Taxes, Financial Distress, and Capital Structure in the United States and Japan

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Abstract

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In Study 1, I examine whether a U.S. firm's proximity to both financial distress and tax exhaustion affects whether debt is negatively related to non-debt tax shields. Effective tax planning requires a firm to consider both the tax and non-tax costs of its financing decisions. Financial distress costs are a non-tax cost of debt financing. Prior studies suggest that it is also important to account for a firm's proximity to tax exhaustion when examining whether taxes affect financing decisions. I find that debt is negatively related to non-debt tax shields for only non-financially distressed firms. The finding suggests that for financially distressed firms, the costs of financial distress outweigh the tax benefit of debt. The results also suggest that a firm's proximity to tax exhaustion does not affect the relation between debt and non-debt tax shields.

In Study 2, I examine whether a Japanese firm's proximity to financial distress, keiretsu membership, and proximity to tax exhaustion affect whether debt is negatively related to non-debt tax shields. If financial distress costs are lower for keiretsu firms, financial distress should have a smaller effect on their financing decisions when compared to non-keiretsu firms, ceteris paribus. I find that debt is positively related to non-debt tax

shields, regardless of financial distress, keiretsu membership, and tax exhaustion. Before concluding, I investigate explanations for why I find a positive relation in Japan; I also discuss explanations for why the results are inconsistent with prior studies that do find a negative relation.

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Dedication

To my parents with love and gratitude

Study 1: Taxes, Financial Distress, and Capital Structure in the United States

1. Introduction

DeAngelo and Masulis (1980) predict that in a cross-sectional analysis, firms with lower non-debt, non-cash tax shields will employ greater debt in their capital structures (i.e., debt will be negatively related to non-debt tax shields).[1] In this study, I examine whether firms' proximity to both financial distress and tax exhaustion affects whether they substitute.

Scholes and Wolfson (1992) stress that effective tax planning requires a firm to consider both the tax and non-tax costs of its financing decisions. Financial distress costs are a non-tax cost of debt financing. If financial distress costs are high enough, the non-tax costs of debt will outweigh the tax benefit of debt, and a financially distressed firm with low non-debt tax shields should not employ greater debt in its capital structure. Therefore, to the extent that financial distress costs are substantial, it is important to account for firms' proximity to financial distress when examining whether they substitute.

MacKie-Mason (1990) argues that one should account for a firm's proximity to tax exhaustion when examining whether taxes affect its financing decisions. A firm reaches tax exhaustion when its tax shields, debt and non-debt, are greater than its taxable income. He predicts that a dollar of non-debt tax shields will crowd out an additional dollar of debt

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[1] Because DeAngelo and Masulis (1980) argue that non-debt tax shields "provide firms with substitutes for the corporate tax shield attributes of debt," Dhaliwal, Trezevant, and Wang (1992) and Trezevant (1992) call this hypothesis the *substitution* hypothesis. Similarly, the negative relation between debt and non-debt tax shields is the *substitution* effect, and firms *substitute* if debt is negatively related to non-debt

tax shields only when a firm is close to tax exhaustion. Thus, if his prediction is correct, debt should be negatively related to non-debt tax shields for only firms that are close to tax exhaustion. The results in Dhaliwal, Trezevant, and Wang (1992) and Trezevant (1992) are consistent with the prediction.

I first examine whether firms substitute, regardless of their proximity to both financial distress and tax exhaustion. Consistent with prior studies (e.g., Bradley, Jarrell, and Kim, 1984; Titman and Wessels, 1988), I do not find a negative relation between debt and non-debt tax shields. The result suggests that U.S. firms do not substitute.

In the second set of empirical tests, I examine whether firms' proximity to financial distress affects whether they substitute. I use Altman's (1968) Z-score to measure a firm's proximity to financial distress. I find a negative relation for only non-financially distressed firms. The finding suggests that—because the costs of financial distress outweigh the tax benefit of debt—financially distressed firms do not substitute. Moreover, it is unique and the primary contribution of this study to the tax and finance literature.

The finding also motivates a review of MacKie-Mason (1990). MacKie-Mason interprets his results as suggesting that the negative relation between debt and non-debt tax shields is stronger for firms that are closer to tax exhaustion. He measures a firm's proximity to tax exhaustion using a modified version of Altman's (1968) Z-score. Altman's Z-score, however, is a predictor of firm bankruptcy; it also measures a firm's proximity to financial distress because firms with a high probability of bankruptcy are

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tax shields. I also use this terminology.

similar to ones that are close to financial distress. Thus his results can also be interpreted as suggesting that the negative relation is stronger for firms that are closer to financial distress. Because this interpretation is clearly inconsistent with the results in this study, I review his methodology. As discussed in Appendix A, MacKie-Mason's regression coefficients cannot be interpreted because he does not account for negative Z-score firms in his empirical tests. Therefore, his results do not suggest that the negative relation between debt and non-debt tax shields is stronger for firms that are closer to financial distress. More importantly, they are not inconsistent with the ones in this study.

In the third and fourth sets of empirical tests, I account for firms' proximity to tax exhaustion—in addition to their proximity to financial distress—when examining whether they substitute. I assume that a firm with a low effective tax rate, total income taxes divided by pretax income, is close to tax exhaustion. The results suggest that firms' proximity to tax exhaustion does not affect whether they substitute. They also support the inference that financially distressed firms do not substitute.

The remainder of the study proceeds as follows. In section 2, I develop the hypotheses to be tested. In section 3, I describe the methodology that I use to test the hypotheses. In section 4, I describe the sample and report descriptive statistics. In section 5, I report the results of the empirical tests. In section 6, I examine the robustness of the results presented in section 5.

2. Hypotheses

DeAngelo and Masulis (1980) predict that in a cross-sectional analysis, firms with lower non-debt, non-cash tax shields will employ greater debt in their capital structures. Prior studies did not find the negative relation between debt and non-debt tax shields predicted by DeAngelo and Masulis. For example, Bradley, Jarrell, and Kim (1984) find a significantly positive relation between debt and non-debt tax shields, and Titman and Wessels (1988) find an insignificantly negative relation. In order to foster comparisons with prior studies, I first examine whether firms substitute—regardless of their proximity to both financial distress and tax exhaustion. I do so by testing the null hypothesis that debt is not related to non-debt tax shields against the following alternative hypothesis.

Hypothesis 1: Debt is negatively related to non-debt tax shields.

One limitation of prior studies is that they do not account for a firm's proximity to financial distress. Scholes and Wolfson (1992) stress that effective tax planning requires a firm to consider both the tax and non-tax costs of its financing decisions. Financial distress costs are a non-tax cost of debt financing.

A variety of factors can give rise to financial distress costs. Customers may not be willing to pay as much for the products of a firm that is financially distressed, and in some cases, they may avoid purchasing from the firm altogether. For example, many Chrysler customers likely switched to other automobile manufacturers when Chrysler experienced financial distress in the late 1970s. Similarly, suppliers and employees may charge a financially distressed firm more for their goods and services, or they may completely avoid doing business with the firm. Financial distress may lead to predatory pricing behavior by a firm's better capitalized competitors. Finally, capital constraints may cause a financially distressed firm to focus on only the short-term when it makes its investment decisions; the firm may avoid investments in not only its physical assets, but also its reputation for producing a high-quality product (Maksimovic and Titman, 1991).

The results in several studies suggest that financial distress costs are substantial. Opler and Titman (1994) find that, during industry downturns, high debt firms lose market share to their low debt competitors. They define debt as the book value of short-term and long-term debt divided by the book value of total assets, and find that industry adjusted sales growth for firms in the top debt decile is 26% lower than for firms in the bottom debt decile; sales growth for firms in the top three deciles is 14% lower than for firms in the bottom seven deciles. Chen, Cheung, and Merville (1997) also find that financial distress adversely affects sales growth; specifically, they find that sales growth is positively related to Altman's (1968) Z-score. Chevalier (1995) examines changes in supermarket prices in local markets after supermarket leveraged buyouts, and finds that following a leveraged buyout, prices decrease if there are multiple low debt competitors or a single low debt competitor that controls a large share of the local market. The price drops are associated with leveraged buyout firms exiting the local market, and suggests that low debt firms engage in predatory pricing behavior against their high debt competitors. Finally, Chen and Merville (1999) find that financially distressed firms invest less than non-financially distressed firms. They define investment growth as the change in invested capital, and find that it is positively related to Z-score.

To the extent that financial distress costs are substantial, it is important to account for a firm's proximity to financial distress when examining whether debt is negatively related to non-debt tax shields. If financial distress costs are high enough, the non-tax costs of debt will outweigh the tax benefit of debt, and a financially distressed firm with low non-debt tax shields should not employ greater debt in its capital structure. In this case, there will be no relation between debt and non-debt tax shields. On the contrary, a non-financially distressed firm with low non-debt tax shields should still behave as predicted by DeAngelo and Masulis (1980). Because the non-tax costs of debt (i.e., financial distress costs) do not outweigh the tax benefit of debt, the firm should employ greater debt in its capital structure. In this case, debt will be negatively related to non-debt tax shields. I examine whether firms' proximity to financial distress affects whether they substitute by testing the following alternative hypothesis.

Hypothesis 2: Debt is negatively related to non-debt tax shields for only non-financially distressed firms.

MacKie-Mason (1990) argues that it is important to account for a firm's proximity to tax exhaustion when examining whether taxes affect its financing decisions. A firm reaches tax exhaustion when its tax shields are greater than its taxable income and thus faces a zero marginal tax rate on any additional interest deductions. A firm with tax shields—debt and non-debt—that are far from exhausting its taxable income can issue additional debt without affecting the expected marginal tax rate on interest deductions. On the contrary, a firm with tax shields that are close to exhausting its taxable income does not have the same tax incentives. If it issues debt, the additional tax shields may exhaust all of its taxable income and as a result lower the expected marginal tax rate on interest deductions to zero. MacKie-Mason predicts that a dollar of non-debt tax shields will crowd out an additional dollar of debt tax shields only when a firm is close to tax exhaustion (i.e., only firms that are close to tax exhaustion substitute).

The findings in Trezevant (1992) and Dhaliwal, Trezevant, and Wang (1990) are consistent with the prediction. Trezevant examines firm responses to the Economic Recovery Tax Act of 1981. He finds a significantly negative relation between changes in non-debt tax shields (caused by the tax act) and changes in debt tax shields for only firms that are close to tax exhaustion.

I examine whether firms' proximity to financial distress affects whether they substitute—after accounting for their proximity to tax exhaustion—by testing the following two alternative hypotheses.

