Macroeconomic and Fiscal Impacts of Japan’s Aging Population
with a Specific Reference to Pension Reforms

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The views expressed here are the author’s and do not represent those of the Economic Planning Agency
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Abstract

The aging of Japan’s population will affect both macroeconomic and fiscal developments in the country. The larger the increase in elderly population, the more inter-generational income transfers are incurred, with heavier burdens levied on the working generations. In addition, the risk is that the government deficit will grow without control due to a substantial increase in social security payments.

In Part I of this paper, we summarize the falling fertility rates and increased longevity rates, which are major factors underlying the rapid aging of Japan’s population, and their macroeconomic and fiscal implications. In Part II, we forecast labor market and macroeconomic projections up to the year 2050. We then go on to discuss the fiscal impacts of an aging population focusing on public pensions and examine possibilities for reducing the excessive burden of the working generations in their support of the elderly.

Our econometric projections, which explicitly analyze the interaction between the public sector strategies and the economy, clearly indicate the vulnerability of the current system to the pressure from demographic developments. To put the fiscal position on a sustainable path and to contain a substantial rise in taxes and contributions, the social security system needs additional adjustments.
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Introduction

The aging of its population is a major challenge for Japan’s economy and society. Japan’s labor force is projected to decline in the twenty-first century with the falling fertility rates and the increasing number of retirees. Household savings, which finance capital accumulation, are likely to decline with the higher ratio of the elderly who withdraw their savings for their retirement years. An increasing shortage of both labor and capital will deteriorate the expected growth of the Gross Domestic Product (GDP) and the per capita income.

The share of the elderly in the total population is projected to rise steadily from 14.6 percent in 1995 to 26.5 percent in 2025, when the postwar baby-boom generation reaches age 75 and above. However, this is only the first peak of the aging; the old age dependency ratio will become 32.3 percent at around 2050 -- at the second peak -- when the second baby-boom generation reaches retirement age. However, the estimated dependency rate at the second peak is vulnerable to the development of fertility in the coming decades. If the fertility ratio recovers significantly -- as projected in the previous population estimate commonly used for the official social security projections -- the ratio of the elderly in 2050 will be much lower.

Demographic pressures will affect both macroeconomic and fiscal developments. The larger the increase in elderly population, the more inter-generational income transfers are incurred, with heavier burdens falling on the working generations. The working generations will thus suffer from both lower income growth and from higher tax burdens for financing the social security scheme. There is already growing pessimism that future generations will be worse-off than the current generations through deteriorating living standards arising from the population aging.

Nevertheless, the increasing burden of the aging of the population is not inevitable. Longevity, a major factor for the aging of the population, is a result of increasing per capita income and medical care, thanks to the country’s successful economic development. That the average person can live longer usually means that he can also work longer. Thus, if a certain portion of the elderly postpone their retirement, the labor force will increase and the average household savings ratio will rise, thereby giving rise to higher economic growth. In addition, both an increase in the number of the contributors and a decrease in the beneficiaries will significantly improve the social security balance. Reversing the trend of earlier retirement is a major key to cope with the aging of the population.

In the first part, we summarize the falling fertility rates and longevity, which are major
factors underlying the rapid aging of Japan’s population, and their macroeconomic and fiscal implications. In the second part, we forecast labor market and macroeconomic projections up to the year 2050, the second peak of the aging, when changes in the participation ratios of women and older persons will be particularly important. We then discuss the fiscal impacts of an aging population -- focusing on public pensions -- and end by examining possibilities for reducing the excessive burden of the working generations in their support of the elderly. We also offer some recommendations concerning public pension reforms.
Part I

1. Major Factors Behind Japan’s Rapidly Aging Population

Although the share of the elderly in the total population is growing in many developed countries, the most striking feature of this phenomenon in Japan is the high speed at which it is occurring. The reasons for it are closely related to Japan’s swift economic development, which has triggered rapid social changes.

Fertility Trends

Japan’s fertility ratio fell sharply from 4.5 in 1947 (the postwar baby boom) to 2.1 in the 1960s, and to 1.43 in 1995 (1). The initial postwar decline in the fertility ratio was mainly due to a fall in the average number of children per family, reflecting a shift from the agricultural to the service sector, and the migration of the population from rural to urban areas. In contrast, the decline in fertility that has taken place from the early 1970s to the present has been mainly due to the postponement of first-time marriage for women. The major factors behind women delaying marriages are their rising enrollment in colleges and resulting expanded job opportunities. The higher their earnings, the more costly it becomes for them to quit their jobs. Thus, so long as there is a trade-off between marriage and child bearing on the one hand and pursuing careers on the other, the age of their first marriage will continue to rise. Besides, the smaller number of children per family by itself stimulates households’ investment in women’s college education, thus opening up the possibility for a vicious circle between fertility decline and women’s higher education. This self-generating process of fertility decline, if not prevented by policy measures, is likely to continue in the near future. An effective policy to counter the trend of fertility decline is the provision of nursery services, which are expected to reduce the trade-off between child-rearing and careers.

Longevity

Another reason for Japan’s increasingly large elderly population is that Japan has the highest life expectancy of all major industrial countries. Average life expectancy for males has increased from 50.1 years in 1947 to 76.4 years in 1995, and for females from 54.0 years to 82.9 years during the same period (2). Initially, increased life expectancy was due to a sharp fall in the mortality rate among children under one year old -- thanks to improvements in nutrition and sanitary conditions. Better health care for the elderly has also significantly increased life expectancy at retirement age and beyond. In Japan, the average years remaining at age 65 for males and females were 16.5 and 20.9, respectively, in 1995. Increased life expectancy reflects a rapid rise in Japan’s average per capita income and medical standards in the postwar period. Also, more equal
distribution of both income and medical services have contributed to giving Japanese the longest life expectancy of all OECD member-countries.

**Future demographic trends**

Demographic projections in Japan are provided by the National Institute of the Population and Social Security Research with alternative assumptions. The 1992 medium estimates, which are based on the fertility trend recovering sharply from 1995 and stabilizing at 1.8, project the Japanese population to peak at around 2010, and decline thereafter. However, the new 1997 estimates, which are based on the fertility trend recovering from 2000 and stabilizing at 1.6, indicate that the Japanese population will decrease by 25 percent in 2050 from the 1995 level. These population projections result in different pictures of the elderly ratios (Figure 1).

The pace of an increasing women's college enrollment ratio has recently accelerated, and their fields of study have become closer to those of men. Thus, it is unlikely that Japan's fertility rate will recover soon, like those in other OECD countries have, such as the United States and Sweden, unless effective policy measures are taken. In the following projections, we use the 1997 medium estimate, which is more pessimistic but more realistic than the 1992 medium estimate.

**2. Labor Market Impacts of the Aging Population**

**Declining Labor Force Growth**

Falling fertility rates have resulted in declining growth in population. The population of those between ages 20 and 64 will fall beyond 2000, and the size of the decline amounts to an annual rate of 1.1 percent between 2025 and 2050. If labor force participation rates remain unchanged, the labor force, which maintained an increase of around 1.0 percent between 1975 and 1995, will decline by 0.55 percent in the first quarter of the twenty-first century, and the speed of the decline will double in the second quarter. Thus, actual developments in the labor force will depend on the extent to which the labor force participation of women and older persons rise, offsetting the declining trend of the population.

