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: A Generational Accounting Approach**

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The views expressed in this paper are those of the authors and not those of the Ministry of Finance or the Policy Research Institute.

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## Abstract

We employed the Generational Accounting model in estimating the generation-specific lifetime (both past and the future) benefits/burdens and income and evaluating their values as of 2010, thus estimating the lifetime net burden ratio (= lifetime net burden/lifetime income).

As a result, the following points were elucidated: 1) Among the current living generations, the lifetime net burden ratio of the 0-year-old generation is about 25 percentage points higher than that of the current 90-year-old generation; 2) The lifetime net burden ratio of the future generations is about 31 percentage points higher than that of the 0-year-old generation; 3) The net burden of the current generations would have to be increased in order to narrow the generational gap between the current generations and the future generations, which would inevitably lead to an expansion of the intragenerational gap of the current generations; and 4) In order to prevent conflict of interest between the current generations, in particular the younger generations and future generations, and at the same time, narrow the intergenerational gap, it is desirable to increase the income of the current generations, in particular that of the younger generations, by achieving a high economic growth rate and implementing macroeconomic policy management that would inhibit increase in the risk premium included in the interest rate.

**Key words:** Generational Accounting, falling birthrates and aging population, fiscal sustainability, government debt

**JEL classification:** H61, E62, B41.

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## 1. Introduction

With its enormous government debt, Japan's fiscal situation has reached a critical point where even its sustainability is being questioned. The trend of a falling birth rate and aging population is expected to accelerate into the middle of this century. If the current primary balance deficit continues and the pay-as-you-go-financed social security system remains unchanged, the future generations would have to bear a huge burden.

Because of this prospect, expenditures are being cut, public pension premiums are being raised, and pension payments are being restrained. And finally, a consumption tax rate increase has been put on the table. These reform measures would help reduce the burden shifted to the future generations, while at the same time, in part, expanding the inequalities among the current living generations, specifically between the working generation and the older generations.

In light of such circumstances, in this study, we clarify the magnitude of the generation-specific lifetime (both past and the future) benefits/burdens, and quantitatively assess the current intergenerational imbalance of benefits/burdens by explicitly considering the amounts of benefits/burdens of the past with the use of the traditional Generational Accounting method developed by Auerbach, Gokhale and Kotlikoff (1991). We also analyze the extent of impact that a policy change would have on benefits and burdens, and identify the generation that would experience such impact.

## 2. What is Generational Accounting?

Financial authorities of many countries including Japan adopt fiscal deficit<sup>1</sup> and government debt as important indicators of fiscal management, and struggle to keep those indicators under control.<sup>2</sup> In Japan, for instance, based on the "Fiscal Management Strategy" approved in a Cabinet meeting in June 2010, "with regard to the primary balance of national and local governments, halve the primary balance deficit relative to GDP by FY2015 from the FY2010 level, and achieve primary balance surplus by FY2020 at the latest" is stated as part of the fiscal consolidation targets. In the UK, in consultations on coalition government between the Conservative Party and Liberal Democratic Party following the general election in 2010, an agreement was reached to eliminate structural fiscal deficits before 2015. EU member countries have the obligation to contain their fiscal deficit relative to nominal GDP at below 3% and government debt to GDP at below 60%, and the EU has put in place necessary measures against any violation.

Then, why do the financial authorities attach particular importance to the fiscal deficit and

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<sup>1</sup> It should be noted that fiscal deficit can encompass different concepts to which different numerical values correspond, such as, 1) traditional fiscal revenue and expenditure, 2) primary balance, and 3) structural balance (primary balance).

<sup>2</sup> See Anderson and Sheppard (2009) concerning OECD countries.

government debt? Two reasons can be raised in general. One reason is that they represent the stance of the past and the present fiscal policies, and another reason is because they serve as proxy indicators for the magnitude of the burdens that are to be put on future generations.

However, Auerbach, Gokhale and Kotlikoff (1991) pointed out the following: 1) How do we define the scope of government?;<sup>3</sup> 2) a mid- to long-term fiscal stance cannot be presented through a short-sighted perspective based on a single year; and 3) the concept and numerical values of fiscal revenue and expenditure have been arbitrarily changed by the government. On the basis of these points, they indicated that the fiscal deficit cannot serve as a valid indicator for the objectives mentioned above, and presented a concept called Generational Accounting.

The purpose of Generational Accounting is to broadly grasp the government income and outlay based on the government's intertemporal budget constraint, break the general government's current and future income and outlay down into generation-specific lifetime benefits/burdens amounts from the perspective of an individual's burdens/benefits, and quantitatively assess the generation-based balance of payments between the government and individuals.

The generational accounts thus estimated are used as the basis to determine which generation bears a big or small net burden, and whether or not the variance is rational or not. In short, it clarifies the extent to which generational inequalities exist in financial terms.

Therefore, Generational Accounting is an attempt to objectively quantify the bills which are generated from the current financial structure that are passed on to future generations.

The Generational Accounting method was first applied by Aso and Yoshida (1996) in Japan, followed by researchers in many different fields, including universities, private think tanks, and government organizations.

With regard to OECD countries, previously Leibfritz, Roseveare, Fore and Wurzel (1995) and recently Auerbach, Kotlikoff and Leibfritz (1999) have estimated generational accounts for 17 countries based on a consolidated analysis framework to enable international comparison. According to Anderson and Sheppard (2009), governments of several countries have performed or are performing estimations in order to use Generational Accounting as a fiscal management tool (Table 1).

In this regard, it can be said that Generational Accounting is being recognized as an influential tool for assessing policies for intergenerational redistribution of resources by the

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<sup>3</sup> Paragraph 2, Article 5 of the Act on Special Measures concerning Promotion of Fiscal Structural Reform which was enacted in December 1997 and abated in December 1998 states that in case the investment-saving balance of the central government and that of the local governments have been published as part of the System of National Account concerning respective fiscal years that are provided in the preceding item, the Minister of Public Management, Home Affairs, Posts and Telecommunications and the Minister of Finance shall calculate and publish the budget deficit in relation to GDP of the relevant fiscal year without delay. Therefore, the Social Security Funds were not included in the budget deficit of the government.

public sector.<sup>4</sup>

Table 1. Examples of generational account estimations by governments (organizations)

Ongoing	Temporary
Netherlands, Norway	UK (2003, 2005), US (OMB: 1992, 1993, 1994), CBO: 1995)

Source: Excerpt from Table 6 (p. 22) of Anderson and Sheppard (2009)

### 3. Benefits and key considerations of Generational Accounting

We took a brief look at the basic principles of Generational Accounting in the above. The use of Generational Accounting can provide us with the following three benefits when we consider the issue of generational gap.

First, as Generational Accounting clarifies the benefit/burden structure by breaking down the government-individual interactions such as tax payment and transfer payments received according to age brackets, it can clearly show how the cost of the current fiscal policies are being borne by different age groups. Therefore, Generational Accounting can reveal which generation would face the burden resulting from changes made to the current fiscal policies (*visualizing the cost burden structure of policies*).

Secondly, by associating the age-specific benefit/burden structure with long-term population projection, Generational Accounting can quantitatively demonstrate the projected level of the government debt in the long run in the case that the present fiscal stance is maintained (*calculation of Fiscal Imbalance*).

Thirdly, Generational Accounting enables us to evaluate the current fiscal policies from the intergenerational equity perspective. That is, as discussed earlier, the generationally equitable fiscal policies as maintained by Kotlikoff mean that the amount of the lifetime net burdens in terms of the present value are the same for the newborn generation and the yet-to-be-born generations. In other words, if the government's intertemporal budget constraint equation is not satisfied in the case that the present fiscal stance is maintained, it will be impossible to keep the tax and social insurance premiums levels unchanged without reducing the transfer spending and non-transfer spending of the government, and the resources will anyway be redistributed from future generations to the current generations in a form of reduced consumption opportunities. A political implication that all generations must be assured of equitable lifetime net burdens can be drawn from this principle (*the principle of intergenerational equity*).

Next, the following are the points to be kept in mind when Generational Accounting is used.

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<sup>4</sup> Generational Accounting is being discussed in the Journal of Economic Perspective, The National Tax Journal, etc. In particular, critical views are expressed by Cutler (1993), Haveman (1994), CBO (1995) and Diamond (1996).

There are roughly six points to be noted:

The first point is that according to Generational Accounting in general, calculation of a lifetime net burden is possible only for the newborn generation and yet-to-be-born future generations at the time of the estimation, thereby making direct comparison possible only between these two generations. This is because for the current existing generations, only the “burden” and “benefit” in their remaining lifetimes are reflected in the generational accounts of each generation, i.e., “burdens” and “benefits” of the past are not considered.<sup>5</sup>

Secondly, the magnitude of Generational Accounting will vary depending on which item of account should be considered as transfer payments received by individuals among the “government spending” which forms a component of the government’s intertemporal budget constraint equation. In principle, account items accompanied by cash benefit or in-kind benefit are recorded as benefit and others are classified into non-transfer spending. However, as it is an extreme view to think that such non-transfer spending provides no facilities to the people, some of the preceding studies considered non-transfer spending as part of benefit. According to such studies, the fewer “non-transfer expenditures” not ascribed to specific generations, i.e., the more account items that can be recorded as benefits from government, the more improved will be the generational accounts for each generation.

Thirdly, so-called “general equilibrium effects” is abstracted in Generational Accounting. For instance, if the consumption tax rate is increased now, we would not consume or save in exactly the same way as we used to, and companies would adjust production in anticipation of changes in household consumption. In other words, policy changes inevitably change the household economy and company activities, thereby impacting the economic climate, not to speak of the fiscal situation. However, Generational Accounting does not factor in the household behavior equation or behavioral principle of companies such as the macro production function and that of households, and disregards the impact of policy changes on households, companies, and the macro economy. In short, Generational Accounting is a “partial equilibrium model.”

The fourth point is related to the third point. For purposes of simplification, Generational Accounting assumes that the economic growth rate and the discount rate are constant. However, the results of Generational Accounting calculation largely depend on how the economic growth rate and discount rate are set.<sup>6</sup> Therefore, which values are used as economic growth rate and

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<sup>5</sup> Generational Accounting is (also) an indicator for assessing the current fiscal stance of the government. Therefore, there is this idea that in order to ascertain any gaps projected in the future under the same system and stance, comparison between the 0-year-old generation and the future generations would suffice. In addition, the inability to compare between different generations is not too disadvantageous in the context of political economics. As Browning (1975) stated, if the current generations excluding the new comers consider their net burden of the past as sunk cost, estimating only the net burden as of the present and beyond would also be significant. In other words, each generation is bound to act (cast one’s vote) to maximize their own future benefits. In the case of Japan today, it is highly likely that such behavior expands (is expanding) the intergenerational gap, and therefore, Generational Accounting provides us with sufficient information.

