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Abstract

This paper evaluates one of the most drastic reforms of the Japanese public health insurance started in year 2006, by numerically examining the reform in an aging Japan in a dynamic context with overlapping generations within a computable general equilibrium framework. Our simulation results are as follows. First of all, an increase in the co-payment rate, which is one of the most prominent changes in the reform, would result in higher economic growth as well as higher welfare since it stimulates private savings. Secondly, an increasing trend of the future national medical expenditure can mainly be explained by an aging population, and an increase in the co-payment rate has little effect to squeeze the national medical expenditure in the future. Thirdly, the effect of a decrease in the national medical expenditure, which can possibly be induced by the improvement in efficiency in the public provision of medical services, the promotion of preventative medical services, or technological progress in the medical field, on the future burdens of medical expenditures is very small. Finally, if the government implements a policy to keep the ratio of the national medical expenditure to GDP constant, then the government has to keep reducing the national medical expenditure over time, and the reduction rate should be 45 percent in year 2050. Such a policy also eventuates in lower economic growth until around year 2035. Our simulation results thus indicate that the reform is not so effective to reduce the future national medical expenditure, but it can achieve higher economic growth by stimulating private savings.

Key Words: Health Insurance; Japan; National medical expenditure; Economic growth; Aging population
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1 Introduction

Japan has experienced one of the most drastic reforms of the public health insurance since the current system was launched. The reform started in year 2006, and several reforming policies have gradually been implemented for 3 years since 2006. The necessity of the reform is found in the fact that Japan will be aged very rapidly, and also that the current scheme of the public health insurance could not be sustainable without drastic reforming. The purpose of this paper is to investigate the effect of the reform on economic growth of Japan by simulating several reforming policies in an aging Japan in a dynamic context with overlapping generations within a general equilibrium framework.

The background of the reform is that growth of the national medical expenditure has been higher than economic growth. It has often been argued that if the current public health insurance scheme is maintained higher growth of the national medical expenditure than economic growth would result in further burdens on the future generations in an aging Japan through an increase in the premium of the public health insurance. Since the age group of 65 and over spends more than a half of the total amount of the national medical expenditure[1], more severe conditions for the public health insurance are expected to be unavoidable due to rapid population aging. Thus, the reform particularly aims at a decrease in the medical expenditure by the elderly, and it consists of several reforming policies related to an aging population. The reform focuses on 1.an importance of preventative medical services, 2. the efficiency in the provision of health services, 3. a launch of a new public health insurance program for the elderly, 4. an increase in the co-payment rate of the elderly, 5. the integration of several public health insurers, and 6. the reform of the medical fee system. These reforming polices target to squeeze the national medical expenditure on the transition to an aging Japan.

This paper explores the effect of the reform on economic growth. In fact, the current

[1] An about 30 % of the total national medical expenditure was spent by the age group of 75 and over in year 2006.

ratio of the national medical expenditure to GDP has already been over 8%, and its effect on GDP is no longer negligible. Furthermore, an increasing trend of the national medical expenditure implies that the effect of the national medical expenditure on economic growth could relatively become larger in the future. Since one of the main purpose of the reform is to reduce the future national medical expenditure in an aging Japan, the detailed numerical examination of the effect of the reform on economic growth should be conducted in order to evaluate the reform.

Another background of the reform is found in the argument that future generations will suffer from higher premiums of the public health insurance if the current scheme is maintained. The intergenerational effect of the scheme has also been an important issue related to the reform. This paper investigates the effect of the reform from the intergenerational aspect by employing a multi-period overlapping generations model developed by Auerbach and Kotlikoff (1983) within a general equilibrium framework[2].

How this paper differs from past studies is that this paper numerically explores the effect of the reform by considering all possible channels in a dynamic context within a general equilibrium framework, and the reform can be evaluated based on welfare of not only the existing but also future generations. Since the paper employes a multi-period overlapping generations model, the effect of the reform can also be explored based on the intergenerational issue.

One of the most prominent changes in the reform is an increase in the co-payment rate. This paper simulates the effect of an increase in the co-payment rate. Since a general equilibrium model is employed in a dynamic context, all possible channels of the effect over time can be taken into account. It has empirically been observed that the effect of the change in the co-payment rate is very small[3], and the empirical studies do not find ex-post

[2]There are many empirical studies on the Japanese health care system. However, almost all of them numerically discuss the efficiency of an individual medical treatment, or predict financial burdens of the system in the partial equilibrium context, and the Japanese health care system has not been examined within a general equilbrium framework. See Ii and Bessho (2006) for the existing empirical literature.

[3]See Ii and Bessho (2006), which mainly surveyed the empirical literature where the micro data were used.

moral hazard in the individual behavior by using the micro data. Note that the main focus in the empirical literature is to evaluate the effect of the change in the co-payment rate on the individual behavior within a partial equilibrium framework, and the effect on the whole economy as well as welfare of different generations has not been explored. Note also that the main purpose of the reform is to reduce the national medical expenditure in an aging Japan. This implies that the reform should be evaluated at the aggregate level in a dynamic context. This paper numerically examines the effect of the change in the co-payment rate over time on the aggregated economy as well as welfare of different generations within a general equilibrium framework.

The reform also focuses on the improvement in efficiency of the provision of the current public health insurance as well as the promotion of preventative medical services, in order to reduce the national medical expenditure. This paper thus considers the effect of the reform from this point of view by simulating the effect of changes in the national medical expenditure as well. The reduction of the future national medical expenditure could be induced by the improvement in efficiency of the provision of the current public health insurance and/or the promotion of preventative medical services. Another import element in terms of the reduction of medical expenditures is technological progress in the medical field. As pointed out by Hiroi (1994), technological progress in the medical field might induce an increase in medical expenditures. Thus, the effect of both directions of changes, an increase as well as a decrease, in the national medical expenditure is simulated in this paper. By changing the future national medical expenditure, this paper numerically evaluates these foci; the improvement in efficiency of the provision of the current public health insurance and the promotion of preventative medical services.

It has recently been argued that the growth rate of the national medical expenditure should be kept at least at the same rate as that of economic growth, in order to make the public health insurance scheme sustainable. In particular when the reform started, the main discussion concerned the reduction of the national medical expenditure, since the sustainability of the scheme was argued based on the financial reason of the scheme. The effect of the recent argument is also simulated.

The paper uses the actual as well as the forecasted future population data in order to capture the realistic demographic structure of an aging Japan. A multi-period overlapping generations model is used within a general equilibrium framework, and the effect of the reform through all possible channels is evaluated in the long-run.

Our simulation results are summarized as follows. First of all, an increase in the co-payment rate, which is one of the most prominent changes in the reform, would result in higher economic growth as well as higher welfare. This is because the increase stimulates private savings. The effect through the channel of the stimulation of private savings can only be captured by the general equilibrium model. However, the magnitude of the effect is not so large. The positive effect on economic growth is relatively larger when the policy change is implemented, and the magnitude of the positive effect becomes smaller as the time passes. The change in the economic growth rate in the long-run is around 0.01 and 0.02% in year 2050, while an increase in the economic growth rate in the short-run is 0.09% when the co-payment rate is increased to 20%, and it is 0.16% when the co-payment rate is increased to 30% for all age groups. Secondly, an increasing tread of the future national medical expenditure can mainly be explained by an aging population, and an increase in the co-payment rate has little effect to squeeze the national medical expenditure in the future. This implies that the effect of the change in the co-payment rate is still small even though it is re-examined within a general equilibrium framework, and the similar result to Ii and Bessho (2006) can also be obtained. Thirdly, the effect of a decrease in the national medical expenditure, which can possibly be induced by the improvement in efficiency in the public provision of medical services, the promotion of preventative medical services, or technological progress in the medical field, on the future burdens of medical expenditures is also very small. A change in the national burden ratio in year 2050 is only 1.2% even when the per capita medical cost changes by 10%. Finally, if the government implements a policy to keep the ratio of the national medical expenditure to GDP constant, then the government has to keep reducing the national medical expenditure over time, and the reduction rate should be 45 percent in year 2050. Such a policy also eventuates in lower economic growth until around year 2035.

Our simulation results thus indicate that the reform is not so effective to reduce the future national medical expenditure, but it can achieve higher economic growth by stimulating private savings. In particular even if the co-payment rate is increased in order to reduce the national medical expenditure, then the magnitude of the effect of the increase is expected to be very small. Note also that the positive effect of an increase in the co-payment rate on economic growth is also small although it results in higher economic growth by stimulating private savings. Furthermore, even when the national medical expenditure is reduced by 10 %, the effect of the reduction on the aggregated economy is also small. This implies that the improvement in efficiency of the provision of the current public health insurance as well as the promotion of preventative medical services does not have an effective result on the aggregated economy, even if it successfully reduces the national medical expenditure. The future burdens on the aggregated economy would not change by improving the efficiency of the provision of the current public health insurance or by promoting preventative medical services. Note that an increasing trend of the future national medical expenditure can mainly been explained by an aging population. Since the effect of the improvement in efficiency of the provision of the current public medical services as well as the promotion of preventative medical services on an aging Japan is marginally small at the aggregate level, the efficiency of the public provision of medical services and/or the promotion of preventative medical services should be examined in the context of the microeconomic rather than macroeconomic perspective.

This paper is organized as follows: The next section introduces the Japanese health care system, and section 3 explains about the reform of the Japanese health care system commenced in year 2006. Section 4 simulates the effect of the changes in several key instruments on the future aggregate national medical expenditure by incorporating population aging, and section 5 concludes this paper.

2 The Japanese Health Care System

The demand side of the Japanese health care system can be characterized by two aspects; free access and the universal compulsory public health insurance[4].

Free access implies that persons can obtain all consultations, medical treatments, and procedures at any medical institutions without referrals, and thus persons (patients) can decide where/when they visit to obtain medical services at any time.

The public health insurance is universal in a sense that it is compulsory, and also that all persons are forced to contribute to a body (insurer) of the public health insurance[5], depending on the difference in their employment type[6]. it consists of several insurers[7], as shown in Figure 1. The Japanese public health insurance can be categorized based on the employment type; employment based health insurances, and the other type of insurances. Persons who are not insured by any of employment based public health insurances are insured by the other type of insurances, which is called Local Governments' National Health Insurances (Shichoson Kokuho). In terms of the self-employed, some of them have their own public health insurance which consists of persons with the similar job such as medical doctors and barbers, and such kinds of public health insurances are integrated into the body called the Unions of National Health Insurances (Kokumin Kenko Hoken Kumiai). Both Local Governments' National Health Insurances (Shichoson Kokuho) and the Unions of National

[4]There is another important public insurance for long-term care, wihch is called the long-term care insurance. Since any persons of age 40 and over also have to contribute to this public insurance, the Japanese public health insurance can be interpreted as being compulsory and universal. Persons of age 65 and over are categorized as category 1 insured persons. Category 1 persons are entitled to obtain long-term care through the public long-term care insurance. Persons between age 40 and 64 are categorized as category 2 insured persons. Category 2 persons are not eligible to obtain services through the public long-term care except for seveal cases, but they have to contribute to the system.

[5]All dependents and the retired persons are also insured.

[6]There is an issue that the number of the insurered who have not paid the premium has been increasing while it is compulsory. This is another issue, and we do not discuss it in this paper.

