Will Abenomics Save Future Generations?

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Abstract

We estimated the lifetime net burden ratio by explicitly considering the burden of inflation tax in order to quantitatively assess the impact of inflation or deflation on the intergenerational imbalances. As a result, the following points were elucidated: 1) The previous studies which do not take inflation tax revenue into consideration underestimate the burden of the currently living generations during an inflationary period and that of the future generations in a deflationary period; 2) Abenomics aiming to trigger a shift from deflation to inflation is desirable from the aspect of filling the intergenerational imbalances; and 3) Although the economic growth promotion measures will reduce the lifetime net burden ratio of all generations, such measures alone will not help to eliminate the intergenerational imbalances in Japan; a concurrent implementation of public finance and social security system reform is necessary.

1. Introduction

In Japan, with the ongoing decline in the birthrate and aging population, the systems that had been established on the premise of a soaring economy have been shaken to their foundation. As a result, sustainability of the Japanese economy, and most notably, the public finance and the social security, is endangered.

Both the public finance and the social security have been maintained by managing to meet costly expenditures with limited revenue, in other words, by making up the revenue/expenditure variance with the issuance of government bonds, thereby postponing today's tax burden. This approach did not expose any problems in a situation in which the economy was growing steadily and the population of future generations who are to bear the postponed debt was steadily increasing. However, with the prolonged economic recession combined with the continuing falling birthrate and aging population, a contradiction has emerged in the concept of the public finance and the social security dependent on shifting of burdens to future generations.

As we will discuss in more detail later, the intergenerational imbalances in Japan is at the world's worst level. The main reason for this can be attributed to the stopgap measures that have been adopted to cope with and maintain the situation—even now when the demographic pyramid is turning upside down—without taking any decisive action to implement the necessary drastic reform of the systems that were established on the premise that the population would steadily increase.

The government of Japan currently has an enormous debt. Looking back at the public finance history of Japan after the high growth periods, Japan's public finances worsened to such an extent that the then-Zenko Suzuki Cabinet declared a fiscal emergency in 1982. Then, the situation took a temporary favorable turn; the government of Japan freed itself, for the first time in 20 years, from the issuance of deficit-covering bonds between FY1990 and FY1993 by taking advantage of the bubble economy that had continued from the latter part of the 1980s. However, starting with the economy-boosting measures implemented in response to the burst of the bubble economy in 1991, discretionary financial policies such as permanent tax reductions and an increase in public investment, with the exception of consumption tax increase in 1996, have been consistently and continuously adopted. As a result, public expenditures have grown steadily while tax revenue has either leveled off or slightly decreased (Figure 1).

However, the Prime Minister Koizumi Cabinet formed in April 2001 shifted away from the conventional expansionary fiscal management and instead implemented spending reductions and structural reforms. Although it took a while before any effect of the spending reductions was seen due partly to a temporary drop in tax revenue associated with the recession, the tax revenue gradually increased, aided by both the economic growth spurred by structural reforms and by an

increase in exports against the backdrop of a weak yen. In 2007, 51 trillion yen tax revenue was achieved, exceeding the level recorded at the time when the economy was shored up by the ICT revolution in Japan.

However, the so-called "Lehman Shock" that occurred in 2008 has completely changed the landscape, triggering a slowdown not only in the Japanese economy but also in the global economy. While tax revenue plunged to 38.7 trillion yen in 2009, expenditures exceeded 101 trillion yen as measures against the "Lehman Shock." Subsequently, expenditures continued to hover at high levels around the mid-90 trillion yen, while tax revenue leveled off.

As a result, the dependence on public bonds has sharply increased, exceeding 50% in FY2009 for the first time in the post-war era. It has decreased, however, to 38.3% (based on the original budget) in FY2015, impacted also by the consumption tax increase (Figure 2).

The trend of expenditures and revenue as explained above has led to a remarkable increase in the government debt. According to the System of National Accounts issued by the Economic and Social Research Institute of the Cabinet Office, the government debt to GDP ratio which stood at about 50% as of 1994 has climbed to 166% in 2013; it has more than tripled in a matter of 20 years. The presence of such enormous government debt can become a major threat to smooth fiscal management in the future. The currently living population is virtually consuming, without permission, the resources that should belong to those in the future. It is considered therefore, that the intertemporal resource allocation is being distorted.

Against the backdrop of this critical situation surrounding Japan's public finances, there was a time, in and after the mid-1990s, when the issue of the sustainability of government debt was highlighted in Japan's academic circles. In reality, however, the absorption of government bonds continued in a stable manner despite the increase of government debt in value terms and as a percentage of the nominal GDP. The interest rate of the government bonds also continued to decrease rather than increase, and the debt-servicing cost remained at low levels. All in all, the environment surrounding the government debt turned out to be stable despite concerns expressed by many economists. Under these circumstances, although the consumption tax was increased from 5% to 8% in April 2014, a further hike to 10% scheduled for April 2017 was postponed to October 2019 on the grounds of the worsening economy. However, in order to ensure the sustainability of Japan's public finances, it has been suggested that Japan should increase its consumption tax to 20% (by OECD (2015)), to between 30 and 60% (by Braun and Joines (2014)), and to 40 to 60% (by Hansen and Imrohoroglu (2014)).

In the face of this critical financial situation, the markets deepened their suspicion about the Japanese government's attitude towards fiscal consolidation, and reduced the credit rating of its bonds in succession.

The second Abe Cabinet inaugurated at the end of 2012 promoted a policy labeled

"Abenomics" with the pillars of "monetary easing," "fiscal policy," and "deregulation." As for the fiscal consolidation, the Cabinet relies entirely on a tax revenue increase driven by inflation and economic growth promotion, and has a negative attitude towards cuts in expenditures and social security spending.

Reinhart and Sbrancia (2011) classified the process in which hugely indebted nations accomplished or failed to accomplish fiscal consolidation into 5 scenarios; 1) economic growth, 2) fiscal consolidation, 3) debt restructuring, 4) sudden high inflation, and 5) financial repression, of which 3) through 5) were categorized in the study as financial collapse.

It also seems as though the government of Japan and the Bank of Japan[2] are aiming to achieve 5) financial repression along with 1) fiscal consolidation driven by economic growth. In fact, according to the revenue (general account budget for FY2016), tax revenue is projected to increase by more than 3 trillion yen over the FY2015 budget to 57.6 trillion yen, and the dependence on government bonds is also expected to drop to 35.6%, the level of FY2008 before the Lehman Shock. However, although the interest rate was stabilized at a low level, the national debt servicing cost rose to a new high at 23.0 trillion yen in the FY2016 budget due to increased principal and interest payment cost associated with the accumulated outstanding government bonds. Therefore, although the Abe Cabinet's fiscal reconstruction track seems to be moving ahead favorably, whether or not it will continue to move on successfully into the future will be another matter. Rather, whether consciously or not, there is no denying the possibility that a substantial government debt reduction triggered by 4) sudden high inflation might end up taking place, just like Japan experienced immediately after the end of the Pacific theater of WWII[3].

"A substantial government debt reduction triggered by a sudden high inflation" means, in short, that the government uses inflation tax revenue as invisible financial resources for fiscal consolidation. Unlike other taxes, the use of inflation tax revenue as a resource for fiscal consolidation is not implemented through a resolution by the Diet, which represents the public, and is therefore contrary to the financial democracy based on Article 83 of the Constitution of Japan as well as to the principle of no taxation without implementation of a law as defined in Article 84 of the Constitution of Japan. At the same time, as we will discuss later in this paper, inflation has a major impact on the intergenerational imbalances as it triggers intertemporal income redistribution.

Use of inflation tax revenue for the purpose of eliminating an enormous government debt

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[2] As a result of the BOJ's current massive government bond buying operation as part of quantitative and qualitative monetary easing measures under the 2% inflation target, the long-term interest rate has remained at historically low levels.

[3] According to Ministry of Finance, the government debt to GDP ratio that was around 200% just before the end of the war largely fell to a little less than 15% in FY1950 as a result that hyperinflation progressed rapidly.

has been conducted frequently throughout history as discussed in Reinhart and Sbrancia (2011). In consideration of the future of the intergenerational imbalances in Japan, it is extremely significant and imperative to consider inflation tax revenue gained through price fluctuations that influence the trends of the government debt in the future.

The intergenerational imbalances in Japan is the most serious in the world due to the absence of a tax increase schedule, at present, that is sufficient to eliminate the enormous government debt, coupled with political parties' cautious and half-hearted approaches towards reform of the social security that is forcing an excessive burden on younger generations, due to a fear of the so-called silver democracy.[4]

As is well known, Japan has been battling deflation for more than a decade since the end of the 1990s. In general, price fluctuations such as deflation and inflation have various impacts on macroeconomics and individual living. One of such effects is on creditors/debt holders. To be more precise, in times of inflation, resources are transferred from creditors to debt holders, whereas in times of deflation, the situation is reversed.

In the case of hugely indebted Japan, if we take into account the fact that over 60% of all the financial assets are owned by the elderly generation, and that the majority of such assets are government bonds held either directly or indirectly, it can be said that the principal debtors of government debt are younger generations, including future generations.[5]

Therefore, in times of deflation that continued from the end of the 1990s, revenue was continuously transferred from future generations to the currently living generations, in particular, to the elderly generation. Now, Japan is currently aiming to shift from deflation to inflation under the banner of Abenomics. If inflation takes root, however, the revenue will conversely be transferred from the currently living generations to future generations. In short, once inflation or deflation is created as a result of a policy adopted by the government (including the central bank), intergenerational resource redistribution is triggered between the currently living generations and

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[4] With regard to whether or not further aging increases the political influence of the elderly and promotes the so-called silver democracy, Shimasawa, Oguro and Toyoda (2014) examined the relationship between the aging and elderly-related expenditures by verifying the median voter model using the data of 47 prefectures in Japan between 2000 and 2010. As a result, it was confirmed that as the median age increased, the welfare expenditures for the elderly increased even after controlling the income and expenditures, economic climate, and political factors. These results are consistent with the implication obtained from the median voter model, which shows that the aged median voters are able to obtain a larger benefit through their voting behaviors. This paper concludes that if such a relationship between the aging at the prefectural level and an increase in the elderly-related expenditures is reflected in the overall trend of Japan, further aging is highly likely to increasingly intensify the elderly population's political pressure for increased social security benefits.

[5] In Japan, the cash paid out by the Government Debt Consolidation Fund and the proceeds from the issuance of refinancing bonds are allocated for redemption of the government bonds. The proportion of the two is determined based on the "60-year redemption rule," which means redeeming government bonds 60 years after issuance. In principle, therefore, the national debt created this year will remain for the next 60 years.

future generations.

Furthermore, deflation hinders fiscal consolidation for the following reasons. First, deflation increases the real value of outstanding debt. Second, as a progressive system is incorporated into Japanese taxes focused mainly on income tax and inheritance tax, and the absolute value of tax elasticity generally exceeds 1, a reduction in tax revenue will overwhelm the rate of price decrease in times of deflation. As a result, if, for instance, the government should attempt to improve the primary balance, which is currently considered by the Japanese government as a milestone towards fiscal consolidation, in a deflationary environment, relatively more tax revenue will be needed compared with an inflationary environment.

As discussed above, an interaction between the government and respective generations in association with price fluctuations is expected to have a significant impact on the intergenerational imbalances. Nevertheless, to the best of authors' knowledge, there are no preceding studies that have discussed the intergenerational imbalances by explicitly considering the different impact that any further inflation/deflation has on the intergenerational imbalances, i.e., inflation tax revenue.

In addition, the economic management of the current Cabinet being promoted on the axis of inflation and economic growth will bring about two conflicting effects on the intergenerational imbalances: 1) the effect of reducing burden by increasing income, and 2) the effect of increasing the burden particularly on younger generations due to a natural increase in tax revenue resulting from economic growth. As a matter of course, which effect is more controlling is not theoretically clear. There is no way other than to depend on a numerical analysis of some sort in order to figure out the scale of these effects.

Hence, in this paper, we perform a quantitative analysis of the effects expected from both the Abenomics-led initiatives aimed at driving Japan's economy into an inflationary situation and the economic growth-dependent economic and fiscal management on the intergenerational imbalances, in particular, on future generations. To do so, we estimate the lifetime net burden ratio by explicitly incorporating the inflation tax revenue as invisible revenue.

Our contributions from the previous studies can be summarized as follows.

First, we estimated the past benefit/burden, prior to the estimation period, of the currently living generations who were alive at the base year of the estimation. That is, we obtain the past net burden of the currently living generations by estimating the past benefit/burden and by revaluating them back to the values as of the estimated year, and then we estimate the generation-specific net burden from births to deaths (lifetime net burden) of the currently living generations by adding it to the net future burden which can be obtained by the usual Generational Accounting method.

