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Shigeki Kunieda, Junichiro Takahata, and Haruna Yada

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Shigeki Kunieda[a,*], Junichiro Takahata[b], Haruna Yada[c]
[a] Hitotsubashi University, Chiyoda-ku, Tokyo, Japan
[b] JICA Research Institute, Shinjuku-ku, Tokyo, Japan
[c] The Dai-ichi Life Insurance Company, Limited, Chiyoda-ku, Tokyo, Japan

ABSTRACT

Understanding the effects of marginal tax rate on debt policy is crucial not only for considering various capital structure theories of firms but also for evaluating corporate tax reform proposals. In this empirical study, we have found a positive relation in most cases between the firm-specific marginal tax rates (simulated using the method of Shevlin (1990) and Graham (1996)) and the debt ratio increase of Japanese firms. This result shows that the marginal tax rates significantly affect the debt policies of Japanese firms. Corporate tax reform to produce equal treatment of equity and debt is desirable in Japan.

JEL Classification Codes: **G32**, **H25**

Keywords: debt, capital structure, marginal tax rate, corporate tax

[*] Corresponding Author: Graduate School of International and Public Policy, Hitotsubashi University, Hitotsubashi 2-1-2, Chiyoda-ku, Tokyo, 101-8439, JAPAN
E-mail address: skunieda@ics.hit-u.ac.jp

1. Introduction

Determinants of capital structure have been one of the most important issues in corporate finance. Modigliani and Miller (1963) point out that when corporate tax exists, more leveraged firms have higher firm values due to the tax-saving effects of debt. At the same time, more leveraged firms have a higher probability of financial distress. The tradeoff theory of capital structure argues that firms choose the optimal debt ratio by comparing the present values of additional tax savings and of the additional expected cost of financial distress caused by marginal increase of debt. The present value of the tax savings of fixed amount of debt D is τD (where τ: corporate tax rate), so that a higher marginal corporate tax rate increases the present value of the tax savings of debt. Thus, firms with higher marginal corporate tax rates tend to have higher debt ratios. However, the pecking order theory of financial choices supposes that firms have certain priorities among alternative financial choices when they raise capital. Firms raise capital from retained earnings first, then by borrowing, and finally by new issue of equity. In the pecking order theory, marginal corporate tax does not play a very important role in the choice of financing methods. Thus, understanding the effects of the marginal corporate tax rate on firms' debt policy is crucial for evaluating alternative theories of capital structure.

In the area of public finance, recent debate about corporate tax reform has focused on the consequences of asymmetric tax treatment of equity and debt. To avoid the possible distortion of debt-equity choices by asymmetric tax treatment, most drastic corporate tax reform proposals, such as the comprehensive business income tax (CBIT) proposal by the U.S. Treasury and the proposals of Mirrlees Review, emphasize equal treatment of equity and debt. Furthermore, the recent studies on the role of tax policy in financial crisis stress that asymmetric tax treatment may have caused excess leverage. Thus, the necessity of the proposed corporate tax reforms depends on the magnitude of distortion caused by the asymmetric tax treatment of equity and debt.

Despite its crucial importance, relatively limited empirical studies have been done on the effects of marginal corporate tax on debt policy, although Graham (1996) and the subsequent studies have confirmed that marginal corporate tax rate does affect the debt policies of U.S. firms. In Japan, as far as we know, no empirical study of the effects of simulated marginal tax rates on debt policy has previously been conducted.

In this analysis, we estimate the marginal tax rates of individual firms following Shevlin (1990) and Graham (1996), and we study the relationship between simulated

marginal tax rates and the debt policies of Japanese firms. Based on the regression results using the cross section or panel data of listed firms, we find that the marginal tax rate affects the debt policy of Japanese firms in most cases. This result is consistent with previous research, such as Graham (1996).

In Section 2, we present a brief review of recent Japanese corporate tax changes and firms' debt policy. In Section 3, we review the existing literature on the relationship between marginal tax rates and the debt policies of firms in the U.S. and Japan. In Section 4, we estimate the marginal corporate tax rates of individual firms by the Monte Carlo method, following Shevlin (1990) and Graham (1996). In Section 5, we explain the dependent variable, control variables and data used in our regressions. In Section 6, we present the results of the regressions using the cross section data of firms in FY2008 and discuss their implications. In Section 7, we present some robustness checks of the basic results. In Section 8, we construct a panel including the data on individual firms from FY2006 to FY2008. We conduct the cross section regressions for FY2006, FY2007 and FY2008 first, and then we conduct the panel regression with fixed time effects and/or firm-specific fixed effects. Based on these regressions, we confirm that marginal tax rate affects the debt policy of Japanese firms. There are also some brief concluding remarks.

2. Recent Japanese corporate tax changes and firms' debt policy

2.1 Changes of statutory tax rates on corporate income in Japan

The basic rate of Japanese corporate tax (national tax) was gradually raised after the 1970s and reached up to 43.3%. However, in the fundamental tax reform in late 1980, the corporate tax rate was reduced gradually to 37.5% in 1990. After the financial crisis, it was reduced to 34.5% with the enlargement of the tax base in 1998 and further reduced to 30% in 1999. The current corporate tax rate stands at 30%.

There are also local taxes on corporate income, such as corporate inhabitant tax and corporate enterprise tax. One of the tax bases of corporate inhabitant tax (local tax) is the amount of corporate tax (national tax) before tax credits. The current standard rate of corporate inhabitant tax is 5.0% for prefectures and 12.3% for municipalities. Corporate enterprise tax is imposed not only on corporate income but also on value-added and corporate equity. The corporate enterprise tax rate on corporate

income (above 8 million JPY) is 7.2% for large corporations[1]. The effective tax rate of local taxes on corporate income was also gradually reduced from 17.40% in 1984 to 11.56% in 2004.

The calculation of the effective tax rate of the sum of national and local taxes on corporate income is shown in formula (7) in Section 3. The effective tax rate has been decreasing since the fundamental tax reform in late 1980s and is currently 39.54%.

2.2 Japanese firms' debt policy

Until recently, high debt ratio was recognized as an important characteristic of the capital structure of Japanese firms. During the postwar rapid economic growth era of Japan, most Japanese firms financed their active equipment investment mainly by borrowing from banks. The debt ratio of Japanese firms was more than 80% in the 1970s. However, after the 1970s, equity finance increased gradually, so that the debt ratio of Japanese firms started to decline. As shown in Figure 1, the debt ratio continued to decline in the 1980s, especially when equity finance surged in response to asset bubbles in the late 1980s. After the collapse of the asset bubbles, while the amount of equity finance decreased, equipment investment demand also fell, and the debt ratio declined further. After experiencing financial crisis in the late 1990s, Japanese firms made serious efforts to reduce debt up until mid-2000s, and the debt ratio of Japanese firms dropped to about 65%. However, after FY2005, the debt ratio changes seemed to have stabilized. The debt ratios of the listed Japanese firms were 65.35% in FY2006, 64.33% in FY2007 and 64.98% in FY2008. In FY2009, due to Lehman shocks, Japanese firms experienced negative shocks, and the debt ratio increased to 66.85%.

The relatively high debt ratio of Japanese firms was often compared with the relatively low debt ratio of U.S. firms in the 1960s and 1970s. Because highly leveraged firms enjoyed more tax savings, American corporate managers complained that Japanese firms enjoyed the advantage of a lower cost of capital due to their high debt ratio. However, without basic knowledge of modern corporate finance theory, Japanese corporate managers and industrial policy makers believed that only dividend payments contributed to the cost of equity capital. Thus, they complained that U. S. firms had a lower cost of capital because their debt ratio was relatively lower. Even in

[1] While there is also a "special regional corporate tax" that was introduced in October 2008, the combined tax rate of the corporate enterprise tax and special regional corporate tax is adjusted to be almost the same as the tax rate of the corporate enterprise tax before the introduction of the special regional corporate tax.

the mid 1990s, only 5% of Japanese CFOs said that the tax-saving effects of debt were one of the important factors in their decision regarding the optimal debt ratio in the survey by Akaishi et al. (1998). Hotei and Kunieda (2008) also empirically confirm that Japanese corporate managers did not determine their dividend policy in a way consistent with modern corporate finance theory before the 2000s.

However, facing strong pressure from foreign investors including hedge funds, Japanese firms tried to reform their corporate governance and financial policy in the 2000s. Especially after the Japanese consumer-product giant Kao introduced EVA® in 2000, many Japanese large firms introduced EVA® or similar methods to improve their corporate performance[2]. To calculate EVA®, CFOs and other corporate managers needed to understand the concept of the after-tax weighted average cost of capital (WACC). These experiences may have changed Japanese CFOs' understanding of the tax-saving effects of debt.

Recognizing this possible change in Japanese firms' debt policy decisions in the early 2000s, this empirical study analyzes the effects of the firm-specific marginal tax rates on their debt policy in Japan in the late 2000s. Another essential reason that we concentrate on the late 2000s is that the necessary data for estimating firm-specific marginal tax rates using the method of Graham (1996) have been available only since FY2000 in Japan, as we explain in more detail later. However, because Japanese firms have been seriously damaged by the financial crisis since FY2009, we exclude the periods since FY2009. Thus, we conduct the detailed cross section analysis using FY2008 data (the latest data before the serious damage of the Lehman shock on Japanese firms' performance) and conduct the panel analysis using FY2006-2008 data.

3. Literature Review

Since Modigliani and Miller (1963), the possible importance of marginal tax rate has been well known in theory. However, it seemed difficult to conduct an effective cross section analysis of a direct relationship between marginal tax rate and debt policy, as most large corporations face the same statutory tax rate. Thus, previous research such as DeAngelo and Masulis (1980) focused on the effects of non-debt tax shields (for example, depreciation) on debt policy, rather than on a direct relationship between marginal tax rate and debt policy.

However, Auerbach and Poterba (1987) and Alshuler and Auerbach (1990) point out

[2] EVA® (Economic Value Added) is the registered trademark of Stern Stewart & Co.

that due to asymmetric tax treatment of profit and loss, the (expected) marginal tax rate may not be equal to the statutory tax rate. Namely, although the statutory tax rate is applied when the taxable income of a firm is positive, no corporate tax is imposed when the taxable income is negative. Furthermore, there are "carry forward" and "carry back" of loss in the corporate tax system. The existence of loss carried forward and loss carried back also causes differences in the marginal tax rates.

