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Abstract

This paper examines the effect of the reduction of an import tariff on the Japanese fishery industry by using a computable general equilibrium model.
Being against our common knowledge, our simulations with very realistic conditions show that both of the domestic consumers and the domestic fishery industry can gain by the subsidy (a negative tariff rate) policy, and also that income of the fishery industry would increase by trade liberalization when all possible linkages of economic activities are taken into account within a general equilibrium framework. Our results suggest a possible situation that there is no political conflict between the domestic fishery industry and the domestic consumer.

Key Words: Fishery Industry, Japan, Trade Liberalization, Import Tariff, Computable General Equilibrium Model, Simulation

JEL Classification: C68, F17, H20, Q17

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1 Introduction

This paper examines the effect of trade liberalization of the Japanese fishery industry on the domestic consumers as well as on the domestic fishery industry by using a computable general equilibrium (CGE) model.

As has being estimated that fishery products account for 40% of the animal protein intake by the Japanese, Japan is the largest country in terms of the amount of imports of fishery products both in volume and in value over the world. Japan imports 14% of the total amount of imports of fishery products of the world in volume, and 22% in value. China has been the largest country to export fishery products to Japan since 1998, and other top exporting countries include Taiwan, Pacific Island Countries (PIC), and South Korea. Thus, the globalization of the market of fishery products depends on to what extent the Japanese fishery industry will be liberalized, and trade liberalization of the fishery industry of Japan does matter not only for Japan, but also for other Asian countries.

It has commonly been recognized that imposing a tariff on imported goods protects the domestic industry of the goods, and also that the import tariff induces welfare loss of domestic consumers. Thus, it seems that there is a trade-off between the protection of the domestic producers and the improvement of welfare of domestic consumers, and the trade-off often appears when economic issues are discussed politically. In the 'conventional' discussion, the domestic industry would suffer from trade liberalization, but the domestic consumers enjoy it through a decrease in the price of the good, and there is always a political conflict in terms of trade liberalization. In fact, imports of fishery products to Japan have still been subject to either an ad valorem tariff, or a differential duty by the Japanese government, while trade liberalization is recognized as being beneficial for domestic consumers.

This paper numerically investigates the effect of the reduction of the tariff imposed on the Japanese fishery industry on domestic consumers as well as on the domestic fishery industry within a general equilibrium framework. This paper uses the latest Input-Output table of Japan in order to make the simulation analysis realistic. By using the actual input-output table of Japan, the paper has successfully realized the real economy within the model.

One of the most striking results obtained in this paper is that both of the domestic consumers and the domestic fishery industry can gain by the subsidy (a negative tariff rate) policy, and thus there is a range of the tariff rate at which both income of the fishery industry and welfare of domestic consumers are improved. Another striking result is that income of the fishery industry would increase by trade liberalization when all possible linkages of economic activities are taken into account by a general equilibrium framework, where the budget constraint of the government is explicitly considered to balance the decreased budget constraint caused by the reduction of the tariff rate. Once the government decides to eliminate trade obstacles caused by an import tariff on the Japanese fishery industry, then complete trade liberalization is not enough and the government has to implement a subsidy policy with a negative tariff rate to make domestic consumers better off. The estimated critical value of the subsidy rate with our very realistic parameter values is around 5%, and a subsidy policy with this rate would eventuate in the situation that there is no political conflict.

The paper is organized as follows. The next section briefly surveys the related literature, and Section 3 explains about our simulation analysis. Section 4 simulates several scenarios with results and evaluations, and Section 5 concludes our paper.

2 Related Literature

The effects of trade liberalization over Asian countries have been explored by several studies, which use a CGE model. For instance, Ando and Urata (2006) included ASEAN and other east Asian countries such as Japan, China, and South Korea in their CGE model, and they simulated the potential effects of FTAs on related countries. Ando and Urata (2006) also survyed the studies which analyzed the effect of FTAs with a CGE framework.

In terms of the effects of trade liberalization of the Japanese economy, there has also been several studies[1]. Fujiki (1998) and Taniguchi (2001)Taniguchi analyzed the effect of trade liberalization of the Japanese rice producing sector, where the impact of the GATT Uruguay Round Accord on the Japanese economy was their main concern. Fujiki (1998) estimated a very small negative effect of trade liberalization on the domestic rice industry by considering the characteristics of the Japanese rice producing farms, and he also concluded that the domestic consumers would gain from trade liberalization of the rice industry. Taniguchi (2001) used a CGE model to simulate the effect of trade liberalization of the rice producing industry, in which households consist of two sectors; farm households and non-farm households. The farm households are further divided into 3 categories, and Taniguchi (2001) considered the detailed properties of the rice producing farms in his CGE model. Taniguchi (2001) concluded that trade liberalization would be welfare-enhancing not only of the farm households but also of the non-farm households.

Pantzios and Taylor (1998) empirically evaluated a subset of Japanese agricultural policies during the 1970s and 1980s by using the Trade Restrictiveness Index, and they concluded that the Japanese agricultural polices related to rice and beef production played an important role in terms of the restriction on the Japanese agricultural imports during the period.

This paper focuses on the effect of trade liberalization of the Japanese fishery industry within a computabel general equilibrium framework. To our best knowledge, the effect of trade liberalization of the fishery industry has not been investigated, while it has been recognized that Japan is a large country in terms of the amount of imports of fishery products, and trade policies of the Japanese fishery industry would become more important in a rapidly globalizing economy. Thus, this paper parcularly separates the fishery sector from all other agricultural sectors, and numerically examines the effect of trade liberalization of the fishery industry. The data and model is now explained in detail.

[1]The literature on trade liberalization related to Japan consists of many studies. For instance, Mulgan (2008) recently discussed the Japan's FTA politics and agricultural trade liberalization.

3 Numerical Analysis

In order to obtain the numerical effects of the reduction of the tariff rate on domestic consumers as well as on the domestic fishery industry, this paper uses the latest Input-Output table of Japan within a general equilibrium framework, in order to make the simulation analysis realistic. By using the actual input-output table of Japan, the paper has successfully realized the real economy within the model. This paper employs the conventional static computable general equilibrium (CGE) model with the actual Input-Output table of Japan of year 2000. Note that parameter values in the model are calculated by using actual values, so that the calculated values of endogenous variables obtained within the model also become quite realistic.

3.1 Data

The latest Input-Output table of Japan of year 2000 with 104 different intermediate sectors has been used in order to construct the social accounting matrix. The SNA data has also been used to obtain the amount of private savings. In order to streamline our analysis on the Japanese fishery industry, it is assumed that the 104 different sectors are simply categorized into 3 different groups; the 'fishery', the 'other agricultural', and the 'all other' sectors. The fishery, other agricultural, and all other groups consist of 'fishery' sector (No. 5), sectors 1 to 4, and sectors 6 to 104 in the Input-Output table, respectively. Based on this simplification, the social accounting matrix (SAM) has been made, which is given by Table 1.

3.2 Model

The computable general equilibrium model of this paper employs the conventional static model[2]. The Japanese economy is assumed to consist of 3 different intermediate sectors,

[2]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

households, the government, and the investment firm sector. All firms consisting of 3 intermediate sectors are assumed to maximize their profit, and households are assumed to maximize their utility. For simplicity, 104 different sectors are assumed to be recognized into 3 intermediate sectors. The 3 intermediate sectors consist of the 'fishery' sector, 'other agricultural' sector, and 'all other' sector. The government is assumed to determine its tax revenue 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 level in equilibrium.

<Households>

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

$$U\left(X_1, X_2, X_3\right) = \prod_{i=1}^{3} X_i^{\alpha_i}, \tag{1}$$

where X_i denotes consumption of good i. $\sum_{i=1}^{3} \alpha_i = 1$ is assumed. i denotes each sector, and $i = 1 =$ the fishery sector, $i = 2 =$ other agricultural sector, and $i = 3 =$ all other sector are assumed. The parameter value of each α_i is determined by using the actual social accounting matrix, which is given in Table 3.

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

$$\sum_{i=1}^{3} p_i X_i = I\left(1 - \tau^I\right) - S^I,$$

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

equilibrium framework, see Auerbach and Kotlikoff (1987). Kato (1998), Kato (2002b), Kato (2002a), and Ihori, Kato, Kawade, and Bessho (2006) also apply the dyanamic model to several policies in Japan.

