Tax reform in Japan: Is it welfare-enhancing? *

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Abstract

The ongoing tax reform in Japan, particularly a corporate income tax cut financed by an increase in consumption tax, is expected to bring positive effects for investment and output. However, the overall effects on government fiscal balance and welfare can be ambiguous, depending on the dynamic responses of macroeconomic variables to changes in tax rates. This paper aims to provide quantitative forecasts of Japanese tax reform on welfare and fiscal balance using a small open two-sector dynamic general equilibrium model calibrated to the Japanese economy. The simulation results show that under conditions of unrestricted international borrowing and no consumption habit, a corporate income tax cut of 5% financed by an increase in consumption tax improves welfare by 0.53%. However, the positive effects of corporate income tax cuts decrease when international borrowing becomes limited or consumers show habit formation. In addition, we show that a corporate income tax cut in the tradable sector generates better welfare and fiscal consequences than a tax cut in the nontradable sector.

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1. Introduction

Japan has been implementing a series of tax reforms since launching Prime Minister Shinzo Abe's administration in 2012. Two main objectives of Japanese tax reform are improving growth and restoring fiscal balance, especially with the impending explosion in social security spending due to the aging population. The main direction of tax reform is to lower corporate income tax, which is expected to boost corporate profitability and promote inward investments from the rest of the world, thereby bolstering economic growth. The Japanese government plans to finance the lost tax revenue from corporate income tax cuts by increasing the consumption tax rate. Currently, the Japanese tax structure shows that the consumption tax rate is too low and that the corporate income tax rate is too high compared to other countries (see Figures 1 and 2). The Abe administration has committed itself to lowering the effective corporate income tax rate from 34.6% to below 30% and increasing the consumption tax rate to from 5% to 10%.[1]

How much of a positive effect can this tax reform generate for investment and output? How will fiscal revenue and welfare respond to this tax reform over time? These are important questions to answer in order to successfully implement a tax reform program in Japan. This paper aims to provide quantitative estimates of the impact of potential Japanese tax reform on the welfare and fiscal budget balance using a small open two-sector (tradable and nontradable sector) dynamic general equilibrium model. Because the Japanese economy is open to international borrowing and lending with a large trade sector, it is important to incorporate these features into the model. The baseline model is similar to the one used in Choi and Kim (2016), who use dynamics scoring to estimate fiscal consequences of tax policies in Korea.[2]

[1] In 1989, the Japanese government introduced a 3% consumption tax rate with a significant reduction in corporate tax and income tax**.** In 1997, the consumption tax rate was raised to 5% with an advanced implementation of a tax cut for three subsequent years. In April 2014, it was raised to 8%, and a fiscal stimulus of 5 trillion Yen was implemented to mitigate the short-term negative impact of the hike. As documented later, the Abe administration has struggled to increase the rate from 8% to 10%.

[2] The model used in this paper has more realistic features such as habit formation compared to the model in Choi and Kim (2016).

In general, tax reform involving a corporate income tax cut financed by an increase in consumption tax enhances welfare (e.g., Kim and Kose, 2014; Mendoza and Tesar, 1998).[3] An increase in the consumption tax rate is likely to be less distortionary than other sources for fiscal revenue, such as income tax (IMF, 2011 & 2013).[4] Some studies in dynamic scoring show that corporate income tax can be self-financing, especially in open economies and in the long-run (e.g., Choi and Kim, 2016).[5] Therefore, the overall effects of a corporate income tax cut on fiscal balance may not be as bad as previously estimated. Exact quantitative forecasts depend on the structure of the model and the parameter values used for model simulation.

The dynamic scoring method employed in this paper has been widely used to measure the dynamic revenue effects of tax reform in recent studies. Using a simple neoclassical growth model, Mankiw and Weinzierl (2006) find that the long-run feedback effect on capital income tax revenue is approximately 50%. Trabant and Uhlig (2011) find similar results for the U.S. and larger effects for Europe. For Japan, Nutahara (2015) reports that the capital tax rate is close to the top of the Laffer curve, i.e., the feedback effects are close to 100%. Hiraga (2011) reports that a five percentage point corporate income tax cut in Japan will increase tax revenue by around 50% in the long run. However, other studies yield much smaller effects, depending on their model structure and calibration. Ganelli and Tervala (2015) employ a new Keynesian two-country model to assess the difference between short- and long-run effects on the budget. They report the feedback effects of income taxes to be on the order of 22% in the long run, whereas the short-run effects might in fact be negative.

[3] Heer and Trede (2003) also constructed a dynamic general equilibrium model for Germany and found that a consumption tax that replaces income tax has only a small impact on labor income distribution but positive effects on employment and long-run welfare levels.

[4] Unlike capital income tax, consumption tax does not distort household saving decisions, investment decisions or trade, and a part of the burden of an increase in tax rate falls on spending financed by past savings, which is completely distortion free because past decisions cannot be changed.

[5] Dynamic scoring calculates the revenue effects of a proposed tax policy by using dynamic macroeconomic models, in which a change in tax rate generates feedback to tax revenue through changes in the tax base over time. For example, a tax cut in capital income (or other distortionary taxes) tends to reduce tax revenue on impact but increases the tax base (and tax revenue) over time because a tax reduction in capital income enhances economic activities such as investment. The first effect of a tax cut is called static scoring, and the second effect (related to an increase in the tax base) is called the feedback (dynamic) effect. Compared to dynamic scoring, static scoring tends to overestimate the fiscal revenue loss from a tax cut as it disregards changes in the tax base.

Some papers have focused on the Japanese case to analyze the effects of a corporate income tax cut on investment and welfare.[6] De Mooij and Saito (2014) argue that a 1% reduction in the corporate income tax rate can boost investment by 0.4%. Employing a Bayesian DSGE model, Hasumi (2014) studies a case in which a corporate tax reduction (matching 1% GDP scale) is replaced by an increase in consumption tax and finds that output increases by 1.1% within two years and that consumption drops on impact but increases later.

This paper analyzes the welfare effects of a 5% cut in the corporate tax rate financed by an increase in either lump-sum tax or consumption tax. In the benchmark case with unrestricted international borrowing and no consumption habit, a corporate income tax cut in both tradable and nontradable sectors financed by consumption tax increases welfare by 0.53%. As restrictions on international borrowing and lending or the intensity of habit persistence increase, the amount of welfare gains decreases. For example, in the closed economy model with strong habit persistence, this type of tax reform yields a welfare loss of 0.51%.