[7]See also Tokita (2002) for the detailed explanation about the Japanese health care system.

Health Insurances (Kokumin Kenko Hoken Kumiai) are together called National Health Insurance (Kokuho). The self-employed, who are not insured by any of insurances of the Unions of National Health Insurances, are insured by Local Governments' National Health Insurances. Employees health insurances consist of 4 different types; Seamen's Insurance, Mutual Aid Associations, Insurances by National Federations of Health Insurances Societies, and Insurances by Japan Health Insurance Association. Table 1 shows the insurers of the bodies.

Almost all of medical services are covered by the public health insurance[8], and the cost of medical services, including medical drugs prescribed at medical institutions, is financed by the following three sources; premiums of the public health insurance, public funds (taxes), and co-payments. The co-payment rate depends on age, but not on different insurers[9]. All insured persons can obtain almost all of medical services by paying a co-payment at any medical institutions at the time when they receive services.

In terms of the public health insurance for the elderly, the government introduced a new system in year 2008, in order to cope with the biased distribution of financial burdens among different bodies consisting of the public health insurance. Figure 2 shows the new public health insurance for the elderly. In general employees usually contribute to their own insurance by paying the premium during their working periods[10]. Then they move to National Health Insurance after their retirement. Since they usually need more medical services as they get aged, this implies that National Health Insurance has to have more 'costly' insured persons who did not contribute to it during their working periods. Hence, the government has divided the group of age 65 and over into two groups as shown in Figure

[8]For instance, normal birth giving and cosmetic surgery are not covered by the public heath insurance. Many expensive medical services are also not covered by the public health insurance.

[9]The current co-payment rates are 20-30%. In terms of the contribution rate, it depends on different insurers, although the range of the contribution is regulated by law.

[10]As explained in Sectrion 4.2.3 later, a premium of the public health insurance is usually paid monthly as a short-term contribution to the social insurance scheme together with a contribution to the public pension. The contribution to the public pension is called a long-term contribution in the scheme. The social insurance scheme consists of several schemes, and the public health insurance and the public pension are main schemes of the social insurance sheme of Japan.

2. The first group consists of the elderly between age 65 and 74. The elderly in this group remains in their body (insurance), but the biased distribution of financial burdens is adjusted among different bodies (insurances) according to the ratio of the number of the elderly to the total number of insured persons in each insurance. Regarding the elderly of age 75 and over, they completely move to a new public health insurance called Choju Iryo Seido. This newly introduced public health insurance for the elderly is financed by the premium of the elderly of age 75 and over (10%), the contributions (premiums) by insured persons of all other existing insurances (40%), and a public fund (50%). Note that the transferred contributions (premiums) from other insurances can be interpreted as intergenerational transfers.

The supply side of the Japanese health care system can be characterized by the fee-for-service scheme[11] with the regulated prices (points) of the medical fee system. The Japanese medical fee system called 'Shinryo-hoshu Seido' employes a point method. Points are allocated to all treatments, procedures, and drugs covered by the public health insurance, and the points are fully controlled by the government. Points include income of physicians generated by the provision of medical services. Since almost all of medical services are covered by the public health insurance, this implies that almost all of prices of medical services are regulated by the government, and prices, including labor income of physicians, are officially determined. The cost of all medical services covered by the public health insurance is reimbursed to physicians and hospitals based on the points[12]. Although the cost is fully reimbursed by the regulated price system, drugs and some services such as medical inspections are traded in the private market, and thus market prices for these items also exist apart from the regulated prices. This implies that there are financial incentives among hospitals and physicians to use more profitable items if the whole sale prices are lower than the regulated prices. Figure 2 shows the actual procedure of payment. In practice, hospitals or physicians

[11] There have been several hospitals which moved to the prospective reimbursement scheme with the DPC (Diagnosis Procedure Combination), which is the Japan's specific DRG. However, many medical services are still reimbursed based on the fee-for-service scheme in Japan.

[12] One point is equivalent to 10 Japanese yen. Thus, for instance, if a physician provides a patient with a medical treatment which earns 1,000 points, then the physician can claim 10,000 Japanese yen minus the amount of a co-payment paid by the patient to the patient's insurer.

do not claim to the insurers of their patients directly. They firstly claim to the local fund based on the allocated points of medical services they provided to their patients. Then the local fund examines their claims, and it reports the amount to each of insurers of patients after investigation[13]. Each of insurers then pays the amount to the local fund, and the local fund reimburses the amount to hospitals and physicians. This implies that each of insurers has no right to investigate medical services provided by hospitals and physicians. Tokita (2002) pointed out that their weak power over the investigation resulted in an increase in the amount of national medical expenditure.

The difference in the employment structure of physicians also characterizes the supply side of the Japanese health care system. Physicians can be categorized by being self-employed or hospital-employed. Note that the Japanese medical fee system does not treat them differently, and any physicians can be self-employed or hospital-employed as long as they are qualified as physicians. The most distinctive difference between the self-employed and the hospital-employed can be found in their income: Income of hospital-employed physicians is usually paid by salary thus fixed, while income of self-employed physicians depends on their choice of working hours, treatments, and procedures they provide to their patients. Although insured persons can visit any medical institutions, they tend to visit self-employed physicians to obtain primary care, and it seems that self-employed physicians have been playing a role as gatekeepers.

3 The Reform

One of the main purposes of the reform is to squeeze the national medical expenditure. A successive increase in the national medical expenditure has politically been discussed, and it has been argued that the growth rate of the national medical expenditure should

[13] The local fund sometimes returns their claims back to hospitals and physcians in order to make them re-calculate their claims after investigation. However, as it will be mentioned, due to the huge amount of claims given to the fund every month, it does not seem in practice that investigation efficiently works to detect all of inadequate claims.

be controlled to be at least the same as the economic growth rate. As shown in Figure 4, both the per capita national medical expenditure and the ratio of the national medical expenditure to GDP have basically been increasing. However, as pointed out by Zweifel and Breyer (1997), it is distortionary to keep the ratio of the national medical expenditure to GDP constant.

The background of the reform is a rapid aging population of Japan. In fact, as shown in Figure 5, the latest estimates of a future population predict a rapid aging population of Japan in a short period. Figure 6 also shows the age difference in the national medical expenditure of year 2006. In year 2006, the ratio of the expenditure by age 65 and over to the total national medical expenditure was 51.6%, and the ratio by age 75 and over was 21.9%. Both figures predict a drastic increase in the future national medical expenditure due to a rapid aging population.

The reform consists of several policies relating to; 1.an importance of preventative medical services, 2. the efficiency in the provision of health services, 3. a launch of a new public health insurance program for the elderly, 4. an increase in the co-payment rate of the elderly, 5. the integration of several public health insurers, and 6. the reform of the medical fee system. Each of them is explained as follows.

Importance of Preventative Medical Services

The Japanese public health insurance consists of many insurers, and each insurer had not had a common system to provide insured persons with preventative medical services. The provision of preventative medical services was not compulsory to each insurer, and the lack of the compulsory system in terms of the provision of preventative medical services resulted in the poor improvement of national health In particular, an importance of preventative medical services has not been considered in terms of the compulsory provision of them by insurers. It is expected that the more provision of preventative medical services would result in a decrease in the national medical expenditure.

Efficiency in the Public Health Insurance

A positive correlation between the number of acute care beds and the amount of the national medical expenditure as well as that between the average length of stay for acute care and the number of the national medical expenditure have been both observed in Japan. In the reform, the point system has been modified in order to shorten the average length of stay. In order to provide medical services more efficiently, the provision of medical services will be considered at the province level (Todohuken) rather than at the nation wide level, while free access is maintained at any medical institutions in Japan. This implies that the quality of medical services including the premium level would differ among different provinces. The plan in order to achieve the efficient provision follows the PDCA (Plan-DO-Check-Act) method, and the plan will be accessed comprehensively in year 2012.

New Public Health Insurance for the Elderly

Based on the prediction of a rapid aging population, a new public health insurance for the elderly has been launched separately from the existing insurances. This newly introduced public health insurance for the elderly called 'Choju Iryo Seido' covers the elderly of age 75 and over. This insurance scheme is financed by the premium of the elderly of age 75 and over (10%), the contributions (premiums) by insured persons of all other existing insurances (40%), and a public fund (50%).

Increase in the Co-payment Rate

The reform has modified the co-payment rates. As shown in Table 2, the co-payment rates do not depend on different insurances, but on the age. In particular, the co-payment rates for the elderly have been increased. In addition, the co-payment rate for the age group between 70 and 74 years old will be increased from 10% to 20% in April 2009. Note that the elderly has to pay the premium regularly in addition to co-payments when they receive medical services.

Integration of Several Insurers

Table 1 shows the current existing insurers of the public health insurance. In fact, there are several insurers which financial basis is relatively weak. In particular, the integration of National Health Insurance, National Federation of Health Insurance Societies, and Japan Health Insurance Association has been discussed.

Reform of the Medical Fee System

The Japanese medical fee system employs a point system, which is called 'Shinryo Hosyu Seido'. Allocated points are modified every 2 years. Points to several medical services and medical drugs were modified in year 2006, and the total points also decreased by 3.16% in year 2006. The modification of points are expected to directly change the allocation of medical resources, and it is often modified in order to fulfill the budget constraint of the public health insurance. Since all prices of medical services covered by the public health insurance are fully regulated by this medical fee system, the modification of points should be carefully considered.

The reform has been conducted basically in order to cope with an increase in the national medical expenditure, which will be caused by an aging population. Thus, a key element behind the reform is that a rapid aging population in the near future will result in further burdens on the current public health insurance scheme. This implies that the accurate prediction of the future population is important to evaluate the reform in the long-run. The next section simulates possible policy instruments by using the realistic demographic structure.

4 Simulation Analysis

The effect of the reform on economic growth as well as welfare is simulated in the long-run, by explicitly taking into account an aging population in the future. Our simulations employ a multi-period overlapping generations model developed by Auerbach and Kotlikoff (1983) within a general equilibrium framework. Taxes, a public pension scheme, and a public health insurance scheme are incorporated into the model to investigate the effect of the reform of the existing Japanese system. The model consists of the household, the private firm, and the government. The government runs the general account and the social insurance account. The social insurance account consists of a pay-as-you-go public pension scheme and a public health insurance scheme. In order to capture the realistic demographic change in an aging Japan, the actual population data as well as the latest estimate of a future population are both used.

4.1 The Model

The representative household is assumed to optimize its intertemporal consumption through its lifetime, taking the wage rate, the interest rate, and its own survival rates as given. The tax system, the public pension scheme, and the public health insurance scheme are also assumed to be taken as given by the household. The household is assumed to obtain its wage income by supplying labor inelastically until it retires, and once it retires it never returns to the labor market. There are no altruistic bequest motives and Ricardian equivalence does not hold.

The firm is assumed to maximize its profit by taking the wage rate and the interest rate as given. The wage rate and the interest rate are determined in each fully competitive factor market in equilibrium.

The government sector is assumed to collect taxes from the household, and also to issue government bonds in order to fulfill its budget constraint. The government sector has its general account as well as the social insurance account. In order to capture the realistic aspect of its accounts, the government is assumed to have transfers from the general account to the social insurance account. The social insurance account is assumed to consist of a pay-as-you-go public pension scheme and a public health insurance scheme. The government is also assumed to accumulate a public pension fund.