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

where the constant ratio, s^I, is given exogenously[3]. The value of s^I has been calculated by using the actual SAM. Then income is given by

$$I = r\overline{K} + w\overline{L},$$

where r and w denote the rental cost and the wage rate, respectively. $\overline{K}$ and $\overline{L}$ are endowments of capital and labour, respectively. Note that the amounts of $r\overline{K}$ and $w\overline{L}$ are both obtained from the actual social accounting matrix.

The first order conditions yield the demand functions such that:

$$X_i = X_i \left(p_i, Y; \alpha_i\right) = \frac{\alpha_i I \left(1 - \tau^I\right) \left(1 - s^I\right)}{p_i}, \;\; i = 1, 2, 3. \tag{2}$$

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

$$\alpha_i = \frac{p_i X_i}{I \left(1 - \tau^I\right) \left(1 - s^I\right)} = \frac{p_i X_i}{\left(1 - s^I\right) \left(1 - \tau^I\right) \left(r\overline{K} + w\overline{L}\right)}, \;\; i = 1, 2, 3,$$

where both the values of the denominator and the numerator can be obtained from the actual social accounting matrix.

<**Private Firms**>

Although each firm is assumed to make a decision over several different items, its multiple decisions are described by the tree structure. 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. This assumption simplifies a complicated decision over several items by each firm. Each step is also shown in Figure 1.

[3]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.

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 $X_{i,j}$ 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 in terms of 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 on 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. 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:

$$\pi_i = p_i^Y Y_i \left(K_i, L_i\right) - rK_i - wL_i, \tag{3}$$

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:

$$Y_i\left(K_i,L_i\right)=K_i^{\beta_{K,i}}L_i^{\beta_{L,i}},\ i=1,2,3, \tag{4}$$

where $\beta_{K,i}+\beta_{L,i}=1$ is assumed for all $i=1,2,3$. 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:

$$K_i=K_i\left(p_i^Y,r,w;\beta_{K,i},\beta_{L,i}\right)=\frac{\beta_{K,i}}{r}p_i^YY_i, \tag{5a}$$

$$L_i=L_i\left(p_i^Y,r,w;\beta_{K,i},\beta_{L,i}\right)=\frac{\beta_{L,i}}{w}p_i^YY_i,\ i=1,2,3. \tag{5b}$$

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

$$\beta_{K,i}=\frac{rK_i}{p_i^YY_i},$$
$$\beta_{L,i}=\frac{wL_i}{p_i^YY_i},\ i=1,2,3,$$

where rK_i,wL_i, and $p_i^YY_i$ can be obtained from the actual social accounting matrix.

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:

$$\underset{Y_i,X_{i,j}}{Max}\ \pi_i=p_i^ZZ_i-\left(p_i^YY_i-\sum_j^3p_j^XX_{i,j}\right),$$
$$st\quad Z_i=\min\left(\frac{X_{i,j}}{ax_{i,j}},\frac{Y_i}{ay_i}\right),\ i=1,2,3,$$

where $X_{i,j}$ and p_j^X denote intermediate good j used by firm i and 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. 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:

$$p_i^Z = p_i^Y ay_i + \sum_j^3 p_j^X ax_{i,j},\ i = 1, 2, 3.$$

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 goods is described as the the decomposition of Z_i ($i = 1, 2, 3$) into exported goods, E_i, and final domestic goods, D_i. Each firm is assumed to maximize its profit such that:

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

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 is the tax rate of a production tax imposed on the production of Z_i, and it is calculated by using the actual social accounting matrix. The decomposition is assumed to follow the Cobb-Douglas technology such that:

$$Z_i = E_i^{\kappa_i^e} D_i^{\kappa_{ii}^d},\ i = 1, 2, 3, \tag{7}$$

where $\kappa_i^d + \kappa_i^e = 1$ ($i = 1, 2, 3$) 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

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

$$D_i = D_i\left(p_i^e, p_i^d, p_i^Z; \tau_i^p, \kappa_i^d, \kappa_i^e\right) = \frac{\kappa_i^d\left(1+\tau_i^p\right)p_i^Z Z_i}{p_i^d},\ i = 1, 2, 3. \tag{8b}$$

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

$$\kappa_i^e = \frac{p_i^e E_i}{\left(1+\tau_i^p\right)p_i^Z Z_i},$$
$$\kappa_i^d = \frac{p_i^d D_i}{\left(1+\tau_i^p\right)p_i^Z Z_i},\ i = 1, 2, 3,$$

where $p_i^e E_i$, $p_i^d D_i$, $p_i^Z Z_i$ and $\tau_i^p p_i^Z Z_i$ can be obtained from the actual social accounting matrix.

Step 4: The Production of the final goods

Denote the final consumption goods by Q_i $(i = 1, 2, 3)$. 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:

$$Q_i = M_i^{\gamma_i^m} D_i^{\gamma_i^d},\ i = 1, 2, 3, \tag{9}$$

where $\gamma_i^m + \gamma_i^d = 1$ ($i = 1, 2, 3$) 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:

$$\pi_i = p_i^Q Q_i - \left(1+\tau_i^m\right)p_i^m M_i - p_i^d D_i,\ i = 1, 2, 3,$$

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. Then, the first order conditions yield

$$M_i = M_i\left(p_i^m, p_i^d, p_i^Q; \tau_i^m, \gamma_i^m, \gamma_i^d\right) = \frac{\gamma_i^m p_i^Q Q_i}{\left(1+\tau_i^m\right) p_i^m}, \tag{10a}$$

$$D_i = D_i\left(p_i^m, p_i^d, p_i^Q; \tau_i^m, \gamma_i^m, \gamma_i^d\right) = \frac{\gamma_i^d p_i^Q Q_i}{p_i^d}, \ \ i = 1, 2, 3. \tag{10b}$$

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

$$\gamma_i^m = \frac{\left(1+\tau_i^m\right) p_i^m M_i}{p_i^Q Q_i},$$
$$\gamma_i^d = \frac{p_i^d D_i}{p_i^Q Q_i}, \ \ i = 1, 2, 3,$$

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 Government>

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

$$\sum_{i=1}^{3} p_i^Q X_i^g + S^g = T^I + T^p + T^m,$$

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. The total government revenue, or the total tax revenue is given by:

$$T^I = \tau^I I = \tau^I \left(r\overline{K} + w\overline{L} \right),$$
$$T^p = \sum_{i=1}^{3} \tau_i^p \left(p_i^Z Z_i \right),$$
$$T^m = \sum_{i=1}^{3} \tau_i^m \left(p_i^m M_i \right),$$

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

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

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 markets, and three goods markets. In terms of factor markets, there are the labor market and the capital market. The equilibrium condition of each factor market is given by:

$$\overline{K} = \sum_{i=1}^{3} K_i,$$
$$\overline{L} = \sum_{i=1}^{3} L_i.$$

In terms of the market clearing condition of good i $(i = 1, 2, 3)$, a private investment sector is introduced in order to close the economy in this paper[4]. 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:

$$Q_i = X_i + X_i^g + X_i^s + \sum_{j}^{3} X_{i,j}, \ i = 1, 2, 3,$$

where the left hand side is the total supply, and the right hand side is the total demand for good i. Note that the budget constraint of the private investment sector is given by:

$$\sum_{i=1}^{3} p_i^Q X_i^s = S^g + S^I + S^f,$$

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[5]. 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

$$\sum_{i=1}^{3} p_i^{w,e} E_i + S^f = \sum_{i=1}^{3} p_i^{w,m} M_i,$$

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:

[4]This is also the conventional assumption in the literature.
[5]The FDI is assumed to be negiligible in this paper.

$$p_i^e = \varepsilon p_i^{w,e},$$
$$p_i^m = \varepsilon p_i^{w,m},\ i = 1, 2, 3,$$

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

4 Simulation Analysis

4.1 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 2 shows the calculated model values as well as the corresponding actual values in year 2000. Note that the tax rates shown in Table 2 have been calculated by using the actual amount of taxes collected, so that they can be interpreted as the average proportional tax rates. The calculated average tariff rate on the fishery industry is 8.956%. As shown in Table 2, the benchmark case has successfully been able to reproduce the real economy within the model.