<sup>6</sup> With regard to the discount rate, when the capital market is complete, the interest rate and discount rate are the

discount rate is vital.

The fifth point is that Generational Accounting in general is able to discuss in detail the intergenerational gap, but not the intragenerational gap. In other words, in order to answer the question “who” is to pay the government debt, we must consider not only “which generation” is to pay, but also “who within that particular generation” is to pay. For instance, assume that there are wealthy elderly persons, poor elderly persons, wealthy young persons, and poor young persons, and that the elderly persons are generally more economically advantaged than young persons. In this instance, redistribution of income from the elderly persons to the young persons (an intergenerational redistribution initiative) would be supported; and similarly, redistribution of income from the wealthy elderly person to the poor elderly person, and from the wealthy young person to the poor young person (an intragenerational redistribution initiative) would also be supported. However, partly due to data restrictions, preceding studies have entirely focused on intergenerational redistribution and were unable to step further into the intragenerational redistribution.<sup>7</sup>

The sixth point is the presence of the Ricardian equivalence theorem. According to the Ricardo’s and Barro’s view, as public debts are, in the first place, offset by private transfer, the intergenerational gap solely focused on public debts is never a problem. However, an experimental study that has demonstrated that the equivalence theorem holds completely true in Japan does not exist. That is to say that not all people are altruistic. Furthermore, because of an increasing number of households without children in recent years, the intergenerational link which is presupposed by Ricard and Barro is also disrupted. As a matter of course, if the number of households with disrupted intergenerational link increases, the public debt will not be offset, and the intergenerational gap becomes a significant issue.<sup>8</sup> Furthermore, an even more fundamental problem is that even if the equivalence theorem is true, the binding public transfer and voluntary private transfer are, in the first place, inhomogenous. All told, regardless of the success or failure of the Ricardian equivalence theorem, Generational Accounting is considered useful.<sup>9</sup>

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same. However, this is not the case in many situations. Therefore, in addition to the interest rate observed, the assumption on the risk premium is important. Another question is which interest rate should be adopted among different interest rates observed. The 10-year government bond interest rate has been frequently used by existing studies in Japan.

<sup>7</sup> However, Masujima, Shimasawa and Tanaka et al. (2010) is the only exception to the best of our knowledge.

<sup>8</sup> In the case where the social security benefits including public pension are granted to households regardless of the number of live births in the households, it is known that the utility level can be improved if one is getting a free ride on other households in terms of births without giving birth to and taking care of child for oneself. In this instance, the utility level of the household that has child(ren) is kept at a lower level, and moreover, the child or children of such household are doubly burdened by the public debt and the social security benefits granted to households without child.

<sup>9</sup> Another concept is the National Transfer Accounts that analyzes not only the intergenerational public transfer but also private transfer. See Lee et al. (2003) for details.

#### 4. Estimation based on traditional Generational Accounting

Initiated by Auebach, Gokhale and Kotlikoff (1991), numerous studies have been pursued both at home and abroad on traditional Generational Accounting. For instance, cases of overseas studies include: Kotlikoff (1992, 1993, 1995, 2003), Auebach, Gokhale and Kotlikoff (1993, 1994, 1995), Gokhale, Page and Sturrock (1997, 2000), Ter Rele (1997), Auerbach, Kotlikoff and Leibfritz (1999), Auerbach and Oreopoulos (1999), European Commission (1999), Fehr, Kotlikoff and Leibfritz (1999), Kotlikoff and Raffelhüschen (1999), Raffelhüschen (1999), Bonin (2001), Kotlikoff, Smetters and Walliser (2001), and Benz and Fetzner (2006). Also in Japan, estimations based on Generational Accounting have been performed by academic researchers, private think tanks, and government organizations, etc. Such study cases include Aso and Yoshida (1996), Hidaka et al. (1996), Yoshida (1998, 2001, 2006, 2008ab), Takayama, Kitamura, and Yoshida (1999), Sato (2001), Shimasawa (2007, 2011), Masujima, Shimasawa and Murakami (2009), Masujima and Tanaka (2010ab), Masujima, Shimasawa and Tanaka et al. (2010).

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

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

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:

$$D_{\infty} \prod_{s=1}^{\infty} (I+r)^{-s} = 0, \text{ that is, the government must not accumulate debts faster than the discount}$$

rate (interest rate).<sup>10</sup>

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

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

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<sup>10</sup> This assumption does not mean that the government debt is ever fully paid off, but that the debt can continue to exist over a long period of time unless it grows faster than the interest cost.



Incidentally, for the government, tax revenue is income and transfer spending 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, equation (1') can be transformed as follows:

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

The left hand side of this equation (1'') stands for the net tax revenue concerned with benefits and burdens, where the government's intertemporal net tax revenue can be divided into those borne by the current living generations and those borne by the future generations.

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

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

where  $N_{t,k}$  stands for the total sum of the present value of the lifetime net tax payment 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  $k$ .

In short, equation (2) means that the sum of the discounted present value flow of the lifetime net tax payment of the current living generations and the future generations (left hand side) must be able to cover the sum of the discounted present value flow of the future government consumption and the sum of the government's net debt at the initial period (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 current living generations, respectively.

Next, the generational account  $N_{t,k}$  is defined by:

$$N_{t,k} = \sum_{s=\max(t,k)}^{k+d} T_{s,k} \frac{P_{s,k}}{P_{t,k}} (I+r)^{-(s-t)} \quad (3)$$

where  $T_{s,k}$  stands for the projected average net tax payment made to the government in year  $s$  by the generation born in year  $k$ . 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  $t$ .

Based on the above, the generational account  $N_{t,k}$  is expressed by the sum of the present value of the average net tax payment imposed on a particular generation, whose member born in

year  $k$  is still alive in year  $t$ , and survives to year  $s$ . In short, generational account  $N_{t,k}$  represents the present value of the lifetime net burden amount by taking into account the probability of survival.

As can be confirmed by equation (3), Generational Accounting is generally applied to the benefits/burdens in the future. That is, the net tax burden of the current living generations is calculated only over their expected remaining lifetime. As this merely reflects the fact that the generational accounts of the current living generations born in different years are different due to varying length of expected remaining life, it is meaningless to compare generational accounts between different generations.<sup>11</sup>

The amount of average net tax burden per capita  $T_{s,k}$  is determined by the amount of tax burden per capita and the amount of transfer spending by the government as shown below:

$$T_{s,k} = \sum_i \tau_{s,k}^i \quad (4)$$

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  $s$ .

In and after the base year  $t$ , the amounts of burden and benefit are assumed to increase at a constant economic growth rate  $g$ .

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

That is,  $\tau_{s,k}^i$  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  $t$ .

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 tax burden to be paid by the future generations.

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

That is,  $\bar{N}(t+1) = \bar{N}(t+2) = \dots = \bar{N}(\infty) = \bar{N}$ .

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

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<sup>11</sup> As said before, what are comparable under the Generational Accounting method that do not reckon past benefits/burdens of the current living generations are, lifetime net burden amount of the newborn generation and the future generations (vertical comparison), and the difference in net burden amount of the same generation according to a different scenario-based (different future policies) comparative analysis (horizontal comparison).

born in year  $t+3$  is  $\bar{N}(I+g)^3$ , and so forth.

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

$$\sum_{s=0}^D N_{t,t-s} P_{t,t-s} + \sum_{s=1}^{\infty} \bar{N}(I+g)^s P_{t,t+s} (I+r)^{-s} = \sum_{s=0}^{\infty} G_{t+s} (I+r)^{-s} + D_t \quad (6)$$

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

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

The thus obtained  $\bar{N}$ , a generational account of the future generations can be directly compared with  $N_{t,t}$ , a generational account of the newborn generation born in year  $t$ .

If  $\bar{N}$  equals  $N_{t,t}$ , the generational policies are balanced. If  $\bar{N}$  exceeds (or is less than)  $N_{t,t}$ , the future generations will face a greater (or smaller) lifetime net burden than the current newborn generation.

## 5. The data used in this paper

### (1) System of National Accounts (SNA) data

In the following we explain the data required for estimating generational accounts before estimating the generational accounts of Japan with 2010 as the base year.

With regard to the data concerning government receipts and expenditures, this study uses “Annual Reports on National Accounts 2011” which is prepared and published by the Department of National Accounts, Economic and Social Research Institute, Cabinet Office, Government of Japan. The System of National Accounts is a representative macroeconomic statistics that comprehensively and systematically records the overall economy 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 mainly 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 2. According to the table, the general government had a total receipts of about 213.1 trillion yen in FY2010, including about 77.3 trillion yen tax revenue, about 57.5 trillion yen social insurance premiums, and about 78.2 trillion yen other income. This means that there was about 213.1 trillion yen burden on the people’s side. In contrast, the general government expenditures were about 262.8 trillion yen, including about 58.9 trillion yen government consumption, about 122.4 trillion yen social security benefit payment, about 14.4 trillion yen

fixed capital formation, and about 81.5 trillion yen of others.

Table 2. Outlay and income of the general government in FY2010 (billion yen)

	Outlay	Income
<b>Income and outlay account</b>	248,498.5	200,438.8
<b>(1) Allocation of primary income account</b>	13,100.8	46,720.0
Property income (payable)	10,008.6	
Taxes on production and imports		39,865.8
Subsidies	3,092.2	
Property income (receivable)		6,854.2
<b>(2) Secondary distribution of income account</b>	139,626.8	153,718.8
Social benefits other than social transfers in kind	67,218.7	
Other current transfers (payable)	72,408.1	
Current taxes on income, wealth, etc.		37,471.5
Social contributions		57,503.5
Other current transfers (receivable)		58,743.8
<b>(3) Redistribution of income in kind account</b>	55,167.6	
Social transfers in kind	55,167.6	
<b>(4) Use of income account</b>	40,603.3	
Actual final consumption	40,603.3	
<b>Capital finance accounts</b>	14,349.7	14,472.7
Gross fixed capital formation	15,217.5	
Consumption of fixed capital	-14,353.4	
Change in inventories	-21.1	
Purchase of land (net)	1,572.0	
Capital transfers (receivable)		14,472.7
Capital transfers (payable)	11,934.7	
<b>Total</b>	<b>262,848.2</b>	<b>213,077.3</b>

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,”<sup>12</sup> and “subsidies” are included in the government outlay (personal benefits), and “actual final consumption,” “gross fixed capital formation,” etc., are not included (Table 3).<sup>13</sup>

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.<sup>14</sup> 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.