**Women's Labor Force Participation**

The labor force participation of women has risen steadily from 45.8 percent in 1975 to 50.0 percent in 1995. The size of the increase in the labor force participation was particularly prominent in the child-bearing age, and that of the 25-29 age group rose from 42.5 percent to 66.4 percent in the same period. This is the result of the following factors. First is a rising ratio of
unmarried women, reaching close to 50 percent in 1995, who have on average more at stake in working. The falling trend of marriage ratio of women has been closely related to their rising college enrollment. Second is a rising participation of married women due to the fewer number of children, better day-care facilities, and shortening of working hours. The trend of women’s higher participation is likely to continue in the twenty-first century. The labor force participation will be even higher if supported by a policy for increasing day-care facilities, encouraging the mother’s incentive to work. Third is a continuous wage increase in the past, which has also been an important factor stimulating women’s labor force participation. However, increasing taxes and social security premiums will be a discouraging factor by reducing net wages.

Care must be taken, however, that despite the increase in the participation rate in each age group of women the average labor force participation will still decline toward 2050. This paradoxical phenomenon can be explained by the shift of the share of women toward the older age group, whose participation rates are relatively low. In this sense, the changes in the participation of older persons, of which share is rising continuously, will play a crucial role in the twenty-first century.

**Elderly Labor Force Participation**

A particular characteristic of the Japanese labor market is a reversal trend of older workers. In Japan, like in other OECD countries, the labor force participation of older workers fell until the mid-1980s, at which time the trend reversed itself. Between 1987 and 1995, the ratio of working males aged 60 to 64 years in the total population rose from 71.1 percent to 74.9 percent, while the share of working males aged 65 and above rose from 35.6 percent to 37.3 percent (3). This upward trend of labor force participation of older males has been mainly due to the tightening of labor market conditions, reflecting by higher wages as well as the flattening of improved pension benefits.

The currently high labor force participation of older workers may well be maintained with a further tightening of labor market conditions, and continued shortening of working hours. Moreover, it would be stimulated by reforms in the public pension schemes. The 1994 reform in the public pension included an increase in the pension eligibility age to 65 and a reduction of the pension benefits, and they will affect the labor market participation of older workers. If the pension eligibility age is extended beyond age 65, the labor force participation rates of those in their 60s will be further stimulated.
3. The Macroeconomic Consequences of an Aging Population

The extent of the fiscal burden associated with an aging population largely depends on macroeconomic factors. The higher a country’s per capita income growth, the lower the burden of the working-age population for taking care of the elderly will be. However, a decrease in labor force beyond 2000 and an increase in the elderly ratio are likely to have negative impacts on macroeconomic performance in the following two ways.

First, household savings are likely to fall as the proportion of elderly rises, resulting in a gradual increase in dissavers as a share of total population. At first glance, however, this life cycle hypothesis on household savings may not apply to Japan, because Japanese elderly do save significantly. It should be noted, however, that there are two types of Japanese elderly: those who are economically independent and are likely to save, and those who are dependent on their children, accounting for 65 percent of the total elderly. The latter type are taken care of by their children, and are thus excluded from statistics on a household basis. If we take this sample selection bias into account, Japan’s elderly as a whole do indeed dissave, as argued by life-cycle theory (Yashiro and Maeda [1993]). With an increase in the share of the retired elderly in total population, the household savings ratio will gradually decline from 13.2 percent in 1994.

Second, the impact of an aging population on investment and labor productivity growth is the result of two counteracting forces. Declining labor force growth may seem to stimulate the demand for labor-saving investment, but in the long-run, business investment may well be discouraged by the falling capital profitability arising from the falling labor supply and higher interest rates associated with falling saving rates. However, this negative impact on investment can be partly offset by labor-enhancing technological development. Past experiences in major OECD countries imply that labor shortages are an important impetus for the more efficient utilization of the existing labor force (4). The more efficient use of market forces through deregulatory measures would enhance these “technological changes,” which are reflected by higher total factor productivity growth. Japan’s aging population thus tends to lower the nation’s propensities to invest and save. How this will affect Japan’s current external balance will depend on the extent of the decline in savings and investment. Although empirical evidence is scant, it is possible that a decline in investment should be slower than that in savings, mainly due to the development of labor-enhancing technology, which is induced by increasing labor shortages. As a result, an aging population may well deteriorate Japan’s current external balance in the twenty-first century (Yoshitomi and Yashiro [1992], Yashiro and Oishi [1993]) (5).
As the population ages, economic growth will decelerate from 3.5 percent average growth during the period between 1970 and 1995. The trend of economic growth rates may overstate the actual changes in real incomes, as the growth in per capita income will exceed that of GDP when the population and labor force declines. The changes in labor productivity growth, which is the approximate of wage growth, are less prominent.

Economic growth will be lower if the technological improvement induced by tightening labor market conditions is deterred, possibly by the failure of structural adjustments. Also, without adequate policy measures for stimulating labor force participation of women and elderly, the labor supply will shrink, and economic growth may well be choked.

4. The Fiscal Impact of Japan’s Aging Population

In industrialized countries, the major fiscal impact of an aging population is a substantial increase in public pension benefits for the retired. Both savings and investment are affected by an aging population due to associated increases in the tax and social security burdens of the working-age population. There is a tendency in the OECD countries for those with a relatively high proportion of elderly to have larger government sectors -- measured by the ratio of social transfers or by the tax and social security burden relative to GDP. Though government size expands with aging population mainly through increased transfer payments, the extent to which this happens differs largely by country and by region (Yashiro [1995]). Thus, there is room for policy maneuvers for determining the size of the government.

Japan’s public pension scheme was closer to a “fully funded” scheme in its initial stage, meaning that contributors accumulate their own savings that they withdraw after retirement. Under this system, both accumulated contributions and benefits per person are relatively low in the beginning. The average benefit per beneficiary increases with time as the average period of contribution becomes longer or the public pension fund becomes more “mature”. (6) Under such a scheme, variations in the age structure of the population lead to corresponding variations in the fund’s net assets, thus lessening the burdens associated with aging population.

However, this “fully funded principle” regarding pensions has not been maintained, and the system has shifted to a de facto “pay-as-you-go” scheme. This means that present beneficiaries are directly supported by present contributors through taxes. This shift is mainly the result of a generous increase in pension benefits brought about by political pressures -- a generosity not
bolstered by sufficiently higher premiums in the 1970s. Moreover, premiums had to be paid for a longer period of time due to unforeseen increases in life expectancy of the elderly discussed earlier. This has been exacerbated by Japan’s low eligibility age by international standards (60 for males and 55 for females) for public pensions (7). These factors naturally produce a “potential deficit” in the public pension balance — that is, future promised benefits unmatched by future debt accumulation — even though an actual surplus has been accumulated. According to estimates, the accumulated “potential debt” amounts to 110 percent of GNP in 1990, compared with the actual assets of the Social Security Fund, which comprise 20 percent of GDP (Hatta and Oguchi [1993]).

This situation has led to a substantial increase in intergenerational transfers. Indeed, current public pension beneficiaries on average have contributed only 30 percent of the benefits actually received (Takayama [1992]). Consequently, public pension fund reserves will eventually be exhausted before population aging reaches its peak, putting a greater burden on current contributors. Without a substantial revision of the current system, the size of social security transfers will automatically increase, reaching the same proportion as those in current European countries by 2050 — just as Japan’s ratio of the elderly to the total population reaches its peak of 33 percent. Thus, demographic changes require adjustments of benefits and contributions in order to mitigate an increased burden on the working generations.
Part II

This part provides a detailed description of our methodology to in analyzing the macroeconomic impact of population aging, and discusses the results of policy simulations. It is divided into two sections. Section 1 presents a basic structure of our econometric model, and Section 2 summarizes the main results of simulations and discusses their policy implications.

