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■論　文

Effects of Tax Rate Cuts on Equity Valuation: Impact of Firms' Profitability and Variability *

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Abstract

This paper investigates changes in firm value triggered by hypothetical corporate tax rate changes with a simulation method and assesses the effects of a government tax rate cut on firms' after tax income and valuation. The study is based on simulations of all firms listed in Japan excluding financial firms. We utilize fundamental valuation equation from the residual income model by Ohlson (1995). To explore the effects on valuation by corporate tax rate changes we pay particular attention to tax loss carry-forward allowances as well as net changes in deferred tax assets and liabilities, which appear on equity or contra accounts of deferred tax assets in financial statements. Our data covers the period between 2000 and 2008 of firms' consolidated financial statements. The sample paths of taxable income are generated using Graham's (1996) method based on the estimated stochastic process of net income before tax. By discounting the future residual income stream with the equity cost of capital computed with the Fama and French three factor model, we obtain the hypothetical equity value of the firm after all corporate tax effects were fully taken care of. Then, we measure the effects of corporate tax rate changes on firm values under alternative hypothetical statutory tax rates. We find that changes in corporate tax rates can enhance the value of firms most of the time, while there are cases in which effects are neutral or even detrimental for firm values. We demonstrate that these different results are triggered by mixed effects of current provision that allows firms to carry their tax loss forward and the net balance of tax deferred accounts of each firm. We claim that past and future profitability and variability of firms are crucial to reach exact threshold points at which firms experience value appreciation or not. The implications are important for both corporate financial managers and regulators.

Keyword：Corporate taxation, tax loss carry-forward, deferred tax assets and liabilities, residual income, fundamental value

1 Introduction

Analyses of changes in firm values triggered by tax rate changes can provide important implications for corporate financial managers as well as regulators. In this paper we employ a

micro foundation approach using individual firm level data and a residual income valuation model to assess effects of tax rate cuts utilizing a simulation method. In this microsimulation approach, actual past data at the micro level for each firm are used to obtain necessary parameter values (Shahnazarian, 2011) and simulations are conducted at each firm level. The effects we found are surprisingly not uniform across firms, which have important implications to firm mangers as well as to investors. The result also demonstrates the difficulty and risk of correctly assessing tax policy effects on valuation and on financial decision making of firms, and provides us with important policy guidance on when to execute an effective tax cut to enhance higher fundamental value of firms and growth of the domestic economy.

In this paper we focus primarily on corporate tax rate cuts. This is because it is widely known that the corporate tax rate in Japan is substantially higher than in other developed countries. As of 2011, for large corporations in Japan, the national tax rate is 30%, the prefecture tax rate is 5%, and the city tax rate is 12.3%. This adds up to an effective tax rate of 40.87%, which is applicable to our sample of listed firms. The long run trend of effective corporate tax rates is depicted in Figure 1, and one finds that the trend in Japan is decreasing overall[1].

The theoretical analysis of how the corporate tax rate affects the equilibrium value of firms, and hence, Tobin's q, was conducted in RBC (Real Business Cycle) general equilibrium framework by Kubota, Saito, and Takehara (2012)[2]. In that paper the effects of the tax subsidy from the use of interest expenses are incorporated in their equilibrium model and empirical assessments with the newly constructed un-levered q measure are conducted for Japanese data. Tajika and Yui (2000) analyzed the effects of corporate taxation focusing on depreciation and firm investment behavior, and conduct a numerical assessment of Japanese firms in a neoclassical framework.

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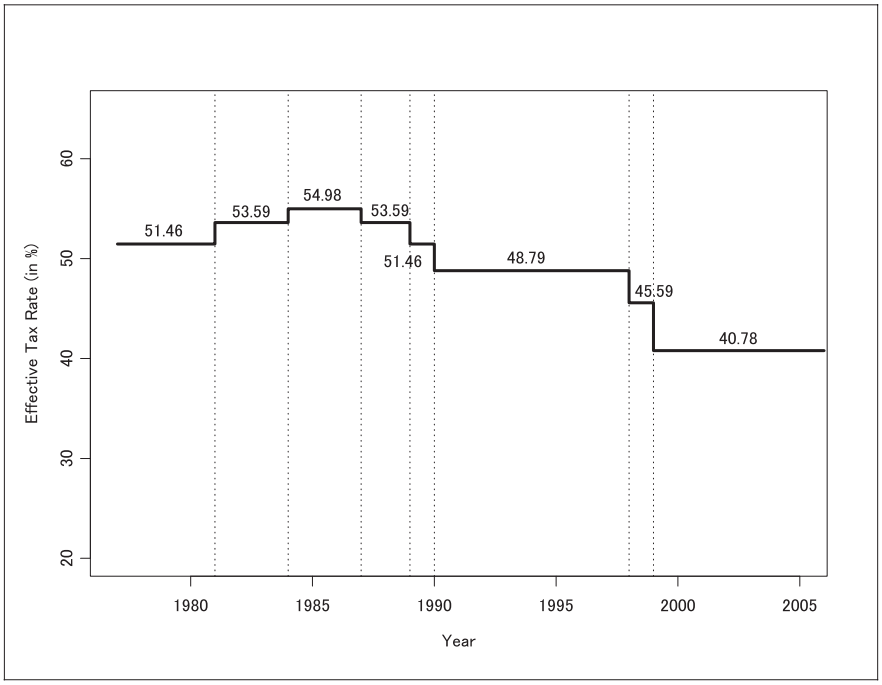
1 The withheld dividend tax rate and the capital gains rate were set to be 10% as a temporary relief measure until 2011 and the dividend tax rate was raised to 20%, while the withheld interest income tax rate is 20%. The analysis of the effects of tax rate cut or increase of individual financial income is our future work.

