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ANOTHER BETTER WAY OF THE CORPORATE TAX REFORM IN JAPAN: CLOSE BUT NOT THE SAME AS THE VALUE-ADDED TAX

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Abstract: This paper examines the impact of Japan's corporate tax reform using a dynamic general equilibrium model. The government reduced the effective corporate income tax rate from 34.62% to 29.74% between 2014 and 2018, while increasing rate of the value-added component of Enterprise Tax in 2016. Its tax base, primarily based on labor cost, differs from value-added tax (VAT). We assess the shift from corporate income to labor cost as a tax base and compare the value-added component of Enterprise Tax to VAT in terms of social welfare and corporate value. Our analysis shows that despite increased tax rate of the value-added component, both corporate value and social welfare improved post-reform. Additionally, substituting the VAT rate for higher rate of the value-added component yields even greater improvements.

Key words: Corporate taxation, corporate value, value-added tax, corporate finance, excess burden.
JEL Classification Number: H25, G32.

1. INTRODUCTION

The Japanese government decided to implement the corporate tax reform in 2015 and 2016. The effective tax rate for corporations will be reduced from 34.62% in 2014 to 29.74% in 2018. At the same time, rates of size-based business taxation or "pro-forma" taxation rose at 2.5 times. The corporate tax reform means expanding tax base of corporate taxation as well as lowering rates of corporate income taxation. Doi (2016a)

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describes that the impact of tax increase on size-based business taxation is 1,170 billion yen (approximately 11 billion US dollars), which is the largest item among items expanding tax bases. It seems that the purpose of the expansion of tax base is to be tax revenue neutral.

Corporate taxation in Japan is composed of Corporate Tax, Inhabitant Tax on Corporations and Enterprise Tax. Enterprise Tax has income, value-added and capital components. Among these taxes, Corporate Tax, Inhabitant Tax on Corporations and the income component of Enterprise Tax are levied on corporate income, while the value-added and capital components of Enterprise Tax are size-based business taxation or "pro-forma" taxation.

The capital component of Enterprise Tax is taxed on capital of companies with paid-in capital of more than 100 million yen. The value-added component of Enterprise Tax is levied on the tax base which is the sum of labor cost, net interest payment, net rental payment and one-year profit and loss.

As with the value-added component of Enterprise Tax, value-added tax (VAT) is a kind of tax on value-added, but the taxation method is different. The differences between the value-added component of Enterprise Tax and the VAT are discussed in Tajika and Yui (1999, 2004), Naganuma (1999), Bird (2014) and others. The tax base of VAT is actually the difference between sales and purchases. So it is called the deduction-method VAT, because the value-added, which is calculated as such a difference, is taxed. On the other hand, the value-added component of Enterprise Tax is called the addition-method VAT, because it adds up the added value elements, as mentioned above.

This difference gives rise to different economic effects. In the case of VAT, the tax paid depends on the amount of value-added, but is not directly related to labor costs and interest payments individually. In the case of the value-added component of Enterprise Tax, the tax paid directly depends on labor costs and interest payments. As wages increase, the tax amount increases. Moreover, the VAT has the system of input tax credits, but the other is no input tax credits. From this fact, the VAT can be prevented from accumulating taxes, while the other cannot prevent it. If accumulation of taxation progresses in the distribution process, it may distort the choice of businesses and inhibit economic activities. Incidentally, there is a tax exemption on exports in the VAT, but not in the Enterprise Tax.

In this study, we examine effects to social welfare and corporate value of the Japanese corporate tax reform in the 2010s. Especially, we focus on the differences in tax distortion between the VAT and the Enterprise Tax. The structure of this paper is as follows. In Section 2, we will construct a dynamic macroeconomic model that analyze effects of the size-based business taxation, and Section 3 shows the results of numerical analyses on the corporate tax reform. Also, we compare tax distortion by the size-based business taxation and the VAT. We provide a sensitivity analysis in Section 4. Finally, Section 5 concludes this paper.

2. THEORETICAL FRAMEWORK

2.1. A Dynamic Macroeconomic Model

In this section, we establish a theoretical model to evaluate the corporate tax reform in Japan. In the following numerical analysis, we adopt a continuous time model in a closed economy, which in provided by Turnovsky (1995). The representative household lives indefinitely, and gains utility from the consumption and leisure in each term. The household determine consumption and leisure in each term to maximize the lifetime utility. The household in this economy are homogeneous, and the population of households is fixed at 1 in each period. Let the price of private goods be 1. Under these assumptions, the lifetime utility function and the instantaneous budget constraint of the representative household are

$$\int_0^\infty U(c,l)\,e^{-\beta t}dt\,, \tag{1}$$

$$\begin{aligned} \dot{b^G} + \dot{b^P} + s\dot{E} = {} & (1-\tau_W)\,wl + (1-\tau_R)\left(r^G b^G + r^P b^P\right) \\ & + (1-\tau_D)\,\chi s E \\ & + (1-\tau_G)\,\dot{s}E - (1+\tau_C)\,c\,. \end{aligned} \tag{2}$$

where c: private consumption (numeraire), l: labor supply, β: discount rate (constant over all time), $U_c > 0, U_{cc} < 0, U_l < 0, U_{ll} \le 0, U_{cl} \le 0$, b^G: outstanding government bonds, b^P: outstanding corporate bonds, s: (relative) price of equities, E: number of shares outstandings, w: wage rate, r^G: interest rate on government bonds, r^P: interest rate on corporate bonds, $\chi \equiv \frac{D}{sE}$: dividend payout ratio, τ_W: labor income tax rate, τ_R: interest income tax rate, τ_D: dividend income tax rate, τ_G: capital gains tax rate, andτ_C: rate of consumption tax (VAT).