Table 3 also shows the values of all parameters which resulted in the successful benchmark case. Since the benchmark case represents the actual Japanese economy, it is now used to compare the current Japanese economy with possible situations caused by the reduction of an import tariff on fishery products in the next section.

4.2 Simulations of Trade Liberalization

As Table 2 shows, the actual average tariff rate for the fishery industry is 8.956%. Note that this tariff rate has been obtained by dividing the total amount of the import tariff on the fishery industry by the total amount of the economic value of the fishery industry, so that the calculated tariff rate of 8.956% can be interpreted as the average tariff rate for the Japanese fishery industry. In this section, the effect of trade liberalization of the fishery industry, or the effect of the reduction of the tariff rate will be investigated. The effect of trade liberalization is simulated by decreasing the tariff rate from 8.956% to 0.0%, and the situation with the tariff rate of 0.0% is interpreted as complete trade liberalization of the fishery industry. Note that the change in the tariff rate results the change in the total amount of the government revenue, and thus the reduction of the tariff rate should be followed by the change in other government policy instruments in order to satisfy the budget constraint of the government. Since the reduction of the tariff rate implies a decrease in the government revenue, the key issue is how the government finances the decrease in the revenue.

The following scenarios simulate several cases. Scenarios are categorized into 3 different financing methods. The first method (Scenario 1) simply decreases the government expenditure to balance the decreased budget constraint of the government caused by the reduction of the tariff rate. in Scenario 1, two cases of different tariff rates are investigated. The second method (Scenario 2) increases the production tax rate to finance the decrease in the government revenue caused by the decrease in the tariff rate. The second method also explores two cases of different tariff rates. Since the production tax is imposed on all 3 different sectors, Scenario 2 is further divided into several cases depending on different production taxes. The third method (Scenario 3) increases the income tax rate. In Scenario 3, two cases of different tariff rates are also simulated. Thus the difference in the financing method comes from the difference in who initially pays the cost of trade liberalization in order to satisfy the budget constraint of the government. The difference in scenarios within the same group is found only in the tariff rate. In this paper, the following scenarios are investigated.

<Method 1: followed by a decrease in the government expenditure>

Scenario S1-1: The tariff rate is reduced from the current level (8.956%) to its half level (4.478%). This case can be called 'half trade liberalization'. A decrease in the government revenue caused by the tariff reduction is followed by a decrease in the government expenditure. The government is assumed to decease its consumption of each good proportionally in order to satisfy the decreased budget constraint.

Scenario S1-2: The tariff rate is reduced from the current level (8.956%) to 0.0%. This case can be called 'complete trade liberalization'. A decrease in the government revenue is followed by a decrease in the government expenditure, and the assumption is the same as **S1-1**.

Only the tariff rate is different between **S1-1** and **S1-2**, and the amount of the government expenditure is endogenized in order to satisfy the decreased budget constraint in Method 1.

<Method 2: followed by an increase in the production tax>

Scenario S2-1-: The tariff rate is reduced from the current level (8.956%) to its half level (4.478%). A decrease in the government revenue is followed by an increase in the production tax rate in order to maintain the budget constraint of the government. Note that the production tax is imposed on the supply side. Scenario **S2-1-1**, **S2-1-2**, and **S2-1-3** increase the production tax rate only of the fishery sector, other agricultural sector, and all other sector, respectively, and **S2-1-All** increases the production tax rate of all 3 sectors. Note that **S2-1-1** simulates the case where an import tariff is replaced with a production tax imposed on the fishery sector to conduct half trade liberalization of the fishery sector, and **S2-1-1** investigates the effect of a shift from a import tariff to a production tax in order to maintain the budget constraint of the government.

Scenario S2-2-: The tariff rate is reduced from the current level (8.956%) to 0.0. The financing method is the same as that of **S2-1-**. Scenario **S2-2-1**, **S2-2-2**, and **S2-2-3** increase the production tax rate only of the fishery sector, other agricultural sector, and all other sector, respectively, and **S2-2-All** increases the production tax rate of all 3 sectors.

Only the tariff rate is different between **S2-1-** and **S2-2-**, and the production tax rate is endogenized in order to satisfy the decreased budget constraint in Method 2.

<Method 3: followed by an increase in the income tax rate>

Scenario S3-1: The tariff rate is reduced from the current level (8.956%) to its half level (4.478%). A decrease in the government revenue is followed by an increase in the income tax rate. Note that the income tax is imposed on households, and thus on the demand side.

Scenario S3-2: The tariff rate is reduced from the current level (8.956%) to 0.0. The financing method is the same as that of **S3-1**.

The only tariff rate is different between **S3-1** and **S3-2**, and the income tax rate is endogenized in order to satisfy the decreased budget constraint in Method 3.

Method 1 (**S1-1** and **S1-2**) is the simplest case in which the government spending is modified to balance the decreased budget constraint. This method does not include any effect of the changes in other taxes, and it investigates the pure effect of the reduction of the import tariff rate on the economy. A decrease in the government spending simply changes resources available to the private sector, but it does not have any distortionary effect, since the amount of the government spending does not affect the private production function. However, the reduction of the import tariff rate followed by a decrease in the government spending would not be realistic. Method 2 (**S2-1-** and **S2-2-**) and Method 3 (**S3-1** and **S3-2**) then simulate more realistic cases.

It is usually argued that consumers gain benefits through trade liberalization, but domestic producers suffer from it. However, the following simulation results predict interesting situations.

4.3 Evaluation of the Simulation Results

In order to evaluate each simulation, a common indicator should be introduced apart from the effects on relevant economic variables. In this paper the equivalent variation is used in order to evaluate the effect of trade liberalization on the economy in welfare. The effect on the whole economy should be explored by the change in utility.

Table 4 shows the relative changes in relevant variables in each simulation, and the results are summarized as follows.

4.3.1 Direct effect on imports of the fishery industry, M_1

The reduction of the tariff rate for the fishery sector, trade liberalization of the fishery industry, has a direct effect on imports of the fishery sector. The rows of M in Table 4 show the effect of the reduction of the tariff rate. The comparison between **S1-1** and **S1-2** shows the pure effect of the reduction of the tariff rate without any other distortionary effects caused by changes in other tax rates. The value of imports of the fishery sector increases by 4.286% in half liberalization (**S1-1**) and by 8,956% in complete liberalization (**S1-2**). Both the value and the price of imports of the fishery sector increase in all cases (**S1-1** to **S3-2**), and the financing method does not matter while the difference in the increased value and price comes from the different financing method. In terms of the quantity of the fishery sector, the difference in the financing method matters. The quantity of imports of the fishery sector decreases except for the case where the production tax imposed on the other agricultural sector is used to balance the budget constraint (**S2-1-2** and **S2-2-2**).

4.3.2 Effect on the final goods of the fishery industry, Q_1

Since the imports of the fishery sector is stimulated by the reduction of the tariff rate for the fishery industry, Q_1, the final good, is expected to increase. Indeed, in Method 1 (**S1-1** and **S1-2**) both the value and the quantity of Q_1 slightly increase. Note that the government consumption of Q_1 decreases proportionally to balance the decreased budget constraint in Method 1, and an increase in Q_1 in equilibrium is rather small. When a decrease in the budget of the government is financed by other taxes, the direction of the effect of trade liberalization is different. If the government budget is maintained by an increase in the income tax rate (Method 3), then all of the value, the quantity and the price of Q_1 decrease, since an increase in the income tax rate reduces income of households, thus resulting in a decrease in consumption of Q_1 by households. When a decrease in the budget of the government is financed by an increase in the production tax rate (Method 2), then the effect on Q_1 is more complicated. If the production tax on the fishery industry ($i = 1$) is only used (**S2-1-1** and **S2-2-1**) to maintain the budget constraint, then both the value and the quantity of Q_1 decrease, although the imports of the fishery sector, M_1, increase. This is because an increase in the production tax rate for the fishery sector reduces the final domestic goods, D_1, and thus results in a decrease in Q_1. Note also that an increase in the production tax rate induces a decrease in exports, E_1 as well. However, if the production tax on the other agricultural sector ($i = 2$) is only used (**S2-1-2** and **S2-2-2**), then D_1 does not decrease[6], and thus both the value and the quantity of Q_1 increase by an increase in M_1. However, if the production tax on all other sector ($i = 3$) is used (**S2-1-3** and **S2-2-3**), the overall effect is more complicated. Note that the share of the all other sector ($i = 3$) is more than 98% as shown in Table 1, and the change in the behavior of the all other sector ($i = 3$) substantially affects the Japanese economy. First of all, an increase in the production tax rate for the all other sector ($i = 3$) reduces the quantity of the final domestic goods of the all other sector ($i = 3$), D_3. The decrease in D_3 then results in a large decrease in both capital and labor income of the all other sector ($i = 3$). Since the share of the all other sector ($i = 3$) is quite large, the large decrease in income of the all other sector($i = 3$) substantially yields a negative effect on the Japanese economy, thus resulting in a decrease in Q_1. This overall linkage among different sectors can only be captured by the general equilibrium framework as shown in Table 4.

