$$\overline{W}_{cc}^{\bullet} = \overline{W}^{\bullet} + \frac{(r-n)B[1-(1+n)t_{cc}]}{(1+r)(2+n)},$$

the latter of which leads to: $\overline{W}_{cc}^{\bullet} > \overline{W}^{\bullet}$ provided the consumption tax rate is lower than 1/(1+*n*), and also to: $\overline{W}_{cc}^{\bullet} < \overline{W}_{c}^{\bullet}$ from (16). It is, however, indeterminate whether or not $\overline{W}_{cc}^{\bullet} > \overline{W}_{i}^{\bullet}$, because a higher benefit requires a higher consumption tax, which in turn raises its rate via price indexation of the benefit.[8] Meanwhile, the CV of net lifetime income is given by

$$CV(W_{cc}^{\bullet}) = \frac{(1+r)\overline{W}}{(1+r)\overline{W} + (1+t_{cc})B} CV(W),$$

which is lower than that in the case of income taxation or consumption tax without price indexation (see (13)). However, we can show that consumption tax with price indexation cannot reduce the CV of net lifetime income from the level with no taxation on the benefit, as far as $n < r$. Consumption tax, if price-indexed, makes both the benefit and the tax rate higher, which adds to the progressivity of consumption tax, but this effect is more than offset by a reduction of net lifetime income with an aging population.

In sum, the analysis in this section concludes:

(i) income tax on the benefit makes average net lifetime income higher than in the case of no taxation on the benefit, while it widens its relative inequality within the same generation;

(ii) consumption tax with no price indexation is preferable to income tax, in that the former makes average net lifetime income higher than the latter, while these two tax policies lead to the same relative inequality of income distribution;

(iii) consumption tax with price indexation makes average net lifetime income lower than

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[8] Simple calculations show that a higher benefit makes average net lifetime income lower provided $r > n$, and that it is necessary for the tax and the benefit to satisfy the condition: $B < [1-(1+n)t_{cc}]\overline{W}/(1+t_{cc})$ in order to make $\overline{W}_{cc}^{\bullet} > \overline{W}_{i}^{\bullet}$. This condition can be simplified to: $B < W/3$ if $n = r = 0$, implying that consumption tax with price indexation is more efficient than income tax if the level of social security benefit is relatively low. This condition becomes stricter with an aging population.

consumption tax with no price indexation and possibly of income tax (but still higher than in the case of no taxation on the benefit), while it makes net lifetime income more equally distributed than those two types of taxation.

Discussions in this section are for a simple social security system that has only a flat benefit and a wage-proportional premium as a baseline, but the key messages are likely to hold with a more realistic system.

3. Empirical Analysis

3.1 Measurement of redistributive effects and progressivity

It is almost impossible to directly measure the impact of social security programs on lifetime income in Japan, because no panel data are available that provide a profile of wage income, social security contributions, and benefits. Our analysis thus depends heavily on cross-section data of the 1996 Survey on the Redistribution of Income, which was conducted and published by the Ministry of Health and Welfare (which is now the Ministry of Health, Labor, and Welfare). The Survey reports an individual's wage, social security contributions and benefits, and income and other taxes, with his/her family, spousal, and occupational characteristics in the survey year, but no longitudinal information is available.

There are several ways to evaluate the overall redistributive effects and progressivity of the system. In this paper, we use three measures. First, we calculate a change in the SCV, for which a larger reduction means more redistribution of income. The SCV is useful in that its change can be easily decomposed as:

$$\frac{SCV(W^*)-SCV(W)}{SCV(W)} = \frac{1}{V(W)}\sum_i \omega_i\left[\left(\overline{W}_i^* - \overline{W}^*\right)^2 - \left(\overline{W}_i - \overline{W}\right)^2\right] + \frac{1}{V(W)}\sum_i \omega_i\left[V\left(W_i^*\right)-V\left(\overline{W}_i\right)\right] + \frac{\overline{W}^2 - \overline{W}^{*2}}{\overline{W}^{*2}}\frac{V(W^*)}{V(W)},$$