The initial conditions of shares and bonds are given as:

$$E(0)\ ,\, b^G(0)\ ,\, b^P(0)$$

The representative household maximizes its lifetime utility under perfect foresight by choosing$\left\{c, l, b^G, b^P, E\right\}$, given w, r^G, r^P, s, and all tax rates:

$$\max\ (1)\ \text{subject to}\ (2).$$

In this optimization problem, we obtain the first order conditions as follows (μ: Lagrangian multiplier of this optimization problem)

$$U_c = (1+\tau_C)\,\mu \tag{3}$$

$$U_l = -w\,(1-\tau_W)\,\mu \tag{4}$$

$$(1-\tau_D)\,\frac{D}{sE} + (1-\tau_G)\,\frac{\dot{s}}{s} = \beta - \frac{\dot{\mu}}{\mu} \tag{5}$$

$$r^G(1-\tau_R) = \beta - \frac{\dot{\mu}}{\mu} \tag{6}$$

$$r^P(1-\tau_R) = \beta - \frac{\dot{\mu}}{\mu} \tag{7}$$

Equations (3) and (4) mean the optimality condition of consumption and labor, respectively. The representative household choose equity E to meet (5). In the above conditions, the rate of return on consumption is denoted as

$$\theta \equiv \beta - \frac{\dot{\mu}}{\mu} \tag{8}$$

Equations (5), (6) and (7) mean that the post-tax equity return on each asset equals the rate of return on consumption. In addition, equations (5), (6), and (7) become

$$\dot{s}E = \frac{\theta s E}{1-\tau_G} - \frac{(1-\tau_D)\,D}{1-\tau_G} \tag{5$'$}$$

$$r^G = r^P = \frac{\theta}{1-\tau_R} \tag{7$'$}$$

Moreover, the transversality conditions are given by

$$\lim_{t\to\infty} \beta s E e^{-\beta t} = 0$$

$$\lim_{t\to\infty} \beta b^G e^{-\beta t} = 0$$

$$\lim_{t\to\infty} \beta b^P e^{-\beta t} = 0$$

Next, the representative firm decides the amount of labor, capital, and finance (by equity or debt) to maximize the intertemporal corporate value. The firm in this economy are homogeneous, and the number of firms is fixed at 1 in each period. We set the following production function of the representative firm:

$$y = F\,(k, l)$$

where y: output, k: capital input, l: labor input, and $F_k > 0$, $F_{kk} < 0$, $F_l > 0$, $F_{ll} < 0$.

Furthermore, we assume homogeneity of degree one in the production function. The production function is assumed to satisfy the Inada condition. Then, we describe the dynamics of capital as follows:

$$\dot{k} = I - \delta k \tag{9}$$

where I: (gross) investment and δ: physical capital depreciation rate (assume the same rate as prescribed by tax law).

Furthermore, the model needs to incorporate the capital structure of the firm, that is, choice of equity, debt, and retained earnings to implement investment. Now, the debt-equity ratio is expressed as

$$\lambda = \frac{b^P}{sE} \geq 0$$

As proposed by Osterberg (1989), we suppose there is an agency cost on debt. Here,$a\,(\lambda)$denotes the per unit agency cost on debt. This function satisfies:

$$a\,(\lambda) > 0\,, \quad \frac{\partial a(\lambda)}{\partial \lambda} \equiv a'\,(\lambda) > 0\,, \quad \frac{\partial^2 a\,(\lambda)}{\partial \lambda^2} > 0$$

This can be interpreted as a financial distress cost to the firm. This agency cost is crucial to the effect of corporate income tax in the long term, particularly when making our model more realistic.

The after-tax profit of the representative firm is represented as follows:

$$y - wl - \{r^P + a(\lambda)\}b^P - \delta k - T^F = D + RE \tag{10}$$

where T^F: the total tax payed by firm and RE: retained earnings.
Also we can define the total tax payed by firm (T^F) as follows:

$$T^F \equiv \tau_F\left[y - wl - \{r^P + a(\lambda)\}b^P - \delta k - T^E\right] - \zeta I + T^E$$

where τ_F: corporate income tax rate, ζ: investment tax credit, and T^E: the total payment of Enterprise Tax. In the current tax system, Enterprise Tax (all components) paid is deductible from tax base of all corporate income taxes. In Enterprise Tax, if the labor cost exceeds 70% of the sum of labor cost, net interest payment, and net rental payment, such firms can apply the deduction that the difference between labor costs and 70% of the sum, and is deducted from the tax base of value-added component.

The total payment of Enterprise Tax is expressed as follows:

$$\begin{aligned} T^E =& \tau_I\left\{y - wl - \{r^P + a(\lambda)\}b^P - \delta k - T^E\right\} \\ &+ \tau_V\left[wl + \{r^P + a(\lambda)\}b^P + y - wl - \{r^P + a(\lambda)\}b^P - \delta k - T^E \right. \\ &\left. - \varepsilon_0\left\{wl - \varepsilon_1\left[wl + \{r^P + a(\lambda)\}b^P\right]\right\}\right] + \tau_K \varphi s E \end{aligned}$$

where τ_I: rate of income component of Enterprise Tax, τ_V: rate of value-added component of Enterprise Tax, and τ_K: rate of capital component of Enterprise Tax.

In this equation, the first term on the right-hand side means payment of income component of Enterprise Tax, the second term means one of the value-added component of Enterprise Tax, and the last term means one of the capital component of Enterprise Tax.

Here, ε_0 is a parameter that sets 1 when the deduction is applied, 0 if not, and ε_1 is a deduction rate. In this paper, considering that the current deduction ratio is 70%, the following models are constructed with $\varepsilon_0 = 1$ and $\varepsilon_1 = 0.7$. In addition, in the model of this paper, we consider that sE is the tax base for Enterprise Tax on capital. However, since the amount of capital which becomes the tax base does not become equal to the net asset value of the enterprise, the tax base for the Enterprise Tax on capital is expressed as $\varphi s E (0 < \varphi < 1)$. Then, we obtain

$$\begin{aligned} T^E =& \frac{\tau_I + \tau_V}{1 + \tau_I + \tau_V}\left[y - wl - \{r^P + a(\lambda)\}b^P - \delta k\right] \\ &+ \frac{\tau_V}{1 + \tau_I + \tau_V}\left[(1 - \varepsilon_0 + \varepsilon_0\varepsilon_1)\, wl \right. \\ &\left. + (1 + \varepsilon_0\varepsilon_1)\{r^P + a(\lambda)\}b^P\right] + \frac{\tau_K \varphi}{1 + \tau_I + \tau_V} s E \end{aligned} \tag{11}$$

In (11), we find that the value-added component of Enterprise Tax has an effect of raising the corporate effective tax rate, as well as affecting payment of wages.

Next, we describe the corporate finance for investment as follows:

$$I = RE + s\dot{E} + \dot{b^P} \tag{12}$$

From equations (5’), (10), (11) and (12), we obtain

$$
\begin{aligned}
s\dot{E}+\dot{b^P} =& D-\frac{1-\tau_F}{1+\tau_I+\tau_V}\left[y-wl-\left\{r^P+a\left(\lambda\right)\right\}b^P-\delta k\right] \\
&+\frac{\left(1-\tau_F\right)\tau_V}{1+\tau_I+\tau_V}\left[\left(1-\varepsilon_0+\varepsilon_0\varepsilon_1\right)wl\right. \\
&\left.+\left(1+\varepsilon_0\varepsilon_1\right)\left\{r^P+a\left(\lambda\right)\right\}b^P\right]+\frac{\left(1-\tau_F\right)\tau_K\varphi}{1+\tau_I+\tau_V}sE \\
&+\left(1-\zeta\right)I \qquad (12')
\end{aligned}
$$

In the above equation, we confirm that dividend D and share repurchase (negative value of $s\dot{E}$) are equivalent. We cannot determine an equilibrium values of D and $s\dot{E}$ without an additional assumption. So we need some assumption of shareholder return policy of the firm, as we will mention below.

