論　文

Studies on Macroeconomic Impacts of Consumption Tax Changes based on DSGE Model ～An Overview

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Abstract

　　This paper aims to clarify the characteristics of the rules of the Japanese tax system, and to verify the effect of tax policy by overviewing the relevant studies based on DSGE model. After surveying this field of research, we find that, although the increase in consumption tax has a direct and a negative impact on the economy on a short-term basis, it seems to be necessary for the Japanese economy on a long-term basis. Some of the overviewed studies in this paper suggest that some appropriate tax reform with a combination of an increase in consumption tax and a cut in corporate tax can improve the economy.

Keywords: Japanese consumption tax, DSGE model, Survey, Fiscal policy, Tax reform

1. Introduction

1.1 Consumption Tax in Japan

　Fiscal policy is one of the two main tools in government attempts to influence the economy, the other being monetary policy. Since the 2008 financial crisis, Japan once again attaches importance to fiscal policy, which refers to the adjustments through government spending and tax levels. Therefore, consumption tax as a fiscal policy plays an important role in the Japanese economy. Speaking of Japanese consumption tax, it is also called VAT （Value-Added Tax） or GST （Goods and Services Tax） in other countries. "Consumption tax （value-added tax or VAT） is levied when a business enterprise transfers goods, provides services, or imports goods into Japan." （Worldwide Tax Summaries, 2020, para.1）. Therefore, the consumption tax is considered to be wide and fair. Nowadays, the Japanese

consumption tax（VAT）rate has been raised from 8% to 10% in October 2019, while food and drink excluding alcoholic drinks and dining out, and newspapers issued twice a week or more（restricted to those by subscription）are subject to the reduced tax rate of 8%.

The previous standard VAT rate in Japan was 5% in 2013. It changed to the current level in 2014. Japan does not have any reduced rates. VAT（CT）was introduced in Japan in 1989 at a standard rate of 3.0%. Since then the minimum and maximum standard rates have been at 3.0% and 8.0% respectively.（OECD, January 2019, p.1）

The impact of consumption tax as a means of fiscal means is getting more and more important, as shown in the figure below.

Figure 1
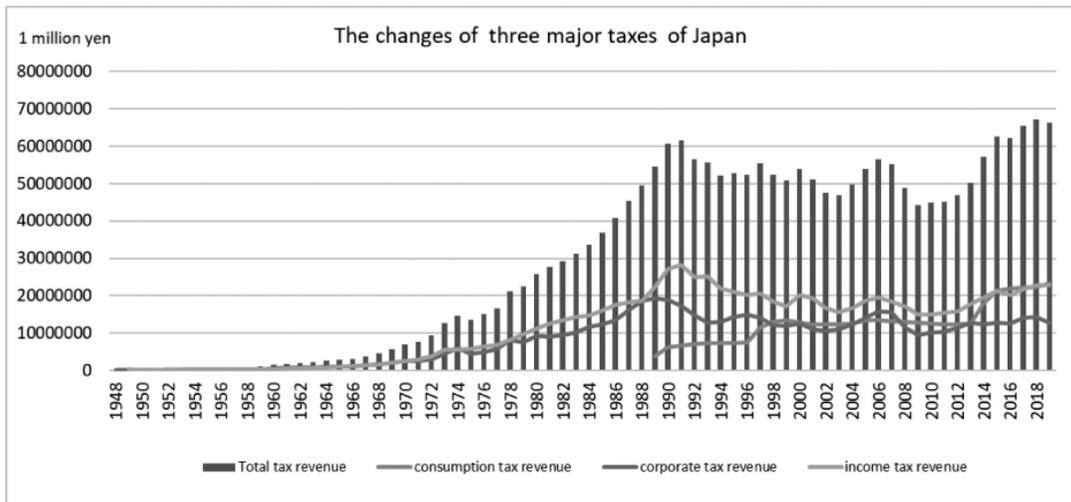
Source: National Tax Agency

From this figure, we can see the changes in the three main taxes of Japan through tax data from 1948 to 2019. On one hand, income tax revenue is the largest among the three main tax revenues until 2015. On the other hand, in the 1980s, the corporate tax revenue was high but still lower than income tax revenue. In general, we find out that the corporate tax revenue has been relatively stable. With regard to the consumption tax revenue, there is an upward trend.

