



Institute of  
Business and  
Economic Research

Fisher Center for  
Real Estate and  
Urban Economics

---

# **PROGRAM ON HOUSING AND URBAN POLICY**

**CONFERENCE PAPER SERIES**

**CONFERENCE PAPER NO. C07-007**

**JAPANESE FISCAL BURDENS  
AND GENERATIONAL ACCOUNTING**

By

Satoko Maekawa

February 2007

These papers are preliminary in nature: their purpose is to stimulate discussion and comment. Therefore, they are not to be cited or quoted in any publication without the express permission of the author.

---

**UNIVERSITY OF CALIFORNIA, BERKELEY**

Japanese Fiscal Burdens and Generational Accounting  
- Evaluation of Japanese Integrated Reform of Expenditure and  
Revenue 2006 -

(Draft Version)

Japan-Berkeley Symposium on Local Public Economics  
February 13, 2007

Satoko MAEKAWA, Kansai University

## 1. Introduction

The amount of Japanese long-term debt, which includes both central government debt and local government debt, is expected to reach 775 trillion yen at FY 2006. It is equal to 150.8% of GDP, the worst level among developed countries.

In order to cope with such a huge amount of debt, the Japanese government has decided to carry out the fundamental fiscal reforms, so called the “Integrated Reform of Expenditures and Revenues” in Japan. The Japanese government aims to achieve a surplus in the primary balance of the central and local governments combined by FY 2011. In order to attain this target, the government has decided to reduce expenditures and promote revenues for the next 5 years (from FY 2007 to 2011).

As considering concrete measures for carrying out the reforms, it is important not only to make sure those effects on future fiscal conditions, but also to make clear how much people should bear. Especially the government would be faced with increasing demands of social security as it should repay its debt. It means that under the process of the declining and aging of the population additional burdens that emerge from the fiscal reforms should create a serious difference in public burdens among generations. The government is more required than ever to do fiscal management considering such a generational gap.

This paper inspects how the “Integrated Reform of Expenditures and Revenues” would change the difference in burdens among generations in Japan. The next section explains the estimation methodology and the data. Section 3 presents the results, and section 4 concludes.

## **2. Methodology and Data**

At the same time when people bear their public burdens, they receive public services. So in order to evaluate the fiscal reforms in terms of generational gaps it is necessary to consider not only public burdens but also public services that each generation has received.

This paper estimates both life-time public burdens and life-time public services, and it reveals the generational gaps by presenting the difference between the life-time public benefits and burdens of each generation, which is calculated by deducting the present value of the life-time public burdens from that of the life-time public benefits of each generation.

This section explains the methodology and the data which are employed in the estimation.

### *Assumption of generation*

This paper assumes a head of a representative household of each generation. He (or she) is considered as an employee, and he begins to work at 23 years old, retires at 60, and dies at 80. The estimations in the paper focus on 7 generations: those born in 1930, 1940, 1950, 1960, 1970, 1980, and 1990.

### **(1) Estimation of public burdens**

The sources of government revenues consist of taxes, social insurance contributions, and bonds. Therefore, we calculate generational burdens of each source. We estimate the generational burdens of income tax, residence tax, and social security premiums based on each generation's life-time income, and we also estimate the generational burden of consumption tax by

considering each generation's life-time consumption. The other burdens, including the burden of bonds, are calculated by dividing the other revenues by total population.

We consider a generational public burden including a burden of bonds as a “generational potential burden”.

#### *Data of each generation's Life-time income*

We use the cohort data in the estimation<sup>1</sup>. The cohort data represents yearly average of income per worker's household by age of household head. It is based on “Annual Report on the Family income and expenditure survey” in Japan from 1953 to 2000. The data after 2001 is calculated by multiplying the data of 2000 by nominal growth rate.

#### *Data of each generation's Life-time consumption*

In order to estimate life-time consumption of each generation, this paper set a life-cycle model in which a head of a representative household maximize its own life-time utility.

A head of a generation- $t$  household consumes private goods ( $c$ ) in each year from 23 to 80 years old. The head of household also derives utility from social security ( $s$ ) and public goods ( $g$ ) provided equally by the government except social security. Therefore, lifetime utility of the head of a generation- $t$  household is written as

$$U^t = U^t(c_{23}^t, c_{24}^t, \dots, c_{80}^t, s_{23}^t, s_{24}^t, \dots, s_{80}^t | \bar{g}_{23}^t, \bar{g}_{24}^t, \dots, \bar{g}_{80}^t) \quad (1)$$

, where  $c_{23}^t, c_{24}^t, \dots, s_{23}^t, s_{24}^t, \dots, \bar{g}_{23}^t, \bar{g}_{24}^t$  represent consumption, social security, and public good

---

<sup>1</sup> The existing analysis based on cohort data in Japan are Hashimoto et al. (1991), and Homma et al.(1989).

in each age (23 - 80) of the generation- $t$  household<sup>2</sup>.