Section 1. Structure of the model

1. Main Features of the Model

Our model consists of the following three sectors:

1) The “Macroeconomic Sector,” which as a main body of our model provides a basic structure of the macroeconomy of Japan;

2) The “Labor Supply Sector,” which projects labor force growth based on population estimates and analyzes the impact of policy changes on labor supply; and

3) The “Public Finance Sector,” which traces Japan’s social security schemes as well as fiscal policy to provide mechanisms for public finance.

These three sectors, linked with each other, can conduct macroeconomic projections and policy simulations to explore alternative long-term scenarios in Japan.

Our model is basically a neo-classical one, which concentrates on the supply side of the economy and focuses on long-term growth potential. Population aging and social security policies will affect the economy’s long-term outlook more substantially than its cyclical performance. In the model, economic growth is mainly determined by capital accumulation, labor force growth, and productivity growth. Labor force projections are based on population estimates, while working incentives are affected by changes in social security policies. Finally, output growth is independent from monetary factors, as argued by the so-called “classical dichotomy.” The inflation rate is given exogenously.

The most important feature of our model is that it can explicitly examine the interaction between social security policies and macroeconomic performance. Several observers, both public and private, have so far published long-term projections on the fiscal balance and the national
burden to finance social security expenditures (e.g. The Ministry of Health and Welfare [1993], Yashiro-Oishi (JCER) [1993], Meredith (IMF) [1995], Economic Council (EPA) [1996], Industrial Structure Council (MITI) [1996]). Most of them, however, failed to fully analyze the policy impact on the macroeconomy and its feedback to the fiscal position. The results of our simulations indicate that policy changes will affect the future of the economy and fiscal position more substantially than is widely recognized. In addition, the linkage of the three sectors makes it possible to explore alternative scenarios regarding burden sharing between the present and future generations.

Another feature of our analysis to be noted is that the projection period is longer than those of previous studies -- from 1995 to 2050 rather than to 2025. Population aging is expected to peak around the year 2025, when the post-war babyboomers will begin to retire. Aging itself, however, will continue after then, as the second babyboomers get older. The projection period thus should be extended to 2050, around the time when the second babyboomers will begin their retirement years, to explore long-term strategies that stand up well to pressures from population aging.

The results of policy simulations toward 2050 are very sensitive to demographic assumptions. Among others, assumptions about the fertility rate tend to dominate the projected population structure and labor force beyond 2025. As discussed below, our baseline simulation is based on the assumption that the fertility rate will not substantially recover from the current low level. The simulations based on this “pessimistic” demographic assumption can assess the sustainability of the current social security programs, which assume a healthy recovery of the fertility rate.

2. Macroeconomic Sector

The macroeconomic sector comprises the main body of our model. This sector summarizes the supply-side of the economy and examines potential growth and policy impact on it. The sector consists of equations for production, savings, gross investment, and interest rates, all of which are estimated by the Ordinary Least Squares method and are based on annual data during 1975-1994. To be sure, long-term projections of this kind are subject to uncertainties; our estimation period to obtain parameters of structural equations also seems too short to conduct fifty-five-year projections. In addition, the specification of the estimation equations lacks a rigorous microeconomic foundation, with no full consideration of intertemporal maximization of utility or profits by households and corporations. Nevertheless, the results of our projections strongly
suggest that the current fiscal and social security systems would be unsustainable unless further policy adjustments are undertaken.

As for exogenous variables in this sector, labor force is imported from the labor supply sector. Inflation is exogenously determined with the rate of GDP deflator inflation fixed at two percent during the simulation period, since the sector is neo-classical. Fiscal policy variables, such as government spending and taxes, are controlled to reflect alternative policy strategies.

Basic features of the macroeconomic sector are explained in as the following:

Production
The production function is a simple Cobb-Douglas one, in which production is determined by capital stock, labor force, and total factor productivity (TFP). The pace of capital stock accumulation is determined by business investment, and growth in labor force is given exogenously in the sector. Both public and private capital stock are included in the production function. Improving the social infrastructure is expected to increase efficiency in the economy, and thus the long-term strategy of government investment will influence growth potential (Aschauer [1989]). Total factor productivity is assumed to grow annually at 1.6 percent, which has been the historical average during the past twenty years. However, stimulated labor-saving productivity caused by an expected labor shortage cannot be ruled out. (Yashiro-Oishi [1993], EPA [1994]).

Investment
Gross domestic investment, which determines the pace of capital stock accumulation, consists of business, residential, government, and inventory investment. The future path of government investment is determined by the government’s long-term strategy of fiscal policy, and the share of inventory investment in GDP is assumed to be fixed through the projection period. Residential investment is explained by household income and the real cost of housing loans. Business investment, a key determinant to the pace of capital stock accumulation, is explained by net business profits and real interest rates. In the long run, an increase in social security taxes on firms is likely to hold down capital accumulation through declining profits, while firms may reduce wage payments and/or raise output prices in the short run.

Savings
The savings function is based on the life-cycle hypothesis, which explains the trend of the savings rate with the old-age dependency ratio and per capita social security benefits. This hypothesis argues that the population aging, which implies increasing dissavers, tends to reduce the
savings rate at the macro level (for Japan see Horioka [1992]). However, it should be noted that the dependency ratio in the savings rate function in our model is calculated as the ratio of the population aged 65 or over to total labor force rather than of the total population. This is because the more elderly people work, the more they are expected to save. And their participation rates would be affected by social security benefits.

Meanwhile, rising social security contributions on the working-age generation are expected to partly offset private savings (Feldstein [1974]). This specification makes sense, if the social security program is financed effectively on a “pay-as-you-go” base like in Japan and most of social security contributions are considered as taxes rather than as premiums. Meanwhile, social security benefits for the elderly are likely to reduce their dissavings. The savings function thus should reflect these two conflicting effects of the social security system.

**Interest Rates**

The neo-classical theory argues that real interest rates should be equal to the marginal product of capital. Hence, we assume that the marginal product of capital -- which is implicitly determined by the production function -- as the long-term norm for real interest rates during the projection period. This is based on the assumption that capital accumulation is financed entirely through savings available in the model. National savings, however, are not necessarily equal to gross domestic investment, and thus excess investment over savings requires borrowing from abroad. For simplicity, we assume no impact on the real interest rate from this external imbalance. This may underestimate “crowding-out” effects and the government’s interest payments.

**Fiscal Balance**

The fiscal balance, which is calculated in the public finance sector discussed below, is affected mainly by public spending, taxation, debt-servicing payments as well as social security policies. Combined with excess savings over investment in the private sector, the fiscal balance determines the saving-investment balance at a national level.

Fiscal sustainability is one of the most important issues to be addressed in our model. Japan's fiscal balance has been deteriorating sharply in recent years due to the “post bubble” recession, and unchanged policies would cause a further increase in the budget deficit and even a debt explosion. The model assess the likelihood of a future deterioration in the fiscal balance as well as the magnitude of adjustments needed to achieve a sustainable fiscal position. To improve the fiscal position, however, would imply a rise in financial burdens on the working-age generation. This trade-off between the fiscal position and social charges on the people also can be explicitly
examined in the model.