We define the corporate value of the representative firm,Vas follows:

$$V=sE+b^P$$

From (5’), (7’), (12’), and the above equation, we can get the differential equation as follows:

$$
\begin{aligned}
\dot{V} =& \left[\left\{\frac{\theta}{1-\tau_G}+\frac{\left(1-\tau_F\right)\tau_K\varphi}{1+\tau_I+\tau_V}\right\}\frac{1}{1+\lambda}\right. \\
&\left.+\frac{\left(1-\tau_F\right)\left\{1+\left(1+\varepsilon_0\varepsilon_1\right)\tau_V\right\}\left\{\theta+\left(1-\tau_R\right)a(\lambda)\right\}}{\left(1+\tau_I+\tau_V\right)\left(1-\tau_R\right)}\frac{\lambda}{1+\lambda}\right]V \\
&+\frac{\tau_D-\tau_G}{1-\tau_G}D-\Gamma\left(k,l,I\right) \qquad (13)
\end{aligned}
$$

$$
\begin{aligned}
\text{where }\ \Gamma\left(k,l,I\right) \equiv& \frac{1-\tau_F}{1+\tau_I+\tau_V}\left[F\left(k,l\right)-wl-\delta k\right] \\
&-\frac{\left(1-\tau_F\right)\tau_V}{1+\tau_I+\tau_V}\left(1-\varepsilon_0+\varepsilon_0\varepsilon_1\right)wl-\left(1-\zeta\right)I \qquad (14)
\end{aligned}
$$

In this equation, the coefficient of V represents the weighted average of the cost of debt capital and equity capital. It is called the weighted average cost of capital (WACC) in the literature of corporate finance.

In this situation, shareholder return policy or financing instrument for investment does matter. Hence, we assume $s\dot{E}+\dot{b^P}=0$ or $I=RE$ for the firm’s shareholder return policy. It implies tax capitalization view (“new view”) of shareholder return policy, proposed by King (1974) and Auerbach (1979, 1981). Based on this assumption, we can get

$$\dot{V}=\gamma V-\frac{1-\tau_D}{1-\tau_G}\Gamma$$

where

$$
\begin{aligned}
\gamma =& \left\{\frac{\theta}{1-\tau_G}+\frac{\left(1-\tau_D\right)\left(1-\tau_F\right)\tau_K\varphi}{\left(1-\tau_G\right)\left(1+\tau_I+\tau_V\right)}\right\}\frac{1}{1+\lambda} \\
&+\frac{\left(1-\tau_D\right)\left(1-\tau_F\right)\left\{1+\left(1+\varepsilon_0\varepsilon_1\right)\tau_V\right\}\left\{\theta+\left(1-\tau_R\right)a(\lambda)\right\}}{\left(1-\tau_G\right)\left(1+\tau_I+\tau_V\right)\left(1-\tau_R\right)}\frac{\lambda}{1+\lambda}
\end{aligned}
$$

The representative firm maximizes its corporate value by choosing $\left\{k, I, l, b^P, E, \lambda\right\}$:

$$\max_{k,l,I} V(0) = \int_0^\infty \frac{1-\tau_D}{1-\tau_G} \gamma(k,l,I) e^{-\int_0^t \gamma(z)dz} dt \tag{15}$$

$$\text{s.t. } \dot{k} = I - \delta k \tag{9}$$

Here, in order to maximize the corporate value over time, the company determines the amount of labor input, investment and the debt-equity ratio. From another point of view, this means that instantaneous costs of capital are minimized in order to maximize corporate value. In other words,

$$\frac{\partial \gamma}{\partial \lambda} = 0$$

The minimized (instantaneous) cost of capital γ^*difined as follows buy using λ^* which satisfies the above equation:

$$\begin{aligned}\gamma^* =& \frac{\theta}{1-\tau_G} + \frac{(1-\tau_D)(1-\tau_F)\tau_K \varphi}{(1-\tau_G)(1+\tau_I+\tau_V)} \\ &- \frac{(1-\tau_D)(1-\tau_F)\{1+(1+\varepsilon_0\varepsilon_1)\tau_V\}}{(1-\tau_G)(1+\tau_I+\tau_V)} a'\left(\lambda^*\right)\left(\lambda^*\right)^2\end{aligned} \tag{16}$$

Then, the representative firm maximizes its corporate value by choosing $\{k, I, l\}$ under γ^* as follows:

$$\max_{k,l,I} V(0) = \int_0^\infty \frac{1-\tau_D}{1-\tau_G} \gamma(k,l,I) e^{-\int_0^t \gamma^*(z)dz} dt \tag{15$'$}$$

$$\text{s.t. } \dot{k} = I - \delta k \tag{9}$$

The optimal conditions of this optimization problem are expressed as follows (q: the lagrangian multiplier for (9)):

$$\dot{q} = \left(\delta + \gamma^*\right) q - \frac{(1-\tau_D)(1-\tau_F)}{(1-\tau_G)(1+\tau_I+\tau_V)} \left(F_k - \delta\right) \tag{17}$$

$$F_l = \{1 + (1 - \varepsilon_0 + \varepsilon_0\varepsilon_1)\tau_V\} w \tag{18}$$

$$q = \frac{1-\tau_D}{1-\tau_G}(1-\zeta) \tag{19}$$

The equation (18) is an optimality condition for marginal productivity of labor, and means that distortion of labor demand occurs due to the value-added component of Enterprise Tax. The value-added component is a source of distortion to the wage, unlike the VAT, τ_C. The equation (19) implies that the tax-adjusted Tobin's q is constant over time.

The government collects revenues from the various taxes mentioned above to meet the following (instantaneous) budget constraints:

$$\dot{b^G} + \tau_W wl + \tau_R\left(r^G b^G + r^P b^P\right) + \tau_D D + \tau_G \dot{s} E + \tau_C c + T^F = r^G b^G \tag{20}$$

We assume that the government makes adjustments to its debt in response to changes of tax revenue. In other words, there is no government spending.

