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The Impact of Marginal Tax Reforms on the Supply of Health Related Services in Japan*

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1. Introduction

This paper presents a computable general equilibrium (CGE) framework to numerically examine the impact of so called marginal tax reforms of health related service sectors in Japan.

This paper uses the latest Input-Output table of Japan of year 2005 with 108 different production sectors, and it explores the effect of marginal changes in tax and subsidy policies from the current situation on economic efficiency, particularly by targeting three important sectors in health related services; hospital service, social welfare service, and long-term care for the elderly service sectors. (1) The main purpose of this paper is to evaluate the effect on the supply side of these three service sectors, so that the tax and subsidy of these sectors are particularly considered. By using the actual input-output table, the paper has successfully realized the real Japanese economy within the model, and it tries to present welfare-enhancing reforms within these three sectors.

A distinctive feature of this paper is to focus on the supply side of these sectors, all of which will play a more important role in aging Japan in the near future. The literature on an aging population of Japan mainly discusses the effect on public schemes such as the public pension, and public health insurance schemes, since its main concern is with financial burdens of population aging on public schemes. It is forecasted not only that population aging will generate more burdens on future and working generations through the current schemes, but also that the total number of a population will drastically shrink in the future Japan. A future decrease in the total population would likely result in decreasing future GDP, and stable economic growth of the Japanese economy needs a merging sector to stimulate the economy in an aging Japan. An aging population will induce more demand for services provided by these three sectors, and these sectors will be more important to stimulate the Japanese economy. Both private and public enterprises in these three sectors have already been taxed and subsidized in the current scheme, and the government can thus navigate these sectors with several tax and subsidy policies in order to achieve higher economic growth. This paper numerically examines the effect of several marginal departures from the current tax and subsidy policy within a CGE model, and it explicitly considers the budget constraint of the government. Any policy change should be followed by a secondary policy in order to fulfill the budget constraint, and this paper tries to present realistic policy scenarios to compensate a sector which will suffer from the policy change.

Simulation results are as follows. First of all, an expansion of the subsidy to the hospital sector creates the largest welfare gain when the government does not take into account its financing explicitly. While such an expansion policy improves economic efficiency, it also induces a certain amount of government deficits. However, the effect of such a policy on economic efficiency is more than ten times as much as the cost. For instance, the amount of newly generated government deficits is 5.3 billion Japanese yen when the net subsidy rate of the hospital sector increases by 50% from the current level, while the improvement in economic efficiency by the policy is measured to be 72.3 billion Japanese yen. Secondly, however, such an expansion policy does necessarily not eventuate in the largest gain if the government considers its balanced budget. The reduction of the subsidy to the hospital sector results in the largest welfare gain to the whole economy if the government uses the government surplus induced by the reduction of the subsidy in order to decrease the tax imposed on the social welfare sector. When the subsidy to the hospital sector is reduced by 50% from the current level, then the expected welfare gain to the whole economy would be approximately 3.8 billion Japanese yen, if the government surplus created by the 50% reduction of the subsidy to the hospital sector is used to reduce the tax on the social welfare sector. In fact, the 50% reduction of the subsidy to the hospital sector eventuates in the social welfare sector being subsidized. Finally, if the hospital sector is compensated by lump-sum transfers when its subsidy is reduced, then a welfare gain could become larger. If the government uses the government surplus not only for reducing the tax on the social welfare sector but also for providing the hospital sector with lump-sum transfers in order to keep income of the hospital sector unchanged, then a larger welfare gain would be obtained, even if the government implements a balanced budget policy. When the government reduces the subsidy to the hospital sector by 50% from the current level, the expected welfare gain to the whole economy is 11.15 billion Japanese yen. Such a policy keeps the total income of the hospital sector unchanged by lump-sum transfers, and also increases the total income of the social welfare sector by reducing its tax. This implies that a welfare enhancing tax reform within the health related sectors is plausible as long as the subsidy to the hospital sector can be reduced. Such a reform does not create any new government deficit either.

The paper is organized as follows. The next section explains the data and numerical model, and Section 3 simulates several scenarios with results and evaluations. Section 4 concludes the paper.

2. Data and Model

This paper employs the conventional static computable general equilibrium (CGE) model with the actual and the latest input-output table of Japan of year 2005. Note that all parameter values in the model are calculated by using the actual data, so that the calculated values of endogenous variables obtained within the model also become quite realistic.

2.1 Data

The latest input-output table of Japan of year 2005 with 108 different intermediate sectors has been used in order to construct the social accounting matrix (SAM). The SNA data has also been used to obtain the amount of aggregate private savings. The last sector, namely the 108th sector, includes all unclassified items. Since the value of its factor payments of some intermediate sectors becomes negative (2), this paper has integrated the 108th sector with the 106th sector which includes all other services. The integration makes the actual input-output table data consistent to the model, and it is assumed in this paper that there are 107 different production sectors, all of which are allowed to have intermediate production processes. Based on this simplification, the social accounting matrix (SAM) has been made. Then this paper particularly pays more attention to the following three sectors in health related services; Medical Service and Health (i = 94), Social Security (i = 95), and Nursing Care (i = 96).(3) The main sector in Medical Service and Health (i = 94) is the hospital sector. Social Security (i = 95) includes economic activities of nurseries, nursing homes, social welfare centers, and administrative work of the public pension as well as public health insurance schemes. Nursing Care (i = 96) shows economic activities of the industry of the long-term care for the elderly.

Figure 1 shows economic values of domestic final consumption goods of these three sectors in the latest input-output table of year 2005. Medical Service and Health (i = 94) is much larger than other sectors, and its value is 37 thousands billion Japanese yen, while the economic values of other two sectors are between 6.4 thousands billion and 6.6 thousands billion Japanese yen, which are less than 18% of the value of Medical Service and Health (i = 94) sector.

2.2 Model

The computable general equilibrium model of this paper employs the conventional static model.(4) The Japanese economy is assumed to consist of 107 different sectors, households, the government, and the investment firm sector. All 107 industries are allowed to have intermediate production processes, and they are assumed to maximize their profit. Households are assumed to maximize their utility over 107 different consumption goods. The government is assumed to determine its tax revenue, the amount of subsidies, and its consumption in order to satisfy its budget constraint. The economy is assumed to be fully competitive, so that all prices are determined in the relevant markets in order to equate the amount of demand to the amount of supply at its fully competitive price level in equilibrium. Note that the model is static and thus the short-run effect is only investigated. Thus, it is assumed for simplicity that factor inputs are not mobile among different sectors in the short-run.

<Households>

Households are assumed to be homogenous, and their utility is given by:

$$U(X_1, X_2, \ldots, X_{107}) = \prod_{i=1}^{107} X_i^{\alpha_i}, \quad (1)$$

where X_I denotes consumption of good i. $\sum_{i=1}^{107} \alpha_i = 1$ is assumed. i denotes each sector. The parameter value of each α_i is determined by using the actual social accounting matrix, which is given in Table 6.

Households are assumed to maximize (1) with respect to their consumption goods subject to their budget constraint such that:

$$\sum_{i=1}^{107} p_i X_i = I(1 - \tau^I) - S^I,$$

where p_i and I denote the price of good i and income, respectively. τ^I is the proportional income tax rate, and it is calculated by using the actual social accounting matrix. S^I denotes the amount of savings, and households are assumed to save the constant amount relative to their disposal income. The amount of savings is assumed to be given by

$$S^I = s^I (1- \tau^I) I,$$

where the constant ratio, s^I, is given exogenously.(5) The value of s^I has been calculated by using the actual SAM. Then income is given by

$$I = \sum_{i=1}^{107} r_i K_i + \sum_{i=1}^{107} w_i L_i$$

where r and w denote the rental cost and the wage rate, respectively. K and L are endowments of capital and labour, respectively. The factor payments change as r or w changes. Note that the amounts of $r_i K_i$ and $w_i L_i$ are both obtained from the actual social accounting matrix.

The first order conditions yield the demand functions such that:

$$X_i = X_i (p_i, Y; \alpha_i) = \frac{\alpha_i I (1- \tau^I)(1- s^I)}{p_i}, i = 1, 2, \ldots, 107. \quad (2)$$

Note that α_i can be calculated by using (2) and the actual social accounting matrix so that:

$$\alpha_i = \frac{p_i X_i}{I (1- \tau^I)(1- s^I)} = \frac{p_i X_i}{(1- s^I)(1- \tau^I)(\sum_{j=1}^{107} r_j K_j + \sum_{j=1}^{107} w_j L_j)}, i = 1, 2, \ldots, 107,$$

where both the values of the denominator and the numerator can be obtained from the actual social accounting matrix. The estimated values of α_i are given in Table 6.

<Private Firms>

Following the conventional assumption, the multiple decisions by each firm are described by the tree structure, where each firm is assumed to make a decision over several different items. In the tree structure, the optimal behavior of each firm which makes a decision over different items is described as if the firm always makes a decision over two different items at different steps. Each firm makes a decision over different items; the amount of exports of its own product, the amount of imported goods and intermediate goods used for its production, and the amount of labor and capital. This assumption simplifies a complicated decision over several items by each rm. Each step is also shown in Figure 2.

At step 1, a private firm, i, is assumed to use labor and capital to produce its composite goods, Y_i. Then, the firm is assumed to produce its domestic goods, Z_i, by using its own Y_i and $Z_{i,j}$ at the second step. $X_{i,j}$ denotes the final consumption goods produced by firm j used by firm i for its production. Thus, $X_{i,j}$ is the amount of the final consumption goods produced by firm j for the intermediate production process of firm i. At the third step, the firm is assumed to decompose its domestic goods, Z_i, into exported goods, E_i, and final domestic goods, D_i. This step is concerned about its optimal decision over the amount of its product to be exported. At the final step (the fourth step), the firm is assumed to produce its final consumption goods, Q_i, by using its final domestic goods, D_i, and imported goods, M_i. This step corresponds to its optimal decision over how much it uses imported goods, M_i, and its own goods, D_i, to produce its final consumption goods, Q_i, which are consumed by domestic households. The assumption of this tree structure in terms of different decisions can incorporate firm's complicated decisions over the amount of exports of its own product, the amount of imported goods and intermediate goods which the firm uses in its production process, and the amount of factor inputs into the model in a tractable way.

Note that all market clearing conditions are used to determine all prices endogenously in their corresponding markets, and also that at each step the private firm is assumed to determine the amount of relevant variables in order to maximize its profit.

By the assumption of the above tree structure, all decision making processes can be simplified, and the optimal behavior about all different decisions can be incorporated as follows:

Step 1: The production of composite goods

Each firm is assumed to produce its composite goods by using capital and labor. Each firm is assumed to maximize its profit given by:

$$\pi_i = p_i^Y Y_i (K_i, L_i) - r_i K_i - w_i L_i, \quad (3)$$

where Y_i and p_i^Y denote the composite goods produced by firm i and its price, respectively. K_i and L_i denote capital and labor used by firm i in order to produce its composite goods, respectively. The production technology is given by:

$$Y_i (K_i, L_i) = K_i^{\beta_{K,i}} L_i^{\beta_{L,i}}, i = 1, 2, \ldots, 107, \quad (4)$$

where $\beta_{K,i} + \beta_{L,i}$ is assumed for all $i = 1, 2, \ldots, 107$. Each firm is assumed to maximize (3) with respect to labor and capital subject to (4), and the first order conditions yield the demand functions such that:

$$K_i = K_i\,(p_i^Y, r_i, w_i; \beta_{K,i}, \beta_{L,i}) = \frac{\beta_{K,i}}{r_i}\, p_i^Y Y_i, \qquad (5a)$$

$$L_i = L_i\,(p_i^Y, r_i, w_i; \beta_{K,i}, \beta_{L,i}) = \frac{\beta_{L,i}}{w_i}\, p_i^Y Y_i,\ i = 1, 2, \ldots, 107. \qquad (5b)$$

Note that $\beta_{K,i}$ and $\beta_{L,i}$ can be calculated by using (5a), (5b), and the actual social accounting matrix so that:

$$\beta_{K,i} = \frac{r_i K_i}{p_i^Y Y_i},$$

$$\beta_{L,i} = \frac{w_i L_i}{p_i^Y Y_i},\ i = 1, 2, \ldots, 107,$$

where $r_i K_i$, and $w_i L_i$ can be obtained from the actual social accounting matrix.

The estimated values of $\beta_{K,i}$ and $\beta_{L,i}$ are given in Table 6.