Under traditional Generational Accounting, as far as the already-born generations are concerned, only the "burden" and "benefit" in the remaining lifetime are reckoned in generational

account of each generation. In other words, "burden" and "benefit" of the past are not considered. Therefore, calculation of the lifetime net burden is possible only for the newborn generation at the time of the estimation and the future generations, thereby making direct comparison possible only for these two generations. However, if the net burden of the past is estimated, entire lifetime net burden of each generation can be grasped, thereby making it possible to assess the imbalance among the currently living generations. In other words, the estimation of the past net burden of the currently living generations was vital in concurrently addressing the intergenerational imbalances among the currently living generations and the imbalances between the future generations and the currently living generations.[6]

Second, we estimated the lifetime income of each generation, and evaluated the magnitude of the intergenerational imbalances by calculating the lifetime net burden ratio, which is the ratio of the lifetime net burden to the lifetime income.[7] This enables us to compare and evaluate the weight of the actual burden of each generation and the difference among them.

In Japan, the tax and the social security burden have largely been proportional to the income, which means that higher income generations bear heavier burden if other conditions are the same. Moreover, after the Japanese economy's growth rate bent downward three times, there has been less and less hope that the younger generations will earn as much income as their predecessors had earned. That is to say that when estimating the net burden of the past, as higher income generations tend to bear heavier net burden, simple comparison of the net burden would convey misleading information concerning intergenerational imbalance. In addition, Shimasawa (2013) also confirmed that a different choice of economic growth rate and discount rate will have a major impact on the magnitude of the lifetime net burden of each generation. For instance, if you compare the present value of the prospective future benefit/burden of the current 65-year-old generation and that of the current 20-year-old generation, even if their profiles and the amount of

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[6] One can surely argue that when deciding on present and future policies, if each generation considers the past benefit/burden as a sunk cost, the magnitude of the past benefit/burden would not have any impact on the decision making, and that the traditional Generational Accounting that estimates only the present and future net burden is sufficient. However, if the information concerning the past net burden of the generation receiving excess benefit is not taken into consideration at all with the use of the traditional Generational Accounting, and, in particular, if the relevant generation had actually borne a heavier burden than any other generations, such additional burden measure targeted at the relevant generation for the purpose of narrowing the intergenerational imbalances would be unfair. Furthermore, the traditional Generational Accounting methods lacked criteria for judging fairness of the burden among the currently living generations. That is, the fairness principle of the traditional Generational Accounting methods could only demand that the intergenerational imbalances between the newborn generation and future generations, who share the same remaining lifespan, be zero, in the case where the same macroeconomic environment and the same policies, i.e. benefit/burden structure, continue. It can be said as a result that a priority was given to reducing the lifetime net burden of the future generations, and the resulting expansion of imbalance among the currently living generations tended to be considered less seriously.
[7] It is called *Lifetime Tax Rate* according to Auebach, Gokhale and Kotlikoff (1993) and *Lifetime Generational Accounting* according to Ter Rele and Labanca (2011).

the benefit/burden should correspond, a technical problem occurs. That is, the farther the generation is from the discount base year, the higher the discount rate, thus resulting in increased burden, reduced benefits, and increased net burden on younger generations in the case where the intergenerational imbalances is evaluated based on the level. Therefore, it is possible to eliminate the impact arising from a particular economic growth rate and discount rate or different choices of them by assessing the ratio of the lifetime net burden to the lifetime income.

Third, we explicitly incorporated the impact of the inflation tax revenue on the intergenerational imbalances.

Previous studies on the estimation of seigniorage including inflation tax revenue include Friedman (1953, 1971), Bailey (1956), Cagan (1956), Marty (1967), Phelps (1972, 1973), Barro (1982), Fischer (1982), Drazen (1985), King and Plosser (1985), Mankiw (1987), Klein and Neumann (1990), Neumann (1996), Buiter (2007), and Oguro and Hattori (2015).

Buiter (2007) defines seigniorage in three ways: 1) opportunity cost of holding money, 2) an addition to the money stock, and 3) revenue from inflation tax which is obtained by multiplying the money stock by inflation rate.

We adopted and estimated the definition 3) of the above three, and explicitly analyzed the impact of inflation tax revenue on the intergenerational imbalances.

The remaining part of this paper is organized as follows. In Section 2, we outline the lifetime net burden ratio. In Section 3, we look at data and scenarios. In Section 4, we estimate lifetime net burden ratio. In Section 5 and Section 6, we introduce simulation results of different policy scenarios. Finally, in Section 7 we summarize.

2. Outline of the lifetime net burden ratio

Lifetime net burden ratio is an indicator that quantitatively assesses the payments and receipts between the government and a certain generation from their births to deaths. The future benefit/burden can be measured by using the traditional Generational Accounting method, which was established by Auebach, Gokhale and Kotlikoff's seminal paper published in 1991, and the past benefit/burden can be measured by employing the same method.

In the following we outline the traditional Generational Accounting and generational accounts of the past.

(a) Traditional Generational Accounting

Initiated by Auebach, Gokhale and Kotlikoff (1991), numerous studies have been pursued both in Japan and outside of Japan on traditional Generational Accounting. For instance, Kotlikoff (1992, 1993, 1995, 2003), Auebach, Gokhale and Kotlikoff (1993, 1994, 1995), CBO (1995), Gokhale, Page and Sturrock (1997, 2000), Ter Rele (1997), Auerbach, Kotlikoff and Leibfritz (1999),

European Commission (1999), Kotolikoff and Raffelhüschen (1999), Raffelhüschen (1999), Bonin (2001), Kotlikoff, Smetters and Walliser (2001), and Benz and Fetzer (2006). Also in Japan, Yoshida and Aso (1995), Economic Planning Agency (1995), Cabinet Office (2001, 2003, 2005), Takayama, Kitamura and Yoshida (1999), Shimasawa (2007, 2013), Masujima, Shimasawa and Murakami (2009), Masujima, Shimasawa and Tanaka et al (2010), Shimasawa, Oguro and Masujima (2014).

Generational Accounting is developed from the general government's intertemporal budget constraint equation as shown below:

$$\sum_{s=0}^{\infty} Tax_{t+s}(1+r)^{-s} = \sum_{s=0}^{\infty}(GT_{t+s}+G_{t+s})(1+r)^{-s} + D_t + D_{\infty}\prod_{s=1}^{\infty}(1+r)^{-s} \tag{1}$$

where Tax_t is the tax revenue and social insurance premium income for year t, GT_t is the transfer spending of the general government's total spending, G_t is the non-transfer spending, which is the balance of the general government's total spending minus transfer spending, r is the interest rate before tax, and D_t is the government's net financial debt of year t, which is derived at by deducting the government's gross financial asset from its gross financial debt. According to Generational Accounting, it is also assumed as follows in order to measure how much burden the currently living generations and the future generations must bear to satisfy the general government's intertemporal budget constraint equation:

$$D_{\infty}\prod_{s=1}^{\infty}(1+r)^{-s} = 0$$

Therefore, the general government's intertemporal budget constraint equation (1) can be rewritten as (1').

$$\sum_{s=0}^{\infty} Tax_{t+s}(1+r)^{-s} = \sum_{s=0}^{\infty}(GT_{t+s}+G_{t+s})(1+r)^{-s} + D_t \tag{1'}$$

Incidentally, for the government, tax revenue is income and transfer benefits is expenditure, whereas, from the individual's standpoint, taxes and social insurance premiums are a burden and transfer spending is a benefit.

Hence, from the perspective of individual's burden and benefit, if equation (1') is transformed as follows:

$$\sum_{s=0}^{\infty}(Tax_{t+s} - GT_{t+s})(1+r)^{-s} = \sum_{s=0}^{\infty}G_{t+s}(1+r)^{-s} + D_t \tag{1''}$$

The left hand side of this equation (1") stands for the net tax revenue concerned with benefits and

burdens.

Furthermore, the government's intertemporal net tax revenue can be divided into those borne by the currently living generations and those borne by the future generations.

Therefore, from the individual's net burden perspective, the following equation can be obtained from the government's intertemporal budget constraint equation (1):

$$\sum_{s=1}^{\infty} N_{t,t+s} P_{t,t+s} (1+r)^{-s} + \sum_{s=0}^{d} N_{t,t-s} P_{t,t-s} = \sum_{s=0}^{\infty} G_{t+s} (1+r)^{-s} + D_t \tag{2}$$

where $N_{t,k}$ stands for the total sum of the present value of the lifetime net tax payment discounted based on year t, or lifetime net burden amount of the generation born in year k, d stands for the maximum age of the living generations, and $P_{t,k}$ stands for the population in year t of the generation born in year k.

Equation (2) means that the sum of the discounted present value flow of the lifetime net tax payment of the currently living generations and the future generations (left hand side) must be able to cover the sum of the discounted present value flow of the government consumption of the present and future and the sum of the government's net debt at present (right hand side). The first and the second terms on the left hand side of equation (2) represent generational account of the future generations and that of the currently living generations, respectively.

Next, the generational account of the currently living generations in the future $N_{t,k}^{f}$ is defined by:

$$N_{t,k}^{f} = \sum_{s=t}^{k+d} T_{s,k} \frac{P_{s,k}}{P_{t,k}} (1+r)^{-(s-t)} \tag{3}$$

where $T_{s,k}$ stands for the projected average per capita net tax payment made to the government in year s by the generation born in year k, which is determined by the amount of tax burden per capita and the amount of transfer spending by the government as shown below:

$$T_{s,k} = \sum_{i} \tau_{s,k}^{i} \tag{4}$$

where $\tau_{s,k}^{i}$ stands for the amount of per capita burden ($\tau^{i} > 0$) or benefit ($\tau^{i} < 0$) of generation born in year k as of year s concerning term i. And the amounts of burden and benefit are assumed to increase at a constant economic growth rate g with t as the base year as shown below:

$$\tau_{s,k}^{i} = (1+g)^{s-t} \tau_{t,t-s+k}^{i} \tag{5}$$

That is, $\tau^i_{s,k}$ stands for the amount of burden or benefit of generation born in year k, as of year s. It's also an economic growth rate-adjusted amount of burden or benefit of the same age group in the base year t. And $P_{s,k}/P_{t,k}$ stands for the percentage of those still surviving in year s among the generation who were born in year k and are living in year t.

(b) Generational account of the future generations

Incidentally, when the right hand side and the second term of the left hand side of equation (2) are given, the first term of the left hand side of the equation is obtained as residual. It represents the present value of the lifetime net burden to be paid by the future generations.

Assume that $\overline{N}$ is the growth rate-adjusted generational account of the future generations.

That is, $\overline{N}$ is the discounted present value of the growth rate-adjusted lifetime net burden amount of a certain future generation, and it equals that of future generations at any given time.

That is, $\overline{N}(t+1) = \overline{N}(t+2) = \cdots = \overline{N}(\infty) = \overline{N}$,

where the actual amount of the lifetime net burden of the generation born in year $t+1$ is $\overline{N}(1+g)$, that of the generation born in year $t+2$ is $\overline{N}(1+g)^2$, and that of the generation born in year $t+3$ is $\overline{N}(1+g)^3$, and so forth.

Based on these equations, equation (2) can be rewritten into equation (6), which is used to obtain $\overline{N}$, the lifetime net burden amount of future generations.

$$\sum_{s=0}^{d} N_{t,t-s} P_{t,t-s} + \sum_{s=1}^{\infty} \overline{N}(1+g)^s P_{t,t+s}(1+r)^{-s} = \sum_{s=0}^{\infty} G_{t+s}(1+r)^{-s} + D_t \qquad (6)$$

Based on equation (6), the lifetime net burden amount of future generations is:

$$\overline{N} = \left\{ \sum_{s=0}^{\infty} G_{t+s}(1+r)^{-s} + D_t - \sum_{s=0}^{d} N_{t,t-s} P_{t,t-s} \right\} \bigg/ \sum_{s=1}^{\infty} (1+g)^s P_{t,t+s}(1+r)^{-s} \qquad (7)$$

(c) Past generational accounts of the currently living generations

The above outlines traditional Generational Accounting. As earlier mentioned, however, under traditional Generational Accounting, the benefit/burden of the past is not reckoned, and the

lifetime net burden is comparable only between the newborn generations and the future generations. That is, it is not possible to compare the lifetime net burden among the currently living generations unless the benefit/burden amount of the past is estimated. Therefore, estimation of the past benefit/burden amount is indispensable in assessing the intergenerational imbalances among the currently living generations.