Finally, the equilibrium of goods market is expressed as follows:

$$F(k,l) = c + I + a(\lambda) b^P \tag{21}$$

2.2. Function Specifications

Now we specify the functions mentioned above to solve the model numerically. We refer to Hayashi and Prescott (2002), which analyzes the recent performance of the Japanese economy. The instantaneous utility function is specified as

$$U(c, l) = \ln c - \rho l$$

The production function is specified as

$$y = Ak^{\alpha} l^{1-\alpha}$$

Both forms are used in Hayashi and Prescott (2002). Furthermore, the function of agency cost is specified as

$$a(\lambda) = a_0 + a_1 \lambda^2$$

This form is used in Doi (2016b, 2020), which analyzes tax incidence after the Japan's corporate tax reform.

2.3. Steady State Equilibrium

Substituting these specified functions into the above equilibrium system, the following conditions holds at the steady state, where $\dot{k} = \dot{E} = \dot{b}^P = \dot{b}^G = \dot{q} = \dot{s} = \dot{\mu} = 0$:

$$\theta = \frac{1}{\beta} - 1 \tag{22}$$

$$\lambda^* = \frac{1}{2}\left[\left\{2Z - 1 + 2\sqrt{Z(Z-1)}\right\}^{-\frac{1}{3}} + \left\{2Z - 1 + 2\sqrt{Z(Z-1)}\right\}^{\frac{1}{3}} - 1\right] \qquad (23)^1$$

$$\begin{aligned} \text{where } Z =& \frac{\theta}{a_1}\left\{\frac{1+\tau_I+\tau_V}{(1-\tau_D)(1-\tau_F)\{1+(1+\varepsilon_0\varepsilon_1)\tau_V\}} - \frac{1}{1-\tau_R}\right\} \\ &+ \frac{\tau_K \varphi}{a_1\{1+(1+\varepsilon_0\varepsilon_1)\tau_V\}} - \frac{a_0}{a_1} \end{aligned} \tag{24}$$

$$\begin{aligned} \gamma^* =& \frac{\theta}{1-\tau_G} + \frac{(1-\tau_D)(1-\tau_F)\tau_K\varphi}{(1-\tau_G)(1+\tau_I+\tau_V)} \\ &- \frac{(1-\tau_D)(1-\tau_F)\{1+(1+\varepsilon_0\varepsilon_1)\tau_V\}}{(1-\tau_G)(1+\tau_I+\tau_V)} 2a_1 \left(\lambda^*\right)^3 \end{aligned} \tag{25}$$

$$q = \frac{1-\tau_D}{1-\tau_G}(1-\zeta) \tag{19}$$

$$\frac{k}{l} = \left\{\frac{(1+\tau_I+\tau_V)(\delta+\gamma^*)(1-\zeta)}{(1-\tau_F)A\alpha} + \frac{\delta}{A\alpha}\right\}^{\frac{1}{\alpha-1}} \tag{26}$$

[1] Equation (16) under the specified function, $a_0 + a_1\lambda^2$,become

$$\lambda^2(3 \times 2\lambda) = \frac{\theta}{a_1}\left\{\frac{1+\tau_I+\tau_V}{(1-\tau_D)(1-\tau_F)\{1+\tau_V(1+\varepsilon_0\varepsilon_1)\}} - \frac{1}{1-\tau_R}\right\} + \frac{1}{a_1}\frac{\tau_K\varphi}{1+\tau_V(1+\varepsilon_0\varepsilon_1)} - \frac{a_0}{a_1}.$$

The above equation is a cubic equation of λ, which has two imaginary roots and one real root. The only real root is expressed as (23).

$$\frac{c}{l} = \mathrm{A}\left(\frac{k}{l}\right)^{\alpha} - \delta\frac{k}{l} - \frac{(1-\tau_D)(1-\zeta)\lambda^* k}{(1-\tau_G)(1+\lambda^*)l}\left\{a_0 + a_1\left(\lambda^*\right)^2\right\} \tag{27}$$

$$w = \frac{A(1-\alpha)}{1+(1-\varepsilon_0+\varepsilon_0\varepsilon_1)\tau_V}\left(\frac{k}{l}\right)^{\alpha} \tag{28}$$

$$c = \frac{(1-\tau_W)A(1-\alpha)}{(1+\tau_C)\{1+(1-\varepsilon_0+\varepsilon_0\varepsilon_1)\tau_V\}\rho}\left(\frac{k}{l}\right)^{\alpha} \tag{29}$$

$$l = \left(\frac{c}{l}\right)^{-1} c \tag{30}$$

$$k = \left(\frac{k}{l}\right) l \tag{31}$$

$$r^G = r^P = \frac{\theta}{1-\tau_R} \tag{32}$$

From equations (22) and (32), θ, r^G, and r^P are independent from rates of corporate taxation ($\tau_F, \tau_I, \tau_V, \tau_K$) at the steady state. Also we can obtain the steady state values of further important variables as follows:

$$\begin{aligned} V =& \frac{1-\tau_D}{\gamma^*(1-\tau_G)}\left[\frac{1-\tau_F}{1+\tau_I+\tau_V}\left\{Ak^{\alpha}l^{1-\alpha} - wl - \delta k\right\}\right. \\ &\left. - \frac{(1-\tau_F)\tau_V}{1+\tau_I+\tau_V}(1-\varepsilon_0+\varepsilon_0\varepsilon_1)wl - (1-\zeta)\delta k\right] \end{aligned} \tag{33}$$

$$b^P = \frac{\lambda^*}{1+\lambda^*}V \tag{34}$$

$$D = \frac{\theta b^P}{(1-\tau_D)\lambda^*} \tag{35}$$

$$b^G = \frac{\tau_W wl + \tau_R r^P b^P + \tau_D D + \tau_C c + T^F}{\theta} \tag{36}$$

3. CORPORATE VALUE AND SOCIAL WELFARE AFTER CORPORATE TAX REFORM

3.1. Corporate Value and Social Welfare at the Steady State

In order to investigate effects of the corporate tax reform on corporate value and social welfare, we compare the values of these variables at the steady state with before and after the corporate tax reform.