Recognizing the existence of loss carried forward and loss carried back in the U.S. corporate tax system, MacKie-Mason (1990) analyzes the effects of the marginal tax rate on debt policy. That study found that when a firm has loss carried forward and investment tax credit (another tax shield), it tends to raise capital less by new debt issue. Because both existing loss carried forward and investment tax credit are substitutes for new debt issue for tax savings, this result is consistent with the tradeoff theory.

However, Shevlin (1990) adopts the Monte Carlo method using a simple linear projection of taxable income based on actual past data to simulate future taxable income. Then, using simulated taxable income series and applying detailed corporate tax law, Shevlin (1990) estimates the (expected) marginal tax rates of individual firms. Further, using Shevlin (1990)'s approach, Graham (1996) estimates the effects of marginal tax rate on U.S. firms' debt policy. He finds a positive relationship between the firm-specific marginal tax rate and the change in debt ratio. Based on a similar method, the effects of personal income tax on debt (Graham (1999)) and the importance of tax savings in firms' values (Graham (2000)) are also analyzed. In addition, there are other empirical studies using statutory tax rates or (effective) average tax rates as proxies for marginal tax rates. For example, Gordon and Lee (2001) analyze the effects of marginal tax rates on debt policy using the differential tax treatment between large corporations and small corporations in the U.S., and they find that the difference in corporate tax rates has significant effects on debt policy. However, the meta-study of the existing empirical studies by Feld et al. (2011) concludes that the simulated marginal tax rates suggested by Graham (1996) have an advantage in avoiding a significant downward bias in estimation. In countries other than the U.S., while Alworth and Arachi (2001) conduct a similar analysis using a panel of data on Italian firms and find a positive relationship between firm-specific marginal tax rates and Italian firms' debt policy, empirical studies of the relationship between the marginal tax rate and firms' debt policy remain limited. (A comprehensive survey of related literature can be found in Graham (2003) and Graham (2006).)

In Japan, several studies such as Matsuura, Takezawa and Suzuki (2000) and Nishioka and Baba (2004) have considered the determinants of Japanese firms' debt

policy[3]. While these studies recognize the possible tax-saving effects of corporate tax, they do not use the firm-specific marginal tax rate as a control variable in their regressions. One exception is Kubota and Takehara (2007), who calculate the firm-specific marginal tax rates of Japanese firms using the estimation method of Shelvin (1990) and Graham (1996). However, because the main concern of Kubota and Takehara (2007) is to consider the appropriate cost of capital with sufficient consideration to the marginal tax rate, they offer no analysis of the relationship between firm-specific marginal tax rates and Japanese firms' debt policy.

In this paper, we consider the relationship between firm-specific marginal tax rates and Japanese firms' debt policy. In the next section, we estimate the firm-specific marginal tax rate following Shevlin (1990) and Graham (1996).

4. Estimation of Marginal Tax Rates of Individual Firms

4.1 Estimation of taxable income of Japanese firms

Because the Japanese corporate tax system treats profit and loss asymmetrically and allows carryover of loss, estimating the marginal tax rates of individual firms can be very complicated. Thus, we estimate the marginal tax rates of Japanese firms by the Monte Carlo method. After simulating the future taxable income of each firm, we estimate the marginal corporate tax rates based on the simulated taxable income. Our estimation method is based on Shevlin (1990)'s estimation procedure, modified to reflect data availability and the differences between the corporate tax systems in U.S. and Japan.

As the first step of the estimation procedure, we forecast the future taxable income of individual firms. Following Shevlin (1990), we assume that firm i's taxable income at time t (denoted by $TI_{i\,t}$) follows a random walk with drift.

$$\Delta TI_{i\,t} = \mu_i + \varepsilon_{i\,t} \qquad (1)$$

where $\Delta TI_{i\,t}$: the first difference in taxable income of firm i
μ_i : drift
$\varepsilon_{i\,t}$: white noise

[3] Previous studies of the determinants of debt ratio of Japanese firms before 2000 are summarized in Table 7.3 of Tsuji (2002).

The drifts and white noises of equation (1) are estimated from taxable income series calculated from the actual financial data for individual firms during the sample period between FY2000 and FY2007[4]. The drift μ_i is set equal to the sample mean of $\Delta TI_{i\,t}$. The white noise $\varepsilon_{i\,t}$ is distributed normally with a mean of zero and a variance equal to the variance of $\Delta TI_{i\,t}$ of the sample period.

Then, we forecast firm i's taxable income during the simulation period between FY2007 and FY2021 by drawing 14 random normal realizations of $\varepsilon_{i\,t}$ and using equation (1).

4.2 Calculation of annual corporate tax bill

Using the simulated taxable income from FY2007 to FY2021, we calculate the corporate tax bill $T_{i,t}$ (including the local corporate tax bill) of firm i in the accounting year t, using the effective corporate tax rates (including local corporate tax) and the loss carry forward and loss carry back rules of Japanese corporate tax system. In the Japanese corporate tax system, carryover of loss is allowed for losses during the previous 7 years after tax law change of 2004. This rule is applied to losses incurred since April 1, 2001. (Before the tax law change of 2004, carry over was allowed only for losses during the previous 5 years.)

However, while the rule of loss carry back (only for one year) exists in Japanese corporate tax law, the rule has been suspended except for small firms. Thus, we ignore the loss carry back in our calculation of the corporate tax bill, as we use the data of listed firms, which are large corporations.

4.3 Simulating expected marginal tax rates

We calculate the present value $PV(T_i)$ of the future tax bills for FY2007 from the simulated values of the annual tax bills T_{it} from FY2007 to FY2021.

$$PV(T_i) = \sum_{t=2007}^{2021} \frac{T_{it}}{(1+R)^{t-2007}} \qquad (2)$$

[4] Most Japanese corporations' fiscal years run from April 1 to March 31 of the following year. Thus, for those corporations, FY2000 implies the fiscal year running from April 1, 1999 through March 31, 2000. Note that this usage is different from the usage of "FY2000" in Japanese, where FY2000 means the fiscal year starting in 2000.

where R is the discount rate. We use R=1.934%, the average of corporate bond interest rates (12 years) in 2006, which is reported in the Financial and Economic Monthly Statistics of the Bank of Japan[5].

Then, after adding one Japanese yen to the taxable income values used above *for every year* from FY2007 to FY2021, we recalculate the annual corporate tax bills T'_{it} from FY2007 to FY2021 using the new taxable income values. From these newly calculated annual corporate tax bills T'_{it}, we recalculate the present value $PV(T'_i)$ using equation (3) below. The discount rate R is the same as before.

$$PV(T_i') = \sum_{t=2007}^{2021} \frac{T_t'}{(1+R)^{t-2007}} \tag{3}$$

In addition, we calculate the present value $PV(\Delta Y)$ of added taxable income (one Japanese yen every year) from FY2007 to FY2021. The discount rate R is the same as before.

$$PV(\Delta Y_i) = \sum_{t=2007}^{2021} \frac{1}{(1+R)^{t-2007}} \tag{4}$$

Now, we can calculate the new marginal corporate tax rate τ_i from (2), (3) and (4).

$$\tau_i = \frac{PV(T_i') - PV(T_i)}{PV(\Delta Y_i)} \tag{5}$$

While Shelvin (1990) and Graham (1996) repeat this procedure 50 times for each firm, we repeat this simulation 10,000 times for each firm to obtain more stable results. Then, the averages of those 10,000 estimated marginal corporate tax rates of firm i are termed the "(expected) marginal corporate tax rate (MTR) of firm i." This simulation is done for all sample firms.

Note that we consider the marginal tax increase in response to one Japanese yen increase in taxable income for every year rather than one Japanese yen increase in taxable income only for the initial period of the simulation period, as in Shevlin (1990), Graham (1996) and Kubota and Takehara (2007). Because intentional debt policy is

[5] Although Shevlin (1990) and Graham (1996) use the corporate bond rates of individual firms, because not all Japanese listed firms issue long-term bonds, we use the average of corporate bond interest rates data for all firms.

lumpy rather than smoothly incremental, it is reasonable to assume that intentional debt policy is decided based on a permanent increase rather than only a one-year increase in taxable income. (However, as we show later in one of the robustness checks, we can see similar results even when we use the marginal tax rate based on an increase of one Japanese yen in taxable income.)

4.4 Data

Following Shelvin (1990), taxable income $TI_{i\,t}$ is calculated using the formula below.

$$\text{Taxable income (TI)} = \text{Pretax profit of the current term} - \frac{\text{Net tax deferred assets}}{\text{Effective statutory tax rate}} \tag{6}$$

The data on "Pretax profit of the current term" and "Net tax deferred assets" are based on Nikkei NEEDS data. In Japan, "Tax Effect Accounting," including the concept of net tax deferred assets, was first introduced in FY2000, so that we can calculate "taxable income" only since FY2000.

"Effective statutory tax rate" is defined by the next formula (7).

$$\text{Effective statutory tax rate} = \frac{\text{Corporate income tax rate} \times (1 + \text{Corporate inhabitant tax rate}) + \text{Corporate enterprise tax rate}}{1 + \text{Corporate enterprise tax rate}} \tag{7}$$

For local taxes (corporate inhabitant tax and corporate enterprise tax), we will use the "standard" statutory tax rates of the local tax rates. While the tax base of corporate enterprise tax on large corporations includes not only income but also shareholders' equity (book value) and value added, we use only the corporate enterprise tax rate on income, as we focus on the tax increase caused by a marginal corporate income increase in this analysis. The effective statutory tax rate calculated by (7) is 39.54%.

Sample firms include all listed firms on the Tokyo Stock Exchange. However, because we are interested in the effects of corporate tax on the debt policy of ordinary firms, we exclude banks from our sample. Also, because a special method of corporate enterprise taxation is applied to the electronic power and gas industry and the insurance industry, we exclude the firms in those industries. Furthermore, we exclude

the firms whose necessary data were incomplete during FY2000 through FY2007 in the Nikkei NEEDS database. Then, the number of sample firms is 1,213. All simulation of marginal tax rates was conducted using Microsoft Excel software.

4.5 Results of simulation of marginal tax rates of individual firms

The average of the estimated marginal tax rates of all firms is 31.87%, which is much lower than the effective statutory rate (39.54%). This gap is caused by asymmetrical tax treatment of profit and loss and by the loss carry forward provision in Japanese corporate tax system. While many firms have marginal tax rates equal to the effective statutory tax rate (39.54%), many other firms face a wide variety of marginal tax rates. The standard deviation of the marginal tax rates is 9.51%, implying that there is moderate variation of the marginal tax rates of all firms.