In addition, we examine the effects of tax reform on fiscal balance using dynamic scoring. A corporate income tax cut of 5% in both sectors generates a fiscal revenue loss of 0.78% at the new steady state, which is equivalent to an increase in government debt by 1.66% every year. When financed by an increase in consumption tax, such a tax cut generates a fiscal revenue gain of 1.27% in the long run. Fiscal revenue calculated by static scoring tends to overestimate revenue loss relative to dynamic scoring because static scoring does not account for changes in the tax base over time, which affects fiscal revenue over time.

Finally, we study the effects of corporate income tax cuts in only one sector. When a 5% corporate income tax cut is applied to the tradable sector, welfare gains are much larger (0.43%) compared to the case of a corporate income tax cut in the nontradable sector only

[6] Several papers have analyzed the fiscal sustainability issue of tax reform, particularly an increase in consumption tax. Most existing studies suggest that the consumption tax rate should be higher than 20% to halt the increase in the government debt-to-output ratio. Braun and Joines (2015) suggest that the consumption tax rate should increase to 33% in 2017 to maintain the fiscal balance, assuming that the consumption tax rate reaches 10% in 2012. Sakuragawa and Hosono (2011) claim that the consumption tax rate should increase by 16% points, i.e., from 5% to 21% in 2031, to raise the primary surplus-to-GDP ratio by 6.5 percentage points. Hoshi and Ito (2014) and Fukao (2012) find that the government needs to increase the consumption tax rate up to nearly 25% to stabilize the government-debt-to-output ratio. Hansen and Imrohoroglu (2016) argue that the revenue required to finance the projected increase in government expenditures and to stabilize Japanese government debt is in the order of 30-40% of aggregate consumption per year.

(0.33%). The effects on budget balance are also favorable when the tax cut is applied to the tradable sector, regardless of the financial market structure.

This paper is organized as follows. Section 2 lays out a small open two-sector dynamic general equilibrium model. Section 3 calibrates the model with explanations on deep parameters. Section 4 provides the main simulation results for the welfare and fiscal balances based on various exercises, including sensitivity checks. Section 5 concludes the paper.

2. The Model

The economy consists of three sectors: households, firms and government. Households supply labor and capital to firms. Their labor income and capital income are subject to taxes, and the households also pay tax on their consumption. There are two types of firms producing tradable and nontradable goods. Both goods are produced by using two factors, labor and capital. The model allows for international borrowing and lending in the form of one-period risk free bonds. The government finances an exogenous stream of expenditures through domestic taxes. Different from the model in Choi and Kim (2016), the model in this paper features a separable utility function with habit formation, which can provide more realistic dynamics.

The representative household solves

$$(1) \qquad Max \sum_{t=0}^{\infty} \beta^t U\left(c_t, h_{xt}, h_{nt}\right), \text{ where } U_t = \frac{\left(c_t - \eta C_{t-1}\right)^{1-\theta}}{1-\theta} - \varphi \frac{\left(h_{xt} + h_{nt}\right)^{1+\xi}}{1+\xi},$$

subject to the budget constraint

$$(2) \quad \left(1+\tau_{ct}\right) p_t c_t + i_{xt} + p_{nt} i_{nt} + B_{t+1} = \left(1-\tau_{ht}\right)\left(w_{xt} h_{xt} + p_{nt} w_{nt} h_{nt}\right) + \left[\left(1-\tau_{kt}^{x}\right) r_{xt} + \tau_{kt}^{x} \delta_x\right] k_{xt} + \left[\left(1-\tau_{kt}^{n}\right) r_{nt} + \tau_{kt}^{n} \delta_n\right] p_{nt} k_{nt} + p_{nt} T_t + R_t B_t,$$

where $w_{xt}, r_{xt}, h_{xt}, i_{xt}, k_{xt}$ $(w_{nt}, r_{nt}, h_{nt}, i_{nt}, k_{nt})$ are wage rate, rental rate, hours worked, investment, and capital for the tradable (nontradable) sectors. The parameters *θ, η, φ, ξ* and C_{t-1} in the utility function denote the inverse of the elasticity of intertemporal substitution (EIS), the degree of external habit persistence, the disutility parameter for labor, the inverse of Frisch elasticity of labor supply and aggregate consumption in the past, respectively.[7] β is the discount factor, and δ_x (δ_n) is the depreciation rate for the tradable (nontradable) sector. The price of the composite consumption good c_t is p_t. B_t represents international bonds purchased in period *t-1* maturing in *t*. R_t is the exogenously given gross interest rate on bonds. T_t is lump-sum transfers from the government, and τ is tax rate (τ_{ht} = labor income tax, τ_{kt}^{n} = tax on capital income from the nontradable sector, τ_{kt}^{x} = tax on capital income from the tradable sector, and τ_{ct} = consumption tax). Investment tax credit is incorporated in the budget constraint. All prices are normalized in terms of tradable goods (p_{xt}), meaning that p_{nt} is the price of the nontradable good in terms of the price of the tradable goods (reciprocal of the real exchange rate).

There is no distinction between corporate and capital income, as households own capital and 100% of the share of domestic firms. Therefore, capital and corporate income tax are equivalent to each other and are used interchangeably in this model.

In each sector, capital is subject to adjustment costs, following Baxter and Crucini (1993),

$$k_{x,t+1} = (1-\delta_x)k_{xt} + \phi\left(\frac{i_{xt}}{k_{xt}}\right)k_{xt}, \tag{3}$$

$$k_{n,t+1} = (1-\delta_n)k_{nt} + \phi\left(\frac{i_{nt}}{k_{nt}}\right)k_{nt}, \tag{4}$$

[7] This additively separable utility functional form is frequently used in the open macro literature (e.g., Erceg et al. 2005; Galí et al. 2005). External habit formation is sometimes called "catching-up-with-the-Jones" preference, which is widely used in the macro literature. For example, Iiboshi et al. (2006) and Smets Wouters (2007) provide the estimates of the degree of external habit by estimating the dynamic stochastic general equilibrium (DSGE) models using the Japanese and U.S. data, respectively.

where $\phi(\cdot)$ is the adjustment cost function with the following properties: $\phi(\cdot) > 0$, $\phi'(\cdot) > 0$ and $\phi''(\cdot) < 0$.

A composite consumption good consists of two goods: tradable (c_{xt}) and nontradable (c_{nt}). The optimal consumption level of the tradable and nontradable goods can be derived from the following expenditure minimization problem:

$$(5) \qquad Min\ p_t c_t - c_{xt} - p_{nt} c_{nt},\ \text{s.t.}\ \ c_t = \left[b_x c_{xt}^{1-\gamma} + b_n c_{nt}^{1-\gamma} \right]^{\frac{1}{1-\gamma}}\ \text{and}\ \ b_x + b_n = 1,$$

where b_x and b_n are share parameters representing a relative weight of consumption of each good, and γ is a parameter related to the elasticity of substitution between the two goods.