As for the transfer spending of the government and tax/social security burden prior to the estimation base year (t) as well, $N_{t,k}^p$, the past generational accounts of the currently living generations, can be obtained as follows by allocating them to respective generations.

$$N_{t,k}^p = \sum_{s=k}^{t-1} T_{s,k}(1+r)^{-(s-t)} \tag{8}$$

Based on the above, generational account of the currently living generations $N_{t,k}$ can be defined as follows:

$$N_{t,k} = N_{t,k}^p + N_{t,k}^f = \sum_{s=k}^{t-1} T_{s,k}(1+r)^{-(s-t)} + \sum_{s=t}^{k+d} T_{s,k}\frac{P_{s,k}}{P_{t,k}}(1+r)^{-(s-t)} \tag{9}$$

That is, the first term on the right hand side of equation (9) stands for the past generational accounts of the currently living generations, and the second term on the right hand side stands for the generational account of the currently living generations in the future. Based on the above, it can be confirmed that the generational account $N_{t,k}$ represents the current value of the lifetime net burden amount of the currently living generations after taking into account the survival probability.

(d) Estimation of lifetime income

Next, the lifetime income of each generation is defined as follows:

First, the lifetime income of the currently living generations.

The present value of the lifetime income $L_{t,k}$ of the generation born in fiscal year k as of the base year (t) is:

$$L_{t,k} = \sum_{s=k}^{t-1} y_{s,k}(1+r)^{-(s-t)} + \sum_{s=t}^{k+d} y_{s,k}\frac{P_{s,k}}{P_{t,k}}(1+r)^{-(s-t)} \tag{10}$$

where $y_{s,k}$ stands for an average income of generation born in fiscal year k as of the fiscal year s.

The right hand side of equation (10) is composed of two parts in terms of time; the first term of the right hand side stands for the income prior to the estimation point in time or income of the past years, and the second term of the right hand side stands for the income after the estimation point in time or income of the future.

In the base year t and beyond, the per capita income is assumed to increase at a constant economic growth rate g as shown by:

$$y_{s,k} = (1+g)^{s-t} y_{t,t-s+k} \tag{11}$$

On the other hand, the lifetime income of the future generations is considered as follows:

Assume that $\overline{L}$ is a discounted present value of the growth rate-adjusted lifetime income of future generations. It equals that of future generations at any given time as shown by:

$$\overline{L}(t+1) = \overline{L}(t+2) = \cdots = \overline{L}(\infty) = \overline{L}$$

That is, the lifetime income of generation born in year $t+1$ is $\overline{L}(1+g)$, and that of the generation born in year $t+2$ is $\overline{L}(1+g)^2$, and that of the generation born in year $t+3$ is $\overline{L}(1+g)^3$, and so forth.

(e) Lifetime net burden ratio

Lastly, the lifetime net burden ratio of each generation can be obtained by dividing the lifetime net burden amount by the lifetime income as shown below:

First, the lifetime net burden ratio $LTR_{t,k}$ of the currently living generations borne in year k is:

$$LTR_{t,k} = \frac{N_{t,k}}{L_{t,k}} \tag{12}$$

Next, the lifetime net burden ratio of the future generations $\overline{LTR}$ is:

$$\overline{LTR} = \frac{\overline{N}}{\overline{L}} \tag{13}$$

3. Data and estimation

(1) System of National Accounts (SNA) data

In the following we explain the data required for estimating the lifetime net burden ratio.

With regard to the data concerning government receipts and expenditures, here we use "Annual Report on National Accounts 2013" which is prepared and published by the Department of National Accounts, Economic and Social Research Institute, Cabinet Office, Government of Japan. More specifically, numerical values of the general government included in the "Income and Outlay Accounts classified by Institutional Sector" and "Capital Finance Accounts classified by Institutional Sector" of the said Reports are used. These "Income and Outlay Accounts classified by Institutional Sector" and "Capital Finance Accounts classified by Institutional Sector" elucidated the reality of the income and outlay of the general government as shown in Table 1. According to the table, the general government had a total receipts of about 231.2 trillion yen in FY2013, including about 86.2 trillion yen tax revenue, about 62.7 trillion yen social insurance premiums, and about 82.3 trillion yen other income. This means that there was about 231.2 trillion yen burden on the people's side. In contrast, the general government expenditures were about 282.3 trillion yen, including about 98.8 trillion yen government consumption, about 127.6 trillion yen social security benefit payment, about 17.2 trillion yen fixed capital formation, and about 38.7 trillion yen of others.

Included in the government income (personal burdens) are "taxes on production and imports," "current taxes on income, wealth, etc.," "social contributions (receivable)," and "inheritance tax and gift tax portion of the capital transfers (receivable)." On the other hand, "social benefits other than social transfers in kind," "other current transfers (payable)," "social transfers in kind,"[8] and "subsidies" are included in the government outlay (personal benefits), and "actual final consumption," "gross fixed capital formation," are not included.[9]

(2) Other data

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[8] The benefit in kind such as medical care and nursing care are not cash benefit, but included in personal benefits.

[9] Havemann (1994) and Buiter (1997) criticized that the non-inclusion of the government's non-transfer spending in the benefits does not make sense as it provides some kind of benefit to its people. Some of the preceding studies reckoned all government consumption items as benefits on the grounds that if the government had not provided them, they would have had to be purchased by households anyway, and therefore, that the burdens were actually lessened.
As a matter of course, of the government outlay items that are not reckoned as benefits, if, for instance, the educational outlay and public investment are considered as benefits, the net burden on each generation would decrease. It should be noted that the net burden of each generation varies depending on which item of the government outlay is included in personal benefits. See, for instance, Jensen and Raffelhüschen (1999), Raffelhüschen (1999), Takayama, Kitamura, and Yoshida (1999), Auerbach, Kotlikoff, and Leibfritz (1999), and Ter Rele and Labanca (2011).

In order to estimate the generational accounts of the currently living generations and future generations as well as the flow of the non-transfer expenditure of the general government, projected population in the future, economic growth rate and discount rates will also be required.

First, let us look at the population. Population data is required for the following three objectives. The first objective is to obtain the benefit/burden structure of the base year, the second is to extrapolate the net burden amount, and the third is to obtain the population of the future generations. As for the population of the base year 2010, the data from the Census of the Statistics Bureau, Ministry of Internal Affairs and Communications was used. From 2011 through 2014, the data of the "Population Estimates" of the Statistics Bureau, Ministry of Internal Affairs and Communications was used. With regard to the population between 2015 and 2110, the median estimates values of the "Population Projection for Japan (January 2012 estimates)" of the National Institute of Population and Social Security Research were used. And as for the population of the year 2111 and beyond, which is needed to determine population of the future generations, as earlier mentioned, the population of the 0-year-old as of 2110 was used.

The next is the economic growth rate and discount rate. We set the economic growth rate for FY2015 at 1.5%, the same rate as the government's economic forecast. For FY2016 and beyond, we set the economic growth rate, discount rate, and the gap between the interest rate and growth rate at 1.5%, 3.5%, and 2 percentage points, respectively.[10]

As for the actual inflation rate and price levels, we used the aggregate indices of the "Consumer Price Index" of the Statistics Bureau, Ministry of Internal Affairs and Communications. As for the future, we used 1.5% of the "Government Economic Outlook" of the Cabinet Office for FY2015, and the numerical values of the "Economic and Fiscal Projections for Medium to Long Term Analysis (a baseline case)" of the Cabinet Office for FY2016 through FY2023, and 1.5% for the subsequent years.

Although all income that adds to the resources of each generation needs to be taken into consideration when we estimate the lifetime income, due to data restrictions, the labor income, specifically, only the compensation of employees based on "Annual Report on National Accounts" of the Cabinet Office was considered in this paper, similarly to Auerbach, Gokhale and Kotlikoff (1993).

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[10] Data from the OECD countries was used to measure the gap between the interest rate and growth rate. Of 2,136 samples from 34 countries between 1994 and 2011, a total of 281 samples recorded 2 percentage points or over with a probability of about 13%. On this basis, we set the gap between the interest rate and growth rate at 2 percentage points. For reference, the mode of the gap between the interest rate and growth rate occurred between the range of 0 and 1 with a total of 925 samples. Considering this result, a 3.5 percentage-point gap between the interest rate and growth rate, which is calculated based on 5% interest rate and 1.5% growth rate used in academic studies, may be somewhat too large. It must be noted however, that Auerbach, Kotlikoff and Leibfritz (1999) justified this by saying that an ultimate method for appropriate risk adjustment has yet to be established for Generational Accounting up to the present, and therefore, the standard practice is to use multiple discount rates to estimate generational accounts.

As for the inflation tax revenue, Bank of Japan notes in circulation and currency in circulation were used based on the "Money Stock Statistics" of Bank of Japan other than price levels and inflation rate.[11]

(3) Historical data

Here, we estimate the past benefit/burden of the currently living generations. To do that, we use the following historical data: "National Accounts (retrospective statistics)" of the Cabinet Office, Government of Japan; "One Hundred Year History of the Bank of Japan: Source Materials," Bank of Japan; "Population Estimates (long-term chronological data)" of the Statistics Bureau, Ministry of Internal Affairs and Communications; "Historical Statistics of Japan: New Edition" of Japan Statistical Association; "Long-Term Economic Statistics" of Toyo Keizai, Inc. and "Long-Term Chronological Data" of the National Tax Agency. As for the currency circulation required for estimating the inflation tax revenue, we used data from "The Financial History of Showa Era: War's End to Peace Treaty" compiled by the then-Office of Financial Administration History, the Ministry of Finance.

(4) Allocation of the benefit/burden data to each generation

In order to estimate generational accounts by age group of the base year, receipts from the government and payments to the government must be allocated by age group. While individual-based micro-data is used in preceding studies overseas including the US, use of such data is virtually prohibited in Japan. Therefore, income and expenditure data of household heads by age group such as those included in the "Family Income and Expenditure Survey" and "National Survey of Family Income and Expenditure". were used in the preceding studies[12].

As is the case with many of the previous studies in Japan, here we also allocate government income and outlay to the burdens/benefits of each age group of each generation by using the income and expenditure data of household heads by age group such as those included in the "National Survey of Family Income and Expenditure" or "Family Income and Expenditure Survey."

where the allocation $Z_{i,j}$ to the generation j of the income/outlay item Z_i of the i th government is obtained by:

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[11] The actual inflation tax revenue (S_t) was calculated based on $S_t = \pi_t(M_{t-1}/CPI_t)$ (π : inflation rate, CPI: consumer price level, M: Bank of Japan notes in circulation and currency in circulation).

[12] Therefore, personal benefits/burdens by age group means, in a strict sense, personal benefits/burdens of each age group which is represented by individuals categorized as heads of households. Individuals as heads of households and those who are not heads of households obviously show different income and consumption patterns. However, as use of personal data is not permitted in Japan, the alternative use of the heads of households data is considered the second best approach.

$$Z_{i,j} = Z_i \frac{\alpha_{i,j} P_j}{\sum_{j=0}^{d} \left(\alpha_{i,j} P_j \right)} \tag{12}$$

$\alpha_{i,j}$ is the data used as the basis for allocating the income/outlay item of the i th government to generation j, and the income/expenditure data by age group of the "2009 National Survey of Family Income and Expenditure" of the Statistics Bureau, Ministry of Internal Affairs and Communications and "Annual Report on the Family Income and Expenditure Survey (yearly version)" of the said bureau were used. In addition, P_j is the population of generation j, and for this, the Japanese population by age of the "2010 Census" of the Statistics Bureau, Ministry of Internal Affairs and Communications was used. d stands for the maximum age of the living generations[13].

Per capita benefit/burden $z_{i,j}$ can be obtained by dividing $Z_{i,j}$ derived from equation (12) by population of the relevant generation P_j.

$$z_{i,j} = \frac{Z_{i,j}}{P_j} \tag{13}$$

Specifically, as for the "taxes on production and imports," "current taxes on income, wealth, etc.," "social contributions," "the inheritance tax and gift tax portion of the capital transfers," "social benefits other than social transfers in kind," "other current transfers," and "social transfers in kind," these items were distributed by age group and ascribed to each generation based on the "Consumption expenditure (wages and salaries) per household by age group of the household head" of the "2009 National Survey of Family Income and Expenditure" of the Statistics Bureau, Ministry of Internal Affairs and Communications. As it was technically difficult to distribute the remainders among the generations, we distributed them evenly to each generation based on the population by age group of the "2010 Census" of the Statistics Bureau, Ministry of Internal Affairs and Communications.