It is assumed that there is no private life insurance, and thus there is no mechanism for the household to hedge the risk of dying in each period. Since the household is assumed to have no bequest motives, this assumption implies that the household leaves an accidental bequest when it dies. However, it is also assumed that there is no uncertainty in the whole economy in terms of the size of each generation, and thus there is no uncertainty in the total (aggregate) amount of bequests inherited in each period.

4.1.1 The Household

The household appears in the economy at age 20 as a decision maker. Although the household faces uncertainty regarding its death in each period, it dies with certainty at the end of its age of 99 if it is alive until age 99. Denote the survival rate of generation i at time t by $q_{i,t}$. The survival risk is assumed to be idiosyncratic, and there is no uncertainty regarding the size of the total population in each period.

The household is assumed to maximize its expected lifetime utility with respect to its own consumption. The household's expected lifetime utility of generation i is given by[14]

$$E[V_i] = \sum_{t=i}^{i+79} q_{i,t}(1+\delta)^{-(t-i)} \frac{(c_{i,t} - m_{i,t})^{1-\rho}}{1-\rho}, \tag{1}$$

where $c_{i,t}$, δ, and ρ denote consumption at time t, the discount rate of time, and the index of relative risk aversion, respectively. $m_{i,t}$ represents a subsistence level of consumption at age $t-i$, and it is the minimum level of consumption at which the household can be "healthy" in the sense that it can only enjoy its consumption in excess of $m_{i,t}$. Note that the net amount of consumption over $m_{i,t}$ only generates utility. $m_{i,t}$ can be interpreted as the amount of medical expenditure measured in a consumption good c to be healthy in each period, while consumption of medical services is not considered explicitly in this paper[15]. In order to

[14]According to the result by Hayashi (1995), bequest motives are not considered here. Strategic bequest motives are also not considered. Since there is also no uncertainty regarding wage income, a precautionary saving motive for uncertain wage fluctuation is not considered, which was discussed in Horioka and Watanabe (1997).

[15]See Johansson (2000) for the case where the household optimally chooses the amount of medical services.

simulate the effect of the change in the amount of medical expenditure in the subsequent sections, it is simply assumed that $m_{i,t}$ is exogenously given in this paper. As pointed out by several studies[16], the amount of per capita medical expenditure by age shows a U-shaped pattern, and $m_{i,t}$ is given to be U-shaped in the simulations. As explained in the previous section, many of medical services are covered by the public health insurance in the current system. Due to the U shape of medical expenditure by age, an aging population results in an increase in the aggregate amount of benefits provided through the public health insurance, although it is assumed that the age pattern of $m_{i,t}$ does not change in the future.

The budget constraint of the s-year-old household of generation i at time t is given by

$$\begin{aligned} a_{i,t} = {} & [1 + (1 - \tau_{r,t})r_t]a_{i,t-1} + (1 - \tau_{y,t} - \tau_{p,t})w_t e_{i,s} + b_{i,s} \\ & + ps_{i,t} + (1 - cp_{i,t})m_{i,t} - (1 + \tau_{c,t})c_{i,t}, \end{aligned} \tag{2}$$

where $a_{i,t}$, r_t, and $e_{i,s}$ denote its assets of generation i at the end of period t, the interest rate, and a measure of effective labor, respectively[17]. The household supplies labor inelastically until it retires, and once it retires, it never comes back to the labor market. w_t is the wage rate per efficiency unit of labor, and $w_t e_{i,s}$ is pre-tax labor income. All taxes are proportional, and $\tau_{y,t}$, $\tau_{r,t}$ and $\tau_{c,t}$ denote the wage income tax rate, the interest income tax rate, and the consumption tax rate, respectively. The contribution rate, or the premium rate of the social insurance account is denoted by $\tau_{p,t}$. The social insurance account consists of a public pension scheme as well as a public health insurance scheme, and the total amount of collected contributions or premiums is divided into the two schemes. $ps_{i,t}$ denotes the amount of per capita public pension benefits. $cp_{i,t}$ denotes a co-payment rate, and thus $cp_{i,t}m_{i,t}$ is the total amount of medical expenditure the household has to pay when it receives medical services at medical institutions. $(1 - cp_{i,t})m_{i,t}$ is the total amount of medical expenditure covered by the public health insurance, and this can be interpreted as the amount of benefits given to

[16] See Reinhardt (2000) for instance.

[17] The profile of effective labor follows Kato (2002).

the household through the public health insurance when it receives medical services. An ex post moral hazard problem of the health insurance is not considered in this paper. Denoting the age when the household starts obtaining pension benefits by R, and the replacement rate by β_p, the amount of pension benefits the household receives is given by

$$ps_{i,s} = \begin{cases} \beta_p \left(\frac{1}{R} \sum_{s=0}^{R-1} w_t e_{i,s} \right) & \text{if } t-i \geq R \\ 0 & \text{if } t-i < R \end{cases}.$$

It is assumed that the household contributes to the social insurance scheme from age 20 to age 64. It is also assumed that there is no private pension market[18].

Savings of the household which dies are left as accidental bequests. These accidental bequests are assumed to be redistributed equally to the household which is alive in each period.

The first order necessary conditions of the household yield the Euler equation such that

$$(c_{i,t} - m_{i,t})^{-\rho} = \frac{q_{i,t+1}}{q_{i,t}} \frac{1+(1-\tau_{r,t+1})r_{t+1}}{1+\delta} \frac{1+\tau_{c,t}}{1+\tau_{c,t+1}} (c_{i,t+1} - m_{i,t+1})^{-\rho}, \tag{3}$$

from which the optimal consumption path can be derived once the initial value of consumption is given. In the simulation section, the initial value of consumption is given to satisfy the lifetime budget constraint of the household, so that the optimal consumption path also satisfies the budget constraint.

4.1.2 The Firm

The firm is assumed to maximize its profits, taking the wage rate and the interest rate as given. The wage rate and the interest rate are determined in perfectly competitive factor markets in equilibrium. The aggregate private production function is assumed to be Cobb-

[18] See Iwamoto, Kato, and Hidaka (1993), Friedman and Warshawsky (1988), and Friedman and Warshawsky (1990) for models which include the private pension market.

Douglas such that

$$Y_t = Z_t L_t^{\alpha} K_t^{1-\alpha}, \tag{4}$$

where Y_t represents aggregate output at time t, K_t the aggregate private capital stock, L_t aggregate labor supply measured by effective labor unit. Z_t denotes technology of production of the private sector. Assuming that each factor market is perfectly competitive with the above aggregate production function, output is fully distributed to labor and capital.

The first order necessary conditions of the firm yield

$$w_t = \alpha Z_t L_t^{\alpha-1} K_t^{1-\alpha} \tag{5a}$$

$$r_t = (1-\alpha) Z_t L_t^{\alpha} K_t^{-\alpha} - \delta_k, \tag{5b}$$

where δ_k denotes the depreciation rate for the capital stock.

4.1.3 The Government Sector

The government sector consists of a general account and a social insurance account.

Expenditure of the general account includes the general government expenditure and transfers to the social insurance account. Expenditure of the general account is financed by taxation and by issuing government bonds. The general government expenditure includes government consumption, government investments, interest payments incurred by government debts, and transfers to the household. Note that these transfers to the household are different from the transfers to the social insurance account.

The social insurance account consists of a public pension account and a public health insurance account. The amount of transfers to the public pension account from the general account is characterized by η, which is the ratio of the amount of transfers to the total amount of social insurance benefits. The government sector is assumed to have no particular objective function which it maximizes. The budget constraint of the general account is

$$G_t + \eta S_t = R_t + B_t - (1 + r_t)B_{t-1} \tag{6a}$$

$$R_t = \tau_{c,t}C_t + \tau_{y,t}w_tL_t + \tau_{r,t}r_tK_t + \tau_{h,t}Q_t, \tag{6b}$$

where B_t, R_t, and G_t denote the amount of outstanding government bonds, the total tax revenue, and the total general government expenditure, respectively. The total amount of bequests is represented by Q_t. Transfers to the public pension account are denoted by ηS_t, where S_t is the total social insurance benefits. $\tau_{h,t}$ denotes the inheritance tax rate. In the following simulations only the consumption tax rate is endogenously determined to satisfy the budget constraint over time, and all other tax rates are exogenously fixed at the value of year 2002.

The budget constraint of the social insurance account and the contribution, or the premium rate, are defined as

$$F_t = (1 + r_t)F_{t-1} + \tau_{p,t}w_tL_t - (1 - \eta)S_t \tag{7}$$

where F_t is an accumulated public pension fund at the end of period t. The total amount of benefits includes public pension benefits and public health insurance benefits. The contribution (premium) rate is determined endogenously in order to satisfy (7), while the realistic value of F_t is given exogenously in each scenario.

4.1.4 Equilibrium

The equilibrium condition of the capital market in period t is given by:

$$\sum_i N_{i,t}a_{i,t-1} + F_{t-1} = K_t + B_t.$$

The equilibrium condition of the goods market is given by:

$$Y_t = C_t + (K_{t+1} - (1 - \delta_k)K_t) + G_t.$$

Note that the general equilibrium of fully competitive markets is described by these two equilibrium conditions with the first order conditions described by (3), (5a), and (5b), where the contribution (premium) rate $\tau_{p,t}$ and the consumption tax rate $\tau_{c,t}$ are also determined endogenously in order to satisfy the budget constraints of the government given by (6a), (6b), and (7).

4.2 Data and Assumptions

In order to make our simulations as realistic as possible, available actual and projected data have been used together with estimated values of relevant parameters based on the empirical research. The key elements are; demography, government deficits, public pension scheme, public health insurance scheme, and the tax structure.

4.2.1 Demography

Actual population data have been used from 1965 to 2000. Before 1965 population data were calculated under the assumption that the fertility rate and the mortality rate were the same as in 1965. Regarding population projections, the "medium variant" projections from the latest edition of Projection of Future Population in Japan (Shourai-Jinko-Suikei, 2006) have been used. Life Tables in Kanzen and Seimeihyo and Shourai-Jinko-Suikei (2006) were used to obtain survival rates. Since Projection of Future Population in Japan only gives estimates of the future population until 2100, it has been assumed that the number of births and deaths, and the survival rates after 2100 are fixed at the same levels as those in 2100.

4.2.2 Government Deficits

Until 2007 the actual data from SNA have been used. From 2008, the future sequence of government deficits has been given based on the following assumptions.

Since the average growth rate of the ratio of government debts to GDP (the debt-to-GDP ratio) between 1998 and 2007 is calculated to be 5%, the growth rate of the debt-to-GDP ratio in year 2008 has been assumed to be 5%. Thus, the growth rate of the debt-to-GDP ratio is assumed to decrease by 0.5% from 2009 every year. This implies that the annual growth rate of the debt-to-GDP ratio from 2009 has been given by 4.5%, 4.0%, 3.5% so on. Then, it has been assumed that the growth rate of the debt-to-GDP ratio keeps decreasing until year 2019, and also that the growth rate of the ratio becomes zero after year 2019. This implies that the debt-to-GDP ratio keeps constant after year 2019, and the constant debt-to-GDP ratio is 150% as shown in Table 1.