3. Labor Supply Sector

The labor supply sector projects long-term growth of labor force toward 2050. The population figures which this sector use are based on the 1997 medium estimates, assuming no significant pickup of the fertility rate. The 1992 medium estimates, which have been commonly used in official projections, expect a healthy pickup in the fertility rate. The new medium estimate is more plausible and realistic, given that there has been no sign of pickup in the fertility rate.

This sector projects labor participation rates for each five-year age group from ages 15-19, 20-24, ..., 65-69, and 70 or over, as well as for both male and female workers. In addition, it analyzes the impact of social security policies on working incentives, especially for female and elderly workers. Together with capital stock accumulation and productivity growth, total labor supply calculated in this sector determines long-term growth potential.

Labor force is divided into three categories: agriculture, the self-employed, and dependent employees. The numbers of the first two are simply extrapolated reflecting their historical trends, and assumed to be independent from social security policies. Projections of the number of dependent employees are based on the estimated functions of their labor participation rates for each age group, as discussed below.

Long-term projections of labor force growth should assume that the economy is kept nearly at full capacity and thus that joblessness is kept as low as “the natural rate of unemployment.” Low participation of elderly workers in recent years due to the deep recession, if unadjusted, could cause an underestimation of labor force growth over coming decades. Projections should thus adjust this cyclical deviation at the starting year, by assuming that capacity utilization will recover soon or later, say by 2000, and remain at its historical norm during the projection period.

Male Workers

Male workers are divided into several age groups, from age 15-19 to age 70 or over. From age 15-19 to age 55-59, the participation rate of dependent employees in each age group is calculated as:

\[
\text{participation rate for male dependent employees} = \text{participation rate for total male workers} \cdot \frac{(\text{the number of agricultural workers and the self-employed})}{\text{the number of total male population}},
\]
where the participation rate of total male workers is fixed at the level observed in most recent years. This formula is based on the assumption that the participation rates of male workers aged below 60 are close to the ceiling and that their working incentives are not significantly affected by any changes in social security contributions.

However, labor force participation of male dependent employees aged 60 and above -- a normal retirement age from the firm where one has worked for a long time in Japan -- is likely to be affected by social security benefits. Their participation rates are explained by their CPI-deflated social security benefits as well as overall business conditions. The more they get benefits, the less they are expected to get eager to work. This is one of the main routes through which social security policies affect long-term economic growth. The eligibility age for full pension benefits is scheduled to be gradually raised from the current 60 to 65 starting the year 2001, and only “partial” pension benefits are received by people until the postponed eligibility age. This labor supply sector will analyze the impact of this change on the working incentives of the elderly.

**Female Workers**

Female labor force is projected by the following three steps. First, female workers are divided into agriculture, the self-employed and dependent employees: the first two are treated in the same way as male workers. Second, female dependent employees are divided into the married and unmarried, and the ratio of the unmarried is estimated for each age group by the average age of the first marriage and/or their previous marital status. Women’s rising enrollment in colleges is likely to expand their job opportunities and to delay their first marriage. Third, the participation rate is estimated for each of the married and unmarried. The specification of the estimation equations is almost the same for the married and unmarried, but the parameters are different, reflecting their different labor supply behaviors.

Our empirical analysis suggests that female workers tend to be quite sensitive to a change in social security policies. Unlike the case of male workers, working incentives of married female workers are affected by real wages excluding social security taxes. Moreover, official support for child-care is expected to help them seek job opportunities: Historical data indicate that the share of children aged zero to five years old cared for in the nursery tends to significantly raise the labor participation rate of married female workers.

Our econometric analysis cannot fully examine the “cohort effects” of the social security policies. Our analysis based on historical data does not conclude that labor participation of female
workers aged above 60 is sensitive to social security benefits. The younger the cohorts are, however, the more they will have more job experiences when young and probably want to remain in the labor market even after age 60. This trend will likely be affected by social security taxes as well as by official support for child care that women face when young. Future research should empirically analyze this sort of long-run impact of the social security policies on the labor force participation of elderly women.

4. Public Finance Sector

Our model contains the public finance sector, which traces the budget structure of the general government. The general government is divided into the social security fund (SSF) and the other part (non-SSF), the latter of which combines central and local governments. The SSF deals with public pensions, health care, and other social welfare services. The non-SSF deals with government investment and consumption, taxation, debt-servicing payments, and other public expenditures. The fiscal balance for the general government as a whole is calculated by combining the fiscal balances of the SSF and non-SSF. The SSF receives net transfers in the shape of government subsidy from the non-SSF, and to what extent the non-SSF finances those transfers by taxes will dominate prospects of the overall fiscal balance in coming decades.

The SSF is largely divided into two parts. The first and most important part is the public pension program, which should be a key determinant to the future trends of social security and benefits and contributions. The second part deals with health care and social welfare programs. Policy changes regarding the public pension program and other social security schemes are reflected in this SSF part as well as in the public finance sector as a whole. Their impact on the economy is analyzed through the linkage with the macroeconomic and labor supply sectors.

Public Pension Program

The Japanese pension program can be broadly divided into three categories:

1) The “National Pension” (NP) "Kokumin Nenkin" which provides basic fixed benefits and covers all residents;

2) The “Employees’ Pension” (EP) "Koisei Nenkin" which provides earnings-linked benefits and covers most dependent employees in the private sector; and

3) The “Mutual Aid Associations’ Pension” (MAAP) "Kyosai Kumiai Nenkin" which provides
earnings-linked benefits like the EP and covers civil servants, private school teachers, and workers in agriculture and fisheries.

The present provisions of each pension program are summarized in what follows:

* National Pension (NP). All nationals aged 20 to 59 years old are required to join the NP, and all nationals aged 65 or over are entitled to receive benefits if they have paid premiums for 40 years. The numbers of NP contributors and beneficiaries are easily projected, since they are closely linked to population estimates. Both NP contributions and benefits are flat and not earnings-linked, while the benefits are wage- and inflation-indexed. EP and MAAP contributors do not need to pay NP premiums. A portion of their premiums equivalent to NP contributions is paid to EP and MAAP beneficiaries.

* Employees' Pension (EP). The EP is the largest segment of public pension schemes and pension reforms concentrate on it. Under the EP, contributions are linked to employees' salaries; the contribution rate is currently 17.35 percent (as of October, 1996), of which half is paid by the employer and half by the employee. Pension benefits are divided into two parts: the one is flat and the other is roughly proportional to beneficiaries' total contributions in the past.

For projections, the contribution per person is estimated on the officially proposed and alternative paces of a rise in contribution rates as well as on projected wage inflation. Benefits per person are estimated on the basis of the official formula. Calculations of pension benefits for the elderly aged 60 to 64 require special treatment, reflecting the 1994 Pension Reform discussed below (see Section 2.1).

The number of contributors is projected mainly on the basis of official population estimates but adjusted by a change in the size of labor force. The latter is calculated in the labor supply sector, and it is in turn affected by changes in public pension policies. The number of EP pensioners is also influenced by the proposed rise in the eligibility age as well as by demographic dynamics.

* Mutual Aid Associations' Pension (MAAP). The MAAP has almost the same provisions for benefits and contributions as the EP, although they are a little different for each Association. The 1994 Pension Reform dose not discuss the MAAP in detail, but the MAAP reform is most likely to follow the EP's.
Altogether, the public pension part analyzes the prospects of the financial positions of each public pension program and of the overall pension system. The output from this part includes the sizes of pension contributions and benefits as well as the numbers of contributors and beneficiaries. In addition, this part predicts pressure on the non-SSF's budget deficit, since a substantial portion of NP benefits is subsided by central and local governments. The projected figures in our model can be compared with their official estimates published by the MHW [1993].