(5) Generation-based benefit/burden structure

As for the benefit/burden structure of the public sector of Japan, the benefits increase as the age advances due to the start of the public pension payment and social security-related benefits including medical care benefit and nursing care benefit, while the burdens increase among the working generations, which is due to the progressive structure of the system in which taxation

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[13] As is the case with Auerbach, Kotlikoff and Leibfritz (1999), we set the maximum age of the living generations at 94 in this paper.

and social security burden are increased with an increase in wage earnings, as well as due to a lack of income, in many cases, among those aged between 60 and 64 after retirement. As a result, it can be pointed out that the net benefits tend to gradually increase with the advancement of age.

We look at the per capita benefit/burden structure by age group in FY2010 with reference to Figure 3 and Table 2. The younger generations under the age of 15 and the older generations aged 65 and over receive excess benefit, and the working generations are put under excess burden. It apparently shows the current benefit/burden structure of Japan where the working generations are put under heavier burden and the retired generation receives bigger benefits.

This intergenerational redistribution by the public sector places emphasis on an intergenerational support function which is based on public pension, health care and nursing care system with an aim to respond to various risks in post-retirement years. Therefore, the fact that the benefit exceeds the burden in the current older generations is, in a way, a logical result, truly reflecting the current system. And the generation-based benefit/burden structure as of the base year can be said to reflect the magnitude of the intergenerational income redistribution function through tax system, public pension system, medical care and nursing care system. However, as the population ages and fewer babies are born, whether or not the intergenerational income redistribution based on the current benefit/burden structure can be sustained into the future will be a different question.

(6) Future policy changes are reflected

According to Generational Accounting, although the benefit/burden structure obtained by equation (5) is assumed to be extended into the future, the rule is to reflect the policy changes that have been approved and are scheduled to be implemented in the future at the time of the estimation.

Based on this rule, we reflected the following initiatives in this paper as well: 1) raising of the pensionable age due to revision of the pension system in FY1994 and FY2000; 2) an increase in insurance premiums due to revision of the pension system in FY2004; 3) automatic adjustment of benefits based on macroeconomic indexation due to revision of the pension system in FY2004; 4) revision of the Medical Insurance System in FY2006; and 5) consumption tax increase to 10% starting from October 2019.

4. Estimation of lifetime net burden ratio

The estimation results of the lifetime net burden ratio based on the above settings are shown in Table 3. According to the table, we can point out the following:

First, if you look at the net burden of the past of the currently living generations, generations of 30-year-olds and under receive excess benefit as they do not pay (or bear a small burden of)

tax or social insurance premiums while receiving benefits such as medical care benefit.   As for generations of 90-year-olds, they also receive excess benefit as the social security benefits they've received in the past exceed the tax/social insurance premiums burden. On the other hand, the rest of the generations from 35-year-olds to 85-year-olds are put under excess burden. In short, the discounted present value of the net burden of the past increases from age 30 through to age 65 and then decreases to age 85.

Next, let us look at the net burden amount of the currently living generations in the future. Roughly speaking, the table shows the following features by generation. First, the generations already retired as of the estimation base year are receiving excess benefit, as their social security benefits largely exceed their burden including taxes and social insurance premium. Second, as for the generations still working as of the estimation base year but who will retire shortly, their lifetime net burden is negative; in other words, they are the net benefit generation. This is because the present value of the social security benefits that they are to receive after retirement will more than offset that of their burden including taxes and social insurance premium that they are to pay now and in the future. On the other hand, the younger generations are the net burden generations, as the present value of their tax burden largely exceeds that of the benefits they are to enjoy now and in the future. More specifically, the 50-year-old and younger generations are put under excess burden, while the 55-year-old and older generations receive excess benefit. The excess benefit reaches its peak for the 70-year-old generation. The excess of benefits over burden of any older generation reduces with age as life gets shorter. In contrast, the 20-year-old generation bears the highest remaining lifetime excess burden. The reasons are outlined below: First, there is still a sufficient period of time before the 20-year-old generation reaches its peak payment period, while majority of their benefits will be received much later. In addition, the present value of the burden that the 20-year-old generation is to pay in the next 40 years or so is larger than that of the benefits they are to receive over a period of about 30 years following that. Second, as for generations younger than 20 years old, the present values of benefit and burden are smaller than those of the 20-year-old generation.

This is because their payments to and receipts from government will occur much later in the future than the 20-year-old generation. And lastly, the generations older than 20 years old are to receive considerable amount of benefit, although much of their past payments are not included in the generational accounts.

Next, it can be said that the impact of the current revenue/expenditure structure of the government will be most strongly reflected on the lifetime net burden of the 0-year-old generation among the currently living generations, as all of their lifetime benefit/burden will be reckoned in their future benefits/burden amounts. According to our estimation, the 0-year-old generation will bear a lifetime net burden of about 37.06 million yen.

Now, let us turn our eyes to the lifetime income by generations. The generation-specific lifetime income in terms of discounted present value as of 2010 was calculated to be about 357.24 million yen for the 70-year-old generation, the highest of all generation, and about 163.42 million yen for the 0-year-old and future generations. These results are attributable to 1) a technical reason, i.e., the more distant the future, the greater the discount rates, and 2) a macroeconomic reason, i.e., the farther into the past, the higher the income growth rate, and the closer to the present, the lower.

On the basis of these numerical values, if we look at the lifetime net burden ratio, which is obtained by dividing the lifetime net burden amount inclusive of both that of the past and the future by lifetime income, the highest was just below 23% recorded for generations from the 0-year-olds through to the 10-year-olds. It then gradually decreases as the age advances further. On the other hand, the older generations at 85 years old and over receive excess benefit, and the 90-year-old generation receives excess benefits by 10.9%. On the whole, the younger the generation, the higher the lifetime net burden ratio. For instance the 0-year-old generation's lifetime net burden ratio is higher than that of the 65-year-old generation by over 11percentage points.

Furthermore, the lifetime net burden of the future generations who will be born after the base year is 88.21 million yen, which means that this generation will have to bear about 51.15 million yen more than the generation aged 0-year-old as of FY2010. It shows that the lifetime net burden of the future generations will be, in fact, twice as much as that of the currently living generations. In addition, the lifetime net burden ratio of the future generations was calculated to be 55.7%, which means that the future generations will transfer nearly half of their lifetime income to other generations through government even with consideration of the benefits receivable such as social security benefits. In addition, their lifetime net burden ratio is as much as nearly 33 percentage points higher than that of the 0-year-old generation who share totally the same macroeconomic environment including the economic growth rate and discount rate, and benefit/burden structure such as the finance and social security systems. The difference in the amount of burden between the 0-year-old generation and the future generations is attributable to the aggregate liability of the general government both as of the present and in the future.

Given the magnitude of such intergenerational imbalance, the current revenue/expenditure structure of the government will impose more burden on the future generations even in view of the reforms and initiatives scheduled to take place. And we have to declare that the changes in the systems and initiatives currently scheduled are totally inadequate in reducing the burden on the future generations. As the falling birthrate and aging population rapidly advances, the intergenerational imbalances between the currently living generations and the future generations is phenomenal in terms of the levels of benefit/burden. And therefore, it can be pointed out that a significant redistribution of income from the future generations to the currently living generations

is occurring.

Based on the above findings, we can point out that there are two types of intergenerational imbalances that the currently living generations and future generations of our country are facing or will face: the intergenerational imbalances among the currently living generations and the intergenerational imbalances between the currently living generations and future generations. With regard to the intergenerational imbalances among the currently living generations, although it is true that the lifetime net burden ratio of the 90-year-old generations down to the 70-year-old generations is very small compared with that of other generations, they were greatly affected by World War II and are in the class of their own. In a nod to this fact, the imbalance among the different generations from the first baby boomers (roughly the 65-year-old generation and 60-year-old generation) down to the 0-year-old generation is merely 11 percentage points at the maximum. In contrast, the imbalances between the currently living generations (0-year-old generation) and future generations is as much as nearly 33 percentage points, which is three times greater than the imbalances among the currently living generations. In short, the intergenerational imbalances between the currently living generations and future generations is bigger than the intergenerational imbalances among the currently living generations. Expressed incisively, it can be assessed that the older living generations are forcing younger living generations to bear the burden; what is more, the currently living generations as a whole have gone so far as to act in collusion to pass additional bills on to the future generations.

5. Simulation results

In this section, with the currently evolving shift in Japan from the long-standing deflation to inflation in mind, we examine the following five scenarios in order to quantitatively grasp the impact of the policy aimed to trigger a shift to inflation on narrowing the intergenerational imbalances.

More specifically, we estimate a case with no consideration for inflation tax revenue, and compare the results with those of the estimation with consideration of inflation tax revenue (baseline scenario) (Scenario 1). Scenario 2 looks at the impact of the case in which the inflation rate deviates above forecasts of the government and BOJ. Conversely, Scenario 3 looks at the impact of the case in which the inflation rate falls below the forecasts of the government and BOJ, and the deflation level of 2013 (- 1%) continues beyond 2015. Next, Scenario 4 is the case in which automatic adjustment of benefits based on macroeconomic indexation is applied in a deflationary environment as well. Under the current public pension system of Japan, the system that automatically adjusts the pension benefit level in accordance with social situations (a decrease in working population or an increase in life expectancy) is not activated in time of deflation. More specifically, we assumed that although the deflation level of 2013 (- 1%) continues beyond 2015

similar to Scenario 3, the automatic adjustment of benefits based on macroeconomic indexation is also applied to the public pension system (Scenario 4). Finally, in order to determine the impact of economic growth on the intergenerational imbalances, we consider a case in which the gap between the interest rate and growth rate narrows from 2 percentage points to 1 percentage point while achieving a 1 percentage point economic growth rate (Scenario 5). We've done this by taking into account that economic growth promotion measures are adopted under Abenomics, while keeping the interest rate low through the BOJ's purchase of government bonds. The differences in the premises of each scenario are summarized in Table 4.

The results of estimations based on the above five scenarios are shown in Table 5 through Table 9.

First, in the case of Scenario 1 with no consideration for inflation tax revenue, as the inflation tax revenue that is considered as a burden in the baseline scenario is disregarded, the burden on currently living generations across the board is reduced, and, as a result, increases the burden on future generations. The government is virtually distributing the tax burden to its people intertemporally through price fluctuations. Therefore, inflation tax revenue needs to be explicitly considered when we consider the intergenerational imbalances. Furthermore, as the net burden on currently living generations will increase (and that on future generations will decrease) compared with the case in which inflation tax revenue is not considered, it is clear that the preceding studies without consideration for the inflation tax revenue underestimate the burden of the currently living generations and overestimate the burden of the future generations.

In the case of Scenario 2 in which the inflation rate deviates above the baseline scenario, as the inflation tax revenue increases along with an increase in the inflation rate, the burden on the currently living generations will increase and that on the future generations will decrease, thereby narrowing the intergenerational imbalances. Considering that the currently living generations pass an enormous government debt on to future generations, Abenomics aimed to trigger a shift from deflation to a positive inflation rate can be evaluated as desirable from the aspect of narrowing the intergenerational imbalances.

Conversely, if deflation instead of inflation should continue as assumed under Scenario 3, the burden on the currently living generations will become smaller due to negative inflation tax compared with the baseline scenario with consideration of positive inflation tax. As a result, the burden on the future generations will grow bigger and the intergenerational imbalances will expand. Considering these, the long-standing deflation in Japan is not desirable from the aspect of narrowing the intergenerational imbalances. It is absolutely imperative to trigger a shift to a positive inflation rate as early as possible and stabilize the trend.

A comparison between the baseline scenario and Scenario 4 confirms that the burden on the currently living generations will be reduced and that on the future generations will be increased

due to negative inflation tax revenue even if the automatic adjustment of benefits based on macroeconomic indexation should be applied in a deflationary environment. Furthermore, a comparison of Scenario 3 and Scenario 4 confirms that non-application of the automatic adjustment of benefits based on macroeconomic indexation in a deflationary environment increases the pension benefits of the currently living generations, and increases the burden on the future generations even further, coupled with a negative inflation tax (i.e., a substantial "tax refund" from the government to the currently living generations). In addition, it shows that by applying the automatic adjustment of benefits based on macroeconomic indexation even in a deflationary environment, the pension benefits of the currently living generations are marginally reduced, thereby reducing the effect of the deflation-induced negative inflation tax on expanding the intergenerational imbalances. In short, from the standpoint of narrowing the intergenerational imbalances, as in the case of an inflationary environment, the application of the automatic adjustment of benefits based on macroeconomic indexation is justified, in a deflationary environment as well, for reducing the negative inflation tax-induced resource redistribution from the future generations to the currently living generations.