4.2.3 Social Insurance Scheme

The social insurance scheme consists of two schemes: the public pension scheme and the public health insurance scheme.

Actual data until 2007 have been used for both schemes. The amount of transfers to the social insurance account from the general account, characterized by η, and the replacement rate, β_p, were calculated from SNA. In terms of the contribution (premium) rate, the actual data have also been used until 2007. In Japan's actual system, the public pension contribution (the long-term contribution) and the public health insurance premium (the short-term contribution) are typically collected together as the social insurance contribution. The contribution rate has been calibrated in order to satisfy (7), where the amount of the pension fund is exogenously given.

Public Pension Scheme The public pension scheme has been assumed to have the same replacement rate β_p of year 2007 in the future. In terms of the years before 2007, the actual data have been used in simulations. Regarding the amount of the public pension fund, the actual data have been used until 2007. From 2008, the ratio of the fund to GDP has been assumed to be constant at the same level as that of 2007.

Public Health Insurance Scheme Actual data have been used until 2007. Based on National Medical Expenditure issued by Japan's Ministry of Health, Labor and Welfare, the SNA data have been modified to obtain per capita public health insurance benefits which the household receives every year. Until 2007, the actual per capita benefits have been calculated, and a U-shaped pattern on age similar to Figure 6 has been obtained for simulations. From 2008, the U-shaped pattern of year 2007 has been assumed to continue. This implies that $m_{i,t}$ changes with s but not with generation i from 2008 onwards. The growth rate of per capita national medical expenditure has been assumed to be the same as that of technology in the benchmark case. In terms of the co-payment rate, $cp_{i,t}$, it has been assumed in the benchmark case that $cp_{i,t}$ are 20% for age 20-69, 10% for age 70-74, and 5% for age over 75, respectively. Note that the actual co-payment rate at the aggregate level in recent years is calculated to be around 14%. The co-payment rates for different age groups in the benchmark case have been calculated by taking into account the cohort and age differences in the distribution of the actual population, so that the calculated co-payment rate at the aggregate level of the benchmark case coincides with the actual rate (14%). The total amount of medical expenditures of different age groups calculated in the benchmark case thus becomes very close to the actual amount, while the co-payment rates in the benchmark case are different from the actual rates given Table 2. The effect of changes in the co-payment rate for different age groups will be simulated.

Except for a consumption tax, all taxes (a labor income tax, an interest income tax, and an inheritance tax) have been assumed to be fixed at the 2007 rates. The 2007 tax rates were obtained from the SNA data. Note that the consumption tax is the only indirect tax in this paper, and its rate has been calculated from the actual total amount of indirect taxes revenue in the national account. Thus the consumption tax rate calculated here does not coincide with the actual rate.

4.2.4 Technological Progress

Technological progress of private production plays a very important role. Thus careful attention should be paid to the assumption on technological progress, since the value of technological progress directly affects simulation results. In this paper technological progress is measured by the Solow residual. Following Hayashi and Prescott (2002), the capital share is set at 0.361585. In the benchmark case the value of technological progress from 2008 is assumed to be 1%.

When values of parameters can be obtained from the existing empirical research, the values have been used in the simulations. The values used in this paper are summarized as follows:

The Values of Parameters

δ	ρ	α	δ_k	β_p
0.02	2	0.63842	0.089	0.54

4.3 Benchmark Simulation

Table 3 shows the result of the benchmark case. The actual values of the debt-to-GDP ratio until 2007 are given to the simulation values, while other simulation values in the table are all calculated values obtained in the benchmark case. Figure 7-1, 7-2, and 7-3 also show the trends of per capital GDP, the ratio of public pension benefits to GDP, and the ratio of public health insurance benefits to GDP, respectively. In all figures, both of the actual and the benchmark figures are shown. Note that the simulation value of the ratio of public pension benefits to GDP as well as the ratio of public health insurance benefits to GDP is very close to the actual value of year 2007. The increasing trend in the ratio of public pension benefits to GDP, as well as in the ratio of public health insurance benefits to GDP can be explained by an aging population, as pointed out by several papers (See Dekle (2002), and Broda and Weistein (2004)). The benchmark case forecasts that the social security burden ratio will become more than double in 2050 in comparison with the ratio in 2005. Our benchmark case also shows that public health insurance benefits would increase by 1% every ten years, while Tokita, Chino, Kitaki, Yamamoto, and Miyagi (1997) argues that the national medical expenditure would increase by 40% over a period of 30 years. It is more expensive to be healthy as aged, and population aging results in an increase in the aggregate amount of public health insurance benefits.

Furthermore, our simulation result shows an interesting result. As shown in the last column of the table, the average co-payment rate at the aggregate level is expected to decrease by an aging population. This is because an aging population results in a relative increase in the number of the elderly, whose co-payment rate is lower than other age groups. Thus, although an aging population induces an increase in the total amount of public health insurance benefits, it reduces the average co-payment rate at the aggregate level.

4.4 Reform Simulations

The effect of the reform of the scheme will be simulated in this section. As presented in the benchmark simulation, an aging population will increase the total amount of public health insurance benefits. The increase in the total amount of benefits obviously makes the financial situation of the scheme more severe, and in fact the government has increased the co-payment rate on the process of the reform in order to cope with an increase in the amount of benefits. One of the most prominent changes in the reform is an increase in the co-payment rate, and in the first simulation the effect of the reform of increasing the co-payment rate will be investigated.

In the second simulation, the effect of changes in medical expenditures will be examined. The reform also focuses on the improvement in efficiency of the provision of the current public health insurance as well as the promotion of preventative medical services, in order to reduce the national medical expenditure. In the second simulation, the effect of the reform is explored from this point of view.

In the last simulation, a recent argument will be examined. One of the main purposes of the reform is to make the public health insurance scheme sustainable in an aging Japan, and it has recently been argued that growth of the national medical expenditure should be controlled to be at least the same as economic growth. The last simulation will study the effect of the recent argument within the general equilibrium framework.

4.4.1 An increase in the co-payment rate

An increase in the co-payment rate is expected to squeeze the amount of public health insurance benefits[19]. In fact the government has increased the co-payment rate for the elderly in the reform in order to reduce the national medical expenditure.

Note that the co-payment rates, $cp_{i,t}$, in the benchmark case were 20% for age 20-69, 10% for age 70-74, and 5% for age over 75, respectively. In this first simulation, the change in the co-payment rate has been assumed to occur in year 2008, and the following two cases have been investigated; 20% for all age groups, and 30% for all age groups from year 2008. When the co-payment rate is set at 20% for all age groups, then the co-payment rate for age 20-69 does not change compared to the benchmark case, while the co-payment rates for all age groups increase when the co-payment rate is set at 30%. The result of the effect of an increase in the co-payment rate is shown in Table 4. Note that the amount of medical expenditures each individual has to bear is exogenously given, and also that an increase in the co-payment rate implies an increase in the amount individuals have to pay at medical institutions at the time when they receive medical services. This also implies a decrease in the cost which the public health insurance covers, and an increase in the co-payment rate

[19] An increase in the co-payment rate is also expected to reduce the number of visits as well as to weaken the ex-post moral hazard behavior. See Ii and Bessho (2006) for the empirical literature, where they argue that the ex-post moral hazard behavior is insignificant in Japan. This paper excludes the possibility of moral hazard.

thus results in a decrease in the contribution rate as shown in Table 4. The reductions in the national burden ratio, the contribution rate, and the consumption tax rate are 2% from the benchmark level in year 2050 when the co-payment rate is set at 20% for all age groups. The reductions are also 4% from the benchmark case when the co-payment rate is set at 30% for all age groups.

A striking result can be found in the effect on economic growth. When the co-payment rate increases higher economic growth is achieved, although the effect is not so large. This can be explained as follows: An increase in the co-payment rate directly reduces the amount of disposal income after individuals pay the medical expenditures. Since the medical expenditures individuals have to pay increase as they get aged due to an increase in the possibility to get ill, individuals have to save more in order to prepare for the larger amount they have to pay at medical institutions if the co-payment increases. An increase in the co-payment rate induces an increase in savings, thus resulting in higher economic growth. This positive effect on economic growth is relatively larger when the policy change is implemented, and the magnitude of the positive effect becomes smaller as the time passes. The change in the economic growth rate in the long-run is around 0.01 and 0.02% in year 2050, while an increase in the economic growth rate in the short-run is 0.09% when the co-payment rate is set at 20%, and it is 0.16% when the co-payment rate is set at 30% for all age groups. This positive effect can also be presented in Table 5, where the effect on welfare is shown.

4.4.2 Changes in the medical cost

The reform also focuses on the improvement in efficiency of the provision of the current public health insurance as well as the promotion of preventative medical services, in order to reduce the national medical expenditure. This paper thus considers the effect of the reform from this point of view by simulating the effect of changes in the national medical expenditure as well. The reduction of the future national medical expenditure could be induced by the improvement in efficiency of the provision of the current public health insurance and/or the promotion of preventative medical services. Another import element in terms of the reduction of medical expenditures is technological progress in the medical field. As pointed out by Hiroi (1994), technological progress in the medical field might induce an increase in medical expenditures; a better medical treatment might be more expensive. Thus, the effect of both directions of changes, an increase as well as a decrease, in the national medical expenditure is simulated in this section. By changing the future national medical expenditure, this paper evaluates these foci; the improvement in efficiency of the provision of the current public health insurance and the promotion of preventative medical services.

In our simulation, the age pattern of $m_{i,t}$, or the U-shape, has been kept, but it has been assumed to shift downward by 10% when the national medical expenditure decreases, while it has been assumed to shift upward by 10% if the national medical expenditure increases. Table 6 shows the simulation result. When the medical cost decreases, the financial situation of the public health insurance becomes better, and the amount of premiums individuals have to pay should decrease. Since the amount of a co-payment also decreases, disposal income increases. Thus, a decrease in the medical cost should be preferable. However, since individuals do not need save as much as before in order to prepare for the large amount of the medical cost when they get aged, the aggregate capital stock should be reduced, thus resulting in a decrease in national income in the long-run. This implies that there are always positive and negative effects. On the other hand, if the medical cost increases, then a completely opposite story should be applied. Table 6 shows that due to two opposite effects the overall effect is insignificant. For instance, a decrease in the national burden ratio in year 2050 is only 1.2% even when the per capita medical cost decreases by 10%.