2 See Cooley (1995).

Figure 1. Trend of Effective Statutory Corporate Tax Rates in Japan

The effective statutory tax rates for large corporations in Japan, including the national tax, the municipal tax, and the enterprise tax. The source is the National Tax Bureau and the uniform rate is assumed for the municipal tax rate.



In this paper, we focus on micro data of firms and investigate the effects of tax rate cuts on the value of firms by utilizing the accounting residual income valuation model devised by Ohlson (1995), and identify conditions under which effects of tax rate changes are neutral, favorable, or rather detrimental. In order to conduct these analyses we use the simulation method proposed by Graham (1996) and compute the residual income to compute firm values[3]. In doing so, we take into consideration both the tax loss carry-forward allowances and changes in net deferred tax assets and liabilities and compute after-tax based residual income.

Section 2 discusses the motivation of our study, previous studies, and our research objective. Section 3 formulates the valuation model. Section 4 explains our data and reports the basic observations. Section 5 explains the simulation method we employ. Section 6 reports the simulation results and Section 7 concludes.

3 Kubota and Takehara (2007) use a similar method to compute the cost of capital for Japanese firms.

2 Taxation and Firm Value

(1) Motivation of the Study

Corporate tax-shield benefits or tax burdens arise from two sources: from debt or from non-debt. In this paper we focus on the latter. When Japanese firms incur losses, they can extend their tax-loss shield against future income, like in many other countries[4]. Hence, allowances from non-debt sources help firms decrease their future tax burden and possibly reduce the cost of capital.

Moreover, the firm may choose to pay a higher or lower tax today, hoping that in the future the firm can re-collect earlier payments by charging against future income to reduce future tax burden. These timing differences between the tax payables reported in income statements and the actual tax payable to the tax authority are charged either to deferred tax assets or to deferred tax liabilities on balance sheets. These tax timing differences can also occur both inside the parent company and between the parent firms and their subsidiaries. These balances are recorded by charging the differences which are either accrued or deferred during the accounting period whose amount is multiplied by current statutory tax rates.

Note the Japanese financial and tax reporting systems follow the so called uniform reporting system like continental European countries[5]. However, from fiscal year 1999, the tax deferral accounts in balance sheets can be recorded in consolidated financial statements on the condition that such an accrued amount had a high probability to be reversed in the future. In spite of this new tax timing difference allowance, the Japanese system can still be classified as a uniform reporting system in the sense that depreciation methods, inventory costing, and other major accounting choices have to follow uniform reporting both for tax and financial accounting purposes.

(2) Previous Studies

The effects of corporate taxation on corporate income and fundamental value of the nonfinancial corporate sector were analyzed by Downs and Tehranian (1988) among others. They focus on the Economic Recovery Act of 1981 and find that this act favored new capital, and the fundamental value of corporations suffered with an average 6.1 percent windfall loss. Collins and Kemsley (2000) extended Ohlson's residual income model on an after tax basis, accounting for dividend taxes and capital gains, and found that dividend taxes were largely capitalized into share prices,

4 In Japan, the Corporation Tax Act (Article 57 Paragraph 3) allows for firms with reported losses to deduct these against future profits up to a maximum of nine years. Also, the provision for tax loss carry-back allowances is provided, although it has not been implemented since 1992 except for the case of firm liquidations. Note also that in the U.S. the tax loss allowances can be charged to both future and past income.

5 See Cummins et al. (1994) for these classifications.

and investors incurred additional taxes on capital gains in addition to dividend taxes. By focusing on accounting and capital structure decisions, Calegari (2000) investigated the effect of changes in tax accounting provisions on firm debt policy and on the magnitude of accounting accruals, and found that there were significant effects on both. From the viewpoint of investors, the effects of tax changes on investors' portfolio decisions were investigated by Poterba (2001).

As to analyses on Japanese firms and the economy, Kubota, Saito, and Takehara (2012) find a partial equilibrium solution with corporate taxation and derive Tobin's q on an after tax basis. However, even though their model was multi-period, it is within a neo-classical framework, and firms and capital are resolved every period. In another macroeconomic approach, Tajika and Yui (2000) analyzed the effects of corporate taxation by focusing on the optimal allocations of capital with tax neutrality in their infinite horizon model. However, their model is a certainty model.

Our paper utilizes the firm valuation model, which can accommodate future uncertainty of after tax income with parameter estimates from all individual firm data. The simultaneous use of both the residual valuation model and the simulation method by Graham (1996) to analyze the effects of corporate taxation on firm values has never been conducted for Japanese data as far as the authors are aware of, and this is a contribution to the literature.

(3) Research Objectives

In this paper we try to assess the importance of the aforementioned tax provisions when the corporate tax rate is changed, which could affect firm values. The effect of tax rate changes on firm valuation becomes a very complex computational procedure and is rather entangled for the multi-period case as multiple integrals. Note the tax loss carry-forward allowances are valid only up to a maximum of five or seven years by the Corporation Tax Act in Japan during our sampling period and the book entry of deferred tax assets is also expected to be reversed in the future in order to be certified by CPAs. Every year the new entry of tax allowances when the firm incurs losses and deferred tax assets or liabilities are recorded and it will generate accumulated processes with finite lives.