Step 2: The production of domestic goods

Each firm is assumed to produce domestic goods, Z_i, by using intermediate goods and its own composite goods, which production has been described at step 1. The optimal behavior of each firm in terms of the production of domestic goods can be described such that:

$$\underset{Y_i\, X_{i,j}}{Max}\, \pi_i = p_i^Z Z_i - \left(p_i^Y Y_i - \sum_j^{107} p_j^X X_{i,j} \right),$$

$$\text{st} \quad Z_i = \min\left(\frac{X_{i,j}}{ax_{i,j}}, \frac{Y_i}{ay_i} \right),\ i = 1, 2, \ldots, 107,$$

where $X_{i,j}$ and p_j^X denote intermediate good used by firm j and i its price, respectively. p_i^Z is the price of Z_i. $ax_{i,j}$ denotes the amount of intermediate good j used for producing one unit of a domestic good of firm i, and ay_i denotes the amount of its own composite good for producing one unit of its domestic good. The estimated values of ay_i are given in Table 6.(6) Note that the production function at this step is assumed to be the Leontief type. Using $ax_{i,j}$ and ay_i, and assuming that the market is fully competitive, the zero-profit condition can be written by:

$$p_i^Z = p_i^Y ay_i + \sum_j^{107} p_j^X ax_{i,j},\ i = 1, 2, \ldots, 107.$$

Step 3: Decomposition of Domestic Goods into Exported Goods and Final Domestic Goods

The optimal decision made by firm i in terms of the amount of exports of its own goods is described as the decomposition of Z_i ($i = 1, 2, \ldots, 107$) into exported goods, E_i, and final domestic goods, D_i. Each firm is assumed to maximize its profit such that:

$$\pi_i = p_i^e E_i + p_i^d D_i - (1 + \tau_i^p - \tau_i^s)\, p_i^Z Z_i, \qquad (6)$$

where p_i^e and p_i^d denote the price when the domestic goods are sold abroad, and the price when the domestic goods are sold domestically, respectively. Note that p_i^e is measured in the domestic currency. τ_i^p and τ_i^s are the tax rates of a production tax imposed on the production of Z_i and the subsidy rate, respectively. The values of τ_i^p and τ_i^s are calculated by using the actual social accounting matrix, and the calculated values are given in Table 2-1 and 2-2. The decomposition is assumed to follow the Cobb-Douglas technology such that:

$$Z_i = E_i^{\kappa_i^e} D_i^{\kappa_{ii}^d},\ i = 1, 2, \ldots, 107, \qquad (7)$$

where $\kappa_i^d + \kappa_i^e = 1$ ($i = 1, 2, \ldots, 107$) is assumed. Each firm is assumed to maximize (6) with respect to E_i and D_i subject to (7), and the first order conditions yield

$$E_i = E_i(p_i^e, p_i^d, p_i^Z; \tau_i^p, \tau_i^s, \kappa_i^d, \kappa_i^e) = \frac{\kappa_i^e (1 + \tau_i^p - \tau_i^s)\, p_i^Z Z_i}{p_i^e}, \qquad (8a)$$

$$D_i = D_i(p_i^e, p_i^d, p_i^Z; \tau_i^p, \tau_i^s, \kappa_i^d, \kappa_i^e) = \frac{\kappa_i^d (1 + \tau_i^p - \tau_i^s)\, p_i^Z Z_i}{p_i^d},\ i = 1, 2, \ldots, 107, \qquad (8b)$$

Note that κ_i^e and κ_i^d can be calculated by using (8a), (8b), and the actual social accounting matrix so that:

$$\kappa_i^e = \frac{p_i^e E_i}{(1 + \tau_i^p - \tau_i^s)\, p_i^Z Z_i},$$

$$\kappa_i^d = \frac{p_i^d D_i}{(1 + \tau_i^p - \tau_i^s)\, p_i^Z Z_i},\ i = 1, 2, \ldots, 107,$$

where $p_i^e E_i$, $p_i^d D_i$, $\tau_i^s p_i^Z Z_i$, and $\tau_i^p p_i^Z Z_i$ can be obtained from the actual social accounting matrix. The estimated values of κ_i^e and κ_i^d are given in Table 6.

Step 4: The Production of the final goods
Denote the final consumption goods by Q_i (i = 1, 2, …, 107). The final consumption goods are assumed to be produced by using the final domestic goods, D_i, and the imported goods, M_i. This step corresponds to the optimal decision making behavior of each firm in terms of the amount of imported goods which are used in its production process. The production technology at this final step is given by the following Cobb-Douglas function:

$$Q_i = M_i^{\gamma_i^m} D_i^{\gamma_i^d},\ i = 1, 2, \ldots, 107, \quad (9)$$

where $\gamma_i^m + \gamma_i^d = 1$ (i = 1, 2, …, 107) is assumed. Each firm is assumed to maximize its profit with respect to M_i and D_i subject to (9). Its profit is given by:

$$\pi_i = p_i^Q Q_i - (1+\tau_i^m)\, p_i^m M_i - p_i^d D_i,\ i = 1, 2, \ldots, 107,$$

where p_i^Q and τ_i^m denote the price of its final consumption goods, Q_i, and the import tariff rate, respectively. The import tariff rate is calculated by using the actual social accounting matrix, and it is given in Table 2-4. Then, the first order conditions yield

$$M_i = M_i\,(p_i^m, p_i^d, p_i^Q; \tau_i^m, \gamma_i^m, \gamma_i^d)$$
$$= \frac{\gamma_i^m p_i^Q Q_i}{(1+\tau_i^m)\, p_i^m}, \quad (10a)$$
$$D_i = D_i\,(p_i^m, p_i^d, p_i^Q; \tau_i^m, \gamma_i^m, \gamma_i^d)$$
$$= \frac{\gamma_i^d p_i^Q Q_i}{p_i^d},\ i = 1, 2, \ldots, 107, \quad (10b)$$

Note that γ_i^m and γ_i^d can be calculated by using (10a), (10b), and the actual social accounting matrix so that:

$$\gamma_i^m = \frac{(1+\tau_i^m)\, p_i^m M_i}{p_i^Q Q_i},$$

$$\gamma_i^d = \frac{p_i^d D_i}{p_i^Q Q_i},\ i = 1, 2, \ldots, 107,$$

where $p_i^m M_i$, $p_i^d D_i$, $p_i^Q Q_i$ and $\tau_i^m p_i^m M_i$ can be obtained from the actual social accounting matrix. The estimated values of γ_i^m and γ_i^d are given in Table 6.

<The Government>
The government is assumed to impose several taxes to satisfy its budget constraint. Its budget constraint is given by:

$$\sum_{i=1}^{107} p_i^Q X_i^g + S^g + Sub = T^I + T^p + T^m,$$

where the left hand side is the total government expenditure, and the right hand side is the total government revenue. X_i^g and S^g denote government consumption of final consumption good i; and government savings, respectively. Sub denotes the total amount of subsidies such that:

$$Sub = \sum_{i=1}^{107} \tau_i^s\,(p_i^z Z_i).$$

The total tax revenue is given by:

$$T^I = \tau^I I = \tau^I \left(\sum_{i=1}^{107} r_i K_i + \sum_{i=1}^{107} w_i L_i \right),$$
$$T^p = \sum_{i=1}^{107} \tau_i^p\,(p_i^z Z_i),$$
$$T^m = \sum_{i=1}^{107} \tau_i^m\,(p_i^m M_i),$$

where T^I, T^p and T^m denote the total income tax revenue, the total production tax revenue, and the total import tariff revenue, respectively. The government is assumed to save the constant amount relative to the total amount of tax revenue, and the government savings are assumed to be given by

$$S^g = s^g\,(T^I + T^p + T^m),$$

where the constant ratio, S^g, is given exogenously, and .its value has been calculated by using the actual SAM.

<Equilibrium Conditions>
There are two factor inputs, labour and capital. Since the model is static and thus the short-run effect is explored, it is assumed that each factor cannot move among different sectors (industries) in the short-run. This implies the equilibrium conditions of factor markets such that

$$K_i = K_i, \quad (11a)$$

$$L_i = L_i,\ i = 1, 2, \ldots, 107, \quad (11b)$$

where the total amount of endowments is given by:

$$K = \sum_{i=1}^{107} K_i,$$
$$L = \sum_{i=1}^{107} L_i,$$

Note that r_i and w_i (i = 1, 2, …, 107) are determined in order to satisfy (11a) and (11b), respectively.

In terms of the market clearing condition of good i (i = 1, 2, …, 107); a private investment sector is introduced in order to close the economy in this paper.(7) Denoting the amount of good i consumed by the private investment sector by X_i^s, the market clearing condition of good i is given by:

$$Q_i = X_i + X_i^g + X_i^s + \sum_j^{107} X_{ij}, i = 1, 2, \ldots, 107, \quad (12)$$

where the left hand side is the total supply, and the right hand side is the total demand for good i. p_i^Q (i = 1, 2, …, 107) is determined in order to satisfy (12). Note that the budget constraint of the private investment sector is given by:

$$\sum_{i=1}^{107} p_i^Q X_i^s = S^g + S^I + S^f,$$

where the left hand side is the total amount of its consumption, and the right hand side is the total amount of its income. S^f denotes the total amount of savings by the foreign sector, or the deficits in the current account, and it is given by subtracting exports from imports.(8) Since both the amount of exports and the amount of imports can be obtained from the actual social accounting matrix, S^f can be calculated from the actual social accounting matrix, and thus it is exogenously given in the model. Furthermore, the foreign trade balance is given by

$$\sum_{i=1}^{107} p_i^{w,e} E_i + S^f = \sum_{i=1}^{107} p_i^{w,m} M_i,$$

where $p_i^{w,e}$ and $p_i^{w,m}$ denote the world price of export goods, and import goods of good i, respectively, and both of them are assumed to be given exogenously. Since p_i^e and p_i^m are both measured in the domestic currency, they are also expressed such that:

$$p_i^e = \varepsilon p_i^{w,e},$$

$$p_i^m = \varepsilon p_i^{w,m}, i = 1, 2, \ldots, 107,$$

where ε denotes the exchange rate. Note that the exogeneity assumption on the world prices implies that the exchange rate is endogenously determined within the model.

3. Simulation Analysis

3.1 Benchmark and Calibration

The benchmark case should reflect the real Japanese economy in order to make the subsequent simulation scenarios realistic. Thus, the benchmark model should carefully be calibrated until the calculated values of all endogenous variables within the model become close to the actual values. Table 1-1 to 1-4 show the calculated model values as well as the corresponding actual values in year 2005. As shown in these tables, the benchmark case has successfully been able to reproduce the real economy within the model. Note that the tax rates and the subsidy rates shown in Table 2-1 to 2-4 have been calculated by using the actual amount of tax and subsidy, so that they can be interpreted as the average proportional rates.

Table 2-3 particularly shows the net rate, which is defined as the difference between the production tax rate and the subsidy rate. The negative value of the net rate implies that the sector is subsidized by a certain amount.(9) As Table 2-3 shows, only Medical Service and Health (i = 94: hospital sector) is subsidized (net subsidy rate: 0.3432%) among all relevant three sectors. Since the effect of changes in the net rate is only simulated in the subsequent sections, the net rates of these three sectors are shown again in Table 2-3-1. Note also that welfare gains in the next section are all measured by equivalent variation (EV), so that the effect of policy changes on economic efficiency are measured financially.

3.2 Simulations

3.2.1 Scenario I without balanced budget

Any policy change should be followed by a secondary policy if the budget constraint of the government is fulfilled even after the policy change. In this paper, the total government expenditure is assumed to be unchanged even after a policy change. This implies that the total revenue should be unchanged in order to fulfill the budget constraint, so that any policy change should be followed by a secondary policy in order to satisfy the budget constraint.

However, a secondary policy conducted in order to fulfill the budget constraint obviously generates another effect on an economy, so that it is very difficult to separate the obtained result into the effects of the first and second policies, respectively. Then, Table 3-1 shows the pure effect of a policy change without a secondary policy based on the assumption that the gap between revenue and expenditure caused by any policy change is financed by government bonds implicitly. While the budget is not balanced after a policy change, it can show how much the Japanese government needs to conduct marginal tax/subsidy reforms. Note that Table 3-1 shows to the extent how much economic gains would be obtained by changing the net rate of each sector from the current level under the assumption that the temporary budget is not balanced. The negative value of government deficits in the table implies that government surplus will be generated by a policy change. Since the economic size of Medical Service and Health (i = 94: hospital sector) is much larger than other two sectors, an increase in the subsidy to Medical Service and Health (i = 94: hospital sector) results in the largest welfare gain. For instance, if the government increases the net subsidy rate of this sector by 50% from the current level, then the expected gain in economic efficiency is measured to be 72.3 billion Japanese yen with newly generated government deficits of approximately 5.6 billion Japanese yen. However, note that the overall effect of such a policy is more than ten times as much as the cost, since the amount of newly generated government deficits (5.3 billion Japanese yen) is less than one tenth of a welfare gain (72.3billion Japanese yen).

3.2.2 Scenario II with balanced budget

In this scenario, the budget constraint is explicitly fulfilled with a secondary tax/subsidy policy. While it is possible to consider many secondary policies to fulfill the budget constraint, it is assumed that the net rates of three sectors are only considered. Note that both the production tax and the subsidy are distortionary. Since the net rate is modified from the current level, the environment considered in this paper is the second-best situation, implying that the overall effect on economic efficiency might be positive or negative as pointed out by Lipsey and Lancaster (1956). The sector, which net rate is modified exogenously, is called the initial sector, and the sector, which net rate is adjusted endogenously in order to fulfill the budget constraint, is called the secondary sector. Table 3-2 shows the overall effect of such policies. A striking result is that when the budget is balanced by a secondary policy the result is quite different. If the balanced budget is not considered explicitly, the most effective welfare enhancing policy is to more subsidize Medical Service and Health (i = 94: hospital sector).However, if the gap between revenue and expenditure caused by the initial policy change is financed by a distortionary tax/subsidy policy within the health related sectors, then the reduction of the subsidy to Medical Service and Health (i = 94: hospital sector) is more preferable oppositely. While a policy to expand the subsidy to Medical Service and Health (i = 94: hospital sector) still eventuates in a welfare gain irrespective of a secondary policy, a welfare gain generated by a policy to reduce the subsidy followed by a secondary policy to adjust the net rate of Social Security (i = 95) is the largest. When the net subsidy rate of Medical Service and Health (i = 94: hospital sector) is reduced by 50% from the current level, the expected welfare gain is 3.78 billion Japanese yen if the policy is followed by the endogenous adjustment of the net rate of Social Security (i = 95) sector.

As long as the effect on economic efficiency of the whole economy with the balanced budget is concerned, a reform with the reduction of the subsidy to Medical Service and Health (i = 94: hospital sector) sector followed by an endogenous tax cut in Social Security (i = 95) sector is most effective. However, such a policy results in a decrease (an increase) in the total income of Medical Service and Health (i = 94: hospital sector) sector. Table 4-1 shows that while the total income of Social Security (i = 95) sector is expected to increase by 1.0188% from the current level, that of Medical Service and Health (i = 94: hospital sector) sector is expected to decrease by 0.1756%. Table 4-2 also shows that such a policy eventuates 17 in Social Security (i = 95) sector being subsidized. This is because the economic size of Medical Service and Health (i = 94: hospital sector) sector is much larger than that of Social Security (i = 95) sector, so that a 50% reduction of the subsidy rate of Medical Service and Health (i = 94: hospital sector) sector induces a huge amount of the government surplus, resulting in the government subsidizing Social Security (i = 95) sector. Such a policy is obviously favorable for Social Security (i = 95) sector, but it is not for Medical Service and Health (i = 94: hospital sector) sector. Since the economic size of Medical Service and Health (i = 94: hospital sector) is quite large, it seems politically difficult to implement such a policy. Then in the next scenario, a compensation policy is investigated.