Finally, the results of Scenario 5, under which economic growth is promoted, show that promotion of economic growth reduces the net burden amount of the generations of 40-year-olds and older, and increases that of the generations of 35-year-olds and under. There is a technical reason behind this: the discount rate of the benefits is greater for the younger generations as they start to receive benefits later in the future. In fact, in terms of lifetime net burden ratio, the net burden decreases throughout all generations including the future generations. However, the degree of reduction at the maximum is a mere amount of - 2.2 percentage points for the future generations.

Based on the above, it is clear that it is difficult to eliminate the intergenerational imbalances solely by depending on inflation and economic growth, and that it is necessary to undertake benefit/burden structural reforms or financial/social security structural reforms on top of improvement in the macroeconomic environment.

6. Alternative scenarios and simulation results

In the previous section, we pointed out that the inflation and economic growth promotion measures are inadequate to eliminate the intergenerational imbalances in Japan, and emphasized the need to correct the age-specific imbalance in the benefit/burden structure as shown in Table 2 and Figure 3 to achieve a more age-neutral benefit/burden structure. It is because the present generation-specific benefit/burden structure of Japan is characterized by greater burden in early life and greater benefit later in life; in which case, the later the generation, the greater is the net burden with the advancement of a falling population and aging society. Moreover, the burden

borne by the younger generations alone is insufficient to cover the benefits for the older generations, and the difference is passed on to the future generations in the form of national bond issuance (debt). Indisputably, this is the source of the serious intergenerational imbalances in Japan.

In this Section, we examined three scenarios that would achieve a break-even benefit/burden structure through the course of a lifetime by implementing financial/social security system reforms. More specifically, as Scenario 6, we examined the case in which an age-neutral benefit/burden structure is attained by increasing burden on working generations through an income tax increase. The aim is accomplished by increasing the current average income tax rate by 2.4 times. Next, as Scenario 7, we examined the case in which the pension benefits are reduced down to about 16% of the current level, i.e., a reduction by 84%. Lastly as Scenario 8, we examined the case in which the intergenerational imbalances is eliminated by increasing the consumption tax to about 22%.

In the following, we look at the estimation results of the above three scenarios.

First, as Scenario 6 is a political measure to eliminate the intergenerational imbalances through an income tax increase, it increases additional burden on the working generations, while limiting additional burden on the retired generation. Therefore, the burden is unequally distributed among the currently living generations, and as a result, the younger the generation, the greater the lifetime net burden ratio (Table 10).

Next is Scenario 7. Scenario 7 is a political measure to eliminate the intergenerational imbalances through a reduction in pension benefits. Unlike Scenario 6 focused mainly on the working generations as the target of increased burden, the burden on the older generations increases as they are the ones who mainly bear the costs arising from this political change. Furthermore, as this scenario is based on the premise that the structure of the reduced pension benefits is sustained into the future, benefits for generations who are yet to receive pension at present will also be reduced. However, the difference in the degree of reduction in benefits by generation is very limited (Table 11).

As for Scenario 8 which aims to eliminate the intergenerational imbalances through a consumption tax increase, the burden increases throughout all generations. However, the lifetime net burden ratio is higher for the younger generations, as the longer the remaining lifetime, the greater the burden of the consumption tax (Table 12).

Now, let us compare financial/social security system reform scenarios.

Scenario 6 which implements an income tax increase largely increases the burden on younger generations, while Scenario 7 which implements reduction in pension benefits increases the burden on older generations. On the other hand, as for Scenario 8 which implements a consumption tax increase to eliminate the intergenerational imbalances, the lifetime net burden

ratio of each generation falls between those of Scenario 6 and Scenario 7. It shows that the political cost for eliminating the intergenerational imbalances is proportionately borne by older generations and younger generations. This intergenerational imbalances elimination measure through a consumption tax increase is considered desirable from the standpoint of not forcing any particular generation to bear the cost of policy change aimed at eliminating the intergenerational imbalances (Figure 4).

The above results show that the imbalances between the currently living generations and the future generations can be eliminated by implementing financial/social security structural reforms on top of inflation and economic growth measures. Furthermore, among such financial/social security system reforms, such measures as income tax increase or pension benefit reduction are not even-handed policy in the sense that they impose policy implementation cost on particular generations. They also leave an unsettled issue in the sense that they could bring about intergenerational conflicts. Hence, it can be said that an intergenerational imbalances elimination measure through consumption tax increase is a politically viable option. It needs to be noted, however, that these political measures are capable of solving, strictly speaking, the intergenerational imbalances between the currently living generations and future generations, and that the intergenerational imbalances among the currently living generations remains unsolved.

7. Summary

This paper extended the Generational Accounting model of Auebach, Gokhale and Kotlikoff (1991), and estimated, both in inflationary and deflationary environments, the difference in an individual's lifetime government-related benefit and burden by generation with consideration of inflation tax revenue. As a result, based on the premise of the deflation that has continued up to the present, the generation of 85-year-olds and over receive excess of benefit throughout their lifetime, while the younger the generation, the greater the burden amount and burden ratio. Most notably, the lifetime net burden ratio of the future generations is 55.7%, which is 33 percentage points greater than that of the 0-year-old generation and as much as 66.6 percentage points greater than that of the 90-year-old generation. In addition, in the case where inflation tax revenue is not considered, the actual burden on the currently living generations becomes smaller (and that on the future generations becomes bigger) in an inflationary environment. It can be also pointed out, therefore, that the preceding studies without consideration of the inflation tax revenue underestimate the burden on the currently living generations and overestimate that on the future generations. Furthermore, from the standpoint of narrowing the intergenerational imbalances, Abenomics aimed to trigger a shift from deflation to inflation can be evaluated as highly desirable. In the early 2000s when Japan was experiencing an advancing deflation, resource redistribution from the future generations to the currently living generations occurred, bringing about an even

greater intergenerational imbalances than in an inflationary environment. If and when Japan should once again fall into deflation in the future, it will be possible to mitigate the expansion of the intergenerational imbalances by applying the automatic adjustment of public pension benefits based on macroeconomic indexation as in the case of inflation. It was also clarified that it is difficult to eliminate the intergenerational imbalances solely by depending on economic growth, and that it is necessary to concurrently undertake the benefit/burden structural reforms.

As discussed earlier in this paper, two types of intergenerational imbalances exist in Japan. In this paper, we discussed only the intergenerational imbalances between the currently living generations and the future generations as the target of the intergenerational imbalances elimination simulation; however, we were unable to discuss the intergenerational imbalances among the currently living generations. In the present situation, roles are expected to be divided by age; the older generations are the benefit recipients, and the younger generations are the payers. In reality, however, some older-generation households must be fully capable of bearing a burden, and some younger-generation households must be subject to benefits. Therefore, a policy of resource transfer from the older and affluent population to the younger and poor population could also be considered. However, under the Generational Accounting model we adopted in this paper, we were unable to discuss the income gap among the same generation, nor could we study the policy mentioned above. One of the challenges that remain is a need to present a framework of analysis for the purpose of studying political measures to solve the intergenerational imbalances among the currently living generations.

References

Ablett, J, and Z. Tseggai-Bocurezion, (2000), "Lifetime Net Average Tax Rates in Australia Since Federation – A Generational Accounting Study," *The Economic Record*, vol. 76, pp.139-151.

Auebach, Alan J., Jagadeesh Gokhale and Laurence J. Kotlikoff, (1991), "Generational Accunts: A Meaningful Alternative to Deficit Accounting," in Bradford, David. eds., *Tax Policy and the Economy*, Vol. 5, pp.55-110.

_____, _____ and _____, (1993), "Generational accounts and lifetime tax rates, 1900-1991," *Economic Review*, Federal Reserve Bank of Cleveland, pp. 2-13.

_____, _____ and _____, (1994), "Generational Accounting: A Meaningful Way to Evaluate Fiscal Policy," *Journal of Economic Perspectives*, Vol.8, No.1, pp.73-94.

_____, _____ and _____, (1995), "Restoring generational balance in US fiscal policy: what will it take?," *Federal reserve bank of Cleveland Economic Review*, vol. 31, pp 2-12.

Auerbach, A. J., Kotlikoff L. J. and Leibfritzin eds., (1999), *Generational Accounting around the World*, Chicago: The University of Chicago Press.

Bailey, M., (1956), "The welfare cost of inflationary finance," *Journal of Political Economy*, vol.64 pp.93-110.

Barro, Robert J., (1982), "Measuring the Fed's Revenue from Money Creation," *Economics Letters*, vol.10 pp.327-332.

Bonin H, (2001), *Generational Accounting: Theory and Application*, Springer Berlin Heidelberg

Braun A. R., and Joines D. H., (2014), "The Implications of a graying Japan for government policy," *Working Paper* 2014-18, Federal Reserve Bank of Atlanta.

Buiter W. H., (1995), "Do generational accounts reveal the effect of the budget on savings and intergenerational redistribution?," *NBER Working Paper* No.5087.

_____, "Generational Accounts, Aggregate Saving and Intergenerational Distribution," *Economica*, Vol.64, pp.605-626.

_____, (2007), "Seigniorage," *NBER Working Paper* No.12919, National Bureau of Economic Research.

Cabinet Office, (2001), *Annual Report on the Japanese Economy and Public Finance 2001* National Printing Bureau, Tokyo, Japan.

_____, (2003), *Annual Report on the Japanese Economy and Public Finance 2003* National Printing Bureau, Tokyo, Japan.

_____, (2005), *Annual Report on the Japanese Economy and Public Finance 2005* National Printing Bureau, Tokyo, Japan.

Cagan P., (1956), "Monetary Dynamics of Hyperinflation," in Milton Friedman, Editor, Studies in the *Quantity Theory of Money*, University of Chicago Press, Chicago, Illinois.

Carmen M. R., and M. Belen Sbrancia, (2015), "The Liquidation of Government Debt," *IMF Working Paper* No. 15/7.

Congressional Budget Office, (1995), "Who pays and when? An assessment of generational accounting."

Cutler D., (1993), "Review of Generational Accounting: Knowing Who Pays, and When, for What We Spend," *The National Tax Journal*, Vol.46, No.1, pp.61-67.

Diamond P., (1996), "Generational Accounts and Generational Balance: An Assessment," *The National Tax Journal*, Vol.49, No.4, pp.597-607.

Drazen, Allan, "A General Measure of Inflation Tax Revenues," *Economics Letters*, vol. 17, 1985, pp. 327–330.

Economic Planning Agency, (1995), *Annual Report on the Japanese Economy1995* the Printing Bureau, Tokyo, Japan.

European Commission, (1999), "Generational Accounting in Europe," *European Economy, Reports and Studies*, vol.6. Brussels: European Communities.

Fischer S., (1982), "Seigniorage and the Case for a National Money," *Journal of Political Economy*, vol.90, No.2, pp.295-313.

Friedman M., "Discussion of the Inflationary Gap" *Essays in Positive Economics*, University of Chicago Press 1953.

_____, (1971), "Government Revenue from inflation," *Journal of Political Economy*, vol.79, No.4, pp.846-56.

Gokhale J. B., Page J. P. and J. Sturrock, (1997), "Generational Accounts for the United States: An Update," *Economic Review* (Federal Reserve Bank of Cleveland), 4th Quarter 1997, pp.2-23.

_____, _____ and _____, (2000), "Generational Accounts for the United States: An Update," *American Economic Review*, vol.90, pp.293-296.

Hansen G., and Selo Imrohoroglu, (2015), "Fiscal reform and government debt in Japan: A neoclassical perspective," *Review of Economic Dynamics*, forthcoming.

Haveman R., (1994), "Should Generational Accounts Replace Public Budgets and Deficits?" *Journal of Economic Perspectives*, Vol.8, No.1, pp.95-111.

King R. G. and C. I. Plossser, (1985), "Money, Deficits and Inflation," *Carnegie-Rochester Conference Series on Public Policy*, vol.22, Spring, pp.147-196.

Klein M. and M. J. M. Neumann, (1990), "Seigniorage: What Is It and Who Gets It?" ,*Weltwirtschaftliches Archiv*, vol.126, pp.205-221.

Kotlikoff L. J., (1992), *Generational Accounting: Knowing Who Pays, and When, for What We*

Spend, New York: The Free Press.

_____, "From Deficit Delusion to the Fiscal Balance Rule: Looking for an Economically Meaningful Way to Assess Fiscal Policy," *Journal of Economics*, Vol.7, pp.17-41.

_____, (1995), "Applying Generational Accounting to Developing Countries," Institute for Economic Development, Boston University.