Hypothesis 3: Among firms that are close to tax exhaustion, debt is negatively related to non-debt tax shields for only non-financially distressed firms.

Hypothesis 3a: Among firms that are close to tax exhaustion, debt is negatively related to non-debt tax shields for both financially distressed and non-financially distressed firms.

Lastly, I examine whether firms' proximity to tax exhaustion affects whether they substitute—after accounting for their proximity to financial distress—by testing the following two alternative hypotheses.

Hypothesis 4: Among non-financially distressed firms, debt is negatively related to non-debt tax shields for only firms that are close to tax exhaustion.

Hypothesis 4a: Among non-financially distressed firms, debt is negatively related to non-debt tax shields for firms that are close to and not close to tax exhaustion.

Hypotheses 3, 3a, 4, and 4a—which are expressed in terms of levels, not changes—are not necessarily inconsistent with MacKie-Mason (1990)—which focuses on incremental financing decisions. The incremental financing decisions that MacKie-Mason focuses on are public issuances of debt and equity, as opposed to more frequent, everyday changes in a firm's capital structure. Furthermore, he defines the explanatory variables in terms of levels, not changes. Focusing on levels is also consistent with Dhaliwal, Trezevant, and Wang (1992). They extend MacKie-Mason by examining whether a firm's proximity to tax exhaustion affects the relation between the level of debt tax shields and the level of non-debt tax shields. They find a significantly negative relation for only firms that are close to tax exhaustion. The negative relation therefore exists not only when a firm adjusts its capital structure, but also after it has adjusted it. Lastly, capital structure theories may be better tested using variables that are defined in terms of levels, not changes. If transactions costs inhibit a firm from immediately restructuring its balance sheet when, for example, its tax status unexpectedly changes, cross-sectional tests that examine changes in debt can fail to find a tax effect when one actually exists. Therefore, to the extent that transactions costs cause capital structure changes to take place over a number of years, levels based tests are more powerful.[2]

3. Methodology

In the first set of tests, I examine whether all firms substitute in order to promote comparisons with prior studies. In the second set of tests, I divide the sample into two groups: (1) non-financially distressed and (2) financially distressed. I then examine whether financial distress affects whether firms substitute after controlling for various factors that can also influence their financing decisions. In the third and fourth sets of tests, I divide the sample into four groups: (1) non-financially distressed, close to tax exhaustion, (2) non-financially distressed, not close to tax exhaustion, (3) financially distressed, close to tax exhaustion, and (4) financially distressed, not close to tax exhaustion. I then examine whether financial distress and tax exhaustion affect whether firms substitute after controlling for various factors that can also influence their financing decisions.

3.1. Financial distress

I use Altman's (1968) Z-score to classify a firm as financially or non-financially distressed. Z-score is defined as

$$1.2\ X_1 + 1.4\ X_2 + 3.3\ X_3 + 0.6\ X_4 + 1.0\ X_5, \tag{1}$$

[2] In order to examine whether changes based tests are less powerful than levels based tests, I estimate the empirical models, equations (3), (4), and (5) presented below, with variables that are defined in terms of changes. The tax effects that I find in the levels based tests disappear, which suggests that levels based tests are more powerful.

where

X_1 = working capital divided by total assets,

X_2 = retained earnings divided by total assets,

X_3 = earnings before interest and taxes divided by total assets,

X_4 = market value of equity divided by book value of total liabilities,

X_5 = sales divided by total assets.

The model is based on a sample of manufacturing firms that went bankrupt between 1946 and 1965. Altman concludes that a firm with a Z-score below 1.81 is bankrupt, and a firm with a Z-score above 2.99 is not bankrupt; the area from 1.81 to 2.99 is a "gray area." The model correctly identifies 94% of the firms that go bankrupt and 97% of the firms that do not go bankrupt in the following year. Altman, Haldeman, and Narayanan (1977) test the model on a sample of manufacturing and retail firms that went bankrupt between 1962 and 1975, and find that it successfully identifies 87% of the firms that go bankrupt and 82% of the firms that do not go bankrupt in the following year. Two recent studies, Chen, Cheung, and Merville (1997) and Chen and Merville (1999), also use the Z-score model and the 1.81 and 2.99 cutoffs to identify financially distressed firms. In section 6.1.2, I show that using an alternative model—Ohlson's (1980) bankruptcy prediction model—to classify a firm as financially or non-financially distressed does not significantly change the results.

I account for a firm's proximity to financial distress using two dummy variables. The dummy variable, DISTRESS, is equal to one if the firm's Z-score is less than either 1.81

or 2.99 and zero otherwise. By using dummy variables, I avoid the methodological problems caused by negative Z-scores, which I discuss in Appendix A. In section 6.1.1, I show that using alternative cutoffs to classify a firm as financially or non-financially distressed does not significantly change the results. I also confirm that the results are not significantly different if I exclude the capital structure variable, X_4 in equation (1), when calculating Z-score.

3.2. Tax variables

The empirical models presented below, equations (3), (4), and (5), contain variables designed to measure a firm's level of non-debt tax shields and proximity to tax exhaustion.

3.2.1. Non-debt tax shields

Consistent with Dhaliwal, Trezevant, and Wang (1992), I define a firm's non-debt tax shields as

$$\text{depreciation and amortization expense} + (\text{investment tax credits}/\tau_c), \qquad (2)$$

where

τ_c equals the maximum marginal federal corporate tax rate.

I gross up the investment tax credits figure so that, similar to depreciation and amortization expense, it measures the amount of income that is shielded from taxation. Trezevant (1992) also grosses up investment tax credits by the maximum corporate tax rate. In Section 6.2, I show that defining non-debt tax shields in an alternative way does not significantly change the results.

Consistent with Dhaliwal, Trezevant, and Wang (1992) and Trezevant (1992), in the empirical tests, I divide non-debt tax shields by earnings before interest, taxes, depreciation, and amortization to control for scale effects. Prior studies scale non-debt tax shields in alternative ways; for example, Titman and Wessels (1988) scale by total assets, and MacKie-Mason (1990) scales by sales. Non-debt tax shields are important because they shield a firm's earnings from taxation. Thus scaling them by earnings produces a more accurate measure of a firm's non-debt tax shields than does scaling by total assets or sales. Nevertheless, in section 6.2, I confirm that the results are little changed if I scale by total assets.

3.2.2. Proximity to tax exhaustion

Dhaliwal, Trezevant, and Wang (1992) and Trezevant (1992) control for a firm's proximity to tax exhaustion using dummy variables that are based on the effective tax rate. Dhaliwal, Trezevant, and Wang define the effective tax rate as the sum of federal, state, and foreign income taxes divided by earnings before interest, taxes, and depreciation. Because of the difficulty of interpreting a tax rate variable with a negative denominator, they remove firms with negative earnings from the sample. They assume that firms in the lower 10%, 25%, or 50% of the effective tax rate distribution are close to tax exhaustion and assign them a "1"; firms in the upper 90%, 75%, or 50% are assigned a "0." Trezevant (1992) defines the effective tax rate as the sum of federal, state, and foreign income taxes divided by earnings before taxes. He classifies firms with negative earnings as low tax firms, but reports that his results do not significantly change if they are removed from the sample. He assumes that firms in the lower 10% or 25% of the effective tax rate distribution are close to tax exhaustion and assigns them a "1"; firms in the upper 90% or 75% are assigned a "0."

I account for a firm's proximity to tax exhaustion using a dummy variable. The dummy variable, ETR_{high}, is based on the effective tax rate, which I define as total income tax expense divided by pretax income. I exclude observations with zero or negative pretax income from the sample because of the difficulty of interpreting a tax rate variable with a zero or negative denominator. I assume that firms in the first quartile of the effective tax rate distribution are close to tax exhaustion. ETR_{high} is equal to one if the firm's effective tax rate is in the second, third, or fourth quartile of the effective tax rate distribution, and zero otherwise. In section 6.2, I show that including the observations with zero or negative pretax income does not significantly change the results.

The effective tax rate is based on income tax expense and thus is retrospective in nature. A simulated marginal tax rate such as the one in Graham (1996) would be more appropriate because this study examines a firm's incentives to issue debt. Thus, to extent that a firm's effective tax rate does not accurately measure its marginal tax rate, the results of the third and fourth sets of tests are inaccurate.

3.3. Dependent variable

Firms generally adjust short-term debt in response to non-tax considerations. For example, many firms use short-term debt to compensate for temporary cash flow deficits (Ross, Westerfield, and Jaffe, 1999). Because this study examines whether taxes affect a firm's financing decisions, the dependent variable is based on only the book value of long-term debt.

I scale the book value of long-term debt by the book value, instead of the market value, of total assets because results estimated using market-value-based debt ratios may be inaccurate (Givoly, Hayn, Ofer, and Sarig, 1992; Hwang and Kim,1998). Changes in market-value-based ratios do not necessarily reflect intentional managerial financing decisions. For example, an increase in debt or a decrease in the market value of equity can cause a market-value-based debt ratio to increase. In the former case, a managerial decision caused the increase, and in the later, a number of factors beyond management's control may have caused it. In Section 6.3, I show that the results do not significantly change if I define the dependent variable in alternative ways.

3.4. Control variables

Many other factors in addition to financial distress and taxes may also influence a firm's financing decisions. I include several variables to control for these factors. The control variables are consistent with prior studies.[3]

A firm's debt should be positively related to the collateral value of its assets. Jensen and Meckling (1976) argue that information asymmetries between shareholders and bondholders of a levered firm provide shareholders with an opportunity to invest suboptimally in order to expropriate wealth from bondholders. Because shareholders are less likely to do so if the firm's debt is secured, a firm with many securable assets should

[3] Titman and Wessels (1988), MacKie-Mason (1990), Dhaliwal, Trezevant, and Wang (1992), Graham

have lower borrowing costs than a firm with less securable assets, ceteris paribus. The empirical models contain three variables, net property, plant, and equipment divided by total assets, net intangible assets divided by total assets, and inventory divided by total assets, to control for the collateral value of a firm's assets.

A firm's debt may be positively or negatively related to its profitability. Jensen (1986) argues that managers may engage in activities that are not beneficial to shareholders. Debt reduces these non-beneficial activities because it reduces the amount of free cash flow available to managers. In this case, a firm's debt and profitability should be positively related. Myers (1984) and Myers and Majluf (1984) argue that a firm can reduce the costs resulting from information asymmetries between current shareholders and new investors by following a pecking order of financing. In this case, a firm's debt and profitability should be negatively related. The models contain a variable, the four-year average of earnings before interest, taxes, depreciation, and amortization divided by total assets, to control for a firm's profitability. I measure profitability over four-years because, according to the pecking order theory, a firm's first source of capital is retained earnings, which are accumulated over more than one year.