With that reason we choose to use the simulation method, and in particular we focus on the tax rate cut case. As we proceed with the analysis, we demonstrate that these effects can be neutral, favorable, or unfavorable. We find that different results depend both on past profitability of firms and its variability, whose interactions we compute by using the simulation method of Graham (1996). The fundamental value of firms is derived utilizing the Edwards-Bell-Ohlson residual income valuation model (Ohlson, 1995).

Finally, we emphasize our analysis is important from the viewpoint of both corporate financial managers and regulators. Real investment decisions chosen by corporate managers may change through a rational response to corporate tax rate changes (MacKie-Mason, 1990). Then regulators would want to assess the directions of new investment behavior by firms triggered by the statutory tax rate cut for the purpose of implementing better economic policies. Such changes in firm behavior will change the allocation of scarce resources in both industry and in the economy. With

these considerations, we try to empirically identify firms which undergo favorable changes, neutral effects, or unfavorable changes triggered by the enactment of corporate tax rate cuts.

3 Firm Stock Valuation Equation

We compute fundamental value of firms using the Edwards-Bell-Ohlson formula (Ohlson, 1995). That is, we plug in the inputs from simulated future income series readjusted for an after tax basis into this formula. The fundamental value is defined in equation (1). In equation (1), BV_t is the owner's equity value measured at its historical cost at the end of the previous period t-1, x_t^a is the "residual income" as defined by Ohlson (1995), and r_f is the risk free rate. The left hand side variable, V_t^*, thus denotes the computed fundamental value.

$$V_t^* = BV_t + \sum_{j=1}^{\infty} \frac{E_t(x_{t+j}^a)}{(1+r_f)^j} \tag{1}$$

Ohlson (1995) originally formulates equation (1) assuming risk-neutral valuation for simplicity. However, by allowing for risk premium, Lehman (1993) demonstrates that the formula can be extended into the risk discounting model as follows.

$$V_t^* = BV_t + \sum_{j=1}^{\infty} \frac{E_t(NI_{t+j} - r_E \cdot BV_{t+j-1} | F_{t-1})}{(1+r_E)^j} \tag{2}$$

In this equation, NI_{t+j} is the future net income stream, r_E is the discount rate which is also the cost of equity, and $F_{t\text{-}1}$ is the publicly available information set at the end of time t-1. Note the cost of equity, r_E, appears both in the numerator to compute the residual income and in the denominator to discount the residual income.

In an original formulation of the Ohlson model which satisfies a clean surplus relationship, it is implicitly assumed that the future net income stream NI_{t+j} is on an after tax basis. Because we focus on the effects of taxation in this paper, we define NI_{t+j} on a before tax basis. We use the following equation (3) in which τ is the effective corporate tax rate. When uniform reporting is imposed for financial and tax purposes, it coincides with the statutory tax rate τ as long as the firm does not incur losses in the past seven years. As is discussed in Graham (1996), computations of taxable income and thus the computation of effective corporate tax rates are much more complex. We track this by the use of numerical simulations with the parameter values estimated from the actual data of Japanese firms in Section 6.[6] The valuation equation we use is based on effective tax rates, τ,

6 Collins and Kimsley (2000) formulate the Ohlson valuation equation by incorporating dividend taxes and capital gains taxes. The use of this form of equation and the accompanied simulation studies are subject to our future research.

taking into consideration both the tax loss carry-forward and deferred tax assets and liabilities. It can be written as follows.

$$V_t^* = BV_t + \sum_{j=1}^{\infty} \frac{E_t((1-\tau)NI_{t+j} - r_E BV_{t+j-1} | F_{t-1})}{(1+r_E)^j} \tag{3}$$

In the following, we assume that the cost of equity, r_E, is the rate of return before personal tax, which can vary over time, and we estimate the cost of equity based on publicly available information with the Fama and French model.[7] In order to estimate r_E we use the unconditional version of the three-factor model (Fama and French, 1993) as in (4), and we roll forward every year with 60 months of the rate of return data. Fama and French's model comprises three factors: excess market returns, the size factor spread portfolio (often referred to as the SMB factor), and the book-to-price ratio factor spread portfolio (also known as the HML factor). The empirical version of the Fama and French (1993) three-factor model can be written as follows, where $r_{j,t}$ is the return of the security j in month t, $r_{M,t}$ is the return of the market portfolio, $r_{f,t}$ is the risk-free rate, and $SMBt$ and $HMLt$ are the Fama-French (1993) Small-Minus-Big and High-Minus-Low factors, and $\varepsilon_{j,t}$ is the residuals, respectively.

$$r_{j,t} - r_{f,t} = \beta_i^M (r_{M,t} - r_{f,t}) + \beta_i^{SMB} SMB_t + \beta_i^{HML} HML_t + \varepsilon_{j,t} \tag{4}$$

Every year we compute the fundamental value of firms at the end of June after all financial statements from the fiscal year end in March become publicly available and are approved at shareholder meetings. We use only the sample of firms whose fiscal year ends in March, which amounts to more than 90 percent of all the listed firms on the Tokyo Stock Exchange.

Note valuation equation (2) includes the summation of the infinite time horizon. However, in the Monte Carlo simulation framework, we compute the intrinsic value of the firm by assuming that residual income becomes zero after the year t=21.[8] Consequently, after generating the sample paths of residual income from taxable income, we sum up the present value of the residual income for the years t=1, 2, ⋯, 20.