where ω_i is a share of each group of a society. The first and second terms of the right hand side indicate changes in the intra-group and inter-group variances, respectively, of income due to redistribution by the social security system. The third term shows the degree of "incompleteness" of income redistribution, which Oshio (2002) discussed in more detail. The social security system is usually incomplete in terms of income redistribution, in that its benefits are covered not only by employees' own contributions but also employers' contributions and government subsidy (which is eventually to be financed by tax), making the average net income higher than gross income, thus lowering the SCV[9]. We have to take into account this incompleteness in order to precisely assess redistribution policies.

Second, we compare the Gini indices before and after social security taxes and benefits. The progressivity can be gauged by the "effective progression" (EP) measure of Musgrave and Thin (1948), also used by Coronado *et al.* (2000) and others:

$$EP = \frac{1 - Gini_{AT}}{1 - Gini_{BT}}$$

where $Gini_{AT}$ and $Gini_{BT}$ are before-tax-and-benefit and after-tax-and-benefit Gini indices. A value of one indicates that $Gini_{AT}$ and $Gini_{BT}$ are the same, and that social security has no impact on income distribution. A value greater than one indicates a progressive system, and a value less than one indicates regressivity of the system.

Third, we compare the magnitude of the net social security tax by income class. The net social security tax rate is defined as the magnitude of the difference between the present discounted value of premiums or taxes paid and benefits received, relative to gross lifetime income. If higher income individuals face a higher net social security tax rate, we can

[9] This incompleteness could be caused by an insufficient sample size rather than institutional factors. Our sample size, however, seems to be large enough to neglect this possibility and the data are randomly selected.

conclude that the system is progressive. We focus on this tax rate when assessing the redistributive impact of policy reforms in 3.4.

First, let us provide a rough picture of income redistribution through the social security system as a whole?including all members of *Kosei Nenkin, Kyosai Kumiai,* and *Kokumin Nenkin*?on an annual basis. The top part of Table 1 summarizes income redistribution through the social security programs as a whole, based on all individuals classified into two age groups: the young (aged 20-59) and the old (aged 60+). The sample size is 18,253, with 12,888 young and 5,365 old individuals of all kinds of occupational status, including non-working housewives. Income data are on an individual basis, with net income calculated as gross income plus social security benefits minus premiums. Gross income in the table is the one reported by each individual in the Survey without any adjustment (see in 3.2).

As can be seen from this table, a significant part of a 21.3% reduction in the SCV is attributable to the "incompleteness" of the programs, which reduces the SCV by 13.3% points. This is consistent with a gap between averages of net and gross income caused by two factors: first, employers pay half of required premiums (gross income reported in the Survey excludes employers' contributions), and second, the government subsidizes one third of the flat Basic Benefit given to the elderly. Aside from the effects of this incompleteness, the social security programs reduce the inter-age group variance of annual income by 4.6% points through income transfers from the young to the old, and they reduce the intra-age group variance by 3.3% points, mainly through income redistribution among the young.

Then we focus on employed workers and pensioners, both of whom seem to be *Kosei Nenkin* or *Kyosai Kumiai* members. We select those (4,876) who are aged 20-59 and pay *Kosei/Kyosai* premiums and those (2,154) who are aged 60+ and receive *Kosei/Kyosai* benefits. The latter individuals are considered to have been employed workers, part-time or full-time, and paid contributions to *Kosei/Kyosai* programs before age 60. The bottom part of Table 1

summarizes the results, which are different from those for all individuals. The redistributive impact of *Kosei/Kyosai* programs, which lowers the SCV by 36.5%, is somewhat stronger than that observed for all individuals. This is largely due to substantial income transfers from the young to the old, in line with a remarkable reduction of the inter-age variance of net income. On the other hand, the SCV for the young remains little changed, because premiums are basically wage-proportional. A reduction of the SCV for the old is mostly due to a rise in net income, which is boosted by the benefit. The level of the incompleteness effect is almost the same as that observed for all individuals.