[6] As shown in Table 4, D_2 decreases by an increase in the production tax rate for the other agricultural sector ($i = 2$).

4.3.3 Effect on income of the fishery industry

Any trade liberalization followed by an increase in other taxes to balance the budget constraint of the government results in a decrease in income of the fishery sector except for the case (**S2-1-2** and **S2-2-2**) where the decreased budget constraint is financed by an increase in the production tax rate for the other agricultural sector ($i = 2$). When Method 3 (**S3-1** and **S3-2**) is used, disposal income of households decreases, thus resulting in a decrease in demand for Q_1. Hence, the total economic value of supply of Q_1 decreases, and income of the fishery sector also decreases. Method 2 also results in a decrease in income of the fishery industry except for **S2-1-2** and **S2-2-2.** These predicted situations are similar to the political debate that the fishery industry would suffer from trade liberalization. However, trade liberalization by Method 1 (**S1-1** and **S1-2)**, **S2-1-2,** or **S2-2-2** results in an increase in income of the fishery industry. The comparison between **S1-1** and **S1-2** or between **S2-1-2** and **S2-2-2** shows that more trade liberalization increases income of the fishery sector. In particular the comparison between **S1-1** and **S1-2** shows the effect of trade liberalization without further distortionary effect by changes in other taxes. An increase in Q_1 results in an increase in income. When the production tax on the other agricultural sector ($i = 2$) is used, income of the fishery industry also increases. This is because the fishery sector does not need pay a more production tax, but the other agricultural sector ($i = 2$) does. Indeed, income of the other agricultural sector ($i = 2$) decreases in **S2-1-2** and **S2-2-2**. Furthermore, when the production tax on all other sector ($i = 3$) is only used, income of the fishery industry also decreases. Since the share of the all other sector ($i = 3$) is more than 98%, the negative effect on the all other sector ($i = 3$) also results in a decrease in income of the fishery industry as well.

Note that the benchmark model has successfully reproduced the actual Japanese economy as shown in Table 2, and it can be predicted that the Japanese fishery industry does necessarily not suffer from trade liberalization, depending on the different financing method in association with the reduction of the import tariff on the fishery industry.

4.3.4 Effect on other sectors

One of the most distinctive features of the general equilibrium framework is that the model can capture the interaction among all economic agents in an economy. Table 4 shows several interesting results in terms of the effect of trade liberalization of the fishery sector on other sectors. In particular, income of other sectors also decreases by trade liberalization of the fishery industry. When trade liberalization of the fishery industry is followed by a decrease in government consumption, the all other sector ($i = 3$) suffers from the trade liberalization. This is because the amount of Q_3 in equilibrium decreases, thus resulting in a decrease in income of the all other sector ($i = 3$). Furthermore, since the size of the all other sector ($i = 3$) is quite large, an increase in the production tax on the all other sector ($i = 3$) reduces income of all sectors ($i = 1, 2, 3$). The same situation also happens when the income tax on households is used, since a decrease in disposal income of households results in a decrease in demand. These result imply that the interaction among different sectors is important, and also that the financing method should carefully be chosen to balance the budget of the government, since trade liberalization of a sector affects not only the sector but also other sectors through several channels of an economy.

4.3.5 Effect on welfare

The previous section explored the effect on income of each sector individually, and the overall effect of trade liberalization on the Japanese economy should be measured by welfare. In particular the effect on consumers is important. This section numerically examines the conventional political debate that consumers gain benefits from trade liberalization. Table 4 shows the equivalent variation. All values of the equivalent variation show negative values, and thus consumers are worse off in all simulated cases of trade liberalization. This surprising result can be explained as follows. Trade liberalization cannot be conducted without satisfying the budget constraint of the government. When trade liberalization is conducted, there are basically two solutions; a decrease in the government expenditure, or an increase in the government revenue. Method 1 corresponds to the former solution by the reduction of consumption by the government. Method 2 and 3 correspond to the latter solution in which either the production tax or the income tax is used to maintain the budget constraint. The values of EV in Table 4 show that Method 1 is the best, but Method 3 is the worst in terms of welfare. However, even Method 1 makes consumers worse off. This is because a relatively large decrease in consumption by the government in Method 1 reduces income of all other sector ($i = 3$), which share in production is more than 98%, thus resulting in a large decrease in income at the aggregate level as well. Then the amount of resources available to the economy decreases, and consumers are worse off. The negative effect of a decrease in the amount of resources available to the economy by trade liberalization becomes stronger as the degree of trade liberalization becomes larger. When the income tax on households is used, the magnitude of the negative effect becomes the largest, and the EV of **S3-2** becomes the smallest.

It seems that the conventional political debate sometimes does not take into account the aspect of the budget constraint of the government. Trade liberalization conducted by the reduction of the import tariff rate should be followed by a decrease in the government expenditure or by an increase in the government revenue by alternative methods, in order to satisfy the budget constraint of the government. If the aspect of the budget constraint of the government is considered explicitly, then it is predicted with very realistic parameter values that consumers in Japan would suffer from trade liberalization.

4.4 Different Import Tariff Policy

The result of the effect on welfare suggests different import tariff policies to improve welfare. The several tariff policies with different tariff rates are now simulated. In the following simulations Method 1 is only used to rule out the distortionary effect of changes in other taxes, and thus the amount of government consumption is only adjusted to balance the modified budget constraint caused by changes in the tariff rate. In this section subsidies to the fishery industry are also taken into account, and negative values of the tariff rate are considered as the provision of subsidies to the fishery sector. A further increase in the tariff rate from the current level is also simulated.

The results are shown in Figure 2 to 4. the effects on welfare as well as on income are surprisingly striking. First of all, as the tariff rate decreases from the current level (8.9561%), the welfare level keeps decreasing until the tariff rate reaches a half of the current level, which is 4.4780%. Then welfare starts to increase, and the subsidy rate to have the same level of welfare as the current level is around 5% (the tariff rate is around -5%). This implies that complete liberalization is not enough to maintain the same level of welfare as the current level, but the government has to subsidize the fishery industry once it starts trade liberalization. The reason for this surprising result can be given as follows. As shown in Table 4, trade liberalization followed by a decrease in government consumption result in a decrease in income of the all other sector ($i = 3$), thus resulting in a decrease in the total amount of income. Until the tariff rate becomes half, this effect is greater than a positive effect to stimulate production of the fishery industry. Once the tariff rate reaches its half of the current level, then the positive effect becomes larger than the negative effect, and welfare starts to increase. Consumers suffer from trade liberalization until the subsidy rate reaches around 5%. Furthermore, consumers are better off as the tariff rate increases from the current level until the tariff rate reaches a certain level. The critical level is 11.64%, which is as 1.3 much as the current level. When the tariff rate keeps increasing beyond the critical level, then welfare starts to decrease. When the tariff rate increases, the government revenue increases, and thus the total amount of govern consumption also increases. This also results in an increase in the total amount of income available to households, and consumer are better off. However, if the tariff rate increases beyond the critical level, then this positive effect relatively becomes smaller, thus resulting in a decrease in welfare.