7 We discount after tax residual income with the rate of return on stock before the corporate tax basis. See Brennan (1970) for CAPM specifications where personal tax parameters are included. In this paper we do not consider Miller (1977) equilibrium. Also, when the estimated equity premium becomes negative for a particular sample, we replace the cost of equity estimate with the yield of long-term JGB bonds.

8 In view of the product life cycle of firms in general, this assumption does not seem to be restrictive. We also thank Kiridaran Kanagartenam for discussing this point.

4 Data and Basic Observations

Our financial data is based on consolidated financial statements of all Japanese firms starting from calendar year 2000 (fiscal year 1999) through 2009 (2008), excluding financial firms. We exclude sample firms with negative book values in equity and also firms with less than 5% and higher than 95 % of estimated drift parameters and variance parameters estimated by the following equation (5). Thus, the numbers of firm observations are a maximum of 1,101 firms for calendar year 2006, and a minimum of 805 firms for calendar year 2000.[9] The data source for financial variables is the Nikkei NEEDS Database, and for stock returns, the Nikkei Portfolio Master Database.

Table 1 shows the frequency distributions of the ratio of each year's tax loss carry-forward balance (shown as LCF in the table) to the book value of equity for Japanese firms for our entire sampling period, 2000 through 2009. These allowances can be charged against future income as up to either five or seven years after the fiscal year they are reported.[10] Numbers reported in the table are in percent, which we label LCF, and we find in the first row from the top that more than 30.58% of the firms did not incur past losses in taxable income between 2000 and 2009. The peak boom year is 2000 when 44.72% of firms incurred cumulative positive income from the past five years

Table 1. Year by Year Frequency Distribution of Tax Loss Carry-Forward to Book value of Equity

LCF is defined as (Tax Loss Carry Forward subject to tax effect accounting) /(Book Value of Equity) in percent.

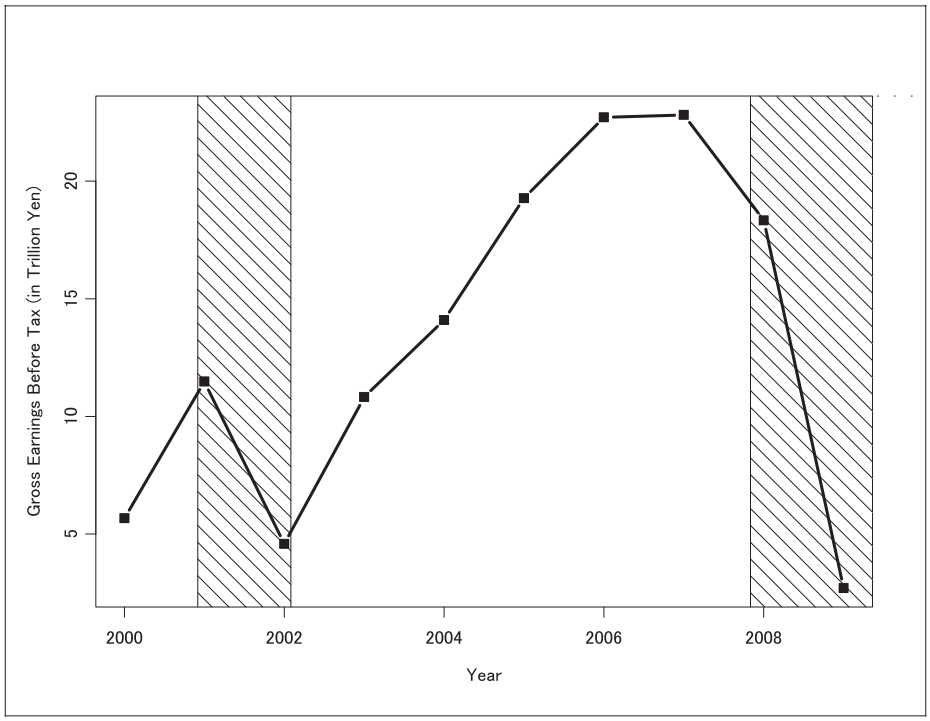
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
LCF=0	44.72	42.00	34.75	32.06	33.44	34.77	36.60	36.07	35.53	30.58
0<LCF≦2	23.85	27.26	28.78	27.37	31.67	35.33	37.42	37.31	35.73	27.79
2<LCF≦4	9.81	11.14	10.55	11.45	12.05	10.03	9.72	10.11	11.88	17.56
4<LCF≦6	5.96	5.68	7.45	8.29	6.33	5.81	5.09	4.77	5.29	7.33
6<LCF≦8	4.60	3.25	5.05	5.02	4.15	3.84	2.72	3.53	3.09	4.03
8<LCF≦10	2.86	1.97	3.44	3.71	2.49	1.97	1.73	1.43	1.70	2.79
10<LCF≦12	1.99	1.74	2.52	2.62	2.49	1.97	1.45	0.95	1.30	2.69
12<LCF≦14	0.50	1.39	1.26	1.85	1.87	1.50	0.54	1.05	1.30	1.34
14<LCF≦18	1.61	1.39	1.61	2.29	0.52	1.12	0.73	0.67	0.50	0.93
16<LCF≦18	0.75	0.93	0.92	0.76	1.14	0.56	0.91	0.67	0.50	0.83
18<LCF≦20	0.75	0.46	0.80	0.98	0.83	0.56	0.54	0.19	0.40	0.52
20<LCF	2.61	2.78	2.87	3.60	3.01	2.53	2.54	3.24	2.79	3.62

9 The Japanese financial reporting system changed from individual filings to consolidated filings in fiscal year 1999. This is why we start the sample observations in 2000.