A firm's debt should be negatively related to its growth. Myers (1977) argues that information asymmetries between shareholders and bondholders of a levered firm provide shareholders with an incentive to act detrimentally to bondholders; specifically, they have an incentive to forgo positive NPV projects if bondholders will receive the benefits. The

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(1996, 1999), Wald (1999).

opportunity to do so is likely to be greater in a growing firm because it has more flexibility regarding future investments. A high-growth firm with an abundance of positive NPV projects should therefore have higher borrowing costs (and less debt) than a low-growth firm, ceteris paribus. Stultz (1990) argues that managers may invest all available cash even if paying it out is better for shareholders. Debt reduces the opportunities for managers to act in ways that are not beneficial to shareholders because it also reduces free cash flow. Thus a low-growth firm without many positive NPV projects should have more debt than a high-growth firm, ceteris paribus. The models contain a variable, the four-year average of the percent change in sales, to control for a firm's growth. Appendix B contains the Compustat annual data item numbers used to create the dependent and independent variables.

3.5. Empirical models

I use equation (3) to test Hypothesis 1. Because the hypothesis does not make predictions regarding firms' proximity to financial distress or tax exhaustion, equation (3) contains only one tax variable, non-debt tax shields (NDTS), in addition to the control variables.

$$\text{DEBT} = \alpha_0 + \alpha_1 \text{ FIXED} + \alpha_2 \text{ INTANGIBLE} + \alpha_3 \text{ INVENTORY} + \alpha_4 \text{ PROFITABILITY} + \alpha_5 \text{ GROWTH} + \alpha_6 \text{ NDTS}, \quad (3)$$

where

DEBT = book value of long-term debt divided by book value of total assets,

FIXED = net property, plant, and equipment divided by book value of total assets,

INTANGIBLE = net intangible assets divided by book value of total assets,

INVENTORY = inventory divided by book value of total assets,

PROFITABILITY = four-year average of earnings before interest, taxes, depreciation, and amortization divided by book value of total assets,

GROWTH = four-year average of the percent change in sales,

NDTS = sum of depreciation and amortization expense plus investment tax credits divided by the maximum marginal federal corporate tax rate, divided by earnings before interest, taxes, depreciation, and amortization.

A negative sign on α_6 would be consistent with Hypothesis 1 and suggest that firms substitute.

I use equation (4) to test Hypothesis 2. Because the hypothesis makes predictions regarding firms' proximity to financial distress—but not tax exhaustion—equation (4) contains only two tax variables, non-debt tax shields (NDTS) and the financial distress dummy variable multiplied by non-debt tax shields (DISTRESS × NDTS), in addition to the control variables.

$$\begin{aligned} \text{DEBT} = {} & \beta_0 + \beta_1 \text{ FIXED} + \beta_2 \text{ INTANGIBLE} + \beta_3 \text{ INVENTORY} \\ & + \beta_4 \text{ PROFITABILITY} + \beta_5 \text{ GROWTH} + \beta_6 \text{ NDTS} \\ & + \beta_7 \text{ DISTRESS} \times \text{NDTS}, \end{aligned} \tag{4}$$

where

DISTRESS = 1 if the firm's Z-score is less than either 1.81 or 2.99 and zero otherwise.

A negative sign on β_6 and a non-negative sign on the sum of β_6 plus β_7 would be consistent with Hypothesis 2 and suggest that only non-financially distressed firms substitute.

Equation (3) is equal to equation (4) with the restriction that β_7 equals zero. Thus another way to test whether financial distress affects the relation between debt and non-debt tax shields is to compare the unrestricted model, equation (4), with the restricted model, equation (3), using an F-test. A significant F-statistic would suggest that financial distress does affect the relation.

I use equation (5) to test Hypotheses 3, 3a, 4, and 4a. Because the hypotheses also make predictions regarding firms' proximity to tax exhaustion, I multiply the two tax variables from equation (4) by the high effective tax rate dummy variable, ETR_{high}.

$$\begin{aligned} DEBT = \delta_0 &+ \delta_1\, FIXED + \delta_2\, INTANGIBLE + \delta_3\, INVENTORY \\ &+ \delta_4\, PROFITABILITY + \delta_5\, GROWTH + \delta_6\, NDTS \\ &+ \delta_7\, DISTRESS \times NDTS + \delta_8\, ETR_{high} \times NDTS \\ &+ \delta_9\, ETR_{high} \times DISTRESS \times NDTS, \end{aligned} \qquad (5)$$

where

EFFECTIVE TAX RATE = total income tax expense divided by pretax income,

ETR_{high} = 1 if the firm is in the second, third, or fourth quartile of the effective tax rate distribution, and zero otherwise.

I first use equation (5) to test Hypotheses 3 and 3a. A negative sign on δ_6 and a non-negative sign on the sum of δ_6 plus δ_7 would be consistent with Hypothesis 3 and suggest that, among firms that are close to tax exhaustion, only non-financially distressed ones substitute. On the contrary, a negative sign on δ_6 and the sum of δ_6 plus δ_7 would be consistent with Hypothesis 3a and suggest that all firms that are close to tax exhaustion substitute.

I next use equation (5) to test Hypotheses 4 and 4a. A negative sign on δ_6 and a non-negative sign on the sum of δ_6 plus δ_8 would be consistent with Hypothesis 4 and suggest that among non-financially distressed firms, only firms that are close to tax exhaustion substitute. On the contrary, a negative sign on δ_6 and the sum of δ_6 plus δ_8 would be consistent with Hypothesis 4a and suggest that all non-financially distressed firms substitute. Table 1.1 contains the predicted signs for the control and tax variable coefficients from equations (3), (4), and (5).

Equation (4) is equal to equation (5) with the restriction that δ_8 and δ_9 equal zero. Thus another way to test whether tax exhaustion affects the relation between debt and non-debt tax shields is to compare the unrestricted model, equation (5), with the restricted model, equation (4), using an F-test. A significant F-statistic would suggest that tax exhaustion does affect the relation.

4. Sample selection and descriptive statistics

I collect the data from the 1979 to 1998 Compustat annual industrial and research files. I apply several screens that reduce the sample. First, I exclude firms from the banking, financial services, insurance, and related industries (first digit SIC code of 6) because their capital structures may be affected by government rules and regulations.[4] Second, I exclude observations if any of the variables necessary to calculate Altman's (1968) Z-score are missing. This leaves 13,483 firms and 98,203 observations. The figures decrease to 12,520 firms and 81,930 observations if data from only the years 1983 to 1988 are included in the sample; these years are more relevant because the growth control variable is measured over 5 years. Third, I exclude observations if any of the variables in equations (3), (4), or (5) are missing. This leaves 5,386 firms and 23,965 observations. Fourth, I exclude observations with zero or negative pretax income. The final sample contains 4,383 firms and 18,054 firm-year observations. Panel A of Table 1.2 contains descriptive statistics about the final sample. Panels B and C contain separate descriptive statistics about financially distressed and non-financially distressed firm-year observations. Table 1.3 contains the correlation coefficients of the variables in Panel A of Table 1.2.

Missing values of the investment tax credits data item used in calculating the non-debt tax shields variable are responsible for many of the excluded observations. The sample increases to 6,235 firms and 33,275 observations if investment tax credits are excluded

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[4] Dhaliwal, Trezevant, and Wang (1992) and Trezevant (1992) also exclude firms from these industries. The capital structures of utilities, however, may also be affected by government rules and regulations. The results are little changed if I exclude utilities (SIC code between 4900 and 5000) in addition to firms from the banking, financial services, insurance, and related industries.

from non-debt tax shields. In section 6.2, I show that excluding investment tax credits from the definition of non-debt tax shields does not significantly change the results.

Missing values of the profit and/or growth control variables are also responsible for many of the excluded observations because they are measured over 4 and 5 consecutive years, respectively. The sample increases to 6,126 firms and 23,426 observations if the variables are not included. In order to reduce possible selection bias (caused by excluding the 5,372 observations with missing profit and/or growth variables), I alternatively measure the variables over shorter time periods. In section 6.3, I confirm that the results are not significantly different if I measure the profit and growth variables over only 2 and 3 consecutive years, respectively.

If all financially distressed firms are close to tax exhaustion, and vice versa, it is not necessary to account for their proximity to both financial distress and tax exhaustion. Panels B and C of Table 1.2 provide some evidence on the relation between financial distress and tax exhaustion. According to Panel B, firms with Z-scores less than 1.81 have higher effective tax rates than firms with Z-scores greater than or equal to 1.81 (i.e., financially distressed firms are farther from tax exhaustion). Panel C, however, suggests that financially distressed firms are closer to tax exhaustion. According to Panel C, firms with Z-scores less than 2.99 have lower effective tax rates than firms with Z-scores greater than or equal to 2.99.

Figures 1.1 to 1.4 display the relation between financial distress and tax exhaustion among the sample firms. According to Figure 1.1, approximately 23% of the firms with

Z-scores less than 1.81 have effective tax rates in the fourth quartile of the effective tax rate distribution (i.e., some financially distressed firms are not close to tax exhaustion). Furthermore, according to Figure 1.3, approximately 79% of the firms with effective tax rates in the first quartile of the distribution have Z-scores greater than 1.81 (i.e., most firms that are close to tax exhaustion are not financially distressed). If a high profit firm uses aggressive tax management strategies, it may end up being close to tax exhaustion; but because the firm is highly profitable, it is not likely to be financially distressed. Figures 1.2 and 1.4, which are based on a Z-score cutoff of 2.99, are similar to figures 1.1 and 1.3, respectively.

In summary, the descriptive statistics suggest neither that all financially distressed firms are close to tax exhaustion nor that all firms that are close to tax exhaustion are financially distressed. Therefore it is important to account for firms' proximity to both financial distress and tax exhaustion when examining whether they substitute.

5. Empirical results

The results reported in this section are estimated using ordinary least squares for the years 1983 to 1998. Annual dummy variables are included in the regressions to control for unmodeled macroeconomic effects. The standard errors are adjusted using White's (1980) method. In section 6.4, I show that the results do not significantly change if I account for influential observations, residual correlation, endogeneity, and fixed effects.