We assume that the economy stays at a steady state before the corporate tax reform. Also, we investigate the steady state after the reform. The subscripts 1 and 2 represent the steady state equilibrium before and after the corporate tax reform, respectively. Tax rates except corporate taxation and the VAT ($\tau_W, \tau_D, \tau_G, \tau_R$) are presumed to be unchanged. First, values of variables at the steady state before the tax reform ($j = 1$) and after the reform ($j = 2$) denote

$$V_j = \frac{1-\tau_D}{\gamma_j^*(1-\tau_G)}\left[\frac{1-\tau_{Fj}}{1+\tau_{Ij}+\tau_{Vj}}\left\{Ak_j^{\alpha}l_j^{1-\alpha} - w_j l_j - \delta k_j\right\} - \frac{\left(1-\tau_{Fj}\right)\tau_{Vj}}{1+\tau_{Ij}+\tau_{Vj}}\left(1-\varepsilon_0+\varepsilon_0\varepsilon_1\right)w_j l_j - (1-\zeta)\,\delta k_j\right] \tag{33'}$$

$$U_j = \ln c_j - \rho l_j \tag{37}$$

where

$$\lambda_j^* = \frac{1}{2}\left[\left\{2Z_j - 1 + 2\sqrt{Z_j(Z_j-1)}\right\}^{-\frac{1}{3}} + \left\{2Z_j - 1 + 2\sqrt{Z_j(Z_j-1)}\right\}^{\frac{1}{3}} - 1\right] \tag{23'}$$

$$Z_j = \frac{\theta}{a_1}\left\{\frac{1+\tau_{Ij}+\tau_{Vj}}{(1-\tau_D)(1-\tau_{Fj})\left\{1+(1+\varepsilon_0\varepsilon_1)\tau_{Vj}\right\}} - \frac{1}{1-\tau_R}\right\} + \frac{\tau_{Kj}\varphi}{a_1\left\{1+(1+\varepsilon_0\varepsilon_1)\tau_{Vj}\right\}} - \frac{a_0}{a_1} \tag{24'}$$

$$\gamma_j^* = \frac{\theta}{1-\tau_G} + \frac{(1-\tau_D)\left(1-\tau_{Fj}\right)\tau_{Kj}\varphi}{(1-\tau_G)(1+\tau_{Ij}+\tau_{Vj})} - \frac{(1-\tau_D)\left(1-\tau_{Fj}\right)\left\{1+(1+\varepsilon_0\varepsilon_1)\tau_{Vj}\right\}}{(1-\tau_G)\left(1+\tau_{Ij}+\tau_{Vj}\right)}2a_1\left(\lambda_j^*\right)^3 \tag{25'}$$

$$\frac{k_j}{l_j} = \left\{\frac{(1+\tau_{Ij}+\tau_{Vj})(\delta+\gamma_j^*)(1-\zeta)}{\left(1-\tau_{Fj}\right)A\alpha} + \frac{\delta}{A\alpha}\right\}^{\frac{1}{\alpha-1}} \tag{26'}$$

$$\frac{c_j}{l_j} = \mathrm{A}\left(\frac{k_j}{l_j}\right)^{\alpha} - \delta\frac{k_j}{l_j} - \frac{(1-\tau_D)(1-\zeta)\lambda_j^* k_j}{(1-\tau_G)\left(1+\lambda_j^*\right)l_j}\left\{a_0 + a_1\left(\lambda_j^*\right)^2\right\} \tag{27'}$$

$$w_j = \frac{A(1-\alpha)}{1+(1-\varepsilon_0+\varepsilon_0\varepsilon_1)\tau_{Vj}}\left(\frac{k_j}{l_j}\right)^{\alpha} \tag{28'}$$

$$c_j = \frac{(1-\tau_W)A(1-\alpha)}{(1+\tau_{Cj})\left\{1+(1-\varepsilon_0+\varepsilon_0\varepsilon_1)\tau_{Vj}\right\}\rho}\left(\frac{k_j}{l_j}\right)^{\alpha} \tag{29'}$$

$$l_j = \left(\frac{c_j}{l_j}\right)^{-1} c_j \tag{30'}$$

$$k_j = \left(\frac{k_j}{l_j}\right) l_j \tag{31'}$$

$$b_j^P = \frac{\lambda_j^*}{1+\lambda_j^*}V_j \tag{34'}$$

$$D_j = \frac{\theta b_j^P}{(1-\tau_D)\lambda_j^*} \tag{35'}$$

$$b_j^G = \frac{\tau_w w_j l_j + \tau_R r^P b_j^P + \tau_D D_j + \tau_{Cj} c_j + T_j^F}{\theta} \tag{36'}$$

From (22) and (32), we can confirmθ,$r^P$and$r^G$are not unchanged.

3.2. *Policy Evaluations*

In order to assess the impact of the tax reform on corporate value, we calculate the following indicators:

$$\frac{V_2 - V_1}{V_1} .$$

It implies the rate of change in corporate value.

On the other hand, the utility of the representative agent may not be appropriate to be represented on a cardinal scale. Hence, we introduce the excess burden (EB) based on the equivalent variation as a measure of economic welfare changes, which is often employ in the literature of public economics.[2]

In order to calculate the EB at the steady state, we set a fixed time endowment,H (assume to be constant over time), and leisure (time not worked),h_j. Then $H = l_j + h_j$. The budget constraint (2) at the steady state is rewritten as

$$\left(1+\tau_{Cj}\right) c_j - (1-\tau_W)\, w_j (H - h_j) = (1-\tau_R)\left(r^G b_j^G + r^P b_j^P\right) + (1-\tau_D)\, D_j . \tag{2'}$$

In the above equation,

$$m_j \equiv (1-\tau_W)\, w_j H + (1-\tau_R)\left(r^G b_j^G + r^P b_j^P\right) + (1-\tau_D)\, D_j .$$

means "full income," defined by Creedy (1994). The full income implies the sum of the value of earnings that would be obtained if all available time were spent working, and non-wage income. Creedy (2000) drives the expenditure function when labor supply is endogenous from the full income.

From (3) and (4), which are two of the utility maximization conditions, we obtain

$$\rho\left(1+\tau_{Cj}\right) c_j = (1-\tau_W)\, w_j .$$

Also we can drive the following equation from (2'):

$$(1-\tau_W)\, w_j \left(\frac{1}{\rho} + H - l_j\right) = m_j .$$

Substituting the above two equations into the utility function at the steady state, the indirect utility function is as follows,

[2] According to Creedy (2000), the excess burden based on the equivalent variation is superior to the one based on the compensating variation as a measure of welfare change. The compensating variation is based on the prices before the policy change, while the tax revenue used to estimate the excess burden is measured in terms of values based on the prices after the policy change. When the compensating variation is employed, comparisons involve different prices for each policy. This does not arise with the use of equivalent variation.

$$U_j = \ln \frac{(1-\tau_W)\, w_j}{\rho\left(1+\tau_{Cj}\right)} - 1 - \rho H + \frac{m_j}{(1-\tau_W)\, w_j}\,.$$

Therefore, we can get the expenditure function at the steady state from the indirect utility function as follows,

$$m_j = \frac{(1-\tau_W)\, w_j}{\rho}\left\{U_j + 1 + \rho H - \ln \frac{(1-\tau_W)\, w_j}{\rho\left(1+\tau_{Cj}\right)}\right\} \equiv M\left(w_j, \tau_{Cj}, U_j\right)\,.$$

In addition, from the instantaneous budget constraint of the government, (20), the tax revenue (function) at the steady state is rewritten as,

$$\begin{aligned} T(w_j, \tau_{Cj}, \tau_{Fj}, \tau_{Ij}, \tau_{Vj}, \tau_{Kj}, m_j) \equiv & \tau_W w_j l_j + \tau_R \left(r^G b_j^G + r^P b_j^P\right) + \tau_D D_j \\ & + \tau_{Cj} c_j + T_j^F\,. \end{aligned}$$

We add a subscript 0 ($j = 0$) to the values of the variables at the steady state without taxation, in order to define the welfare change relative to the no-tax situation. Indeed, $\tau_{C0} = \tau_{F0} = \tau_{I0} = \tau_{V0} = \tau_{K0} = 0$, and we set $\tau_W = \tau_R = \tau_D = \tau_G = \zeta = 0$ at the steady state without taxation.