10 Up to fiscal year 2004, the maximum number that tax loss could be carried forward for five years, and then it changed to seven years, and currently, it is nine years.

Figure 2. Expansion and Contraction Period and the Trend of Corporate Earnings before tax in Japan

The solid line is the sum of earnings before corporate tax for the sample firms and the shaded area is the contraction period as defined by the Cabinet Office of Japan.



before and the lowest year is 2009 when only 30.58% of firms had cumulative positive income from the past seven years.

When one adds the percentages within the LCF range between 0 and 2 percent, one finds that in both 2000 and 2001 and in 2006 and 2007, these numbers are higher, which means the majority of firms had been generating profits or losing very little. For example, in 2001, the number is 69.26%, and in 2006 it is 74.02%. However, after the Lehman shock of September 2008, one finds that this number drastically decreased in 2009. The comparable number is 58.09%, which was 71.26% in previous 2008. Also, in the bottom row of the table for 2009 we find that more than 3.62 percent of firms have a LCF percentage exceeding 20%, which is a large loss. We also find that these numbers are also large at 2.87% in 2002, and 3.60% in 2003. Note year 2002 corresponds to the year after the information technology bubble crushed.

In Figure 2, for the purpose of referring to business cycles in Japan, we plot the expansion and contraction periods as well as the time trend of the total value of net income before tax for all sample firms.

The figures for one year after 2001 and 2008 are conspicuous in terms of the sudden drop in net income numbers. Also, one can reconfirm that from 2002 through 2007, Japan experienced a slow

Table 2. Year by Year Frequency Distribution of Deferred Tax Assets to Book Value of Equity

DTA is defined as (Deferred Tax Assets －Deferred Tax Liabilities)/(Book Value of Equity) in percent.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DTA≦－20	2.86	2.20	2.87	2.29	2.70	3.19	4.36	3.44	0.80	0.52
－20<DTA≦－15	0.62	0.81	1.38	0.76	1.35	1.12	2.18	2.86	0.60	0.72
－15<DTA≦－10	0.75	1.62	1.83	1.20	2.28	2.53	4.63	4.48	1.30	0.62
－10<DTA≦－5	1.74	2.78	2.87	1.74	3.84	4.69	8.90	9.16	4.29	2.69
－5<DTA<0	7.08	10.09	9.40	6.22	12.46	14.62	20.44	19.47	15.47	12.19
DTA=0	1.49	0.93	0.34	0.55	0.42	0.19	0.09	0.19	0.50	1.14
0<DTA≦5	46.58	35.73	30.85	28.79	35.31	34.58	32.24	33.87	40.82	39.05
5<DTA≦10	21.61	24.83	24.89	27.59	20.98	20.34	13.35	14.12	20.36	22.52
10<DTA≦15	8.94	9.63	11.12	13.74	8.72	8.15	7.08	6.58	7.88	10.64
15<DTA≦20	4.72	6.03	6.54	7.09	5.30	4.97	3.18	2.96	4.99	4.96
20<DTA	3.60	5.34	7.91	10.03	6.65	5.62	3.54	2.86	2.99	4.96

but sustainable expansion period.

Next, Table 2 shows the balance of net deferred tax assets, which are defined as deferred tax assets minus deferred tax liabilities in this case, divided by the book value of equity for all years of our sample period, from 2000 through 2009. We call this variable DTA.

The sixth row from the top shows the ratio, DTA, of the cases where there is no outstanding balance. When the firms carry zero balance on their deferred tax account, this applies to a case in which the timing of the tax payment and financial reporting coincide, if there were not any balance from the previous period. The percentage is a minimum with 0.091% in 2006 and a maximum of 1.491% in 2000. As one reads through these numbers for DTA from the top to the bottom row, one finds that the majority of firms in Japan have balances on the debit side, whose balance appears on the Deferred Tax Assets account.[11] Also, we find the majority of firms belong to ranges of DTA from zero to 10 in three consecutive rows. On the other hand, the largest number of negative DTA cases, whose balance appears in the Deferred Tax Liabilities account, lies within the range of DTA between -5 and 0 for all years. So, unlike financial statements in the U.S., in which tax accounting and financial accounting are separated and the balance on the deferred tax liabilities side is more common by deferring the tax payment while expensing for financial reporting purposes in earlier years, financial statements in Japan seem to have more balance on the debit side. When the

11 US firms have their balances more frequently in deferred tax liabilities accounts. For example, when a firm chooses the Modified Accelerated Cost Recovery System of the Tax Reform Act of 1986 for depreciation, and this firm can still use the straight-line depreciation method for financial reporting.

corporate tax rate is reduced according to Japanese Accounting Standards, this deferred tax asset balance has to be downwardly readjusted for the balance amount of assets to account for the lower tax rate. Also, in the case of firms with a debit (credit) balance, future income after tax payments may increase (decrease), and thus the value of these firms may appreciate (depreciate). We further investigate this effect in Section 6 with the simulation method.