4.4.3 Recent Argument

It has recently been argued that the growth rate of the national medical expenditure should be controlled to be at least the same as the economic growth rate. In order to examine the recent argument, the following simulation has been conducted: First of all, the ratio of the national medical expenditure to GDP in year 2008 of the benchmark case was calculated, and the calculated value has been 7.846%. Then the total national medical expenditures from 2009 were calculated by using the benchmark model under the assumption that the ratio keeps constant at 7.846% even after 2009. This implies that the path of the total national medical expenditures from 2009 has been obtained when the ratio of the national medical expenditure to GDP keeps constant at the same level as that of year 2008, which is 7.846%. Furthermore, the ratio of these calculated values of the total national medical expenditures to the total medical expenditures obtained in the benchmark model was calculated from 2008. The ratio in year 2008 is obviously unity. This ratio is called the reduction rate in this paper, since the ratio presents how much the national medical expenditure should be reduced in order to keep the amount relatively constant to GDP. Then by using the reduction rate as well as the age pattern of $m_{i,t}$, the age specific amount of the medical cost at each age was calculated from 2008, and the numerical calculation was conducted again. Note that this simulation takes into account the behavioral response of all agents since the simulation was re-executed by using the new amount of $m_{i,t}$ which is exogenously given to the individual. This simulation thus examines the case if the government announces the policy in year 2008 that the national medical expenditure will be reduced in the future in order to keep the amount relatively constant to GDP by using the most likely amount of future GDP. The simulation result is given by Table 7[20], where the reduction rate is shown in the second column. The reduction rate shows how much the government has to reduce the current national medical expenditure. As the table shows, the reduction rate keeps increasing to maintain the policy over time, and the government has to reduce the national medical expenditure by 45% in year 2050. Another interesting result is that until around year 2035 economic growth would be lower when the government implements the policy on the recent argument.

[20]As shown in Table 7, the ratio of the national medical expenditure to GDP does not coinside with 7.846% from 2009, since GDP in this simulation is different from that of the benchmark model.

5 Concluding Remarks

The paper has investigated the effect of the reform of the Japanese public health insurance scheme on economic growth by simulating several reforming policies in an aging Japan within a general equilibrium framework.

The paper has used the actual and forecasted future population data in order to capture the realistic demographic structure, and the effect of the reform as well as the recent argument has been evaluated in the long-run.

Our simulation results are summarized as follows. First of all, an increase in the co-payment rate, which is one of the most prominent changes in the reform, would result in higher economic growth as well as higher welfare. This is because the increase stimulates private savings. The effect through the channel of the stimulation of private savings can only be captured by the general equilibrium model. However, the magnitude of the effect is not so large. The positive effect on economic growth is relatively larger when the policy change is implemented, and the magnitude of the positive effect becomes smaller as the time passes. The change in the economic growth rate in the long-run is around 0.01 and 0.02% in year 2050, while an increase in the economic growth rate in the short-run is 0.09% when the co-payment rate is set at 20%, and it is 0.16% when the co-payment rate is set at 30% for all age groups. Secondly, a rise in the future national medical expenditure can mainly be explained by an aging population, and an increase in the co-payment rate has little effect to squeeze the national medical expenditure in the future. This implies that the effect of the change in the co-payment rate is still small even though it is re-examined within a general equilibrium framework, and the similar result to Ii and Bessho (2006) can also be obtained. Thirdly, the effect of a decrease in the national medical expenditure, which can possibly be induced by technological progress in the medical field, the improvement in efficiency in the public provision of medical services, or the promotion of preventative medical services, on the future burdens of medical expenditures is also very small. A change in the national burden ratio in year 2050 is only 1.2% even when the per capita medical cost changes by 10%. Finally, if the government implements a policy to keep the ratio of the national medical expenditure to GDP constant, then the government has to keep reducing the national medical expenditure over time, and the reduction rate should be 45 percent in year 2050. Such a policy also eventuates in lower economic growth until around year 2035.

Our simulation results thus indicate that the reform is not so effective to reduce the future national medical expenditure, but it can achieve higher economic growth by stimulating private savings. In particular even if the co-payment rate is increased in order to reduce the national medical expenditure, then the magnitude of the effect of the increase is expected to be very small. Note also that the positive effect of an increase in the co-payment rate on economic growth is also small although it results in higher economic growth by stimulating private savings. Furthermore, even when the national medical expenditure is reduced by 10 %, the effect of the reduction on the aggregated economy is also small. This implies that the improvement in efficiency of the provision of the current public health insurance as well as the promotion of preventative medical services does not have an effective result on the aggregated economy, even if it successfully reduces the national medical expenditure. The future burdens on the aggregated economy would not change by improving the efficiency of the provision of the current public health insurance or by promoting preventative medical services. Note that an increasing trend of the future national medical expenditure can mainly been explained by an aging population. Since the effect of the improvement in efficiency of the provision of the current public medical services as well as the promotion of preventative medical services on an aging Japan is marginally small at the aggregate level, the efficiency of the public provision of medical services and/or the promotion of preventative medical services should be examined in the context of the microeconomic rather than macroeconomic perspective.

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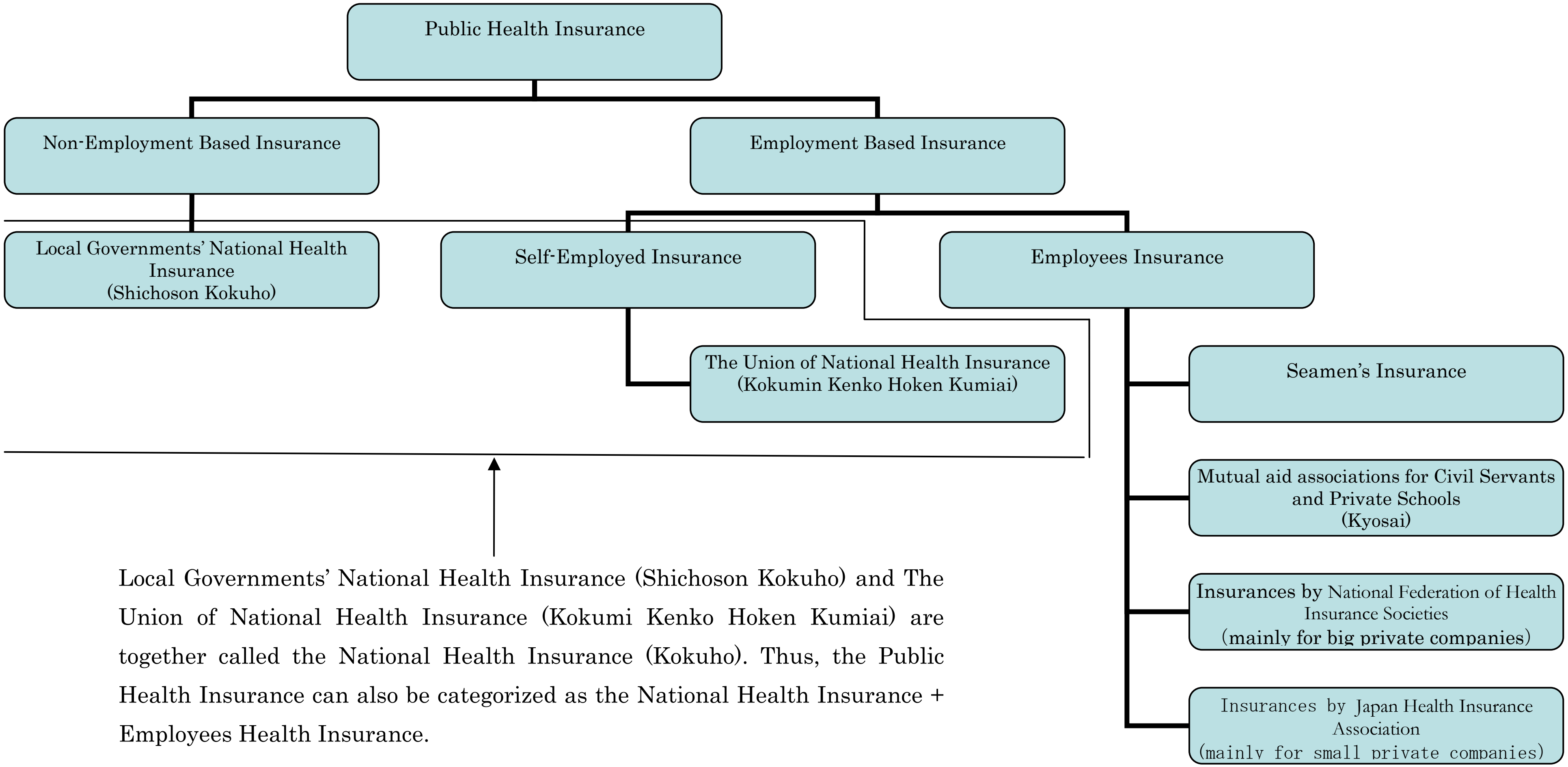
Figure 1

The Structure of the Public Health Insurance of Japan



Local Governments' National Health Insurance (Shichoson Kokuho) and The Union of National Health Insurance (Kokumi Kenko Hoken Kumiai) are together called the National Health Insurance (Kokuho). Thus, the Public Health Insurance can also be categorized as the National Health Insurance + Employees Health Insurance.

Table 1

	Type	Insurers
National Health Insurance (Kokuho)	Local Governments National Health Insurance (Shichoson Kokuho)	Local governments
	Unions of National Health Insurance (Kokumin Kenko Hoken Kumiai)	Each union of National Health Insurances
Employees Health Insurance	Seamen's Insurance	Central Government
	Insurances by mutual aid associations	Each mutual aid association
	Insurances by each member of National Federation of Health Insurance Societies	Each member of National Federation of Health Insurance Societies
	Insurance by Japan Health Insurance Association	Japan Health Insurance Association

Figure 2

(New Public Health Insurance for the Elderly)