From the above preparation, the excess burden, EB, at the steady state before or after the tax reform ($j = 1, 2$) compared to the situation without taxation, based on the equivalent variation, is defined as:

$$EB_j \equiv m_0 - M(w_0, \tau_{C0}, U_j) - T(w_j, \tau_{Cj}, \tau_{Fj}, \tau_{Ij}, \tau_{Vj}, \tau_{Kj}, m_j)$$

Moreover, we employ the marginal excess burden, MEB, as the change in excess burden per additional yen of tax revenue, which is defined by Dahlby (2008) and Fullerton and Ta (2016), as;

$$MEB \equiv (EB_2 - EB_1)/(T_2 - T_1)\,.$$
$$\text{where } \; T_j \equiv T(w_j, \tau_{Cj}, \tau_{Fj}, \tau_{Ij}, \tau_{Vj}, \tau_{Kj}, m_j)$$

In fact, the tax revenue before or after the reform depends on the values of the parameters. Therefore, the MEB is used so that welfare changes can be analyzed without the impact of tax revenue amount.

Since we employ a dynamic general equilibrium model, the excess burden and the marginal excess burden include the general equilibrium effect. Unlike a partial equilibrium analysis, it is favorable, as Goulder and Williams (2003) and Fullerton and Ta (2016) pointed out.

3.3. *Numerical Analysis*

We make the numerical analysis based on the above theoretical model. Now, we set the values of the parameters that is in the specific functions and the policy variables. The values of variables are shown in Table 1. In this paper, the analysis is based on quarter and one period means one quarter. Then, we set $\alpha = 0.362$, $\beta = 0.993945(= (0.976)^{1/4})$, $\rho = 0.34325(= 1.373/40)$, $\delta = 0.021543(= (1{+}0.089)^{1/4}{-}1)$, which are used by Hayashi and Prescott (2002). These values are set close to the present condition of the Japanese economy. Also we set the value of $a_0 = 0.0003$ and $a_1 = 0.0005$, which are used by Doi (2020). The parameters in the production function and the function of

Table 1. Parameter Values in the Numerical Analysis

β	0.993945	τ_D	0.2
ρ	0.34325	τ_G	0.15
A	1	τ_R	0.2
α	0.362	τ_W	0.1
a_0	0.0003	φ	0.2453
a_1	0.0005	ζ	0.01
δ	0.021544	ε_0	1
		ε_1	0.7

Table 2. Values of Variables at the Steady State

	Before the reform	$\rightarrow$	After the reform	After VAT hike
τ_F	0.299115		0.272136	0.272136
τ_I	0.072		0.036	0.036
τ_V	0.0048		0.012	0.0048
τ_K	0.002		0.005	0.002
τ_C	0.08		0.08	0.084391
θ	0.00609		0.00609	0.00609
r^P	0.00761		0.00761	0.00761
γ^*	0.00630		0.00676	0.00653
λ^*	1.23556		1.21798	1.13196
w	1.70114		1.72351	1.74196
l	1.76458		1.76376	1.76728
c	4.12998		4.18430	4.21205
k	26.74474		28.10106	28.59885
b_G	169.20368		167.14984	167.14984
V	24.91980		26.18357	26.64740
U	0.81258		0.82593	0.83132
T^F	0.36224		0.33965	0.31447
T	1.28846		1.27282	1.27282
EB	0.11476		0.04739	0.01382
MEB	—		4.30755	6.45443

agency cost on debt are set as their steady-state values, which are close to the present condition of the Japanese economy. The tax rates that are used in this paper are almost the same rates in Japan.

Solution of each variable at the steady state when the value of the parameter is set above are shown in Table 2. We find that those values are fairly practical. Also, rates of corporate taxation (τ_F,τ_I,τ_V,τ_K) are changed as shown in Table 2.

Table 2 implies that the corporate value increases after the corporate tax reform. In the benchmark case, $\frac{V_2-V_1}{V_1} = 0.0507$. It means that corporate value increases by about 5.07% after the reform. The reason is that burden of corporate taxation (T^F) totally decreases as shown in Table 2, in spite of an increase in the size-based business taxation.

We can analyze welfare change in the corporate tax reform. Before the analyses, the minimum expenditure at the no-tax situation, m_0, needs to be estimated. At the steady state without taxation, where values of the parameters except tax rates on Table 1 are the same, $l_0 = 2.29947$, $c_0 = 6.21850$, $w_0 = 2.13450$.[3] Since l_0 is between 2 and 3, we set $H = 3$.[4] Hence, $m_0 = 7.71378$.

Based on the estimation, we can calculate the steady-state values before the corporate tax reform, shown in Table 2. At this steady state, $EB_1 = 0.12052$ and $T_1 = 1.28270$. Also, we obtain the steady-state values after the corporate tax reform. $EB_2 = 0.05345$ and $T_2 = 1.26677$.[5] In this case, the excess burden and total tax revenue decreases after the corporate tax reform and tax revenue.

Therefore, MEB $= 4.21021$, based on the definition of MEB, shown in Table 2. The positive value of MEB in this case implies marginal welfare improvement because the excess burden decreases. The larger the MEB is, the more desirable it is.

3.4. Value of Corporation Whose Debt-Equity Ratio Are Different After Reform

The result in Table 2 is in the case of the representative firm whose optimal debt-equity ratio is 1.2356 before the corporate tax reform. How is the result changed in other firms whose debt-equity ratio is different?

