.065
	(0.033)	(0.033)	(0.033)	(0.033)
Square of ALE	-0.095	-0.121	-0.118	-0.110
	(0.071)	(0.065)	(0.072)	(0.066)
Age	-0.029		0.036	
	(0.022)		(0.024)	
Age55		0.321		0.432
		(0.238)		(0.234)
Age56		0.067		0.554
		(0.309)		(0.252)
Age57		0.418		0.843
		(0.286)		(0.247)
Age58		0.060		0.607
		(0.324)		(0.271)
Age59		-0.142		1.253
		(0.601)		(0.279)
Age60		0.225		1.270
		(0.469)		(0.284)
Age61		0.044		1.117
		(0.490)		(0.317)
Age62		-0.433		0.656
		(0.515)		(0.365)
Age63		-0.675		0.454
		(0.521)		(0.380)
Age64		0.275		1.314
		(0.494)		(0.391)
Age65		-0.216		0.795
		(0.542)		(0.454)
Age66		-0.276		0.759
		(0.607)		(0.759)
Age67		-0.981		0.182
		(0.544)		(0.418)
Age68		-0.283		0.699
		(0.725)		(0.616)
Pseudo R^2	0.151	0.172	0.125	0.168
Other controls	YES	YES	YES	YES

Notes: Other control variables are 9 occupational dummies, dummies for 4 categories of establishment size, and 8 regional dummies. The estimated parameters on these variables are not reported.
Figures in parentheses show robust standard errors.