From the figure above, we can also find out the changes in consumption tax. In 1989, consumption tax was introduced, and the rate was raised in 1997 and 2014. Furthermore, the consumption tax revenue is getting higher and higher than corporate tax and now it is almost the same as the income tax. Then, in October 2019, the consumption tax has been

increased from 8% to 10%. Therefore, consumption tax revenue is expected to make up the highest among the tax revenues.

1.2 The Introduction of DSGE Model

"DSGE models have come to play a dominant role in macroeconomic research. Some see them as a sign that macroeconomics has become a mature science, organized around a micro founded common core." (Blarchard, 2016. P.1). Many researches have studied the impact of the consumption tax hike based on the Dynamic Stochastic General Equilibrium model (DSGE model). Therefore, this study will analyze and discuss recent researches on the macroeconomic effects of the consumption tax to understand the effects of consumption tax in Japan. We think it is very meaningful and necessary.

"DSGE models represent the core of contemporary macroeconomics focusing on monetary policy and business cycle. Their distinctive feature is that they are derived from the microeconomic foundations." (Slanicay, 2014, p.2). As for the DSGE model, a Lucas critique must be mentioned.

Lucas (1976) argued that the parameters of traditional macroeconometric models depended implicitly on agents' expectations of the policy process and were unlikely to remain stable as policymakers changed their behavior. This critique was influential in two respects. First, it helped re-orient macroeconomic research toward models with explicit expectations and "deep" parameters of taste and technology. These models, which were to be invariant to policy shifts, included estimated first-order conditions or Euler equations, calibrated general equilibrium models with explicit optimization, and, most recently, "New Keynesian" models. Second, the Lucas critique helped change the focus of policy evaluation from consideration of alternative paths of the policy instrument to consideration of alternative policy rules, which allowed individual agents to formulate forward-looking dynamic optimization problems. (Rudebusch, 2002, p.2)

Therefore, policy conclusions based on these models would be potentially misleading. The development of DSGE models is connected to an effort to derive a model which would be more immune to the Lucas critique. The first DSGE model was formed by Finn E. Kydland and Edward C.Prescott, see Kydland and Prescott (1982). Their concepts became the core of the real business cycle (RBC) theories. After their seminal paper had been published, many other RBC models appeared, for example see Prescott (1986) or Long

and Plosser (1983), each of them with different assumptions and purposes. All of them had several common features, though. RBC models in general assume perfect competition on the goods and labor markets and flexible prices and wages. The concept of RBC models due to neutrality of the monetary policy is another controversial implication of RBC models and New Keynesian models adopting the methodology and the underlying structure of RBC models, i.e. principles of optimizing agents. However, unlike RBC models, NK models were enhanced with some "Keynesian" assumptions, namely monopolistic competition on the goods and/or labor markets, price and wage rigidities, etc. The distinction between New Keynesian models and RBC models is primarily based on assumptions of price and wage rigidities. (Slanicay, 2014, pp. 4-6)

Furthermore, with regard to the structure or knowledge of DSGE models, there are many books and studies. In terms of studies, Blanchard and Perotti (2002), Smets and Wouters (2007), Galí et al. (2007), etc. are usually referred to. In terms of books, The ABCs of RBCs: An Introduction to Dynamic Macroeconomic Models (McCandless G., 2008). Methods for Empirical Macroeconomic Analysis with DSGE model (in Japanese) (Hirose, 2012), etc. are used as a textbook. Moreover, for different study purposes or methods, the content of the consumption tax is different. For example, consumption tax in a broad sense refers to the tax levied on consumption spending of all goods and services, while consumption tax in a narrow sense does not include alcohol tax, tobacco tax, etc. When analyzing and summarizing the impact of consumption tax, this study does not distinguish between consumption tax in a broad sense and consumption tax in a narrow sense, besides, other taxes are the same.