The numbers in the last rows in the both parts of Table 1 report the effective progression *of the social security programs: 1.206 for the total sample and 1.227 for Kosei/Kyosai members.* These values indicate that the current social security system is progressive in terms of annual income, which is in line with the above-mentioned results based on a change of the SCV.

3.2 Modifying annual income and setting up lifetime income

To quantify the redistributive effects of social security more precisely, we modify and reorganize the data from the Survey. First, we modify "gross income" so that it includes employers' *contributions to social security, because gross income reported in the Survey excludes them.* Consequently, gross income hereafter means total compensation paid by an employer, which is equivalent to "employment compensation" on a national accounts basis. We need to make this modification to get a comprehensive picture of income redistribution. We also assume that this redefined gross income is fixed regardless of policy changes; for example, even if a new system allows employers to pay no social security contributions, they are assumed to make the same contributions as they have to pay under the current system on wages.

When calculating this redefined gross income, we take into account the relationships among redefined gross income (W_a), reported gross income (W_a^R), and "standardized" income

[*hyojun hoshu*] (on which the social security premiums are levied and which is capped with *A* as the maximum for calculating premiums) (W_a^S):

$$W_a^R = W_a - \frac{t_0}{2} W_a^S, \quad W_a^S = \min\left[A, (1-\lambda) W_a^R\right],$$

where t_0 is the premium rate and λ denotes the share of bonus payments in reported gross income. Assuming for simplicity that λ is equal for all employees and neglecting the employers' contributions to other social security programs, we estimate gross income from the reported one by

$$W_a = \left[1 + \frac{(1-\lambda)t_0}{2}\right] W_a^R \quad if \; W_a^R \leq \frac{A}{1-\lambda},$$

$$W_a = W_a^R + \frac{t_0 A}{2} \quad otherwise.$$

Reflecting the current *Kosei Nenkin* program, we set t_0=0.165 and *A*=7,080,000 yen (=590,000 yen/month x 12 months), both of which are statutory parameters in the survey year of 1996, and also that λ =1/4 is close to the average among Japanese employees.

Second, and more importantly, we have to set up lifetime income. Because no panel data are available in Japan, we reorganize the micro-data of the Survey to roughly estimate lifetime income, and then we evaluate the potential redistributive effects of the social security system, focusing on the *Kosei Nenkin* program.

We reorganize the micro-data in the following ways. First, we choose only male employees in the private sector aged 59 or under from the Survey. Second, we classify these individuals into eight age groups at intervals of five years, from 20-24 years old to 55-59 years old. Third, we divide each age group into 20 income classes, to get 160 (=8 x 20) "cells" in total. Fourth, we calculate average income and *Kosei Nenkin* premiums for each cell through age 50-59. Then, we assume that each individual stays at one of 20 income classes at each

of the life stages and earns income and pays premiums, which are estimated to be earned on average at each cell based on the micro-data[10].

Naturally, each individual may move from one income class to another at each life stage. So, we tentatively define "the degree of immobility" of income classes as α $(0 \leq \alpha \leq 1)$; if the individual belongs to income class *j* at any life stage, the individual will remain in the class *j* at the next life stage with a probability of $(1+2\alpha)/3$x100%, and move to the neighboring class *j*-1 or class *j*+1 with a probability of $(1-\alpha)/3$x100%, respectively (as illustrated in Figure 1). The individual is assumed to move to no other classes for simplicity. And if the individual belongs to either the 1st (the poorest) class or the 20th (the richest) class at any life stage, we assume that the probability of remaining in that class is $(2+\alpha)/3$x100% at the next stage, and that the probability of moving to either the 2nd class or the 19th class is $(1-\alpha)/3$x100%. Lifetime income is calculated as the expected value of the present discounted income obtained by this simulation.