The signs of the control variable coefficients are mostly consistent with the predictions in Table 1.1. In equations (3), (4), and (5), the FIXED and INVENTORY coefficients are significantly positive at the 1% level, while the PROFITABILITY and GROWTH coefficients are significantly negative at the 1% level. The INTANGIBLE coefficients, however, are significantly positive at the 1% level, not negative as predicted. The positive coefficients suggest that intangible assets may also have collateral value.[5]

Column (4a) of Table 1.4 reports the results from estimating equation (3). α_6, which measures the relation between debt and non-debt tax shields, is insignificantly negative and thus inconsistent with Hypothesis 1. It is, however, consistent with prior studies that do not find a significantly negative relation between debt and non-debt tax shields (e.g., Bradley, Jarrell, and Kim, 1984; Titman and Wessels, 1988). It is also supportive of the inference that firms do not substitute.

Columns (4b) and (4c) of Table 1.4 report the results from estimating equation (4), which are consistent with Hypothesis 2. In column (4b), the financial distress dummy variable is equal to one if the firm's Z-score is less than 1.81 and zero otherwise. β_6, which measures the relation between debt and non-debt tax shields for non-financially distressed firms, is significantly negative at the 1% level. The sum of β_6 plus β_7, which measures the relation for financially distressed firms, is insignificantly positive. In column (4c), the financial distress dummy variable is equal to one if the firm's Z-score is less than 2.99 and zero otherwise. β_6 is significantly negative at the 1% level, and the sum of β_6

[5] The positive coefficient is also consistent with Graham (1996) who finds a positive relation between

plus β_7 is significantly positive at the 5% level. Thus the results strongly imply that only non-financially distressed firms substitute. More importantly, they also provide strong support for the inference that financially distressed firms do not substitute because the costs of financial distress outweigh the tax benefit of debt.

I also test whether financial distress affects the relation between debt and non-debt tax shields by comparing equation (4) with equation (3) using an F-test. When the 1.81 (2.99) Z-score cutoff is used, the F-statistic is 221.09 (811.52), which is significant at the 1% level. The significant F-statistic suggests that financial distress does affect the relation and thus supports the inference (that I draw from the results in Table 1.4) that financially distressed firms do not substitute.

Table 1.5 reports the results from estimating equation (5), which are consistent with Hypothesis 3. In column (5a), the financial distress dummy variable is equal to one if the firm's Z-score is less than 1.81 and zero otherwise. δ_6, which measures the relation between debt and non-debt tax shields for non-financially distressed firms that are close to tax exhaustion, is significantly negative at the 1% level. The sum of δ_6 plus δ_7, which measures the relation for all firms that are close to tax exhaustion, is significantly positive at the 1% level. In column (5b), the financial distress dummy variable is equal to one if the firm's Z-score is less than 2.99 and zero otherwise. δ_6 is significantly negative at the 1% level, and the sum of δ_6 plus δ_7 is significantly positive at the 1% level. The results

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changes in debt and changes in intangible assets.

suggest that, among firms that are close to tax exhaustion, only non-financially distressed ones substitute.

In addition, the results in Table 1.5 are consistent with Hypotheses 4a. In column (5a), δ_6 is significantly negative at the 1% level. The sum of δ_6 plus δ_8, which measures the relation between debt and non-debt tax shields for all non-financially distressed firms is also significantly negative at the 1% level. The results in column (5b) are similar to the ones in column (5a); both δ_6 and the sum of δ_6 plus δ_8 are significantly negative at the 1% level. The results confirm the earlier inference that all non-financially distressed firms substitute, regardless of their proximity to tax exhaustion.[6]

Finally, I note that the results in Table 1.5 are also consistent with Hypothesis 2. As discussed above, the sum of $\delta_6 + \delta_8$ is significantly negative at the 1% level. The sum of $\delta_7 + \delta_9$, which measures the relation between debt and non-debt tax shields for all financially distressed firms, is significantly positive at the 1% level, regardless of the Z-score cutoff used to classify a firm as financially distressed. Thus the results also support the inference that only non-financially distressed firms substitute.

I also test whether tax exhaustion affects the relation between debt and non-debt tax shields by comparing equation (5) with equation (4) using an F-test. When the 1.81 (2.99) Z-score cutoff is used, the F-statistic is 61.83 (141.66), which is significant at the 1%

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[6] The results in Table 1.5 are also consistent with Hypothesis 2. As discussed above, the sum of $\delta_6 + \delta_8$ is significantly negative at the 1% level. The sum of $\delta_7 + \delta_9$, which measures the relation between debt and non-debt tax shields for all financially distressed firms, is significantly positive at the 1% level—regardless of the Z-score cutoff used to classify a firm as financially distressed. Thus the results support the inference that financially distressed firms do not substitute.

level. The significant F-statistic suggests that tax exhaustion does affect the relation. However, according to the results in Table 1.(5), all non-financially distressed firms substitute—regardless of their proximity to tax exhaustion. Therefore, although tax exhaustion has a statistically significant effect on the relation between debt and non-debt tax shields, the effect is not economically meaningful in the sense that it does not affect whether non-financially distressed firms substitute.

Before summarizing the results, I note that proximity to financial distress can also affect the relation between the dependent and the growth and intangible assets control variables. A financially distressed high growth firm should have less debt than a financially distressed low growth one, ceteris paribus. A high growth firm will lose considerable value if financial distress eventually leads to bankruptcy liquidation because it is likely to have considerable firm specific intangible assets (e.g., human capital). A similar argument applies to a firm with high intangible assets (as a percent of total assets) to the extent that intangible assets are also firm specific. The results are little changed if I account for the two effects.[7]

In addition, I discuss the significantly positive relations that I find between debt and non-debt tax shields. In column (4c) of Table 1.4, the sum of β_6 plus β_7, which measures the relation for financially distressed firms, is significantly positive. Similarly, in columns (5a) and (5b) of Table 1.5, the sums of δ_6 plus δ_7, which measure the relation for financially distressed firms that are close to tax exhaustion, are also significantly positive.

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[7] I account for the two effects by adding two variables to equations (4) and (5), DISTRESS × GROWTH

The positive coefficients are a puzzle because I only predict that they should be non-negative. One possible explanation for the positive coefficients is that a debt securability effect, which overwhelms the substitution effect, exists. Jensen and Meckling (1976) argue that a firm's debt should be positively related to the collateral value of its assets. Because the collateral value of a firm's assets is positively related to its fixed asset depreciation, a firm's debt should also be positively related to its depreciation expense. For financially distressed firms, this positive relation (i.e., the debt securability effect) could be overwhelming the weak or non-existent substitution effect, which in turn gives rise to the positive coefficients.[8]

In summary, I do not find the negative relation between debt and non-debt tax shields that is predicted by DeAngelo and Masulis (1980). After accounting for firms' proximity to financial distress, however, I find a negative relation for only non-financially distressed firms. The finding provides strong support for the inference that financially distressed firms do not substitute because the costs of financial distress outweigh the tax benefit of debt. Moreover, it is unique and the primary contribution of this study to the tax and finance literature. Lastly, the results suggest that firms' proximity to tax exhaustion does not affect whether they substitute.

6. Robustness tests

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and DISTRESS × INTANGIBLE.

[8] The argument raises the possibility that the FIXED control variable is not accurately measuring collateral asset value. In this case, the FIXED coefficient is biased towards zero, and the other coefficients are biased in unknown directions.

In this section, I examine the robustness of the results presented in section 5. Table 1.s 6 and 7 report the coefficients and significance levels for only the tax-based variables from equations (3), (4), and (5). (The tax-based variables are α_6, β_6, $\beta_6 + \beta_7$, δ_6, $\delta_6 + \delta_7$, and $\delta_6 + \delta_8$.) In general, the results are consistent with the ones in section 5. All unreported results are available upon request.

6.1. Financial distress

6.1.1. Altman (1968) Z-score

First, I use the percentiles of the Z-score distribution to identify financially distressed firms because Altman's original cutoffs of 1.81 and 2.99 are no longer valid if there have been significant structural changes since 1968. I assume that firms in the lower 10% or 25% of the Z-score distribution are financially distressed, and create two sets of dummy variables. DISTRESS is equal to one if the firm's Z-score is in the lower 10% or 25% of the distribution and zero otherwise. The cutoffs are arbitrary, but I do not have any reason to believe that one will work better than another. Rows (6c) and (6d) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.[9]

Second, I exclude the capital structure variable, X_4 in equation (1), when calculating Z-score. An endogeneity problem might exist in equations (4) and (5) because a firm's capital structure affects both the dependent and financial distress dummy variables. According to the substitution hypothesis, a firm with low non-debt tax shields should

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[9] I interpret the results as being little changed (different) if the sign and significance level of one or zero

employ greater debt in its capital structure. And because the increase in debt concurrently lowers its Z-score, I could mistakenly infer that some financially distressed firms with low non-debt tax shields also have high debt. I reduce the likelihood of this happening by excluding the capital structure variable when calculating Z-score. I assume that firms in the lower 10% or 25% of the modified Z-score distribution are financially distressed. The correlation between the dummy variables based on Altman's Z-score and the ones based on the modified Z-score is 0.789 if the 10% cutoff is used, and 0.708 if the 25% cutoff is used. Rows (6e) and (6f) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

6.1.2. Ohlson (1980) bankruptcy prediction model

I also use Ohlson's (1980) bankruptcy prediction model to classify a firm as financially or non-financially distressed. The model provides an estimate of the probability of bankruptcy within one year. The probability, π, is defined as

$$[1 + \exp(-X)]^{-1},$$

where

$$X = 1.32 - 0.407\ \mathrm{SIZE} + 6.03\ \mathrm{TLTA} - 1.43\ \mathrm{WCTA} + 0.0757\ \mathrm{CLCA}$$
$$- 2.37\ \mathrm{NITA} - 1.83\ \mathrm{FUTL} + 0.285\ \mathrm{INTWO} - 1.72\ \mathrm{OENEG}$$
$$- 0.521\ \mathrm{CHIN}, \qquad (6)$$

with

SIZE = log(total assets divided by the GNP implicit price deflator, 1996 = 100),

(more than one) of the tax-based variable coefficients are different from the ones in section 5.

TLTA = total liabilities divided by total assets,

WCTA = working capital divided by total assets,

CLCA = current liabilities divided by current assets,

NITA = net income divided by total assets,

FUTL = funds provided by operations divided by total liabilities,

INTWO = 1 if net income was negative for the last two years and zero otherwise,

OENEG = 1 if total liabilities is greater than total assets and zero otherwise,

CHIN = $(NI_t - NI_{t-1})/(|NI_t| + |NI_{t-1}|)$, where NI_t is the net income for period t.