Furthermore, 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.

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<sup>12</sup> The benefit in kind such as medical care and nursing care are not cash benefit, but included in personal benefits.

<sup>13</sup> Havemann (1994) and Buiters (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.

<sup>14</sup> See, for instance, Franco et al. (1992), Ter Rele (1997), Jensen and Raffelhüschen (1999), Raffelhüschen (1999), Takayama, Kitamura, and Yoshida (1999), Auerbach, Kotlikoff and Leibfritz (1999).

Table 3. Benefit/burden items based on the Generational Accounting

Benefit items: general government outlay		
Transfer spending	Pension	Social benefits other than in kind [Pension]
	Medical care	Social transfers in kind [medical care]
		Social benefits other than in kind [medical care]
	Nursing care	Social transfers in kind [nursing care]
		Social benefits other than in kind [nursing care]
Others	Social transfers in kind [others]	
	Social benefits other than in kind [others]	
Subsidies, etc.	Subsidies [subsidies for companies]	
	Other current transfers [Subsidies for individuals, etc.]	

Non-benefit items: general government		
Non-transfer spending	Government consumption	Actual final consumption – Consumption of fixed capital
		Social transfers in kind [education]
Government investment	Government consumption	Other current transfers (payable) [current international cooperation, etc.]
		Property income (payable)
Government investment	Government investment	Consumption of fixed capital
		Capital transfers (payable)

Burden items: general government income	
Social insurance premiums	Social contributions [pension]
	Social contributions [medical care]
	Social contributions [nursing care]
	Social contributions [others]
Tax	Fixed property tax
	Value-added tax [consumption tax]
	Taxes on production and imports [excluding the above two taxes]
	Current taxes on income, wealth, etc. [income tax, corporate tax, etc.]
	Capital transfers (receivable) [inheritance tax]
Other income	Other current transfers (receivable) [penalties, etc.]
	Property income (receivable) [distributive income, etc. of business corporations, excluding interests]
	Capital transfers (receivable) [others]

## (2) Other data

The basic data used for estimating generational accounts are as mentioned above. However, in order to estimate the generational accounts of the current 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 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 calculate the net burden amount of the current generations into the future, 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. For 2011, the data of the “Population Estimates” of the Statistics Bureau, Ministry of Internal Affairs and Communications was used. With regard to the population between 2012 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. As for FY2011 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%<sup>15</sup> and 2 percentage points,<sup>16</sup> respectively.

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

In order to estimate generational accounts by age group of the base year, government receipts or individual’s payment/burden and government spending or individual’s receipts/benefits must be obtained by age group. While individual-based micro-data is used in studies overseas including the US, use of such data is substantially restricted 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,” etc. were used

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<sup>15</sup> Considering the risks associated with Generational Accounting that covers a longer period of time, use of the actual interest rate of the government bond is questionable.

<sup>16</sup> 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. 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.

in the preceding studies.<sup>17</sup>

In this study, we allocate government income and outlay to the burdens/benefits of each age group of the current living generations by using a method similar to that of Auerbach, Gokhale and Kotlikoff (1991) and preceding studies in Japan.

That is, the allocation  $G_{i,j}$  to the generation  $j$  of the income/outlay item  $G_i$  of the  $i$ th government is obtained by:

$$Z_{i,j} = Z_i \frac{\alpha_{i,j} P_j}{\sum_{j=0}^d (\alpha_{i,j} P_j)} \quad (8)$$

$\alpha_{i,j}$  is the data used as the basis for allocating the income/outlay item of the  $i$ th government to generation  $j$ , and, as mentioned earlier, the income/expenditure data by age group of the “2009 National Survey of Family Income and Expenditure”<sup>18</sup> of the Statistics Bureau, Ministry of Internal Affairs and Communications was 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.<sup>19</sup>

Per capita benefit/burden  $z_{i,j}$  can be obtained by dividing  $Z_{i,j}$  derived from equation (8) by population of the relevant generation  $P_j$ .

$$z_{i,j} = \frac{Z_{i,j}}{P_j} \quad (9)$$

As mentioned in the preceding section, when calculating the net burden of each generation by subtracting its benefits from its burdens, with a view to studying benefits/burdens that directly affect personal budget constraint through the involvement of government, we included in the government income (or personal burdens) all taxes and insurance premiums paid by individuals. With regard to the government outlay (personal benefits), however, not all of it was taken into consideration, i.e., only the direct transfer payments that individuals receive from the government were calculated and non-transfer spending such as government consumption and investment was not taken into account.

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<sup>17</sup> 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.

<sup>18</sup> When using the National Survey of Family Income and Expenditure,” data of all households was used, in principle. However, when using workers’ household data, the ratio of the workers’ households to the total households was used to correct it according to Yoshida (2006).

<sup>19</sup> As is the case with Auerbach, Kotlikoff and Leibfritz (1999) and Yoshida (2006), we set the maximum age of the living generations at 94 in this study. This may be too old compared with the average length of life in Japan. It goes without saying, however, that the lifetime benefits will decrease if the lifespan is shortened.



#### (4) Future policy changes are reflected

Although the revenue/expenditure structure of the general government as of the base year is used as the premise according to the rules of Generational Accounting, policy changes that have been approved and are scheduled to be implemented in the future at the time of the estimation must be reflected, too.

Based on this rule, we reflected the following initiatives in this study: 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;<sup>20</sup> 4) revision of the Medical Insurance System in FY2006; and 5) the consumption tax increase bill enacted on August 10, 2012, in which consumption tax rate was increased to 8% starting from April 2014 and will be increased to 10% from October 2015.

#### (5) Benefit/burden structure of FY2010

We look at the per capita benefit/burden structure by age group in the base year (FY2010) with reference to Figure 1 and Table 4. 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, etc., while increased taxation and social security contributions due to increased wage earnings increase the burden on the working generation. As a result, it can be pointed out that the benefits tend to gradually increase with the advancement of age. Accordingly, the younger generation under the age of 15 and the older generations aged 65 and over receive excess benefit (negative net burden: benefit > burden), and the working generations are put under excess burden (positive net burden: benefit < 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 of income by the public sector places emphasis on an intergenerational support function which is based on public pension and health 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

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<sup>20</sup> According to the revision of the pension system in FY2004, a macroeconomic indexation system was introduced as a system to adjust the levels of pension benefits in the future. Under the macroeconomic indexation system, the levels of benefits are automatically adjusted in response to the changes in the benefits/burden from a macroeconomic perspective, i.e., changes in the number of workers who support the pension system and an increase in benefits associated with increased average life expectancy. However, this macroeconomic indexation system will be implemented for a special period until FY2023 aimed at balancing the pension finance. The pension benefits beyond FY2023 will be revised in accordance with the economic growth rate.

said to reflect the magnitude of the intergenerational income redistribution function through tax system, public pension system, medical care/nursing care system, etc. 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 is a different question.

Figure 1. Benefit/burden structure of FY2010

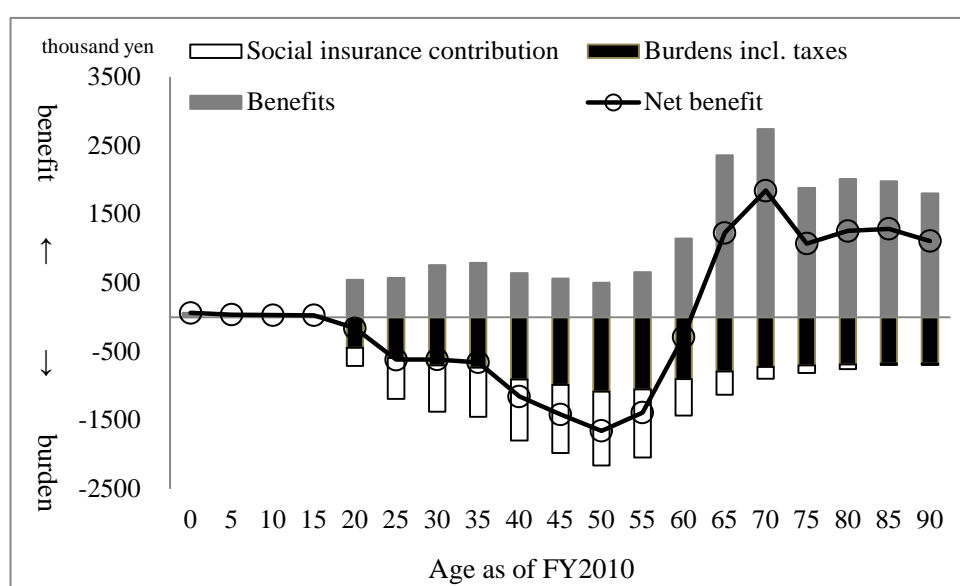


Table 4. Benefit/burden structure of FY2010

(thousand yen)

	Burden			Benefit	Net benefit
	Total	Taxes	Social insurance premiums		
0	0	0	0	62	62
5	0	0	0	37	37
10	0	0	0	30	30
15	0	0	0	28	28
20	708	444	264	547	▲162
25	1,188	592	595	571	▲616
30	1,376	699	677	760	▲616
35	1,449	732	718	792	▲658
40	1,795	904	892	641	▲1,154
45	1,977	983	994	562	▲1,415

50	2,160	1,084	1,076	504	▲1,656
55	2,045	1,048	997	655	▲1,390
60	1,433	901	531	1,147	▲286
65	1,131	789	342	2,360	1,229
70	896	726	170	2,741	1,846
75	811	698	112	1,883	1,073
80	756	686	70	2,014	1,258
85	694	671	23	1,981	1,287
90	694	671	23	1,805	1,110

(6) Estimation of generational accounts

Here, we estimate the present value of the lifetime net burden amount of the current living generations, or so-called generational accounts. The estimation results are shown in Table 5.