Net interest receipts and payments also are an important force affecting the financial position of the public pension program. Japan's public pension currently holds huge net assets reflecting its relatively young population structure, and so interest receipts are expected to keep helping its financial position for some years. Once the net position of the public pension reserves turns into a debt, however, interest payments will accelerate a deterioration of its financial position.

Health Care and Social Welfare Services

The second part of the SSF deals with health care and social welfare services. Health care is divided into health care for the elderly and that for others. Projections of health care expenditures are based mainly on estimated national income in both cases, but expenditures for the elderly are also affected by the increasing number of people aged 70 or over. Health care expenditures are financed by contributions and the government subsidy. For the baseline projection, contributions are linked to estimated national income, and the government subsidy is linked to estimated expenditures. Projections for expenditures for social welfare services are undertaken in almost the same way as those for health care.

Section 2. Simulations and Policy Implications

1. Baseline Simulation -- Standard Case

Key Assumptions

The baseline simulation, referred to as the “Standard Case” hereafter, presents a scenario based on the combination of plausible population estimates and officially announced reforms about social security policies. The results of the baseline simulation can examine the sustainability of the government’s present strategy of fiscal and social security policies, and also provide a benchmark to assess alternative scenarios.
Key assumptions for the “Standard Case” are as follows:

* Total population will grow in line with the 1997 medium estimates, in which the fertility rate is assumed to recover gradually to the 1.61 level. The rise in the old-age dependency ratio would thus be larger than the previous medium estimates on which the official pension projections are based. However, it should be noted that most of the impact of the lower fertility rate would not be felt until 2025 and beyond.

* Annual working hours are assumed to decline gradually to 1500 hours by 2050. The college enrollment ratio of males is to be kept constant at the current 40 percent level, while that of females is to reach the 80 percent level of males in 2020, flattening thereafter.

* Key parameters regarding the public pension program reflect the 1994 Pension Reform, which calls for:

1) a gradual rise in the eligibility age from 60 to 65 for EP pensioners, starting in 2001 for males and 2006 for females, by one year for every three years. The “partial” pension benefits -- equivalent to 50-60 percent of the full pension -- will be received by the retirees until the postponed eligibility age;

2) a shift to “net” wage earnings (those paid after payments of wage taxes and social security contributions) from the “gross” wage earnings to index EP’s earnings-related benefits;

3) an additional one percent EP premium (with no additional benefits) on bonus payments, which share about one-fourth of annual wage earnings; and

4) an accelerated rise in EP contribution rate from the previously planned pace: The contribution rate is now scheduled to rise to 29.6 percent by 2025.

* Other social security expenditures, such as health care and social welfare, are expected to grow in line with a rise in the dependency ratio and income level. For simplicity, we assume that social security taxes and transfer from the non-SSF are automatically raised to finance these expenditures, given their “pay-as-you-go” scheme.

* Government investment and consumption are solved endogenously in the model in such a way that they will grow at the same pace as economic growth. This means that capital spending and consumption in the public sector will be kept neutral to growth.
* As for taxation, consumption tax rates will be automatically adjusted to keep the “primary balance” of the non-SSF balanced after 2000. No statutory change in income tax is assumed, and income tax revenues are projected with the estimated income elasticity.

**Labor Market Developments**

The labor force participation of those aged 60 and over is projected to decline steadily during the projection period, mainly because of an improvement in public pension benefits. The labor force participation of young females will increase, making the M-shaped participation pattern less marked in 2050, largely due to an increasing marriage age. The average female participation ratio will fall to 37.3 percent in 2050 from 50 percent in 1995, reflecting the aging of the labor force shifting toward the older age cohorts with lower labor force participation and declining share of the self-employed.

Total labor force is projected to decline to 55 million in 2025 from 68 million in 2000, and the speed of the decline will accelerate to 41.5 million in 2050, as the population declines due to the falling fertility ratio in the past and the labor force participation of the elderly and females falls persistently.

**Macroeconomic Performance**

The main results of the “Standard Case” are summarized in Table 1. On the macroeconomic side, real GDP growth is projected to slow toward 2050. This is mainly due to a significant reduction in labor force. Also, a continuous fall in the savings rate is likely to lower the pace of capital stock accumulation and thus potential output growth. Real output growth is projected to decelerate to 1.37 percent on average during the 2000-2025 period, and 0.55 percent during the 2025-2050 period, well below the 4 percent pace averaged over the 1970-90 period.

Population aging would also result in a drastic change in Japan’s saving-investment balance. Combined with the widening fiscal deficit, decreasing private savings would eventually turn Japan’s external position from a surplus to a deficit by 2025. Japan would have to borrow money from abroad to finance its increasing costs of social security for the elderly.

Increasing social security contributions would weigh on firms’ profits and thus subdue demand for investment on machinery and equipment. This impact is expected to decrease the pace of capital accumulation and reduce productivity growth. Heavier burdens from social security contributions on workers would also reduce working incentives, especially for female and elderly
workers, who, our analysis shows, are more sensitive than male non-elderly workers to social security contributions. Hence, the population aging would hold down growth potential not only by reducing labor force growth but also by discouraging capital accumulation and working incentives.

**Fiscal Position**

The results of the baseline simulation clearly indicate that population aging will have drastic impacts on the economy and fiscal position in Japan toward 2050. The prospects of the financial position of the public pension will be dominated by demographic and macroeconomic impacts:

Demographic impacts. The MHW’s official projections -- based on the 1992 population estimates and optimistic macroeconomic assumptions (2% real GDP growth, 2% inflation, 5.5% long-term interest rate on the average of the 1995-2050 period) -- indicate that the surplus in the EP would be maintained through 2050 (Case I, Figure 2). With the unexpected decline in the fertility ratio since then, however, the 1997 population estimates indicate a larger decline in the population and thus lower labor force population beyond the year 2000. With these new projections, the number of the pension contributors in the future will be much less than originally projected, resulting in a large pension deficit beyond the year 2030 (Case II, Figure 2).

Macroeconomic impacts. If we account for the macroeconomic development projected by our macroeconomic model shown above, the deterioration of the pension fiscal balance beyond 2030 would be even worse, mainly due to the deceleration of economic growth to one percent and the lower interest rates of around three percent, both deteriorating the pension budget (Standard Case, Figure 3).

Mounting social security expenditures, even after implementing all measures incorporated in the 1994 Pension Reform, would eliminate the Social Security Funds (SSF)’s surplus by 2030 (see previous Table 1). The new schemes proposed by the Reform is unlikely to be able to sustain a surplus of the SSF by the time babyboomers begin to retire. Along with a deterioration of the SSF’s financial position, the fiscal deficit for the general government as a while is projected to continue increasing. Since a substantial portion of social security payments is subsidized by the central and local governments, no statutory change in inter-governmental transfers and/or tax policies would cause a huge budget deficit on the non-SSF side.

Moreover, net government debt is projected to keep mounting as a result of a continued central government fiscal deficit, which arises mainly due to increasing grants to the Pension Fund.
Nevertheless, the Pension Fund would be exhausted by 2050, and substantial debts would be accumulated.

2. Alternative Scenarios

The results of the baseline simulation provides a warning signal that the current social security system is quite vulnerable to pressures from the population aging. The 1994 Pension Reform cannot guarantee the sustainability of Japan’s public pension system beyond 2025. The fiscal position is most likely to worsen drastically on both flow and stock bases, and heavier social security costs would discourage economic activities in the private sector.