Firms in the tradable and nontradable sectors produce output using labor and capital based on the typical Cobb-Douglas technology with zero profit conditions:

$$(6) \qquad y_{xt} = w_{xt} h_{xt} + r_{xt} k_{xt}, \quad y_{xt} = A_{xt} k_{xt}^{\mu} h_{xt}^{1-\mu}$$

$$(7) \qquad y_{nt} = w_{nt} h_{nt} + r_{nt} k_{nt}, \quad y_{nt} = A_{nt} k_{nt}^{\alpha} h_{nt}^{1-\alpha},$$

where y_{xt} (y_{nt}) denotes output of the tradable (nontradable) sector, and $\mu(\alpha)$ indicates the capital share of the tradable (nontradable) sector. A_{xt} and A_{nt} are defined as productivity in production function and are assumed to be constant at one in this deterministic model.

The government's budget constraint is given by

$$(8) \qquad \tau_{ct} p_t c_t + \tau_{ht} \left(w_{xt} h_{xt} + p_{nt} w_{nt} h_{nt} \right) + \tau_{kt}^{x} \left(r_{xt} - \delta_x \right) k_{xt} + \tau_{kt}^{n} \left(r_{nt} - \delta_n \right) p_{nt} k_{nt} = p_{nt} G_{nt} + p_{nt} T_t,$$

where G_{nt} is exogenous government spending on nontradable goods. We assume that government spending and lump-sum transfers are in the nontraded sector only. Combining the household's budget constraint with the government's budget constraint yields the following aggregate budget constraints:

(9) $$y_{nt} = c_{nt} + i_{nt} + G_{nt},$$

(10) $$y_{xt} + R_t B_t = c_{xt} + i_{xt} + B_{t+1}.$$

3. Calibration

We calibrate the model parameters based on the Japanese data and adopt certain parameter values from the previous literature. Table 1 reports the parameters and steady state values of the benchmark model. The discount factor β is set at 0.95 to match the annual steady state world real interest rate of approximately 5%.[8] θ is equal to 1.9, implying a low EIS, which is commonly used in the DSGE literature. The parameter for habit persistence η is set at 0 and 0.5 for different types of experiments. These values fall within commonly used values in the literature (e.g., Christiano et al. 2005; Smets and Wouters 2007). The inverse of the Frisch elasticity of the labor supply ξ is set at 2.1, suggesting a low Frisch elasticity that is close to the value used in Smets and Wouters (2007).[9] The labor disutility parameter φ is set to ensure that the steady state value of hours worked (i.e., the sum of hours worked in the tradable and nontradable sectors) is one third.

Share parameters b_x and b_n in the CES form of consumption function are set to match the actual consumption shares in Japanese data from 2000 to 2013. The data show that the consumption shares of the tradable and nontradable goods are 43% and 57%, respectively.[10] The parameter γ is set at 2 to make the elasticity of substitution between tradable and nontradable goods in Japan equal to 0.5, according to Batini et al. (2008).[11] We set the depreciation rate at 8% for both production sectors according to Hayashi and Prescott (2002),

[8] The U.S. 3-month Treasury bill rate is used as a proxy for the world interest rate. We calculate the long-run annualized average Treasury bill rate from 1970 to 2013.

[9] The EIS and the Frisch elasticity of labor supply are taken from Iiboshi et al. (2006), who employ the Bayesian estimation method to estimate a DSGE model using the Japanese data.

[10] The consumption share data are taken from ESRI (Economic and Social Research Institute, Cabinet Office, Government of Japan), *Annual Reports on National Accounts*.

[11] Some earlier studies show that the elasticity of substitution between tradable and nontradable goods is less than unity. For example, Mendoza (1995) and Stockman and Tesar (1995) use 0.74 and 0.44, respectively, which correspond to the parameter γ of approximately 1.35 and 2.27, respectively. The value γ used in this paper is between these two values.

and this rate is close to a commonly used value in the literature. The elasticity of the marginal adjustment cost function ϕ in the tradable and nontradable sectors is set at 25 to match the relative volatility of investment.[12] The capital share in the tradable sector μ is set at 0.44, and the capital share in the nontradable sector α is set at 0.35 to match the long-run average labor income share in the Japanese data.[13]

To set the initial tax rates for calibration, we first calculate the relative tax revenue shares from consumption, labor income and capital income taxes in Japan. The data in the OECD dataset from 2000 to 2012 show that the tax revenue shares for consumption, labor income and capital income taxes are 16.9%, 55.7% and 27.5%, respectively. The effective tax rates that can match these tax revenue shares are 9.50%, 28.78% and 40.54% for consumption, labor and capital income tax, respectively. We use these values for the steady state tax rates (τ_c, τ_h and τ_k) in the model economy.[14]

The government expenditure on the nontradable sector G_n over y_n is set at 28.92% to match the government expenditure over GDP ratio at 18.8%, allowing the government budget over GDP to be a deficit of -6.29% under the steady state value.[15] The initial asset holding position (which is a free parameter) is set to zero, and p_{xt} is set to one. We solve the model using the double-shooting algorithm that Mendoza and Tesar (1998), Gorodnichenko et al. (2012), and Kim and Kose (2014) employ.[16]

4. Main Results

Because the results are sensitive to two main assumptions in the model (the degree of capital mobility and the intensity of habit formation), we experiment with different values for

[12] Iiboshi et al. (2006) estimate a quadratic capital adjustment cost function using the Japanese data and obtain 0.04 as a posterior mean of the inverse of the capital adjustment cost function.

[13] Freeman (2008) classifies the tradable and nontradable sectors using the OECD dataset, which is based on the International Standard Industry Classification (ISIC Rev.3) and employs the "industry" ("market services") in the OECD dataset as the tradable (nontradable) sector. Following Freeman (2008), we compute the long-run average of the labor income share from 1970 to 2010.

[14] We adopt the method by Mendoza et al. (1994) that calculate the effective tax rates for G7 countries by dividing actual tax payments by corresponding national accounts. See Mendoza et al. (1994) for details.

[15] The data show that the government budget over GDP is -6.29% from 2000 to 2013.

[16] For a detailed shooting algorithm, see Mendoza and Tesar (1998).

these two parameters. The benchmark refers to a condition in which no restrictions in international borrowing and lending (open economy) and no habit formation are present. Then, we experiment with a closed economy and a positive habit–formation case.