5. Determinants of Debt Policy

Using the simulated marginal tax rates of the sample firms, we analyze the determinants of firms' debt policy by OLS. The dependent variables and control variables are explained below.

5.1 Dependent variable: ΔDEBT

Previous studies such as MacKie-Mason (1990) and Graham (1996) show that it is more effective to analyze the change in debt ratio rather than the debt ratio itself to study the effects of the marginal tax rate on the debt policy of firms. Based on their findings, we also focus on the change in debt ratio. We define a dependent variable ΔDEBT as below.

$$\Delta \mathrm{DEBT} = \frac{\Delta(\text{Current Liabilities})}{\text{Current Liabilities} + \text{Shareholders' Equity} + \text{Other Comprehensive Income}} \tag{8}$$

"Current Liabilities" and "Other Comprehensive Income" are taken from the balance sheets of firms at the end of FY2008. "Shareholders' Equity" is measured by market price. In Japan, the negative effects of the sub-prime problem were limited before the

end of FY2008 (the end of March 2008 for most firms), while many firms experienced negative shocks during the period of FY2009 and after. We exclude the outliers whose values of ΔDEBT are less than μ(average of ΔDEBT)－5σ(standard deviation of ΔDEBT) or greater than μ＋5σ, implying that outliers are less than -34.435 or greater than 33.058. According to this criterion, two outliers are excluded from the samples. Without these two outliers, the number of sample firms is 1,211. The average value of ΔDEBT for all sample firms in FY2008 is －0.718%. The negative average value implies that many Japanese firms were trying to reduce their debt ratio in FY2008.

MacKie-Mason (1990) and Graham (1996) pointed out that ΔDEBT may be affected not only by intentional debt policy but also by the exogenous change in the market price of shareholders' equity. To focus on the debt ratio changes caused by intentional changes in debt policy, MacKie-Mason (1990) and Graham (1996) conduct another regression using only the firms whose ΔDEBT is smaller than －2% or larger than +2%. For convenience, we term those 772 firms with intentional debt policy "IDP firms". The average of ΔDEBT of IDP firms in FY2008 is －1.048%.

5.2 Marginal Tax Rate (MTR)

The most important explanatory variable in this study is the marginal corporate tax rates (MTR) of individual firms simulated in the previous section. Because more leveraged firms have a higher probability of loss, firms with higher debt ratios tend to have lower expected marginal tax rates. To avoid the endogeneity problem caused by this relationship, MTR in the previous period is used as an explanatory variable in the regressions in the previous studies. This choice can be justified by noting that important debt policy decisions in large corporations may take a long time before implementation. Thus, the expected MTR at the end of FY2007 is used as an explanatory variable in the regressions, while ΔDEBT is calculated at the end of FY2008. The average MTRs of all sample firms and of IDP firms in FY2007 are 31.87% and 31.06%, respectively.

Because higher MRT raises the value of tax savings, the tradeoff theory predicts that the sign of the estimated coefficient with MTR is positive.

5.3 Other Control Variables

The previous research of determinants of firms' debt policy in the U.S. and Japan found that there are various other determinants of debt policy. We also use other

variables described below as control variables in our regressions. Because the dependent variable (ΔDEBT) is the change of debt ratio, following Graham (1996), we use the changes in possible determinants as control variables, except for the variables SAFPROB, NDTS*SAFPROB, industry dummies, large shareholder ratio, foreign shareholder ratio and corporate group dummy. The data are taken from Nikkei NEEDS and "Kaisha Shikiho (Quarterly Report of Corporations)" unless other sources are mentioned.

① Bankruptcy probability index based on SAF2002 (SAFPROB)

The tradeoff theory of capital structure predicts that if the bankruptcy probability of a firm is higher, the expected cost of financial distress is higher, and the firm tends to reduce debt ratio. The previous studies in the U.S. include a bankruptcy probability index based on accounting indexes such as Altman (1968)'s Z score in the control variables of the regression analysis[6].

In this analysis, we use an index based on SAF2002 (Simple Analysis of Failure 2002), proposed by Shirota (2003, 2008) as a bankruptcy probability index of Japanese firms, as a control variable. SAF2002 is bankruptcy probability index derived from four accounting indexes based on formula (9) below. (This formula is a simplified version of the original. More detailed definitions of the accounting indexes in the formula can be found in Shirota (2003, 2008).)

$$\mathrm{SAF2002} = 1.036 \times \frac{\text{Retained earnings}}{\text{Total assets}} + 2.682 \times \frac{\text{Pretax profit if the current term}}{\text{Total assets}} - 0.06610 \times \frac{\text{Inverntories} \times 12}{\text{Sales}} - 2.368 \times \frac{\text{Interest(net)}}{\text{Sales}} + 0.70773 \quad (9)$$

A higher SAF2002 means a lower probability of bankruptcy. SAF2002 can be negative, while Altman (1968)'s Z score cannot be negative by definition.

MacKie-Mason (1990) and Graham (1996) use the inverse of Altman (1968)'s Z score as a control variable. Similarly, we use the inverse of SAF2002, but to avoid

[6] In previous studies in Japan, the standard deviation of corporate income has often been used as a proxy for the bankruptcy probability index. However, if corporate income is more volatile, because corporate income becomes negative more often, the expected MTR tends to be lower. Thus, it seems inappropriate to use the standard deviation of corporate income as a control variable in the regression when we focus on the effects of MTR on debt policy.

negative values, we use the variable defined by formula (10) below rather than a simple inverse. We call this bankruptcy probability index SAFPROB.

$$SAFPROB = \frac{1}{1 + SAF2002 - SAF2002_{\min}} \tag{10}$$

where $SAF2002_{min}$ is the minimum value of SAF2002 of all sample firms.

SAFPROB is 1 for the firm with the lowest SAF2002 (=$SAF2002_{min}$), implying its bankruptcy probability is the highest, while SAFPROB is lowest (but positive) for the firm with the highest SAF2002, implying its bankruptcy probability is lowest.

The tradeoff theory of capital structure predicts that firms with higher bankruptcy probabilities have stronger incentives to reduce debt ratio. Thus, the expected sign of the coefficient with SAFPROB is negative.

② Non-debt tax shield "(ΔNDTS) and "NDTS*SAFPROB"(NDTSSAF)

DeAngelo and Masulis (1980) point out that not only debt but also other factors ("non-debt tax shield" or "NDTS") such as depreciation have tax-saving effects. They claim that because debt and non-debt tax shields are substitutes under the constraint of a limited amount of positive taxable income, the optimal debt ratio is lower when NDTS is larger.

However, MacKie-Mason (1990) criticizes their view by pointing out that firms with more profitable projects tend to have larger amounts of both depreciation and borrowing, and therefore NDTS may have a positive rather than a negative association with debt ratio. Based on this recognition, MacKie-Mason (1990) introduces "NDTS*(bankruptcy probability index)" as another control variable in addition to NDTS. According to MacKie-Mason (1990)'s argument, the expected sign of the coefficient of NDTS*(bankruptcy probability index) is negative, while the expected sign of the coefficient of NDTS is positive.

Following Mackie-Mason (1990), we introduce both NDTS and "NDTS*SAFPROB ('NDTSSAF' in short)" as control variables in the regressions, where SAFPROB is used for the bankruptcy probability index of Japanese firms. NDTS is defined as below.

$$NDTS = \frac{Depreciation(book\_value)}{Current\_Liabilities(book\_value) + Shareholders'Equity(market\_value)}$$

(11)[7]

Following Graham (1996), we use the first differential of NDTS (ΔNDTS) as a control variable in the regression, but we use NDTSSAF without such differentiation.

③ Free Cash Flow (ΔFCF)

Jensen (1996)'s free cash flow hypothesis points out that because corporate managers tend to pursue their private benefit with ample free cash flow, a higher debt ratio may be preferred to discourage such misbehavior of managers in firms with larger free cash flow. However, the pecking order theory of financing choices claims that a larger free cash flow provides cheaper capital for investment and reduces the necessity of more costly borrowing. Based on these theories, we include the differential of free cash flow (ΔFCF) in our regressions. Free cash flow (FCF) is defined as "Net cash from operating activities minus net cash used in investing activities" on the cash flow statement of firms. The expected sign ofΔ FCF is positive based on the free cash flow hypothesis or negative based on the pecking order theory of financing choices.

④ Investment opportunities: Price-book ratio of capital (ΔPBR)

The pecking order theory argues that firms with more investment opportunities may try to reduce debt ratio to avoid losing profitable opportunities due to a lack of relatively cheaper internal capital (Myers (1977), Slutz (1990)). We use the price-book ratio of capital (PBR) as a proxy for investment opportunities, as in the previous studies. It is supported that higher PBR reflects more profitable investment opportunities. Then, from the pecking order theory, the expected sign of PBR is negative.

However, there are other interpretations of the relationship between PBR and debt policy. For example, the market timing hypothesis proposed by Baker and Wurgler (2002) points out that firms raise capital by issuing new equities when their managers observe over-evaluation of their corporate stocks in capital markets. Then, higher PBR firms prefer stocks rather than debt. However, if the bankruptcy probability of firms with high PBR is low, then the tradeoff theory predicts that higher PBR firms will tend to have higher debt ratio. Thus, while we include the differential of PBR (ΔPBR) in

[7] While not only depreciation but also investment tax credit (ITC) have often been included in NDTS in previous studies in the U.S., we include only depreciation, as investment tax credit is less important in Japanese corporate tax policy than in U.S. corporate tax policy.

the regressions, the expected sign of ΔPBR can be positive or negative according to alternative views of capital structure.

⑤ Firm size (ΔSIZE)

Previous studies have found that firm size is a significant determinant of debt policy. One view argues that because the bankruptcy probability of larger firms is lower due to their greater diversification of business, the tradeoff theory predicts that larger firms will have higher debt ratios. Another view claims that because the asymmetric information problem between mangers and investors is less serious for larger firms, the free cash flow hypothesis predicts that larger firms do not need higher debt ratios. Thus, while we include the differential of SIZE (ΔSIZE) in the regression, the expected sign of the coefficient with ΔSIZE can be positive or negative. Following Graham (1996), we use the log of sales as a proxy for firm ΔSIZE in the regression.