The next step is to present alternative scenarios to avoid a debt explosion of the government and to sustain healthy economic performance. It is tough, however, to provide the “best” scenario to cope with demographic pressures. Instead, we first undertake some “sensitivity analyses” to examine how additional adjustments would improve the financial position of the EP, the core of the social security program and a major determinant to the fiscal balance as a whole. We then present a couple of alternative scenarios regarding social security strategies and compare their economic effects.

Sensitivity Analysis

First, we estimate the impacts of higher economic growth induced by an exogenous factor, such as technical changes, by 0.5 percent point. Higher GDP growth will obviously have a positive effect on the public pension budget through higher wages and larger employment, resulting in increased revenues in the EP. On the contrary, higher GDP growth will have a negative effect on the NP, which is for the self-employed. This is because NP contributions are fixed, unlike in the case of the EP, while the NP benefits are wage-indexed and thus increased with higher economic growth (Figure 3):

Second, with the assumption of higher long-term interest rates by one percent, the pension budgets will be benefited by larger interest receipts. However, the higher interest rates will adversely affect the budget, once the pension reserves get exhausted in 2040 and the benefits start to be financed by borrowing.

Third, the lower fertility of 1.38 as the stationary level (assumed in the 1997 lower estimates), instead of 1.61 used in the baseline projection, will make the pension balance deteriorate further. This is mainly due to the lower number of contributors.
The impacts of these exogenous changes on pension balances are minor to the NP, as the percentage of non-employees to total employment will decline from the current 18 percent to 8 percent in 2050.

**Additional Pension Reforms**

To begin, we examine the sensitivity of the financial position of the public pension to additional adjustments. The analysis focuses on the Employee Pension (EP), which dominates the trend of the overall public pension system in Japan. The fiscal effects of the pension reforms are shown in Table 2 and Figure 5.

The first pension reform will abolish wage indexation while maintaining the price indexation of the pension benefits of both earnings-related and basic pensions (Case I). This reform is expected to substantially improve the pension balance -- by 260 trillion yen in 2050 from the baseline -- and more than offset the deficit. The less moderate case is to abolish the wage indexation of the earnings-related portion only, while maintaining that of the basic pension (Case II). In that case, the net effect would be about one-third of the previous reform, as the earnings-related benefits will increase more rapidly than the basic pension benefits.

The second reform will raise the eligibility age for earnings-related pension benefits from 60 to 65 (case III). In the 1994 reform, only the eligibility for basic pension was raised to age 65. In our simulation, the eligibility age of both pensions is assumed to be raised gradually, starting from the year 2001 by one year for every three years. The fiscal impact will be 68.5 trillion yen in 2050 from the baseline.

The third reform is to lower the rate of return of the pension benefits from the current 0.75 to 0.67 (case IV). This reform indicates that the necessary years of the contribution for being eligible for the full pension benefits will be extended from the current 40 years to 45 years, which is likely to have similar fiscal effects as extending the pension eligibility age from 60 to 65 based on the assumption that the average person starts working at age 20.

The fourth reform is to impose contributions for non-working dependent spouses of employees by the same amount as that of the self-employed (Case V). Currently, non-working dependent spouses are exempted from contributions for being eligible for their own basic pension benefits. The fiscal impact of this reform will be 19.5 trillion yen. However, this does not include the effect of stimulating the labor force participation of married women by making the contribution
scheme more neutral to work.

To illustrate the sustainability of the current EP scheme, we roughly calculate the contribution rate path to achieve the EP's financial position projected by the MHW (Table 3). The MHW plans to raise the EP’s contribution rate to 29.6 percent by 2025, and keep that level thereafter, but this plan is based on the optimistic 1992 medium estimates. With the new demographic projections in 1997, the MHW suggested that the contribution rate should be raised to 34.3 percent. Nevertheless, even this higher contribution rate is not sufficient to sustain the public pension scheme through 2050, with decelerated economic growth and lower interest rates. According to our projections, a contribution rate of 37.0 percent would be necessary if there are no reforms of the public pensions.

The final contribution rates are calculated assuming a variety of assumed pension reforms. First, abolishment of the wage indexation of earning-related benefits could contain a contribution rate below 31.0 percent in 2050. Second, the combination of abolishment of the wage indexation of earning-related benefits and a rise in the eligibility age to 65 could contain a contribution rate below 27.7 percent. In addition to those changes, the contribution could be reduced to 19.7 percent if the wage indexation of basic benefits is abolished. Finally, imposing contributions on dependent spouses of the employees can reduce the contribution rate further to 19.1 percent.

Results of Pension Reforms

The above-mentioned pension reforms are expected to improve macroeconomic and fiscal performance (Table 4). We choose one of the most comprehensive reforms — the combination of 1) abolishing the wage indexation of both wage-related and basic benefits, 2) raising the eligibility age to 65, 3) imposing the contributions on dependent spouses of the employees, and 4) containing the final contribution rate below 19.1 percent — and call it the “Pension Reform Case.”

Compared to the pre-reform “Standard Case” which is shown in Table 1, the “Pension Reform Case” will improve the long-term prospects of the Japanese economy. First, long-term economic growth will be raised by 0.2-0.3 percentage point, as labor supply grows faster due to reduced social security burdens as well as increased labor force participation among the elderly. This indicates that pension reforms will at least partly offset negative impact of declining labor force. Second, fiscal balance is expected to keep almost balanced despite demographic pressures, in sharp contrast with a mounting fiscal deficit in the “Standard Case.” The social security fund can keep its surplus through 2050 thanks to the pension reforms. As a result, the current account deficit will be contained in the 5-percent-of-GDP level in 2050. Third, tax and social security
contributions that people are forced to pay to the government will be kept below 50 percent of national income in 2050, compared to 56.6 percent in the “Standard Case.”

The effective reduction in pension benefits called for in any pension reform will inevitably reduce the replacement rate—that is, the rate of average pension benefits of pensioners to average wage payments of workers. Table 5 compares the replacement rates in several cases, in both cases where taxes and social security contributions are included (“gross”) and not (“net”). The “Pension Reform Case” will substantially reduce the replacement rate: to 11.8 percent in 2050 from 40.6 percent in 1995 on a gross basis, and to 17.9 percent in 2050 from 53.0 percent in 1995 on a net basis. These results should be cautiously interpreted. To be sure, future pensioners will get less benefits relative to wages, but they will pay fewer contributions and be able to save more when young. Thus a reduction in the replacement rate, caused by pension reforms, does not necessarily mean that future generations will become worse off.

Figure 6 compares the net effects of pension reforms among different generations. For both cases of a single male worker and married male worker (who is assumed to get married at age 29 with a woman three years younger than himself), we analyze how net gains from pension reforms differ from generation to generation. We first calculate the discounted values of his pension benefits and contributions (evaluated at 1995), and get net pension benefits by subtracting the latter from the former. We then analyze how pension reforms (which are included in the “Pension Reform Case”) will change his net pension benefits (relative to discounted lifetime wages) from the case where the contribution rate will be raised to 37.0 percent to sustain the EP’s surplus through 2050.