On the other hand, the effect on income is stable as shown in Figure 3 and 4. However, against our conventional knowledge and the political debate, income of the fishery industry becomes smaller when the tariff rate increases. Hence, there is a range of the tariff rate (subsidy rate) which results in both of the domestic consumers and the domestic fishery industry being better off. In fact a higher subsidy rate over 5% would expect to make both of them better off. However, note that the simulated case in this section assumes that the government decreases its consumption to balance its budget constraint. In practice It would be difficult to cut its consumption easily. Furthermore, in all of our simulations, consumption of the government is not assumed to contribute to private production at all, and the model cannot capture a negative aspect of a decrease in the government expenditure. If this negative effect is taken into account, the magnitude of this striking result might be smaller. However, as long as our very realistic parameter values are used in simulations, it would be possible to conclude that not only consumers but also the fishery industry are better off by a subsidy policy.

5 Concluding Remarks

This paper has examined the effect of trade liberalization of the Japanese fishery industry on the domestic consumers as well as on the domestic fishery industry by using a computable general equilibrium (CGE) model. The latest available data has been used to obtain a very realistic benchmark model which can successfully reproduce the real Japanese economy.

Several simulations have been conducted with our very realistic parameter values, and several striking results have been obtained. In particular one of the most striking results obtained in this paper is that both of the domestic consumers and the domestic fishery industry can gain by the subsidy (a negative tariff rate) policy, and thus there is a range of the tariff rate at which both income of the fishery industry and welfare of domestic consumers are improved. Another striking result is that income of the fishery industry would increase by trade liberalization when all possible linkages of economic activities are taken into account by a general equilibrium framework. Our general equilibrium framework has explicitly considered the budget constraint of the government to balance the decreased budget constraint caused by the reduction of the tariff rate. Furthermore, once the government decides to eliminate trade obstacles caused by an import tariff on the Japanese fishery industry, then complete trade liberalization is not enough and the government has to implement a subsidy policy with a negative tariff rate to make domestic consumers better off. The estimated critical value of the subsidy rate with our very realistic parameter values is around 5%, and a subsidy policy with this rate would eventuate in the situation that there is no political conflict.

Our simulation model has not incorporated other realistic aspects such as a positive effect of government consumption to stimulate the private sector through an expansion of public investments on public capital. However, by considering the effect of trade liberalization within a computable general equilibrium framework, it has evaluated the effect of trade liberalization of the Japanese fishery industry numerically.

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Table 1: Social Accounting Matrix of year 2000

unit: 1million Japanese yen

		production			**factors**		**tax**		**final consum**			**foreign**	**total**
		fishery	Other agriculture	All other	capital	labour	production	tariff	households	government	investment	trade	
production	Fishery	93568	0	1680096					413127	0	37110	57080	2280981
	Other agriculture	1172	1463729	8244588					3552800	0	930088	14938	14207315
	All other	665364	4071022	423185029					296195470	85706217	129321540	57414699	996559341
factors	Capital	630372	5537580	183705829									189873781
	labour	438299	934351	293387683									294760333
tax	production	98337	435895	34313546									34847778
	tariff	29088	115390	3691458									3835936
final consum	households				189873781	294760333							484634114
	government						34847778	3835936	155729317				194413031
	investment								28743400	108706814		-7161476	130288738
foreign	trade	324781	1649348	48351112									50325241
total		2280981	14207315	996559341	189873781	294760333	34847778	3835936	484634114	194413031	130288738	50325241	

	Fishery	Other agriculture	All other
ratio in production	0.23%	1.40%	98.37%

Figure 1: Tree Structure of Production

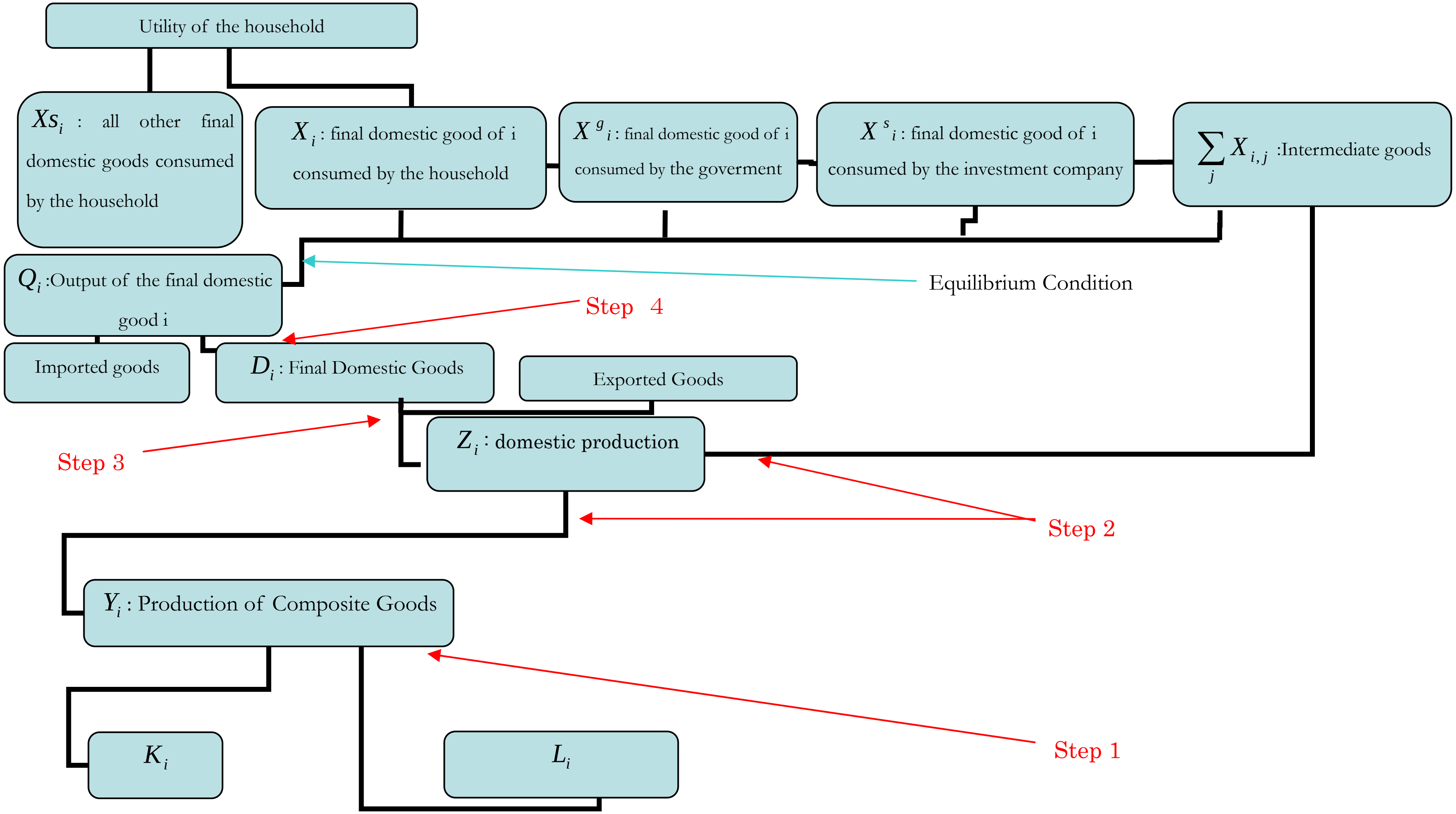

Table 2: Economic Values of the Benchmark Model

Unit: 1 million Japanese yen

	private consumption actual	model	government consumption actual	model	The amount of Q (final goods) actual (value)	model (value)	model quantity	model price
Fishery	413127.000	413127.000	0.001	0.001	2223901.001	2223900.985	2790710.732	0.797
Other agriculture	3552800.000	3552800.000	0.001	0.001	14192377.001	14192376.983	22039909.391	0.644
All other	296195470.000	296195470.000	85706217.000	85706216.998	939144642.000	939144642.000	1080261972.729	0.869

	The amount of D (domestic goods) actual (value)	model (value)	model quantity	model price	The amount of M (imported goods) actual (value)	model (value)	model quantity	model price
Fishery	1870032.000	1870031.987	3142506.113	0.595	324781.000	324780.998	1490175.584	0.218
Other agriculture	12427639.000	12427638.984	22234063.299	0.559	1649348.000	1649347.998	20719812.931	0.080
All other	887102072.000	887102072.000	1306222630.858	0.679	48351112.000	48351112.000	42409325.067	1.140