Table 5. Estimation results of the generational account (thousand yen)

Age as of FY2010	Lifetime net burden (3)=(2)-(1)	Lifetime benefit (1)	Lifetime burden (2)	Social insurance premiums	
				Taxes, etc.	
0	26,623	36,763	63,386	33,959	29,427
5	27,967	38,093	66,060	35,500	30,561
10	29,027	39,305	68,332	36,859	31,473
15	30,125	40,600	70,726	38,344	32,381
20	30,766	41,358	72,124	39,413	32,711
25	29,611	39,798	69,408	38,032	31,377
30	27,000	38,524	65,524	36,512	29,012
35	24,275	36,696	60,971	34,631	26,339
40	20,847	35,189	56,036	32,728	23,307
45	14,037	34,865	48,903	29,677	19,226
50	5,536	35,207	40,743	26,193	14,550
55	▲4,306	36,081	31,775	22,317	9,458
60	▲13,456	36,792	23,336	18,529	4,807
65	▲18,205	36,088	17,883	15,252	2,632
70	▲15,894	29,658	13,764	12,427	1,337
75	▲10,237	20,969	10,732	9,989	743
80	▲8,410	16,501	8,091	7,732	359
85	▲5,739	11,516	5,777	5,628	148
90	▲2,780	6,537	3,757	3,670	87
Future generations	75,405	—	—	—	—
Intergenerational imbalance (level)	48,781	—	—	—	—
Intergenerational imbalance (%)	183.2	—	—	—	—

(a) Current living generations

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, etc. Secondly, 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, etc. that they are to pay now and in the future. However, 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 of about 18.21 million yen for the 65-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 of about 30.77 million yen. This is because 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, and because 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.

Furthermore, as for generations younger than 20 years old, as there is still an ample time for them to reach their peak payment ages, the present values of benefit and burden are smaller, while older generations 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 current living generations, as all of their lifetime benefit/burden will be reckoned. According to our estimation, the 0-year-old generation will bear a lifetime net burden of about 26.22 million yen.

#### (b) Future generations

The lifetime net burden of the future generations who will be born in FY2011 and beyond is 75.41 million yen; they will have to bear about 48.78 million yen more than the 0-year-old generation as of FY2010. The difference in the amount of burden between the 0-year-old generation and the future generations is precisely attributable to the aggregate liability of the general government. And the percentage imbalance between these two generations at around 183.2% means that the lifetime net burden of the future generations will be, startlingly, twice as much as that of the current living generations. Given the magnitude of such intergenerational

imbalance, it can be said that 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. As the falling birthrate and aging population rapidly advances, the intergenerational gap between the current 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 current living generations is occurring.

Although direct comparison is difficult because the difference in measurement years, the international comparison presented by Auerbach, Kotlikoff and Leibfritz (1999) clearly shows how big a burden is passed on to the future generations of Japan (Table 6).

Table 6. International comparison of generational gap (as of 1995, %)

U.S.	Germany	Italy	Canada	Thailand	Australia	New Zealand
51.1	92.0	131.8	0.0	-88.0	32.2	-3.4
Netherlands	France	Norway	Portugal	Sweden	Argentina	Denmark
76.0	47.1	63.2	59.7	-22.2	58.6	46.9
Belgium	Brazil					
58.0	88.8					

Source: Auerbach, Kotlikoff and Leibfritz (1999)

According to the said study, the results of the intergenerational imbalance of Case A, in which the educational spending is considered as government consumption, are: 51.1% for US, 92.0% for Germany, 131.8% for Italy, 47.1% for France, -22.2% for Sweden, 63.2% for Norway, and so on.

#### 6. Estimation of lifetime net tax rate

According to the Generational Accounting methods in general that we've discussed so far, as for the current living generations, only the "burden" and "benefit" in their remaining lifetime were included in the generational accounts of each generation. Accordingly, the traditional Generational Accounting methods were able to compare only how the policy changes affect the net burden amount of respective generations after such policy changes take place, and the magnitude of the literal lifetime net burden of the generation just born at the time of the estimation (newborn generation) and that of the future generations.

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, in order to compare the lifetime net burden among the current living generations, the past benefit/burden, which has been neglected by the traditional Generational Accounting methods that we've discussed in the above, needs to be estimated first.

If it becomes evident that a certain generation is apparently more favorably treated than other generations due to past and present policies, then, and only then, it would be possible to approve a policy change that has an impact on the net burden of that generation, such as increased burden or reduced benefit. If, for instance, a particular generation is currently receiving excess benefit, while another generation is put under excess burden, it is very likely that policy will be implemented so that the burden of the generation put under excess burden is reduced and that of the generation receiving excess benefit is increased. However, if the information concerning the past net burden of the generation receiving excess benefit is not taken into consideration at all, and, in particular, if the relevant generation had actually borne a heavier burden than any other generation, such additional burden measure would be unfair. The traditional Generational Accounting methods that we've examined lacked criteria for judging fairness of the burden among the current living generations. That is, the fairness principle of the traditional Generational Accounting methods could only demand that the intergenerational gap 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. Although it may sound like a tautology, the traditional Generational Accounting methods, by their nature, were unable to draw out a fairness principle for the current living generations whose past macroeconomic environments, benefit/burden structures, and, moreover, the remaining lifespan are different. 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 in the lifetime net burden among the current living generations tended to be considered less seriously.

Therefore, in this section, we make retrospective measurements of the benefit/burden of the current living generations in order to study, as accurately as possible, not only intergenerational fairness but also intragenerational fairness among the current living generations, and estimate, literally, lifetime net burden of all generations.

The preceding studies on estimation of generational accounts including the benefit/burden of the past include Auerbach, Gokhale and Kotlikoff (1993) in US; Ablett and Tsegai-Bocurezion (2000) in Australia; Ter Rele and Labanca (2011) in the Netherlands; and Masujima, Shimasawa, and Murakami (2009), Miyazato (2009), Masujima and Tanaka (2010a, 2010b), etc. in Japan.<sup>21</sup> Other than the reference literature above, there are very few preceding

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<sup>21</sup> Preceding studies focused entirely on lifetime net burden of specific generation(s) include Van Kempen (1996) in

studies on lifetime net burden ratio both nationally and internationally to the best of our knowledge—mainly due to a lack of data. In order to calculate benefit/burden from the past governments, detailed data concerning the scale and the contents of the past governments' income and outlay must be available. Another reason is that this data, even if it is readily available, would require a considerable amount of time and labor to gather and process.

#### 7. Difference from the conventional Generational Accounting

The difference from the traditional Generational Accounting methods that we've discussed above can be summarized as follows:

First, as for the current living generations (0-year-old to 94-year-old) who were alive at the time of the estimation (FY2010), we employ the Generational Accounting method to estimate the past benefit/burden prior to the estimation period. That is, we obtain the past net burden of the current living generations by estimating the past benefit/burden structure and by discounting them back to the values as of the base year, and then we estimate the generation-specific net burden from births to deaths (lifetime net burden) of the current living generations by adding it to the previously obtained net future burden.

As pointed out earlier, 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 intragenerational imbalance among the current generation. In other words, it can be said that the estimation of the past net burden of the current living generations was vital in concurrently addressing the intragenerational gap of the current living generations and the gap between the future generations and the current generations.

Secondly, we estimated the lifetime income of each generation, and evaluated it by using the lifetime net burden ratio (*Lifetime Net Tax Rate*), which is the ratio of the lifetime net burden to the lifetime income.<sup>22</sup> This enables us to evaluate the weight of the actual burden of each generation and the difference among them.

In Japan, the tax systems and the social security burden have largely been proportional to changes in income, which means that higher income generations bear heavier burden. Moreover, after the Japanese economy's growth rate bent downward three times, there has been less and

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the Netherlands, Wolfson, Rowe, Lin and Gribble (1998) in Canada, and Gal and Tarcali (2003) in Hungary.

<sup>22</sup> It is called *Lifetime Generational Accounting* according to Ter Rele and Labanca (2011).



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, in estimating generational accounts, 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 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. Furthermore, if such nature is understood, it is possible to conduct a certain operation to make the lifetime net burden of a particular generation look larger or smaller by arbitrarily choosing the economic growth rate and discount rate, which is, needless to say, not something permissible.

Hence, one of the purposes of using the lifetime net burden ratio is 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.

#### 8. Methods for estimating the benefit/burden of the past and lifetime income

This section provides explanation on the difference between the estimation methods of traditional Generational Accounting. In short, there is no difference in terms of the estimation of the benefit/burden structure of the base year, estimation of the net burden of the current living generations in the future, and the estimation of the lifetime net burden of the future generations. What differs is the estimation of the past benefit/burden of the current generations.

As mentioned earlier, under traditional Generational Accounting, the benefit/burden of each generation as of the base year is estimated based on the government income/outlay and the distribution standard data. But here, we traced the government income/outlay and distribution standard data back to the pre-base year periods, and, similar to the base year processing flow, distributed the sum of the general government income/outlay to each generation according to the distribution standard that is expressed by the earlier mentioned equation (8) :

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

thereby estimating the benefit/burden structure of each generation in each year. Then, we obtained the amount of benefit and burden in the past of the current generations by discounting the benefit/burden (nominal values) of each year back to the present value as of

the base year at the time of estimation with the use of the nominal long-term interest rate in the past.<sup>23</sup>

The estimation of the past years in this section target FY1916 when the 94-year-olds, the oldest among the current generations as of year FY2010, were born and FY2009, when the one-year-old generation, as of year 2010, was born.

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

First, the lifetime income of the current generations.

The present value of the lifetime income  $L_{t_0,k}$  of the generation born in fiscal year  $k$  as of the base year ( $t_0$ ) is:

$$L_{t_0,k} = \sum_{s=k}^{t_0-1} y_{s,k} \sum_{s=t}^{t_0-1} (I+r)^{-s} + \sum_{s=t_0}^{k+d} y_{s,k} \frac{P_{s,k}}{P_{t_0,k}} (I+r)^{-(s-t)} \quad (*)$$

where  $y_{s,k}$  stands for an average income of generation born in fiscal year  $k$  as of fiscal year  $s$ . The right hand side of equation (\*) 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:

$$y_{s,k} = (I+g)^{s-t} y_{t,t-s+k}$$

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

The lifetime income of the generation born the year after the base year (year  $t_0$ ) is:

$$L_{F1} = \sum_{s=t_0+1}^{t_0+d+1} y_s P_s (I+r)^{-s}$$

where, if the population of the future generations is considered invariable,  $L_{F2}$  or the lifetime income of the generation born in the year following generation  $F_1$  is expressed as  $L_{F2} = (I+g)L_{F1}$ . Eventually, the lifetime income of the future generations  $\bar{L}_F$  is expressed as  $L_{F1} = \bar{L}_F$ .