If α =1, that is, if we assume no mobility between income classes, each individual will continue to belong to the income class to which he belongs when he is in the 20-24 age bracket until they reach the 55-59 age bracket. Therefore, the income distribution observed by the cross-section analysis of the age groups from the 20-24 to 55-59 age brackets will be presented in exactly the same form as it is. However, it is easy to prove that whatever value α may have?that is, whatever lifetime income distribution may look like?the annual income distribution shown in the Survey will be reproduced as it is. Put another way, we create synthetic streams of individuals' lifetime income that would always reproduce the annual income distribution shown in the Survey. We ignore here a variety of factors affecting income

[10] In the United States, there have been several pieces of research using arbitrary levels of income for different groups to analyze intragenerational redistribution of social security. See Boskin, Kotlikoff, and Puffert (1987) for example.

redistribution, such as cohort effects and technical development. However, we believe that this is one of the most easily tractable methodologies for grasping a rough picture of lifetime income distribution, which is consistent with the cross-section actual data, especially with limited longitudinal information.

For calculations of social security benefits, we assume that *Kosei Nenkin* members pay premiums for forty years from 20 to 59 years of age, retire completely at age 60, and then depend entirely on benefits (without any other income) until they die at age 80. The benefit multiplier (b) for the wage-proportional component of the benefit is 0.3 (for those who have paid premiums for forty years), and the amount of the flat Basic Benefit (B) is 1,560,000 yen (=65,000 yen/month x 12 months x 2 persons) a year, which is paid to them and their wives.[11] For simplicity, we assume no price and wage inflation, which means that the wage proportional component of the benefit is proportional to?that is, 30% of?the average nominal annual wage earnings. The data for pension benefits and retirement lump-sum payments for the elderly can be obtained from the Survey, but are disregarded because it is impossible to trace the relations with their income when they were active workers. Income other than employment income, such as interest and dividend income is also ignored for the same reason.

3.3 Redistributive effect of the *Kosei Nenkin* program

This section provides a simple and rough assessment of the redistributive effect of the current *Kosei Nenkin* program, based on our society, which is composed of 240 individuals in total (12 age groups (20-24 to 75-79 years) x 20 income classes). Table 2 summarizes it. We assume that the population shrinks 0.5% at an annual rate, close to the trend in recent decades, meaning that older age groups occupy higher shares of population.

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[11] Our samples are all males and we assume that they all have non-working dependent wives, who get the flat Basic Benefits without any contributions.

First, we measure progressivity on an annual basis, using the 16.5% premium rate and leave the "incompleteness" of the system as it is[12]. As reported in the "Incomplete System" part of Table 2, the SCV of gross annual income of these groups is 0.986, which is somewhat higher than the actual value of 0.825 shown in Table 1 (2). This difference is mainly due to the assumption in Table 2 that individuals have no earnings except social security benefits after retirement, leading to higher differentials of annual income between young and old. The *Kosei Nenkin* program reduces the SCV by 65.4% but 11% points of it (not shown in the table) must be fulfilled by resources other than *Kosei Nenkin* premiums, in line with the result that average net annual income is 14.8% higher than gross income. Besides, the estimated effective progression is 1.4898, confirming the system's substantial redistribution on an annual basis.

Now we focus on the redistributive effects on a lifetime basis. We compare the results with three different interest rates (i=1%, 2%, and 3% at an annual rate) and three degrees of immobility of income classes (α =0, 0.5, and 1). As can be clearly seen in Table 2, the redistributive effects on a lifetime basis are much more limited than on an annual basis, and depend on the interest rate as well as the degree of immobility of income classes. The reduction of the SCV is in the 8-16.1% range and the effective progression is in the 1.01-1.02 range, both of which are much smaller than observed on an annual basis[13]. A higher interest rate reduces the progressivity of the *Kosei Nenkin* program, because it lowers net lifetime income due to a PAYGO structure and increases its relative inequality. Indeed, if the interest rate is as high as 3%, net lifetime income falls short of gross income, despite the government

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[12] However, it should be noted that employers' contributions are reflected in the calculations, unlike in Table 1.