3.2.3 Scenario III with balanced budget and a compensation policy

Scenario II shows that the reduction of the subsidy to Medical Service and Health (i = 94: hospital sector) sector followed by a decreasing tax policy of Social Security (i = 95) sector results in the largest welfare gain to the whole economy. Thus, Scenario III only investigates the case where the net tax rate of Social Security (i = 95) sector is endogenously modified as a secondary policy in order to full the budget constraint. Furthermore, Scenario III assumes that Medical Service and Health (i = 94: hospital sector) sector is compensated by lump-sum transfers, so that the total income of Medical Service and Health (i = 94: hospital sector) sector keeps unchanged even after an exogenous decrease in its net subsidy rate. Table 5 shows the striking result. When the net subsidy rate of Medical Service and Health (i = 94: hospital sector) sector is reduced by 50% from the current level, a welfare gain to the whole economy is measured to be 11.15 billion Japanese yen, which is much larger than the case where all government surplus generated by the reduction of the subsidy is used to decrease the tax on Social Security (i = 95) sector. If the surplus is only used for the reduction of the tax on Social Security (i = 95) sector, then expected amount of a welfare gain is only 3.78 billion Japanese yen as shown in Table 3-2. While the net tax rate for Social Security (i = 95) sector is higher in Scenario III compared to Scenario II, it still obtains an increase in its income, since its net rate can be reduced by such a policy. This implies that it is plausible to enhance welfare (economic efficiency) even in the health related sectors if the amount of the subsidy to Medical Service and Health (i = 94: hospital sector) sector can be reduced. Note that Scenario III uses non-distortionary lump-sum transfers in order to compensate Medical Service and Health (i = 94: hospital sector) sector. In Scenario III, the distortionary subsidy to Medical Service and Health (i = 94: hospital sector) sector and the distortionary tax on Social Security (i = 95) sector are both reduced, and the government surplus is redistributed to Medical Service and Health (i = 94: hospital sector) sector by lump-sum transfers. Note also that the amount of lump-sum transfers is more than three times as much as a welfare gain to the whole economy. This implies that the government has to redistribute lots of resources through transfers to improve economic efficiency if the government tries to reform health related production sectors.

4. Concluding Remarks

This paper has presented a computable general equilibrium (CGE) framework to numerically examine the effect of marginal tax reforms on the supply side of health related sectors in Japan. This paper has used the latest Input-Output table of Japan of year 2005 with different production sectors.

Several simulations have been conducted in comparison with a very realistic benchmark model, and the obtained results are as follows. First of all, an expansion of the subsidy to the hospital sector creates the largest welfare gain when the government does not take into account its financing explicitly. While such an expansion policy improves economic efficiency, it also induces a certain amount of government deficits. However, the effect of such a policy on economic efficiency is more than ten times as much as the cost. For instance, the amount of newly generated government deficits is 5.3 billion Japanese yen when the subsidy to the hospital sector increases by 50% from the current level, while the improvement in economic efficiency by the policy is measured to be 72.3 billion Japanese yen. Secondly, however, such an expansion policy does necessarily not eventuate in the largest gain if the government considers its balanced budget. The reduction of the subsidy to the hospital sector results in the largest welfare gain to the whole economy if the government uses the government surplus induced by the reduction of the subsidy in order to decrease the tax imposed on the social welfare sector. When the subsidy to the hospital sector is reduced by 50% from the current level, then the expected welfare gain to the whole economy would be approximately 3.8 billion Japanese yen, if the government surplus created by the 50% reduction of the subsidy to the hospital sector is used to reduce the tax on the social welfare sector. In fact, the 50% reduction of the subsidy to the hospital sector eventuates in the social welfare sector being subsidized. Finally, if the hospital sector is compensated by lump-sum transfers when its subsidy is reduced, then a welfare gain could become larger. If the government uses the government surplus not only for reducing the net tax rate of the social welfare sector but also for providing the hospital sector with lump-sum transfers in order to keep income of the hospital sector unchanged, then a larger welfare gain would be obtained, even if the government implements a balanced budget policy. When the government reduces the subsidy to the hospital sector by 50% from the current level, the expected welfare gain to the whole economy is 11.15 billion Japanese yen. Such a policy keeps the total income of the hospital sector unchanged by lump-sum transfers, and also increases the total income of the social welfare sector by reducing its tax. This implies that a welfare enhancing tax reform within the health related sectors is plausible as long as the subsidy to the hospital sector can be reduced. Such a reform does not create any new government deficit either.

While this paper has used the Japanese input-output table, it is applicable to all other countries in order to investigate the effect of several health policies. By explicitly considering the budget constraint within a computable general equilibrium framework, this paper has thrown light on the importance of explicit consideration of the government budget constraint when simulations on tax and subsidy policies are conducted.

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Notes

*) Keywords: Computable General Equilibrium (CGE) Model, Marginal Tax Reform, Health Sectors, Taxation, Subsidy, Simulation; JEL Classification: C68, H51, and H53.

1) Kato (2011) also discusses the effect of reforms on the supply side of the pharmaceutical industry.

2) Labor income and capital income are factor payments.

3) The numbers in the brackets are numbers allocated to the sectors in the actual input-output table of year 2005 with 108 different production sectors.

4) In terms of the conventional static model, see Ballard, Fullerton, Shoven, and Whalley (1985), Shoven and Whalley (1992), and Scarf and Shoven (2008). In particular, the model used in this paper is similar to Hosoe, Ogawa, and Hashimoto (2004). Regarding the dynamic model, it is conventional to employ an overlapping generations model In terms of computable overlapping generations model within a general equilibrium framework, see Auerbach and Kotlikoff (1987). Kato (1998), Kato (2002b), Kato (2002a), Ihori, Kato, Kawade, and Bessho (2006), and Ihori, Kato, Kawade, and Bessho (2011) also apply the dyanamic model to several policies in Japan.

5) The assumption that the ratio is exogenously given is made only for the model to be consistent to the actual social accounting matrix, and this assumption is very common in the literature.

6) The estimated values of ax_{ij} are not presented in Table 2, since the number of the estimated values reach 11,449. The estimated values are given upon request.

7) This is also the conventional assumption in the literature.

8) The FDI is assumed to be negligible in this paper.

9) A tariff is differently treated, so that the net rate is defined above.

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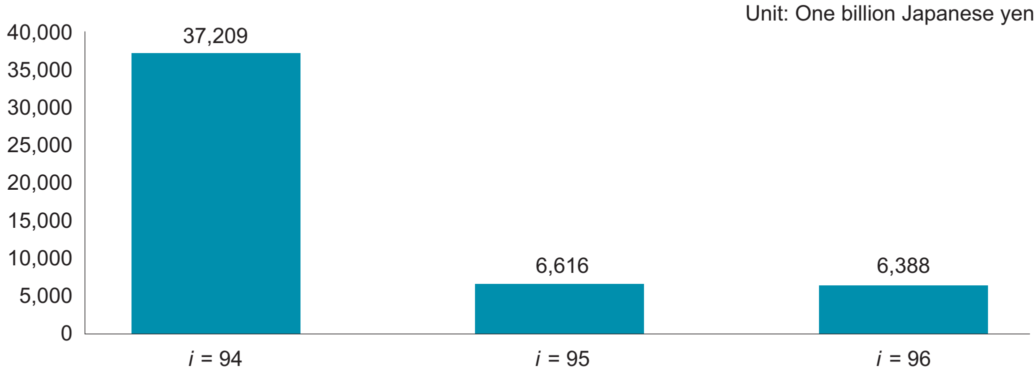
Figure 1: Economic Values of the Domestic Final Consumption Goods in the IO Table of Year 2005



i = 94: Medical Service and Health Sector (incl. hospitals)
i = 95: Social Security Sector (incl. nurseries, nursing homes, social welfare centers, and administrative work of public schemes)
i = 96: Nursing Care Sector (incl. long term care for the elderly)

Table 1-1: Economic Values of the Benchmark Model
Final Consumption Goods, $P_i^Q Q_i$; i = 1, 2, …, 107

Unit: One million Japanese yen

i	1	2	3	4	5	6	7	8	9
model	7992445	3076453	867591	1507966	1889503	1673551	997155	13666806	28226829
actual	7992445	3076453	867591	1507966	1889503	1673551	997155	13666806	28226829

i	10	11	12	13	14	15	16	17	18
model	8448175	1528645	3087907	2024194	5403523	3545906	2864489	4718832	3383067
actual	8448175	1528645	3087907	2024194	5403523	3545906	2864489	4718832	3383067

i	19	20	21	22	23	24	25	26	27
model	6295844	388535	2014268	2646909	5170128	2438742	417929	7287054	6308055
actual	6295844	388535	2014268	2646909	5170128	2438742	417929	7287054	6308055

i	28	29	30	31	32	33	34	35	36
model	17484729	1289256	10137398	2776993	1249173	1559315	2988851	716762	1675103
actual	17484729	1289256	10137398	2776993	1249173	1559315	2988851	716762	1675103

i	37	38	39	40	41	42	43	44	45
model	7818878	11656182	1901806	2113988	3624169	5085451	4791626	7716325	7736765
actual	7818878	11656182	1901806	2113988	3624169	5085451	4791626	7716325	7736765

i	46	47	48	49	50	51	52	53	54
model	9649963	3346489	3968133	5585456	1924973	2445823	2919353	6776294	4409610
actual	9649963	3346489	3968133	5585456	1924973	2445823	2919353	6776294	4409610

i	55	56	57	58	59	60	61	62	63
model	4075496	9563708	7856948	2718049	25319384	1004116	3563331	3809563	5232559
actual	4075496	9563708	7856948	2718049	25319384	1004116	3563331	3809563	5232559

i	64	65	66	67	68	69	70	71	72
model	648298	30715358	9119713	16205999	7196254	15754107	2893277	4549749	3745112
actual	648298	30715358	9119713	16205999	7196254	15754107	2893277	4549749	3745112

i	73	74	75	76	77	78	79	80	81
model	98358600	41431380	8595547	11913778	45678819	6638078	16293277	9960768	3554235
actual	98358600	41431380	8595547	11913778	45678819	6638078	16293277	9960768	3554235

i	82	83	84	85	86	87	88	89	90
model	3512957	489752	1786627	6506596	16367961	3678393	17614538	1214895	7440836
actual	3512957	489752	1786627	6506596	16367961	3678393	17614538	1214895	7440836

i	91	92	93	94	95	96	97	98	99
model	38537877	23178561	13371738	37209390	6616330	6387536	5044458	9175582	11969164
actual	38537877	23178561	13371738	37209390	6616330	6387536	5044458	9175582	11969164

i	100	101	102	103	104	105	106	107
model	12657970	30319697	10129655	21613601	7671606	6337175	12761623	1517809
actual	12657970	30319697	10129655	21613601	7671606	6337175	12761623	1517809

i = 94: Medical Service and Health Sector (incl. hospitals)
i = 95: Social Security Sector (incl. nurseries, nursing homes, social welfare centers, and administrative work of public schemes)
i = 96: Nursing Care Sector (incl. long term care for the elderly)

Table 1-2: Economic Values of the Benchmark Model (Continued)
Capital Income, rK_i; i = 1, 2, …, 107

Unit: One million Japanese yen

i	1	2	3	4	5	6	7	8	9
model	3013193	619764	196982	729575	522992	4630	105212	21743	2970822
actual	3013193	619764	196982	729575	522992	4630	105212	21743	2970822

i	10	11	12	13	14	15	16	17	18
model	1565909	238849	402011	93908	122904	354057	147044	692022	323586
actual	1565909	238849	402011	93908	122904	354057	147044	692022	323586

i	19	20	21	22	23	24	25	26	27
model	1100374	43932	348142	171629	401898	261535	43896	1438660	727686
actual	1100374	43932	348142	171629	401898	261535	43896	1438660	727686

i	28	29	30	31	32	33	34	35	36
model	221319	152394	640925	367357	59695	349608	426126	91958	273911
actual	221319	152394	640925	367357	59695	349608	426126	91958	273911

i	37	38	39	40	41	42	43	44	45
model	778178	1758911	294256	97254	143678	377406	368039	709631	930517
actual	778178	1758911	294256	97254	143678	377406	368039	709631	930517

i	46	47	48	49	50	51	52	53	54
model	1384756	375474	322166	352810	170457	506256	306073	427506	301195
actual	1384756	375474	322166	352810	170457	506256	306073	427506	301195

i	55	56	57	58	59	60	61	62	63
model	428739	526290	601345	172999	1211068	207040	332438	377004	433360
actual	428739	526290	601345	172999	1211068	207040	332438	377004	433360

i	64	65	66	67	68	69	70	71	72
model	42930	1674911	443521	1341333	571988	4231709	403822	1540735	503561
actual	42930	1674911	443521	1341333	571988	4231709	403822	1540735	503561

i	73	74	75	76	77	78	79	80	81
model	2.50E+07	1.30E+07	3894961	8303863	3.80E+07	2135328	1216237	0	605096
actual	2.50E+07	1.30E+07	3894961	8303863	3.80E+07	2135328	1216237	0	605096

i	82	83	84	85	86	87	88	89	90
model	246642	54476	316483	2092779	5289614	835932	3579498	229693	967790
actual	246642	54476	316483	2092779	5289614	835932	3579498	229693	967790

i	91	92	93	94	95	96	97	98	99
model	1.20E+07	3190946	1238479	4579116	283558	807134	366078	1127663	6291773
actual	1.20E+07	3190946	1238479	4579116	283558	807134	366078	1127663	6291773

i	100	101	102	103	104	105	106	107
model	763930	5863257	3249479	2501464	1084820	1975728	1549710	0
actual	763930	5863257	3249479	2501464	1084820	1975728	1549710	0

i = 94: Medical Service and Health Sector (incl. hospitals)
i = 95: Social Security Sector (incl. nurseries, nursing homes, social welfare centers, and administrative work of public schemes)
i = 96: Nursing Care Sector (incl. long term care for the elderly)