The model is based on a sample of manufacturing firms that went bankrupt between 1970 and 1976 and provides an estimate of the probability of bankruptcy within one year. Using a cutoff of 0.5 to identify bankrupt firms, Ohlson correctly identifies 96% of the firms that go bankrupt in the following year. Burgstahler, Jiambalvo, and Noreen (1989) also use the model to identify financially distressed firms.

I include only firms with SIC codes less than 6000 because Ohlson's (1980) model is applicable to only manufacturing firms. I also apply several screens similar to the ones in section 4. First, I exclude observations if any of the variables necessary to calculate π are missing. This leaves 10,609 firms and 80,019 observations. The figures decrease to 10,142 firms and 72,136 observations if data from only the years 1983 to 1988 are included in the sample. Second, I exclude observations if any of the variables in equations (3), (4), or (5) are missing. This leaves 4,850 firms and 23,375 observations. Third, I exclude observations with zero or negative pretax income. The final sample contains

4,021 firms and 18,024 firm-year observations. The financial distress dummy variable is equal to one if the firm's π is greater than 0.5 and zero otherwise. For the 15,866 observations in both samples, the correlation between the dummy variables based on Ohlson's model and the ones based on Altman's (1968) Z-score is 0.324 if the 1.81 cutoff is used and 0.475 if the 2.99 cutoff is used. Row (6g) of Table 1.6 reports the results for the tax-based variables, which are little changed from the ones in section 5.

6.2. Tax variables

First, I redefine a firm's non-debt tax shields as

$$\text{depreciation and amortization expense} + (\text{investment tax credits}/\tau_c) + (\text{deferred taxes}/\tau_c), \qquad (7)$$

where

τ_c equals the maximum marginal federal corporate tax rate.

Deferred taxes are a surrogate for timing differences between book and tax expenses (Dhaliwal, Trezevant, and Wang, 1992). I gross up the deferred taxes figure so that, similar to depreciation and amortization expense, it measures the amount of income that is shielded from taxation. I divide the sum by earnings before interest, taxes, depreciation, and amortization to control for scale effects. I exclude 1,138 observations because the deferred taxes data item is missing. Rows (6h) and (6i) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

Second, because missing values of the investment tax credits data item used in calculating the non-debt tax shield variable are responsible for many of the excluded observations, I redefine a firm's non-debt tax shields as only depreciation and amortization expense. I divide by earnings before interest, taxes, depreciation, and amortization to control for scale effects. The sample increases to 6,235 firms and 33,275 observations. Rows (6j) and (6k) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

Third, I scale non-debt tax shields—as defined in equation (2)—by the book value of total assets. Rows (6l) and (6m) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

Fourth, I assign firms with zero or negative pretax income a zero effective tax rate. I scale non-debt tax shields by the book value of total assets because of the difficulty of interpreting a non-debt tax shield variable with a positive numerator and a negative denominator. Furthermore, depending on whether the denominator is positive or negative, the non-debt tax shield coefficients have two interpretations. The sample increases to 5,386 firms and 23,965 observations. Rows (6n) and (6o) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

6.3. Dependent and control variables

First, I redefine the dependent variable as the book value of long-term debt divided by the book value of equity. I exclude 3 observations because the book value of equity data item is missing. I also exclude 180 observations with zero or negative book value of equity because of the difficulty of interpreting a debt ratio with a zero or negative denominator. Rows (6p) and (6q) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

Second, I redefine the dependent variable as the book value of short and long-term debt, divided by the book value of total assets. I exclude 167 observations because the short-term debt data item is missing. Rows (6r) and (6s) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

Third, I redefine the profit control variable as the two-year average of earnings before interest, taxes, depreciation and amortization divided by total assets. I also redefine the growth control variable as the two-year average of the percent change in sales. The sample size increases to 4,869 firms and 19,308 observations. Rows (6t) and (6u) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

6.4. Econometric issues

6.4.1. Influential observations

I examine whether the results are significantly different if I remove influential observations from the sample. An influential observation is one that has a demonstrably larger impact on the results than most of the other observations. Two statistics that are widely used for checking whether an observation is influential are DFBETA and DFFITS (Kennedy, 1998).

DFBETA measures the difference between the coefficient when the i^{th} observation is included and excluded, the difference being scaled by the estimated standard error of the coefficient. I remove an observation if the absolute value of one of its DFBETAs is greater than 2/sqrt(n), where n equals the number of observations (Belsley, Kuh, and Welsch, 1980). Rows (6v) and (6w) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

DFFITS is the scaled difference between the predicted values for the i^{th} case when the regression is estimated with and without the i^{th} observation. I remove an observation if its DFFITS is greater than 2sqrt(k/n), where k-1 equals the number of independent variables and n equals the number of observations (Belsley, Kuh, and Welsch, 1980). Rows (6x) and (6y) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

6.4.2. Residual correlation

I examine whether the results are significantly different if I account for residual correlation. The standard errors are biased if the residuals are serially or cross-sectionally correlated. In order to address this issue, I run four additional tests. In the first test, I assume that the residuals for a given firm—not among firms—are correlated and adjust the variance-covariance matrix accordingly.[10] Rows (6z) and (6aa) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

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[10] The adjusted variance-covariance matrix is equal to $V = (X'X)^{-1}\sum_{j=1}^{N} u_j' u_j (X'X)^{-1}$, where

N = number of firms, $u_j = \sum_{i=1}^{n} e_i x_i$, with

n = number of observations for firm j

e_i = ith residual for firm j,

x_i = ith row of X for firm j.

In the second test, I separately estimate equations (3), (4), and (5) for each year from 1983 to 1998. Table 1.7 reports the results for the tax-based variables. The results from equation (3), when examined by themselves, suggest that all firms substitute; α_6 is significantly negative at the 5% level in 10 of the 16 annual regressions. The combined results of equations (3), (4), and (5), however, provide strong support for the inference that only non-financially distressed firms substitute. For example, if the 1.81 cutoff is used in equation (4), β_6 is significantly negative at the 5% level in 14 of the 16 regressions, and the sum of $\beta_6 + \beta_7$ is never significantly negative; similarly, in equation (5), δ_6 is significantly negative at the 5% level in 11 of the 16 regressions, and the sum of δ_6 plus δ_7 is never significantly negative.

In the third test, I calculate the mean of the annual tax variable coefficients from equations (3), (4), and (5). Because the coefficients from successive annual regressions are unlikely to be independent, it is important to account for serial correlation in the coefficients when estimating the standard error of their mean. I adjust the standard errors using the method in Abarbanell and Bernard (2000), who assume that the annual coefficients are first-order autocorrelated. They multiply the standard error by the square root of $[(1+\rho)/(1-\rho)] - [2\rho(1-\rho^n)/n(1-\rho)^2]$, where ρ is the estimated first-order autocorrelation of the annual coefficients and n equals the number of years. The last three rows of Panels A and B of Table 1.7 report the results, which are consistent with the ones from the annual regressions.

In the fourth test, I estimate equations (3), (4), and (5) with industry dummy variables because the residuals may exhibit a systematic pattern associated with industry differences if debt ratios differ according to industry. The dummy variables are based on two-digit SIC codes. Rows (6bb) and (6cc) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

6.4.3. Other econometric issues

First, consistent with Rajan and Zingales (1995), I lag the independent variables one year to reduce the problem of endogeneity. The sample decreases to 15,318 observations. Rows (6dd) and (6ee) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

Second, I estimate equations (3), (4), and (5) using a fixed effects model to account for the effects of any unknown, omitted variables that are specific to individual firms but stay constant over time. Rows (6ff) and (6gg) of Table 1.6 report the results for the tax-based variables, which are little changed from the ones in section 5.

Prior studies use tobit models because the dependent variables (debt ratios) are censored at zero.[11] According to Maddala (1991), however, this is an inappropriate use of the tobit model; a firm has a zero debt ratio because it chooses not to issue any debt, not because debt ratios below zero are unobservable. Thus I do not use a tobit model to estimate equations (3), (4), and (5).

6.5. Summary of robustness tests

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[11] Anderson and Makhija (1999), Graham (1999), Wald (1999).

Rows (6hh) and (6ii) of Table 1.6 summarize the results in rows (6c) to (6gg). The summary statistics confirm the robustness of the results in section 5. More importantly, they illustrate the importance of accounting for financial distress when examining whether firms substitute. For non-financially distressed firms, the relation between debt and non-debt tax shields is significantly negative at the 5% level in 28 of the 31 regressions; moreover, the relation is never significantly negative for financially distressed firms.

7. Conclusion

In this study, I examine whether a firm's proximity to both financial distress and tax exhaustion affects whether debt is negatively related to non-debt tax shields. I find that debt is negatively related to non-debt tax shields for only non-financially distressed firms. The finding is supportive of the inference that financially distressed firms do not substitute because the costs of financial distress outweigh the tax benefit of debt. The results also suggest that firms' proximity to tax exhaustion does not affect whether they substitute.

This study contributes to the tax and finance literature in two ways. First, it shows that a firm's proximity to financial distress affects its financing decisions and thus helps to explain why some studies fail to find that debt is negatively related to non-debt tax shields (e.g., Bradley, Jarrell, and Kim, 1984; Titman and Wessels, 1988). Second, it adds to the growing number of studies which show that firms also consider non-tax costs when they make business decisions (e.g., Matsunaga, Shevlin, and Shores, 1992; Hunt, Moyer, and Shevlin, 1996).

This study also suggests two directions for future research. In Study 2, I examine the role of financial distress (in determining whether firms substitute) in a business environment where membership in large industrial groups affects the costs of financial distress. More specifically, I examine the financing decisions of Japanese firms because financial distress costs should be lower for a firm that is a member of a keiretsu. The second direction for future research is to examine whether the result in this study—that financially distressed firms behave differently than non-financially distressed ones—generalizes to the results from other studies that examine whether taxes affect firm behavior. For example, several studies examine whether firms engage in tax-motivated income shifting across time (e.g., Scholes, Wilson, and Wolfson, 1992; Guenther, 1994) or across jurisdictions (e.g., Collins, Kemsley, and Shackelford, 1997; Collins, Kemsley, and Lang, 1998).

Table 1.1
Predictions

This table contains the predicted signs for the control and tax variable coefficients from equations (3), (4), and (5). H1 to H4a refer to Hypotheses 1 to 4a, respectively. * corresponds to a non-negative predicted sign.