	The amount of E (exported goods) actual (value)	model (value)	model quantity	model price	The amount of Y (composite goods) actual (value)	model (value)	model quantity	model price
Fishery	57080.000	57080.000	57080.000	1.000	1068671.000	1068671.000	2606774.600	0.410
Other agriculture	14938.000	14938.000	14938.000	1.000	6471931.000	6471931.000	41679135.474	0.155
All other	57414699.000	57414699.000	57414699.000	1.000	477093512.000	477093512.000	682104409.938	0.699

Table 2(continued): Economic Values of the Benchmark Model

Unit: 1 million Japanese yen

	capital income		labor income	
	actual	model	actual	model
Fishery	630372.000	630372.000	438299.000	438299.000
Other agriculture	5537580.000	5537580.000	934351.000	934351.000
All other	183705829.000	183705829.000	293387683.000	293387683.000

The amount of taxes	actual (value)	model (value)
Fishery	155729317.000	155729317.000
Other agriculture	34847778.000	34847778.000
All other	3835936.000	3835936.000

savings	actual (value)	model (value)
private	28743400.000	28743400.000
government	108706814.000	108706814.000
foreign	-7161476.000	-7161476.004

	production tax rate (%)	tariff rate (%)
Fishery	5.377	8.956
Other agriculture	3.630	6.996
All other	3.770	7.635

	income tax rate (%)
household	32.13

Table 3: Parameter Values

	α_1	α_2	α_3	β_{K1}	β_{K2}	β_{K3}	β_{L1}	β_{L2}	β_{L3}	ay_1	ay_2	ay_3
Values	0.0013763	0.0118362	0.987873	0.58986	0.85563	0.38505	0.41013	0.14436	0.61494	0.58436	0.53902	0.52416

	κ_1^e	κ_2^e	κ_4^e	κ_1^d	κ_2^d	κ_4^d	γ_1^m	γ_2^m	γ_1^m	γ_1^d	γ_2^d	γ_4^d
Values	0.029619	0.012005	0.060787	0.97038	0.99879	0.93921	0.15912	0.12434	0.05541	0.84087	0.87565	0.94458

	ax_{11}	ax_{12}	ax_{13}	ax_{21}	ax_{22}	ax_{23}	ax_{31}	ax_{32}	ax_{33}	s^I	s^g
Values	0.05116	0.00000	0.00184	0.00064	0.12190	0.00905	0.36383	0.33906	0.46493	0.08739	0.55915

Table 4: Relative Changes in value from the current level

		S1-1	S1-2	S2-1-1	S2-1-2	S2-1-3	S2-1-ALL	S2-2-1	S2-2-2	S2-2-3	S2-2-ALL	S3-1	S3-2
private consumption													
Of	fishery	-0.000007%	-0.000007%	-0.001599%	-0.001494%	-0.001496%	-0.001496%	-0.003312%	-0.003117%	-0.003119%	-0.003119%	-0.004740%	-0.009897%
	non-agricultural	-0.000007%	-0.000007%	-0.001599%	-0.001494%	-0.001496%	-0.001496%	-0.003312%	-0.003117%	-0.003119%	-0.003119%	-0.004740%	-0.009897%
	all other	-0.000007%	-0.000007%	-0.001599%	-0.001494%	-0.001496%	-0.001496%	-0.003312%	-0.003117%	-0.003119%	-0.003119%	-0.004740%	-0.009897%
government consumption													
of	fishery	-0.007167%	-0.014969%	-0.001565%	-0.001328%	-0.001336%	-0.001336%	-0.003358%	-0.002790%	-0.002786%	-0.002786%	-0.000090%	-0.000183%
	non-agricultural	-0.007167%	-0.014969%	-0.001565%	-0.001328%	-0.001336%	-0.001336%	-0.003358%	-0.002790%	-0.002786%	-0.002786%	-0.000090%	-0.000183%
	all other	-0.007167%	-0.014969%	-0.001565%	-0.001328%	-0.001337%	-0.001336%	-0.003358%	-0.002790%	-0.002786%	-0.002786%	-0.000090%	-0.000183%

Table 4 (Continued): Relative Changes from the current level

		S1-1			S1-2			S2-1-1			S2-1-2			S2-1-3			S2-1-ALL		
		value	quantity	price	value	quantity	price	value	quantity	price	value	quantity	price	value	quantity	price	value	quantity	price
Q	Fishery	0.000036%	0.000023%	0.000013%	0.000122%	0.000077%	0.000044%	-0.031445%	-0.475984%	0.446665%	0.000064%	0.000041%	0.000023%	-0.001249%	-0.000792%	-0.000456%	-0.001291%	-0.001726%	0.000435%
	Other agriculture	0.000333%	0.000282%	0.000051%	0.000705%	0.000596%	0.000108%	0.000280%	0.000237%	0.000043%	-0.012379%	-0.105057%	0.092775%	-0.000612%	-0.000518%	-0.000094%	-0.000763%	-0.001876%	0.001113%
	All other	-0.000011%	-0.000006%	-0.000005%	-0.000017%	-0.000009%	-0.000007%	0.000190%	0.000108%	0.000083%	0.000299%	0.000169%	0.000130%	0.000098%	-0.000777%	0.000875%	0.000101%	-0.000763%	0.000864%
D	Fishery	0.000036%	0.000022%	0.000014%	0.000122%	0.000076%	0.000046%	-0.031445%	-0.489521%	0.460330%	0.000064%	0.000040%	0.000024%	-0.001249%	-0.000779%	-0.000470%	-0.001291%	-0.001739%	0.000448%
	Other agriculture	0.000333%	0.000282%	0.000051%	0.000705%	0.000596%	0.000108%	0.000280%	0.000237%	0.000043%	-0.012379%	-0.105168%	0.092887%	-0.000612%	-0.000518%	-0.000094%	-0.000763%	-0.001877%	0.001114%
	All other	-0.000011%	-0.000006%	-0.000005%	-0.000017%	-0.000009%	-0.000008%	0.000190%	0.000102%	0.000088%	0.000299%	0.000160%	0.000138%	0.000098%	-0.000834%	0.000932%	0.000101%	-0.000819%	0.000920%
M	Fishery	4.286194%	0.000025%	4.286168%	8.956322%	0.000084%	8.956230%	4.253363%	-0.404412%	4.676689%	4.286223%	0.000044%	4.286177%	4.284854%	-0.000866%	4.285757%	4.284810%	-0.001656%	4.286537%
	Other agriculture	0.000333%	0.000282%	0.000051%	0.000705%	0.000597%	0.000107%	0.000280%	0.000237%	0.000043%	-0.012379%	-0.104273%	0.091990%	-0.000612%	-0.000519%	-0.000093%	-0.000763%	-0.001867%	0.001104%
	All other	-0.000011%	-0.000012%	0.000001%	-0.000017%	-0.000018%	0.000001%	0.000190%	0.000199%	-0.000009%	0.000299%	0.000312%	-0.000013%	0.000098%	0.000188%	-0.000090%	0.000101%	0.000191%	-0.000089%
E	Fishery	0.000036%	0.000036%	0.000000%	0.000122%	0.000122%	0.000000%	-0.031445%	-0.031445%	0.000000%	0.000064%	0.000064%	0.000000%	-0.001249%	-0.001249%	0.000000%	-0.001291%	-0.001291%	0.000000%
	Other agriculture	0.000333%	0.000333%	0.000000%	0.000705%	0.000705%	0.000000%	0.000280%	0.000280%	0.000000%	-0.012379%	-0.012379%	0.000000%	-0.000612%	-0.000612%	0.000000%	-0.000763%	-0.000763%	0.000000%
	All other	-0.000011%	-0.000011%	0.000000%	-0.000017%	-0.000017%	0.000000%	0.000190%	0.000190%	0.000000%	0.000299%	0.000299%	0.000000%	0.000098%	0.000098%	0.000000%	0.000101%	0.000101%	0.000000%
Y	Fishery	0.000036%	0.000000%	0.000036%	0.000122%	0.000000%	0.000122%	-0.748396%	0.000000%	-0.748396%	0.000064%	0.000000%	0.000064%	-0.001249%	0.000000%	-0.001249%	-0.002721%	0.000000%	-0.002721%
	Other agriculture	0.000333%	0.000000%	0.000333%	0.000705%	0.000000%	0.000705%	0.000280%	0.000000%	0.000280%	-0.124128%	0.000000%	-0.124128%	-0.000612%	0.000000%	-0.000612%	-0.002217%	0.000000%	-0.002217%
	All other	-0.000011%	0.000000%	-0.000011%	-0.000017%	0.000000%	-0.000017%	0.000190%	0.000000%	0.000190%	0.000299%	0.000000%	0.000299%	-0.001376%	0.000000%	-0.001376%	-0.001351%	0.000000%	-0.001351%