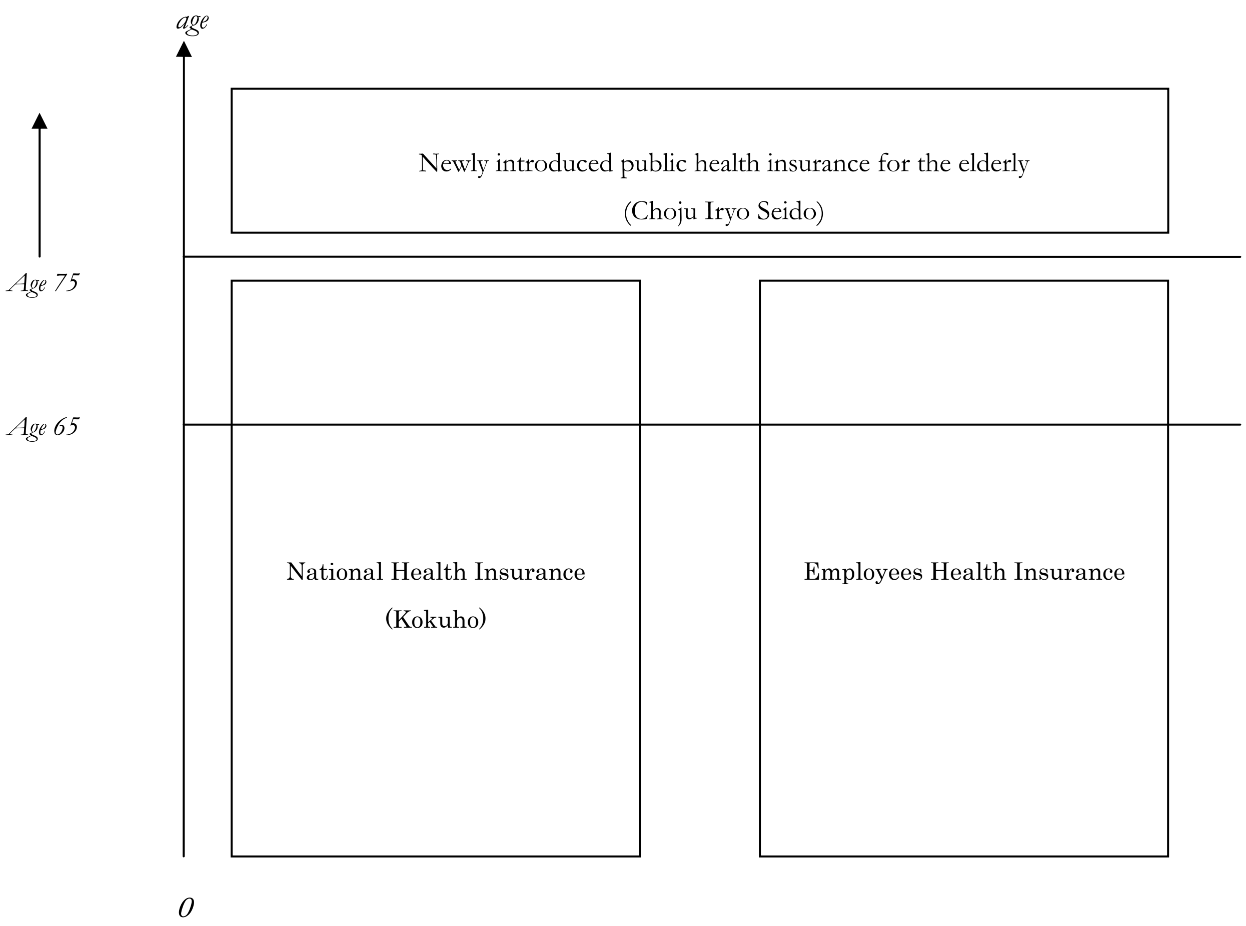
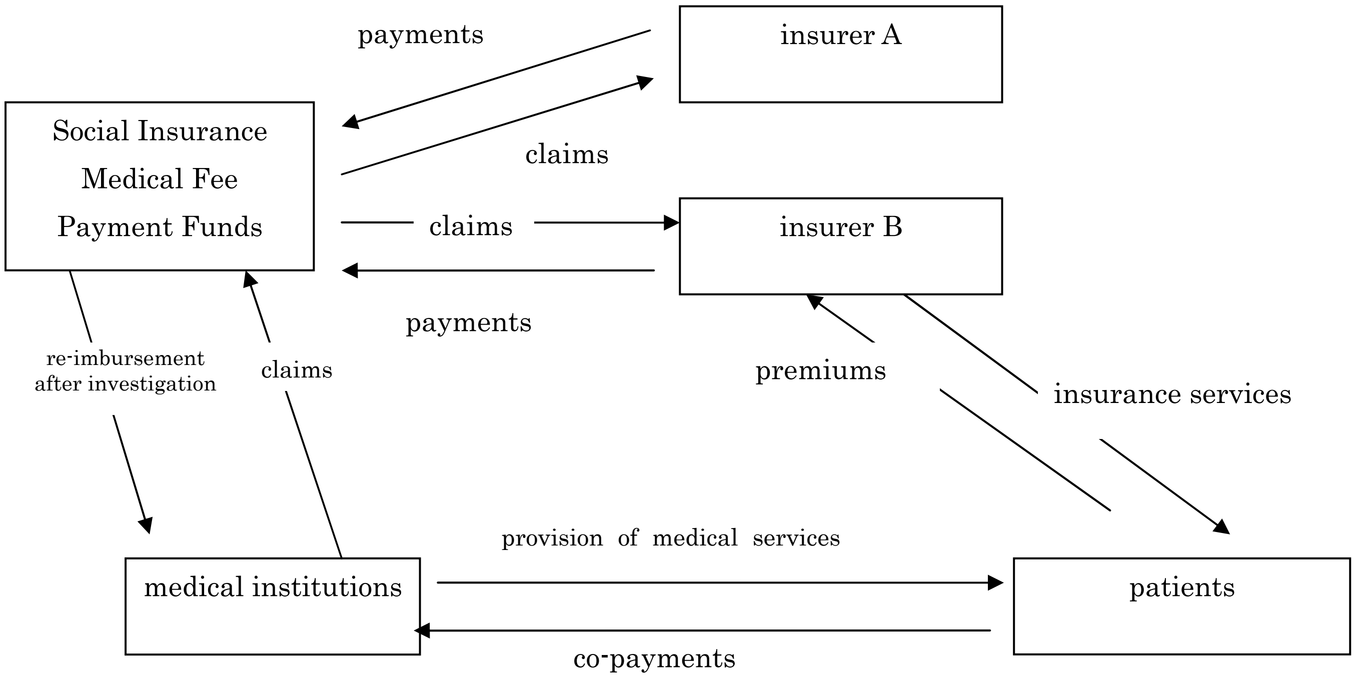
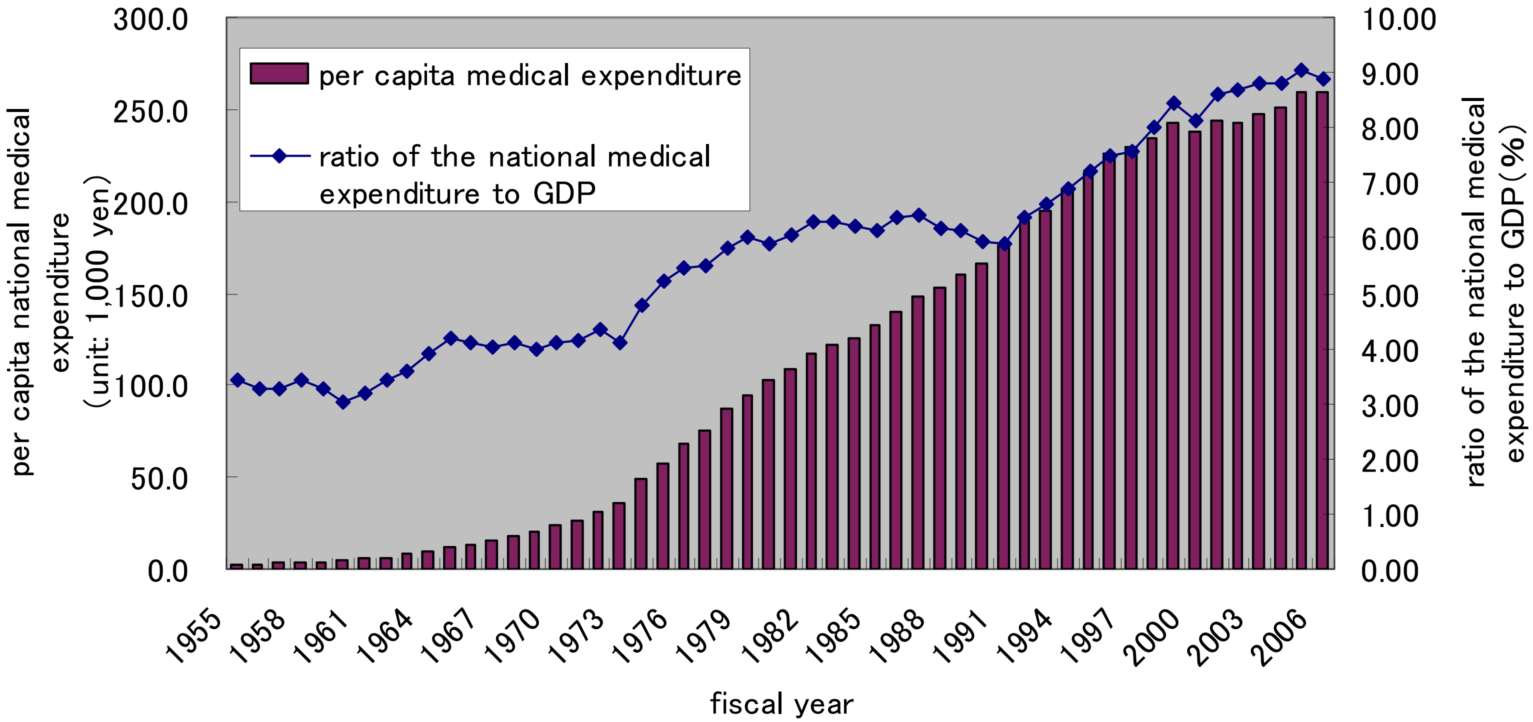


Figure 3



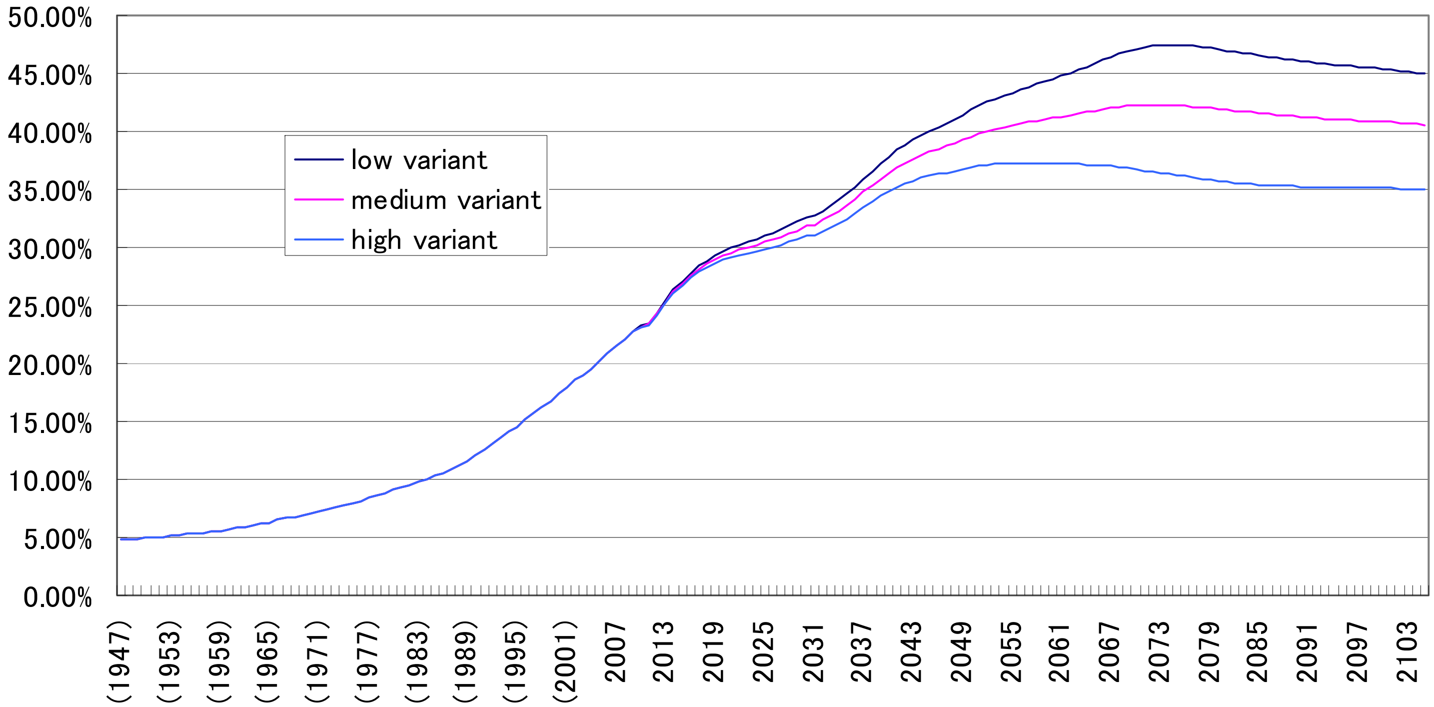
payments
insurer A
Social Insurance
Medical Fee
Payment Funds
claims
claims
insurer B
payments
re-imbursement
after investigation
claims
premiums
insurance services
provision of medical services
medical institutions
patients
co-payments