		Control variables	H1	H2	H3	H3a	H4	H4a
FIXED	$\alpha_1/\beta_1/\delta_1$	+						
INTANGIBLE	$\alpha_2/\beta_2/\delta_2$	–						
INVENTORY	$\alpha_3/\beta_3/\delta_3$	+						
PROFITABILITY	$\alpha_4/\beta_4/\delta_4$	+/–						
GROWTH	$\alpha_5/\beta_5/\delta_5$	–						
NDTS	$\alpha_6/\beta_6/\delta_6$		–	–	–	–	–	–
	$\beta_6 + \beta_7$			*				
	$\delta_6 + \delta_7$				*	–		
	$\delta_6 + \delta_8$						*	–

Table 1.2
Descriptive statistics

Panel A: Final sample

	Mean	Standard deviation	Median
Long-term debt[a]	0.192	0.164	0.173
Fixed[b]	0.378	0.238	0.322
Intangible[c]	0.054	0.100	0.005
Inventory[d]	0.173	0.150	0.150
Profitability[e]	0.158	0.096	0.153
Growth[f]	0.616	24.419	0.099
NDTS[g]	0.327	0.674	0.291
Z-score[h]	4.321	14.149	3.585
Effective tax rate[i]	0.337	3.974	0.379
N	18054		

Panel B: Firm-year observations are partitioned into two groups using Altman's (1968) Z-score.[h]

	Financially distressed (Z-score < 1.81)			Non-financially distressed (Z-score ≥ 1.81)		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Long-term debt[a]	0.355	0.184	0.342	0.162	0.142	0.142
Fixed[b]	0.629	0.259	0.729	0.333	0.204	0.293
Intangible[c]	0.051	0.126	0.000	0.055	0.095	0.009
Inventory[d]	0.053	0.083	0.025	0.194	0.149	0.177
Profitability[e]	0.117	0.130	0.126	0.165	0.086	0.162
Growth[f]	0.393	6.642	0.066	0.656	26.367	0.105
NDTS[g]	0.349	1.406	0.318	0.323	0.426	0.285
Effective tax rate[i]	0.408	5.788	0.357	0.324	3.552	0.381
N	2744			15310		

Panel C: Firm-year observations are partitioned into two groups using Altman's (1968) Z-score.[h]

	Financially distressed (Z-score < 2.99)			Non-financially distressed (Z-score ≥ 2.99)		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Long-term debt[a]	0.301	0.166	0.297	0.127	0.124	0.103
Fixed[b]	0.513	0.265	0.550	0.299	0.179	0.270
Intangible[c]	0.061	0.117	0.000	0.050	0.088	0.007
Inventory[d]	0.111	0.128	0.056	0.209	0.150	0.197
Profitability[e]	0.127	0.099	0.131	0.176	0.089	0.173
Growth[f]	0.353	5.009	0.075	0.772	30.589	0.112
NDTS[g]	0.377	1.024	0.344	0.297	0.314	0.258
Effective tax rate[i]	0.316	6.442	0.368	0.349	0.716	0.382
N	6730			11324		

See next page for variable definitions.

Table 1.2 continued
Descriptive statistics

[a] Book value of long-term debt divided by book value of total assets.
[b] Net property, plant, and equipment divided by book value of total assets.
[c] Net intangible assets divided by book value of total assets.
[d] Inventory divided by book value of total assets.
[e] Four-year average of earnings before interest, taxes, depreciation, and amortization divided by book value of total assets.
[f] Four-year average of the percent change in net sales.
[g] Sum of depreciation and amortization expense plus investment tax credits grossed up by the maximum marginal federal corporate tax rate, divided by earnings before interest, taxes, depreciation, and amortization.
[h] Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).
[i] Total income tax expense divided by pretax income.
[j] Tests the null hypothesis that the means in Panel A are equal to the means in Panel D.

Table 1.3
Correlation coefficients

Final sample. N=18,054.

	Long-term debt	Fixed	Intangibles	Inventory	Profitability	Growth	NDTS	Z-score	Effective tax rate
Long-term debt[a]	1.000								
Fixed[b]	0.381**	1.000							
Intangible[c]	0.163**	-0.276**	1.000						
Inventory[d]	-0.159**	-0.464**	-0.131**	1.000					
Profitability[e]	-0.117**	0.068**	-0.032**	-0.057**	1.000				
Growth[f]	-0.016*	0.000	-0.001	-0.012	0.025**	1.000			
NDTS[g]	0.015*	0.067**	-0.009	-0.043**	-0.049**	-0.002	1.000		
Z-score[h]	-0.116**	-0.074**	-0.012	0.029**	-0.276**	0.008	-0.014	1.000	
Effective tax rate[i]	-0.001	-0.014	0.027**	0.005	0.007	0.000	-0.023**	0.001	1.000

** and *, statistically significant at the 1 and 5 percent levels.[j]

[a] Book value of long-term debt divided by book value of total assets.
[b] Net property, plant, and equipment divided by book value of total assets.
[c] Net intangible assets divided by book value of total assets.
[d] Inventory divided by book value of total assets.
[e] Four-year average of earnings before interest, taxes, depreciation, and amortization divided by book value of total assets.
[f] Four-year average of the percent change in net sales.
[g] Sum of depreciation and amortization expense plus investment tax credits grossed up by the maximum marginal federal corporate tax rate, divided by earnings before interest, taxes, depreciation, and amortization.
[h] Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).
[i] Total income tax expense divided by pretax income.
[j] The significance level is calculated using a t-test with n – 2 degrees of freedom. The t-statistic is equal to $\rho(n-2)^{1/2}/(1-\rho^2)^{1/2}$, where ρ is the estimated correlation coefficient.

Table 1.4
Pooled cross-sectional time-series regressions – Equations (3) and (4)

Column (4a) contains the results from estimating equation (3). Columns (4b) and (4c) contain the results from estimating equation (4). The dependent variable is the book value of long-term debt divided by the book value of total assets. Annual dummy variables are included in the regression, but the coefficients are not reported. White's (1980) standard errors are in parenthesis. N= 18,054.

		(4a)	(4b) Z-score[a] < 1.81	(4c) Z-score < 2.99
Intercept	α_0/β_0	0.046**	0.056**	0.069**
		(0.009)	(0.009)	(0.011)
Fixed[b]	α_1/β_1	0.369**	0.363**	0.345**
		(0.005)	(0.005)	(0.007)
Intangible[c]	α_2/β_2	0.537**	0.533**	0.508**
		(0.017)	(0.017)	(0.018)
Inventory[d]	α_3/β_3	0.131**	0.134**	0.139**
		(0.008)	(0.008)	(0.008)
Profitability[e]	α_4/β_4	-0.242**	-0.242**	-0.223**
		(0.043)	(0.043)	(0.040)
Growth[f]	α_5/β_5	-0.067**	-0.067**	-0.066**
		(0.011)	(0.011)	(0.011)
NDTS[g]	α_6/β_6	-0.005	-0.036**	-0.099**
		(0.004)	(0.009)	(0.028)
DISTRESS[h] × NDTS	β_7		0.047**	0.109**
			(0.011)	(0.027)
	$\beta_6 + \beta_7$		0.011	0.009*
			(0.007)	(0.005)
F statistic		271.68**	264.96**	272.38**
R^2		0.257	0.266	0.289

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests.

[a] Altman (1968) Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).
[b] Net property, plant, and equipment divided by book value of total assets.
[c] Net intangible assets divided by book value of total assets.
[d] Inventory divided by book value of total assets.
[e] Four-year average of earnings before interest, taxes, depreciation, and amortization divided by book value of total assets.
[f] Four-year average of the percent change in net sales (÷ 1000).
[g] Sum of depreciation and amortization expense plus investment tax credits grossed up by the maximum marginal federal corporate tax rate, divided by earnings before interest, taxes, depreciation, and amortization.
[h] Dummy variable based on Altman's (1968) Z-score. DISTRESS is equal to one if the firm's Z-score is in the indicated cutoff and zero otherwise.

Table 1.5
Pooled cross-sectional time-series regressions – Equation (5)

This table contain the results from estimating equation (5). The dependent variable is the book value of long-term debt divided by the book value of total assets. Annual dummy variables are included in the regression, but the coefficients are not reported. White's (1980) standard errors are in parenthesis. N= 18,054.

		(5a) Z-score[a] < 1.81	(5b) Z-score < 2.99
Intercept	δ_0	0.053**	0.073**
		(0.009)	(0.009)
Fixed[b]	δ_1	0.359**	0.341**
		(0.005)	(0.006)
Intangible[c]	δ_2	0.534**	0.511**
		(0.017)	(0.017)
Inventory[d]	δ_3	0.140**	0.151**
		(0.008)	(0.008)
Profitability[e]	δ_4	-0.228**	-0.195**
		(0.041)	(0.036)
Growth[f]	δ_5	-0.068**	-0.067**
		(0.010)	(0.009)
NDTS[g]	δ_6	-0.029**	-0.065**
		(0.008)	(0.023)
DISTRESS[h] × NDTS	δ_7	0.129**	0.083**
		(0.017)	(0.023)
	$\delta_6 + \delta_7$	0.101**	0.019**
		(0.016)	(0.008)
ETR_{high}[i] × NDTS	δ_8	-0.008	-0.113**
		(0.013)	(0.020)
	$\delta_6 + \delta_8$	-0.037**	-0.177**
		(0.013)	(0.013)
ETR_{high} × DISTRESS × NDTS	δ_9	-0.085**	0.100**
		(0.022)	(0.021)
F statistic		252.22**	275.27**
R^2		0.271	0.300

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests.

[a] Altman (1968) Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).
[b] Net property, plant, and equipment divided by book value of total assets.
[c] Net intangible assets divided by book value of total assets.
[d] Inventory divided by book value of total assets.
[e] Four-year average of earnings before interest, taxes, depreciation, and amortization divided by book value of total assets.
[f] Four-year average of the percent change in net sales (÷ 1000).

Table 1.5 continued
Pooled cross-sectional time-series regressions – Equation (5)

[g] Sum of depreciation and amortization expense plus investment tax credits grossed up by the maximum marginal federal corporate tax rate, divided by earnings before interest, taxes, depreciation, and amortization.
[h] Dummy variable based on Altman's (1968) Z-score. DISTRESS is equal to one if the firm's Z-score is in the indicated cutoff and zero otherwise.
[i] ETR_{high} is a dummy variable based on the effective tax rate, total income tax expense divided by pretax income. ETR_{high} is equal to one if the firm's effective tax rate is in the second, third, or fourth quartile of the distribution and zero otherwise.