5 Simulating the Future Net Income Path

We compute the present value of the future net income stream after tax, using a simulation method proposed by Graham (1996). First, we estimate a simple time series model of taxable income for each firm. The definition of income before tax for our study is the sum of earnings before tax plus the net deferred tax balance, divided by statutory tax rates. Japanese accounting standards require firms to report the deferred tax balance on an after tax basis.[12]

The change in taxable income is defined as the change in earnings plus tax deferrals, and we assume it follows a stochastic process (5), in which ΔTI_{it} is the first difference of taxable income for firm i between time period t and t+1, μ_i the mean drift parameter for firm i, and η_{it} an identically and independent normal random variable for all t for each i with finite and constant variance σ_t which are also estimated and used for generating simulation paths.

$$\Delta TI_{it} = \mu_i + \eta_{it} \tag{5}$$

The parameters for the stochastic process of taxable income are estimated using the past five years of data for the mean trend and the volatility of the error term for each firm. Based on these parameter values, we compute the expected present value of future tax payable, and consequently, future residual income on an after tax basis, defined in previous equation (3). In this computation, we take into account both outstanding tax carry-forward balances and future tax loss possible allowances in cases where a firm happens to incur losses on any one of the 10000 simulation paths in future 20 years.[13] We use the new statutory tax rate to readjust the future tax deferral balance by using Japanese accounting standards.[14] In the simulation, we assume that the remaining balance on deferred tax assets is resolved in the first next period when firms incur enough profit, and if not, in consequent next periods, irrespective of possible decision by tax authority. Furthermore, we

12 We use the earnings data from consolidated financial statement.

13 For firms which have experienced losses less than 7 years ago, the tax loss carry-forward benefits will accrue. We conducted our simulations for the period of 20 consecutive years to fully account for future cumulative effects.

14 The recommendation to include tax deferral accounts in Japanese accounting standards, Accounting Standards for Tax Effect Accounting, was released on October 30, 1998 and was enacted in April 1999. Some firms began their voluntary disclosure in April 1998.

assume that the firms keep their average payout ratio in the past five years, and that the firms which incur negative earnings do not pay dividends.

6 Simulated Results from Hypothetical Corporate Tax Cuts

In Table 3 we report the year-by-year results of our simulations. We compare V_0, the valuation based on the current effective tax rate of 40.87%, to V_1, the hypothetical valuation under the effective tax rate of 35%, which is equivalent to an approximately 5 percent cut in corporate tax rate computed from equation (3). We report the ratio V_1/V_0, called VR in the table, which is a hypothetical value under the tax rate cut to the value when the current tax rate is continued. All our calibrated valuations are computed each year for June 30th. For example, for calendar year 2000, balance sheet data from March 2000 is used, which is from financial statements of firms for fiscal year 1999. With this ratio we can contrast firms which are expected to increase equity values by a tax cut (lower half of table) with firms which are expected to decrease values (upper half of table).

In Table 3 we find that for a majority of firms, the ranges of VR values are within 1.00 to 1.15 in three rows from the top. The mode values lie between 1.05 and 1.10. Thus, with an effective 5.87% tax rate cut, the equity value increases from 5% to 10% for a majority of firms. Note that this is purely from tax effects. With possible additional productivity increases, we may expect even higher changes in firm values.[15]

Table 3. Year-by-Year Frequency Distribution of Intrinsic Value Ratio

Intrinsic Value Ratio, VR, is defined as the (V at hypothetical tax rate=35%)/(V at current corporate tax rate=40.87%).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
VR≦0.8	3.23	3.83	5.39	3.93	2.39	2.25	2.27	0.38	1.60	4.75
0.80<VR≦0.85	0.75	0.70	0.69	1.09	0.52	0.66	0.27	0.29	0.50	1.45
0.85<VR≦0.90	1.24	1.04	2.52	1.31	0.62	0.94	0.91	0.48	0.20	1.65
0.90<VR≦0.95	2.61	2.32	4.59	3.49	1.77	1.03	1.45	0.95	1.50	4.86
0.95<VR≦1.00	13.17	14.15	22.25	13.96	5.71	3.84	5.54	3.91	5.89	27.38
1.00<VR≦1.05	16.52	14.15	15.71	8.62	6.02	5.34	6.45	5.53	7.19	13.33
1.05<VR≦1.10	42.48	41.65	27.29	38.06	57.94	61.20	64.40	73.76	66.37	29.03
1.10<VR≦1.15	13.04	11.83	11.01	14.83	14.43	14.71	11.35	10.11	9.08	9.19
1.15<VR≦1.20	2.24	3.94	3.44	5.78	4.05	4.12	2.82	1.72	3.19	2.89
1.20<VR	4.72	6.38	7.11	8.94	6.54	5.90	4.54	2.86	4.49	5.48

15 We are not taking into consideration firms' potential productivity improvements caused by corporate tax rate cuts. It is subject to our future research. .

Noteworthy is the fact that the slight value decrease can be observed in 2002 and 2009. For the range of VR within 0.95 and 1.00, 22.25 % of the sample firms fall into this category in 2002 and the corresponding number is 27.38% for 2009. In other years these numbers are smaller. The reason why this happens is partly due to the downturn of the economy (see Figure 2). When future profits are expected to decline along with higher volatility, corporate tax reduction effects will become smaller because the effective tax rates for the firms which may incur loss can utilize the tax loss carry forward and, thus the marginal tax rates become smaller than the average tax rates (Kubota and Takehara, 2007). This effect will cancel out the decrease in statutory tax rates and it cancels (added to) any gain (loss) from deferred tax liabilities (assets). This result has important implications to financial managers, and it suggests that they have to carefully watch the impact of corporate tax rate cut and assess its effects upon their firm values.