As clearly seen in Figure 5, the proposed pension reforms will make future generations better off at the expense of present generations. For present generations, the effect of reduced pension benefits will more than offset the effect of lower contribution rates. Specifically, a married worker born in 1965 will lose the most—6.3 percent of lifetime wages—and a single worker born in 1955 will lose the most—3.3 percent of lifetime wage. However, future generations will get about 3% (if married) and 8% (if single) of lifetime wages on net due to the proposed pension reforms (8). This kind of inter-generational effect may also be observed in the transition from a “pay-as-you-go” scheme to a “funded” system.
Conclusion

Population aging does not create new problems, but simply aggravates the current dilemma concerning economic efficiency and equity. Japan must reform its currently too-generous social security system, and reduce excessive inter-generational income transfers. There are several options that can be used to alleviate the negative impacts on macroeconomic activities arising from higher tax and social security premiums: modifying the public pension system by basing it on an “actuarially fair” principle, and broadening the tax base.

With the rising life expectancies of the elderly, the “equivalent retirement age” that is necessary to maintain the financial balance of the pension system without disturbing fixed benefits and premiums must also be raised. Raising the statutory age of pension eligibility in parallel with the increase in longevity should have a double impact in improving the fiscal balance of the pension fund. It would reduce the number of beneficiaries while increasing contributors, thereby substantially helping to improve the fiscal balance. Also, the additional labor supply would increase the outputs, incomes and thus revenues of social insurance.

Rapid population aging is a major challenge to Japan’s economy, which has long enjoyed an abundant labor force supply and a low old-age dependency ratio. However, the increased burdens brought on by an aging society may well be overcome by improving resource allocation through structural reforms in the tax and social security systems. Providing better employment opportunities for the elderly will increase the number of social security contributors, while reducing the number of beneficiaries, thus helping to prevent negative impacts on the economy and on society.

Based on realistic population estimates, the present package of fiscal and social security policies is likely to cause a sharp rise in the fiscal deficit and costs to finance social security benefits. The full implementation of the measures incorporated in the 1994 Pension Reform would not guarantee the sustainability of the public pension system. The problem will likely become much more serious beyond 2025, as the aging of the society will continue and the impact of policy failures will accumulate. Our econometric projections, which explicitly analyze the interaction between the public-sector strategies and the economy, clearly indicate the vulnerability of the current system to pressures from demographic developments.

To put the fiscal position on a sustainable path and to contain a rise in taxes and contributions, the social security system needs additional adjustments. Restricting eligibility for
benefits -- including a reduction in pension benefits. Abolishment of wage indexation and postponement of the pension eligibility age -- is expected to reduce the financial pressures that arise from aging. Additional social security reforms, if combined with efforts to make the primary balance of the government balanced, would not only prevent an explosive rise in government debt but also help sustain growth potential. The results of our simulations suggest that the vicious cycle between the deteriorating fiscal position and the worsening economic performance can be broken by improving efficiency in all systems. More efficient income transfer among generations and more efficient labor markets are able to contain demographic and economic pressures from Japan's aging population.
Notes

(1) The fertility ratio here is defined as the average number of children born to a woman during her lifetime. Recent corresponding fertility ratios in the OECD countries are 2.05 for the United States, 1.65 for France, and 1.34 for Germany. The ratio is particularly low in Japan’s urban areas, for example, in Tokyo Prefecture, where it was 1.1 in 1995.

(2) This refers to the average life expectancy at birth. Recent corresponding ratios for males (females) in other OECD countries are 72.2 (78.9) in the United States in 1991, 72.9 (81.1) in France in 1991, 72.8 (79.3) in Germany from 1933.

(3) These figures include self-employed older workers, many of whom are in the agricultural sector. Because the average ratio of labor force participation of self-employed is higher, and their share in total labor force is now shrinking in size, there has been a downward bias on the average participation ratio. Because of this, the ratio of employees (rather than total workers) to the population is a better indicator of the labor force behavior of older workers. Between 1987 and 1993, the comparable ratios of male employees (i.e. excluding the self-employed) age 60 to 64 to the population went from 38 percent to 46.5 percent, and the same ratio for male workers age 65 and above went from 13.3 percent to 17 percent (Management and Coordination Agency [1994]).

(4) Through the 1980s, those countries with relatively higher labor force growth such as the United States and Australia had low rate of total factor productivity (TFP) growth, while major European countries with relatively low rates of labor force growth had high TFP growth (Yashiro and Oishi [1993]).

(5) The logic behind the projected decline in the external surplus is that household savings are more dependent on the life cycle patterns of household members, while business investment is primary affected by changes in the labor force growth as well as in its quality improvement, which can be enhanced with technology.

(6) For example, in 1992 the average public pension benefit for a couple in Japan was 151,000 yen per month in 1992 (about 1192 US dollars), which is roughly 20 percent lower than a similar pension in Sweden. In contrast, the full pension granted to Japanese who have contributed into the fund for 35 years would be 43 percent larger, a figure well exceeding the current pension level in Sweden.
(7) The majority of OECD countries, except France, Italy, and New Zealand, set the eligibility age for males and females at 65 years and 60 years or above, respectively (OECD [1988]). Also, in Japan, public pension for the self-employed set it at 65 years.

(8) The pension reforms are less in favor of a married worker, since under the new pension scheme he is assumed to pay his wife’s contributions and basic pension payments to his wife will be reduced due to abolishment of the wage indexation.
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Figure 1 Comparison of Demographic Projection

Source: National Institute of the Population and Social Security Research
Figure 2 Projections on Public Pension Balance (exogenous macroeconomic activities)

Notes: Case I: 1994 Official Projections
Case II: Adjusted to 1997 medium estimates
Figure 3  Projections on Public Pension Balance (endogenous macroeconomic activities)

Notes: Case II: Same as the previous Figure 2
Standard Case: Endogenous macroeconomic activities
Figure 4  Changes in Economic Circumstances and Pension Benefits

Notes: Case I: Higher GDP growth by 0.5% point
Case II: Higher long-term interest rate by 1% point
Case III: Lower demographic projections
Figure 5  Pension Reform Effect

Notes: Case I: Abolishing wage-indexation (both earning-related & basic pensions)
Case II: Abolishing wage-indexation (earning-related pension)
Case III: Full extension of pension eligibility ages
Case IV: Lowering the rate of return from 0.75 to 0.667
Case V: Imposing contributions on the dependent spouses of employees
Figure 6  Net Gains from Pension Reform among Generations

Note: Net gains from the pension reforms proposed in the “Pension Reform Case” relative to lifetime wage income are illustrated for each generation.
Table 1  Macroeconomic Performance (Standard Case)