[13] Using Dutch micro data, Nelissen (1998) reported similar results to this paper, including the fact that the lifetime income-based redistribution effect of social security tends to be less than annual income-based effects, and that if the discount rate rises, redistribution effects decrease. Nelissen (2000) also compared the redistributive impacts of several Dutch social security programs on a lifetime basis.

subsidy for the benefit. On the other hand, lower mobility of income classes?that is, a higher value of α ?reduces the progressivity of the system, but not substantially because it raises the inequality of both gross and net income.

How will these results change if we adjust the premium rate to make the system "complete," that is, to make total premium revenues and total benefit payments balanced every year? By making the system complete, we provide a steady-state picture of intragenerational redistribution in the "Complete System" part of Table 2. The premium rate is endogenously solved as 37.5%, which is much higher than the current 16.5%, and strongly raises concerns about the sustainability of the current system, which relies heavily on future generations' burdens and/or financial sources other than social security premiums[14]. This high premium rate adds to redistributive effects and progressivity on an annual basis, but it reduces them substantially on a lifetime income basis, mainly due to a sharp drop in average net income under an aging society. If the interest rate is as high as 3% and there is limited mobility of income classes, it is quite difficult to justify the current system, as it reduces lifetime income by 17% but makes little improvement in the equality of income distribution.

3.4 Policy simulations

This section makes some policy simulations and compares the impacts of five pension and tax reforms on lifetime income and its distribution, taking as a benchmark the current system, which is made "complete" by the endogenously solved premium rate (37.5%), and assuming

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[14] This endogenously determined premium rate in our model is not affected by the assumptions on the interest rate or the degree of income class immobility, because 1) it is determined to balance premiums and benefits on an annual basis and 2) the actual distribution of annual income is reproduced regardless of the immobility of income class. On the other hand, 37.5% seems to be prohibitively high, but the Ministry of Health, Labor and Welfare stated in its report (May, 2002) that the premium rate has to be eventually raised to 29-35% to maintain the current level of pension benefits. In addition, these figures in MHLW's estimates do not include taxes to finance the government subsidy for the Basic Pension benefits.

that the interest rate is 2% and the degree of immobility is 0.5. We conducted several simulations assuming different values for the degree of immobility, obtaining only minor differences in results.

First, we remove the cap on earnings and take into account each individual's full monthly income (excluding bonus payments) (reform I). Discussions in 2.4 suggest that this reform will reduce average net income, whereas its redistributive effect is indeterminate because the intra-group variance of net lifetime changes in opposite directions for the two income classes. Table 3 shows that the premium rate falls to 27.2%, reflecting a broader tax base, and that the redistributive effect becomes much stronger with a limited change of average net income.

Figure 2, which compares each reform's impact on lifetime income by income class, helps to explain this result. In this figure we compare the magnitude of the net social security tax relative to gross lifetime income. Under the current system, upper middle income classes face a higher net tax rate than any other class, largely because the cap system reduces the decrease in income for higher income classes. Removal of the cap called for by reform I makes the tax curve slope monotonically upward, enhancing the overall progressivity of the system. In addition, tax reductions in lower income classes and tax increases in higher income classes largely offset each other, leading to a limited increase in the average net lifetime income. Once the cap is removed, shifting the tax base from monthly income to annual income (which includes bonus payments)[15] does not matter in our model, provided we assume that the share of bonus payments is the same (1/4) for all individuals, and that the government reduces the benefit multiplier (to 22.5% [=30% x (1-1/4)]) to keep the level of

[15] This reform was actually implemented as of April 2003. However, it should be noted that its impact will not be recognized soon, because it will take several years for the base for calculating wage-proportional benefits to completely shift to annual income from the current monthly (standardized) income. Thus, we should interpret the simulation results reported here as a long-run, potential impact of the reform. In our simulations, the benefit multiplier is endogenously solved to be 24.81% in reform I.

benefits unchanged.