2. Studies on Japanese Consumption Tax based on DSGE Model

2.1 The role of Tax Policy Rules assessed through Policy Experiments

This section focuses on making policy recommendations based on the analysis of the consumption tax hike. Iwata (2011) uses the DSGE model to investigate the effect of tax rules in determining the size of the government spending multiplier with two types of household: non-Ricardian and Ricardian. "Ricardian households, who can trade in asset markets and, thus, can smooth consumption, and non-Ricardian households, who do not hold any assets and therefore just consume their disposable income." (Coenen and Straub, 2004, p.6) Whereas most of the current workhorse DSGE models employed by policy

institutions use non-Ricardian households to amplify the effects of fiscal stimulus, particular tax policy rules can be of even greater importance.（Iwata, 2011, p.5）

This paper is often quoted and referenced to, and it is well known in Japan. Moreover, the model parameters are estimated by Bayesian estimation, besides, seven series: output, private consumption, investment, labor hours, wages, the inflation rate and the interest rate are employed. The Ordinary Least Squares（OLS）method is used to estimate the single-equation fiscal rules which combines different fiscal instruments, for declaring the changes in the fiscal policy regime in Japan. Moreover, the sensitivity of the government spending multiplier to changes in the coefficients of tax rules is considered for examining the impact of tax rules on the effect of fiscal stimulus. Through comparing estimation results of Japan's tax rules based on the data from 1980 to 1998 quarterly with estimation results of the euro area's tax rules based on the data from 1980 to 2005 quarterly, the result suggests that the capital income tax is the main means of financing Japanese debt, whereas instead of capital income tax labor income taxation is the main means of financing debt in euro.

With regard to the impact multipliers for different tax rules, at an early stage, the output multipliers of the estimated model are greater than those when tax rules of the adjusted FMS[1] are adopted. At a later stage, greater declines can be seen. Furthermore, three taxes as financing-schemes: a consumption tax-financing scheme, a labor tax-financing scheme, a capital tax-financing scheme, in addition, a spending reversal policy and a balanced budget as five alternative financing schemes are examined. From the results, the stimulus effect of the capital tax-financing scheme is the largest among five alternative financing schemes in the short-term, in other words, the largest increase of consumption is brought by the capital tax-financing scheme initially. Whereas, the balanced budget has the smallest stimulus effect. Moreover, through comparing the first-year average responses for different tax-financing schemes, we can know that the introduction of non-Ricardian households brings a crowding-in effect on consumption. The stimulative effects of capital tax-financing scheme are greater than the effects of consumption tax-financing scheme and labor tax-financing scheme, even if consumption

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[1] Of the studies conducted within the New Keynesian framework, Forni et al.（2009）（FMS, hereafter）was the first to attempt to examine the effects of fiscal policy using an estimated DSGE model augmented by distortionary tax rules and non-Ricardian households.

tax-financing and labor tax-financing schemes have a relatively high non-Ricardian share. In addition, we can also know the choice of tax rules can change the results of fiscal stimulus plans expected by given non-Ricardian shares.

Concerning the general equilibrium framework, an increase in government spending is financed by the increase of tax finally. Based on this study, the effect of the fiscal stimulus is persistent, whereas the monetary policy does not respond positively to inflation. In addition, consumption tax and labor income tax have a restraining effect on working hours. Therefore, whether to stabilize debt through consumption tax or labor income tax, compared with stabilizing debt through capital income tax, both can limit the initial increase of labor input after a fiscal stimulus. The role of monetary policy is also estimated, by the means of the sensitivity of the multipliers to changes in parameter values as above. Japan's monetary policy's expectation of inflation is less aggressive than that in the euro area. From the estimation of the impact multipliers for different tax-financing schemes under the adjusted FMS monetary policy for the euro area, we can see that under the relatively aggressive monetary policy rule, the short-term impact multiplier of capital tax-financing expenditure decreases until they are almost equal to the multiplier of consumption and labor income tax financing expenditure.

Based on cumulative present-value multipliers and welfare effects of a government spending shock, the impacts of five alternative financing schemes in the medium- and long-run are examined. Concerning the welfare criterion, a quadratic approximation of the representative household's utility is used. The results suggest that capital tax-financing schemes have the greatest effect on output declaration and welfare loss. However, on condition that the fiscal adjustment is slow, an investment boom in the initial period brought by capital tax-financing expenditure shock is possible.

Moreover, there is a Hirose Seminar, focused on the DSGE model from 2001. In addition, there are many studies about the consumption tax on DSGE models. Here, Maeda (2013) and Ogino et al. (2013) are introduced as examples.