The budget constraint for a representative household of generation  $t$  is given by

$$\begin{aligned}
& (1 - t_{c23})p_{23}c_{23} + \frac{(1 - t_{c24})p_{24}c_{24}}{(1 + (1 - \tau_{r24}))r_{24}} + \dots + \frac{(1 - t_{c80})p_{80}c_{80}}{\{(1 + (1 - \tau_{r80}))r_{80}\}^{57}} \\
& = income_{23} - PB_{23} + \frac{income_{24} - PB_{24}}{(1 + (1 - \tau_{r24}))r_{24}} + \dots + \frac{income_{60} - PB_{60}}{\{(1 + (1 - \tau_{r60}))r_{60}\}^{37}} \quad (2) \\
& + \frac{pen_{61}}{\{(1 + (1 - \tau_{r61}))r_{61}\}^{38}} + \frac{pen_{62}}{\{(1 + (1 - \tau_{r62}))r_{62}\}^{39}} + \dots + \frac{pen_{80}}{\{(1 + (1 - \tau_{r80}))r_{80}\}^{57}}
\end{aligned}$$

, where  $p_i$  is price of private good,  $r_i$  is interest rate,  $\tau_{ci}$  is tax rate on interest,  $income_i$  is annual income,  $PB_i$  is public burden including income tax, residence tax, and social security contribution (health insurance contribution and pension premium), and  $pen_i$  is pension at  $i$ - years old.

Based on the model explained above, we calculate life-time consumption which maximize the utility (1) under the life-time income (2).

<sup>2</sup> The following utility function is used in the analysis.

$$U = \beta \sum_{t=1}^T (1 + \delta)^{-(t-1)} \frac{C_t^{1-1/\gamma}}{1 - 1/\gamma} + (1 - \beta)(1 + \delta)^{-(T-1)} \frac{K^{1-1/\gamma}}{1 - 1/\gamma}$$

, where  $\delta$  is the ratio of time preference,  $\gamma$  is the elasticity of substitution between the present and the future,  $C_t$  is the level of consumption per person at time  $t$ ,  $K$  is the amount of inheritance,  $\beta$  is a weight parameter of inheritance,  $T$  is the age of death ( $= 80$  years old). It is assumed that  $\delta = 0.01$  and  $\gamma = 0.3$ , which are based on Homma et al. (1987) and that  $\beta = 0.000001$ , which is based on Hashimoto(1998).

We can get the following euler equation by solving the maximization of the utility function above subject to the life-time income constraint (equation (2)). By using this euler equation, we calculate life-time consumption of a representative household.

$$C_t = \left( \frac{1 + (1 - \tau_r)r_t}{1 + \delta} \right)^\gamma \left( \frac{v_{t-1}}{v_t} \right)^\gamma C_{t-1} .$$

, where  $\tau_r$  is tax rate on interest income,  $v_t = (1 + (1 - \tau_r)r)^{t-1} \phi_t$ , and  $\phi$  is a lagrange multiplier.

### *Data of the population*

When we calculate per-capita burdens, we use “Population Estimation of Japan 1920-2000” by Statistic Bureau of Japan, and “Population Projection for Japan: 2001-2050” by National Institute of Population and Social Security Research (January 2004).

### (2) Estimation of public benefits: 1953-2004

We regard the public expenditures for administrative service, public investment, and social securities benefits (pension, medical care, and nursing care for the elderly) as public benefits.

We use the generational government data in the System of National Accounts (SNA). ‘Final consumption expenditure’ of the general government in SNA is used for representing administrative services, ‘public capital formation’ is used for public investment, and ‘Social security transfers’ is used for social securities benefits. The summary of the estimation is as follows.

### *Final Consumption Expenditure*

We consider “final consumption expenditure” of the general government as one of the public benefits. We calculate per-capita benefit by dividing total amount of “final consumption expenditure” by total population.

### *Public Investment*

We use “gross public fixed investment” in the National Account for representing the benefit

of public investment.<sup>3</sup> Its per-capita benefit is calculated by dividing total annual amount of “gross public fixed investment” by total population in Japan at the same year. The gross investment, not net investment data is used in the estimation because the depreciation can be considered as repairing expenses that the government pays for.

### *Social Security Benefits*

Social security benefits in this analysis consist of public pension, medical care, nursing care for the elderly, and other social security transfers. The summary of the estimation of each social security benefit as follows.