For reform II, we remove the wage-proportional component from the benefit on top of reform I. Individuals now pay a wage-proportional premium when young (with no cap) and receive a flat benefit when old. As implied in the discussions in 2.1, this reform is expected to raise net lifetime income, but widen its relative inequality, making the government face a trade-off between efficiency and intragenerational equity. According to our simulation, the required premium rate falls remarkably to 14.3%, which suppresses the reduction of average lifetime income to 7.2%. On the other hand, the reduction of the progressivity from reform I becomes quite limited, probably because a remarkable rise in average income appears to largely offset the effect of an increase in its variance of income. This situation is also consistent with a substantial downward shift of the tax curve in Figure 2, which shows an increase in net lifetime income across income classes, and contributes to a reduction of its relative inequality.

Accordingly, we can state that downsizing the social security system to a simple one whose benefit has only a flat component succeeds in raising net lifetime income on average, without substantially raising its relative inequality compared to the current system. On an annual income basis, by contrast, it leads to a substantial reduction of progressivity, because the young pay less and the old receive less.

Reform III uses income tax, which is commonly applied to wages earned by the young and benefits received by the old, instead of premiums, to finance the flat benefits. The tax base includes bonus payments. The tax rate is now endogenously solved as 12.5%, which is somewhat lower than the premium rate 14.3% in reform II, because not only the working young but also the retired old finance benefits. In line with expectations based on the discussions in 2.5, a shift to income taxation suppresses a reduction in average lifetime income and reduces the progressivity of the system, both compared to reform II. Progressivity on an annual

income basis also falls, because the old have to pay taxes.

Reform IV applies consumption tax with no price indexation instead of income tax to finance the benefits. In our simple model, net lifetime income (before consumption tax) is proportional to the sum of gross lifetime income and (not price-indexed) benefits. Hence, a reduction of the SCV and effective progression are the same in both reforms III and IV. This result contrasts with that on an annual basis, which shows that consumption tax is less progressive because the old have to pay more taxes than under income taxation. Meanwhile, a reduction of average lifetime income is more limited in reform IV than in reform III, suggesting that consumption tax with no price indexation is preferable to income tax.

It seems, however, to be more realistic to presume price indexation for the social security benefits when introducing consumption tax. Reform V attempts to do this. Consumption tax with price indexation makes average net lifetime income somewhat lower than in the case of no price indexation, but still higher than in the case of income tax. However, it makes net lifetime income more equally distributed than those two reforms, but still less than in the case of no taxation. Looking again at Figure 2, we recognize the possibility that lower income individuals can be better off net even under a PAYGO system, once the social security benefit is limited to its flat component. The introduction of consumption tax raises this possibility, because it can reduce the decrease of average net income[16].

Figure 3 plots a combination of a change in average lifetime income and a reduction of the SCV reported in Table 2, to help compare each reform in terms of efficiency and intragenerational equity[17]. Starting with the current system as a benchmark, upward and

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[16] This appears to contradict the conventional view that emphasizes the regressivity of a consumption tax, considering that lower income individuals have a higher propensity to consume. In our model, all individuals spend all of their lifetime income through life, thus the propensity to consume through life is equal to one for all individuals.

[17] We can draw almost the same figure if we use effective progression instead of a reduction of the SCV.

rightward shifts indicate improvements of efficiency and equity, respectively. Reform I reduces inequality of income, but little improvement in average income makes it less attractive, especially compared to reforms II-V. Accordingly, removing the cap does not appear to be enough. Reforms II-V, which call for scaling down the social security benefit to only a flat component on top of removing the cap, are all preferable to the current one in terms of both efficiency and equity.

Which is the best choice? Reform III is clearly inferior to reforms IV and V as can be clearly seen in the figure, but it is difficult to compare the remaining three. Reforms IV and V are superior in terms of efficiency, whereas reforms II and V are relatively desirable in terms of equity. Taking into account a small difference in the reduction of the SCV between reforms II and V, as well as a small difference in the reduction of average income between reforms IV and V, and also considering that having no price indexation incorporated in reform IV is difficult in practice, reform V could be the most desirable and plausible choice; that is, it appears advisable for the government to finance the flat social security benefit with consumption tax and price indexation, provided it wants to maintain a PAYGO system.