Maeda (2013) analyzes three policies: gradual increase, fiscal stimulus and clauses of consumption tax increase at the time of consumption tax hike. Furthermore, this study suggests that it is valid to postpone the consumption tax increase, according to three policies: gradual increase, fiscal stimulus and clauses of consumption tax increase.

Furthermore, GHH (Greenwood, Hercowitz and Huffman (1988)) type utility function is

used, assumed by Monacelli and Perotti（2008）. Based on a reference to Iwata（2009）, Sugo and Ueda（2008）, in addition to Monacelli and Perotti（2008）, deep parameters which are invariant with changes in economic policy are set. Since the bill of the consumption tax increase is officially passed and decided in August 2012, the fourth quarter of 2012 is set as the 0th period（t=0）, and the simulation period in this study is set up to t = 20, five years later, the fourth quarter of 2017 is as the 20th（t=20）. Besides, according to the implementation of the tax increase that has been announced in advance, it is treated as an expected shock.

With regard to the policy of gradual increase, four options are set and examined. The options are A: Increase tax rate by 5% at the same time as announcing the tax increase, B: First time to increase tax rate is by 5% at once in the second quarter of 2014 C: Second time to increase tax rate is by 5% at once in the fourth quarter of 2015 D: Increase in two stages as currently proposed. As a result, from option A to option C, the consumption decreases sharply, but option D-gradual increase in consumption tax has the effect on making consumption fall more moderately. Therefore, the policy of gradual increase is effective, and the policy of gradual increase as the current plan is valid.

Concerning fiscal policy, there are also four options similar to the mentioned above. From the analysis in this part, the results indicate that it is possible to moderate the decline in consumption by implementing appropriate fiscal spending when the policy of consumption tax in increase is implemented. Moreover, a simulation is carried out regarding the postponement of the tax increase due to the economic clause of the consumption tax increase. The postponement of tax increases due to economic clauses has little effect on the dynamic path of consumption. Therefore, if the national tax rate is stable, it is reasonable to postpone the tax increase due to the deterioration of the economy.

Ogino et al.（2013）uses the DSGE model to make a theoretical investigation on the mechanism of consumption decline caused by the increase of consumption tax. Aim to examine the policies desirable to the Japanese economy and to avoid breaking "Three Arrows".

Speaking of the "three arrows", we would better understand the "Abenomics". "Abenomics" refers to the economic policies advocated by Prime Minister Shinzo Abe who became prime minister of Japan for a second time when his party-the Liberal Democratic

Party won an overwhelming majority at the general election in December 2012. Abenomics has "three arrows": (i) aggressive monetary policy, (ii) fiscal consolidation, and (iii) growth strategy. (Yoshino and Taghizadeh-Hesary, 2014, p.2)

Moreover, this study takes the 10% consumption tax increase scheduled in October 2015 as the analysis object. Besides, this study refers to and does a change in the model of Iwata (2011). Therefore, not only the impact of the tax rate change but also the analysis of last-minute demand owing to the announcement of the tax increase are examined. Besides, based on taking the 10% consumption tax increase scheduled in October 2015 as an analysis object, this study conducted a policy simulation in which the amount of improvement in primary balance is about 3.2 trillion yen. The policy simulation is as follows:

1. Decrease in consumption tax increase

   The consumption tax rate is increased from 8% to 9% instead of 8% to 10%.

2. Income tax reduction

   Income tax of tax burden rate is reduced by 0.56%.

3. Corporate tax reduction

   The effective corporate tax rate is reduced by 8.4%.

4. Combination of income tax reduction and corporate tax reduction

   Income tax of tax burden rate 0.36% tax reduction and corporate tax effective tax rate 3.15% tax reduction are carried out at the same time.

5. Increase in government spending

   The government spending is increased by 3% from the current level.