In the dynamic model in this paper, the representative firm chooses optimally capital structure. As shown above, it depends on agency cost on debt. Therefore, different (optimal) debt-equity ratio means different agency cost on debt, particularly, different value of a_1.[6]

We calculate $\frac{V_2 - V_1}{V_1}$ in a different (optimal) debt-equity ratio. According to Figure 1, between 0.5 and 2.5 of the optimal debt-equity ratio at the steady state before the corporate tax reform, λ_1, $\frac{V_2 - V_1}{V_1}$ ncreases as the optimal debt-equity ratio increases. The result is affected by tax shield effect of debt. As the optimal debt-equity ratio, λ_1, increases, tax shield effect of debt enlarges and the corporate value increases.

Moreover, we can calculate welfare change in the case of the representative firm whose optimal debt-equity ratio is different. In the range between 0.5 and 2.5 of λ_1, the excess burden is smaller after the reform than before. Also, the marginal excess burden, MEB, is shown in Figure 2. We find that the MEB increases as the optimal debt-equity ratio increases.

3.5. Is the Value-added Component of Enterprise Tax a Good Tax?

As mentioned in Section 1, the Enterprise Tax, whose rates of value-added and capital components increase in the corporate tax reform, is close but not the same as the

[3] At this steady state, λ^* faces a corner solution.

[4] We have to set value of H once to calculate value of m_0. However, $\mathrm{EB_j}$ and MEB do not depend on value of H from the definition of expenditure function at the steady state and EBj

[5] The corporate tax reform was designed to be revenue neutral. However, the tax revenue after the reform in the model becomes lower than before the reform because the model does not include all the items that would increase taxes dealt with in this paper, such as shrinking the carry forward of tax losses.

[6] Certainly, as the optimal debt-equity ratio changes, the steady-state values without taxation, for example m_0, may vary. Then the excess burden and the marginal excess burden are estimated based on different equilibrium values corresponding to different ratios.

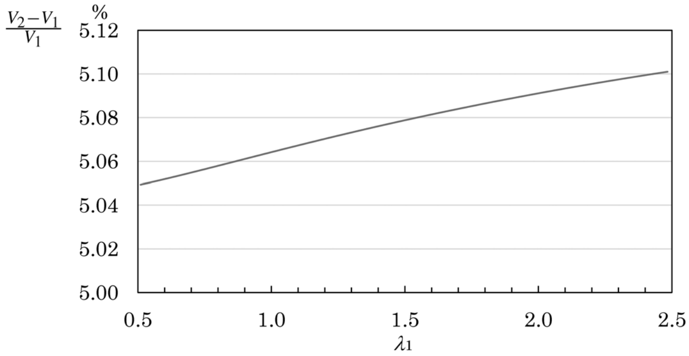

Figure 1. $\frac{V_2-V_1}{V_1}$ and Optimal Debt-Equity Ratio

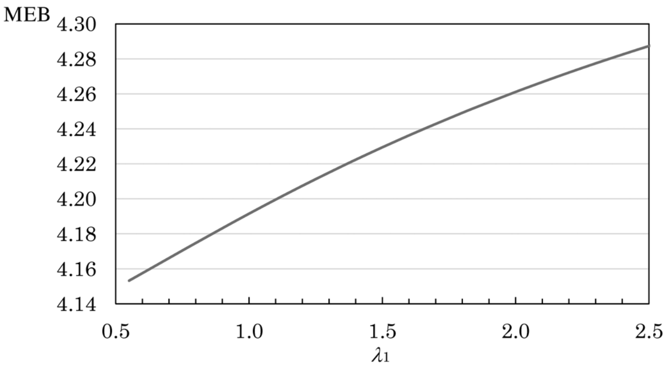

Figure 2. Marginal Excess Burden and Optimal Debt-Equity Ratio

VAT. Though the Japanese government has decided to increase the rate of value-added component of Enterprise Tax, how does corporate value change by replacing raising the rate of value-added component of Enterprise Tax with the VAT rate?

To compare the case in an increase in the rate of value-added component of Enterprise Tax with one in an increase in the VAT rate, we set tax revenue after policy change, T_2, constant. In other words, we examine the VAT rate, τ_C, at the steady state where rates of the size-based business taxation, τ_V and τ_K, are unchanged to obtain the same tax revenue at the steady state after the corporate tax reform, as shown above. We estimate the corporate value and welfare change if the VAT rate increases, rates of the size-based business taxation, τ_V and τ_K, are unchanged, and T_2 remains constant. The result is shown in Table 2.

Table 2 implies that the corporate value increases after a policy change with the VAT hike. In this case, the VAT rate becomes about 8.44% to obtain the same tax revenue

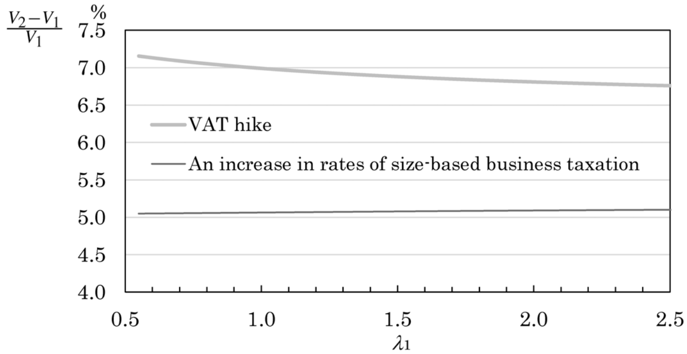

Figure 3. $\frac{V_2-V_1}{V_1}$ and Optimal Debt-Equity Ratio (Comparison of an Increase in Rates of Size-based Business Taxation and VAT Hike)

($T_2 = 1.26677$).[7] In this case, $\frac{V_2-V_1}{V_1} = 0.0691$. It means that the corporate value increases by about 6.91% after the reform. The reason is that burden of corporate taxation (T^F) totally decreases as shown in Table 2. Moreover, we find that the corporate value after the reform with the VAT hike is better than one with an increase in rates of size-based business taxation, from the results of Table 2.

Furthermore, we demonstrate a change in the corporate value in the case of the representative firm whose optimal debt-equity ratio is different in Figure 3. According to Figure 3, $\frac{V_2-V_1}{V_1}$in the VAT hike is higher than one in an increase in rates of the size-based business taxation.

Also, from Table 2, social welfare improves after the reform with the VAT hike. In this case, the excess burden is 0.01993, smaller than the post-reform case. We can confirm MEB $= 6.31400$, shown in Table 2. The MEB is larger the post-reform case. Moreover, we can analyze welfare change in the case of the representative firm whose optimal debt-equity ratio is different. The excess burden in the VAT hike is smaller than one in an increase in rates of the size-based business taxation. Also, as shown in Figure 4, MEB in the VAT hike is higher than one in an increase in rates of the size-based business taxation.

To sum up, an increase in rates of the size-based business taxation deteriorates the corporate value and social welfare, compared with the VAT hike.