Table 4 (Continued): Relative Changes from the current level

		S2-2-1			S2-2-2			S2-2-3			S2-2-ALL			S3-1			S3-2		
		value	quantity	price	value	quantity	price	value	quantity	price	value	quantity	price	value	quantity	price	value	quantity	price
Q	Fishery	-0.065218%	-0.989508%	0.933527%	0.000186%	0.000118%	0.000068%	-0.002556%	-0.001622%	-0.000934%	-0.002649%	-0.003576%	0.000926%	-0.000837%	-0.000531%	-0.000306%	-0.001704%	-0.001081%	-0.000623%
	Other agriculture	0.000596%	0.000505%	0.000092%	-0.025839%	-0.219274%	0.193860%	-0.001271%	-0.001076%	-0.000195%	-0.001587%	-0.003914%	0.002327%	-0.000604%	-0.000511%	-0.000093%	-0.001253%	-0.001061%	-0.000193%
	All other	0.000397%	0.000224%	0.000173%	0.000624%	0.000353%	0.000272%	0.000212%	-0.001620%	0.001832%	0.000218%	-0.001590%	0.001808%	-0.000084%	-0.000047%	-0.000036%	-0.000168%	-0.000095%	-0.000073%
D	Fishery	-0.065218%	-1.017585%	0.962159%	0.000186%	0.000116%	0.000070%	-0.002556%	-0.001593%	-0.000963%	-0.002649%	-0.003604%	0.000955%	-0.000837%	-0.000522%	-0.000315%	-0.001704%	-0.001062%	-0.000642%
	Other agriculture	0.000596%	0.000505%	0.000092%	-0.025839%	-0.219506%	0.194093%	-0.001271%	-0.001076%	-0.000195%	-0.001587%	-0.003917%	0.002330%	-0.000604%	-0.000511%	-0.000093%	-0.001253%	-0.001061%	-0.000193%
	All other	0.000397%	0.000213%	0.000184%	0.000624%	0.000335%	0.000289%	0.000212%	-0.001738%	0.001950%	0.000218%	-0.001707%	0.001925%	-0.000084%	-0.000045%	-0.000039%	-0.000168%	-0.000090%	-0.000078%
M	Fishery	8.885130%	-0.840998%	9.808618%	8.956392%	0.000129%	8.956251%	8.953404%	-0.001773%	8.955335%	8.953302%	-0.003426%	8.957036%	4.285283%	-0.000580%	4.285889%	8.954333%	-0.001181%	8.955620%
	Other agriculture	0.000596%	0.000506%	0.000091%	-0.025839%	-0.217638%	0.192217%	-0.001271%	-0.001078%	-0.000194%	-0.001587%	-0.003894%	0.002307%	-0.000604%	-0.000512%	-0.000092%	-0.001253%	-0.001063%	-0.000191%
	All other	0.000397%	0.000414%	-0.000018%	0.000624%	0.000652%	-0.000028%	0.000212%	0.000401%	-0.000189%	0.000218%	0.000404%	-0.000187%	-0.000084%	-0.000087%	0.000004%	-0.000168%	-0.000176%	0.000008%
E	Fishery	-0.065218%	-0.065218%	0.000000%	0.000186%	0.000186%	0.000000%	-0.002556%	-0.002556%	0.000000%	-0.002649%	-0.002649%	0.000000%	-0.000837%	-0.000837%	0.000000%	-0.001704%	-0.001704%	0.000000%
	Other agriculture	0.000596%	0.000596%	0.000000%	-0.025839%	-0.025839%	0.000000%	-0.001271%	-0.001271%	0.000000%	-0.001587%	-0.001587%	0.000000%	-0.000604%	-0.000604%	0.000000%	-0.001253%	-0.001253%	0.000000%
	All other	0.000397%	0.000397%	0.000000%	0.000624%	0.000624%	0.000000%	0.000212%	0.000212%	0.000000%	0.000218%	0.000218%	0.000000%	-0.000084%	-0.000084%	0.000000%	-0.000168%	-0.000168%	0.000000%
Y	Fishery	-1.551237%	0.000000%	-1.551237%	0.000186%	0.000000%	0.000186%	-0.002556%	0.000000%	-0.002556%	-0.005637%	0.000000%	-0.005637%	-0.000837%	0.000000%	-0.000837%	-0.001704%	0.000000%	-0.001704%
	Other agriculture	0.000596%	0.000000%	0.000596%	-0.259026%	0.000000%	-0.259026%	-0.001271%	0.000000%	-0.001271%	-0.004625%	0.000000%	-0.004625%	-0.000604%	0.000000%	-0.000604%	-0.001253%	0.000000%	-0.001253%
	All other	0.000397%	0.000000%	0.000397%	0.000624%	0.000000%	0.000624%	-0.002868%	0.000000%	-0.002868%	-0.002816%	0.000000%	-0.002816%	-0.000084%	0.000000%	-0.000084%	-0.000168%	0.000000%	-0.000168%

Table 4 (Continued): Relative Changes from the current level

		S1-1	S1-2	S2-1-1	S2-1-2	S2-1-3	S2-1-ALL	S2-2-1	S2-2-2	S2-2-3	S2-2-ALL	S3-1	S3-2
capital income	fishery	0.000036%	0.000122%	-0.748396%	0.000064%	-0.001249%	-0.002721%	-1.551237%	0.000186%	-0.002556%	-0.005637%	-0.000837%	-0.001704%
	non-agricultural	0.000333%	0.000705%	0.000280%	-0.124128%	-0.000612%	-0.002217%	0.000596%	-0.259026%	-0.001271%	-0.004625%	-0.000604%	-0.001253%
	all other	-0.000011%	-0.000017%	0.000190%	0.000299%	-0.001376%	-0.001351%	0.000397%	0.000624%	-0.002868%	-0.002816%	-0.000084%	-0.000168%
labor income	fishery	0.000036%	0.000122%	-0.748396%	0.000064%	-0.001249%	-0.002721%	-1.551237%	0.000186%	-0.002556%	-0.005637%	-0.000837%	-0.001704%
	non-agricultural	0.000333%	0.000705%	0.000280%	-0.124128%	-0.000612%	-0.002217%	0.000596%	-0.259026%	-0.001271%	-0.004625%	-0.000604%	-0.001253%
	all other	-0.000011%	-0.000017%	0.000190%	0.000299%	-0.001376%	-0.001351%	0.000397%	0.000624%	-0.002868%	-0.002816%	-0.000084%	-0.000168%
the amount of taxes	income tax	-0.000007%	-0.000007%	-0.001459%	-0.001363%	-0.001366%	-0.001365%	-0.003022%	-0.002844%	-0.002846%	-0.002847%	0.008850%	0.018496%
	production tax	-0.000007%	-0.000007%	0.037727%	0.038642%	0.038586%	0.038586%	0.078199%	0.080636%	0.080631%	0.080630%	-0.000092%	-0.000186%
	tariff	-0.362901%	-0.758297%	-0.362833%	-0.362985%	-0.362829%	-0.362831%	-0.757903%	-0.758479%	-0.758137%	-0.758141%	-0.363002%	-0.758502%
Production tax rates (%)	Fishery			14.156179%	0.000113%	0.000113%	0.028133%	29.580563%	0.000113%	0.000113%	0.058660%		
	Other agriculture			0.000187%	3.194023%	0.000187%	0.041689%	0.000187%	6.673777%	0.000187%	0.086904%		
	All other			0.000197%	0.000197%	0.040772%	0.040164%	0.000197%	0.000197%	0.084977%	0.083707%		
income tax rate (%)												0.010122%	0.019862%
EV		-8.864839	-4.890774	-6887.107141	-8163.626319	-7078.155603	-7090.783551	-14292.985993	-17039.970517	-14774.749512	-14803.878648	-14116.323220	-29480.223523