4.1. Capital income tax cuts in both sectors

We conduct two policy experiments: a one-time permanent cut in capital income tax financed by a lump-sum tax or a consumption tax. We consider the case of a 5% tax cut in capital income (from 40.54% to 35.54%). This case is similar to what the Abe administration is currently doing. We then examine how welfare changes in the short- and long-run following this type of tax reform. We also analyze the extent to which fiscal variables, the tax base, and tax revenue from each source change in the new steady state using dynamic scoring.

4.1.1. Financed by lump-sum tax

As a benchmark case, we assume that the government uses a lump-sum tax to finance the lost revenue from the capital income tax cuts, producing the least amount of distortion in the economy. It should be noted that levying a lump-sum tax is equivalent to issuing new government bonds, as Ricardian equivalence holds in this model (see Mendoza and Tesar, 1998). Table 2 reports how much new government bond should be issued to finance the revenue loss from the capital income tax cut. In the open economy, a 5% tax cut in capital income tax requires an annual increase in government debt by 1.66% of GDP in the long-run. In the closed economy, the required increase in government debt is approximately 1.18% of GDP. These are quite significant amounts considering the size of Japan's GDP.

The first panel in Table 2 reports welfare effects under two financial market structures and two types of habit formation. Welfare gains are measured by percentage changes in certainty equivalent consumption, which is frequently used in macro public finance literature (e.g., Lucas, 1987). Overall welfare gains are measured by conditional welfare changes, which are calculated by taking a discounted sum of periodic utility (measured by certainty equivalent consumption) over time. Long-run welfare gains are measured by percentage changes in steady state welfare before and after tax reform. The difference between overall welfare gains and long-run gains is defined as transitional gains. We consider both an open

economy model with unrestricted international borrowing and a closed economy model with no international borrowing. For habit formation, we consider the case of no habit and a moderate habit with $\eta=0.5$.

The simulation results show sizeable long-run welfare gains in all cases. In the long run, capital income tax cuts financed by lump-sum tax (government debt) always increase welfare, ranging from 0.64% ~ 2.16% of permanent consumption. The lower capital income tax increases investment and output in the long run, which increases private demand and accordingly raises the consumption level in the economy. However, transitional welfare gains are negative in all cases, indicating that a capital income tax cut reduces consumption and/or increases the labor supply over a transitional period. Capital income tax cuts increase investment but are accompanied by a decrease in consumption due to limited resources in the economy. Welfare gains from an increase in investment do not materialize immediately.

The size of transitional welfare loss depends on the financial market structure and the intensity of the habit persistence. As restrictions in international borrowing increase, transitional welfare loss also increases, lowering overall welfare gains. In a closed economy, an increase in investment should be entirely financed by a decrease in consumption because international borrowing is not allowed. Transitional welfare loss in the closed economy (no habit) is 1.4%, which is much larger than that in an open economy (0.06%). The presence of habit formation induces a slow adjustment of consumption, which implies that dynamic path of consumption is suboptimal. Therefore, habit persistence would lead to smaller overall welfare gains compared to the case without habit persistence. In terms of overall welfare gains, a capital income tax cut in an open economy model with unrestricted borrowing and no habit formation yields substantial welfare gains of 0.76%, whereas a closed economy model with strong habit persistence exhibits a welfare loss of 0.63%.

A policy lesson that we can learn from this exercise is that capital (corporate) income tax cuts do not always generate welfare gain, especially during a transitional period. If the government has a short window for policy evaluation, a capital income tax cut may not serve the originally intended goal of increasing welfare because it will only produce welfare gains in the long run. Welfare gains from a capital income tax cut can be maximized when a country allows for unrestricted international borrowing, and consumption can freely adjust to changes in the economic environment.

The bottom panel of Table 2 shows the long-run steady state changes in the tax base and in tax revenue when a 5% capital income tax cut is implemented. Simulation is performed assuming no habit in both open and closed economies, and the reported numbers are percentage changes between the initial and new steady states. It should be noted that lump-sum tax is not included in the calculations of the fiscal revenue because it represents a new issue of government bonds. The results exhibit significant feedback effects from a capital income tax cut. In particular, dynamic scoring results in positive feedback effects on consumption and labor income. In an open economy, capital income tax cuts increase the consumption tax base by 1.63%, the labor income tax base by 3.68%, and the capital income tax base by 0.02%, respectively. The total tax revenue under dynamic scoring decreases by 0.78% from the initial steady state. This value is much smaller than that of static scoring (3.14%). It implies that static scoring tends to overestimate revenue loss from a tax cut due to an absence of feedback effects captured by increases in the tax base over time. In a closed economy, the fiscal revenue loss is larger (1.22%) than that in an open economy (0.78%).

4.1.2. Financed by consumption tax

We compare how the previous results change when the government raises the consumption tax to finance lost tax revenue from capital income tax cuts. To calculate the necessary amount of increase in the consumption tax rate, we assume that the government's goal is to return the fiscal budget balance back to the initial steady state level (-6.29% of GDP) over the four years after the tax cut was implemented.[17] Because we only consider a time-invariant one-time change in the tax rate, lump-sum taxes are used to match the budget balance in every period. We use the double-shooting algorithm for simulation.

Table 3 shows that the 5% capital income tax cut can be fully compensated by an increase in consumption tax from the initial 9.50% to 11.90% in the open economy without habit formation and 11.12% in the closed economy without habit formation. Habit persistence

[17] We use four years to match the current Japanese government election cycle. If we extend it to a longer period, the necessary amount of increase in the consumption tax rate becomes lower. If we assume that the government has a stricter fiscal goal, such as returning the fiscal balance to zero or even to a fiscal surplus, the consumption tax rate should increase to a much higher level. Another way to implement this exercise is to assume that the government matches the intertemporal budget constraint for a certain number of years instead of a target balance at a specific time in the future.

slightly increases the amount of consumption tax rate hike necessary to achieve the balanced budget. With a stronger habit behavior, consumption becomes less responsive to changes in tax rates and therefore consumption tax rate should increases more.

The results in terms of welfare effects are similar to those in the case of lump-sum tax financing: long-run welfare gains are positive, and transitional welfare gains are negative in all cases. Overall welfare gains depend on the relative size of transitional and long-run gains. In the case of an open economy with no consumption habit, the size of welfare gains in the case of consumption tax financing (0.53%) is lower than the size of welfare gains in the case of lump-sum tax financing (0.76%). This is because lump-sum taxation is the least-distorting taxation method. However, when a consumption habit exists, consumption-tax financing generates larger welfare gains compared to lump-sum tax financing. A consumption habit prohibits the optimal level of substitution from consumption to investment, but now, an increase in consumption tax expedites a movement of resources from consumption to investment, thereby increasing welfare.