The path of the benchmark is reduced to -0.5% after the last-minute demand and then converges near that point. The path moves in the same way for policies 1, 2 and 5, and the path of policy 1 and 2 are decreased about -0.2%, while that of policy 5 is -1%. On the other hand, for policies 3 and 4, the path shows an upward trend after the decline of tax increase. Above all, Policy 4: Combination of income tax reduction and corporate tax reduction seems to be the best policy. On the condition that the primary balance improvement amount is more than 3.2 trillion yen, based on considering the variance of corporate taxes cut as small as possible, the policy to cut corporate tax by 6.3% is appropriate. This policy is called Policy 6. From the result of the simulation, the study confirms that there is a trade-off between improving the primary balance and stabilizing

consumption unless excessive tax cuts are taken. In addition, from the viewpoint of a fall in consumption, it is easy to see that non-Ricardian households have a great fall in consumption.

Based on the result of the simulation, the new analyses about not only tax cut policies but also "three arrows" of Abenomics are conducted. Therefore, this study recommends that while increasing the consumption tax, the tax burden rate of income tax and resident tax are better to be decreased by 0.36%, and the effective corporate tax rate is better to be decreased by 3.15%.

The growth strategy as the third arrow growth strategy in "three arrows" brings the most increase in consumption and improves primary balance significantly. Concerning the growth strategy, as the third arrow in Abenomics refers to "a growth strategy to stimulate private investment", one of which is a corporate tax cut. Since the positive impact on non- Ricardian households is small, as an income transfer measure, the rates of income tax and resident tax are better to be reduced.

While studying the policy effect of corporate tax, Hasumi（2014）also analyzes the effect of the consumption tax. Hasumi（2014）examines the short-term and the long-term effects of tax policy changes on the Japanese economy based on a small open economy DSGE model with endogenous stochastic trends. The estimated period is from 1980 to 2010 based on quarterly data, besides, the parameters of the model are estimated by Bayesian statistics.

This model has some characteristics as follows: first, considering the overseas sector, it can analyze the trends of export product and import product; second, by introducing investment special technological progress, it can capture the trends of investment goods and consumer goods separately. However, in order to simplify, investment goods are only made up of domestic goods. Besides, retail enterprises do not use labor and capital, but the main body bundles intermediate products as final products. The actual production activity is done by the intermediate goods firm, which uses the capital and labor provided by the family, conducts the production activity, and returns the profit to the family. Moreover, based on the parameters estimated by Bayesian statistics, this study makes a simulation of the following three cases to examine the effect of different tax policies. Assume one quarter as one period.

Case 1:

The continuous increase of the corporate tax（capital income tax）is equivalent to 1% of GDP.

Case 2:

The continuous increase of the labor income tax is equivalent to 1% of GDP.

Case 3:

The consumption tax rate is continuously increased by 2%.

Comparing the effect of case I, II and III, no matter which tax, the impact on the balance of government debt is not much different, but the impact on the real economy and prices are different. Among the three taxes, the increase of corporate tax has the greatest negative impact on real GDP and consumer prices. On the other hand, the consumption tax has the smallest negative impact on real GDP and consumer prices. Since consumption tax has an increase of just over 1% in GDP, a 0.6-0.7% decrease in real GDP and a drop in inflation slightly less than 0.05 percentage points are brought. Moreover, this study examines the impact of the consumption tax increase including the pre-announcement period, as an example of the impact of expectation on the future.

As in the previous section, assume one quarter as one period. The increase in the consumption tax rate is set at 10%. t = 0 is the initial stable state（consumption tax rate is 8%）, when t = 10, the consumption tax rate is increased to 18%, and the announcement is made in advance one period. Therefore, the period t=1～9 have a last-minute effect.

The result shows that before the increase in actual consumption tax rate increase, investment fell significantly（up to 28%）, because consumption is in last-minute demand. The gross domestic product falls immediately after announcing the consumption tax increase, due to the effect of the decrease in capital stock. The decrease in capital stock is caused by a decrease in investment. Due to the increase of consumption tax, the marginal disutility of labor increased. Thus the production in the new steady-state is lower than the level in the initial steady-state, and the effects show up without lag.

Meanwhile, Domestic goods are more expensive than foreign goods whenever they are in before or after the tax increase. Besides, due to the tax increase, the amount of exports decreases by about 2%. Since the amount of exports is determined by the real exchange rate, the real exchange rate decreases. The current account balance is not in a state of balance due to last-minute demand as the tax rate is raised, but it soon converges to 0.