#### (Pension)

The benefit of pension is calculated by using the income of each generation derived from the cohort data, because the pension in Japan, especially Employee’s Pension Insurance, depends basically on average annual income during the insured period.

#### (Medical care)

The generational benefit of medical care is estimated by dividing the total amount of transfer by the number of people who receive it. The data of medical care has been divided into two groups, general medical care and medical care for the elderly, since 1982. So the estimation of the per-capita general medical care has been calculated by dividing the amount of general medical care expenditure by the number of people who are younger than 70 years old. The per-capita medical care for the elderly is calculated by dividing the total amount of care by the number of

---

<sup>3</sup> Although it is important to estimate the benefit of social capital (stock) as well as public investment (flow), this paper focuses on the benefit of public investment.



people who are older than 70 years old.

(Nursing care for the elderly)

The generational benefit of nursing care for the elderly is estimated in the same way as the benefit of medical care for the elderly. That is, it is calculated by dividing the total amount of care by the number of people who receive it. In the case of nursing care, the people who receive it are older than 65 years old.

(The other social security benefits)

The generational benefits of the other social security transfers except for pension, medical care, and nursing care are calculated by dividing the total amount of those transfers by total population.

### (3) Estimation of future public benefits: 2004-2070

In order to estimate generational life-time public benefits, we need the data from 1953, when the generation born in 1930 becomes 23 years old, to 2070, when the generation born in 1990 is assumed to die at 80 years old. But the available data of National Account is from 1953 to 2004. So it is necessary to make the future public benefits after 2004.

The forecast of future benefits depends on economic circumstances; economic growth rate, price index, interest rate, population, and so on. Table 1 presents the assumption in the analysis. Those assumptions are the same as those in the reports of the Cabinet, called “Basic Policies for Economic and Fiscal Management and Structural Reform 2006”, which presents the details of the “Integrated Reform of Expenditures and Revenues”.

Table 1 Assumptions for future economic circumstances in Japan

	2005	2006	2007	2008	2009	2010	2011
<b>Growth Rate (nominal)</b>	1.6	2.0	2.3	2.5	2.7	2.9	3.1
<b>Interest Rate (nominal)</b>	1.4	1.7	2.5	2.9	3.3	3.7	4.1
<b>Growth Rate (Real)</b>	2.7	1.9	1.6	1.6	1.6	1.6	1.6
<b>GDP Deflator</b>	-1.1	0.1	0.7	0.9	1.1	1.3	1.5
<b>CPI Growth Rate</b>	0.1	0.5	1.1	1.4	1.6	1.9	2.1
<b>Interest Rate (Real)</b>	1.3	1.2	1.4	1.5	1.7	1.8	2.0

The future amounts of administrative service, public investment, and the other social transfers except for pension, medical care, and nursing care are estimated by increasing total amount of each transfer and service in 2004 by the annual growth rate in table 1. The generational future benefits of those benefits are calculated by dividing the future amount of those benefits by the future total population<sup>4</sup>.

The future social security benefits such as pension, medical care, and nursing care are estimated as we can get the same results presented in the reports of Ministry of Health, labor, and welfare in Japan. Those reports are called “The 1999 Actuarial Valuation of the Employees’ Pension Insurance and the National Pension”, and “Review of the future social security benefits and burdens –Revised May 2006-”, which are the basic reports when the Japanese government

---

<sup>4</sup> The data of future population is based on “Population Projection for Japan: 2001-2050” by National Institute of Population and Social Security Research (January, 2004).

decides the budget of social security and reforms the social security systems<sup>5</sup>.

### **3. Estimation Results**

The aim of this paper is to reveal how the “Integrated Reform of Expenditures and Revenues” would change the difference in public benefits and burdens among generations in Japan. By using each generation’s annual benefits and burdens estimated as explained at the previous section we can get the life-time public benefits and burdens of each generation<sup>6</sup>. We calculate the difference between the life-time public benefits and burdens of each generation, and present how those differences would be changed by implementing the “Integrated Reform of Expenditures and Revenues”.

It is characteristic in the estimation that we consider the each generation’s burden of fiscal deficit. Although in terms of national burden, we often pay attention to the potential national burden, which is sum of national burden and the ratio of fiscal deficit to national income, there are few analysis that estimate generational potential burdens. The analysis based on generational accounting usually has a representative future generation bear all of the government debt. On the other hand, this paper estimate the potential burdens of both present and future generations by distributing the amount of annual fiscal deficit to all generations who live at that year.

---

<sup>5</sup> The detailed ways of estimation are not announced officially. Therefore, the estimated benefits are the same as those of the ministry reports although the estimation ways might be different.