_____, (1997), "Reply to Diamond's and Cutler's Reviews of Generational Accounting," *The National Tax Journal*, Vol.50, No.2, pp.303-314.

_____, (2003), *Generational Policy (Cairoli Lecture Series)*, Cambridge, MA: The MIT Press.

Kotlikoff L.J. and Bernd Raffelhüschen, (1999), "Generational Accounting around the Globe," American Economic Review, vol. 89 No.2 May pp.161-166.

Kotlikoff L.J., Kent Smetters and Jan Walliser, (2001), "Finding a Way Out of America's Demographic Dilemma," *NBER Working Paper No. 8258*, National Bureau of Economic Research.

Kotlikoff L.J., and Scott Burns, (2005), *The Coming Generational Storm: What You Need to Know about America's Economic Future*, The MIT Press.

Mankiw, N.G., (1987), "The optimal collection of seigniorage: Theory and evidence," *Journal of Monetary Economics*, vol. 20, Issue 2, pp.327-341.

Marty, A. L., (1967), "Growth and the Welfare Cost of Inflationary Finance," *Journal of Political Economy*, vol.75, No. 1, pp.71-76.

Masujima Minoru, Manabu Shimasawa, and Takaaki Murakami, (2008), "Generation-specific Benefits and Burdens: Generational Accounting Model-Based Analysis Reflecting the Social Security Systems" [in Japanese], ESRI Discussion Paper Series No. 217, Economic and Social Research Institute, Cabinet Office, Government of Japan.

Masujima Minoru, Manabu Shimasawa, Goro Tanaka, Masahiro Sugishita, Hiroshi Yamamoto, Makoto Takanaka, (2010), "Inter- and Intra-Generational Inequality III": Difference in Benefit/Burden Structure among the Currently living generations" [in Japanese], ESRI Discussion Paper Series No. 248, Economic and Social Research Institute, Cabinet Office, Government of Japan.

National Institute of Population and Social Security Research *2012 Population Prospects for Japan* [in Japanese], 2014 March, National Institute of Population and Social Security Research, Tokyo Japan.

Neumann M.J.M. (1996) A Comparative Study of Seignorage: Japan and Germany. Bank of Japan Monetary and Economic Studies, vol.14 No.1, pp.104-142.

OECD, *Economic Survey of Japan*, 2015, OECD, Paris.

Kazumasa Oguro, Takahiro Hattori (2015), "An Endeavor to Estimate Seigniorage Before the

End of and Immediately After the Pacific War," *CIS Discussion Paper Series* (No. 641), Institute of Economic Research, Hitotsubashi University.

Phelps E. S., (1972), *Inflation Policy and Unemployment Theory*. W. W. Norton and Co., New York.

_____, (1973), "Inflation in the Theory of Public Finance," *Swedish Journal of Economics,* vol.75, No.1 pp.67-82.

Raffelhüschen B and Risa A, (1997), "Generational accounting and intergenerational welfare," *Public Choice* vol.93, pp.149-163.

Shimasawa Manabu, (2007), "The Impact of Fiscal Consolidation on Intergenerational Imbalance: Quantitative Analysis based on Generational Accounting" [in Japanese], Institute for Research in Contemporary Political and Economic Affairs, Waseda University, Working Paper Series No. 0604.

_____, (2013), *Introduction to Generational Accounting: On the Japanese Economy from the Viewpoint of Intergenerational Inequity* [in Japanese], Nippon Hyoron Sha, Tokyo.

Shimasawa Manabu, Kazumasa Oguro and Minoru Masujima, (2014), "Population Aging, Policy Reforms, and Lifetime Net Tax Rate in Japan: A Generational Accounting Approach", *PRI Discussion Paper Series* (No.14A-04), Research Department Policy Research Institute, Ministry of Finance.

Takayama Noriyuki, Yukinobu Kitamura and Hiroshi Yoshida, (1999), "Generational Accounting in Japan," in Auerbach, A. J., Kotlikoff L. J. and Leibfritzin eds., *Generational Accounting around the World*, The University of Chicago Press, pp.447-469.

Ter Rele, Harry and Claudio Labanca, (2011), "Lifetime Generational Accounts for the Netherlands," CPB Discussion Paper No.170, CPB Netherlands Bureau for Economic Policy Analysis.

Table 1. Outlay and income of the general government in FY2013 (billion yen)

	Outlay	Income
Income and outlay account		
(1)Allocation of primary income account		
Property income (payable)	10,288	
Taxes on production and imports		41,737
Subsidies	2,980	
Property income (receivable)		7,378
(2)Secondary distribution of income account		
Social benefits other than social transfers in kind	68,866	
Other current transfers (payable)	68,592	
Current taxes on income, wealth, etc.		44,463
Social contributions		62,701
Other current transfers (receivable)		62,496
(3)Redistribution of income in kind account		
Social transfers in kind	58,716	
(4)Use of income account		
Actual final consumption	40,063	
Capital finance accounts		
Gross fixed capital formation	17,204	
Consumption of fixed capital	-14,353.4	
Change in inventories	24	
Purchase of land (net)	1,454	
Capital transfers (receivable)		12,401
Capital transfers (payable)	14,123	
Total	**282,311**	**231,176**

Table 2. Benefit/burden structure of FY2010 (thousand yen)

| | Burden | | | Benefit | Net benefit |
	Total	Taxes	Social insurance premiums		
0	0	0	0	209	209
5	1	1	0	103	102
10	1	1	0	69	68
15	3	3	0	60	57
20	577	321	256	323	- 254
25	1,021	458	562	511	- 510
30	1,247	568	678	512	- 735
35	644	644	764	581	- 63
40	890	890	942	629	- 261
45	1,025	1,025	1,094	604	- 422
50	1,153	1,153	1,129	567	- 586
55	1,119	1,119	995	581	- 538
60	916	916	509	1,125	209
65	774	774	299	1,964	1,190
70	734	734	150	2,584	1,850
75	716	716	99	2,883	2,168
80	695	695	62	3,139	2,444
85	672	672	20	3,246	2,574
90	672	672	20	3,193	2,521

Source: Estimated by the authors.

Table 3. Estimation results of the lifetime net burden ratio with 2010 as the base year

(thousand yen)

| | Lifetime net burden | Future | | | Past | | | Lifetime income | Lifetime net burden ratio (%) |
		Net burden	Benefit	Burden	Net Burden	Benefit	Burden		
0	37,084	37,084	34,828	71,913	0	0	0	163,415	22.7
5	38,378	39,613	35,279	74,892	-1,235	1,235	0	168,099	22.8
10	39,120	41,405	35,965	77,370	-2,285	2,289	4	173,341	22.6
15	39,194	43,029	36,855	79,884	-3,835	3,847	12	179,393	21.8
20	40,948	45,140	37,732	82,872	-4,191	4,227	35	186,395	22.0
25	40,733	43,713	36,885	80,597	-2,980	6,145	3,165	194,335	21.0
30	39,759	40,339	35,994	76,333	-580	9,927	9,348	203,199	19.6
35	41,230	35,768	35,032	70,800	5,462	11,808	17,270	215,218	19.2
40	45,230	30,360	34,881	65,242	14,870	14,818	29,688	233,091	19.4
45	46,773	21,565	35,044	56,608	25,209	19,782	44,990	253,660	18.4
50	46,655	10,833	35,798	46,632	35,822	26,589	62,410	277,992	16.8
55	44,631	-1,334	37,163	35,828	45,965	34,023	79,988	305,368	14.6
60	44,242	-13,574	39,455	25,881	57,816	37,858	95,674	327,033	13.5
65	39,689	-20,181	39,946	19,765	59,870	45,754	105,624	348,803	11.4
70	33,103	-21,630	37,088	15,458	54,732	57,412	112,144	357,237	9.3
75	21,065	-20,434	32,442	12,009	41,499	71,609	113,108	353,293	6.0
80	5,894	-17,895	26,820	8,925	23,789	89,420	113,209	341,763	1.7
85	-7,829	-13,518	19,749	6,231	5,688	103,827	109,515	301,234	-2.6
90	-28,313	-7,797	11,738	3,941	-20,517	123,398	102,881	258,683	-10.9
Future generations	88,644	—	—	—	—	—	—	159,024	55.7

Table 4. Scenarios

Baseline scenario	・A 3.5% interest rate, 1.5% growth rate, and 1.5% inflation rate in 2015 and beyond ・Consumption tax increase to 10% in October 2019 and beyond ・Apply the "macroeconomic slide formula."
Scenario 1	・A 3.5% interest rate, 1.5% growth rate, and 1.5% inflation rate in 2015 and beyond ・Consumption tax increase to 10% in October 2019 and beyond ・Apply the "macroeconomic slide formula." ・No consideration for inflation tax revenue
Scenario 2	・A 3.5% interest rate, 1.5% growth rate, and 4.0% inflation rate in 2015 and beyond ・Consumption tax increase to 10% in October 2019 and beyond ・Apply the "macroeconomic slide formula."
Scenario 3	・A 3.5% interest rate, 1.5% growth rate, and - 1.0% inflation rate in 2015 and beyond ・Consumption tax increase to 10% in October 2019 and beyond ・Non-application of the "macroeconomic slide formula"
Scenario 4	・A 3.5% interest rate, 1.5% growth rate, and - 1.0% inflation rate in 2015 and beyond ・Consumption tax increase to 10% in October 2019 and beyond ・Apply the "macroeconomic slide formula."
Scenario 5	・A 3.5% interest rate, 2.5% growth rate, and 1.5% inflation rate in 2015 and beyond ・Consumption tax increase to 10% in October 2019 and beyond ・Apply the "macroeconomic slide formula."
Scenario 6	・A 3.5% interest rate, 1.5% growth rate, and 1.5% inflation rate in 2015 and beyond ・Consumption tax increase to 10% in October 2019 and beyond ・Apply the "macroeconomic slide formula." ・Income tax rate increase by 2.4 times (on average)
Scenario 7	・A 3.5% interest rate, 1.5% growth rate, and 1.5% inflation rate in 2015 and beyond ・Consumption tax increase to 10% in October 2019 and beyond ・Apply the "macroeconomic slide formula." ・Pension benefits reduction by about 16%
Scenario 8	・A 3.5% interest rate, 1.5% growth rate, and 1.5% inflation rate in 2015 and beyond ・Consumption tax increase to about 22% in and after FY2019 ・Apply the "macroeconomic slide formula."

Table 5. Estimation results (Scenario 1)

	Scenario 1.					Deviation from the baseline scenario				
	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	36,529	34,828	71,357	163,415	22.4	- 555	0	- 555	0	- 0.3
5	37,797	36,514	74,311	168,099	22.5	- 581	0	- 581	0	- 0.3
10	38,516	38,254	76,770	173,341	22.2	- 605	0	- 605	0	- 0.3
15	38,565	40,702	79,267	179,393	21.5	- 629	0	- 629	0	- 0.4
20	40,385	41,959	82,344	186,395	21.7	- 563	0	- 563	0	- 0.3
25	40,256	43,030	83,286	194,335	20.7	- 477	0	- 477	0	- 0.2
30	39,377	45,921	85,298	203,199	19.4	- 382	0	- 382	0	- 0.2
35	40,902	46,840	87,743	215,218	19.0	- 328	0	- 328	0	- 0.2
40	44,916	49,699	94,615	233,091	19.3	- 314	0	- 314	0	- 0.1
45	46,480	54,825	101,305	253,660	18.3	- 294	0	- 294	0	- 0.1
50	46,319	62,387	108,706	277,992	16.7	- 336	0	- 336	0	- 0.1
55	44,147	71,185	115,332	305,368	14.5	- 484	0	- 484	0	- 0.2
60	43,502	77,313	120,815	327,033	13.3	- 740	0	- 740	0	- 0.2
65	38,820	85,700	124,520	348,803	11.1	- 870	0	- 870	0	- 0.2
70	32,096	94,499	126,595	357,237	9.0	- 1,007	0	- 1,007	0	- 0.3
75	19,972	104,052	124,024	353,293	5.7	- 1,093	0	- 1,093	0	- 0.3
80	4,683	116,240	120,924	341,763	1.4	- 1,210	0	- 1,210	0	- 0.4
85	- 9,132	123,576	114,444	301,234	- 3.0	- 1,303	0	- 1,303	0	- 0.4
90	- 29,620	135,135	105,515	258,683	- 11.5	- 1,307	0	- 1,307	0	- 0.5
Future generations	89,914	—	—	159,024	56.5	1,270	—	—	0	0.8

Table 6. Estimation results (Scenario 2)