Table 1-3: Economic Values of the Benchmark Model (Continued)
Labor Income, wL_i; i = 1, 2, …, 107

Unit: One million Japanese yen

i	1	2	3	4	5	6	7	8	9
model	435559	159785	324614	194298	320754	6254	196860	34609	3937017
actual	435559	159785	324614	194298	320754	6254	196860	34609	3937017

i	10	11	12	13	14	15	16	17	18
model	934570	98389	100053	519501	593274	533880	640107	494854	852997
actual	934570	98389	100053	519501	593274	533880	640107	494854	852997

i	19	20	21	22	23	24	25	26	27
model	2212473	46512	251076	58033	445681	303412	87151	1046236	1032481
actual	2212473	46512	251076	58033	445681	303412	87151	1046236	1032481

i	28	29	30	31	32	33	34	35	36
model	213753	90498	2451248	716890	109334	377955	700852	197407	420682
actual	213753	90498	2451248	716890	109334	377955	700852	197407	420682

i	37	38	39	40	41	42	43	44	45
model	651357	1066983	415523	329327	175601	784184	1174627	2746319	2197655
actual	651357	1066983	415523	329327	175601	784184	1174627	2746319	2197655

i	46	47	48	49	50	51	52	53	54
model	2985889	1352278	472061	1771645	568377	660530	381689	1221040	516848
actual	2985889	1352278	472061	1771645	568377	660530	381689	1221040	516848

i	55	56	57	58	59	60	61	62	63
model	1078927	2065088	1160290	348384	4307408	405285	677728	985003	976858
actual	1078927	2065088	1160290	348384	4307408	405285	677728	985003	976858

i	64	65	66	67	68	69	70	71	72
model	271545	1.20E+07	3319718	5612059	2778276	1914977	453536	797235	2009988
actual	271545	1.20E+07	3319718	5612059	2778276	1914977	453536	797235	2009988

i	73	74	75	76	77	78	79	80	81
model	4.40E+07	1.30E+07	1722796	588194	0	1633166	9598060	0	921774
actual	4.40E+07	1.30E+07	1722796	588194	0	1633166	9598060	0	921774

i	82	83	84	85	86	87	88	89	90
model	416659	288537	739983	1998002	4994099	759999	6466088	254219	2154436
actual	416659	288537	739983	1998002	4994099	759999	6466088	254219	2154436

i	91	92	93	94	95	96	97	98	99
model	1.70E+07	1.60E+07	6022563	1.60E+07	4407172	3816420	2825959	1464649	1474520
actual	1.70E+07	1.60E+07	6022563	1.60E+07	4407172	3816420	2825959	1464649	1474520

i	100	101	102	103	104	105	106	107
model	3734524	1.50E+07	2492172	6489054	1883934	2351357	2914220	0
actual	3734524	1.50E+07	2492172	6489054	1883934	2351357	2914220	0

i = 94: Medical Service and Health Sector (incl. hospitals)
i = 95: Social Security Sector (incl. nurseries, nursing homes, social welfare centers, and administrative work of public schemes)
i = 96: Nursing Care Sector (incl. long term care for the elderly)

Table 1-4: Economic Values of the Benchmark Model (Continued)

Unit: One million Japanese yen

savings					
private sector		government sector		foreign sector	
model	actual	model	actual	model	actual
27265700	27265700	70847256	70847256	-6059608	-6059608

tax and subsidy							
income tax		production tax		import tax		subsidy	
model	actual	model	actual	model	actual	model	actual
146907949	146907949	34024445	34024445	4774091	4774091	3506668	3506668

The above figures indicate the total amount.

Table 2-1: Calculated Production Tax Rates
$TAUP\ (i) = \tau_i^p;\ i = 1, 2, \ldots, 107$ (Subsidy Rate)

TAUP (1)	TAUP (2)	TAUP (3)	TAUP (4)	TAUP (5)	TAUP (6)	TAUP (7)	TAUP (8)	TAUP (9)
5.9867%	2.5114%	6.1820%	1.2527%	4.3722%	3.8090%	6.3187%	12.9820%	1.8945%

TAUP (10)	TAUP (11)	TAUP (12)	TAUP (13)	TAUP (14)	TAUP (15)	TAUP (16)	TAUP (17)	TAUP (18)
27.6149%	1.1470%	162.3026%	3.8493%	3.4444%	2.8209%	3.1706%	3.6937%	3.3152%

TAUP (19)	TAUP (20)	TAUP (21)	TAUP (22)	TAUP (23)	TAUP (24)	TAUP (25)	TAUP (26)	TAUP (27)
3.6528%	2.9897%	1.8001%	1.7417%	2.1078%	1.3484%	6.8352%	2.7184%	2.7862%

TAUP (28)	TAUP (29)	TAUP (30)	TAUP (31)	TAUP (32)	TAUP (33)	TAUP (34)	TAUP (35)	TAUP (36)
38.7680%	1.8750%	2.2056%	3.5739%	2.2774%	3.3468%	5.0663%	5.5992%	4.0437%

TAUP (37)	TAUP (38)	TAUP (39)	TAUP (40)	TAUP (41)	TAUP (42)	TAUP (43)	TAUP (44)	TAUP (45)
5.2686%	1.1492%	4.0811%	2.1405%	4.2144%	2.4866%	3.2158%	3.4331%	2.2434%

TAUP (46)	TAUP (47)	TAUP (48)	TAUP (49)	TAUP (50)	TAUP (51)	TAUP (52)	TAUP (53)	TAUP (54)
1.7931%	1.8188%	2.0160%	1.6598%	1.3144%	1.7305%	1.4357%	1.5851%	1.4624%

TAUP (55)	TAUP (56)	TAUP (57)	TAUP (58)	TAUP (59)	TAUP (60)	TAUP (61)	TAUP (62)	TAUP (63)
1.6600%	1.3251%	1.2068%	1.3410%	1.6146%	2.4806%	1.4796%	2.6985%	2.7755%

TAUP (64)	TAUP (65)	TAUP (66)	TAUP (67)	TAUP (68)	TAUP (69)	TAUP (70)	TAUP (71)	TAUP (72)
7.2375%	3.3239%	3.7016%	3.8125%	3.9683%	7.6883%	3.0249%	4.5282%	5.5395%

TAUP (73)	TAUP (74)	TAUP (75)	TAUP (76)	TAUP (77)	TAUP (78)	TAUP (79)	TAUP (80)	TAUP (81)
3.7119%	4.6608%	9.9487%	5.9533%	5.1196%	5.8426%	6.2693%	0.0000%	2.0770%

TAUP (82)	TAUP (83)	TAUP (84)	TAUP (85)	TAUP (86)	TAUP (87)	TAUP (88)	TAUP (89)	TAUP (90)
5.2643%	2.8005%	6.7776%	6.6531%	3.2352%	3.5600%	4.4300%	2.4485%	2.7756%

TAUP (91)	TAUP (92)	TAUP (93)	TAUP (94)	TAUP (95)	TAUP (96)	TAUP (97)	TAUP (98)	TAUP (99)
0.2775%	0.4211%	1.5446%	1.7759%	0.6563%	1.9178%	3.0825%	3.2853%	2.0742%

TAUP (100)	TAUP (101)	TAUP (102)	TAUP (103)	TAUP (104)	TAUP (105)	TAUP (106)	TAUP (107)
1.7716%	3.8589%	10.2152%	2.4778%	3.8533%	5.0795%	8.6114%	0.0000%

$i = 94$: Medical Service and Health Sector (incl. hospitals)
$i = 95$: Social Security Sector (incl. nurseries, nursing homes, social welfare centers, and administrative work of public schemes)
$i = 96$: Nursing Care Sector (incl. long term care for the elderly)

Table 2-2: Calculated Subsidy Rates
$SUBR\ (i) = \tau_i^s$; i = 1, 2, …, 107 (Subsidy Rate)

SUBR (1)	SUBR (2)	SUBR (3)	SUBR (4)	SUBR (5)	SUBR (6)	SUBR (7)	SUBR (8)	SUBR (9)
0.7094%	1.7234%	0.0459%	3.0764%	0.2472%	0.0369%	0.0096%	1.6950%	0.8771%

SUBR (10)	SUBR (11)	SUBR (12)	SUBR (13)	SUBR (14)	SUBR (15)	SUBR (16)	SUBR (17)	SUBR (18)
0.0045%	0.5283%	0.0053%	0.0165%	0.0110%	0.0153%	0.0079%	0.0035%	0.0061%

SUBR (19)	SUBR (20)	SUBR (21)	SUBR (22)	SUBR (23)	SUBR (24)	SUBR (25)	SUBR (26)	SUBR (27)
0.0085%	0.0037%	0.0038%	0.0009%	0.0027%	0.0030%	0.0056%	0.0044%	0.0044%

SUBR (28)	SUBR (29)	SUBR (30)	SUBR (31)	SUBR (32)	SUBR (33)	SUBR (34)	SUBR (35)	SUBR (36)
0.4716%	0.0016%	0.0054%	0.0089%	0.0694%	0.0069%	0.0073%	0.0102%	0.0079%

SUBR (37)	SUBR (38)	SUBR (39)	SUBR (40)	SUBR (41)	SUBR (42)	SUBR (43)	SUBR (44)	SUBR (45)
0.0028%	0.0042%	0.0079%	0.0036%	0.0042%	0.0051%	0.0078%	0.0102%	0.0068%

SUBR (46)	SUBR (47)	SUBR (48)	SUBR (49)	SUBR (50)	SUBR (51)	SUBR (52)	SUBR (53)	SUBR (54)
0.0068%	0.0091%	0.0047%	0.0066%	0.0053%	0.0058%	0.0049%	0.0050%	0.0034%

SUBR (55)	SUBR (56)	SUBR (57)	SUBR (58)	SUBR (59)	SUBR (60)	SUBR (61)	SUBR (62)	SUBR (63)
0.0064%	0.0062%	0.0022%	0.0025%	0.0049%	0.0130%	0.0682%	0.0087%	0.0113%

SUBR (64)	SUBR (65)	SUBR (66)	SUBR (67)	SUBR (68)	SUBR (69)	SUBR (70)	SUBR (71)	SUBR (72)
0.0085%	0.0163%	0.0165%	0.2631%	3.5499%	0.0130%	2.9362%	3.7943%	0.0077%

SUBR (73)	SUBR (74)	SUBR (75)	SUBR (76)	SUBR (77)	SUBR (78)	SUBR (79)	SUBR (80)	SUBR (81)
0.0716%	2.7243%	0.0071%	0.6671%	0.0000%	0.9291%	0.4615%	0.0000%	0.4080%

SUBR (82)	SUBR (83)	SUBR (84)	SUBR (85)	SUBR (86)	SUBR (87)	SUBR (88)	SUBR (89)	SUBR (90)
0.0063%	0.0244%	0.0202%	0.3951%	0.0080%	0.0074%	0.0289%	0.0026%	0.0189%

SUBR (91)	SUBR (92)	SUBR (93)	SUBR (94)	SUBR (95)	SUBR (96)	SUBR (97)	SUBR (98)	SUBR (99)
0.0000%	0.0007%	0.4221%	2.1191%	0.0118%	0.7001%	2.5735%	0.0073%	0.0040%

SUBR (100)	SUBR (101)	SUBR (102)	SUBR (103)	SUBR (104)	SUBR (105)	SUBR (106)	SUBR (107)
0.0076%	0.1523%	0.0072%	0.0033%	0.0118%	0.0137%	0.0140%	0.0000%

i = 94: Medical Service and Health Sector (incl. hospitals)
i = 95: Social Security Sector (incl. nurseries, nursing homes, social welfare centers, and administrative work of public schemes)
i = 96: Nursing Care Sector (incl. long term care for the elderly)

Table 2-3: Calculated Net Rates (Production Tax Rate minus Subsidy Rate)

i = 1	*i* = 2	*i* = 3	*i* = 4	*i* = 5	*i* = 6	*i* = 7	*i* = 8	*i* = 9
5.2772%	0.7881%	6.1362%	-1.8236%	4.1251%	3.7721%	6.3091%	11.2870%	1.0174%

i = 10	*i* = 11	*i* = 12	*i* = 13	*i* = 14	*i* = 15	*i* = 16	*i* = 17	*i* = 18
27.6104%	0.6188%	162.2973%	3.8328%	3.4334%	2.8056%	3.1627%	3.6902%	3.3091%

i = 19	*i* = 20	*i* = 21	*i* = 22	*i* = 23	*i* = 24	*i* = 25	*i* = 26	*i* = 27
3.6442%	2.9860%	1.7964%	1.7408%	2.1051%	1.3454%	6.8296%	2.7140%	2.7819%

i = 28	*i* = 29	*i* = 30	*i* = 31	*i* = 32	*i* = 33	*i* = 34	*i* = 35	*i* = 36
38.2964%	1.8735%	2.2002%	3.5650%	2.2081%	3.3398%	5.0591%	5.5890%	4.0358%

i = 37	*i* = 38	*i* = 39	*i* = 40	*i* = 41	*i* = 42	*i* = 43	*i* = 44	*i* = 45
5.2657%	1.1451%	4.0732%	2.1369%	4.2102%	2.4815%	3.2080%	3.4229%	2.2366%

i = 46	*i* = 47	*i* = 48	*i* = 49	*i* = 50	*i* = 51	*i* = 52	*i* = 53	*i* = 54
1.7863%	1.8097%	2.0113%	1.6532%	1.3091%	1.7247%	1.4308%	1.5801%	1.4590%

i = 55	*i* = 56	*i* = 57	*i* = 58	*i* = 59	*i* = 60	*i* = 61	*i* = 62	*i* = 63
1.6536%	1.3190%	1.2046%	1.3385%	1.6097%	2.4676%	1.4114%	2.6898%	2.7642%

i = 64	*i* = 65	*i* = 66	*i* = 67	*i* = 68	*i* = 69	*i* = 70	*i* = 71	*i* = 72
7.2290%	3.3077%	3.6851%	3.5494%	0.4184%	7.6753%	0.0887%	0.7338%	5.5319%

i = 73	*i* = 74	*i* = 75	*i* = 76	*i* = 77	*i* = 78	*i* = 79	*i* = 80	*i* = 81
3.6403%	1.9365%	9.9416%	5.2861%	5.1196%	4.9135%	5.8078%	0.0000%	1.6689%

i = 82	*i* = 83	*i* = 84	*i* = 85	*i* = 86	*i* = 87	*i* = 88	*i* = 89	*i* = 90
5.2580%	2.7762%	6.7574%	6.2580%	3.2272%	3.5526%	4.4011%	2.4459%	2.7567%

i = 91	*i* = 92	*i* = 93	*i* = 94	*i* = 95	*i* = 96	*i* = 97	*i* = 98	*i* = 99
0.2775%	0.4205%	1.1226%	-0.3432%	0.6446%	1.2177%	0.5090%	3.2780%	2.0702%

i = 100	*i* = 101	*i* = 102	*i* = 103	*i* = 104	*i* = 105	*i* = 106	*i* = 107
1.7640%	3.7066%	10.2081%	2.4745%	3.8415%	5.0658%	8.5974%	0.0000%

i = 94: Medical Service and Health Sector (incl. hospitals)
i = 95: Social Security Sector (incl. nurseries, nursing homes, social welfare centers, and administrative work of public schemes)
i = 96: Nursing Care Sector (incl. long term care for the elderly)

Table 2-3-1: Calculated Net Rates (Production Tax Rate minus Subsidy Rate)

	i = 94	*i* = 95	*i* = 96
production tax rate	1.7759%	0.6563%	1.9178%
subsidy rate	2.1191%	0.0118%	0.7001%
net rate	-0.3432%	0.6446%	1.2177%

i = 94: Medical Service and Health Sector (incl. hospitals)
i = 95: Social Security Sector (incl. nurseries, nursing homes, social welfare centers, and administrative work of public schemes)
i = 96: Nursing Care Sector (incl. long term care for the elderly)

The net rate is defined as the production tax rate minus the subsidy rate.
The negative value of the net rate implies that the sector is subsidized in the net value.