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, etc., only the labor income was included, similarly to Auerbach, Gokhale and Kotlikoff (1993).

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<sup>23</sup> According to Auerbach, Gokhale and Kotlikoff (1993), the birth year of each generation is used as the base year for estimating the present values of both the lifetime net burden and lifetime income. In short, the lifetime net burden ratio of each generation is compared on the basis of their birth years.

The actual flow of estimation process is as follows. The national income at a point in time in the future was assumed to increase in line with the economic growth rate as is the case with the benefit/burden items. Then, by allocating the national income thus obtained to each generation based on equation (8) as was used in the above, the per capita income was obtained, which was then discounted back to the present value as of the base year to obtain the lifetime income.

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

First, the lifetime net burden ratio  $LTR_{t,k}$  of the current generation borne in year  $k$  is:

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

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

$$\overline{LTR} = \frac{\overline{N}}{\overline{L}_F}$$

#### 9. Estimation results of lifetime net burden ratio

Here, we estimate the lifetime net burden ratio of each generation. To do that, we use the following historical data in constructing generational accounts by going back to those born in 1916. The data sources include “National Accounts (retrospective statistics)” of the Cabinet Office, Government of Japan; “100 Years of History of the Bank of Japan,” Bank of Japan; “Population Estimates (long-term chronological data)” of the Statistics Bureau, Ministry of Internal Affairs and Communications; “Historical Statistics of Japan (each volume)” of Japan Statistical Association; “Long-Term Economic Statistics (each volume)” of Toyo Keizai, Inc. and “Long-Term Chronological Data” of the National Tax Agency. However, as the retrospective period is different depending on the item of each data, we had to set a number of assumptions. Although not reported here, regardless of how the assumptions were set, the results were judged to be relatively robust.

The estimation results are shown in Table 7 and Figure 2.

Table 7. Estimation results of the lifetime net burden ratio with 2010 as the base year

(thousand yen)

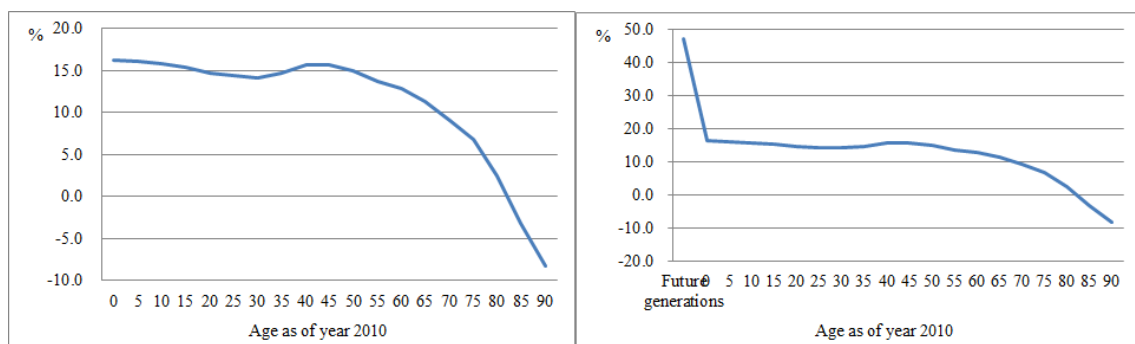
	Lifetime net burden	Future			Past			Lifetime income	Lifetime net burden
		Net burden	Benefit	Burden	Net burden	Benefit	Burden		

									ratio
0	26,623	26,623	36,763	63,386	0	0	0	163,482	16.3
5	27,008	27,967	38,093	66,060	▲959	959	0	167,036	16.2
10	27,430	29,027	39,305	68,332	▲1,598	1,598	0	173,652	15.8
15	27,871	30,125	40,600	70,726	▲2,255	2,255	0	181,334	15.4
20	28,041	30,766	41,358	72,124	▲2,725	2,725	0	190,682	14.7
25	29,149	29,611	39,798	69,408	▲461	5,472	5,011	202,087	14.4
30	30,387	27,000	38,524	65,524	3,387	8,472	11,859	214,232	14.2
35	33,456	24,275	36,696	60,971	9,182	11,353	20,534	228,379	14.6
40	38,659	20,847	35,189	56,036	17,812	13,815	31,627	245,820	15.7
45	41,530	14,037	34,865	48,903	27,493	16,490	43,983	265,439	15.6
50	44,259	5,536	35,207	40,743	38,723	19,585	58,308	295,936	15.0
55	44,990	▲4,306	36,081	31,775	49,296	22,275	71,570	329,729	13.6
60	44,690	▲13,456	36,792	23,336	58,145	23,113	81,258	347,617	12.9
65	39,382	▲18,205	36,088	17,883	57,587	28,491	86,077	349,480	11.3
70	32,397	▲15,894	29,658	13,764	48,291	38,342	86,633	355,048	9.1
75	23,902	▲10,237	20,969	10,732	34,139	49,733	83,872	347,631	6.9
80	8,236	▲8,410	16,501	8,091	16,646	62,388	79,034	346,030	2.4
85	▲10,742	▲5,739	11,516	5,777	▲5,003	77,038	72,035	332,667	▲3.2
90	▲26,045	▲2,780	6,537	3,757	▲23,265	88,564	65,299	314,737	▲8.3
Future generations	75,405	75,405	—	—	—	—	—	160,177	47.1

Figure 2. Estimation results of the lifetime net burden ratio with 2010 as the base year

(i) Current generations

(ii) Current and future generations



If you look at the net burden of the past of the current generations, generations of 25-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 85-year-olds and over, they also receive excess benefit as the social security benefits they've received in the past exceed the tax/social insurance premiums burden.<sup>24</sup>

On the other hand, the rest of the generations from 30-year-olds to 80-year-olds are put under excess burden.

In short, as is obvious from Table 7, the discounted present value of the net burden of the past increases from age 30 through to age 60 and then decreases to age 80.

Now, let us turn our eyes to the lifetime income by generation.

The generation-specific lifetime income in terms of discounted present value as of 2010 was calculated to be about 355.05 million yen for the 70-year-old generation, the highest of all generations, and about 160 million yen for the 0-year-old and future generations (Table 8). 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.

If we look at the lifetime net tax rate of the current generations, which is obtained by dividing the lifetime net burden by lifetime income based on these numerical values, the highest was 16.3% recorded for the 0-year-old generation, which then gradually decreases down to 14.2% for the 30-year-old generation. Although the lifetime net tax rate increases again for the 35- and 40-year-old generations, it decreases as the age advances further. The older generations at 85 years old and over receive excess benefit, and the 90-year-old generation receives excess benefits by 8.3%. On the whole, the younger the generation, the higher the lifetime net tax rate. For instance, the 0-year-old generation's lifetime net tax rate is 24.6 percentage points higher than that of the 90-year-old generation.

Furthermore, the lifetime net tax rate of the future generations who are to be born was calculated to be 47.1%, which means that this generation 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, etc. In addition, the rate is as much as 30.8 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.

Based on the above findings, we can point out the following two features of the generational gap that the current generations and future generations of our country are to face.

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<sup>24</sup> It should be noted that survival rate applies only to the future, so the amount (ratio) of the lifetime net burden on older generation at estimation point in time tends to be lower. Even so, however, the amount (ratio) of the burden on older generation is considerably smaller when compared with other countries, as will be discussed later.

One is that the intergenerational gap among the current generations is minor; and another is that the intergenerational gap between the current generations and future generations is enormous.

With regard to the intergenerational gap among the current 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 gap 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 a 5 percentage points at the maximum. Furthermore, when focused on the lifetime net burden ratio of the generations younger than 50-year-olds, the gap is about 1 percentage point at the most, which can be considered as nearly the same level. In short, although the generational gap among the current generations does exist, it can be said that the members of the current generations are treated virtually equal.

In contrast, as for the gap between the current generations and future generations, there is an enormous 30.8 percentage point difference between the 0-year-old generation who bear the largest lifetime net burden ratio among the current generations and the future generations. Expressed incisively, it can be assessed that the current generations are acting in collusion to pass the bills on to the future generations.

#### 10. International comparison of lifetime net burden ratio

As discussed in the previous section, the lifetime net burden ratio of respective generations including future generations of Japan is characterized by 1) a small intergenerational gap among the current generations, and 2) an enormous intergenerational gap between the current generation and future generations.

Now, let us take a look at situations internationally. In this section, we focus on the US and Australia through the preceding two studies by Auerbach, Gokhale and Kotlikoff (1993), and Ablett and Tseggai-Bocurezion (2000).<sup>25</sup>

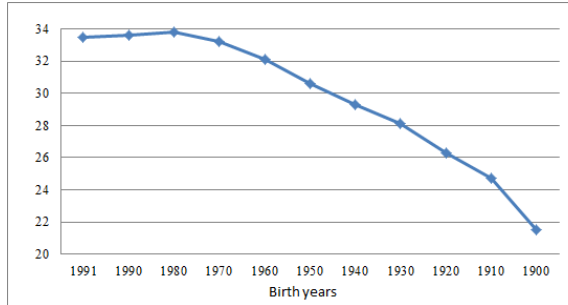
As for the US, whose estimation was performed in 1991, the current generations include the generations going back to those born in the year 1900, the 0-year-old generation is born in 1991, the economic growth rate is 0.75%, and the discount rate is 6.0%. The estimation results are shown in Figure 3.

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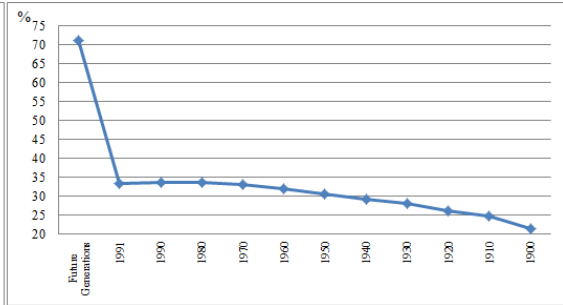
<sup>25</sup> Apart from the above mentioned two preceding studies abroad on lifetime net burden ratio, the only example is the Rele and Labanca (2011) in Netherlands. Ter Rele and Labanca were not discussed in this section due to the following reasons: different from traditional Generational Accounting, their paper 1) estimated including a fiscal consolidation measure equivalent to  $4\frac{1}{2}\%$  as a percentage of GDP aimed at ensuring fiscal sustainability, which was not planned by the government at the time of the estimation; 2) included in benefits what are normally not included in the estimation under Generational Accounting such as noncash benefit including education and benefits from social capital stock, and considered seigniorage as burden; and 3) the oldest generation of the current generation is relatively young, i.e. those born in 1946 (64 years old as of the estimation year 2010).