	Scenario 2.					Deviation from the baseline scenario				
	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	37,944	34,894	72,838	163,415	23.2	860	66	926	0	0.5
5	39,279	36,582	75,862	168,099	23.4	901	68	969	0	0.5
10	40,058	38,324	78,382	173,341	23.1	938	70	1,008	0	0.5
15	40,158	40,774	80,932	179,393	22.4	964	72	1,036	0	0.5
20	41,881	42,033	83,914	186,395	22.5	932	74	1,006	0	0.5
25	41,600	43,106	84,706	194,335	21.4	868	76	944	0	0.4
30	40,559	46,000	86,559	203,199	20.0	800	78	878	0	0.4
35	41,955	46,921	88,877	215,218	19.5	726	81	807	0	0.3
40	45,877	49,783	95,661	233,091	19.7	647	84	731	0	0.3
45	47,324	54,909	102,233	253,660	18.7	551	84	635	0	0.2
50	47,107	62,467	109,574	277,992	16.9	452	80	532	0	0.2
55	44,993	71,258	116,251	305,368	14.7	362	73	435	0	0.1
60	44,531	77,373	121,903	327,033	13.6	289	60	348	0	0.1
65	39,917	85,744	125,661	348,803	11.4	228	44	272	0	0.1
70	33,279	94,528	127,807	357,237	9.3	177	29	206	0	0.0
75	21,191	104,069	125,260	353,293	6.0	126	17	143	0	0.0
80	5,971	116,249	122,220	341,763	1.7	77	8	86	0	0.0
85	- 7,797	123,579	115,782	301,234	- 2.6	33	3	35	0	0.0
90	- 28,313	135,135	106,822	258,683	- 10.9	0	0	0	0	0.0
Future generations	86,446	—	—	159,024	54.4	- 2,198	—	—	0	- 1.4

Table 7. Estimation results (Scenario 3)

	Scenario 3.					Deviation from the baseline scenario				
	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	29,702	41,285	70,987	163,415	18.2	- 7,382	6,457	- 926	0	- 4.5
5	30,698	43,225	73,923	168,099	18.3	- 7,680	6,711	- 969	0	- 4.6
10	31,221	45,145	76,366	173,341	18.0	- 7,899	6,891	- 1,008	0	- 4.6
15	31,098	47,762	78,860	179,393	17.3	- 8,096	7,061	- 1,036	0	- 4.5
20	32,659	49,242	81,901	186,395	17.5	- 8,289	7,283	- 1,006	0	- 4.4
25	32,343	50,475	82,819	194,335	16.6	- 8,389	7,445	- 944	0	- 4.3
30	31,209	53,594	84,802	203,199	15.4	- 8,551	7,672	- 878	0	- 4.2
35	32,497	54,767	87,264	215,218	15.1	- 8,733	7,927	- 807	0	- 4.1
40	36,293	57,905	94,198	233,091	15.6	- 8,937	8,206	- 731	0	- 3.8
45	37,975	62,989	100,964	253,660	15.0	- 8,798	8,164	- 635	0	- 3.5
50	38,405	70,105	108,510	277,992	13.8	- 8,250	7,718	- 532	0	- 3.0
55	37,359	78,023	115,382	305,368	12.2	- 7,272	6,837	- 435	0	- 2.4
60	38,385	82,821	121,206	327,033	11.7	- 5,856	5,508	- 348	0	- 1.8
65	35,451	89,667	125,118	348,803	10.2	- 4,239	3,967	- 272	0	- 1.2
70	30,363	97,033	127,396	357,237	8.5	- 2,739	2,534	- 206	0	- 0.8
75	19,486	105,488	124,974	353,293	5.5	- 1,579	1,437	- 143	0	- 0.4
80	5,130	116,918	122,048	341,763	1.5	- 763	678	- 86	0	- 0.2
85	- 8,066	123,778	115,712	301,234	- 2.7	- 237	202	- 35	0	- 0.1
90	- 28,313	135,135	106,822	258,683	- 10.9	0	0	0	0	0.0
Future generations	115,287	—	—	159,024	72.5	26,644	—	—	0	16.8

Table 8. Estimation results (Scenario 4)

	Scenario 4.					Deviation from the baseline scenario				
	Lifetime ne burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	36,227	34,760	70,987	163,415	22.2	- 857	- 69	- 926	0	- 0.5
5	37,481	36,443	73,923	168,099	22.3	- 898	- 71	- 969	0	- 0.5
10	38,185	38,181	76,366	173,341	22.0	- 935	- 73	- 1,008	0	- 0.5
15	38,234	40,626	78,860	179,393	21.3	- 960	- 75	- 1,036	0	- 0.5
20	40,019	41,882	81,901	186,395	21.5	- 929	- 78	- 1,006	0	- 0.5
25	39,868	42,950	82,819	194,335	20.5	- 864	- 79	- 944	0	- 0.4
30	38,963	45,839	84,802	203,199	19.2	- 796	- 82	- 878	0	- 0.4
35	40,508	46,756	87,264	215,218	18.8	- 722	- 85	- 807	0	- 0.3
40	44,587	49,612	94,198	233,091	19.1	- 644	- 88	- 731	0	- 0.3
45	46,226	54,737	100,964	253,660	18.2	- 547	- 88	- 635	0	- 0.2
50	46,207	62,303	108,510	277,992	16.6	- 448	- 84	- 532	0	- 0.2
55	44,272	71,109	115,382	305,368	14.5	- 359	- 76	- 435	0	- 0.1
60	43,956	77,251	121,206	327,033	13.4	- 286	- 62	- 348	0	- 0.1
65	39,464	85,654	125,118	348,803	11.3	- 226	- 46	- 272	0	- 0.1
70	32,927	94,469	127,396	357,237	9.2	- 176	- 30	- 206	0	- 0.0
75	20,940	104,034	124,974	353,293	5.9	- 125	- 18	- 143	0	- 0.0
80	5,817	116,232	122,048	341,763	1.7	- 77	- 9	- 86	0	- 0.0
85	- 7,862	123,573	115,712	301,234	- 2.6	- 32	- 3	- 35	0	- 0.0
90	- 28,313	135,135	106,822	258,683	- 10.9	0	0	0	0	0.0
Future generations	90,830	—	—	159,024	57.1	2,186	—	—	0	1.4

Table 9. Estimation results (Scenario 5)

	Scenario 5.					Deviation from the baseline scenario				
	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	53,155	60,683	113,838	247,240	21.5	16,071	25,854	41,925	83,825	- 1.2
5	52,377	60,430	112,807	242,129	21.6	13,999	23,916	37,915	74,031	- 1.2
10	50,845	60,018	110,863	237,646	21.4	11,725	21,764	33,489	64,305	- 1.2
15	48,603	60,322	108,925	233,970	20.8	9,408	19,621	29,029	54,577	- 1.1
20	48,094	59,545	107,639	231,250	20.8	7,146	17,586	24,732	44,855	- 1.2
25	45,678	58,430	104,109	229,968	19.9	4,946	15,400	20,346	35,633	- 1.1
30	42,743	59,315	102,057	230,464	18.5	2,983	13,394	16,377	27,265	- 1.0
35	42,445	58,398	100,844	235,095	18.1	1,216	11,558	12,774	19,877	- 1.1
40	44,836	59,803	104,639	246,656	18.2	- 394	10,104	9,710	13,565	- 1.2
45	45,047	63,636	108,683	262,133	17.2	- 1,727	8,811	7,084	8,472	- 1.3
50	44,086	69,936	114,022	282,736	15.6	- 2,569	7,549	4,980	4,744	- 1.2
55	41,808	77,428	119,236	307,778	13.6	- 2,823	6,243	3,420	2,410	- 1.0
60	41,699	82,184	123,882	328,269	12.7	- 2,543	4,871	2,327	1,236	- 0.8
65	37,654	89,270	126,924	349,450	10.8	- 2,036	3,570	1,535	647	- 0.6
70	31,629	96,918	128,548	357,565	8.8	- 1,473	2,419	946	328	- 0.4
75	20,119	105,523	125,642	353,441	5.7	- 946	1,471	525	149	- 0.3
80	5,393	116,989	122,382	341,817	1.6	- 501	749	248	54	- 0.1
85	- 8,004	123,830	115,826	301,247	- 2.7	- 175	254	80	13	- 0.1
90	- 28,324	135,151	106,827	258,684	- 10.9	- 11	15	4	1	- 0.0
Future generations	135,060	—	—	252,729	53.5	46,416	—	—	93,705	- 2.2

Table 10. Estimation results (Scenario 6)

	Scenario 6.					Deviation from the baseline scenario				
	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	53,430	34,828	88,259	163,415	32.7	16,346	0	16,346	0	10.0
5	55,359	36,514	91,873	168,099	32.9	16,981	0	16,981	0	10.1
10	56,604	38,254	94,859	173,341	32.7	17,484	0	17,484	0	10.1
15	57,228	40,702	97,930	179,393	31.9	18,034	0	18,034	0	10.1
20	59,053	41,959	101,013	186,395	31.7	18,105	0	18,105	0	9.7
25	57,831	43,030	100,860	194,335	29.8	17,098	0	17,098	0	8.8
30	55,658	45,921	101,579	203,199	27.4	15,899	0	15,899	0	7.8
35	55,511	46,840	102,351	215,218	25.8	14,281	0	14,281	0	6.6
40	57,166	49,699	106,866	233,091	24.5	11,936	0	11,936	0	5.1
45	55,579	54,825	110,404	253,660	21.9	8,806	0	8,806	0	3.5
50	52,381	62,387	114,768	277,992	18.8	5,726	0	5,726	0	2.1
55	47,440	71,185	118,625	305,368	15.5	2,809	0	2,809	0	0.9
60	45,912	77,313	123,225	327,033	14.0	1,670	0	1,670	0	0.5
65	40,751	85,700	126,451	348,803	11.7	1,061	0	1,061	0	0.3
70	33,675	94,499	128,174	357,237	9.4	572	0	572	0	0.2
75	21,326	104,052	125,378	353,293	6.0	261	0	261	0	0.1
80	5,991	116,240	122,231	341,763	1.8	97	0	97	0	0.0
85	- 7,783	123,576	115,793	301,234	- 2.6	46	0	46	0	0.0
90	- 28,313	135,135	106,822	258,683	- 10.9	0	0	0	0	0.0
Future generations	52,068	—	—	159,024	32.7	- 36,575	—	—	0	- 23.0

Table 11. Estimation results (Scenario 7)

	Scenario 7.					Deviation from the baseline scenario				
	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	45,210	26,703	71,913	163,415	27.7	8,126	- 8,126	0	0	5.0
5	46,836	28,057	74,892	168,099	27.9	8,457	- 8,457	0	0	5.0
10	47,829	29,546	77,374	173,341	27.6	8,708	- 8,708	0	0	5.0
15	48,163	31,733	79,896	179,393	26.8	8,968	- 8,968	0	0	5.0
20	50,279	32,628	82,907	186,395	27.0	9,331	- 9,331	0	0	5.0
25	50,320	33,443	83,762	194,335	25.9	9,587	- 9,587	0	0	4.9
30	49,714	35,966	85,680	203,199	24.5	9,955	- 9,955	0	0	4.9
35	51,603	36,467	88,070	215,218	24.0	10,373	- 10,373	0	0	4.8
40	56,315	38,615	94,930	233,091	24.2	11,085	- 11,085	0	0	4.8
45	58,896	42,702	101,599	253,660	23.2	12,123	- 12,123	0	0	4.8
50	60,220	48,822	109,042	277,992	21.7	13,565	- 13,565	0	0	4.9
55	60,107	55,709	115,816	305,368	19.7	15,476	- 15,476	0	0	5.1
60	60,661	60,894	121,555	327,033	18.5	16,419	- 16,419	0	0	5.0
65	53,972	71,418	125,389	348,803	15.5	14,282	- 14,282	0	0	4.1
70	44,504	83,098	127,602	357,237	12.5	11,402	- 11,402	0	0	3.2
75	29,466	95,651	125,117	353,293	8.3	8,400	- 8,400	0	0	2.4
80	11,368	110,766	122,134	341,763	3.3	5,474	- 5,474	0	0	1.6
85	- 5,149	120,896	115,747	301,234	- 1.7	2,680	- 2,680	0	0	0.9
90	- 28,313	135,135	106,822	258,683	- 10.9	0	0	0	0	0.0
Future generations	44,038	—	—	159,024	27.7	- 44,606	—	—	0	- 28.1

Table 12. Estimation results (Scenario 8)