Table 2-4: Calculated Import Tariff Rates
$TAUM\ (i) = \tau_i^m$; i = 1, 2, …, 107 (Import Tariff Rate)

TAUM (1)	TAUM (2)	TAUM (3)	TAUM (4)	TAUM (5)	TAUM (6)	TAUM (7)	TAUM (8)	TAUM (9)
6.8081%	15.5478%	0.0000%	5.6808%	8.7406%	5.0000%	5.0004%	9.8945%	14.4770%

TAUM (10)	TAUM (11)	TAUM (12)	TAUM (13)	TAUM (14)	TAUM (15)	TAUM (16)	TAUM (17)	TAUM (18)
25.5089%	5.3134%	109.5661%	9.3138%	12.6582%	7.9865%	5.1066%	4.9944%	5.5484%

TAUM (19)	TAUM (20)	TAUM (21)	TAUM (22)	TAUM (23)	TAUM (24)	TAUM (25)	TAUM (26)	TAUM (27)
4.9737%	5.0410%	6.1612%	5.0006%	6.0696%	7.6112%	10.8256%	5.0446%	5.8942%

TAUM (28)	TAUM (29)	TAUM (30)	TAUM (31)	TAUM (32)	TAUM (33)	TAUM (34)	TAUM (35)	TAUM (36)
5.7067%	5.2018%	6.7533%	9.9136%	14.9538%	5.7152%	5.8357%	5.5806%	5.4506%

TAUM (37)	TAUM (38)	TAUM (39)	TAUM (40)	TAUM (41)	TAUM (42)	TAUM (43)	TAUM (44)	TAUM (45)
7.2644%	5.0002%	5.0047%	4.9999%	5.1549%	5.9397%	5.2741%	5.6103%	5.0002%

TAUM (46)	TAUM (47)	TAUM (48)	TAUM (49)	TAUM (50)	TAUM (51)	TAUM (52)	TAUM (53)	TAUM (54)
5.1301%	4.9999%	4.9994%	4.9999%	5.0000%	8.9702%	4.9828%	4.9800%	5.2524%

TAUM (55)	TAUM (56)	TAUM (57)	TAUM (58)	TAUM (59)	TAUM (60)	TAUM (61)	TAUM (62)	TAUM (63)
5.0000%	4.9998%	4.9557%	4.9848%	5.0001%	2.7342%	4.8217%	4.9596%	5.1917%

TAUM (64)	TAUM (65)	TAUM (66)	TAUM (67)	TAUM (68)	TAUM (69)	TAUM (70)	TAUM (71)	TAUM (72)
0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%

TAUM (73)	TAUM (74)	TAUM (75)	TAUM (76)	TAUM (77)	TAUM (78)	TAUM (79)	TAUM (80)	TAUM (81)
0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%

TAUM (82)	TAUM (83)	TAUM (84)	TAUM (85)	TAUM (86)	TAUM (87)	TAUM (88)	TAUM (89)	TAUM (90)
0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.4634%	0.0000%	1.8618%

TAUM (91)	TAUM (92)	TAUM (93)	TAUM (94)	TAUM (95)	TAUM (96)	TAUM (97)	TAUM (98)	TAUM (99)
0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%

TAUM (100)	TAUM (101)	TAUM (102)	TAUM (103)	TAUM (104)	TAUM (105)	TAUM (106)	TAUM (107)
0.0000%	0.1495%	0.0000%	0.0000%	0.0000%	0.0000%	0.1669%	0.0000%

i = 94: Medical Service and Health Sector (incl. hospitals)
i = 95: Social Security Sector (incl. nurseries, nursing homes, social welfare centers, and administrative work of public schemes)
i = 96: Nursing Care Sector (incl. long term care for the elderly)

Table 3-1: Welfare Changes and Government Deficits in Scenario I without balanced budget

Unit: One million Japanese yen

Sectors of the Policy Change			Changes from the current level by				
			No Change	50% decrease	30% decrease	10% decrease	5% decrease
	i = 94 Hospital Services	Level of Net Rate	**-0.3430%**	-0.5145%	-0.4459%	-0.3773%	-0.3602%
		EV	**0.0000**	72,324.9558	43,320.3350	14,358.9275	7,124.9091
		Government Deficits	**0.0000**	5,575.5926	3,391.4450	1,193.5028	642.2169
	i = 95 Social Welfare Services	Level of Net Rate	**0.6445%**	0.3223%	0.4512%	0.5801%	0.6123%
		EV	**0.0000**	23,907.6071	14,283.1010	4,683.3031	2,288.8036
		Government Deficits	**0.0000**	1,858.7765	1,154.6368	446.4262	2.6740
	i = 96 Long-term Care Services	Level of Net Rate	**1.2177%**	0.6089%	0.8524%	1.0959%	1.1568%
		EV	**0.0000**	43,349.2401	25,904.0652	8,542.7766	4,215.3597
		Government Deficits	**0.0000**	3,308.7305	2,031.2598	740.5164	415.8710

Sectors of the Policy Change			**No Change**	5% increase	10% increase	30% increase	50% increase
	i = 94 Hospital Services	Level of Net Rate	**-0.3430%**	-0.3259%	-0.3087%	-0.2401%	-0.1715%
		EV	**0.0000**	-7,122.4607	-14,347.9576	-43,224.0817	-72,058.8886
		Government Deficits	**0.0000**	-642.8764	-1,197.1323	-3,422.1261	-5,659.5404
	i = 95 Social Welfare Services	Level of Net Rate	**0.6445%**	0.6767%	0.7090%	0.8379%	0.9668%
		EV	**0.0000**	-2,286.8033	-4,677.0281	-14,226.5194	-23,750.3989
		Government Deficits	**0.0000**	-268.0347	-447.5516	-1,164.7836	-1,887.0301
	i = 96 Long-term Care Services	Level of Net Rate	**1.2177%**	1.2786%	1.3395%	1.5830%	1.8266%
		EV	**0.0000**	-4,210.2109	-8,522.1494	-25,715.9784	-42,827.4288
		Government Deficits	**0.0000**	-416.6577	-743.6905	-2,062.0392	-3,393.6230

Table 3-2: Welfare Changes in Scenario II with balanced budget

Unit: One million Japanese yen

The Initial Sector	The Secondary Sector		No Change	Changes from the current level by 50% decrease	30% decrease	10% decrease	5% decrease
i = 94 Hospital Services		Level of Net Rate	**-0.3430%**	-0.5145%	-0.4459%	-0.3773%	-0.3602%
	i = 94 Hospital Services						
	i = 95 Social Welfare Services	EV	**0.0000**	2423.5141	1,309.6103	1,118.9443	1,213.9380
	i = 96 Long-term Care Services	EV	**0.0000**	3246.7760	1,829.1769	1,291.9113	1,293.1866
i = 95 Social Welfare Services		Level of Net Rate	**0.6445%**	0.3223%	0.4512%	0.5801%	0.6123%
	i = 94 Hospital Services	EV	**0.0000**	2281.5951	1833.4901	1472.8157	1352.1648
	i = 95 Social Welfare Services						
	i = 96 Long-term Care Services	EV	**0.0000**	2158.1755	1,725.3315	1,433.2618	1,335.0303
i = 96 Long-term Care Services		Level of Net Rate	**1.2177%**	0.6089%	0.8524%	1.0959%	1.1568%
	i = 94 Hospital Services	EV	**0.0000**	2914.0142	2,042.8615	1,496.7929	1,401.9186
	i = 95 Social Welfare Services	EV	**0.0000**	2415.5614	1,612.7331	1,324.7827	1,325.2900
	i = 96 Long-term Care Services						

The Initial Sector	The Secondary Sector		No Change	Changes from the current level by 5% increase	10% increase	30% increase	50% increase
i = 94 Hospital Services		Level of Net Rate	**-0.3430%**	-0.3259%	-0.3087%	-0.2401%	-0.1715%
	i = 94 Hospital Services						
	i = 95 Social Welfare Services	EV	**0.0000**	-1,165.917	-897.6839	874.8535	3,776.3527
	i = 96 Long-term Care Services	EV	**0.0000**	-1,248.378	-1,082.384	244.4483	2,632.1345
i = 95 Social Welfare Services		Level of Net Rate	**0.6445%**	0.6767%	0.709%	0.8379%	0.9668%
	i = 94 Hospital Services	EV	**0.0000**	-1347.323	-1449.459	-1,607.558	-1,646.823
	i = 95 Social Welfare Services						
	i = 96 Long-term Care Services	EV	**0.0000**	-1,329.610	-1,402.244	-1,391.838	-1,202.263
i = 96 Long-term Care Services		Level of Net Rate	**1.2177%**	1.2786%	1.3395%	1.5830%	1.8266%
	i = 94 Hospital Services	EV	**0.0000**	-1,382.471	-1,419.171	-1,311.084	-863.7073
	i = 95 Social Welfare Services	EV	**0.0000**	-1,300.396	-1,209.075	-499.6253	884.8772
	i = 96 Long-term Care Services						

Table 4-1: Total Income When the Net Rate of Hospital Services (*i* = 94) Sector is Exogenously Changed (Scenario II)

Unit: One million Japanese yen

	The Secondary Sector	**No Change (-0.3430%)***	50% decrease (-0.5145%)*	30% decrease (-0.4459%)*	10% decrease (-0.3773%)*	5% decrease (-0.3602%)*
i = 94 Hospital Services	*i* = 95 Social Welfare Services	20,846,651.00	20,883,516.78	20,868,751.96	20,854,027.85	20,850,353.13
i = 95 Social Welfare Services		4,690,730.00	4,646,766.45	4,664,250.61	4,682,302.62	4,686,903.79
i = 96 Long-term Care Services		4,623,554.00	4,623,560.38	4,623,557.78	4,623,557.34	4,623,557.56
i = 94 Hospital Services	*i* = 96 Long-term Care Services	20,846,651.00	20,883,492.80	20,868,738.05	20,854,023.59	20,850,351.20
i = 95 Social Welfare Services		4,690,730.00	4,690,780.65	4,690,758.84	4,690,750.58	4,690,750.60
i = 96 Long-term Care Services		4,623,554.00	4,578,947.52	4,596,704.68	4,615,004.36	4,619,663.26
		Relative Changes (%)				
i = 94 Hospital Services	*i* = 95 Social Welfare Services	0.0000%	0.1768%	0.1060%	0.0354%	0.0178%
i = 95 Social Welfare Services		0.0000%	-0.9372%	-0.5645%	-0.1797%	-0.0816%
i = 96 Long-term Care Services		0.0000%	0.0001%	0.0001%	0.0001%	0.0001%
i = 94 Hospital Services	*i* = 96 Long-term Care Services	0.0000%	0.1767%	0.1060%	0.0354%	0.0177%
i = 95 Social Welfare Services		0.0000%	0.0011%	0.0006%	0.0004%	0.0004%
i = 96 Long-term Care Services		0.0000%	-0.9648%	-0.5807%	-0.1849%	-0.0842%

	The Secondary Sector	**No Change (-0.3430%)***	5% increase (-0.3259%)*	10% increase (-0.3087%)*	30% increase (-0.2401%)*	50% increase (-0.1715%)*
i = 94 Hospital Services	*i* = 95 Social Welfare Services	20,846,651.00	20,842,951.20	20,839,284.11	20,824,643.69	20,810,048.13
i = 95 Social Welfare Services		4,690,730.00	4,694,585.49	4,699,293.22	4,718,556.31	4,738,519.88
i = 96 Long-term Care Services		4,623,554.00	4,623,550.55	4,623,551.18	4,623,555.32	4,623,562.09
i = 94 Hospital Services	*i* = 96 Long-term Care Services	20,846,651.00	20,842,953.09	20,839,288.24	20,824,656.38	20,810,068.51
i = 95 Social Welfare Services		4,690,730.00	4,690,710.09	4,690,712.64	4,690,733.05	4,690,769.77
i = 96 Long-term Care Services		4,623,554.00	4,627,472.06	4,632,232.46	4,651,684.27	4,671,795.58
		Relative Changes (%)				
i = 94 Hospital Services	*i* = 95 Social Welfare Services	-0.0177%	-0.0353%	-0.1056%	-0.1756%	0.0178%
i = 95 Social Welfare Services		0.0822%	0.1826%	0.5932%	1.0188%	-0.0816%
i = 96 Long-term Care Services		-0.0001%	-0.0001%	0.0000%	0.0002%	0.0001%
i = 94 Hospital Services	*i* = 96 Long-term Care Services	-0.0177%	-0.0353%	-0.1055%	-0.1755%	0.0177%
i = 95 Social Welfare Services		-0.0004%	-0.0004%	0.0001%	0.0008%	0.0004%
i = 96 Long-term Care Services		0.0847%	0.1877%	0.6084%	1.0434%	-0.0842%