Furthermore, from fiscal year 2008 to 2009, the percentage of a majority of firms for which VR values stayed between 1.00 and 1.10 suddenly decreased from 73.56% (=7.19+66.37) to 42.36% (=13.33+29.03). This means that the percentage of firms for which positive effects can be expected drastically decreased in 2009, which would have attenuated policy effects of the corporate tax rate cut, if the tax cut policy had been enacted in that year. These results demonstrate very important implications for policy makers on the right timing of policy implementation. Accordingly, in Japan,

Table 4. Industry-wise Frequency Distribution of Intrinsic Value Ratio at the end of June 2009

	#Firms	VR≦0.8	0.80<VR ≦0.85	0.85<VR ≦0.90	0.90<VR ≦0.95	0.95<VR ≦1.00	1.00<VR ≦1.05	1.05<VR ≦1.10	1.10<VR ≦1.15	1.15<VR ≦1.20	1.20<VR
Construction	68	4.41	0.00	4.41	0.00	14.71	7.35	38.24	14.71	7.35	8.82
Foods	47	4.26	2.13	2.13	4.26	12.77	10.64	38.30	12.77	2.13	10.64
Textiles & Apparels	31	6.45	0.00	0.00	12.90	38.71	16.13	16.13	6.45	3.23	0.00
Chemicals	88	0.00	3.41	3.41	3.41	29.55	14.77	27.27	7.95	3.41	6.82
Pharmaceutical	19	0.00	0.00	0.00	0.00	15.79	5.26	63.16	10.53	5.26	0.00
Glass & Ceramics Products	26	7.69	0.00	0.00	0.00	46.15	15.38	11.54	11.54	3.85	3.85
Iron & Steel	24	4.17	4.17	4.17	16.67	33.33	4.17	29.17	4.17	0.00	0.00
Metal Products	33	6.06	3.03	3.03	6.06	27.27	24.24	15.15	9.09	0.00	6.06
Machinery	88	4.55	1.14	1.14	12.50	23.86	6.82	30.68	7.95	2.27	9.09
Electric Appliances	107	4.67	0.93	1.87	0.93	43.93	17.76	24.30	1.87	2.80	0.93
Transportation Equipment	41	7.32	0.00	0.00	4.88	31.71	21.95	21.95	9.76	0.00	2.44
Precision Instruments	22	0.00	0.00	0.00	0.00	45.45	18.18	22.73	9.09	0.00	4.55
Other Products	37	0.00	0.00	0.00	5.41	40.54	13.51	18.92	8.11	5.41	8.11
Electric Power & Gas	19	5.26	0.00	0.00	0.00	15.79	47.37	26.32	5.26	0.00	0.00
Land Transportation	32	0.00	0.00	3.13	0.00	12.50	9.38	46.88	15.63	0.00	12.50
Warehousing	15	0.00	6.67	0.00	0.00	20.00	13.33	6.67	13.33	26.67	13.33
Wholesale Trade	92	5.43	1.09	1.09	7.61	20.65	7.61	35.87	11.96	3.26	5.43
Retail Trade	37	2.70	0.00	0.00	8.11	21.62	13.51	37.84	13.51	2.70	0.00
Services	67	10.45	2.99	0.00	5.97	14.93	11.94	38.81	8.96	1.49	4.48

if the government ever wanted a tax rate cut, the corporate tax cut should have been enacted in 2007 when 79.29% (=5.53+73.76) belonged to this category,

Next, Table 4 reports industry-wide distribution of VR ratios as of June 2009. Industry classification is based on 33 classifications by the Tokyo Stock Exchange. We imposed the condition that there are at least 15 firms in an industry.

Overall, we find positive effects of corporate tax cuts in the food industry, pharmaceuticals, land transportation, warehousing, retail trade, and services by counting the percentage of firms whose VR values are larger than 1.00.[16] Slight negative effects from counting VR values between 0.95 to 1.00 are observed for chemicals, iron and steel, machinery, electric appliances, precision instruments and other products. Note the latter group is more heavily equipped. Hence, even if the corporate tax cut is not as effective as other alternative corporate tax cut policies the policy maker could devise an accelerated depreciation, or shortened estimated life of heavy equipment in order to augment the smaller effects of the tax rate cut, like the case of the U.S. Tax Reform Act of 1986.[17]

Table 5 summarizes the characteristics of firms by classifying them by the magnitude of VR values to further interpret our previous results.

Table 5. Summary of Firms' Characteristics at the end of June 2009

Definition of DTA and LCF are the same as in Tables 1 and 2. lnMV denotes the natural logarithm of market value of equity in million yen and B/M denotes the book-to-market ratio of the firm in percent. μ_{TI} and σ_{TI} are the drift term and volatility of taxable income divided by book value of equity in percent. The figures in each cell is the mean value for each category.