4. SENSITIVITY ANALYSIS

We also confirm that the above results are robust. For example, α in the production function is equal to 0.5. It implies that capital share in the representative firm is higher than the benchmark case in Section 3. Other parameters are unchanged in the following case.

[7] Because the tax revenue is equal to $r^G b^G$ at the steady state from the equation (36'), when the interest rate at steady states, r^G, is the same, the government deb at steady states, b^G, is the same, if tax revenue at steady states is the same.

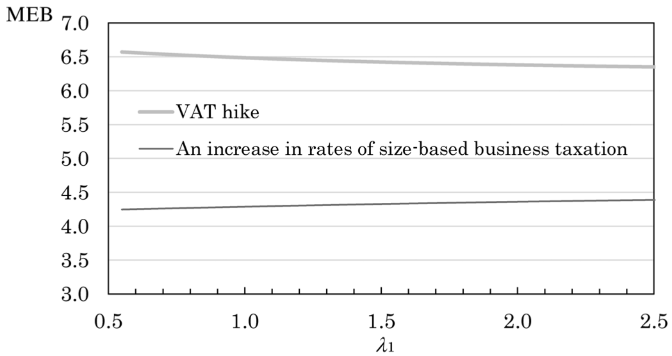

Figure 4. Marginal Excess Burden and Optimal Debt-Equity Ratio (Comparison of an Increase in Rates of Size-based Business Taxation and VAT Hike)

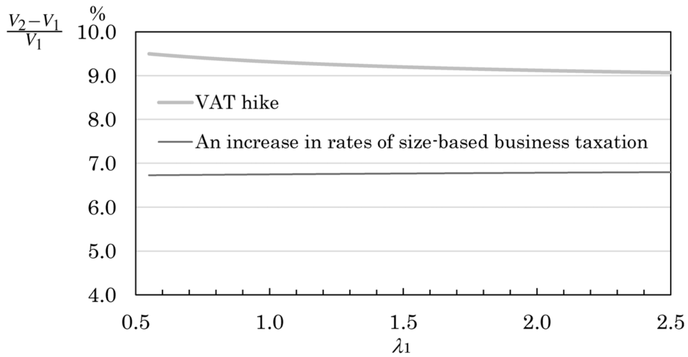

Figure 5. $\frac{V_2 - V_1}{V_1}$ and Optimal Debt-Equity Ratio (in case of $\alpha = 0.5$) (Comparison of an Increase in Rates of Size-based Business Taxation and VAT Hike)

We calculate $\frac{V_2 - V_1}{V_1}$ in a different (optimal) debt-equity ratio in case of $\alpha = 0.5$, shown in Figure 5. According to Figure 5, between 0.5 and 2.5 of the optimal debt-equity ratio at the steady state before the corporate tax reform, $\frac{V_2 - V_1}{V_1}$ is positive, as same as Figure 3. The reason is that burden of corporate taxation (T^F) totally decreases. Furthermore, we demonstrate a change in the corporate value in the case of the representative firm whose optimal debt-equity ratio is different in Figure 5. $\frac{V_2 - V_1}{V_1}$ in the VAT hike is higher than one in an increase in rates of the size-based business taxation, shown in Figure 5. As in the previous section, we set the VAT rate to obtain the same tax revenue at the steady state after the corporate tax reform, including an increase in rates of the size-based business taxation. The result is the same as Figure 3.

Moreover, we can estimate welfare change in the case of the representative firm whose optimal debt-equity ratio is different. Figure 6 shows the marginal excess burden between 0.5 and 2.5 of the optimal debt-equity ratio at the steady state before policy changes. Figure 6 suggests that the marginal excess burden in the VAT hike is higher

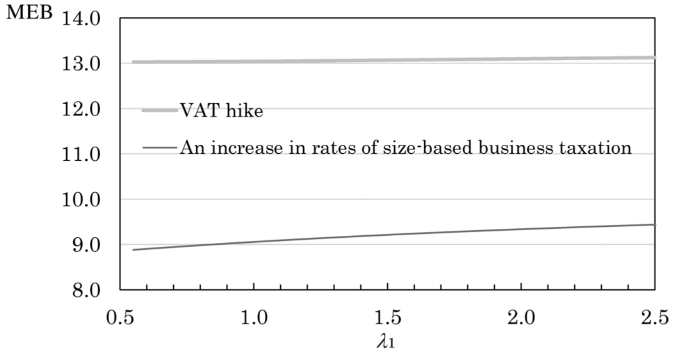

Figure 6. Marginal Excess Burden and Optimal Debt-Equity Ratio (in case of $\alpha = 0.5$) (Comparison of an Increase in Rates of Size-based Business Taxation and VAT Hike)

than one in an increase in rates of the size-based business taxation. That is, social welfare after the reform with the VAT hike is better than one with an increase in rates of the size-based business taxation.

In case of $\alpha = 0.5$, we find that the corporate values and social welfare are more improved by replacing raising the rate of value-added component of Enterprise Tax with the rate of VAT, like in the benchmark case.

5. CONCLUDING REMARKS

The paper examines long-run effects of the corporate tax reform on the corporate value and social welfare using a dynamic general equilibrium model. Though the Japanese government implemented an increase in the value-added component of Enterprise Tax, which is a kind of tax on value-added and one of corporate taxation, in the corporate tax reform, we find that the VAT hike would have been better instead of this tax hike to get the same tax revenue, using the model including capital structure (i.e., choices of equity, debt, and retained earnings) in the proposed model in order to implement investment. The model also includes a progressively increasing per unit agency cost on debt. We apply numerical analyses based on the dynamic model, and compare corporate value, capital structure and social welfare with before and after the corporate tax reform.

From results of numerical analyses, we confirm that the corporate value and social welfare are improved after the tax reform in Japan, in spite of an increase in rates of the size-based business taxation. Corporate value increases by about 5.07% after the reform under plausible setting of the parameter values. We also confirm social welfare improves after the reform.

Furthermore, we find that the corporate value and social welfare are more improved by replacing raising rates of the size-based business taxation with raising the VAT rate. Unlike the VAT, the value-added component of Enterprise Tax gives distortion to the labor demand and the instantaneous cost of capital, shown in the above theoretical model.

Indeed, the VAT distorts allocation between consumption and labor (or leisure). However, the former distortion is larger than the latter in the above numerical analysis.

The results are limited, since we assume that marginal source of finance for investment is retained earnings. This assumption means tax capitalization view or "new view" in the literature of corporate taxation. On the other hand, the "traditional view" exists. It means that marginal source of finance for investment is new equity. We leave a study on effects of the corporate tax reform on corporate values and social welfare under the "traditional view" for future research.

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