*) The level of the net rate of Hospital Service Sector (*i* = 94)

Table 4-2: Endogenous Net Rates When the Net Rate of Hospital Services (*i* = 94) Sector is Exogenously Changed (Scenario II)

	No Change (-0.3430%)*	50% decrease (-0.5145%)*	30% decrease (-0.4459%)*	10% decrease (-0.3773%)*	5% decrease (-0.3602%)*
The Secondary Sector					
i = 95 Social Welfare Services	0.6446%	1.5976%	1.2164%	0.8261%	0.7272%
i = 96 Long-term Care Services	1.2177%	2.2039%	1.8090%	1.4053%	1.3030%
i = 95 Social Welfare Services	0.0000%	147.8545%	88.7127%	28.1626%	12.8113%
i = 96 Long-term Care Services	0.0000%	80.9910%	48.5614%	15.4060%	7.0075%

	No Change (-0.3430%)*	5% increase (-0.3259%)*	10% increase (-0.3087%)*	30% increase (-0.2401%)*	50% increase (-0.1715%)*
The Secondary Sector					
i = 95 Social Welfare Services	0.6446%	0.561519%	0.460865%	0.051324%	-0.369249%
i = 96 Long-term Care Services	1.2177%	1.131899%	1.027978%	0.605579%	0.172610%
i = 95 Social Welfare Services	0.0000%	-12.8853%	-28.5009%	-92.0376%	-157.2857%
i = 96 Long-term Care Services	0.0000%	-7.0446%	-15.5790%	-50.2677%	-85.8247%

*) The level of the net rate of Hospital Service Sector (*i* = 94)

Table 5: Welfare Changes in Scenario III with balanced budget and compensation

Unit: One million Japanese yen

	Changes in the Net Rate of *i* = 94 from the Current Level by				
	No Change	5% increase	10% increase	30% increase	50% increase
Level of Net Rate of *i* = 94	**-0.3430%**	-0.3259%	-0.3087%	-0.2401%	-0.1715%
EV	**0.0000**	1053.2306	2200.9788	6581.5326	11153.1617
Lump-Sum Transfers to *i* = 94	**0.0000**	3651.9486	7301.1207	21889.4770	36453.1860
Endogenous Net Rate of *i* = 95	**0.644574%**	0.590619%	0.535496%	0.318110%	0.099000%
	Relative changes in the endogenous net rate of *i* = 95				
	0.0000%	-8.3706%	-16.9225%	-50.6480%	-84.6410%

Figure 2:

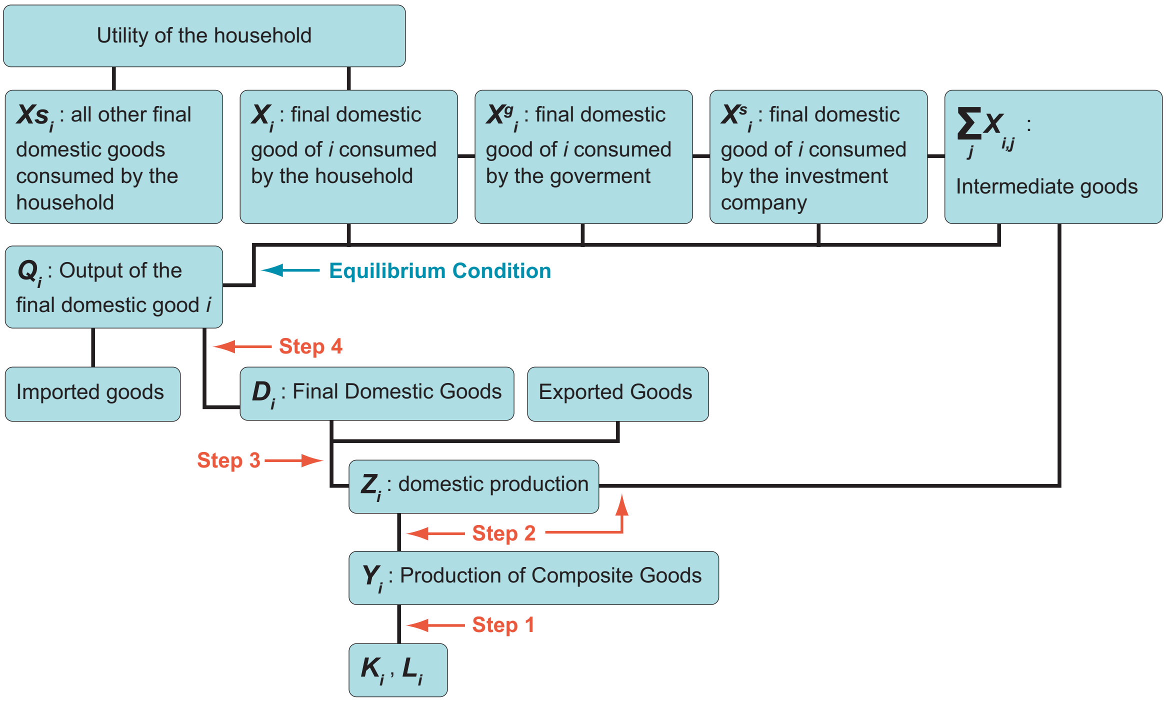

Utility of the household
Xs_i : all other final domestic goods consumed by the household
X_i : final domestic good of i consumed by the household
X^g_i : final domestic good of i consumed by the goverment
X^s_i : final domestic good of i consumed by the investment company
$\sum_j x_{i,j}$: Intermediate goods
Q_i : Output of the final domestic good i
Equilibrium Condition
Step 4
Imported goods
D_i : Final Domestic Goods
Exported Goods
Step 3
Z_i : domestic production
Step 2
Y_i : Production of Composite Goods
Step 1
K_i , L_i

Table 6: Parameter Values
***ALPHA* (*i*) = α_i ; *i* = 1, 2, …, 107**

ALPHA (1)	ALPHA (2)	ALPHA (3)	ALPHA (4)	ALPHA (5)	ALPHA (6)	ALPHA (7)	ALPHA (8)	ALPHA (9)
0.008454	0.000697	0.000958	0.000563	0.001298	0.000000	-0.000051	0.000000	0.061399

ALPHA (10)	ALPHA (11)	ALPHA (12)	ALPHA (13)	ALPHA (14)	ALPHA (15)	ALPHA (16)	ALPHA (17)	ALPHA (18)
0.020494	0.000777	0.010540	0.000647	0.012440	0.000165	0.000860	-0.000143	0.001110

ALPHA (19)	ALPHA (20)	ALPHA (21)	ALPHA (22)	ALPHA (23)	ALPHA (24)	ALPHA (25)	ALPHA (26)	ALPHA (27)
0.000310	0.000021	0.000047	0.000000	0.000001	0.000000	0.000000	0.002072	0.007346

ALPHA (28)	ALPHA (29)	ALPHA (30)	ALPHA (31)	ALPHA (32)	ALPHA (33)	ALPHA (34)	ALPHA (35)	ALPHA (36)
0.019774	0.000005	0.001354	0.001304	0.003456	0.000226	0.000005	0.000202	0.000427

ALPHA (37)	ALPHA (38)	ALPHA (39)	ALPHA (40)	ALPHA (41)	ALPHA (42)	ALPHA (43)	ALPHA (44)	ALPHA (45)
-0.000110	0.000000	0.000000	0.000000	0.000315	0.000048	0.000131	0.001049	0.000057

ALPHA (46)	ALPHA (47)	ALPHA (48)	ALPHA (49)	ALPHA (50)	ALPHA (51)	ALPHA (52)	ALPHA (53)	ALPHA (54)
0.000099	0.000001	0.000152	0.000082	0.000000	0.002079	0.007615	0.013658	0.003033

ALPHA (55)	ALPHA (56)	ALPHA (57)	ALPHA (58)	ALPHA (59)	ALPHA (60)	ALPHA (61)	ALPHA (62)	ALPHA (63)
0.000005	0.000803	0.015434	0.002895	0.000037	0.000035	0.000304	0.003085	0.005440

ALPHA (64)	ALPHA (65)	ALPHA (66)	ALPHA (67)	ALPHA (68)	ALPHA (69)	ALPHA (70)	ALPHA (71)	ALPHA (72)
0.000086	0.000000	0.000000	0.000000	0.000000	0.015339	0.004461	0.006358	0.000813

ALPHA (73)	ALPHA (74)	ALPHA (75)	ALPHA (76)	ALPHA (77)	ALPHA (78)	ALPHA (79)	ALPHA (80)	ALPHA (81)
0.163165	0.040117	0.001186	0.040023	0.153327	0.013895	0.021978	0.000000	0.000848

ALPHA (82)	ALPHA (83)	ALPHA (84)	ALPHA (85)	ALPHA (86)	ALPHA (87)	ALPHA (88)	ALPHA (89)	ALPHA (90)
0.007116	0.000420	0.000817	0.006671	0.024290	0.003689	0.004204	0.000372	0.005041

ALPHA (91)	ALPHA (92)	ALPHA (93)	ALPHA (94)	ALPHA (95)	ALPHA (96)	ALPHA (97)	ALPHA (98)	ALPHA (99)
0.002643	0.024685	0.000874	0.025467	0.014922	0.002219	0.013087	0.000018	0.002299

ALPHA (100)	ALPHA (101)	ALPHA (102)	ALPHA (103)	ALPHA (104)	ALPHA (105)	ALPHA (106)	ALPHA (107)
0.010085	0.003110	0.031930	0.072608	0.025772	0.017842	0.025222	0.000000

Table 6: Parameter Values (continued)
***TETA* (*i*) = ; *i* = 1, 2, …, 107**

TETA (1)	TETA (2)	TETA (3)	TETA (4)	TETA (5)	TETA (6)	TETA (7)	TETA (8)	TETA (9)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002854

TETA (10)	TETA (11)	TETA (12)	TETA (13)	TETA (14)	TETA (15)	TETA (16)	TETA (17)	TETA (18)
0.000000	0.000000	0.000000	0.000005	0.000000	0.000015	0.000125	0.000000	0.000000

TETA (19)	TETA (20)	TETA (21)	TETA (22)	TETA (23)	TETA (24)	TETA (25)	TETA (26)	TETA (27)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

TETA (28)	TETA (29)	TETA (30)	TETA (31)	TETA (32)	TETA (33)	TETA (34)	TETA (35)	TETA (36)
0.000000	0.000000	0.000037	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

TETA (37)	TETA (38)	TETA (39)	TETA (40)	TETA (41)	TETA (42)	TETA (43)	TETA (44)	TETA (45)
-0.000231	0.000000	0.000000	0.000000	0.000000	0.000000	0.000007	0.000015	0.000930

TETA (46)	TETA (47)	TETA (48)	TETA (49)	TETA (50)	TETA (51)	TETA (52)	TETA (53)	TETA (54)
0.000659	0.000033	0.000241	0.000536	0.001528	0.000354	0.000025	0.000893	0.001975

TETA (55)	TETA (56)	TETA (57)	TETA (58)	TETA (59)	TETA (60)	TETA (61)	TETA (62)	TETA (63)
0.000000	0.000000	0.000188	0.000312	0.000000	0.000541	0.000320	0.001057	0.000936

TETA (64)	TETA (65)	TETA (66)	TETA (67)	TETA (68)	TETA (69)	TETA (70)	TETA (71)	TETA (72)
0.000000	0.023000	0.000000	0.139914	0.015876	0.000000	0.000000	-0.003126	0.008649

TETA (73)	TETA (74)	TETA (75)	TETA (76)	TETA (77)	TETA (78)	TETA (79)	TETA (80)	TETA (81)
0.003668	0.000000	0.000000	0.000000	0.000323	0.000001	0.000251	0.000000	0.000009

TETA (82)	TETA (83)	TETA (84)	TETA (85)	TETA (86)	TETA (87)	TETA (88)	TETA (89)	TETA (90)
0.000001	0.000009	0.000016	-0.000682	0.000000	0.000000	0.009389	0.000000	0.000312

TETA (91)	TETA (92)	TETA (93)	TETA (94)	TETA (95)	TETA (96)	TETA (97)	TETA (98)	TETA (99)
0.319013	0.133885	0.012411	0.250054	0.018932	0.049862	0.000000	0.000000	0.000000

TETA (100)	TETA (101)	TETA (102)	TETA (103)	TETA (104)	TETA (105)	TETA (106)	TETA (107)
0.000000	0.004877	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Table 6: Parameter Values (continued)
AY **(*i*)** $= ay_i$ **;** $i = 1, 2, \ldots, 107$

AY (1)	AY (2)	AY (3)	AY (4)	AY (5)	AY (6)	AY (7)	AY (8)	AY (9)
0.569112	0.259441	0.638091	0.714903	0.545627	0.502516	0.372137	0.509977	0.288914

AY (10)	AY (11)	AY (12)	AY (13)	AY (14)	AY (15)	AY (16)	AY (17)	AY (18)
0.399620	0.243640	0.558255	0.302586	0.326348	0.364356	0.335517	0.269011	0.365120

AY (19)	AY (20)	AY (21)	AY (22)	AY (23)	AY (24)	AY (25)	AY (26)	AY (27)
0.545367	0.300808	0.313485	0.079872	0.158423	0.196041	0.282342	0.383997	0.266826

AY (28)	AY (29)	AY (30)	AY (31)	AY (32)	AY (33)	AY (34)	AY (35)	AY (36)
0.038388	0.198565	0.297147	0.374181	0.363061	0.439348	0.394900	0.416436	0.421920