The bottom panel of Table 3 reports the effects on the tax base and on tax revenue in the case of consumption-tax financing. As in the case of lump-sum tax financing, dynamic scoring leads to substantial feedback effects: the consumption and labor tax bases increase by 1.06% and 3.14%, respectively, in an open economy. Due to an increase in consumption tax, consumption tax revenue increases by 26.59% (19.31%) in an open (closed) economy, which offsets a decrease in capital income tax revenue (12.80% in an open economy and 13.43% in a closed economy). The total tax revenue under dynamic scoring increases by 3.48% (1.70%) in an open (closed) economy, which is much larger than the increase seen in static scoring (1.60% in an open economy and 0.06% in a closed economy).

When a consumption tax replaces a capital income tax, the long-run consequences for the budget balance are positive in all cases. Moreover, when a consumption habit exists in the open economy, a capital income tax cut financed by a consumption tax improves both welfare and the fiscal revenue simultaneously. These findings indicate that the current

administration's tax reform plan is proceeding in the right direction, however, its postponement of consumption tax hike is not a right move because it is currently too low.[18]

4.2. Capital income tax cuts in one sector only

One of the advantages of using a multisector model is that we can analyze the effects of capital income tax cuts in one sector only. Tables 4 and 5 report the welfare and fiscal effects of a 5% capital income tax cut in one sector, when the capital income tax rate in the other sector is held constant. We first analyze the case of lump-sum tax financing in Table 4 and consumption-tax financing in Table 5.

In the open economy model, the welfare effects of a corporate income tax cut in the tradable sector are much better than the welfare effects deriving from a tax cut in the nontradable sector. This result holds regardless of the degree of habit formation. In an open economy model with no habit, for instance, the overall welfare gains of a capital tax cut in the tradable sector are 0.43%, whereas a tax cut in the nontradable sector generates welfare gains of only 0.33%. Because the tradable sector is more capital intensive than the nontradable sector in the Japanese economy (capital intensity in the production function is 0.44 vs. 0.35 in calibration), a capital income tax cut is more beneficial when applied to the tradable sector. The main reason for this asymmetric result is the sectoral shift of resources from the nontradable to the tradable sector.

In the closed economy, there is not much difference in welfare gains between capital income tax cuts in the tradable and nontradable sectors. In the closed economy, the channel for intertemporal optimization does not exist due to a lack of international borrowing. Therefore, the capital income tax cut in the tradable sector does not generate a sectoral resource shift from the nontradable to the tradable sector as much as in an open economy, which limits the welfare gains from a tax cut. However, financial openness does not affect the optimal decision in the nontradable sector. Therefore, the capital income tax cut in the

[18] The consumption tax rate was increased from 5% to 8% in April 2014 as planned and was expected to be increased from 8% to 10% in October 2015, but the administration postponed the hike to 10% two times, i.e., the first is from October 2015 to April 2017 and the second is from April 2017 to October 2019.

nontradable sector produces similar welfare gains regardless of whether the financial market is open.

The bottom panel of Table 4 presents the effects on tax revenue from a capital income tax cut in one sector only. The results show that the positive revenue effects of a tax cut in the tradable sector are much larger than those in the nontradable sector in an open economy. For example, a tax cut in the tradable sector increases the consumption, labor, and capital tax bases by 2.25%, 3.67%, and 2.20%, respectively. However, a tax cut in the nontradable sector reduces the tax base: the labor income tax base does not change, and the consumption and capital tax bases decrease by 0.59% and 2.10%, respectively. All of these results translate into fiscal revenue. The tax revenue increases by 1.75% from a tax cut in the tradable sector, whereas it decreases by 2.43% when the tax cut is implemented in the nontradable sector. Similar results hold for the case of the closed economy. Overall, the capital income tax cut in the tradable sector generates much better consequences in terms of welfare and the fiscal balance compared to those in the nontradable sector.

When the consumption tax is used to finance a capital income tax cut, as shown in Table 5, the basic results in Table 4 hold: the welfare and fiscal balance effects from a tax cut in the tradable sector are better than those of a tax cut in the nontradable sector. Compared to the case of lump-sum tax financing, consumption tax financing generates lower welfare gains because of its relatively distortional features, but a higher fiscal surplus from a tax cut. This property applies to a capital income tax cut in the tradable and nontradable sectors.

4.3. Sensitivity analysis

In this section, we experiment with different key parameter values to test whether the main conclusion holds. We change three parameters in this section: the inverse of the EIS (θ), the inverse of Frisch elasticity of the labor supply (ξ), and the elasticity of substitution between tradable and nontradable goods (γ). For the benchmark case, we use the case of lump-sum tax financing when the capital income tax cut is in both sectors (Table 2).

In the first panel of Table 6, we lower the value of θ from 1.9 to 1 (log utility) to attain a high elasticity of intertemporal substitution in the utility function.[19] Hansen and Imrohoroglu (2016), who study fiscal sustainability issues in Japan, use this value. Compared to the benchmark case, the overall welfare gains from a tax cut slightly increase from 0.76% to 0.88% in an open economy with no habit. With habit persistence, the welfare gains actually decrease with a high elasticity of substitution. This is due to more negative transitional welfare loss.

In the second panel, we lower the elasticity of the labor supply from 2.1 to 1.0 according to Kuroda and Yamamoto (2008). The results do not change significantly from the benchmark case. Finally, in the third panel, we lower the elasticity of substitution between tradable and nontradable goods in the formation of a composite consumption good from 2 to 0.5. The baseline elasticity of substitution between tradable and nontradable goods in Obstfeld and Rogoff (2005) is 1, and they also use 2 for sensitivity analysis. In this case, the amount of the sectoral shift of resources would be smaller due to the lower substitution of the two goods in consumption. However, the simulation results for welfare are quite similar to the benchmark case. Overall, changes in key parameters do not change the main results compared to the benchmark case.

5. Conclusion

We examine the welfare and dynamic revenue effects of a permanent tax cut in capital income in the case of Japan by using a small open two-sector dynamic general equilibrium model. We evaluate the consequences on tax revenue using dynamic scoring. All the results show that the feedback effect is not negligible, and static scoring overestimates the revenue loss from a tax cut.