Figure 2: Effect of Changes in the Tariff Rate on Utility

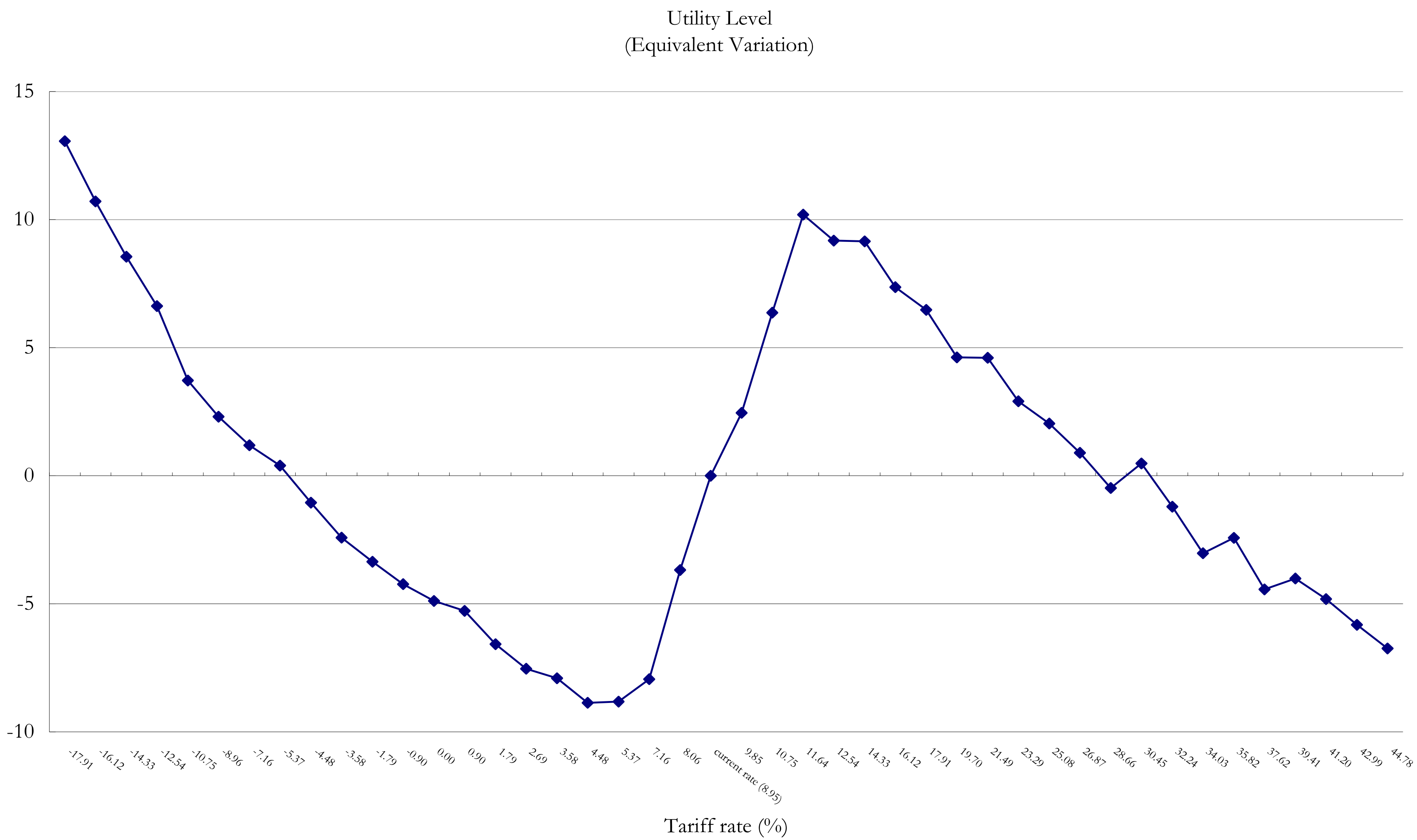

Figure 3: Effect of Changes in the Tariff Rate on Labor Income of the Fishery Industry

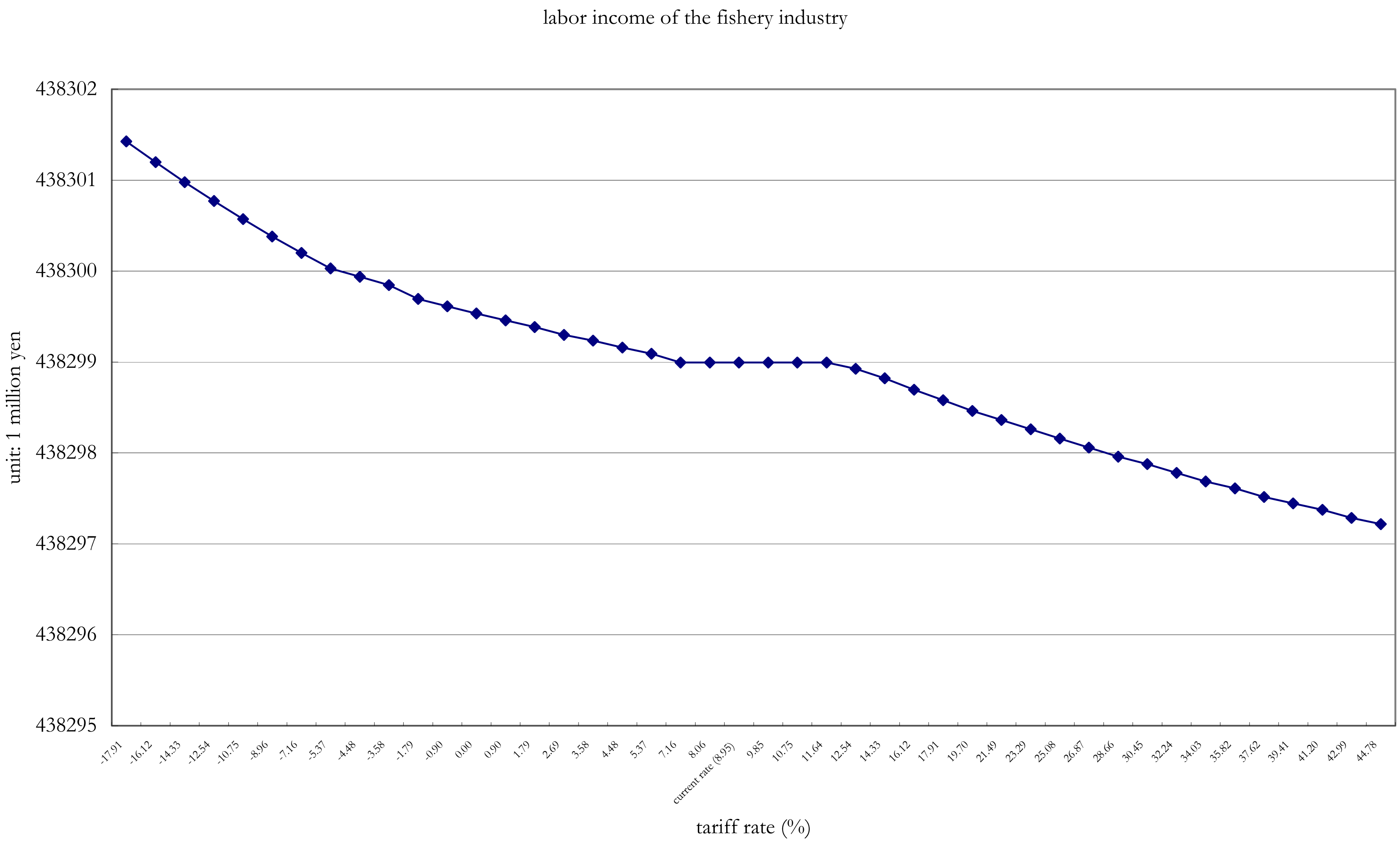

Figure 4: Effect of Changes in the Tariff Rate on Capital Income of the Fishery Industry