AY (37)	AY (38)	AY (39)	AY (40)	AY (41)	AY (42)	AY (43)	AY (44)	AY (45)
0.198469	0.206669	0.388615	0.217738	0.154559	0.229930	0.340688	0.457585	0.335708

AY (46)	AY (47)	AY (48)	AY (49)	AY (50)	AY (51)	AY (52)	AY (53)	AY (54)
0.342878	0.453480	0.202632	0.315002	0.281943	0.323336	0.263178	0.228452	0.225449

AY (55)	AY (56)	AY (57)	AY (58)	AY (59)	AY (60)	AY (61)	AY (62)	AY (63)
0.292368	0.239345	0.121935	0.128995	0.195727	0.257239	0.319016	0.375707	0.335744

AY (64)	AY (65)	AY (66)	AY (67)	AY (68)	AY (69)	AY (70)	AY (71)	AY (72)
0.387335	0.445074	0.427856	0.444292	0.467505	0.419332	0.296537	0.516646	0.707740

AY (73)	AY (74)	AY (75)	AY (76)	AY (77)	AY (78)	AY (79)	AY (80)	AY (81)
0.673664	0.630237	0.718393	0.784767	0.885020	0.605151	0.671504	0.000000	0.303933

AY (82)	AY (83)	AY (84)	AY (85)	AY (86)	AY (87)	AY (88)	AY (89)	AY (90)
0.243508	0.669003	0.600236	0.636452	0.648946	0.449275	0.602636	0.407587	0.440701

AY (91)	AY (92)	AY (93)	AY (94)	AY (95)	AY (96)	AY (97)	AY (98)	AY (99)
0.735921	0.851534	0.558195	0.558358	0.713532	0.732654	0.637750	0.294748	0.655198

AY (100)	AY (101)	AY (102)	AY (103)	AY (104)	AY (105)	AY (106)	AY (107)
0.361597	0.735262	0.631194	0.439779	0.470239	0.717599	0.399887	0.000000

Table 6: Parameter Values (continued)
***GSAI* (*i*) = ; *i* = 1, 2, …, 107**

GSAI (1)	GSAI (2)	GSAI (3)	GSAI (4)	GSAI (5)	GSAI (6)	GSAI (7)	GSAI (8)	GSAI (9)
0.000418	0.001846	0.000000	0.007704	0.000023	0.000009	0.000378	-0.001540	0.001904

GSAI (10)	GSAI (11)	GSAI (12)	GSAI (13)	GSAI (14)	GSAI (15)	GSAI (16)	GSAI (17)	GSAI (18)
0.001241	0.000105	-0.000541	0.000953	0.001007	0.001002	0.003683	0.000401	-0.000053

GSAI (19)	GSAI (20)	GSAI (21)	GSAI (22)	GSAI (23)	GSAI (24)	GSAI (25)	GSAI (26)	GSAI (27)
0.000015	0.000003	0.000119	-0.000029	0.000609	0.000388	-0.000063	-0.000118	0.000100

GSAI (28)	GSAI (29)	GSAI (30)	GSAI (31)	GSAI (32)	GSAI (33)	GSAI (34)	GSAI (35)	GSAI (36)
-0.001943	0.000210	0.000776	0.000078	-0.000038	0.000057	0.000003	0.000154	0.000419

GSAI (37)	GSAI (38)	GSAI (39)	GSAI (40)	GSAI (41)	GSAI (42)	GSAI (43)	GSAI (44)	GSAI (45)
-0.001777	0.002139	0.000111	0.000180	-0.001248	0.002241	0.000520	0.003091	0.041242

GSAI (46)	GSAI (47)	GSAI (48)	GSAI (49)	GSAI (50)	GSAI (51)	GSAI (52)	GSAI (53)	GSAI (54)
0.071786	0.018354	0.029925	0.024607	0.015242	0.002979	0.002122	0.019012	0.032610

GSAI (55)	GSAI (56)	GSAI (57)	GSAI (58)	GSAI (59)	GSAI (60)	GSAI (61)	GSAI (62)	GSAI (63)
0.000412	-0.000317	0.035209	0.019425	0.001465	0.002726	0.014186	0.018706	0.011439

GSAI (64)	GSAI (65)	GSAI (66)	GSAI (67)	GSAI (68)	GSAI (69)	GSAI (70)	GSAI (71)	GSAI (72)
0.000000	0.304971	0.000000	0.001472	0.058366	0.000000	0.000000	0.000000	0.000000

GSAI (73)	GSAI (74)	GSAI (75)	GSAI (76)	GSAI (77)	GSAI (78)	GSAI (79)	GSAI (80)	GSAI (81)
0.136365	0.000000	0.000000	0.000000	0.000000	0.000015	0.007806	0.000000	0.000501

GSAI (82)	GSAI (83)	GSAI (84)	GSAI (85)	GSAI (86)	GSAI (87)	GSAI (88)	GSAI (89)	GSAI (90)
0.000020	0.000294	0.000577	0.000000	0.000000	0.000000	0.078944	0.000000	0.000560

GSAI (91)	GSAI (92)	GSAI (93)	GSAI (94)	GSAI (95)	GSAI (96)	GSAI (97)	GSAI (98)	GSAI (99)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

GSAI (100)	GSAI (101)	GSAI (102)	GSAI (103)	GSAI (104)	GSAI (105)	GSAI (106)	GSAI (107)
0.000000	0.024440	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Table 6: Parameter Values (continued)
***GAMMAM* (*i*) = γ_i^M ; *i* = 1, 2, …, 107**

GAMMAM (1)	GAMMAM (2)	GAMMAM (3)	GAMMAM (4)	GAMMAM (5)	GAMMAM (6)	GAMMAM (7)	GAMMAM (8)	GAMMAM (9)
0.204213	0.015883	0.000000	0.159696	0.169359	0.989016	0.161561	0.991011	0.151897

GAMMAM (10)	GAMMAM (11)	GAMMAM (12)	GAMMAM (13)	GAMMAM (14)	GAMMAM (15)	GAMMAM (16)	GAMMAM (17)	GAMMAM (18)
0.057352	0.092149	0.244285	0.205769	0.588887	0.296517	0.178307	0.078185	0.031427

GAMMAM (19)	GAMMAM (20)	GAMMAM (21)	GAMMAM (22)	GAMMAM (23)	GAMMAM (24)	GAMMAM (25)	GAMMAM (26)	GAMMAM (27)
0.007000	0.228893	0.166364	0.015279	0.262157	0.150654	0.139844	0.130729	0.132632

GAMMAM (28)	GAMMAM (29)	GAMMAM (30)	GAMMAM (31)	GAMMAM (32)	GAMMAM (33)	GAMMAM (34)	GAMMAM (35)	GAMMAM (36)
0.151774	0.065853	0.059744	0.174788	0.634839	0.133737	0.005358	0.134695	0.126247

GAMMAM (37)	GAMMAM (38)	GAMMAM (39)	GAMMAM (40)	GAMMAM (41)	GAMMAM (42)	GAMMAM (43)	GAMMAM (44)	GAMMAM (45)
0.046285	0.038267	0.010569	0.057458	0.518190	0.143344	0.030947	0.067039	0.090442

GAMMAM (46)	GAMMAM (47)	GAMMAM (48)	GAMMAM (49)	GAMMAM (50)	GAMMAM (51)	GAMMAM (52)	GAMMAM (53)	GAMMAM (54)
0.159450	0.094953	0.057172	0.167955	0.392915	0.159768	0.164382	0.199346	0.671938

GAMMAM (55)	GAMMAM (56)	GAMMAM (57)	GAMMAM (58)	GAMMAM (59)	GAMMAM (60)	GAMMAM (61)	GAMMAM (62)	GAMMAM (63)
0.587932	0.147661	0.120402	0.027670	0.026757	0.039290	0.299314	0.389652	0.289767

GAMMAM (64)	GAMMAM (65)	GAMMAM (66)	GAMMAM (67)	GAMMAM (68)	GAMMAM (69)	GAMMAM (70)	GAMMAM (71)	GAMMAM (72)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000068	0.000063	0.000318	0.000072

GAMMAM (73)	GAMMAM (74)	GAMMAM (75)	GAMMAM (76)	GAMMAM (77)	GAMMAM (78)	GAMMAM (79)	GAMMAM (80)	GAMMAM (81)
0.007164	0.012048	0.000000	0.000123	0.000000	0.030748	0.011163	0.000000	0.453834

GAMMAM (82)	GAMMAM (83)	GAMMAM (84)	GAMMAM (85)	GAMMAM (86)	GAMMAM (87)	GAMMAM (88)	GAMMAM (89)	GAMMAM (90)
0.394777	0.000000	0.000000	0.043256	0.005262	0.000000	0.022020	0.002268	0.031897

GAMMAM (91)	GAMMAM (92)	GAMMAM (93)	GAMMAM (94)	GAMMAM (95)	GAMMAM (96)	GAMMAM (97)	GAMMAM (98)	GAMMAM (99)
0.000000	0.002954	0.042848	0.000056	0.000000	0.000000	0.006711	0.022928	0.002069

GAMMAM (100)	GAMMAM (101)	GAMMAM (102)	GAMMAM (103)	GAMMAM (104)	GAMMAM (105)	GAMMAM (106)	GAMMAM (107)
0.000019	0.026586	0.018407	0.041963	0.220840	0.000424	0.058544	0.000000

Table 6: Parameter Values (continued)
***GAMMAD* (*i*) = γ_i^D ; *i* = 1, 2, …, 107**

GAMMAD (1)	GAMMAD (2)	GAMMAD (3)	GAMMAD (4)	GAMMAD (5)	GAMMAD (6)	GAMMAD (7)	GAMMAD (8)	GAMMAD (9)
0.795787	0.984117	1.000000	0.840304	0.830641	0.010984	0.838439	0.008989	0.848103

GAMMAD (10)	GAMMAD (11)	GAMMAD (12)	GAMMAD (13)	GAMMAD (14)	GAMMAD (15)	GAMMAD (16)	GAMMAD (17)	GAMMAD (18)
0.942648	0.907851	0.755715	0.794231	0.411113	0.703483	0.821693	0.921815	0.968573

GAMMAD (19)	GAMMAD (20)	GAMMAD (21)	GAMMAD (22)	GAMMAD (23)	GAMMAD (24)	GAMMAD (25)	GAMMAD (26)	GAMMAD (27)
0.993000	0.771107	0.833636	0.984721	0.737843	0.849346	0.860156	0.869271	0.867368

GAMMAD (28)	GAMMAD (29)	GAMMAD (30)	GAMMAD (31)	GAMMAD (32)	GAMMAD (33)	GAMMAD (34)	GAMMAD (35)	GAMMAD (36)
0.848226	0.934147	0.940256	0.825212	0.365161	0.866263	0.994642	0.865305	0.873753

GAMMAD (37)	GAMMAD (38)	GAMMAD (39)	GAMMAD (40)	GAMMAD (41)	GAMMAD (42)	GAMMAD (43)	GAMMAD (44)	GAMMAD (45)
0.953715	0.961733	0.989431	0.942542	0.481810	0.856656	0.969053	0.932961	0.909558

GAMMAD (46)	GAMMAD (47)	GAMMAD (48)	GAMMAD (49)	GAMMAD (50)	GAMMAD (51)	GAMMAD (52)	GAMMAD (53)	GAMMAD (54)
0.840550	0.905047	0.942828	0.832045	0.607085	0.840232	0.835618	0.800654	0.328062

GAMMAD (55)	GAMMAD (56)	GAMMAD (57)	GAMMAD (58)	GAMMAD (59)	GAMMAD (60)	GAMMAD (61)	GAMMAD (62)	GAMMAD (63)
0.412068	0.852339	0.879598	0.972330	0.973243	0.960710	0.700686	0.610348	0.710233

GAMMAD (64)	GAMMAD (65)	GAMMAD (66)	GAMMAD (67)	GAMMAD (68)	GAMMAD (69)	GAMMAD (70)	GAMMAD (71)	GAMMAD (72)
1.000000	1.000000	1.000000	1.000000	1.000000	0.999932	0.999937	0.999682	0.999928

GAMMAD (73)	GAMMAD (74)	GAMMAD (75)	GAMMAD (76)	GAMMAD (77)	GAMMAD (78)	GAMMAD (79)	GAMMAD (80)	GAMMAD (81)
0.992836	0.987952	1.000000	0.999877	1.000000	0.969252	0.988837	1.000000	0.546166

GAMMAD (82)	GAMMAD (83)	GAMMAD (84)	GAMMAD (85)	GAMMAD (86)	GAMMAD (87)	GAMMAD (88)	GAMMAD (89)	GAMMAD (90)
0.605223	1.000000	1.000000	0.956744	0.994738	1.000000	0.977980	0.997732	0.968103

GAMMAD (91)	GAMMAD (92)	GAMMAD (93)	GAMMAD (94)	GAMMAD (95)	GAMMAD (96)	GAMMAD (97)	GAMMAD (98)	GAMMAD (99)
1.000000	0.997046	0.957152	0.999944	1.000000	1.000000	0.993289	0.977072	0.997931

GAMMAD (100)	GAMMAD (101)	GAMMAD (102)	GAMMAD (103)	GAMMAD (104)	GAMMAD (105)	GAMMAD (106)	GAMMAD (107)
0.999981	0.973414	0.981593	0.958037	0.779160	0.999576	0.941456	1.000000

Table 6: Parameter Values (continued)
***KAPPAE* (*i*) = κ_i^E ; *i* = 1, 2, …, 107**

KAPPAE (1)	KAPPAE (2)	KAPPAE (3)	KAPPAE (4)	KAPPAE (5)	KAPPAE (6)	KAPPAE (7)	KAPPAE (8)	KAPPAE (9)
0.003039	0.000270	0.000000	0.001252	0.025258	0.182150	0.031150	0.001016	0.008845