Several findings emerge from this study. First, capital income tax cuts in an open economy model with unrestricted borrowing and no habit yield positive welfare gains, whether financed by a lump-sum or consumption tax. Welfare gains from a 5% tax cut range from 0.53% to 0.76% of permanent consumption. More restrictions on international

[19] This is equivalent to a lower risk-aversion parameter if we interpret θ as a risk-aversion parameter.

borrowing or larger habit persistence reduce the overall welfare gains and, in some cases, yield a welfare loss. Second, in an open economy model with no habit, a 5% capital income tax cut requires the government to increase fiscal debt by 1.66% of GDP every year or to increase the consumption tax from 9.50% to 11.90% to return to the initial fiscal balance in four years. Third, the positive feedback effects of a tax cut are much larger in the open economy model compared to the closed economy case. In the open economy, households do not need to sacrifice consumption to take advantage of a capital income tax cut and produce more because they can rely on international borrowing. Finally, sectoral responses to a capital income tax cut exhibit a stark contrast in the tradable and nontradable sectors. Because the tradable sector is more capital intensive than the nontradable sector in this model, there is a significant resource shift from the nontradable to the tradable sector when there is a capital income tax cut. This result suggests the policy implication that if the government can implement a selective capital income tax cut in different sectors, a tax cut in the tradable sector generates better revenue effects than a tax cut in the nontradable sector.

There are several other important points that should be considered in the study of Japanese tax reform. First, an increase in consumption tax is expected to help improve fiscal revenue in the midst of population aging. IMF (2011) reports, “Aging implies dissaving by households (spending exceeding income), making the consumption tax base more robust than that of taxes on labor income, which will grow more slowly than spending as the population ages.” Second, the currently proposed tax reform scenario may be enough to improve distortions in the current Japanese fiscal revenue structure: too low consumption tax revenue with too high corporate tax revenue. Finally, an increase in consumption tax has negative side effects on income distribution because consumption tax is regressive. Consumption tax has a broader base than income tax because it also falls on spending financed by social transfers.

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Table 1. Deep parameters and key steady state values

Parameters	*Description*	*Benchmark Values*
Preference		
β	Discount factor (annual)	0.95
θ	Inverse of elasticity of intertemporal of substitution (EIS)	1.90
η	Degree of external habit persistence	0, 0.50
ξ	Inverse of Frisch elasticity of labor supply	2.10
γ	Coefficient of elasticity of substitution b/w tradable and nontradable goods	2.00
b_x	Weight of tradable good	0.43
b_n	Weight of nontradable good	0.57
Technology		
	Tradable Sector	
μ	Share of capital income	0.44
δ_x	Depreciation rate (annual value)	0.08
η_x	Elasticity of marginal adjustment cost function	25.00
	Nontradable Sector	
α	Share of capital income	0.35
δ_n	Depreciation rate (annual value)	0.08
η_n	Elasticity of marginal adjustment cost function	25.00
Other Steady States		
g_n	Government expenditure (ratio of GDP)	28.92%
nx	Net exports (ratio of GDP)	0.00
p_x	Price of tradable good	1.00
Tax Rates		
τ_c	Consumption tax	9.50%
τ_h	Labor income tax	28.78%
τ_k^x, τ_k^n	Capital income tax	40.54%

Table 2. Welfare and fiscal implications of a capital income tax cut in both sectors — Lump sum tax financing

	Open economy	Closed economy
Welfare implications		
No habit persistence ($\eta = 0$)		
Increase in government debt (% of GDP, annual)	1.66	1.18
Overall welfare gains	0.76	0.56
Transitional gains	-0.06	-1.40
Long-run gains	0.82	1.96
Habit persistence ($\eta = 0.5$)		
Increase in government debt (% of GDP, annual)	1.66	1.17
Overall welfare gains	0.44	-0.63
Transitional gains	-0.20	-2.79
Long-run gains	0.64	2.16

Long-run effects on fiscal balance

Changes in tax base (%)	**Open economy**		**Closed economy**	
C-tax base	1.63		2.35	
L-tax base	3.68		3.01	
K-tax base	0.02		-0.92	
K_x-tax base	2.27		-0.75	
K_n-tax base	-1.49		-1.03	
Changes in tax revenue (%)	**Dynamic**	**Static**	**Dynamic**	**Static**
C-tax revenue	1.63	0.00	2.35	0.00
L-tax revenue	3.68	0.00	3.01	0.00
K-tax revenue	-12.31	-12.33	-13.14	-12.33
K_x-tax revenue	-10.34	-12.33	-12.99	-12.33
K_n-tax revenue	-13.64	-12.33	-13.24	-12.33
Changes in total tax revenue (%)	-0.78	-3.14	-1.22	-3.14

Notes:
1. C, L, K, K_x and K_n stands for consumption tax, labor income tax, capital income tax, capital income tax in the tradable sector and capital income tax in the nontradable sector, respectively.
2. "Dynamic" and "Static" denote dynamic scoring and static scoring.
3. Effects on fiscal balance are calculated by using the case with no habit formation. Long-run effects on fiscal balance measure percentage changes of fiscal variable from the initial steady state to a new steady state after the tax reform is implemented.
4. Increase in government debt measures how much new government bond should be issued annually at the new steady state in order to finance the capital income tax cut.

Table 3. Welfare and fiscal implications of a capital income tax cut in both sectors — Consumption tax financing

Welfare implications				
	Open economy		**Closed economy**	
No habit persistence ($\eta = 0$)				
Required increase in consumption tax (%)	11.90		11.12	
Overall welfare gains	0.53		0.42	
Transitional gains	-0.06		-1.33	
Long-run gains	0.59		1.74	
Habit persistence ($\eta = 0.5$)				
Required increase in consumption tax (%)	11.91		11.10	
Overall welfare gains	0.57		-0.51	
Transitional gains	-0.15		-2.66	
Long-run gains	0.72		2.15	
Long-run effects on fiscal balance				
Changes in tax base (%)	**Open economy**		**Closed economy**	
C-tax base	1.06		1.93	
L-tax base	3.14		2.68	
K-tax base	-0.54		-1.25	
K_x-tax base	1.41		-1.16	
K_n-tax base	-1.86		-1.30	
Changes in tax revenue (%)	**Dynamic**	**Static**	**Dynamic**	**Static**
C-tax revenue	26.59	25.26	19.31	17.05
L-tax revenue	3.14	0.00	2.68	0.00
K-tax revenue	-12.80	-12.33	-13.43	-12.33
K_x-tax revenue	-11.09	-12.33	-13.35	-12.33
K_n-tax revenue	-13.96	-12.33	-13.48	-12.33
Changes in total tax revenue (%)	3.48	1.60	1.70	0.06

Notes:
1. C, L, K, K_x and K_n stands for consumption tax, labor income tax, capital income tax, capital income tax in the tradable sector and capital income tax in the nontradable sector, respectively.
2. "Dynamic" and "Static" denote dynamic scoring and static scoring.
3. Effects on fiscal balance are calculated by using the case with no habit formation. Long-run effects on fiscal balance measure percentage changes of fiscal variable from the initial steady state to a new steady state after the tax reform is implemented.