Of course, this is just a rough comparison without any rigorous judgment criteria, and the relative performance of each reform depends on assumptions of economic and demographic variables. Moreover, the government has another choice: shifting to a fully funded system, which is located at the origin in Figure 3. This reform appears to improve efficiency over the current system[18], but loses progressivity, suggesting that the government needs another policy measure to redistribute lifetime income within the same generation.

4. Concluding Remarks

[18] As mentioned in note 3, we ignore the need to compensate the existing pension liabilities.

This paper investigates how a social security system redistributes lifetime income within the same generation in Japan. As is widely recognized, a PAYGO social security system reduces net lifetime income with an aging population, because it entails income transfers from the young to the old. Even on a lifetime basis, however, it may redistribute income from high-income individuals to low-income individuals due to its progressive structure. Hence, it is important to assess the intragenerational redistribution of a PAYGO social security system.

The key results of our analysis based on a simple life-cycle model and policy simulations using data from the 1996 Survey on the Redistribution of Income are summarized as follows. First, the redistributive effects and the progressivity of the current social security system are much more limited on a lifetime basis than observed on an annual basis. Also, the "incompleteness" of the system makes it difficult to capture the whole structure of its progressivity. Second, shifting to a simple system that consists of a flat benefit and a wage-proportional premium and has no contribution cap can be one of the most desirable PAYGO reforms with an aging population, because it can suppress a reduction of net lifetime income on average, as well as reduce its relative inequality within the same generation. Third, once the system is simplified, financing a price-indexed flat benefit with consumption tax appears to be a good choice in terms of both efficiency and intragenerational equity.

Our analysis, however, has several limitations and many issues remain to be addressed. Due to a lack of longitudinal information, our estimation of the redistributive effects relies heavily on data that are synthetically reorganized from cross-section data from the Survey. Heterogeneity regarding family structure, mortality, and other factors, which is totally neglected in this paper, would likely provide different pictures of income distribution, as already demonstrated by earlier research in the United States. In particular, more labor force participation by women would affect the overall progressivity of the social security system.

Finally, our comparative statics, which focus on the policy impact on steady states and ignore the issues how to compensate for existing pension liabilities, cannot provide a comprehensive assessment of policy reforms.

References

Boskin, M. J., L. J. Kotlikoff, D. J. Puffert, and J. B. Shoven (1987) "Social Security: A financial appraisal across and within generations," *National Tax Journal,* Vol. 40, pp. 19-34.

Breyer, F. (1989) "On the intergenerational Pareto efficiency of pay-as-you-go financed pension systems," *Journal of Institutional and Theoretical Economics*, Vol. 145, pp. 643-658.

Coronado, J. L., D. Fullerton, and Th. Glass (2000) "The progressivity of social security," *NBER Working Paper* 7520.

_____, _____, and _____ (2002) "Long-run effects of social security reform on Lifetime Progressivity," in M. Feldstein and Jeffrey B. Liebman, ed., *The Distributive Aspects of Social Security and Social Security Reform*, Chicago: The University of Chicago Press, pp. 149-205,.

Geanakoplos, J., O. S. Mitchell and S. P. Zeldes (1998), "Would a privatized social security system pay a higher rate of return?" in D. Arnold, M.Graetz and A. Munnell, eds., *Framing the Social Security Debates,* Washington, D.C.: Brooking Institution, pp. 137-156.

Gustman, A. and Th. Steinmeier (2001) "How effective is redistribution under the Social Security benefit formula?" *Journal of Public Economics*, Vol. 82, No. 1, pp. 1-28.

Hatta, T., N. Oguchi, and W. Sakamoto (1998). "Nenkin kaikaku to sedaikan saibunpai [Public pension reform and intergenerational redistribution]," *Quarterly of Social Security Research* Vol. 34, No. 2, pp. 155-164.

Liebman, Jeffrey B. (2002). "Redistribution in the current U.S. social security system," in M. Feldstein and J. B. Liebman, ed., *The Distributive Aspects of Social Security and Social Security Reform*, Chicago: The University of Chicago Press, pp. 11-48.