KAPPAE (10)	KAPPAE (11)	KAPPAE (12)	KAPPAE (13)	KAPPAE (14)	KAPPAE (15)	KAPPAE (16)	KAPPAE (17)	KAPPAE (18)
0.002643	0.003551	0.010760	0.236228	0.021328	0.004348	0.027498	0.049164	0.015724

KAPPAE (19)	KAPPAE (20)	KAPPAE (21)	KAPPAE (22)	KAPPAE (23)	KAPPAE (24)	KAPPAE (25)	KAPPAE (26)	KAPPAE (27)
0.007009	0.032443	0.137034	0.109029	0.301676	0.290771	0.275001	0.046991	0.193032

KAPPAE (28)	KAPPAE (29)	KAPPAE (30)	KAPPAE (31)	KAPPAE (32)	KAPPAE (33)	KAPPAE (34)	KAPPAE (35)	KAPPAE (36)
0.053784	0.033542	0.103752	0.236375	0.041396	0.210679	0.008462	0.154667	0.145432

KAPPAE (37)	KAPPAE (38)	KAPPAE (39)	KAPPAE (40)	KAPPAE (41)	KAPPAE (42)	KAPPAE (43)	KAPPAE (44)	KAPPAE (45)
0.016499	0.189440	0.010059	0.004244	0.188856	0.158541	0.006420	0.078360	0.261322

KAPPAE (46)	KAPPAE (47)	KAPPAE (48)	KAPPAE (49)	KAPPAE (50)	KAPPAE (51)	KAPPAE (52)	KAPPAE (53)	KAPPAE (54)
0.374836	0.219185	0.064306	0.322125	0.559810	0.440164	0.079687	0.259846	0.607049

KAPPAE (55)	KAPPAE (56)	KAPPAE (57)	KAPPAE (58)	KAPPAE (59)	KAPPAE (60)	KAPPAE (61)	KAPPAE (62)	KAPPAE (63)
0.679630	0.256909	0.527340	0.354772	0.139857	0.604501	0.222479	0.375409	0.139016

KAPPAE (64)	KAPPAE (65)	KAPPAE (66)	KAPPAE (67)	KAPPAE (68)	KAPPAE (69)	KAPPAE (70)	KAPPAE (71)	KAPPAE (72)
0.255331	0.000000	0.000000	0.000000	0.000000	0.001922	0.000244	0.002235	0.000838

KAPPAE (73)	KAPPAE (74)	KAPPAE (75)	KAPPAE (76)	KAPPAE (77)	KAPPAE (78)	KAPPAE (79)	KAPPAE (80)	KAPPAE (81)
0.081116	0.015740	0.000207	0.001465	0.000000	0.015210	0.054490	0.000000	0.619934

KAPPAE (82)	KAPPAE (83)	KAPPAE (84)	KAPPAE (85)	KAPPAE (86)	KAPPAE (87)	KAPPAE (88)	KAPPAE (89)	KAPPAE (90)
0.258458	0.070603	0.049171	0.088519	0.004668	0.000010	0.010135	0.003421	0.010506

KAPPAE (91)	KAPPAE (92)	KAPPAE (93)	KAPPAE (94)	KAPPAE (95)	KAPPAE (96)	KAPPAE (97)	KAPPAE (98)	KAPPAE (99)
0.000000	0.001252	0.027012	0.000006	0.000000	0.000000	0.003981	0.013002	0.012756

KAPPAE (100)	KAPPAE (101)	KAPPAE (102)	KAPPAE (103)	KAPPAE (104)	KAPPAE (105)	KAPPAE (106)	KAPPAE (107)
0.000177	0.013158	0.008165	0.011575	0.088229	0.000147	0.008925	0.000000

Table 6: Parameter Values (continued)
***KAPPAD* (*i*) = κ_i^E ; *i* = 1, 2, …, 107**

KAPPAD (1)	KAPPAD (2)	KAPPAD (3)	KAPPAD (4)	KAPPAD (5)	KAPPAD (6)	KAPPAD (7)	KAPPAD (8)	KAPPAD (9)
0.996961	0.999730	1.000000	0.998748	0.974742	0.817850	0.968850	0.998984	0.991155

KAPPAD (10)	KAPPAD (11)	KAPPAD (12)	KAPPAD (13)	KAPPAD (14)	KAPPAD (15)	KAPPAD (16)	KAPPAD (17)	KAPPAD (18)
0.997357	0.996449	0.989240	0.763772	0.978672	0.995652	0.972502	0.950836	0.984276

KAPPAD (19)	KAPPAD (20)	KAPPAD (21)	KAPPAD (22)	KAPPAD (23)	KAPPAD (24)	KAPPAD (25)	KAPPAD (26)	KAPPAD (27)
0.992991	0.967557	0.862966	0.890971	0.698324	0.709229	0.724999	0.953009	0.806968

KAPPAD (28)	KAPPAD (29)	KAPPAD (30)	KAPPAD (31)	KAPPAD (32)	KAPPAD (33)	KAPPAD (34)	KAPPAD (35)	KAPPAD (36)
0.946216	0.966458	0.896248	0.763625	0.958604	0.789321	0.991538	0.845333	0.854568

KAPPAD (37)	KAPPAD (38)	KAPPAD (39)	KAPPAD (40)	KAPPAD (41)	KAPPAD (42)	KAPPAD (43)	KAPPAD (44)	KAPPAD (45)
0.983501	0.810560	0.989941	0.995756	0.811144	0.841459	0.993580	0.921640	0.738678

KAPPAD (46)	KAPPAD (47)	KAPPAD (48)	KAPPAD (49)	KAPPAD (50)	KAPPAD (51)	KAPPAD (52)	KAPPAD (53)	KAPPAD (54)
0.625164	0.780815	0.935694	0.677875	0.440190	0.559836	0.920313	0.740154	0.392951

KAPPAD (55)	KAPPAD (56)	KAPPAD (57)	KAPPAD (58)	KAPPAD (59)	KAPPAD (60)	KAPPAD (61)	KAPPAD (62)	KAPPAD (63)
0.320370	0.743091	0.472660	0.645228	0.860143	0.395499	0.777521	0.624591	0.860984

KAPPAD (64)	KAPPAD (65)	KAPPAD (66)	KAPPAD (67)	KAPPAD (68)	KAPPAD (69)	KAPPAD (70)	KAPPAD (71)	KAPPAD (72)
0.744669	1.000000	1.000000	1.000000	1.000000	0.998078	0.999756	0.997765	0.999162

KAPPAD (73)	KAPPAD (74)	KAPPAD (75)	KAPPAD (76)	KAPPAD (77)	KAPPAD (78)	KAPPAD (79)	KAPPAD (80)	KAPPAD (81)
0.918884	0.984260	0.999793	0.998535	1.000000	0.984790	0.945510	1.000000	0.380066

KAPPAD (82)	KAPPAD (83)	KAPPAD (84)	KAPPAD (85)	KAPPAD (86)	KAPPAD (87)	KAPPAD (88)	KAPPAD (89)	KAPPAD (90)
0.741542	0.929397	0.950829	0.911481	0.995332	0.999990	0.989865	0.996579	0.989494

KAPPAD (91)	KAPPAD (92)	KAPPAD (93)	KAPPAD (94)	KAPPAD (95)	KAPPAD (96)	KAPPAD (97)	KAPPAD (98)	KAPPAD (99)
1.000000	0.998748	0.972988	0.999994	1.000000	1.000000	0.996019	0.986998	0.987244

KAPPAD (100)	KAPPAD (101)	KAPPAD (102)	KAPPAD (103)	KAPPAD (104)	KAPPAD (105)	KAPPAD (106)	KAPPAD (107)
0.999823	0.986842	0.991835	0.988425	0.911771	0.999853	0.991075	1.000000

Table 6: Parameter Values (continued)
***BETA* (*i, j*) = β_j^i; *i* = 1 (*capital*), 2 (*labor*), *j* = 1, 2, …, 107**

BETA (11)	BETA (21)	BETA (12)	BETA (22)	BETA (13)	BETA (23)	BETA (14)	BETA (24)	BETA (15)
0.873705	0.126295	0.795029	0.204971	0.377652	0.622348	0.789692	0.210308	0.619845

BETA (25)	BETA (16)	BETA (26)	BETA (17)	BETA (27)	BETA (18)	BETA (28)	BETA (19)	BETA (29)
0.380155	0.425395	0.574605	0.348301	0.651699	0.385843	0.614157	0.430065	0.569935

BETA (110)	BETA (210)	BETA (111)	BETA (211)	BETA (112)	BETA (212)	BETA (113)	BETA (213)	BETA (114)
0.626244	0.373756	0.708251	0.291749	0.800717	0.199283	0.153092	0.846908	0.171611

BETA (214)	BETA (115)	BETA (215)	BETA (116)	BETA (216)	BETA (117)	BETA (217)	BETA (118)	BETA (218)
0.828389	0.398741	0.601259	0.186805	0.813195	0.583062	0.416938	0.275022	0.724978

BETA (119)	BETA (219)	BETA (120)	BETA (220)	BETA (121)	BETA (221)	BETA (122)	BETA (222)	BETA (123)
0.332154	0.667846	0.485737	0.514263	0.580994	0.419006	0.747311	0.252689	0.474172

BETA (223)	BETA (124)	BETA (224)	BETA (125)	BETA (225)	BETA (126)	BETA (226)	BETA (127)	BETA (227)
0.525828	0.462937	0.537063	0.334964	0.665036	0.578962	0.421038	0.413419	0.586581

BETA (128)	BETA (228)	BETA (129)	BETA (229)	BETA (130)	BETA (230)	BETA (131)	BETA (231)	BETA (132)
0.508695	0.491305	0.627415	0.372585	0.207273	0.792727	0.338813	0.661187	0.353164

BETA (232)	BETA (133)	BETA (233)	BETA (134)	BETA (234)	BETA (135)	BETA (235)	BETA (136)	BETA (236)
0.646836	0.480519	0.519481	0.378114	0.621886	0.317792	0.682208	0.394347	0.605653

BETA (137)	BETA (237)	BETA (138)	BETA (238)	BETA (139)	BETA (239)	BETA (140)	BETA (240)	BETA (141)
0.544357	0.455643	0.622426	0.377574	0.414574	0.585426	0.227985	0.772015	0.450008

BETA (241)	BETA (142)	BETA (242)	BETA (143)	BETA (243)	BETA (144)	BETA (244)	BETA (145)	BETA (245)
0.549992	0.324905	0.675095	0.238573	0.761427	0.205336	0.794664	0.297464	0.702536

BETA (146)	BETA (246)	BETA (147)	BETA (247)	BETA (148)	BETA (248)	BETA (149)	BETA (249)	BETA (150)
0.316831	0.683169	0.217319	0.782681	0.405635	0.594365	0.166071	0.833929	0.230711

BETA (250)	BETA (151)	BETA (251)	BETA (152)	BETA (252)	BETA (153)	BETA (253)	BETA (154)	BETA (254)
0.769289	0.433889	0.566111	0.445027	0.554973	0.259323	0.740677	0.368190	0.631810

BETA (155)	BETA (255)	BETA (156)	BETA (256)	BETA (157)	BETA (257)	BETA (158)	BETA (258)	BETA (159)
0.284373	0.715627	0.203093	0.796907	0.341356	0.658644	0.331808	0.668192	0.219457

BETA (259)	BETA (160)	BETA (260)	BETA (161)	BETA (261)	BETA (162)	BETA (262)	BETA (163)	BETA (263)
0.780543	0.338121	0.661879	0.329092	0.670908	0.276800	0.723200	0.307300	0.692700

BETA (164)	BETA (264)	BETA (165)	BETA (265)	BETA (166)	BETA (266)	BETA (167)	BETA (267)	BETA (168)
0.136513	0.863487	0.126572	0.873428	0.117856	0.882144	0.192903	0.807097	0.170729

BETA (268)	BETA (169)	BETA (269)	BETA (170)	BETA (270)	BETA (171)	BETA (271)	BETA (172)	BETA (272)
0.829271	0.688454	0.311546	0.471007	0.528993	0.659005	0.340995	0.200339	0.799661

BETA (173)	BETA (273)	BETA (174)	BETA (274)	BETA (175)	BETA (275)	BETA (176)	BETA (276)	BETA (177)
0.356460	0.643540	0.507732	0.492268	0.693330	0.306670	0.933852	0.066148	1.000000

BETA (277)	BETA (178)	BETA (278)	BETA (179)	BETA (279)	BETA (180)	BETA (280)	BETA (181)	BETA (281)
0.000000	0.566626	0.433374	0.112466	0.887534	0.000000	0.000000	0.396298	0.603702

BETA (182)	BETA (282)	BETA (183)	BETA (283)	BETA (184)	BETA (284)	BETA (185)	BETA (285)	BETA (186)
0.371840	0.628160	0.158816	0.841184	0.299568	0.700432	0.511584	0.488416	0.514368

BETA (286)	BETA (187)	BETA (287)	BETA (188)	BETA (288)	BETA (189)	BETA (289)	BETA (190)	BETA (290)
0.485632	0.523790	0.476210	0.356325	0.643675	0.474659	0.525341	0.309968	0.690032

BETA (191)	BETA (291)	BETA (192)	BETA (292)	BETA (193)	BETA (293)	BETA (194)	BETA (294)	BETA (195)
0.408598	0.591402	0.162627	0.837373	0.170565	0.829435	0.219657	0.780343	0.060451

BETA (295)	BETA (196)	BETA (296)	BETA (197)	BETA (297)	BETA (198)	BETA (298)	BETA (199)	BETA (299)
0.939549	0.174570	0.825430	0.114685	0.885315	0.435003	0.564997	0.810139	0.189861

BETA (1100)	BETA (2100)	BETA (1101)	BETA (2101)	BETA (1102)	BETA (2102)	BETA (1103)	BETA (2103)	BETA (1104)
0.169821	0.830179	0.276521	0.723479	0.565949	0.434051	0.278234	0.721766	0.365413

BETA (2104)	BETA (1105)	BETA (2105)	BETA (1106)	BETA (2106)	BETA (1107)	BETA (2107)
0.634587	0.456596	0.543404	0.347163	0.652837	0.000000	0.000000