	Scenario 8.					Deviation from the baseline scenario				
	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	51,166	34,828	85,994	163,415	31.3	14,082	0	14,082	0	8.6
5	53,125	36,514	89,639	168,099	31.6	14,747	0	14,747	0	8.8
10	54,463	38,254	92,717	173,341	31.4	15,343	0	15,343	0	8.9
15	55,186	40,702	95,887	179,393	30.8	15,991	0	15,991	0	8.9
20	56,576	41,959	98,536	186,395	30.4	15,628	0	15,628	0	8.4
25	55,426	43,030	98,456	194,335	28.5	14,693	0	14,693	0	7.6
30	53,464	45,921	99,385	203,199	26.3	13,705	0	13,705	0	6.7
35	53,869	46,840	100,710	215,218	25.0	12,639	0	12,639	0	5.9
40	56,782	49,699	106,482	233,091	24.4	11,552	0	11,552	0	5.0
45	56,872	54,825	111,697	253,660	22.4	10,099	0	10,099	0	4.0
50	55,164	62,387	117,551	277,992	19.8	8,509	0	8,509	0	3.1
55	51,614	71,185	122,799	305,368	16.9	6,983	0	6,983	0	2.3
60	49,880	77,313	127,193	327,033	15.3	5,638	0	5,638	0	1.7
65	44,106	85,700	129,806	348,803	12.6	4,417	0	4,417	0	1.3
70	36,507	94,499	131,006	357,237	10.2	3,404	0	3,404	0	1.0
75	23,496	104,052	127,548	353,293	6.7	2,431	0	2,431	0	0.7
80	7,431	116,240	123,672	341,763	2.2	1,537	0	1,537	0	0.4
85	- 7,103	123,576	116,473	301,234	- 2.4	726	0	726	0	0.2
90	- 28,313	135,135	106,822	258,683	- 10.9	0	0	0	0	0.0
Future generations	49,810	—	—	159,024	31.3	- 38,834	—	—	0	- 24.4

Figure 1. Trends of expenditures, revenue, and newly issued public bonds
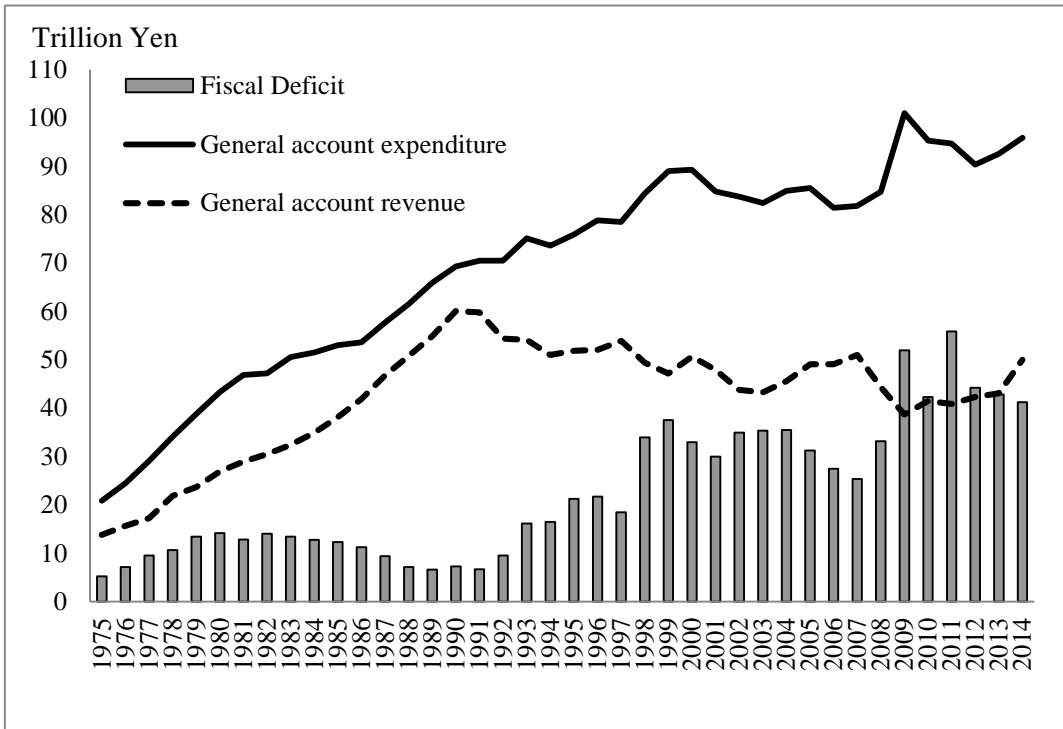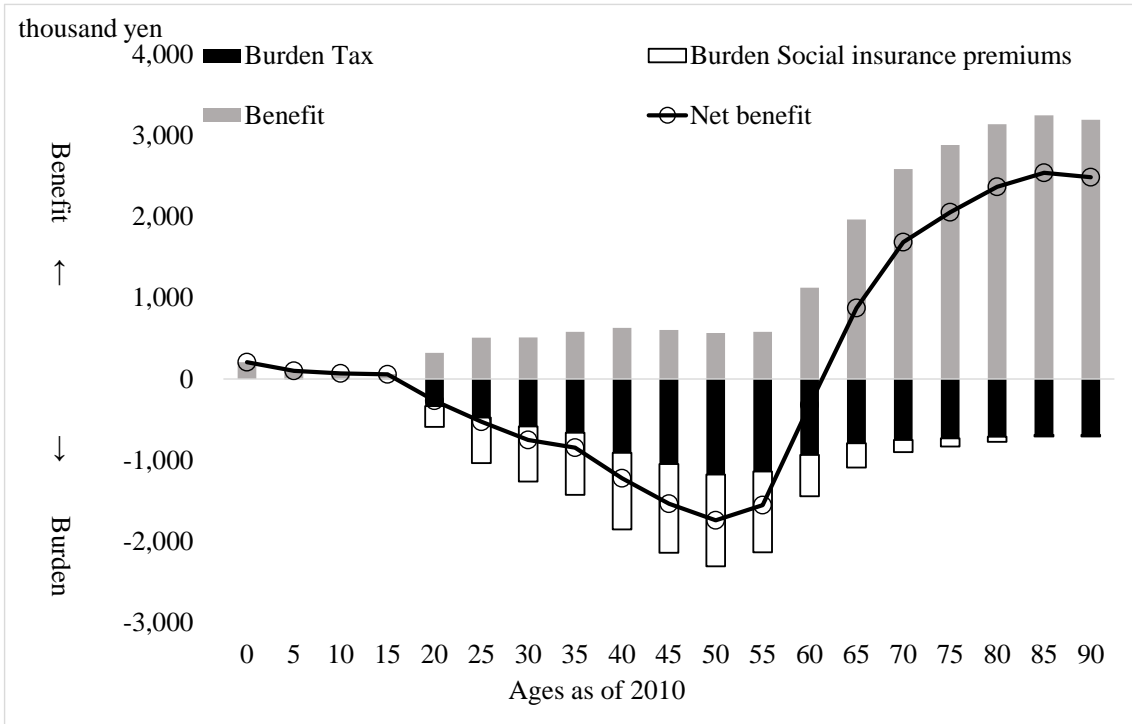

Source: Prepared based on the Ministry of Finance data.

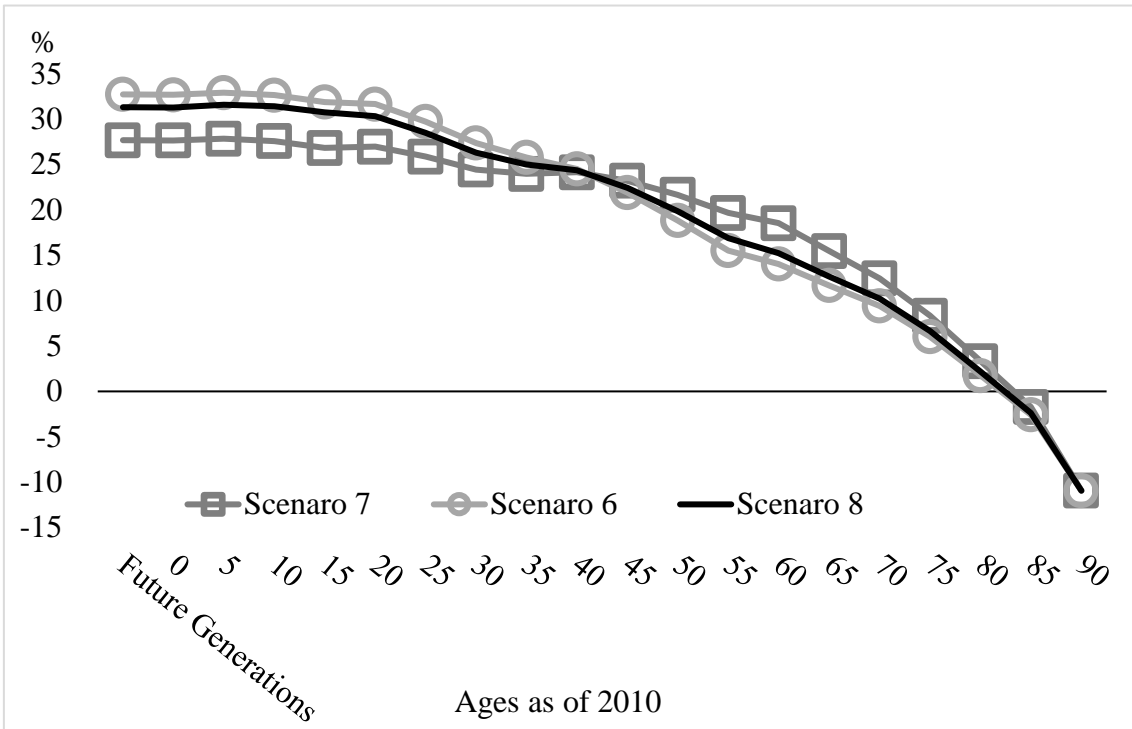Figure 2. Trends of dependence on public bonds
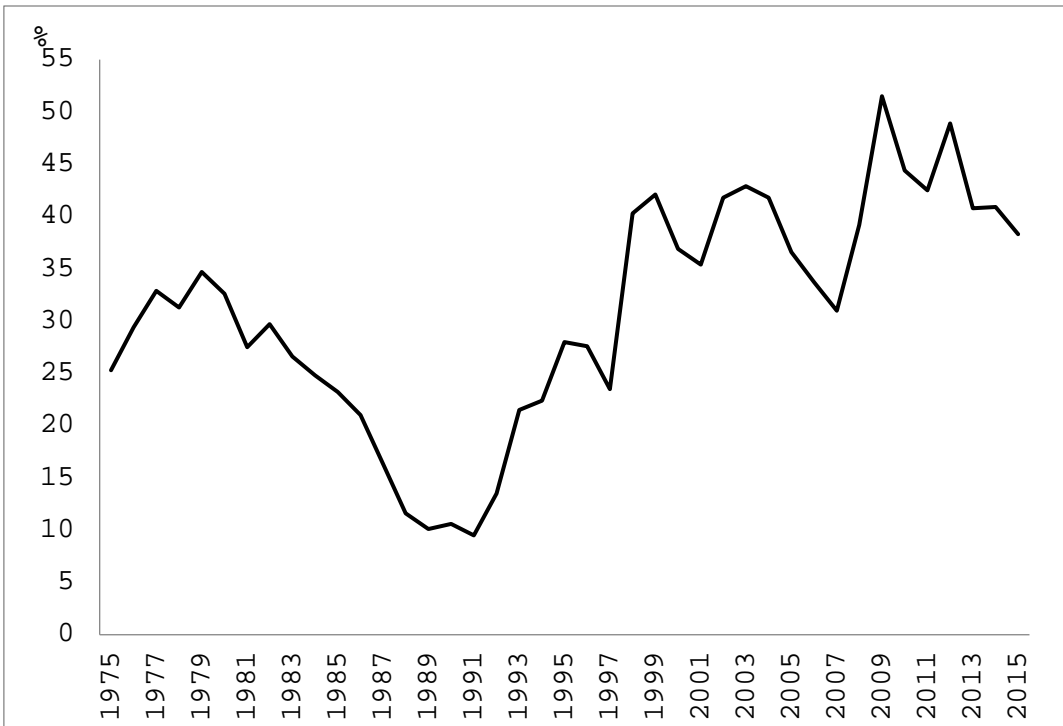
Source: Prepared based on the Ministry of Finance data.

Figure 3. Generation-specific benefit/burden structure

Source: Estimated by the authors.

Figure 4. Comparison of the effects of financial/social insurance system reforms

Source: Estimated by the authors.