Finally, this study conducts a simulation analysis of changes in the fiscal neutral tax system that combines corporate tax cuts equivalent to 1% of GDP and consumption tax increases of the same scale. The result shows that on the one hand, consumption declines temporarily due to the increase of consumption tax, but eventually increases by 0.4% over the baseline. As a result of the corporate tax cut, the investment increase immediately and increases by 4% compared with the baseline in the long run. As a result of the accumulation of capital stocks, the rate of return on capital decreases, but wages rise. As the increase in the demand for investment goods exceeds the decrease in the demand for consumption goods, the inflation rate rises by about 0.25% in the short term according to the maximum annual rate. On the other hand, since the positive effect of corporate tax cuts is larger than the negative effect of consumption tax increase, GDP increases.

Moreover, concerning the growth strategy, as the third arrow in Abenomics refers to "a growth strategy to stimulate private investment", one of which is a corporate tax cut. The result from the simulation suggests that the change of tax policy about a combination of corporate tax reduction and consumption tax increase brings the increase of growth rate and prices in short-term.

2.2 The Role of Tax Policy Rules assessed through the Estimation of Tax Incidence

From this section, we can learn more about the impact of tax increase on consumption. Hayashida et al.（2017）investigates the tax incidence caused by the increase of consumption tax from 5% to 8% to rebuild fiscal systems. Furthermore, this model is characterized by two types of labors with different wage rates, namely high-skilled labors and low-skilled labors, so that the effect of tax reform on the wage gap can be analyzed at the same time.

The data is from the first quarter of 1993 to the second quarter of 2016. In addition, six variables are examined, namely GDP, consumption, investment, wage rate, inflation rate, and interest rate. As for the wage rate data, there are two series: high skilled labors and low skilled labors. Based on Bayesian statistics, parameters are appropriately set. Moreover, through the impulse response functions of technology shock, preference shock, and easy money policy shock, it shows that the response is in line with economic theory, so it can be said that the estimated model is generally valid.

Based on the estimation about the two kinds of the impulse response of consumption tax

hike, the effect of consumption tax incidence can be shown. One is the impulse of each factor income in the proportion of total factor income. The result shows that an increase in the consumption tax reduces the share of capital income and raises the share of labor income, high-skilled and low-skilled labors which have the same and little effect from the consumption tax hike. As the income of both high-skilled and low-skilled labors is increased, it can be seen that the increase in consumption tax rate has the same effect on labor income, therefore, the effect on the distribution rate of high-skilled and low-skilled is the same too. Moreover, the capital distribution rate is low and the incidence of the burden on capital income is high at the initial stage. However, in the medium term, the capital distribution rate is increasing, the incidence of the burden on labor income is increasing. The other impulse response about consumption tax hike is the impulse of two kinds of the wage rate. This result suggests that at the beginning (two periods), the increase in the wage rate of type low-skilled labors is higher than that of type high-skilled labors, the wage gap between two types of labors tends to be smaller. After two periods, the increase in the wage rate of type low-skilled labors is lower than that of type high-skilled labors until 30 periods. This shows that the wage gap is expanded. This result is coupled with the argument about the regression of the consumption tax.

Kotera and Sakai (2018) uses four kinds of government expenditure (merit goods expenditure, public goods expenditure, government investment expenditure, lump-sum income transfers) and three kinds of tax (consumption tax, labor income tax and capital income tax) to construct a dynamic stochastic general equilibrium (DSGE) model.

The data is from the first quarter of 1981 to the fourth quarter of 2012 in Japan. From the data period, we can know that the consumption tax increase in 1997 is estimated. The quarterly data has 13 series which are: real GDP, real private consumption, real private consumption, real wages, real merit goods expenditure, real public goods expenditure, real government investment, working hours, the inflation rate, the nominal interest rate, the effective consumption tax rate, the effective labor income tax rate, and effective capital income tax. By using standard Bayesian statistics, the structural parameters of the model and the coefficient parameters of policy rules are estimated, moreover, the effects of Japan's fiscal policy are quantified.