⑥ Advertising Expense (ΔAD) and Research and Development (ΔRD)

Because intangible assets such as advertising expense (AD) and research and development (RD) are difficult to monitor, firms with more intangible assets may have more incentive for asset substitution. Then, outside investors such as banks are reluctant to lend money to firms with more intangible assets. Also, if advertising expense and research and development work as non-debt tax savings in addition to depreciation and ITC (Bradley et al. (1984)), firms with higher advertising expense and research and development will tend to have lower debt ratios. Thus, we include both the differential of advertising expense as a percentage of sales (ΔAD) and the differential of research and development expenses as a percentage of sales (ΔRD). The expected signs of both coefficients are negative.

⑦ Fixed asset ratio (ΔFAR)

If a higher fixed asset ratio (FAR) implies a lower probability of bankruptcy, the tradeoff theory predicts that firms with higher fixed ratios will tend to have lower debt ratios. Furthermore, the view emphasizing the agency cost of debt also supports that expectation, as fixed assets can easily be used as collateral for debt. We include the differential of the fixed asset ratio (ΔFAR), which is defined as fixed assets ("property, plant and equipment" in the balance sheet) divided by total assets (book value). The

expected sign of the coefficient with ΔFAR is positive.

⑧ Return on assets (ΔROA)

The pecking order theory predicts that more profitable firms accumulating more internal funds depend less on borrowing. The return rate of assets (=Pretax profit of the current term/Total assets (book value)) is used as a proxy for the profitability of firms. The differential of ROA (ΔROA) is included as a control variable in the regressions. The expected sign of the coefficient with ΔROA is negative.

⑨ Dummy for Industries (D1~D7)

The characteristics of firms' debt policies can be different in different industries. Following Nishioka and Baba (2004), we use seven industry dummies: Construction (D1), Transportation (D2), Information and Communication (D3), Wholesale trade (D4), Retail trade (D5), Real estate (D6) and Services (D7) in the regression. (The industry of each firm is identified according to its Tokyo Stock Exchange classification.)

⑩ Large shareholder ratio (LSHARE) and Foreign shareholder ratio (FSHARE)

The existence of large shareholders improves the effectiveness of corporate governance (Shleifer and Vishny (1986)). Also, in Japan, it is believed that the existence of significant numbers of foreign shareholders improves corporate governance, as foreign shareholders are more active in monitoring the management. According to the free cash flow hypothesis, the free cash flow of firms with ineffective corporate governance should be reduced by higher debt ratios. Thus, firms with more large shareholders or more foreign shareholders will tend to have lower debt ratios. We define the share of the top 10 largest shareholders as "large shareholder ratio (LSHARE)" and the share of foreign shareholders as "foreign shareholder ratio (FSHARE). The expected signs of the coefficients for both LSHARE and FSHARE are negative.

⑪ Corporate group dummy (DGROUP)

Hirota (1999) confirms that the firms affiliated with the six largest corporate groups (Keiretsu) in Japan have higher debt ratios. Because the other members of the same

corporate groups including a main bank help a member firm in financial distress, it is recognized that the probability of bankruptcy of the member firms of the six largest corporate groups is low. This recognition of the low probability of bankruptcy explains the high debt ratio of the firms affiliated with the six largest corporate groups. Thus, we include corporate group dummy (DGROUP) as a control variable in the regressions. To identify the membership of the six corporate groups, the previous studies have often used the membership of the CEOs' meetings ("Shacho-kai") listed in the book "Kigyo Keiretsu Soran (General guide of corporate groups)". However, after the several recent mergers of main banks, even the membership of the presidents' meetings is not clear, with only a few exceptions. In this study, we mainly follow the study of the membership of the CEO meetings in 2003 by Tanaka (2003). If a firm's CEO is considered to be a member of the CEO meetings of the former six largest corporate groups, the corporate group dummy (DGROUP) is one. If not, it is zero. According to Hirota (1999), the expected sign of this coefficient is positive.

Descriptive statistics of these variables are shown in Table 1. Eviews software is used for the regressions. Because we find heteroskedasticity by White's general test, we show White heteroskedasticity consistent estimators in all of the results below.

6. Estimation Results

6.1 Results of the regression using all sample firms

The result of the regression using all sample firms (except outliers) is shown in the center column of Table 2.

The estimated coefficient of the marginal tax rate (MTR) is 0.066, and it is statistically significant at the 1% level. This result supports the tradeoff theory of capital structure, predicting that firms with higher marginal tax rates will increase their debt ratio more rapidly, as the tax-saving effect of debt increases with increasing marginal tax rate.

The coefficient of the bankruptcy probability index (SAFPROB) is negative (－5.977). This result is consistent with the tradeoff theory. However, this coefficient is not statistically significant.

The coefficient of non-debt tax shield (ΔNDTS) is positive, while the coefficient of "NDTSSAF" is negative. This result is consistent with MacKie-Mason (1990)'s

finding, although only the coefficient of ΔNDTS is statistically significant at the 5% level.

The coefficient of free cash flow (ΔFCF) is negative and is statistically significant at the 5% level. It is consistent with the pecking order theory of financing choices. The coefficient of price-book ratio (ΔPBR) is positive but statistically insignificant. The coefficients of advertising expense (ΔAD), research and development expense (ΔRD) and fixed asset ratio (ΔFAR) are negative, positive and positive respectively, but only the coefficient of ΔRD is statistically significant at the 1% level. The positive coefficient of ΔRD is not expected based on the discussion in the previous section. The coefficient of return on asset (ΔROA) is negative and is statistically significant. This result is consistent with the pecking order theory.

Statistically significant industry dummies are construction (D1) (at the 1% level), transportation (D2) (at the 5% level), information and communication (D3) (at the 5% level), retail trade (D5) (at the 5% level) and real estate (D6) (at the 1% level). The signs of these coefficients are positive except for D1.

The signs of the coefficients of both large shareholder ratio (LSHARE) and foreign shareholder ratio (FSHARE) are positive. The former is statistically significant at the 10% level and the latter at the 5% level. This result contradicts the view that firms with more effective governance through the existence of large shareholders or foreign shareholders have lower debt ratios.

The coefficient of corporate group dummy (DGROUP) is negative but statistically insignificant. The recent transformation of corporate groups, such as mergers of the largest banks, may weaken the functions corporate groups traditionally perform.

Adjusted R^2 is 0.203 for the regression using all sample firms.

6.2 Results of the regression using only IDP firms

The results of the regression using only IDP firms are shown in the right column of Table 2. The coefficient of MTR is 0.088 (statistically significant at the 1% level), which is larger than in the regression using all sample firms. Because IDP firms are the firms that seem to have intentional debt policies, this result supports the claim that the marginal tax rate affects intentional debt policy.

The sign of the coefficient of SAFPROB is negative, which is consistent with the tradeoff theory, but the coefficient is not statistically significant. The coefficient of ΔNDTS is positive, and the coefficient of NDTSSAF is negative, both of which are consistent with MacKie-Mason (1990)'s argument.

The signs of the estimated coefficients of the other control variables, except for ΔAD, are the same as in the regression using all sample firms. The coefficients of two of the industrial dummies, (D2 (transportation) and D3 (information and communication), large shareholder ratio (LSHARE) and foreign shareholder ratio (FSHARE) are statically insignificant, whereas they are statistically significant in the regression using all sample firms. However, the statistical significance of the coefficient of D5 (retail trade) increases to the 5% level. The adjusted R^2 of the regression using only IDP firms is 0.254, which is a little larger than that of the regression using all sample firms.

6.3 Importance of the effects of marginal tax rates on debt policies of Japanese firms

From the regressions above, it is shown that the marginal tax rate affects the debt policy of Japanese firms. This result is consistent with previous research, such as Graham (1996) and Alworth and Arachi (2001), which found significant effects of the marginal tax rates on the debt policies of firms in the U.S. and Italy. It is interesting that the magnitudes of the estimated coefficients for the marginal tax rates (0.066 in the regression using all firms and 0.088 in the regression using only IDP firms) are similar to those of U.S. firms (0.069 for all samples in Table 2 of Graham (1996)) and Italian firms (0.082 in Table 7 of Alworth and Arachi (2001)).

To address the importance of the effects of marginal tax rates, we consider the effects of a hypothetical reduction of the marginal tax rate from 31.06% (average for IDP firms) to 21.06%. Then, the regression result for IDP firms predicts that the increase of debt ratio will decrease by 0.88%. This effect is not trivial, as the average of the change in debt ratio for IDP firms is －1.048% in FY2008.

Many of the other estimated coefficients are consistent with the tradeoff theory, but the rest are consistent with the pecking order theory.

7. Robustness Checks

We consider several robustness checks of the main estimation result that the marginal tax rate affects the debt policy of Japanese firms. Because our main concern is the effects of the marginal tax rate on debt policy, we report mainly the results related to tax-related variables.

First, while the debt ratio change *in market value* that we used in the previous

section is an appropriate dependent variable from the perspective of economic theory, it may reflect not only intentional debt policy but also exogenous equity price shocks in stock markets. To eliminate the effects of unintentional changes in debt ratio, we use the debt ratio change *in book value* rather than market value as a dependent variable in the new regression. Namely, in the definition of the dependent variables (equation (8)), shareholders' equity is measured by book value. We call the debt ratio change measured in book value "ΔDEBT(Book)". Other variables remain the same as before. The estimation results of the regressions with ΔDEBT(Book) using all sample firms and using only IDP firms are shown in Table 3.

The coefficients for marginal tax rate (MTR) are 0.069 in the regression using all sample firms and 0.091 in the regression using only IDP firms. Both of them are statistically significant at the 1% level. Thus, even when the debt ratio change in book value is used as a dependent variable, it is shown that the marginal tax rate affects the debt policy of Japanese firms.

Second, Graham (1996) points out that not only the marginal tax rate but also the variance of the marginal tax rate matters for the debt policy of U.S. firms. To check this possibility, we add the standard deviation of the marginal tax rates (MTRDEV) to the regressions using all sample firms and using only IDP firms. Namely, when we estimate the expected marginal tax rates for each firm, we simulate the marginal tax rates 10,000 times based on the procedure explained in subsection 3-(2). The standard deviation of these 10,000 simulated values of marginal tax rates for each firm is used as a control variable, MTRDEV, in the regressions.