Figure 3. Lifetime net burden ratio in the US

(i) Current generations



(ii) Current and future generations



Source: Auerbach, Gokhale and Kotlikoff (1993)

The lifetime net burden ratio of the current generation elucidates the following points: 1) the lifetime net burden ratios are positive across all generations, which means that no generation receives net benefit (in Japan, the 85- and 90-year-old generations are the net benefit generations); 2) however, the lifetime net burden ratio increases from those born in 1900 to 1980, and then almost flattens in the subsequent generations; 3) even the generation born in 1900 whose lifetime net burden ratio is the lowest, stands at 21.5% and exceeds 16.3% of the most heavily burdened 0-year-old generation in Japan by 5.2 percentage points; and 4) the intergenerational gap among the current generation is about 12 percentage points, which is smaller than that of Japan at 24.6 percentage points.<sup>26</sup>

If you look at the intergenerational gap between the current generation and future generations, the lifetime net burden ratio of future generations is 71.1%, which is 37.6 percentage points over the 33.5% of the 0-year-old generation. This is bigger than the 30.8 percentage point gap of Japan.

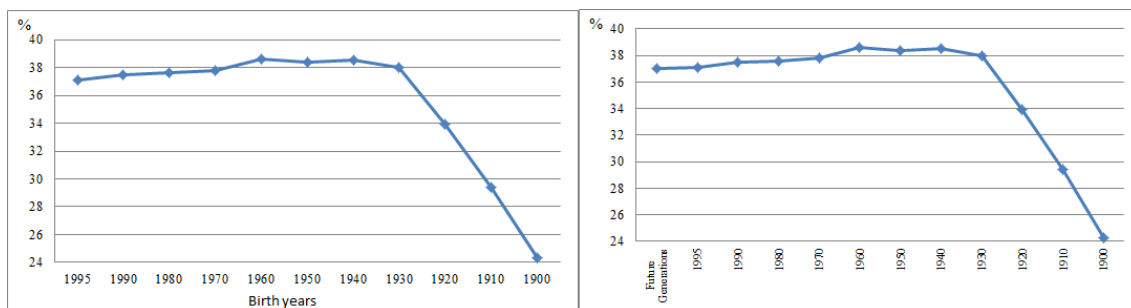
The next is Australia. The estimation was performed in 1995, and the current generations include generations going back to those born in the year 1900, the 0-year-old generation is born in 1995, the economic growth rate is 1.0%, and the discount rate is 5.0%.

Figure 4. Lifetime net burden ratio in Australia

(i) Current generation

(ii) Current generation and future generations

<sup>26</sup> There is little difference from the estimation results of the CBO (1995).



Source: Ablett and Tsegai-Bocurezion (2000)

Similar to the case of US, the lifetime net burden ratio of the current generation elucidates the following points: 1) the lifetime net burden ratios are positive across all generations, which means that no generation receives net benefit (in Japan, the 85- and 90-year-old generations are the net benefit generations); 2) even the generation born in 1900 whose lifetime net burden ratio is the lowest, stands at 24.3% and exceeds 16.3% of the most heavily burdened 0-year-old generation in Japan by 8.0 percentage points; 3) the lifetime net burden ratio increases for those born in 1900 to 1930, and then flattens in the subsequent generations, and an intergenerational balance is nearly attained among the current generation born in 1930 and later.

If you look at the intergenerational gap between the current generation and future generations, the lifetime net burden ratio of the future generations at 37.0% is almost on a similar level with 37.1% of the 0-year-old generation. It can be said, therefore, that there is no intergenerational gap between the current generation and future generations in Australia<sup>27</sup>.

As discussed above, based on comparison with situations in the US and Australia, it can be said that all current generations in Japan bear a small net burden, and that they are passing a bigger burden on to the future generations. This is considered to reflect the situations in the US and Australia, where average wages are computed lower due to the presence of an income gap and where the taxation base is larger than that of Japan. Also, it can be said that the shape of the graph line showing the intergenerational gap measured by the lifetime net burden ratio of Japan is similar to that of the US.

#### 11. Policy changes and lifetime net tax rate

In this section, we examine the following five scenarios in order to see how the policy changes affect the lifetime net burden ratio of each generation: 1) a consumption tax increase scenario, i.e., an intergenerational imbalance reduction scenario in which the consumption tax is raised to 8% in April 2014, then to 10% in October 2015, and then again up to 24% in or after April

<sup>27</sup> It should be noted, however, that this is an assessment at the time of estimation in 1995 and the present situation is not known.



2016; 2) an increased pension insurance premiums scenario; 3) a reduced pension benefit scenario; 4) an economic growth stimulation scenario, in which the economic growth rate is assumed to increase by 1 percentage point to 2.5% from the estimated 1.5% baseline scenario; and lastly, 5) a scenario of concurrent increases in consumption tax and the economic growth rate (up to 2.5%) aimed at eliminating the intergenerational gap.

(1) Consumption tax increase scenario

The estimation results of a consumption tax increase scenario, in which the consumption tax rate is eventually increased up to 24% in April 2016 with the purpose of eliminating the intergenerational gap measured by lifetime net burden ratio, are shown in Table 8 and Table 9.

Table 8. Estimation results (thousand yen)

	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)
0	39,881	36,763	76,644	163,482	24.4
5	40,904	39,052	79,956	167,036	24.5
10	41,903	40,903	82,806	173,652	24.1
15	42,735	42,855	85,590	181,334	23.6
20	42,077	44,083	86,160	190,682	22.1
25	42,309	45,270	87,579	202,087	20.9
30	42,683	46,996	89,679	214,232	19.9
35	44,874	48,049	92,922	228,379	19.6
40	49,008	49,003	98,011	245,820	19.9
45	50,516	51,355	101,871	265,439	19.0
50	51,747	54,792	106,539	295,936	17.5
55	51,127	58,355	109,482	329,729	15.5
60	49,603	59,905	109,508	347,617	14.3
65	43,180	64,579	107,758	349,480	12.4
70	35,202	68,000	103,201	355,048	9.9
75	25,851	70,702	96,553	347,631	7.4
80	9,406	78,889	88,295	346,030	2.7
85	▲10,262	88,554	78,292	332,667	▲3.1
90	▲26,045	95,100	69,055	314,737	▲8.3
Future generations	39,075	—	—	160,177	24.4

Table 9. Comparison with the standard scenario (thousand yen)

	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	13,257	0	13,257	0	8.1
5	13,895	0	13,895	0	8.3
10	14,474	0	14,474	0	8.3
15	14,864	0	14,864	0	8.2
20	14,036	0	14,036	0	7.4
25	13,160	0	13,160	0	6.5
30	12,297	0	12,297	0	5.7
35	11,417	0	11,417	0	5.0
40	10,349	0	10,349	0	4.2
45	8,985	0	8,985	0	3.4
50	7,488	0	7,488	0	2.5
55	6,137	0	6,137	0	1.9
60	4,914	0	4,914	0	1.4
65	3,798	0	3,798	0	1.1
70	2,805	0	2,805	0	0.8
75	1,948	0	1,948	0	0.6
80	1,171	0	1,171	0	0.3
85	480	0	480	0	0.1
90	0	0	0	0	0.0
Future generations	▲36,330	—	—	0	▲22.7

As is obvious from the above tables, as a result of increased burden on the current generations due to increased consumption tax, the lifetime net burden ratio of the future generations reduces by 22.7 percentage points, and eliminates the intergenerational imbalance between the 0-year-old generation and the future generations.

On the other hand, it is also obvious that the burden is increased unequally among the current generations. This is because, as earlier pointed out, the shorter the remaining lifetime, the smaller the additional burden; and the longer the remaining lifetime, the larger the additional burden. For instance, the lifetime net burden ratio of the 65-year-old generation is increased by 1.1 percentage points, and that of the 20-year-old generation is increased by 7.4 percentage points, i.e., the younger the generation, the greater the level of increase. The same also applies

to assessment in value terms.

Based on the above, we can conclude that while the consumption tax increase narrows the intergenerational gap between the current generations and future generations, it expands the gap among the current generations.

(2) Increased pension insurance premiums scenario

Let us now look at the increased pension insurance premiums scenario, which is intended to increase the pension premium by the same amount according to the same schedule as the consumption tax increase in and after FY2014. The results of the estimation are shown in Table 10 and Table 11.

Table 10. Estimation results (thousand yen)

	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)
0	30,256	36,763	67,019	163,482	18.5
5	30,777	39,052	69,829	167,036	18.4
10	31,306	40,903	72,209	173,652	18.0
15	31,847	42,855	74,701	181,334	17.6
20	31,880	44,083	75,963	190,682	16.7
25	32,667	45,270	77,937	202,087	16.2
30	33,537	46,996	80,533	214,232	15.7
35	36,206	48,049	84,255	228,379	15.9
40	40,919	49,003	89,923	245,820	16.6
45	43,219	51,355	94,575	265,439	16.3
50	45,317	54,792	100,109	295,936	15.3
55	45,451	58,355	103,806	329,729	13.8
60	44,840	59,905	104,744	347,617	12.9
65	39,422	64,579	104,000	349,480	11.3
70	32,413	68,000	100,413	355,048	9.1
75	23,910	70,702	94,612	347,631	6.9
80	8,239	78,889	87,128	346,030	2.4
85	▲10,741	88,554	77,813	332,667	▲3.2
90	▲26,045	95,100	69,056	314,737	▲8.3
Future generations	67,753	—	—	160,177	42.3

Table 11. Comparison with the standard scenario

(thousand yen)

	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	3,633	0	3,633	0	2.2
5	3,769	0	3,769	0	2.3
10	3,877	0	3,877	0	2.2
15	3,976	0	3,976	0	2.2
20	3,839	0	3,839	0	2.0
25	3,518	0	3,518	0	1.7
30	3,151	0	3,151	0	1.5
35	2,750	0	2,750	0	1.2
40	2,260	0	2,260	0	0.9
45	1,689	0	1,689	0	0.6
50	1,058	0	1,058	0	0.4
55	461	0	461	0	0.1
60	150	0	150	0	0.0
65	40	0	40	0	0.0
70	16	0	16	0	0.0
75	8	0	8	0	0.0
80	3	0	3	0	0.0
85	1	0	1	0	0.0
90	0	0	0	0	0.0
Future generations	▲7,651	—	—	0	▲4.8

The results show that the lifetime net burden ratio increases across all current living generations, and decreases among future generations. To be more specific, it increases by 2.2 percentage points among 0-year-old generation, decreases by 4.8 percentage points among future generations, thereby reducing the intergenerational gap between the 0-year-old generation and future generations in terms of lifetime net burden ratio by mere 7.0 percentage points. This is because as the insurance premiums are borne mainly by working generations, the younger generations, whose remaining contribution period is longer, naturally bear more burden. And as the total burden on the working generations increases, the burden on the future generations decreases. Consequently, while the intergenerational gap between the 0-year-old and future

generations in terms of the lifetime net burden ratio narrows, the gap among the current generation expands.