<sup>6</sup> When we calculate the life-time benefits and burdens, we evaluate each generation’s annual benefits and burdens at constant price in 2006.

### *Outline of the “Integrated Reform of Expenditures and Revenues”*

Before presenting the estimation results, we briefly summarize the outline of the “Integrated Reform of Expenditures and Revenues”.

For advancing fiscal consolidation, the Japanese government has set several goals. The first goal is to achieve a surplus in the primary balance of the central and local governments combined in FY 2011. The government has decided to attain the first goal by both reducing expenditures and increasing revenues and has made a plan of the reform. The detail of the plan is presented in “Basic Policies for Economic and Fiscal Management and Structural Reform 2006 (Basic Policies 2006)”.

“Basic Policies 2006” has stated that the required amount of expenditure reduction and revenue increase will be approximately 16.5 trillion yen. The government has made two reform plans; the one that plans to reduce expenditures by 14.3 trillion yen and increase revenues by 2.2 trillion yen and the other that plans to reduce expenditures by 11.4 trillion yen and increases revenues by 5.1 trillion yen from 2007 to 2011. In this paper, we call the first plan “Reform A” and the second one “Reform B”.

The main items of expenditure reductions are personnel expenses, public investment, and social security. The total required amount of personnel expenses reduction during the next 5 years is 2.6 trillion yen in both Reform A and Reform B. That of public investment is 5.6 trillion yen in Reform A and 3.9 trillion yen in Reform B. The required amount of social security cut is 1.6 trillion yen in both Reform A and Reform B. The other expenditure except for personnel expenses, public investment, and social security will be reduced by 4.5 trillion yen in Reform A

and 3.3 trillion yen in Reform B.

On the other hand, the Basic Policies 2006 has not made clear the detail of revenue increases. Especially the government has not decided clearly which kind of taxes it would increase. In this paper, we assume that revenue reform would be implemented by increasing consumption tax.

### *Estimation Results*

We estimate the life-time public benefits and burdens of each generation in the case of Reform A and Reform B respectively. We also estimate the case if no reform would be done. By comparing the results in these two cases of reform with the result in the case of no reform we can see how the generational gap in public benefits and burdens would be changed if the fiscal reform would be implemented. Moreover, we compare the results considering the potential burden of fiscal deficit with the results not considering the potential burden.

#### (1) The estimation results in the case of not including potential burden of fiscal deficit

Figure 1 shows us the estimation results of generational difference between life-time public benefits and burdens not including potential burden of fiscal deficit. This figure tells that the fiscal reforms would expand the generational gap in public benefits and burdens.

The “integrated reform of expenditures and revenues” is a reform that will be carried out in the near future. So the reform could affect only the existing young generations and future generations, not the existing old generations. The young and future generations would receive less public benefits and bear more burdens while the old generations would receive almost same

amount of public benefits as in the case of no reform and bear no additional burdens. This is the reason why the “integrated reform of expenditures and revenues” would worsen the generational gaps.