The results of the regressions including MTRDEV are shown in Table 4. The coefficients of MTRDEV in the regressions using all sample firms and using only IDP firms are statistically insignificant. Thus, for Japanese firms, the variance of the marginal tax rates seems to have no significant effects on the debt policy of Japanese firms. In these regressions, while the statistical significance is lower than before, the coefficients of the marginal tax rates (MTR) are positive. Even in the regressions using the standard deviation of the marginal tax rates as a control variable, we confirm that the marginal tax rate itself affects debt policy.

Thirdly, in estimating the marginal tax rate, we calculate the marginal increase of the present value of the tax bill caused by an increase of one Japanese yen in taxable income *for every year*. However, Shevlin (1990) and Graham (1996) consider the marginal increase of the present value of the tax bill caused by an increase of one in taxable income only for the initial year of the simulation period. Following their approach, we consider the marginal increase of the present value of the tax bill caused

by an increase of one Japanese yen in taxable income *only for the initial year* of the simulation period and calculate the marginal tax rate. Using the newly estimated marginal tax rate ("MTR (one period)" in short), we obtain regressions with all the other control variables remaining the same. The regression results are shown in Table 5. The estimated coefficients for MTR (one period) are positive and statistically significant, so that the change of this assumption does not change the conclusion that the marginal tax rate affects the debt policy of Japanese firms.

Finally, we implicitly assume that the magnitudes of the marginal effects of the marginal tax rates on the debt policy of firms are the same for all firms. However, it is possible that firms with more effective corporate governance or more CFOs having better knowledge of modern corporate finance theory may have a stronger response of debt policy to marginal tax rates[8]. To explore such possibilities, we add three cross terms, MTR*ΔSIZE, MTR*LSHARE and MTR*FSHARE, to the regressions simultaneously. MTR*ΔSIZE is added because larger firms are considered to have more CFOs with greater knowledge of modern corporate finance in Japan. MTR*LSHARE is added because firms with more large shareholders are considered to have more effective corporate governance. MTR*FSHARE is added because firms with more foreign shareholders are considered to have more effective corporate governance in Japan. The estimation results of the regression with MTR*ΔSIZE, MTR*LSHARE and MTR*FSHARE in addition to the control variables in the previous regression are shown in Table 6. While both of them are statistically insignificant, the signs of the estimated coefficients for MTR*ΔSIZE and MTR*FSHARE in the regressions using all samples and using only IDP firms are positive. These results are consistent with the claim that the marginal tax rates affect debt policy more in the case of firms with more CFOs with better knowledge of modern corporate finance theory. However, the coefficients for MTR*LSHARE are negative and are statically insignificant. Because all of the coefficients of the three cross terms are statistically insignificant, it is difficult to confirm that the marginal tax rates affect debt policy more in the case of firms with more effective corporate governance.

8. Further Estimation with Panel Data

[8] This possibility is pointed out by Professor Shinichi Hirota of Waseda University. We greatly appreciate his suggestions.

8.1 Estimation of Marginal Tax Rate (MTR)

So far, we have concentrated on the cross section regression with debt ratio change in FY2008. However, because we cannot deny that the debt policy of Japanese firms may reflect some events specific to FY2008, it is desirable to have an estimation with cross section and panel analysis using data not only from FY2008 but also from the fiscal years before FY2008. Unfortunately, there is one disadvantage a regression using multiple fiscal years' data. In the regression in the previous sections, we use the data of eight fiscal years from FY2000 to FY2007 to estimate taxable income series by equation (1) and to estimate the marginal tax rate for FY2007. However, because the concept of "net tax deferred assets" was first introduced to the Japanese accounting standard in FY2000, we can calculate taxable income by this method only since FY2000. Thus, to estimate the marginal tax rates in the fiscal years before FY2008, we need to estimate taxable income series using the data from shorter periods. This reduction may weaken the accuracy of the estimation of taxable income series and of the marginal tax rates.

Despite this possible disadvantage, we estimate the (expected) marginal tax rates at the ends of FY2005 and FY2006 using data for six years instead of eight years. Furthermore, to have a panel with consistent data, we also estimate the marginal tax rate at the end of FY2007 using the data for only six years.

To estimate the (expected) marginal tax rate at the end of FY2005, we assume that firm i's taxable income follows a random walk with drift defined by equation (11) (which is the same as equation (1).)

$$\triangle \quad TI_{i\,t} = \mu_i + \varepsilon_i\, t \qquad (11)$$

The drift and white noise of this equation are estimated from taxable income calculated from the actual financial data of individual firms during sample periods between FY2000 and FY2005. Using equation (11) with the estimated drift and white noise, we forecast firm i's taxable income during the simulation period between FY2005 and FY2019. Then, following the same procedure explained in Section 3, we estimate the (expected) marginal tax rate at the end of FY2005.

To estimate the (expected) marginal tax rate at the end of FY2006, we also assume that firm i's taxable income follows a random walk with drift defined by equation (11). The drift and white noise of this equation are estimated from taxable income calculated from the actual financial data of individual firms during sample periods between

FY2001 and FY2006. Using equation (11) with the estimated drift and white noise, we forecast firm i's taxable income during the simulation period between FY2006 and FY2020.

Furthermore, as explained above, to obtain a consistent panel of data, we also re-estimate the (expected) marginal tax rate at the end of FY2007 with the data for only 6 fiscal years, namely, from FY2002 to FY2007. Except for this change, the estimation procedure is the same as before.

8.2 Cross Section Regressions for FY2006, FY2007 and FY2008

Using the marginal tax rates derived above, we have cross section regressions regarding the debt policy of Japanese firms in FY2006, FY2007 and FY2008.

For the regression for FY2006, we use the same dependent variable (ΔDEBT defined by equation (8)) and control variables as in the regression explained in Section 4. The values of these variables are taken from the values of FY2006, except for MTR. The marginal tax rate at the end of FY2005, estimated above, is used for MTR. The sample firms with larger ΔDEBT than "μ(average of ΔDEBT)+5σ(standard deviation of ΔDEBT)" or smaller ΔDEBT than "μ－5σ" are excluded as outliers.

The regression for FY2007 also uses the same dependent and control variables in FY2007, except for MTR (which is the marginal tax rate at the end of FY2006 estimated above.) Other procedures are the same as in the regression regarding debt policy in FY2006. Also, we have the regression for FY2008, but with the marginal tax rate (MTR) estimated using the data only from FY2002 to FY2007, as explained above. The basic statistics of the dependent and control variables in FY2006 and FY2007 are shown in Table 7. The basic statistics of the dependent and control variables in FY2008 and the panel data (from FY2006-2008) are shown in the left column of Table 8.

The cross section regression results for FY2006, FY2007 and FY2008 are shown in Table 9. Because both the regressions using all sample firms (except outliers) and using only IDP firms have similar results, we only report the regression results using all sample firms (excluding the outliers) in the cross section regression, the pooled cross section and the panel data analysis.[9]

In all estimation results for FY2006, FY2007 and FY2008, the coefficients of MTR are statistically significant at the 1% level. This stable positive relation between the

[9] The cross section regression results using only IDP firms for FY2006, FY2007 and FY2008, reported in Kunieda (2010), are similar to the regression results using all sample firms.

marginal tax rate and the debt policy of Japanese firms is different from the relatively unstable relation between the marginal tax rate and the debt policy of U.S. firms in different years shown in Graham (1996).

Although some of them are statistically insignificant, the coefficients for the bankruptcy probability index SAFPROB are all negative, which is consistent with the tradeoff theory.

The signs of the coefficients for non-debt tax shield (ΔNDTS) and NDTS*SAFPROB (NDTSSAF) are mixed. While the signs in the regression for FY2008 are consistent with the findings of MacKie-Mason (1990), those in the regressions for FY2006 and FY2007 are not.

For all three years, the signs on free cash flow (ΔFCF), firm size (ΔSIZE) and return on asset (ΔROA) are negative, positive and negative respectively. The coefficients for those variables are statistically significant. The signs of the coefficients of price book ratio (ΔPBR) and fixed asset ratio (ΔFAR) are mixed. Among the coefficients for industry dummies, only those of D2 (Transportation) and D6 (Real estate) are statistically significant for all three years. The coefficients for corporate governance (FSHARE, LSHARE and DGROUP) are statistically insignificant except in FY2008.

Thus, these results clearly support that the marginal tax rates affect the debt policies of Japanese firms.

8.3 Panel Data Analysis

We conduct the pooled cross section regression using all three years' samples (except for the outliers explained in the previous section.) The basic statistics of the panel data are shown in the right column of Table 8. The results of the pooled cross section are shown in the left column of Table 10.

The coefficient of MTR is 0.099, and it is statistically significant at the 1% level. Again, it is confirmed that the marginal tax rate affects the debt policy of Japanese firms. The coefficient of SAFROB is negative, which is consistent with the tradeoff theory, although it is statistically insignificant. The signs of the coefficients of ΔNDTS and NDTSSAF are both positive, but only the coefficient of NDTSSAF is statistically significant. These signs are not consistent with MacKie-Mason (1990)'s argument.

The signs of the coefficients for ΔFCF, ΔPBR, ΔSIZE, ΔFAR and ΔROA are negative, negative, positive, negative and negative respectively. The coefficients for these variables are all statistically significant at the 1% level. Among the coefficients for

industry dummies, D1 (construction), D2 (transportation), D4 (whole sales) and D6 (real estate) are statically significant. All the control variables related to corporate governance (LSHRA, FSHARE, and DGROUP) are statistically insignificant. The adjusted R^2 is 0.277. Thus, the pooled cross section regression also confirms that the marginal tax rate affects the debt policy of Japanese firms.

Adding year-specific dummies for FY2006, FY2007 and FY2008, we also conduct the regression using the panel data with all sample firms except the outliers in those three years. The results of the regressions using the panel data with year-specific dummies are shown in the right column of Table 10. The coefficient of MTR is 0.113 and is statistically significant at the 1% level. With year-specific dummies, the estimated coefficient of MTR is a little larger than the estimated coefficient in the pooled cross section regression. Again, it is confirmed that the marginal tax rate affects the debt policy of Japanese firms. The coefficient of SAFPROB is negative but statistically insignificant. Both of the coefficients of NDTS and NDTSSAF are positive, but only the coefficient of NDTSSAF is statistically significant. The coefficients of the remaining control variables are similar to those in the pooled cross section regression, with a few exceptions. The adjusted R is 0.294.

Thus, the regression using the panel data with year dummies supports that the marginal tax rate affects the debt policy of Japanese firms.