### (3) Reduced pension benefit scenario

Here, we examine a reduced pension benefit scenario by an average of 20%. The results of estimation are shown in Table 12 and Table 13.

Table 12. Estimation results (thousand yen)

	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)
0	29,087	34,299	63,386	163,482	17.8
5	29,577	36,483	66,060	167,036	17.7
10	30,080	38,252	68,332	173,652	17.3
15	30,605	40,120	70,726	181,334	16.9
20	30,800	41,324	72,124	190,682	16.2
25	31,964	42,455	74,419	202,087	15.8
30	33,312	44,070	77,383	214,232	15.5
35	36,521	44,984	81,505	228,379	16.0
40	41,893	45,770	87,662	245,820	17.0
45	44,963	47,923	92,886	265,439	16.9
50	47,947	51,104	99,051	295,936	16.2
55	48,980	54,364	103,345	329,729	14.9
60	48,797	55,798	104,594	347,617	14.0
65	43,048	60,913	103,961	349,480	12.3
70	35,339	65,057	100,397	355,048	10.0
75	26,090	68,515	94,605	347,631	7.5
80	9,703	77,422	87,125	346,030	2.8
85	▲9,955	87,766	77,811	332,667	▲3.0
90	▲25,900	94,955	69,055	314,737	▲8.2
Future generations	62,542	—	—	160,177	39.0

Table 13. Comparison with the standard scenario (thousand yen)

	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
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0	2,464	▲2,464	0	0	1.5
5	2,569	▲2,569	0	0	1.5
10	2,650	▲2,650	0	0	1.5
15	2,735	▲2,735	0	0	1.5
20	2,760	▲2,760	0	0	1.4
25	2,815	▲2,815	0	0	1.4
30	2,926	▲2,926	0	0	1.4
35	3,064	▲3,064	0	0	1.3
40	3,233	▲3,233	0	0	1.3
45	3,432	▲3,432	0	0	1.3
50	3,688	▲3,688	0	0	1.2
55	3,991	▲3,991	0	0	1.2
60	4,107	▲4,107	0	0	1.2
65	3,665	▲3,665	0	0	1.0
70	2,942	▲2,942	0	0	0.8
75	2,187	▲2,187	0	0	0.6
80	1,467	▲1,467	0	0	0.4
85	787	▲787	0	0	0.2
90	145	▲145	0	0	0.0
Future generations	▲12,863	—	—	0	▲8.0

The results of the estimation show that the amount of benefit decreases across all current living generations, thus increasing their lifetime net burden. Hence, the intergenerational gap between the current generation and future generations is narrowed. In addition, although the reduction in benefit is minor for the 65-year-old generation and above among the current generations, the level of reduction will be almost the same for the older generations. In short, although the gap slightly expands between the 65-year-olds and above generations and younger generations, it will be trivial, and the gap among the current living generations will be sustained at a nearly constant level.

#### (4) Economic growth stimulation scenario

Here, we examine an economic growth stimulation scenario in which a 2.5% economic growth rate is achieved, which is 1 percentage point higher than the estimated 1.5% baseline scenario in and after FY2014.<sup>28</sup> The estimation results are shown in Table 14 and Table 15.

<sup>28</sup> We assume that the interest rate would rise by the same percentage as the economic growth rate, thereby leaving the gap between the two at 2.0%. In addition, as mentioned in note 16, this is within normal levels based on the

Table 14. Estimation results

(thousand yen)

	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)
0	26,807	37,156	63,963	164,999	16.2
5	27,173	39,425	66,597	168,488	16.1
10	27,572	41,250	68,822	174,991	15.8
15	27,988	43,175	71,163	182,552	15.3
20	28,131	44,370	72,501	191,768	14.7
25	29,213	45,524	74,737	203,036	14.4
30	30,426	47,221	77,647	215,045	14.1
35	33,473	48,248	81,721	229,062	14.6
40	38,652	49,181	87,833	246,383	15.7
45	41,503	51,513	93,015	265,892	15.6
50	44,217	54,929	99,146	296,292	14.9
55	44,942	58,470	103,412	330,004	13.6
60	44,646	59,995	104,641	347,828	12.8
65	39,348	64,644	103,992	349,639	11.3
70	32,374	68,043	100,418	355,161	9.1
75	23,888	70,730	94,617	347,706	6.9
80	8,227	78,905	87,132	346,073	2.4
85	▲10,746	88,561	77,815	332,687	▲3.2
90	▲26,046	95,102	69,056	314,742	▲8.3
Future generations	72,174	—	—	161,758	44.6

Table 15. Comparison with the standard scenario

(thousand yen)

	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage points)
0	184	393	577	1,517	▲ 0.0
5	165	372	537	1,452	▲ 0.0
10	142	347	489	1,339	▲ 0.0
15	118	320	438	1,218	▲ 0.0

experience of the OECD.

20	90	286	376	1,086	▲ 0.0
25	64	254	318	949	▲ 0.0
30	39	225	265	813	▲ 0.0
35	16	200	216	684	▲ 0.0
40	▲ 7	177	171	563	▲ 0.0
45	▲ 28	157	130	453	▲ 0.0
50	▲ 42	137	95	357	▲ 0.0
55	▲ 48	114	67	275	▲ 0.0
60	▲ 44	90	47	211	▲ 0.0
65	▲ 34	66	32	159	▲ 0.0
70	▲ 23	44	21	113	▲ 0.0
75	▲ 14	27	13	75	▲ 0.0
80	▲ 8	16	7	43	▲ 0.0
85	▲ 4	7	3	20	▲ 0.0
90	▲ 1	2	1	5	▲ 0.0
Future generations	▲ 3,230	—	—	1,580	▲ 2.5

The results show that the lifetime net burden ratio decreases across all generations. More specifically, the reduction rate of the future generations is 2.5 percentage points. As a result, the gap between the 0-year-old generation and future generations will narrow by only 2.4 percentage points.

This mechanism can be interpreted as follows:

According to this model, as the economic growth rate increases, income will increase, the newly awarded pension benefits that are subject to sliding pay scale and the medical care/nursing care benefits will increase, and the social security benefits will increase. An increase in the growth rate will boost income, thereby increasing the medical care/nursing care insurance premiums, tax burden, non-transfer spending, and income. On the other hand, the net burden will increase for the 35-year-old and younger current living generations, and decrease for the older current living generations.

As the current existing generations as a whole will bear a larger burden, the net burden on future generations will decrease.<sup>29</sup>

<sup>29</sup> Kotlikoff and Burns (2005) pointed out that increased productivity, which leads to an increase in substantial wages and subsequent increase in social security benefits, is not very helpful in improving the fiscal revenue and expenditure, as it also leads to an increase in both revenue and expenditure. Gokhale and Smetters (2002) compared two cases, i.e., a 1.7% productivity growth rate case and a 2.2% productivity growth rate case, and concluded that the lifetime net tax rate required to close the fiscal revenue and expenditure gap in the future will not vary so much.



(5) Concurrent increases in consumption tax and economic growth rate scenario

Here, we examine a scenario of concurrent increases in consumption tax and economic growth rate (by 1 percentage point) aimed at eliminating the intergenerational imbalance between the 0-year-old generation and the future generations.<sup>30</sup> The estimation results are shown in Table 16 and Table 17.

Table 16. Estimation results (thousand yen)

	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (%)
0	39,238	37,156	76,394	164,999	23.8
5	40,189	39,425	79,614	168,488	23.9
10	41,116	41,250	82,366	174,991	23.5
15	41,886	43,175	85,061	182,552	22.9
20	41,247	44,370	85,617	191,768	21.5
25	41,505	45,524	87,029	203,036	20.4
30	41,906	47,221	89,127	215,045	19.5
35	44,127	48,248	92,375	229,062	19.3
40	48,305	49,181	97,486	246,383	19.6
45	49,881	51,513	101,393	265,892	18.8
50	51,197	54,929	106,126	296,292	17.3
55	50,661	58,470	109,131	330,004	15.4
60	49,223	59,995	109,218	347,828	14.2
65	42,885	64,644	107,529	349,639	12.3
70	34,985	68,043	103,029	355,161	9.9
75	25,701	70,730	96,431	347,706	7.4
80	9,316	78,905	88,221	346,073	2.7
85	-10,300	88,561	78,261	332,687	-3.1
90	-26,046	95,102	69,056	314,742	-8.3
Future generations	38,467	—	—	161,758	23.8

Table 17. Comparison with the Consumption tax increase scenario (thousand yen)

	Lifetime net burden	Lifetime benefit	Lifetime burden	Lifetime income	Lifetime net burden ratio (percentage)
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<sup>30</sup> Similar to Scenario 4, the interest rate was increased by 1 percentage point in line with the increase in economic growth rate.

					points)
0	▲ 643	393	▲ 250	1,517	▲ 0.6
5	▲ 714	372	▲ 342	1,452	▲ 0.6
10	▲ 787	347	▲ 440	1,339	▲ 0.6
15	▲ 849	320	▲ 529	1,218	▲ 0.6
20	▲ 830	286	▲ 543	1,086	▲ 0.6
25	▲ 805	254	▲ 551	949	▲ 0.5
30	▲ 777	225	▲ 552	813	▲ 0.4
35	▲ 747	200	▲ 548	684	▲ 0.4
40	▲ 703	177	▲ 526	563	▲ 0.3
45	▲ 635	157	▲ 478	453	▲ 0.3
50	▲ 550	137	▲ 413	357	▲ 0.2
55	▲ 466	114	▲ 351	275	▲ 0.2
60	▲ 380	90	▲ 290	211	▲ 0.1
65	▲ 295	66	▲ 229	159	▲ 0.1
70	▲ 216	44	▲ 173	113	▲ 0.1
75	▲ 149	27	▲ 122	75	▲ 0.0
80	▲ 90	16	▲ 74	43	▲ 0.0
85	▲ 38	7	▲ 30	20	▲ 0.0
90	▲ 1	2	1	5	▲ 0.0
Future generations	▲ 607	-	-	1,580	▲ 0.6

By concurrently implementing a consumption tax increase and stimulating the economic growth rate, the level of consumption tax rate that would be required to eliminate the intergenerational imbalance between the 0-year-old generation and the future generations will be about 23%, which is lower than that of the scenario solely dependent on consumption tax increase. In addition, as Table 17 shows, compared with the consumption tax increase-reliant scenario, a concurrent economic growth simulation scenario will increase benefits and decrease burden of all generations excluding the 90-year-olds, and also increase their lifetime income, thereby decreasing both their lifetime net burden ratio and lifetime net burden amount.