Table 1.6
Robustness tests

This table contains the tax variable coefficients from the robustness tests in section 6. Annual dummy variables are included in the regressions. The standard errors are adjusted using White's (1980) method. Underlined (boldface) indicates that the sign (significance level) is different from the section 5 regressions. Underlined and boldface indicates that both the sign and significance level are different.

		Equation (3) α_6	Equation (4) β_6	Equation (4) $\beta_6 + \beta_7$	Equation (5) δ_6	Equation (5) $\delta_6 + \delta_7$	Equation (5) $\delta_6 + \delta_8$
	Section 5 results						
(6a)	1.81 cutoff	-0.005	-0.036**	0.011	-0.029**	0.101**	-0.037**
(6b)	2.99 cutoff		-0.099**	0.009*	-0.065**	0.019**	-0.177**
	Financial distress						
(6c)	Percentile Z-score distribution[a] – 10th		-0.030**	0.009	-0.024**	0.108**	-0.031**
(6d)	Percentile Z-score distribution – 25th		-0.067**	0.011*	-0.046**	0.057**	-0.108**
(6e)	Modified Z-score[b] – 10th percentile		-0.021**	0.004*	-0.016**	0.020	-0.025**
(6f)	Modified Z-score – 25th percentile		-0.042**	0.004*	-0.027**	0.009	-0.071**
(6g)	Ohlson (1980)[c]	-0.005	-0.215**	0.004*	-0.145**	0.006	-0.317**
	Tax variables						
(6h)	Deferred taxes[d] – 1.81 cutoff	-0.001*	-0.005*	0.010	-0.003*	0.064**	-0.010*
(6i)	Deferred taxes – 2.99 cutoff		-0.009	0.007*	-0.004	0.013*	-0.093**
(6j)	Depreciation and amortization[e] – 1.81 cutoff	-0.003**	-0.032**	0.006	-0.026**	0.004	-0.037**
(6k)	Depreciation and amortization – 2.99 cutoff		-0.096**	0.006*	-0.076**	0.004	-0.111*
(6l)	Scale by total assets[f] – 1.81 cutoff	-0.317**	-0.378**	1.427**	-0.275*	1.185**	-0.568**
(6m)	Scale by total assets – 2.99 cutoff		-0.635**	0.875**	-0.444*	0.644**	-0.992**

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests. See next page for test definitions.

Table 1.6 continued
Robustness tests

		Equation (3) α_6	Equation (4) β_6	Equation (4) $\beta_6+\beta_7$	Equation (5) δ_6	Equation (5) $\delta_6+\delta_7$	Equation (5) $\delta_6+\delta_8$
(6n)	Negative pretax income[g] – 1.81 cutoff	-0.018*	-0.040	0.149*	-0.015*	0.067	-0.767**
(6o)	Negative pretax income – 2.99 cutoff		-0.045	0.178**	-0.014*	0.067	-1.612**
	Dependent & control variables						
(6p)	Book value equity[h] – 1.81 cutoff	0.050	-0.259**	0.209	-0.142**	3.358	-0.188**
(6q)	Book value equity – 2.99 cutoff		-0.498**	0.133	-0.289**	0.776	-0.829**
(6r)	Total debt[i] – 1.81 cutoff	-0.005	-0.044**	0.017	-0.031**	0.153**	-0.048**
(6s)	Total debt – 2.99 cutoff		-0.128**	0.014*	-0.081*	0.035**	-0.241**
(6t)	Profit and growth measured over 2 years[j] – 1.81 cutoff	-0.004	-0.033**	0.013	-0.023**	0.111**	-0.039**
(6u)	Profit and growth measured over 2 years – 2.99 cutoff		-0.104**	0.010*	-0.068**	0.017**	-0.184**
	Econometric issues						
(6v)	DFBETA[k] – 1.81 cutoff	-0.014**	-0.063**	0.055**	-0.053**	0.111**	-0.062**
(6w)	DFBETA – 2.99 cutoff		-0.144**	0.025**	-0.123**	0.018**	-0.189**
(6x)	DFFITS[l] – 1.81 cutoff	-0.009**	-0.046**	0.010	-0.039**	0.054**	-0.051**
(6y)	DFFITS – 2.99 cutoff		-0.109**	0.009	-0.081*	0.011	-0.172**
(6z)	Adjusted variance/covariance[m] – 1.81 cutoff	-0.005	-0.036**	0.011	-0.029**	0.101**	-0.037**
(6aa)	Adjusted variance/covariance – 2.99 cutoff		-0.099**	0.009*	-0.065**	0.019**	-0.177**
(6bb)	Industry dummy variables[n] – 1.81 cutoff	-0.003	-0.029**	0.009	-0.021**	0.088**	-0.032**
(6cc)	Industry dummy variables – 2.99 cutoff		-0.091**	0.009*	-0.057**	0.021**	-0.172**
(6dd)	Lagged independent variables[o] – 1.81 cutoff	-0.004	-0.040**	0.010	-0.032**	0.093**	-0.047**
(6ee)	Lagged independent variables – 2.99 cutoff		-0.092**	0.009*	-0.063**	0.013*	-0.154**

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests. See next page for test definitions.

Table 1.6 continued
Robustness tests

		Equation (3) α_6	Equation (4) β_6	Equation (4) $\beta_6 + \beta_7$	Equation (5) δ_6	Equation (5) $\delta_6 + \delta_7$	Equation (5) $\delta_6 + \delta_8$
(6ff)	Fixed effects[p] – 1.81 cutoff	0.001	-0.010**	0.004**	-0.004	0.037**	-0.016**
(6gg)	Fixed effects – 2.99 cutoff		-0.037**	0.005**	-0.022**	0.015**	-0.077**
	Summary (Rows 6c to 6gg)						
(6hh)	Significantly negative at 5% level or better	6/14	28/31	0/31	29/31	0/29	31/31
(6ii)	Significantly positive at 5% level or better	0/14	0/31	19/31	0/31	21/31	0/31

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests.

[a] The financial distress dummy variable, DISTRESS, is calculated using Altman's (1968) Z-score. DISTRESS is equal to one if the firm's Z-score is in the lower 10% or 25% of the distribution and zero otherwise. Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).

[b] The financial distress dummy variable is equal to one if the firm's modified Z-score is in the lower 10% or 25% of the modified Z-score distribution and zero otherwise. Modified Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 1.0 (sales/total assets).

[c] The financial distress dummy variable, DISTRESS, is calculated using Ohlson's (1980) bankruptcy prediction model. DISTRESS is equal to one if the firm's probability of bankruptcy, π, is greater than 0.5 and zero otherwise. $\pi = [1 + \exp(-x)]^{-1}$, where $x = -1.32 - 0.407$ SIZE + 6.03 TLTA – 1.43 WCTA + 0.0757 CLCA – 2.37 NITA – 1.83 FUTL + 0.285 INTWO – 1.72 OENEG – 0.521 CHIN, with SIZE = log(book value of total assets divided by the GNP price-level index), TLTA = total liabilities divided by book value of total assets, WCTA = working capital divided by book value of total assets, CLCA = current liabilities divided by current assets, NITA = net income divided by book value of total assets, FUTL = funds provided by operations divided by total liabilities, INTWO = 1 if net income was negative for the last two years and zero otherwise, OENEG = 1 if total liabilities is greater than book value of total assets and zero otherwise,
CHIN = $(NI_t - NI_{t-1})/(|NI_t| + |NI_{t-1}|)$, where NI_t is the net income for period t. The results are compared to the ones in Row (6b).

[d] The non-debt tax shields variable is [depreciation and amortization expense + (investment tax credits/τ_c) + (deferred taxes/τ_c)] + earnings before interest, taxes, depreciation, and amortization, where τ_c equals the maximum marginal federal corporate tax rate.

[e] The non-debt tax shields variable is depreciation and amortization expense divided by earnings before interest, taxes, depreciation, and amortization.

[f] The non-debt tax shields variable is [depreciation and amortization expense + (investment tax credits/τ_c)] + book value of total assets, where τ_c equals the maximum marginal federal corporate tax rate.

[g] Firms with zero or negative pretax income are assigned a zero effective tax rate. The non-debt tax shields variable is [depreciation and amortization expense + (investment tax credits/τ_c)] + book value of total assets, where τ_c equals the maximum marginal federal corporate tax rate.

Table 1.6 continued

Robustness tests

[h] The dependent variable is the book value of long-term debt divided by the book value of equity.

[i] The dependent variable is the book value of short and long-term debt, divided by the book value of total assets.

[j] The profit control variable is the two-year average of earnings before interest, taxes, depreciation and amortization divided by total assets. The growth control is the two-year average of the percent change in sales.

[k] Observations are eliminated if the absolute value of one of its DFBETAs is greater than 2/sqrt(n), where n equals the number of observations.

[l] Observations are eliminated if its DFFITS is greater than 2sqrt(k/n), where k-1 equals the number of independent variables and n equals the number of observations.

[m] The adjusted variance-covariance matrix is equal to $V = (X'X)^{-1} \sum_{j=1}^{N} u_j' u_j (X'X)^{-1}$, where

N = number of firms, $u_j = \sum_{i=1}^{n} e_i x_i$, with

n = number of observations for firm j

e_i = ith residual for firm j,

x_i = ith row of X for firm j.

[n] The empirical models contain industry dummy variables based on two-digit SIC codes.

[o] The independent variables are lagged one year.

[p] The empirical models are estimated using a fixed effects model.

Table 1.7
Annual regressions

This table contains the tax variable coefficients from annually estimating equations (3), (4), and (5). Annual dummy variables are included in the regressions. The standard errors are adjusted using White's (1980) method.

Panel A: Financial distress dummy variable is equal to one if Z-score[a] is less than 1.81 and zero otherwise.