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>1995</th>
<th>2000</th>
<th>2025</th>
<th>2050</th>
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<tbody>
<tr>
<td>Real GDP Growth (*)</td>
<td>2.43</td>
<td>2.94</td>
<td>1.37</td>
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<td>Fiscal Balance (ratios to GDP)</td>
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<tr>
<td>general government</td>
<td>-4.0</td>
<td>-1.9</td>
<td>-4.6</td>
<td>-10.8</td>
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<tr>
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<td>-4.1</td>
<td>-3.4</td>
<td>-3.4</td>
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<td>2.1</td>
<td>-1.2</td>
<td>-7.4</td>
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<tr>
<td>pension assets (trillion yen)</td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>Employees' Pension</td>
<td>111.8</td>
<td>157.4</td>
<td>366.3</td>
<td>-481.2</td>
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<td>tax</td>
<td>36.5</td>
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<td>56.6</td>
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<td>social security contribution</td>
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<td>28.8</td>
<td>31.3</td>
<td>35.3</td>
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<tr>
<td>(ratios to NI)</td>
<td>13.3</td>
<td>14.6</td>
<td>19.2</td>
<td>21.4</td>
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<tr>
<td>employment growth(*)</td>
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<td>0.1</td>
<td>-0.9</td>
<td>-1.4</td>
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<td>Real Wage Growth (*)</td>
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<td>(before taxes)</td>
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<td>(after taxes)</td>
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<td>Aggregate Savings (ratios to GDP)</td>
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<td>Aggregate Investment (ratios to GDP)</td>
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<td>Current Balance (ratios to GDP)</td>
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<td>Long-term interest rates (*)</td>
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Note: (*) indicates the average for 25 years for 2000, 2050 and the average for the previous five years for 2000.
<table>
<thead>
<tr>
<th>Year</th>
<th>Standard Case</th>
<th>Price indexation</th>
<th>Pension eligibility age</th>
<th>Rate of return</th>
<th>Contribution from dependent spouses</th>
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<td></td>
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<td>Earnings-related</td>
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<td>(0.75 → 0.667)</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Earnings-related &amp; basic</td>
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<tr>
<td>2000</td>
<td>10.0</td>
<td>10.1 (0.1)</td>
<td>12.2 (2.2)</td>
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<td>2010</td>
<td>6.3</td>
<td>8.6 (2.3)</td>
<td>19.0 (12.7)</td>
<td>13.9 (7.5)</td>
<td>10.1 (3.8)</td>
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<td>2025</td>
<td>7.0</td>
<td>20.4 (13.3)</td>
<td>55.8 (48.8)</td>
<td>26.2 (19.2)</td>
<td>17.4 (10.4)</td>
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<tr>
<td>2050</td>
<td>-104.2</td>
<td>-17.6 (86.7)</td>
<td>157.3 (261.5)</td>
<td>-35.8 (68.5)</td>
<td>-69.1 (35.1)</td>
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</table>

(2) National Pension

<table>
<thead>
<tr>
<th>Year</th>
<th>Standard Case</th>
<th>Price indexation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>0.6</td>
<td>1.0 (0.4)</td>
</tr>
<tr>
<td>2010</td>
<td>0.2</td>
<td>2.2 (2.0)</td>
</tr>
<tr>
<td>2025</td>
<td>-0.5</td>
<td>7.1 (7.7)</td>
</tr>
<tr>
<td>2050</td>
<td>-7.0</td>
<td>31.8 (38.9)</td>
</tr>
</tbody>
</table>

Note: The figures in the parentheses show the differences from the standard case.
Table 3 Final Contribution Rates

required to maintain pension through 2050

<table>
<thead>
<tr>
<th>Contents of Pension Reform</th>
<th>Medium estimates in population</th>
<th>Lower estimates in population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher contribution rates</td>
<td>37.0</td>
<td>40.0</td>
</tr>
<tr>
<td><strong>Price indexation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earnings-related</td>
<td>31.0</td>
<td>33.5</td>
</tr>
<tr>
<td>Earnings-related + pension eligibility age</td>
<td>27.7</td>
<td>29.5</td>
</tr>
<tr>
<td>Earnings-related &amp; basic pension + pension eligibility age</td>
<td>19.7</td>
<td>20.5</td>
</tr>
<tr>
<td>Earnings-related &amp; basic pension + pension eligibility age +</td>
<td>19.1</td>
<td>20.0</td>
</tr>
<tr>
<td>contribution from dependent spouses</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4  Macroeconomic Performance (Pension Reform Case)  

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>1995</th>
<th>2000</th>
<th>2025</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP Growth (*)</td>
<td>2.43</td>
<td>2.97</td>
<td>1.50</td>
<td>0.82</td>
</tr>
<tr>
<td>Fiscal Balance (ratios to GDP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>general government</td>
<td>-4.0</td>
<td>-1.1</td>
<td>-0.5</td>
<td>0.3</td>
</tr>
<tr>
<td>local government</td>
<td>-6.8</td>
<td>-4.0</td>
<td>-3.6</td>
<td>-3.4</td>
</tr>
<tr>
<td>social security fund</td>
<td>2.8</td>
<td>2.9</td>
<td>3.1</td>
<td>3.6</td>
</tr>
<tr>
<td>pension assets  (trillion yen)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employees’ Pension</td>
<td>111.8</td>
<td>159.9</td>
<td>571.2</td>
<td>913.4</td>
</tr>
<tr>
<td>National Pension</td>
<td>7.0</td>
<td>10.6</td>
<td>83.0</td>
<td>501.2</td>
</tr>
<tr>
<td>Tax and Social Security Contributions (ratios to NI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tax</td>
<td>36.5</td>
<td>43.6</td>
<td>46.5</td>
<td>48.0</td>
</tr>
<tr>
<td>social security contribution</td>
<td>23.2</td>
<td>28.8</td>
<td>30.5</td>
<td>31.4</td>
</tr>
<tr>
<td>(ratios to NI)</td>
<td>13.3</td>
<td>14.8</td>
<td>16.1</td>
<td>16.7</td>
</tr>
<tr>
<td>employment growth(*)</td>
<td>0.1</td>
<td>0.1</td>
<td>-0.7</td>
<td>-1.1</td>
</tr>
<tr>
<td>Real Wage Growth (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(before taxes)</td>
<td>0.84</td>
<td>2.03</td>
<td>1.65</td>
<td>1.78</td>
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<tr>
<td>(after taxes)</td>
<td>-0.30</td>
<td>1.42</td>
<td>1.35</td>
<td>1.62</td>
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<tr>
<td>Aggregate Savings (ratios to GDP)</td>
<td>30.8</td>
<td>33.8</td>
<td>23.1</td>
<td>14.9</td>
</tr>
<tr>
<td>Aggregate Investment (ratios to GDP)</td>
<td>28.9</td>
<td>32.8</td>
<td>25.0</td>
<td>20.2</td>
</tr>
<tr>
<td>Current Balance (ratios to GDP)</td>
<td>1.9</td>
<td>1.0</td>
<td>-1.9</td>
<td>-5.3</td>
</tr>
<tr>
<td>Long-term interest Rates (*)</td>
<td>3.1</td>
<td>4.6</td>
<td>3.7</td>
<td>3.0</td>
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</tbody>
</table>

Note: (*) indicates the average for 25 years for 2000, 2050 and the average for the previous five years for 2000.
Table 5  Replacement Rates

<table>
<thead>
<tr>
<th></th>
<th>gross</th>
<th></th>
<th></th>
<th>net</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1995</td>
<td>2025</td>
<td>2050</td>
<td>1995</td>
<td>2025</td>
<td>2050</td>
</tr>
<tr>
<td>Higher contribution rates</td>
<td>40.6</td>
<td>27.9</td>
<td>28.3</td>
<td>53.0</td>
<td>44.1</td>
<td>47.6</td>
</tr>
<tr>
<td>Price indexation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earnings-related</td>
<td>23.7</td>
<td>20.3</td>
<td></td>
<td>36.1</td>
<td>32.1</td>
<td></td>
</tr>
<tr>
<td>Earnings-related + pension eligibility age</td>
<td>21.6</td>
<td>19.0</td>
<td></td>
<td>32.3</td>
<td>29.5</td>
<td></td>
</tr>
<tr>
<td>Earnings-related &amp; basic pension + pension eligibility age</td>
<td>17.3</td>
<td>11.8</td>
<td></td>
<td>24.5</td>
<td>17.4</td>
<td></td>
</tr>
<tr>
<td>Earnings-related &amp; basic pension + pension eligibility age + contribution from dependent spouses</td>
<td>17.3</td>
<td>11.8</td>
<td></td>
<td>25.0</td>
<td>17.9</td>
<td></td>
</tr>
</tbody>
</table>