Figure 4



Data Source: Ministry of Health, Labor and Welfare

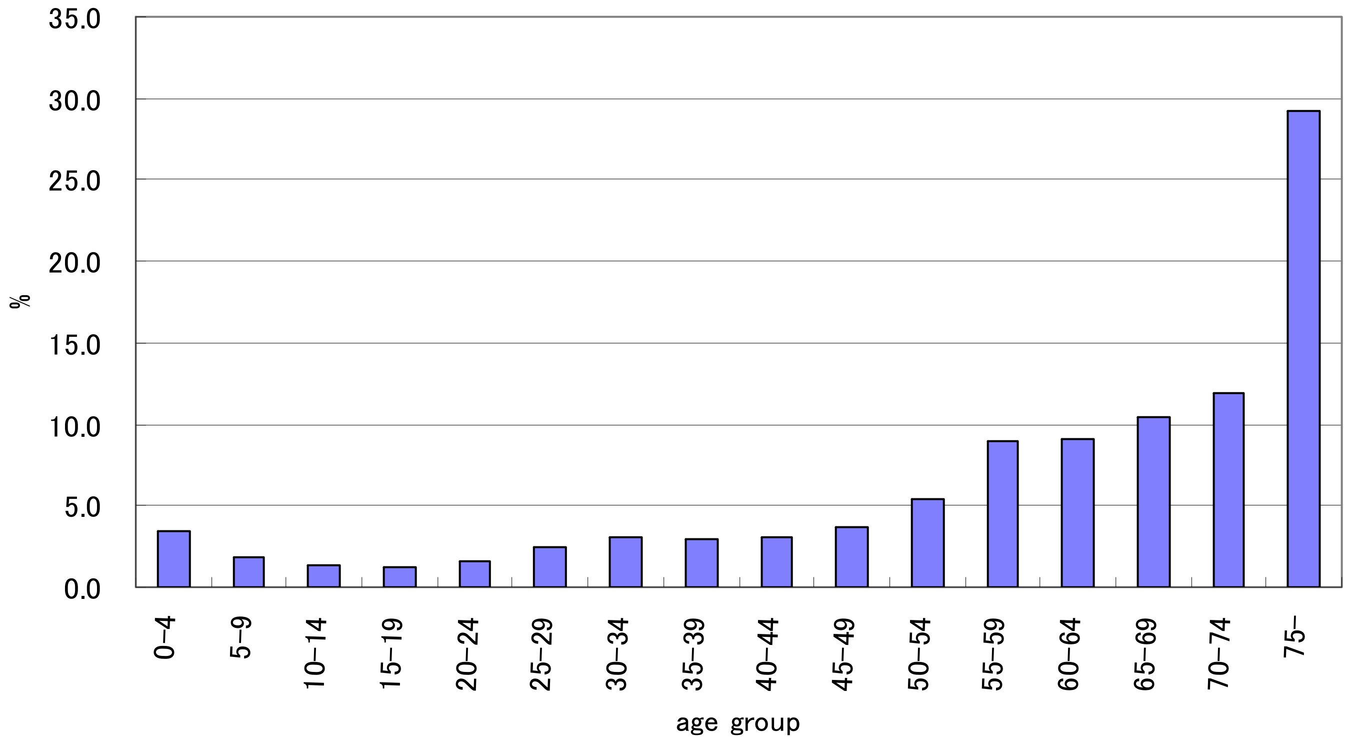
Figure 5: Aging Rates



Until 2005 actual data has been used. From 2006 the latest population projection by the National Institute of Population and Social Security Research has been used.

Figure 6

(The age group difference in the national medical expenditure of year 2006)



Data Source: Ministry of Health, Labor and Welfare

Table 2: The Co-Payment Rates

Age	0 ～ before junior high school	After junior high school ～ 69	70 ～74	75 and over
Co−payment rates	20 %	30 %	20 % *	10 %

*) 10 % until the end of March of 2009

Notice: a 30% rate is applied to the elderly of 70 and over with high income.

Table 3. Benchmark simulation results

Year	Outstanding debts GDP ratio	GDP Growth rate %	Primary balance GDP ratio	National burden GDP ratio	Contribution rate %	Public pension benefits GDP ratio	Public health insurance benefits GDP ratio	Interest rate %	Co-payment rate %
Actual									
2005	1.279	2.5262	-7.445	27.047	19.552	8.437	6.421		14.4
Simulation									
2005	1.279	1.745	3.781	38.032	15.185	8.586	6.462	8.259	13.5
2010	1.359	1.381	4.054	39.005	15.256	10.024	7.292	8.167	13.0
2015	1.489	0.795	6.822	44.927	18.860	12.162	8.112	7.561	12.4
2020	1.507	0.903	8.955	48.967	20.946	13.395	8.878	7.381	11.7
2025	1.507	0.777	9.177	50.344	22.204	13.932	9.556	7.331	11.1
2030	1.507	0.456	9.022	51.668	23.873	14.694	10.232	7.173	10.9
2035	1.507	0.159	8.932	53.510	26.037	15.893	10.939	6.957	10.8
2040	1.507	-0.028	9.170	56.334	28.889	17.876	11.607	6.787	10.8
2045	1.507	0.079	9.808	58.641	30.669	19.082	12.246	6.970	10.5
2050	1.507	0.124	10.506	60.477	31.851	19.745	12.915	7.305	10.1

Note: Public health insurance benefits exclude the amount of co-payments.

Figure 7-1 : Per Capita GDP (Benchmark Model)

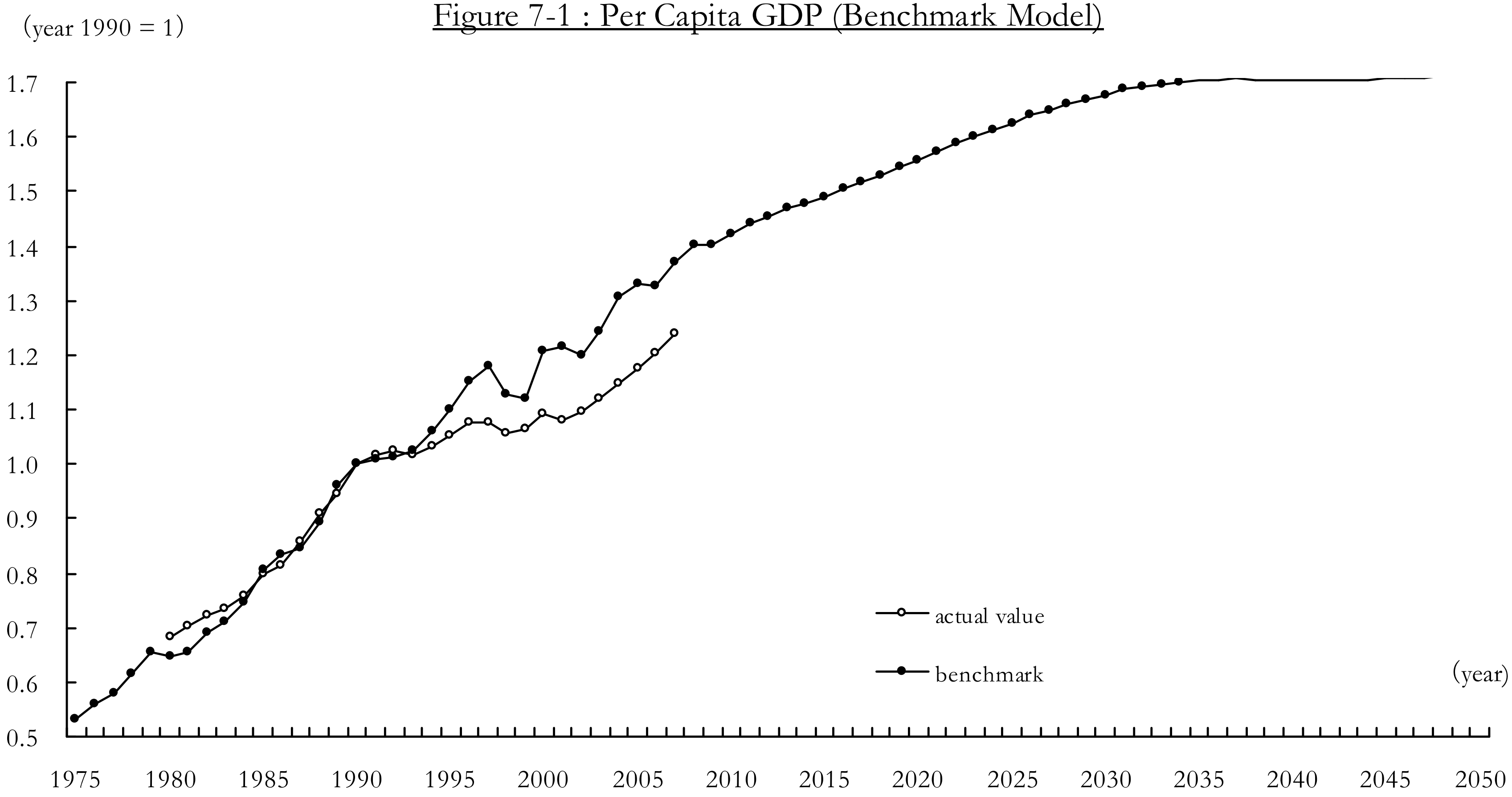


Figure 7-2 : The Ratio of Public Pension Benefits to GDP (Benchmark Model)