Also, we conduct the regression using the same panel data with both year-specific dummies and firm-specific dummies. Industry dummies and the DGROUP dummy are excluded from the control variables because they are redundant when the control variables include all firm-specific dummies. The results are shown in the left column of Table 11. The coefficient of MTR is still positive, but its magnitude is much smaller than in the previous regressions. Also, it is statistically insignificant. The other variables, such as NDTSSAF, Δ FCF, ΔPBR, ΔSIZE, ΔFAR and ΔROA, continue to be statistically significant.

Instead of a fixed-effect model, we also conduct a random-effect model regression. The result is shown in the right column of Table 11.

The estimated coefficient of MTR is 0.080, and it is statistically significant at the 1% level. The coefficient of SAFPROB is negative, but it is statistically insignificant. Both of the coefficients of NDTS and NDTSSAF are positive, but only the coefficient of NDTSSAF is statistically significant. The other variables, such as Δ FCF, ΔPBR, ΔSIZE, ΔFAR and ΔROA, continue to be statistically significant at the 1% level.

To determine whether the random-effect model or the fixed-effect model is more appropriate, the Hausman specification test is frequently used. However, because we

find heteroskedasticity in the random-effect model regression, one of the required assumptions for the Hausman specification test does not hold. Instead of the Hausman specification test, we apply the test proposed by Arellano (1993), which is robust to heteroskedasticity. By Arellano (1993)'s test, we cannot reject the null hypothesis that fixed effects do not exist at the 5% significance level. Thus, we cannot reject the estimation result of the random-effect regression showing that the marginal tax rate has significant effects on Japanese corporations' debt policy.

In conclusion, we can claim that the marginal tax rate affects the debt policy of Japanese firms in our panel data (from FY2006 to FY2008) analysis.

9. Concluding Remarks

In the first empirical study of the relationship between firm-specific marginal tax rates and the debt ratio changes of individual firms in Japan, we have found a positive relationship between them in most cases. This result is consistent with the claim that marginal tax rates significantly affect the debt policies of Japanese firms. It is also consistent with previous findings by the empirical studies of the debt policies of U. S. firms (Graham (1996)) and Italian firms (Alworth and Arachi (2001))

From the point of view of tax policy, this result proves that asymmetric treatment of equity and debt in the current Japanese corporate tax system distorts the debt policies of Japanese firms. Thus, it is desirable to have corporate tax reform in the direction toward equal tax treatment of debt and equity in Japan.

Because the effects of marginal tax rate on debt policy are so crucial not only for understanding the capital structure of firms but also for evaluating various corporate tax system reform proposals, further study of the effects of tax policy on the debt policy of Japanese firms is strongly desirable. We hope that this empirical study contributes to deeper understanding of the determinants of the debt policies of Japanese firms.

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REFERENCES

Akaishi, M., T. Baba, I. Muramatsu, 1998. Kouzou henkakuki ni okeru wagakuni kigyou no zaimu kodo (Financial policy of Japanese firms in the era of structural change), in: Mori, S., Akaishi, M. (Eds.), Kouzou Kaikaku ki no Kigyo Zaimu (Financial Policy in the Era of Structural Change), Chikura Shobo, Tokyo. pp. 3-81. (in Japanese)

Altman, E. I., 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. J. Finance. 23(4), 589-609.

Altshuler, R., Auerbach, A. J., 1990. The significance of tax law asymmetries: an empirical investigation, Q. J. Econ. 105(1), 61-86.

Alworth, J., Arachi,G., 2001. The effects of taxes on corporate financing decisions: evidence from a panel of Italian firms. Int. Tax and Public Finance. 8, 353-376.

Auerbach, A. J., Poterba, J. M., 1987. Tax-loss carryforwards and corporate tax incentives. In: Feldstein, M. (Eds.), The Effects of Taxation on Capital Accumulation. University of Chicago Press, Chicago, pp. 305-338.

Baker, M., Wurgler, J., 2002. Market timing and capital structure. J. Finance. 57(1), 1-32.

Bradley, M., Jarrell, G., Kim, E. H., 1984. On the existence of an optimal capital structure: theory and evidence. J. Finance. 39(3), 857-878.

DeAngelo, H., Masulis, R. W., 1980. Optimal capital structure under corporate and personal taxation. J. Financ. Econ. 8(1), 3-29.

Gordon, R. H., Lee, Y., 2001. Do taxes affect corporate debt policy? Evidence from U.S. corporate tax return data. J. Public Econ. 82, 195-224.

Graham, J. R., 1996. Debt and the marginal tax rate. J. Financ. Econ. 41(1), 41-74.

Graham, J. R., 1999. Do personal taxes affect corporate financing decisions? J. Public

Econ. 73(2), 147-185.
Graham, J. R., 2000. How big are the tax benefits of debt? J. Finance. 55(5), 1901-1941.
Graham, J. R., 2003. Taxes and corporate finance: a review. Rev. Financ. Stud. 16(4), 1075-1129.
Graham, J. R., 2006. A review of taxes and corporate finance. Foundations and Trends in Finance. 1(7), 573-691.
Graham, J.R., Harvey, C. R., 2001. The theory and practice of corporate finance: Evidence from the field. J. Financ. Econ. 60, 187-243.
Feld L. P., Heckemeyer, J. H., Overesch, M., 2011., Capital structure choice and company taxation: a meta-study. CESifo working paper series, No. 3400, Munich
Hirota, S., 1999. Are corporate financing decisions different in Japan? An empirical study on capital structure. J. Jpn. Int. Econ. 13(3), 201-229.
Hotei, M., Kunieda, S., 2008. Nihon kigyo no haitou seisaku to zeisei (Japanese firms' dividend policy and tax policy). Zaisei Kenkyu (Fiscal Studies). 4, Yuhikaku, Tokyo, pp. 165-183. (in Japanese)
Jensen, M.C., 1986. Agency costs of free cash flow, corporate finance, and takeovers. Am. Econ. Rev. 76(2), 323-329.
Kubota, K., Takehara, H., 2007. Effects of tax rate changes on the cost of capital: the case of Japanese firms. FinanzArchiv. 63(2), 163-185.
Kunieda. S., 2010. Nihon kigyo no fusai seisaku to zeisei: paneru anarisisu (Japanese firms' debt policy and tax policy). Discussion paper, Financial and Training Center of Financial Supervisory Agency of Japan. (in Japanese)
MacKie-Mason, J. K., 1990. Do taxes affect corporate financing decisions? J. Finance. 45(5), 1471-1493.
Matsuura, K., Takezawa, Y., Suzuki, M., 2000. 90 Nendai ni okeru jyojyo kigyo no zoushi kodo: paneru anarisisu (Equity financing behaviors of listed firms in 1990s: a panel analysis). Shoken Keizai Kenkyu, 27, 79-93. (in Japanese)
Modigliani, F., Miller, M. H., 1963. Corporate taxes and the cost of capital: a correction (in communications). Am. Econ. Rev. 53(3), 433-443.
Myers, S. C., 1977. Determinants of corporate borrowing. J. Financ. Econ. 5(2), 147–175.
Nishioka, S., Baba, N., 2004. Dynamic capital structure of Japanese firms: How far has the reduction of excess leverage progressed in Japan? Bank of Japan working paper series No. 04-E-16, Bank of Japan
Shevlin, T., 1990. Estimating corporate marginal tax rates with asymmetric tax treatment of gains and losses. J. Am. Tax. Assoc. 12, 51-67.

Shleifer, A., Vishny, R. W., 1986. Large shareholders and corporate control. J. Polit. Econ. 94(35), 461-488.

Shirota, K., 2003. Kigyo Tosan Yochi Moderu (Model for Predicting Corporate Bankruptcy). Chuo Keizaisha, Tokyo. (in Japanese)

Shirota, K., 2008. Tosan Yochi Moderu ni yoru Kakuduke no Jitsumu (Practice of Credit Rating based on Model for Predicting Bankruptcy). Chuo Keizaisha, Tokyo. (in Japanese)

Slutz, R. M., 1990. Managerial discretion and optimal financing policies. J. Financ. Econ. 26(1), 3-27.

Tanaka, A., 2003. Rokudai kigyo shudan no mu-kinou ka-kigyo kan nettowaku no oganaijingu (Ineffectiveness of six largest corporate groups: organizing corporate network).” Discussion paper No. 372, Department of Economics, University of Nagoya City.

Tsuji, Y., 2002. Kigyo Kinyu no Keizai Riron (Economic theory of corporate finance). Soseisha, Tokyo. (in Japanese)

Table 1. Basic Statistics

Samples	All Sample Firms		Only IDP Firms	
	Average	Standard Deviation	Average	Standard Deviation
Dependent Variable				
△DEBT	−0.718	6.109	−1.048	7.591
Control Variables				
Marginal tax rate (MTR)	31.868	9.507	31.057	9.881
Bankruptcy probability index (SAFPROB)	0.386	0.061	0.395	0.061
Non-debt tax shield (△NDTS)	0.003	0.005	0.003	0.006
NDTS*SAFPROB (NDTSSAF)	0.011	0.008	0.011	0.008
Free cash flow (△FCF) (in billion JPY)	2.611	78.690	−2.313	70.209
Price-book ratio of capital (△PBR)	1.712	1.145	1.849	1.230
Firm size (△SIZE)	0.021	0.046	0.199	0.049
Advertising expense (△AD)	0.009	0.780	−0.012	0.541
Research and Development (△RD)	0.079	0.941	0.088	1.014
Fixed asset ratio (△FAR)	0.294	0.166	0.291	0.168
Return on asset (△ROA)	0.059	0.058	0.050	0.056
D1 (construction)	0.071	0.257	0.089	0.285
D2 (transportation)	0.036	0.185	0.032	0.177
D3 (information and communication)	0.061	0.240	0.051	0.219
D4 (wholesale trade)	0.091	0.287	0.098	0.298
D5 (retail trade)	0.068	0.251	0.070	0.255
D6 (real estate)	0.027	0.163	0.038	0.190
D7 (service)	0.046	0.210	0.040	0.196
Large shareholder ratio (LSHARE)	47.339	14.178	46.922	14.090
Foreign shareholder (FSHARE)	14.428	11.956	13.463	11.394
Corporate group dummy (DGROUP)	0.092	0.290	0.097	0.296
Number of observations	1211		772	