	DTA	LCF	lnMV	B/M	μ_{TI}	σ_{TI}
VR≦0.8	5.91	6.90	9.93	152.97	−1.16	15.85
0.80<VR≦0.85	5.02	3.27	10.70	122.12	−0.87	11.79
0.85<VR≦0.90	5.20	4.54	10.64	126.32	−1.34	8.58
0.90<VR≦0.95	4.41	2.71	10.21	149.91	−1.10	9.27
0.95<VR≦1.00	4.54	5.66	10.10	154.23	−2.66	10.58
1.00<VR≦1.05	7.84	4.07	10.63	146.35	−2.82	6.37
1.05<VR≦1.10	5.69	1.43	10.54	124.45	1.12	5.34
1.10<VR≦1.15	5.65	3.17	10.39	134.81	0.35	11.07
1.15<VR≦1.20	5.96	7.34	10.27	128.18	−0.08	14.30
1.20<VR	5.21	6.06	10.05	150.20	−0.50	14.49

16 Although the percentages of the firms with VR> are high in the construction and in the electric power and gas industry, for the former industry the realization of earnings is based on the completion criterion and for the latter the rates are regulated based on cost-added approach, and the tax effects of these industries will be different from other industries. Thus, we will not adopt these industries as typical industries in our study and leave the discussion for our future inquiry.

The first column DTA is the balance of net tax deferred assets as reported in Table 2, and the second column LCF is the tax loss carry-forward as reported in Table 1. We find overall that DTA is larger for the group with favorable effects of a tax cut, which means that the tax cut causes favorable effects for firms via the net tax deferred asset account. We infer that the effects are dependent upon both the trends and the variability of firms' income before tax and the resultant income after tax is also dependent upon the balance of deferred tax assets or liabilities and tax loss carry forward. The effect of tax cut will be, thus stronger, whether it may be appreciation or deprecation of the firm values, when the income trends are extremely upward or downward and at the same time their variability is larger.

As to LCF values, the tendency is not so clear cut. It seems the distributions are similar between above and below the value of VR 1.00. We find that LCF values are the largest again in extreme points where VR is less than or equal to 0.8 and larger than 1.2 depending on the past trends and variability of income series for each firm. Accordingly, we claim that there are extreme losing firms with large tax loss carry-forward amounts on one side, but still the tax cut may have either positive or negative effects. We infer that these effects are caused by joint effects of both DTA and LCF. However, we cannot identify analytically which element is more decisive in a dynamic context. In addition, we do not find differences in firm size as measured by the natural logarithm of the total market value of equity for 10 separate rows. As to the "value" factor, the book-to-market ratio used in financial economics, we find that firms with positive tax cut effects have higher book-to-market ratios, which means the stock price is low relative to the book value. Therefore, the tax cut effect works stronger in the so called value firm group, a group of distressed firms as judged by capital market participants which is labeled as "fallen angels" by Fama and French (1993).

The final two columns are the mean growth rates of net income before tax and their standard deviations. Among firms for which the tax effect is unfavorable (VR 1), the mean growth rate is all negative as expected. For the favorable tax cut effect group, even though some numbers are negative, they are uniformly larger than the negative group. For standard deviations, larger values on the two extreme ends seem to have significant roles to make VR much larger or much smaller than one.

In sum, we have demonstrated with a simulation method that the estimated stochastic process of net income after taking into consideration the outstanding net balance of both DTA and LCA, reveals the final effect of corporate tax cuts on firm values. It is a new finding which has never been explored with the recent data for countries with uniform tax reporting systems like Japan, and it is a new contribution to the literature.

17 Samuelson (1964) is the first study which theoretically analyzed the effects of tax depreciation methods on firm value as well as social equity between large and small firms. Note that the higher accelerated depreciation rates and smaller salvage values were permitted for tax purposes in Japan since 2007.

7 Conclusion and Final Remarks

This paper addressed a fundamental query in changes in firm values triggered by hypothetical corporate tax rate cuts. The study is based on micro foundations of simulations of all the firms listed in Japan. We utilized the fundamental Ohlson residual income valuation model. To disentangle the effects on firm value triggered by corporate tax rate changes, we paid particular attention to net changes on deferred tax liabilities in equity and contra accounts of deferred tax assets. Future paths of taxable net income for all individual firms were generated using the method of Graham (1996) based on the estimated stochastic process of this income. As a discounting rate we use the cost of equity computed from unconditional rolling forward Fama and French three factor model using 60 months of past return data.

We measured the effects that these tax rate changes impose on firm values using simulated future paths of taxable income and the assumed alternative hypothetical statutory tax rates.[18] Our results demonstrate that corporate tax rate changes can enhance the market price of equity most of the time, while there are cases in which the effects were neutral or even detrimental. These different results are caused by mixed effects of current provisions that allowed firms to carry their tax losses forward and the net balance on firms' tax deferred accounts on either the debit or credit side.

Overall, we find that firms' profitability and variability are crucial in identifying the exact threshold points at which firms experience value fluctuations from the corporate tax rate change. Extensions to incorporate parametric changes of firms' productivity as well as profitability by corporate tax rate cuts (Auerbach, 2002) as well as to introduce individual income taxes for investors (Collins and Kemsley, 2000) are our future work.

As a final remark, to update the current trend of Japanese tax rates after we had conducted this research, we note the corporate tax rate was reduced 5 % from fiscal year 2012 with added smaller corporate tax for the sake of recovery from the Great Eastern Japan Earthquake, and the similar small additional recovery tax is also burdened on personal income and financial income tax rates to enhance this recovery from fiscal year 2013. The investigation of the effects of these recent tax rate changes is also subject to our future work.

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18 Note we implicitly assume the "me first rule" (Fama and Miller, 1972) holds, and furthermore assume away the existence of any agency costs between shareholders and debt holders. Accordingly, the maximization of firm values and the maximization of the market value of equity are equivalent.

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