Table 4. Welfare and fiscal implications of a capital income tax cut in one sector — Lump-sum tax financing

	Open economy	Closed economy
Welfare implications		
No habit persistence ($\eta = 0$)		
Increase in government debt (% of GDP, annual)	1.13 (0.55)	0.75 (0.44)
Overall welfare gains	0.43 (0.33)	0.25 (0.30)
Transitional gains	0.26 (-0.33)	-0.62 (-0.77)
Long-run gains	0.17 (0.66)	0.88 (1.07)
Habit persistence ($\eta = 0.5$)		
Increase in government debt (% of GDP, annual)	1.12 (0.55)	0.74 (0.44)
Overall welfare gains	0.47 (-0.00)	-0.33 (-0.33)
Transitional gains	0.50 (-0.67)	-1.25 (-1.54)
Long-run gains	-0.03 (0.67)	0.93 (1.21)

Long-run effects on fiscal balance

Changes in tax base (%)	**Open economy**		**Closed economy**	
C-tax base	2.25 (-0.59)		2.71 (-0.34)	
L-tax base	3.67 (0.00)		3.25 (-0.23)	
K-tax base	2.20 (-2.10)		1.61 (-2.44)	
K_x-tax base	0.88 (1.37)		-1.03 (0.29)	
K_n-tax base	3.10 (-4.45)		3.40 (-4.29)	
Changes in tax revenue (%)	**Dynamic**	**Static**	**Dynamic**	**Static**
C-tax revenue	2.25 (-0.59)	0.00 (0.00)	2.71 (-0.34)	0.00 (0.00)
L-tax revenue	3.67 (0.00)	0.00 (0.00)	3.25 (-0.23)	0.00 (0.00)
K-tax revenue	-2.82 (-9.13)	-4.98 (-7.36)	-3.31 (-9.48)	-4.98 (-7.36)
K_x-tax revenue	-11.57 (1.37)	-12.33 (0.00)	-13.24 (0.29)	-12.33 (0.00)
K_n-tax revenue	3.10 (-16.23)	0.00 (-12.33)	3.40 (-16.09)	0.00 (-12.33)
Changes in total tax revenue (%)	1.75 (-2.43)	-1.27 (-1.87)	1.48 (-2.61)	-1.27 (-1.87)

Notes:
1. C, L, K, K_x and K_n stands for consumption tax, labor income tax, capital income tax, capital income tax in the tradable sector and capital income tax in the nontradable sector, respectively.
2. "Dynamic" and "Static" denote dynamic scoring and static scoring.
3. Effects on fiscal balance are calculated by using the case with no habit formation. Long-run effects on fiscal balance measure percentage changes of fiscal variable from the initial steady state to a new steady state after the tax reform is implemented.
4. Main numbers are for the case of a capital income tax cut in the tradable sector only, while the numbers in parentheses indicate the case for the capital income tax cut in the nontradable sector.

Table 5. Welfare and fiscal implications of a capital income tax cut in one sector — Consumption tax financing

	Open economy	Closed economy
Welfare implications		
No habit persistence ($\eta = 0$)		
Required increase in consumption tax (%)	10.75 (10.65)	10.05 (10.55)
Overall welfare gains	0.31 (0.22)	0.21 (0.20)
Transitional gains	0.26 (-0.33)	-0.60 (-0.72)
Long-run gains	0.04 (0.55)	0.81 (0.92)
Habit persistence ($\eta = 0.5$)		
Required increase in consumption tax (%)	10.75 (10.65)	10.04 (10.54)
Overall welfare gains	0.53 (0.05)	-0.29 (-0.24)
Transitional gains	0.51 (-0.66)	-1.21 (-1.45)
Long-run gains	0.02 (0.71)	0.92 (1.21)

Long-run effects on fiscal balance

Changes in tax base (%)	**Open economy**		**Closed economy**	
C-tax base	1.94 (-0.86)		2.56 (-0.61)	
L-tax base	3.39 (-0.25)		3.14 (-0.44)	
K-tax base	1.90 (-2.37)		1.50 (-2.65)	
K_x-tax base	0.43 (0.96)		-1.17 (0.01)	
K_n-tax base	2.90 (-4.62)		3.30 (-4.46)	
Changes in tax revenue (%)	**Dynamic**	**Static**	**Dynamic**	**Static**
C-tax revenue	15.36 (11.14)	13.16 (12.11)	8.50 (10.37)	5.79 (11.05)
L-tax revenue	3.39 (-0.25)	0.00 (0.00)	3.14 (-0.44)	0.00 (0.00)
K-tax revenue	-3.09 (-9.39)	-4.98 (-7.36)	-3.42 (-9.68)	-4.98 (-7.36)
K_x-tax revenue	-11.96 (0.96)	-12.33 (0.00)	-13.36 (0.01)	-12.33 (0.00)
K_n-tax revenue	2.90 (-16.38)	0.00 (-12.33)	3.30 (-16.24)	0.00 (-12.33)
Changes in total tax revenue (%)	3.99 (-0.44)	1.20 (0.40)	2.47 (-0.76)	-0.18 (0.20)