Table 2. Regressions Using All Sample Firms and Only IDP Firms

Dependant Variable	△DEBT	
Samples	All Sample Firms	Only IDP Firms
Control Variables		
C	−2.740 (−0.99)	−4.362 (−1.04)
MTR	0.066 (−2.96) ***	0.088 (2.89) ***
SAFPROB	−5.977 (−1.05)	−6.110 (−0.73)
△NDTS	99.372 (2.14) **	134.613 (2.02) **
NDTSSAF	−33.766 (−1.01)	−71.558 (−1.58)
△FCF	−0.008 (−3.26) ***	−0.015 (−4.81) ***
△PBR	0.229 (0.84)	0.455 (1.31)
△SIZE	39.118 (5.76) ***	47.651 (5.70) ***
△AD	−0.250 (−1.04)	0.214 (0.38)
△RD	0.572 (3.01) ***	0.586 (2.52) **
△FAR	0.699 (0.46)	2.034 (0.96)
△ROA	−19.701 (−3.16) ***	−25.165 (−2.94) ***
D1	−2.899 (−3.51) ***	−3.286 (−3.16) ***
D2	1.573 (1.99) **	1.683 (1.48)
D3	1.145 (1.99) **	0.881 (0.86)
D4	−0.139 (−0.20)	−0.109 (−0.11)
D5	1.279 (1.89) *	2.057 (2.04) **
D6	6.631 (3.47) ***	6.937 (3.03) ***
D7	0.907 (0.98)	0.890 (0.57)
LSHARE	0.031 (1.71) *	0.030 (1.00)
FSHARE	0.029 (1.97) **	0.033 (1.45)
DGROUP	−0.186 (−0.37)	−0.318 (−0.43)
Adjusted R^2	0.203	0.254
Number of obs.	1211	772
Mean (△DEBT)	−0.718	−1.048

Table 3. Regressions with ΔDEBT(Book)

Observations	All sample firms	Only IDP firms
Control Variables		
C	−3.746 (−1.118)	−5.714 (−1.271)
MTR	0.069 (2.607) ***	0.091 (2.671) ***
SAFPROB	−6.579 (−0.978)	−6.210 (−0.697)
△NDTS	105.376 (2.628) ***	128.625 (2.517) **
NDTSSAF	−39.790 (−1.038)	−81.767 (−1.661) *
△FCF	−0.018 (−3.346) ***	−0.028 (−8.247) ***
△PBR	0.332 (1.098)	0.590 (1.650) *
△SIZE	53.057 (6.269) ***	61.554 (6.355) ***
△AD	−0.330 (−0.915)	0.192 (0.306)
△RD	1.316 (2.697) ***	1.273 (2.600) ***
△FAR	1.708 (0.835)	2.578 (0.982)
△ROA	−23.052(−2.890) ***	−24.482 (−2.448) **
D1	−2.499 (−2.745) **	−3.090 (−2.728) ***
D2	2.055 (1.953)	2.209 (1.685) *
D3	2.238 (2.572) **	2.218 (1.816) *
D4	0.349 (0.452)	0.362 (0.342)
D5	1.960 (2.071) **	2.7606 (2.274) **
D6	8.586 (3.133) ***	8.714 (2.779) ***
D7	1.845 (1.605)	2.582 (1.678) *
LSHARE	0.029 (1.573)	0.033 (1.308)
FSHARE	0.056 (2.210) **	0.067 (1.878) **
DGROUP	−0.109 (−0.144)	0.149 (0.154)
Adjusted R^2	0.243	0.296
Number of obs.	1211	874
Mean (△DEBT (Book))	−0.538	−0.702

Table 4. Regressions with MTRDEV as a Control Variable

Samples	All sample firms	Only IDP firms
Control Variables		
C	−1.635 (−0.56)	−3.017 (−0.66)
MTR	0.051 (1.96) *	0.072 (2.03) **
MTRDEV	−0.052 (−1.26)	−0.057 (−0.97)
SAFPROB	−6.217 (−1.09)	−6.637 (−0.79)
△NDTS	98.356 (2.12) **	133.275 (1.99) **
NDTSSAF	−30.810 (−0.92)	−68.104 (−1.50)
△FCF	−0.008 (−3.18) ***	−0.015 (−4.76) ***
△PBR	0.216 (0.79)	0.438 (1.27)
△SIZE	38.792 (5.68) ***	47.269 (5.61) ***
△AD	−0.233 (−0.97)	0.207 (0.36)
△RD	0.568 (3.04) ***	0.579 (2.54) **
△FAR	0.605 (0.39)	1.957 (0.91)
△ROA	−20.669 (−3.36) ***	−26.329 (−3.12) ***
D1	−2.893 (−3.51) ***	−3.309 (−3.19) ***
D2	1.610 (2.01) **	1.691 (1.48)
D3	1.183 (2.05) **	0.889 (0.87)
D4	−0.154 (−0.22)	−0.132(−0.13)
D5	1.223 (1.81)	1.962 (1.95) *
D6	6.646 (3.47) ***	6.994 (3.04) ***
D7	0.884 (0.96)	0.811 (0.52)
LSHARE	0.028 (1.56)	0.028 (0.89)
FSHARE	0.029 (1.95) *	0.033 (1.43)
DGROUP	−0.182 (−0.36)	−0.312 (−0.43)
Adjusted R^2	0.204	0.254
Number of obs.	1211	772

Table 5. Regression with MTR (1 year)

Samples	All sample firms	Only IDP firms
Control Variables		
C	−5.879 (−2.007)	−8.304 (−1.942)
MTR (1 year)	0.104 (4.422) ***	0.132 (4.437) ***
SAFPROB	−2.563 (−0.442)	−1.206 (−0.144)
△NDTS	102.314 (2.277) **	135.078 (2.114) **
NDTSSAF	−44.796 (−1.348)	−85.394 (−1.909) *
△FCF	−0.008 (−3.363) ***	−0.015 (−5.000) ***
△PBR	0.225 (0.827)	0.436 (1.258)
△SIZE	39.513 (5.815) ***	48.588 (5.837) ***
△AD	−0.272 (−1.131)	0.209 (0.373)
△RD	0.586 (3.053) ***	0.600 (2.549) **
△FAR	0.960 (0.648)	2.195 (1.058)
△ROA	−18.130 (−2.965) ***	−23.288 (−2.756) ***
D1	−2.858 (−3.511) ***	−3.275 (−3.223) ***
D2	1.333 (1.702) *	1.581 (1.401)
D3	1.069 (1.858) *	0.833 (0.812)
D4	−0.175 (−0.250)	−0.197 (−0.193)
D5	1.280 (1.869) *	2.069 (2.023) **
D6	6.148 (3.288) ***	6.329 (2.832) ***
D7	0.971 (1.053)	1.048 (0.673)
FSHARE	0.031 (2.126) **	0.030 (1.014)
LSHARE	0.032 (1.784) *	−0.234 (−0.316)
DGROUP	−0.136 (−0.271)	0.035 (1.548)
Adjusted R^2	0.213	0.266
Number of obs.	1211	772

Table 6. Regression with Cross Terms MTR*ΔSIZE, MTR*LSHARE and MTR*FSHARE

Observations	All sample firms	Only IDP firms
Control Variables		
C	−4.711 (−1.236)	−7.384 (−1.340)
MTR	0.134 (1.934) *	0.185 (1.911) *
MTR*△SIZE	0.840 (1.443)	1.114 (1.517)
MTR*LSHARE	−0.002 (−1.475)	−0.003 (−1.338)
MTR*FSHARE	0.002 (0.928)	0.001 (0.397)
SAFPROB	−6.235 (−1.097)	−5.652 (−0.677)
△NDTS	102.582 (2.186) **	137.471 (2.053) **
NDTSSAF	−31.604 (−0.940)	−67.606 (−1.487)
△FCF	−0.008 (−3.286) ***	−0.015 (−4.657) ***
△PBR	0.238 (0.873)	0.450 (1.292)
△SIZE	13.850 (0.700)	14.149 (0.569)
△AD	−0.276 (−1.192)	0.167 (0.298)
△RD	0.531 (2.712) ***	0.538 (2.156) **
△FAR	0.600 (0.387)	1.865 (0.859)
△ROA	−20.390 (−3.218) ***	−25.558 (−2.955) ***
D1	−2.975 (−3.620) ***	−3.378 (−3.256) ***
D2	1.509 (1.884) *	1.511 (1.318)
D3	1.248 (2.171) **	0.988 (0.971)
D4	−0.117 (−0.166)	−0.091 (0.088)
D5	1.242 (1.839) *	1.999 (1.988) **
D6	6.775 (3.547) ***	7.119 (3.094) ***
D7	0.903 (0.960)	0.777 (0.487)
LSHARE	0.092 (1.867) *	0.108 (1.647) *
FSHARE	−0.026 (−0.400)	−0.006 (−0.068)
DGROUP	−0.294 (−0.604)	−0.430 (−0.611)
Adjusted R^2	0.208	0.258
Number of obs.	1213	772

Table 7. Basic Statistics of FY2006, and 2007 Cross Section Data Using All Sample Firms

Period	FY2006		FY2007	
	Average	Standard Deviation	Average	Standard Deviation
Dependent Variable				
△DEBT	2.010	6.939	3.902	10.013
Control Variables				
Marginal tax rate (MTR)	30.942	9.079	30.437	10.204
Bankruptcy probability index (SAFPROB)	0.320	0.041	0.426	0.066
Non-debt tax shield (△NDTS)	0.001	0.0051	0.002	0.008
NDTS*SAFPROB (NDISSAF)	0.009	0.007	0.010	0.008
Free cash flow (△FCF) (in billion JPY)	5.996	65.507	1.413	63.780
Price-book ratio of capital (△PBR)	0.674	0.339	0.791	0.402
Firm size (△SIZE)	0.031	0.057	0.062	0.083
Advertising expense (△AD)	0.043	0.447	0.084	0.777
Research and Development (△RD)	0.114	0.846	0.204	1.203
Fixed asset ratio (△FAR)	0.288	0.162	0.287	0.163
Return on asset (△ROA)	0.060	0.060	0.063	0.053
D1 (construction)	0.070	0.2559	0.071	0.256
D2 (transportation)	0.036	0.187	0.036	0.186
D3 (information and communication)	0.061	0.240	0.062	0.240
D4 (wholesale trade)	0.091	0.288	0.091	0.288
D5 (retail trade)	0.069	0.253	0.069	0.254
D6 (real estate)	0.024	0.154	0.027	0.161
D7 (service)	0.046	0.210	0.046	0.209
Large shareholder ratio (LSHARE)	43.897	17.020	46.995	13.910
Foreign shareholder (FSHARE)	14.256	11.529	14.789	11.765
Corporate group dummy (DGROUP)	0.092	0.289	0.091	0.287
Number of observations	1193		1204	