Furthermore, two kinds of simulation analysis are performed. One of them is the simulation of financing merit goods expenditure with different types of taxes. The merit

goods expenditure refers to "individual consumption such as healthcare, long-term care, and education." (Kotera and Sakai, 2018, p.2). Using the posterior mean of the parameters estimated in the previous section, the 1% increase in merit goods expenditure to output ratio is financed with a single type of tax, without adjustment by other taxes, expenditures, or issuance of government bonds. Therefore, the impact of increases in consumption tax, labor income tax, and capital income tax on the economy can be compared. We can learn something from this simulation. For the merit goods expenditure as a financial means of government expenditure, there is no big difference between consumption tax and labor income tax to merit goods expenditure, which is a financial means of government expenditure, but capital income tax significantly reduces investment and capital accumulation. In addition, along with the fluctuations in relative prices of production factors, the inhibitory effect of capital income tax on medium and long-term prosperity increases.

The other one is a simulation of different government expenditures due to the increase in consumption tax. Based on the different government spending due to the increase of consumption tax revenue, the effect of consumption tax is examined. When the increase in consumption tax revenue is used as merit goods expenditure, according to the consumption of the Ricardian households and the complementarity of the merit goods, consumption increases slightly momentarily in response to the rise in the consumption tax rate, but decreases by about 0.6% in the medium to long term. When the increase in consumption tax revenue is used for public goods expenditure, consumption decreases by 2% in the short-term, due to the substitutability of Ricardian households' consumption and public goods. Furthermore, in the medium to long term, it decreases by about 0.6%, which is the same as in the case of merit goods expenditure. Therefore, the increase in public goods and the decrease in consumption are offset, and the effective consumption of Ricardian households hardly changed. Because of the decrease in consumption and output, public debt is expected to be increased slightly.

While investing by the government, the increase in productivity is caused by the accumulation of public capital in the long run. Owing to the increase in productivity, consumption and output increase by 0.36% and 0.67%, respectively. Consequently, there is an increase in total tax revenue and a decrease in public debt. Meanwhile, an increase in productivity through public capital accumulation leads to a positive effect on the economy

in the long run. With regard to lump-sum income transfers, Kotera and Sakai (2018) "do not employ observation data on income transfers in the estimation".

3. Suggestions and Implications of these Studies: An Outline

The methods of analyzing consumption tax and the impacts of consumption tax have been introduced in detail in the above sections. This section summarizes the results of these studies for understanding the impact of consumption tax easily.

Iwata (2011) shows that the tax policies of stabilizing debt adopted by Japan during the 1980s and 1990s play a role in expanding the short-term multipliers of government spending. Moreover, consumption tax and labor tax have a greater effect on dampening labor input than capital tax, in addition, the increase in labor input was the key factor that can contribute to the effectiveness of fiscal stimulus in a general equilibrium framework. Therefore, Iwata (2011) suggests that the debt is paid mainly by gradually increasing capital tax under an accommodative monetary policy, besides, the fiscal stimulus plans should be announced together with the financing plans, because the prospect of future taxation affects the size of multiplier greatly.

Maeda (2013) shows the consumption tax increase almost certainly lead to a decline in consumption and a sluggish economy. Nonetheless, from the previous analysis, gradual increase, fiscal stimulus, clauses of consumption tax increase policies are examined and can be considered to limit the negative effects of a sharp decline in consumption. In addition, to make fiscal stimulus has the effect on suppressing last-minute demand, it is effective to decide on the fiscal stimulus at the same time as the announcement of the tax increase. However, except for consumption tax, other tax rates are assumed to be constant, so we cannot compare consumption tax with other taxes on impact.

Ogino et al. (2013) indicates that the growth strategy as the third arrow in Abenomics brought very desirable results: not only the decline in consumption is alleviated but also the fiscal balance is improved. Ogino et al. (2013) indicates that the consumption tax hike has a negative effect on consumption. With the consumption tax increase to 10%, the decline in consumption is about 1%. Furthermore, compared to consumption tax, corporate tax has a smaller negative effect on tax revenue and a larger positive effect on the economy. Besides, considering the income transfer measure, reducing the rate of income tax and resident tax seems a good choice. Therefore, Ogino et al. (2013) suggests that it is

best to reduce the burden rate of income tax and resident tax and the rate of corporate tax, while raising consumption tax.