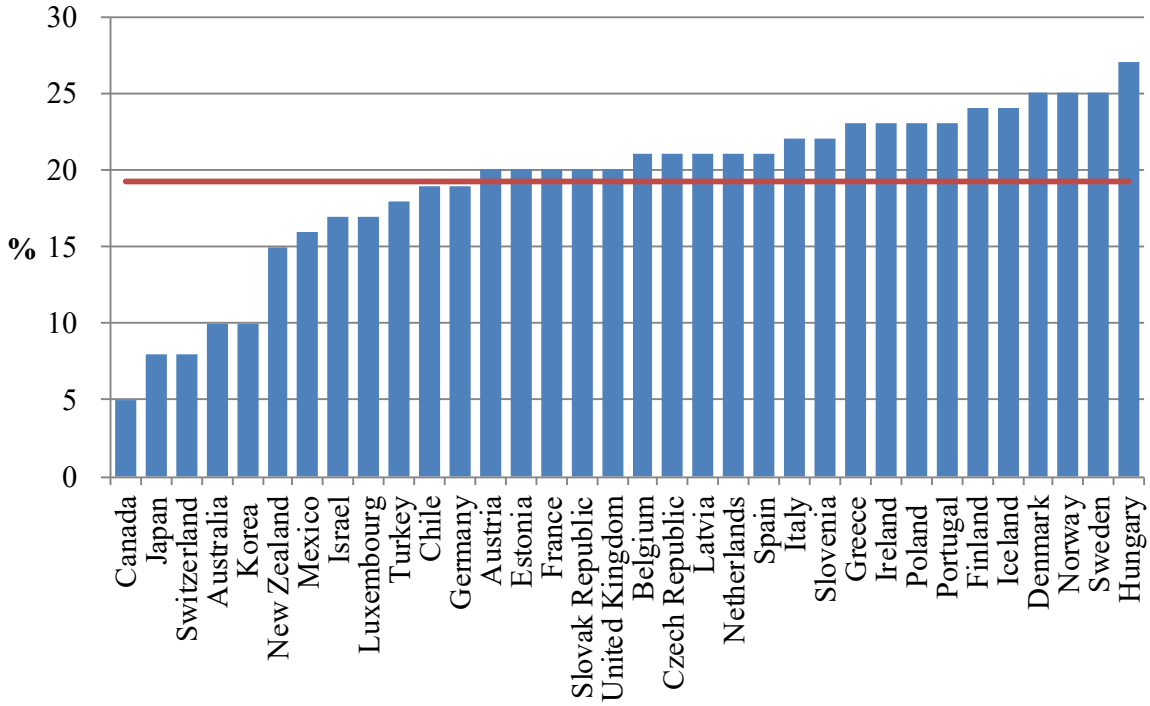
Notes:
1. C, L, K, K_x and K_n stands for consumption tax, labor income tax, capital income tax, capital income tax in the tradable sector and capital income tax in the nontradable sector, respectively.
2. "Dynamic" and "Static" denote dynamic scoring and static scoring.
3. Effects on fiscal balance are calculated by using the case with no habit formation. Long-run effects on fiscal balance measure percentage changes of fiscal variable from the initial steady state to a new steady state after the tax reform is implemented.
4. Main numbers are for the case of a capital income tax cut in the tradable sector only, while the numbers in parentheses indicate the case for the capital income tax cut in the nontradable sector.

Table 6. Sensitivity Analysis: welfare implications
— Lump sum tax financing

	Open economy	Closed economy
High elasticity of intertemporal substitution ($\theta = 1$)		
No habit persistence ($\eta = 0$)		
Increase in government debt (% of GDP, annual)	1.66	1.26
Overall welfare gains	0.88	0.71
Transitional gains	-0.15	-1.57
Long-run gains	1.02	2.27
Habit persistence ($\eta = 0.5$)		
Increase in government debt (% of GDP, annual)	1.65	1.27
Overall welfare gains	0.29	-0.97
Transitional gains	-0.40	-3.13
Long-run gains	0.69	2.17
Low elasticity of labor supply ($\xi = 1$)		
No habit persistence ($\eta = 0$)		
Increase in government debt (% of GDP, annual)	1.70	1.09
Overall welfare gains	0.79	0.60
Transitional gains	0.01	-1.30
Long-run gains	0.79	1.90
Habit persistence ($\eta = 0.5$)		
Increase in government debt (% of GDP, annual)	1.72	1.09
Overall welfare gains	0.42	-0.45
Transitional gains	-0.07	-2.61
Long-run gains	0.49	2.16
Low elasticity of substitution b/w tradable and nontradable goods ($\gamma = 0.5$)		
No habit persistence ($\eta = 0$)		
Increase in government debt (% of GDP, annual)	1.56	1.16
Overall welfare gains	0.79	0.57
Transitional gains	0.03	-1.42
Long-run gains	0.76	1.98
Habit persistence ($\eta = 0.5$)		
Increase in government debt (% of GDP, annual)	1.55	1.16
Overall welfare gains	0.54	-0.63
Transitional gains	-0.03	-2.83
Long-run gains	0.57	2.20

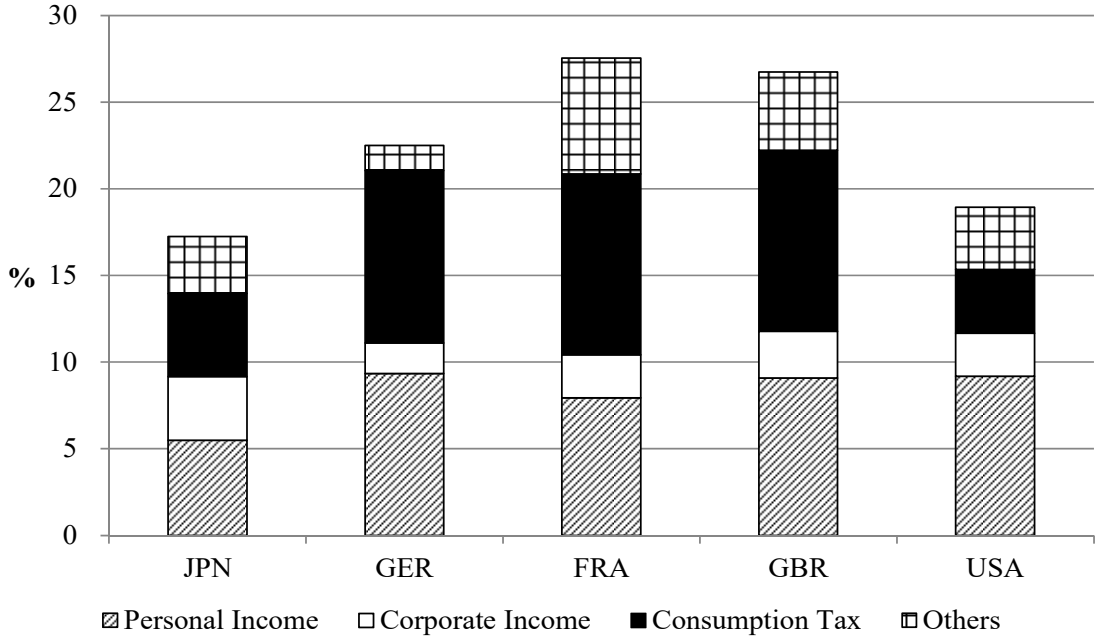
Note: These results are based on a capital income tax cut in both sectors.

Figure 1. Value added and sales tax rates



Note: The rates are applicable on 1 January 2016.
Sources: OECD, Tax Database.

Figure 2. Tax revenue by sources



Notes: Y-axis denotes % of GDP in 2012. Each item corresponds to the source of tax revenue in 2014. Social Security is excluded.
Source: OECD, Revenue Statistics 2014.