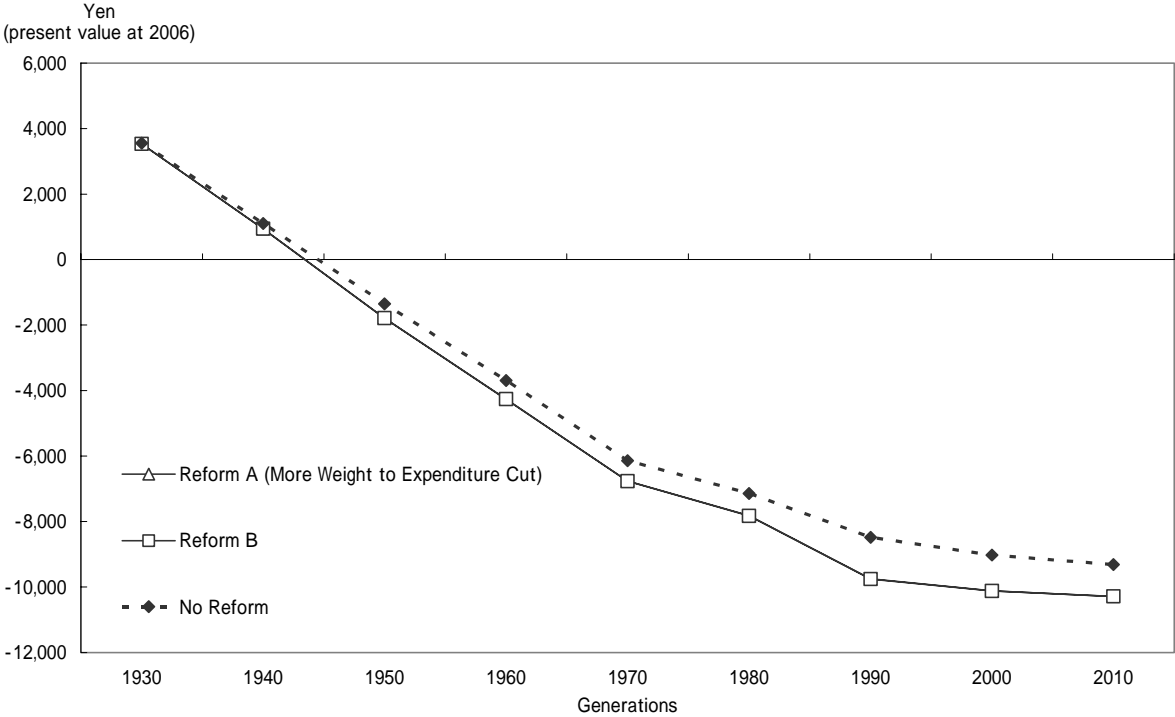


Figure 1 Generational Difference between Life-time Public Benefits and Burdens (not including potential burden of fiscal deficit)

(2) The estimation results in the case of including potential burden of fiscal deficit

Figure 2 shows us the estimation results of generational difference between life-time public benefits and burdens including potential burden of fiscal deficit. This figure makes it clear that the fiscal reforms would have the generational gap in public benefits and burdens a little smaller.

If no reform had been done, the fiscal deficit would have been increased much more. The

reforms of expenditure reduction and revenue increase are expected to reduce the fiscal deficit.

This would reduce the potential burden of young and future generations.



Figure 2 Generational Difference between Life-time Public Benefits and Burdens (including potential burden of fiscal deficit)

#### 4. Concluding Remarks

As the declining and aging of the population has been advancing, it has become more important to consider the difference in public benefits and burdens among generations. This paper aims to reveal how the difference in public benefits and burdens among generations would be changed when the “integrated reform of expenditures and revenues” which the Japanese

government has decided to implement during the next five years.

The estimation results insist that the fiscal reform would improve the generational difference a little especially because the reform could reduce the fiscal deficit. But we should remember that even if the fiscal reform could reduce the fiscal deficit, the debt would continue to be accumulated. In addition to that, if the reform would be ended at FY 2011, the fiscal situation would become worse again in a long period. The huge amount of potential burden which would be required for certain reduction of the total government debt would be imposed on the future generations. It means that the generational gap in benefits and burdens would become much worse. So we can say at least that the fiscal reform should be lasted after achieving a surplus of the primary balance of the central and local government in FY 2011.

## References

Aso, Y., and H. Yoshida (1996) "Generational benefits and burdens on Generational Accounts",

*Financial Review* (Policy Research Institute, Ministry of Finance, Japan) No.39, p.1-31.

Auerhach, A.J. and L. Kotlikoff (1987) *Dynamic Fiscal Policy*, Cambridge, Cambridge University Press.

Auerhach, A.J., J. Gokhale, and Laurence J. Kotlikoff (1991) "Generational Accounts - A Meaningful Alternative to Deficit Accounting", *NBER Working Paper*, No.3589.

Cabinet Office (2001) *Annual Report on Japan's Economy and Public Finance 2000-2001*, Chapter 3, Section 3, p.166-181.



Fehr, H. and L. Kotlikoff (1995) "Generational Accounting in General Equilibrium", *NBER Working Paper*, No.5090.

Hashimoto, K., H. Hayashi, N. Atoda (1991) "Population aging and Tax and Pension system – Analysis on effects of fiscal reforms using cohort data - ", *Economic Research* (Hitotsubashi University), Vol.42, No.4, p.330-340.

Hidaka, M. H. Katsumi, Y. Wakabayashi, K. Arai, Y. Tanabe, and Y. Kurachi (1996) "Estimation of Social Security Policy in Aging Society by Generational Accounting ", *Economic and Social Research Institute Document*, Cabinet Office, No.6-96-1.

Homma, M., K. Hashimoto, H. Hayashi, N. Atoda, and F. Otake (1989) "Generational Public Buerdn – Comparison based on cohort data-" *Financial Review* (Policy Research Institute, Ministry of Finance, Japan) No.10, p.96-105.

Iwamoto, Y., T. Ozaki, and Y. Maekawa (1996) "Fiscal deficit and Generational Accounts", *Financial Review* (Policy Research Institute, Ministry of Finance, Japan) No.39, p.64-87.