Hasumi（2014）indicates that from the analysis about fiscal-neutral tax system reform that combines corporate tax cuts and consumption tax increases in the same scale, consumption declines temporarily due to the increase in consumption tax, but increase in the end. In addition, the positive effect of corporate tax cuts is larger than the negative effect of consumption tax increase, so GDP increases. Furthermore, tax reform raises the short-term growth rate and prices, while increasing the long-term level of GDP, but not the long-term growth rate of GDP. In this study, the long-term growth rate of this model is determined by the steady-state rate of the change rate of labor efficiency technology and investment special technology. Furthermore, these are influenced by some growth strategies like technological innovation and market efficiency.

Hayashida et al.（2017）suggests that the increase in consumption tax from 5% to 8% raises the price level, leading to a decrease in consumption and output. Therefore, the consumption tax increase has an effect of depression on the economy. Moreover, the increase in consumption tax raises the wage rate. The income gap between low-skilled labors and high-skilled laborers narrows in the short term but widens in the medium term. Besides, the capital distribution rate decreases and the labor distribution rate rises due to the consumption tax hike. Therefore, it does not necessarily give preferential treatment to the wealthy who owns capital, while it is desirable for the general income group who mainly earns wage income. Besides, the increase in income tax is also analyzed, but the result is the same as the consumption tax increase.

Kotera and Sakai（2018）analyzes the data from the first quarter of 1981 to the fourth quarter of 2012, so we can know the impact of the increase in consumption tax in 1997（from 3% to 5%）. Kotera and Sakai（2018）implies that Japan's fiscal policy rules have little effect on the business cycle and debt accumulation quantitatively on the whole. Nonetheless, capital income tax has the greatest restraining effect on the economy as a means of financing government expenditure among consumption tax and labor income tax. Furthermore, there is not much difference between the consumption tax and labor income tax as the means of financing government expenditure.

According to the increase in tax revenue due to the consumption tax hike used for different kinds of additional government expenditure, the different effects of the increase

in consumption tax are examined. On condition that the increase of consumption tax revenue is used for public goods spending, because of the substitution effect, it brings a significant decline in consumption. Moreover, on condition that the increase of consumption tax revenue is used for merit goods spending, because of the Edgeworth complementarity between merit goods and private consumption, which does not cause a decrease of consumption in the short-term and has a positive effect on the economy. Furthermore, on condition that the increase in consumption tax revenue is used for government investment, the short-term effect lies between merit goods expenditure and public goods expenditure, but in the long term, the positive effect on the economy is devoted by the increase in productivity caused by public capital accumulation.

4. Conclusion

From the above studies based on the DSGE model, we can understand not only the characteristics and effects of the rules of the Japanese tax system but also the policy recommendations according to the impacts of a consumption tax hike.

Moreover, we compare consumption tax with other taxes in the above section to learn more about the characteristics and impacts of consumption tax. Hayashida et al. (2017) and Kotera and Sakai (2018) imply that the consumption tax and labor income tax have similar effects based on the DSGE model. As for this result, the lack of consideration of the characteristics of labor income tax may be the reason. Iwata (2011) and Kotera and Sakai (2018) have a different opinion on capital tax. Concerning the difference in the result, we think the reason may be that different data are used. Ogino et al. (2013) and Hasumi (2014) suggest that the corporate tax cuts has a large and positive effect on the economy and the positive effect of corporate tax cuts is larger than the negative effect of consumption tax increases. Therefore, we suggest that the government should implement the policy of corporate tax cuts and consumption tax increases. Furthermore, according to the characteristics of different tax systems, the effects of the taxes can be analyzed by setting the model accurately and exquisitely. The labor income tax and capital tax should be better analyzed.

Furthermore, Miyazaki (2009) uses Business Cycle Accounting (BCA) to evaluate how much the Dynamic General Equilibrium Tax (DGET) model explains the macro variables of the Japanese economy. Based on Miyazaki (2009), it implies that the DGET model may

not be enough to explain the real macroeconomy of Japan, but it is attempting to use the BCA model and DGET model to examine the effect of the tax, and it seems to be very innovative and meaningful.

Therefore, we hope that this study will be helpful to the readers to understand not only the effect of the Japanese consumption tax but also the means to examine the Japanese consumption tax. Thus, it is our future topic to analyze consumption tax more exquisitely, while considering the role of income tax based on the DSGE model.

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