Ministry of Health, Labor, and Welfare (2002). *White Paper on Health, Labor, and Welfare.*

Musgrave, R.A. and T. Thin (1948). "Income Tax Progression 1929-1948," *Journal of Political Economy,* Vol. 56, pp. 498-514.

Nelissen, J. H. M. (1998). "Annual and lifetime income redistribution by social security," *Journal of Public Economics,* Vol. 68, pp.223-249.

_____ (2000). "Lifetime income redistribution by social security," *Journal of Population Economics*, Vol.8, pp.89-105.

Ohtake, Fumio and Makoto Saito (1999). "Shotoku fubyodoka no haikei to sono seisakuteki gan'i [On the Income Inequity during the 1980s: Causes and implications]," *Quarterly of Social Security Research,* Vol. 35, No. 1, pp. 65-75.

Oshio, Takashi (2002). "Intra-age, inter-age and lifetime income redistribution," *Journal of Population and Social Security*, Vol. 1, No.1, pp. S36-S49

Shimono, Keiko and Toshiaki Tachibanaki (1985), "Lifetime income and public pension," *Journal of Public Economics*, Vol. 26, 75-87.

Sinn, Hans-Werner (2000). "Why a funded pension system is useful and why it is not useful?" *NBER Working Paper* 7592.

Takayama, Noriyuki *et al.* (1990). "Jinteki shisan no suikei to koteki nenkin no saibunpai kouka [Estimation of Human Assets and Redistributive Effects of Public Pensions]", *Keizai Bunseki* 118.

_____ and Yukinobu Kitamura (1999). "Lessons from generational accounting in Japan," *American Economic Review*, Vol.89, pp. 171-175.

Terui, Hroshi and Takatoshi Ito (1994). "Misekake no fubyodo to shin no fubyodo [Apparent inequalities and true inequalities: A simulation analysis using an overlapping generations model]" in Tsuneo Ishikawa ed., *Nihon no Shotoku to Tomi no Bunpai* [*Income and Wealth Distribution in Japan*], Tokyo: University of Tokyo Press, pp. 279-320.

Table 1 Income reditribution of the social security system as a whole

(1) Total

[sample:18,253 (young 12,888, old: 5,365)]

Gross Income (1,000 yen)	average	st. dev.	SCV
Total	2,385	3,494	2.147
Young (age 20–59)	2,914	3,530	1.468
Old (age 60+)	1,114	3,051	7.500
Gini Index (G_{BT})			0.662
Net Income with Social Security (1,000 yen)	**average**	**st. dev.**	**SCV**
Total	2,579	3,352	1.690
Young (age 20–59)	2,789	3,408	1.494
Old (age 60+)	2,075	3,157	2.315
Gini Index (G_{AT})			0.593
Reduction in SCV (%)			
Total			21.3
Inter-age group			4.6
Intra-age group			3.3
Incompleteness			13.3
Effective Progression [$=(1-G_{AT})/(1-G_{BT})$]			1.2057

(2) Private and public employees' pension programs

[sample:7,030 (young 4,876, old: 2,154)]

Gross Income (1,000 yen)	average	st. dev.	SCV
Total	3,867	3,511	0.825
Young (age 20–59)	5,128	2,998	0.342
Old (age 60+)	1,012	2,853	7.953
Gini Index (G_{BT})			0.475
Net Income with Social Security (1,000 yen)	**average**	**st. dev.**	**SCV**
Total	4,239	3,068	0.524
Young (age 20–59)	4,838	2,884	0.355
Old (age 60+)	2,882	3,042	1.114
Gini Index (G_{AT})			0.355
Reduction in SCV (%)			
Total			36.5
Inter-age group			22.6
Intra-age group			1.0
Incompleteness			12.8
Effective Progression [$=(1-G_{AT})/(1-G_{BT})$]			1.2269

(Source) The micro data from the 1996 Survey on the Redistribution of Income.

Figure 1 Simulated Life (an Example)