Table 8. Basic Statistics of FY2008 (Explained in Sec. 6) and Panel Data Using All Sample Firms

Period	FY2008		panel (FY2006-08)	
	Average	Standard Deviation	Average	Standard Deviation
Dependent Variable				
△DEBT	-0.718	6.109	1.726	8.092
Control Variables				
Marginal tax rate (MTR)	32.946	8.847	31.446	9.455
Bankruptcy probability index (SAFPROB)	0.386	0.061	0.377	0.072
Non-debt tax shield (△NDTS)	0.003	0.005	0.002	0.006
NDTS*SAFPROB (NDISSAF)	0.011	0.007	0.010	0.008
Free cash flow (△FCF) (in billion JPY)	2.611	65.507	3.331	69.683
Price-book ratio of capital (△PBR)	1.712	0.339	1.061	0.865
Firm size (△SIZE)	0.021	0.057	0.038	0.066
Advertising expense (△AD)	0.009	0.447	0.045	0.687
Research and Development (△RD)	0.079	0.846	0.132	1.009
Fixed asset ratio (△FAR)	0.294	0.162	0.290	0.164
Return on asset (△ROA)	0.059	0.060	0.061	0.057
D1 (construction)	0.071	0.256	0.071	0.256
D2 (transportation)	0.036	0.187	0.036	0.186
D3 (information and communication)	0.061	0.240	0.061	0.240
D4 (wholesale trade)	0.091	0.288	0.091	0.288
D5 (retail trade)	0.068	0.253	0.069	0.253
D6 (real estate)	0.027	0.154	0.026	0.159
D7 (service)	0.046	0.210	0.046	0.210
Large shareholder ratio (LSHARE)	47.339	17.020	46.086	15.168
Foreign shareholder (FSHARE)	14.428	11.529	14.492	11.751
Corporate group dummy (DGROUP)	0.093	0.289	0.092	0.289
Number of observations	1211		3608	

Table 9. Results of Cross Section Regression for FY2006, FY2007, and FY2008

	FY2006	FY2007	FY2008
C	6.767 (1.476)	6.105 (1.462)	−3.492 (−1.261)
MTR	0.090(3.095)***	0.153 (5.453)***	0.080 (3.594) ***
SAFPROB	−23.416(−2.027)**	−9.492 (−1.258)	−5.727 (−1.010)
△NDTS	−74.910(−1.012)	83.452 (1.324)	94.279 (2.063)**
NDTSSAF	247.222(5.204)***	159.334 (3.804)***	−31.063 (−0.933)
△FCF	−0.013(−3.668)***	−0.015 (−2.238)**	−0.008 (−3.215)***
△PBR	−0.568(−0.660)	−1.154 (−1.292)	0.209 (0.759)
△SIZE	36.863(4.841)***	62.125(8.929)***	39.174(5.781)***
△AD	−0.200 (−0.388)	−0.529 (−1.478)	−0.217(−0.917)
△RD	−0.250(−0.722)	−0.702 (−2.718)***	0.571(3.001)***
△FAR	−8.686(−4.723)***	−14.772 (−6.853)***	0.838 (0.553)
△ROA	−22.805 (−2.880)***	−59.459(−6.319)***	−19.865 (−3.208)***
D1	−0.932(−0.979)	−0.254 (−0.221)	−2.889 (−3.524)***
D2	1.912 (2.093)**	2.917(2.450)**	1.579 (1.993)**
D3	−0.674 (−0.807)	−2.406 (−1.837)*	1.347 (2.289)**
D4	1.933(2.570)**	1.679 (1.934)*	−0.113 (−0.160)
D5	0.066(0.091)	1.296 (1.282)	1.378 (2.042)**
D6	4.235 (2.174) **	11.475 (4.005)***	6.691 (3.499)***
D7	−0.835 (−0.856)	0.166 (0.109)	1.022 (1.112)
LSHARE	0.014 (1.054)	0.007 (0.358)	0.031 (2.095)**
FSHARE	0.013 (0.543)	−0.016 (−0.597)	0.031(1.753)*
DGROUP	0.575 (0.876)	0.111 (0.155)	−0.222 (−0.440)
Adjusted R^2	0.162	0.393	0.206
Number of obs.	1193	1204	1211
Mean (△DEBT)	2.010	3.902	−0.718

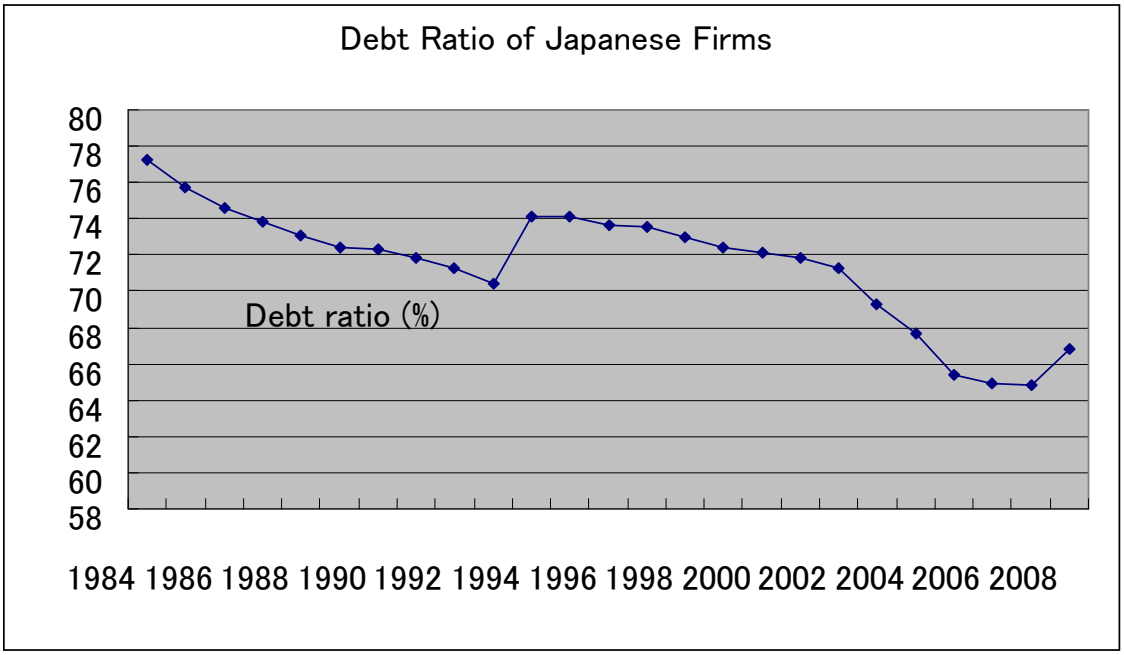
Table 10. Results of Pooled Cross Section and Panel Regressions

	Pooled Cross Section	Panel with Year-specific Dummies
C	0.261 (0.200)	−0.525 (−0.242)
MTR	0.099 (5.530) ***	0.113 (6.315)***
SAFPROB	−2.602 (−0.940)	−4.582 (−0.954)
△NDTS	32.774 (0.670)	52.128 (1.033)
NDTSSAF	127.584 (4.684) ***	117.537 (4.273)***
△FCF	−0.012 (−4.530) ***	−0.012 (−4.518)***
△PBR	−0.940 (−4.269) ***	−0.101 (−0.400)
△SIZE	53.996 (9.377) ***	50.435 (8.623)***
△AD	−0.425 (−1.657) *	−0.410 (−1.753)*
△RD	−0.263 (−1.387)	−0.266 (−1.359)
△FAR	−7.816 (−6.118) ***	−7.441 (−5.918)***
△ROA	−27.914 (−7.210) ***	−26.903 (−6.403)***
D1	−1.375 (−2.105) **	−1.440 (−2.247)**
D2	1.874 (2.542) **	2.072 (2.834)***
D3	−0.707 (−1.067)	−0.466 (−0.699)
D4	1.230 (2.391) **	1.182 (2.323)**
D5	0.737 (1.490)	0.894 (1.779)*
D6	7.687 (4.387) ***	7.429 (4.271)***
D7	−0.117 (−0.137)	0.073 (0.086)
LSHARE	0.013 (1.340)	0.016(1.686) *
FSHARE	0.008 (0.664)	0.011 (0.890)
DGROUP	−0.136 (−0.322)	0.146 (0.346)
Adjusted R^2	0.277	0.294
Number of obs.	3608	3608

Table 11. Fixed Effect Model (Year- and Firm-specific Effects) and Random Effect Model

	Fixed effect model (year- and firm-specific effects)	Random effect model
C	12.539 (2.040)**	0.917 (0.749)
MTR	0.011 (0.395)	0.080 (4.525)***
SAFPROB	−11.317 (−0.827)	−1.551 (−0.608)
△NDTS	31.403 (0.412)	31.463 (0.684)
NDTSSAF	327.165 (3.056)***	144.297 (5.178)***
△FCF	−0.014 (−4.132)**	−0.0125 (−4.773)***
△PBR	−1.341 (−2.824)***	−1.259 (−5.734)***
△SIZE	36.018 (4.758)***	51.855 (9.180)***
△AD	−0.338 (−1.260)	−0.457 (−1.823)*
△RD	−0.183 (−0.779)	−0.243 (−1.321)
△FAR	−28.540 (−2.571)**	−8.574 (−6.387)***
△ROA	−36.495 (−3.797)***	−27.160 (−6.821)***
D1		−1.463 (−2.197)**
D2		1.985 (2.650)***
D3		−0.835 (−1.243)
D4		1.281 (2.455)**
D5		0.701 (1.361)
D6		8.236 (4.388)***
D7		−0.113 (−0.132)
LSHARE	0.013 (1.340)	0.012 (1.239)
FSHARE	0.008 (0.664)	0.010 (0.782)
DGROUP		−0.217 (−0.502)
Adjusted R^2	0.277	0.261
Number of obs.	3608	3608

Figure 1. Debt Ratio of Japanese Listed Firms



（出所）Nikkei NEEDS. The average of the debt ratios of Japanese listed firms (excluding banks, security companies and insurance companies) with more than 25 years financial data. “Debt ratio” is defined as “Total liability /Total capital (book value).”