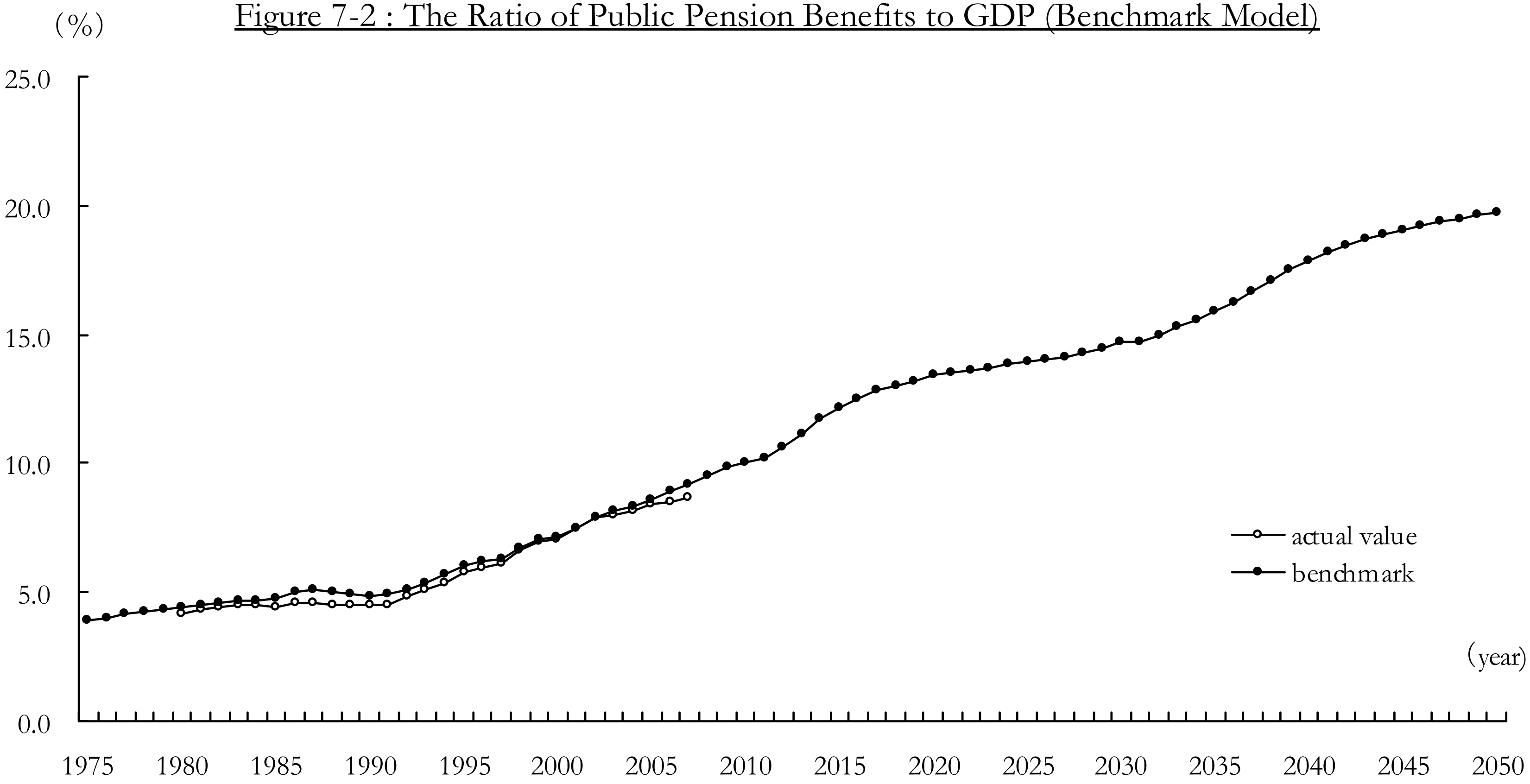
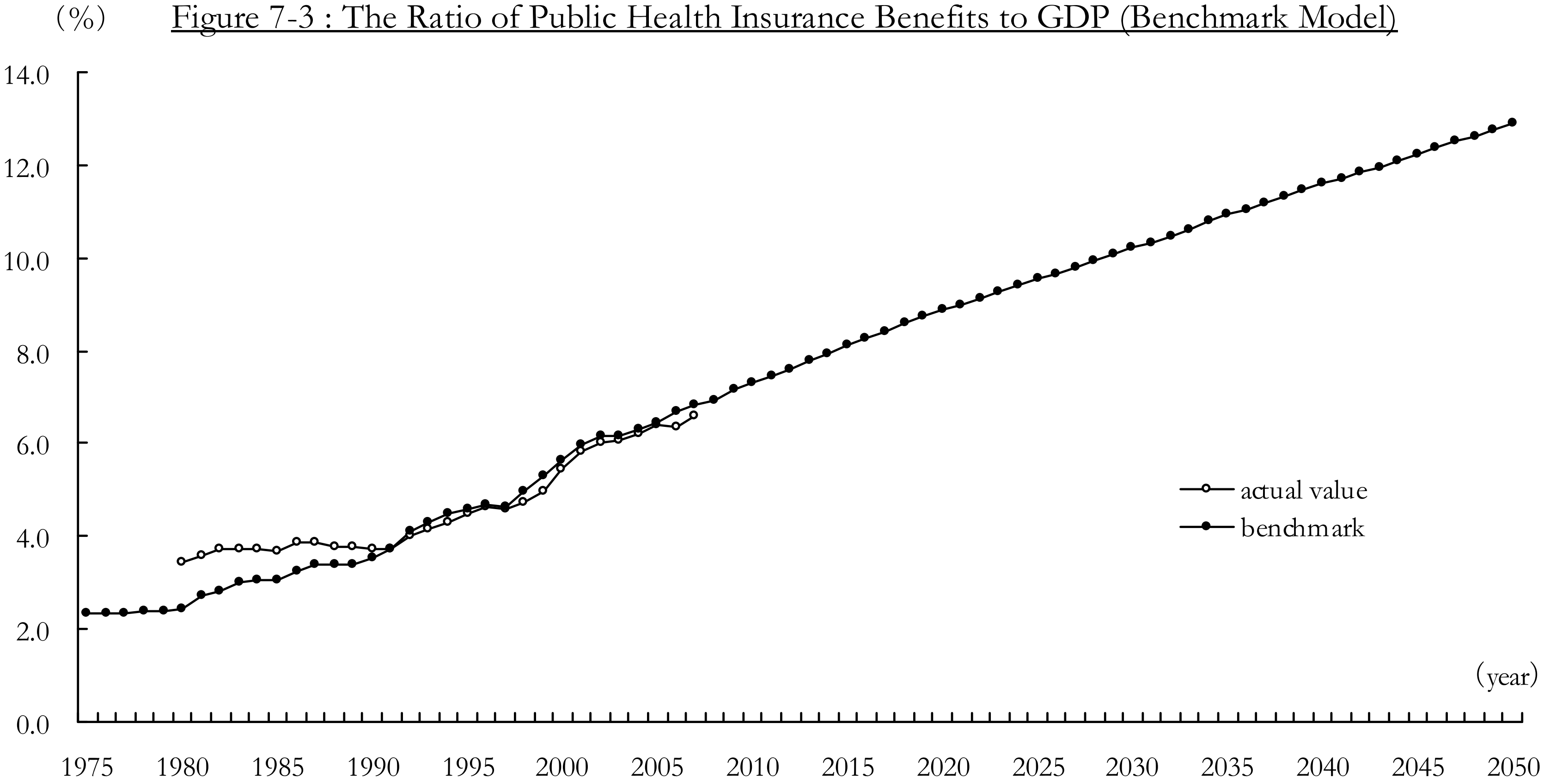


Figure 7-3 : The Ratio of Public Health Insurance Benefits to GDP (Benchmark Model)



<u>Table 4. Increases in the co-payment rate</u>

Unit: %

	National burden ratio			Social security contribution rate			Consumption tax rate			GDP growth rate		
	base	20%	30%	base	20%	30%	base	20%	30%	base	20%	30%
2010	39.01	38.25	37.31	15.26	14.67	13.81	35.76	35.47	35.06	1.38	1.47	1.54
2015	44.93	43.95	42.84	18.86	18.16	17.21	41.68	41.19	40.64	0.80	0.85	0.89
2020	48.97	47.79	46.55	20.95	20.09	19.06	46.38	45.74	45.09	0.90	0.94	0.97
2025	50.34	49.01	47.67	22.20	21.22	20.12	47.23	46.46	45.73	0.78	0.80	0.82
2030	51.67	50.22	48.79	23.87	22.79	21.60	47.41	46.57	45.77	0.46	0.47	0.48
2035	53.51	51.97	50.44	26.04	24.86	23.58	47.84	46.94	46.09	0.16	0.17	0.18
2040	56.33	54.70	53.08	28.89	27.62	26.26	49.07	48.13	47.23	-0.03	-0.02	-0.01
2045	58.64	56.87	55.17	30.67	29.28	27.84	50.66	49.64	48.70	0.08	0.09	0.09
2050	60.48	58.56	56.77	31.85	30.33	28.81	51.99	50.89	49.89	0.12	0.13	0.14

Table 5. Welfare effects of an increase in the copayment rate

	20%	30%
1920	0.036	0.013
1925	0.038	0.006
1930	0.035	-0.005
1935	0.035	-0.017
1940	0.031	-0.028
1945	0.028	-0.047
1950	0.033	-0.040
1955	0.047	-0.021
1960	0.083	0.034
1965	0.154	0.139
1970	0.295	0.334
1975	0.466	0.581
1980	0.733	0.949
1985	0.905	1.250
1990	1.424	1.891
1995	1.405	1.938
2000	1.470	2.045

The values show the difference in the calculated value of utility between the benchmark case and simulated cases. The negative value implies a decrease in welfare. The year shows when they were born, and thus the generation.

Table 6. Changes in medical expenditures (unit: %)

	National burden ratio			Social security contribution rate			Consumption tax rate			GDP growth rate		
	base	10% increase	10% decrease	base	10% increase	10% decrease	base	10% increase	10% decrease	base	10% increase	10% decrease
2010	39.01	39.68	38.32	15.26	16.10	14.42	35.76	36.13	35.39	1.38	1.41	1.35
2015	44.93	45.65	44.20	18.86	19.79	17.93	41.68	42.03	41.33	0.80	0.81	0.78
2020	48.97	49.75	48.17	20.95	21.96	19.93	46.38	46.75	46.01	0.90	0.91	0.90
2025	50.34	51.19	49.49	22.20	23.29	21.11	47.23	47.61	46.84	0.78	0.78	0.77
2030	51.67	52.57	50.75	23.87	25.03	22.71	47.41	47.82	47.00	0.46	0.46	0.45
2035	53.51	54.49	52.52	26.04	27.27	24.80	47.84	48.27	47.41	0.16	0.16	0.16
2040	56.33	57.37	55.28	28.89	30.19	27.58	49.07	49.53	48.61	-0.03	-0.03	-0.03
2045	58.64	59.74	57.52	30.67	32.04	29.29	50.66	51.13	50.17	0.08	0.08	0.08
2050	60.48	61.65	59.29	31.85	33.30	30.40	51.99	52.48	51.49	0.12	0.12	0.13

Table 7: The Effect of the Constant Ratio of National Medical Expenditure to GDP (unit: %)

	Reduction Rate	National Medical Expenditure ratio to GDP		National burden ratio		Social security contribution rate		Consumption tax rate		GDP growth rate	
		base	constant	base	constant	base	constant	base	constant	base	constant
2010	4.0	7.29	7.02	39.01	39.06	15.26	14.71	35.76	35.60	1.38	1.17
2015	16.0	8.11	7.10	44.93	44.45	18.86	17.41	41.68	41.50	0.80	0.67
2020	21.0	8.88	7.16	48.97	47.87	20.95	18.66	46.38	46.02	0.90	0.83
2025	26.0	9.56	7.19	50.34	48.65	22.20	19.17	47.23	46.67	0.78	0.73
2030	31.0	10.23	7.20	51.67	49.33	23.87	20.08	47.41	46.62	0.46	0.43
2035	36.0	10.94	7.20	53.51	50.46	26.04	21.45	47.84	46.78	0.16	0.15
2040	39.0	11.61	7.19	56.33	52.59	28.89	23.57	49.07	47.72	-0.03	-0.02
2045	42.0	12.25	7.21	58.64	54.26	30.67	24.67	50.66	49.04	0.08	0.09
2050	45.0	12.92	7.23	60.48	55.40	31.85	25.15	51.99	50.12	0.12	0.16