The results of the above five scenarios clarified an intergenerational competition for a larger share of the resources as such measures as consumption tax increase or increased pension insurance premiums are simply a means to redistribute resources among different generations without changing the total sum of available resources. As a consequence, the gap among the current living generations expanded, while the intergenerational gap between the current

generations and future generations narrowed.

However, under a policy intended to increase the total sum of resources available to all generations through the promotion of economic growth, it will be possible to grow free of a zero-sum game situation.

## 12. Conclusions

In this study, by applying the Generational Accounting method, we estimated the benefits/burdens of the current and future generations that are projected to be generated through the government. At the same time, we estimated the benefits/burdens that had been generated for the current existing generations, and by adding them together, clarified the lifetime net burden of the current living generations and future generations. Furthermore, in order to measure the actual weight of burden on each generation, we estimated their lifetime income, and calculated their lifetime net burden ratio by dividing the lifetime net burden by the lifetime income.

As a result, it has become evident that the current living generations in Japan are engaged in tacit collusion that lets future generations shoulder their burdens.

In order to narrow this intergenerational gap between the current and future generations, we have no other choice but to increase the net burden on the current generations, which will inevitably expand the intergenerational gap among the current generations. In order to prevent conflict of interest between the current generations, in particular, younger generations and future generations, and, at the same time, narrow the intergenerational gap, it is desirable to increase the income of the current generations, particularly, that of the younger generations by achieving a high economic growth rate and implementing macroeconomic policy management that inhibits increase in the risk premium included in the interest rate. Shimasawa, Oguro and Toyoda (2014) pointed to the Japanese government's political stance that is predisposed to value the political intention of the older generations and postpone institutional reforms which would force increased burden on them, combined also with the acceleration of demographic aging. The presence of a so-called "Gray Democracy" will be a major obstacle in narrowing the intergenerational gap.

## References

- Ablett, John, (1996), "Generational Accounting-An Australian Perspective," *Review of Income & Wealth*, vol. 42, No.1, pp. 91-105.
- 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.
- Anderson, B. and J. Sheppard (2009) "Fiscal Futures: Institutional Budget Reforms and Their Effects, What Can Be Learned?" *OECD Journal on Budgeting*, vol.2009/3, OECD Publishing, Paris.
- Auebach, Alan J., Jagadeesh Gokhale and Laurence J. Kotlikoff, (1991), "Generational Accounts: 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.
- Auerbach, A.J. and Philip Oreopoulos, (1999), "Generational Accounting and Immigration in the United States," NBER Working Papers No. 7041.
- Benz, U. and S. Fetzer (2006), "Indicators for Measuring Fiscal sustainability: A Comparison of the OECD Method and Generational Accounting," *FinanzArchiv*, vol. 62 (3), pp. 367-391.
- Bonin, H. (2001), *Generational Accounting: Theory and Application*, Springer Berlin Heidelberg.
- Congressional Budget Office, (1995), "Who Pays and When? An Assessment of Generational Accounting," *CBO Study*, Congress of the United States.
- Cutler, D., (1993), "Review of Generational Accounting: Knowing Who Pays, and When, for What We Spend," *National Tax Journal* vol. 46 No. 1 pp. 61-67.
- Diamond, P.,(1996), "Generational Accounts and Generational Balance: An Assessment," *National Tax Journal* vol. 49 No. 4 pp. 597-607.
- European Commission, (1999), "Generational Accounting in Europe," *European Economy*,

- Reports and Studies*, vol. 6. Brussels: European Communities.
- Fehr, Hans, Laurence J. Kotlikoff and Willi Leibfritz, (1999), "Generational Accounting in General Equilibrium," NBER Chapters, in *Generational Accounting around the World*, pp. 43-72 National Bureau of Economic Research.
- Gokhale, J, B. Page, 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.
- Gokhale, J, B. Page, J. Potter, and J. Sturrock, (2000), "Generational Accounts for the United States: An Update," *American Economic Review*, vol. 90, pp. 293-296.
- Haveman R., (1994), "Should Generational Accounts Replace Public Budgets and Deficits?" *Journal of Economic Perspectives*, Vol. 8, No.1, pp. 95-111.
- Kotlikoff L. J., (1992), *Generational Accounting: Knowing Who Pays, and When, for What We Spend*, New York: The Free Press.
- \_\_\_\_\_, (1993), "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 (Cairolì 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 Papers 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.
- Lee, R., Mason, A. and Miller, T., (2003), "Saving, Wealth, and the Transition from Transfers to Individual Responsibility: the Cases of Taiwan and the United States," *Scandinavian Journal of Economics*, vol. 105 No. 3. pp. 339-357.
- Lee, R. and Mason, A., (2011), *Population Aging and the Generational Economy: A Global Perspective*. Cheltenham, UK: Edward Elgar.
- Leibfritz, Willi, Deborah Roseveare, Douglas Fore, and Eckhard Wurzel, (1995), "Aging populations, pension systems, and government budgets: How do they affect saving?"

- OECD Economics Department Working Paper No. 156, Paris.*
- Raffelhüschen, Bernd, (1999), “Generational Accounting in Europe,” *American Economic Review, Papers and Proceedings*, vol. 89 (May), pp. 167–70.
- Shimasawa Manabu, Kazumasa Oguro and Nao Toyoda, (2014), “Does Japan have a Gray Democracy? An empirical analysis of prefectural data,” *CIS Discussion paper series No. 615.*
- 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.*
- Yoshihumi Aso and Hiroshi Yoshida, (1996), “Benefits and Burdens of Each Generation from Generational Accounting Perspective,” *The Financial Review*, No. 39. pp. 1-31.
- 2012 Population Prospects for Japan* [in Japanese], National Institute of Population and Social Security Research.
- Yasuhito Sato, (2001), “Generational Accounting Approach and Japan’s Fiscal Reform” [in Japanese], *The Tohoku Gakuin University Review: Economics*, No. 148. pp. 227-258.
- Manabu Shimasawa, (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.
- \_\_\_\_\_, (2011), “Political Economics of Generational Gap” [in Japanese], *Kikan Kojin Kinyu* (Quarterly of Personal Finance), Vol. 6, No. 2, July 2011, pp. 63-73, Yu-cho Foundation.
- \_\_\_\_\_, (2013), *Introduction to Generational Accounting: On the Japanese Economy from the Viewpoint of Intergenerational Inequity* [in Japanese], Nippon Hyoron Sha, Tokyo.
- Masahiro Hidaka, Hiroshi Katsumi, Yoshio Wakabayashi, Koichi Arai, Yoshihiko Tanabe and Yasuhiro Kurachi, (1996), “Assessment of Social Security Policy in Aging Society based on Generational Accounting: Intergenerational Comparison of Benefits and Burdens” [in Japanese], Economic Research Institute, Economic Planning Agency.
- Minoru Masujima, 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.
- Minoru Masujima, Goro Tanaka, (2010a), “Inter- and Intra-Generational Inequality I: Fiscal

Sustainability and Intergenerational Inequality” [in Japanese], ESRI Discussion Paper Series No.246, Economic and Social Research Institute, Cabinet Office, Government of Japan.

\_\_\_\_\_. (2010b), “Inter-and Intra-Generational Inequality II: Difference in Benefit/Burden Structure among the Future Generations” [in Japanese], ESRI Discussion Paper Series No.247, Economic and Social Research Institute, Cabinet Office, Government of Japan.

Minoru Masujima, 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.

Naomi Miyazato, (2009), “Changes in the Intergenerational Redistribution Policies in 1990s: Analysis based on Generational Accounting” [in Japanese], *Japan’s Economy during the Bubble/Deflation Periods and Economic Policies 5: Fiscal Policy and Social Security*, Keio University Press.

Hiroshi Yoshida, (1998), “Generational Accounting and the Public Debt of Japan” [in Japanese], *The Economic Review (Keizai Kenkyu)*, Vol. 49, No. 4, pp. 327-335.

\_\_\_\_\_. (2001) “Intergenerational Gap of Social Security” [in Japanese], *Research on Household Economics*, No. 51, pp. 30-39.

\_\_\_\_\_. (2006) “A Study on Aging Society and Intergenerational Imbalance based on Generational Accounting” [in Japanese], Project on Intergenerational Equity, Institute of Economic Research, Hitotsubashi University, Discussion Paper No. 287.

\_\_\_\_\_. (2008a) “Assessment of Social Security Reform based on Generational Accounting: Analysis of the True Effect of Pension/Elderly Medical Care Reform” [in Japanese], Japan Institute of Public Finance, 65<sup>th</sup> Annual Conference (October 26, 2008), Session E, report materials concerning social security and fiscal deficit.

\_\_\_\_\_. (2008b) “Measurement of Intergenerational Imbalance based on Generational Accounting and Policy Assessment” [in Japanese], pp. 257-296, compiled by Keimei Kaizuka and Ministry of Finance, Policy Research Institute, *A Study on Social Security System Reform in the Population Declining Society*, Chapter 8, Chuokeizai-sha, Inc. (December 2008).