Year	N	Equation (3) α_6	Equation (4) β_6	Equation (4) $\beta_6 + \beta_7$	Equation (5) δ_6	Equation (5) $\delta_6 + \delta_7$	Equation (5) $\delta_6 + \delta_8$
1983	1573	-0.073**	-0.069**	0.202**	-0.058**	0.275**	-0.095**
1984	1488	-0.008**	-0.008**	0.255**	-0.008	0.277**	-0.009**
1985	1299	-0.027	-0.067**	0.092**	-0.040**	0.092	-0.125**
1986	1213	-0.027*	-0.032*	0.180**	-0.063**	0.109*	-0.027*
1987	1108	-0.024**	-0.084**	0.010	-0.073**	0.154**	-0.075**
1988	987	-0.065**	-0.093**	0.147**	-0.096**	0.124**	-0.087**
1989	973	-0.010	-0.104**	0.097*	-0.115**	0.069	-0.081**
1990	922	-0.039	-0.049	0.173**	-0.055*	0.172**	-0.045
1991	904	-0.002	-0.008	0.138**	-0.006	0.170**	-0.015
1992	898	-0.006**	-0.012**	0.029	-0.012	0.117**	-0.010
1993	843	-0.005	-0.048**	0.003*	-0.052**	0.022	-0.040*
1994	844	-0.030	-0.113**	0.052*	-0.107**	0.038	-0.093**
1995	831	-0.002**	-0.155**	0.002**	-0.183**	-0.011	-0.142**
1996	1012	-0.026**	-0.064*	0.001	-0.046	0.119*	-0.096**
1997	1703	-0.019*	-0.046*	0.091*	-0.038*	0.149**	-0.062**
1998	1456	-0.013*	-0.023*	0.163**	-0.017	0.045	-0.035**
Significantly negative at 5% level or better		10/16	14/16	0/16	11/16	0/16	13/16
Significantly positive at 5% level or better		0/16	0/16	13/16	0/16	10/16	0/16
Mean		-0.023**	-0.061**	0.102**	-0.061**	0.120**	-0.065**
Standard error[b]		0.001	0.003	0.005	0.003	0.005	0.003
Adjusted standard error[c]		0.001	0.004	0.007	0.004	0.008	0.003

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests. See next page for variable definitions.

Table 1.7 continued
Annual regressions

Panel B: Financial distress dummy variable is equal to one if Z-score[a] is less than 2.99 and zero otherwise.

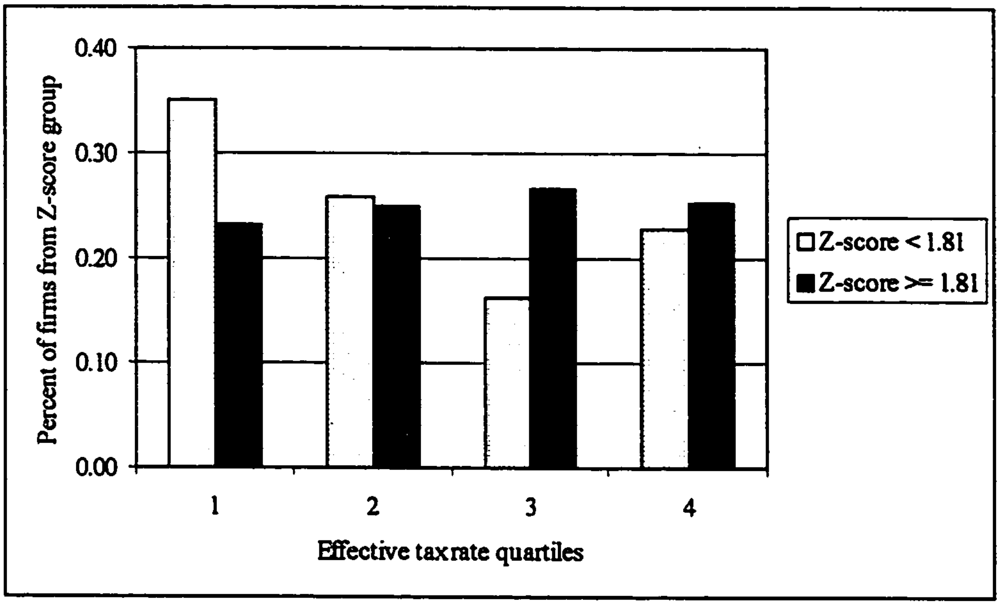
Year	Equation (4) β_6	Equation (4) $\beta_6 + \beta_7$	Equation (5) δ_6	Equation (5) $\delta_6 + \delta_7$	Equation (5) $\delta_6 + \delta_8$
1983	-0.157**	0.028	-0.132**	0.023	-0.207**
1984	-0.165**	-0.005	-0.134**	0.002	-0.203**
1985	-0.112**	0.050*	-0.082**	0.063**	-0.199**
1986	-0.189**	-0.004	-0.166**	-0.047*	-0.222**
1987	-0.247**	-0.003	-0.197**	0.049*	-0.279**
1988	-0.183**	0.078**	-0.201**	0.073**	-0.170**
1989	-0.175**	0.063**	-0.164**	0.047**	-0.181**
1990	-0.182**	0.059**	-0.179**	0.077*	-0.184**
1991	-0.155**	0.024	-0.165**	0.017	-0.129**
1992	-0.019	0.020	-0.012	0.014	-0.092**
1993	-0.159**	0.001	-0.155**	-0.026**	-0.164**
1994	-0.208**	0.036*	-0.186**	0.017	-0.193**
1995	-0.252**	0.002**	-0.253**	-0.051	-0.266**
1996	-0.085	0.005	-0.050	0.012	-0.211**
1997	-0.065*	0.109**	-0.042	0.093*	-0.126**
1998	-0.051	0.072	-0.030	0.015	-0.142**
Significantly negative at 5% level or better	13/16	0/16	12/16	2/16	16/16
Significantly positive at 5% level or better	0/16	7/16	0/16	6/16	0/16
Mean	-0.150**	0.033**	-0.134**	0.024**	-0.186**
Standard error[b]	0.004	0.002	0.004	0.003	0.003
Adjusted standard error[c]	0.006	0.003	0.006	0.003	0.005

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests.

[a] Altman (1968) Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).
[b] Standard deviation of the annual coefficients divided by the number of years.

Table 1.7 continued
Annual regressions

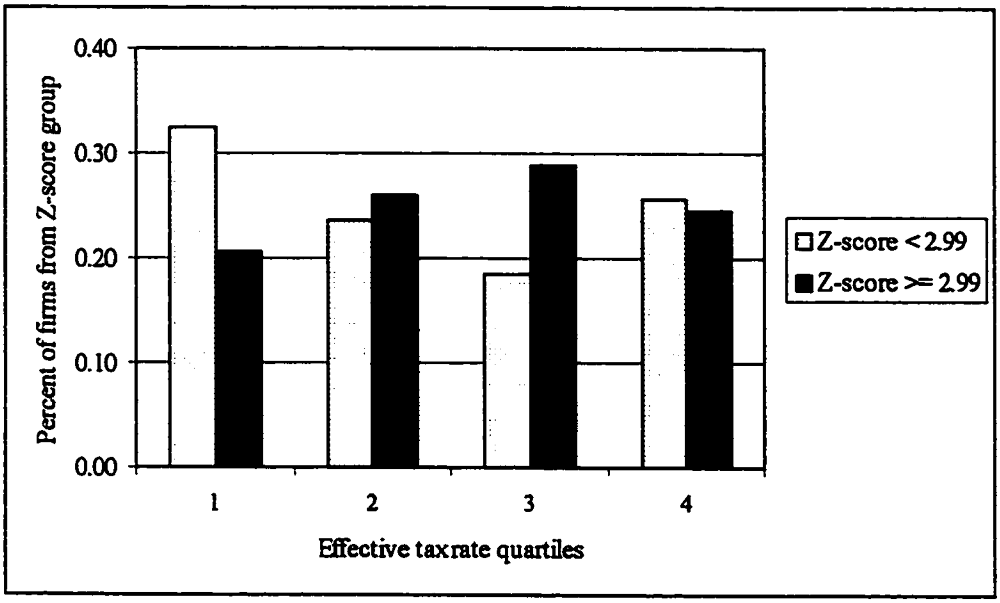
[a] The standard errors are adjusted using the method in Abarbanell and Bernard (2000). They multiply the standard error times the square root of $[(1+\rho)/(1-\rho)] - [2\rho(1-\rho^n)/n(1-\rho)^2]$, where ρ is the estimated first-order autocorrelation of the annual coefficients and $n = 16$.



Firms are partitioned into two groups using Altman's (1968) Z-score.[a] The figure shows the percent of firms from each group that has an effective tax rate, total income tax expense divided by pretax income, that falls in a particular quartile of the effective tax rate distribution. For example, approximately 35% of the firms with a Z-score less than 1.81 have effective tax rates that fall in the first quartile of the effective tax rate distribution.

[a] Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).

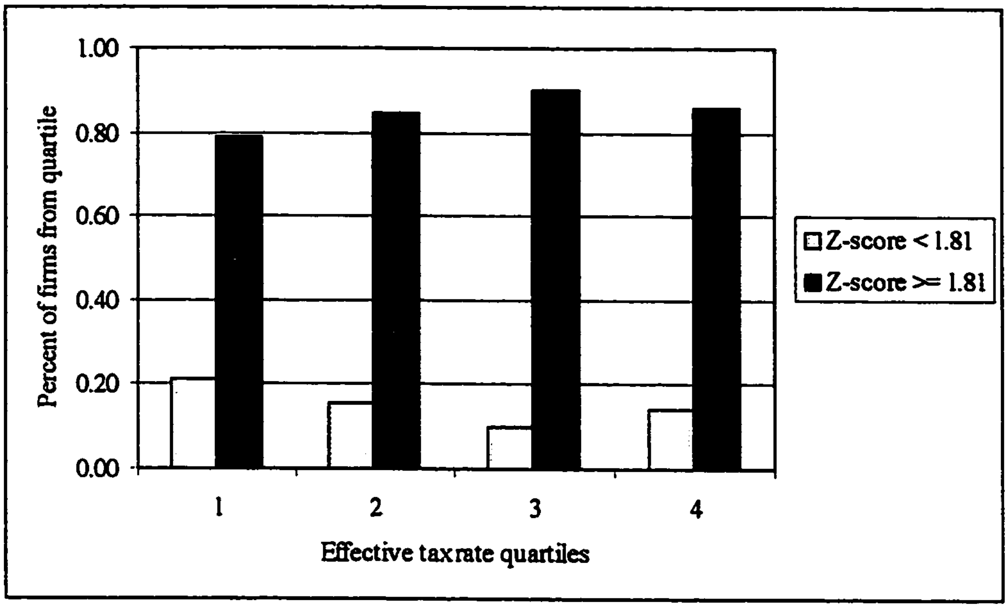
Figure 1.1
Effective tax rates of low and high Z-score firms – 1.81 cutoff



Firms are partitioned into two groups using Altman's (1968) Z-score.[a] The figure shows the percent of firms from each group that has an effective tax rate, total income tax expense divided by pretax income, that falls in a particular quartile of the effective tax rate distribution. For example, approximately 32% of the firms with a Z-score less than 2.99 have effective tax rates that fall in the first quartile of the effective tax rate distribution.

[a] Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).

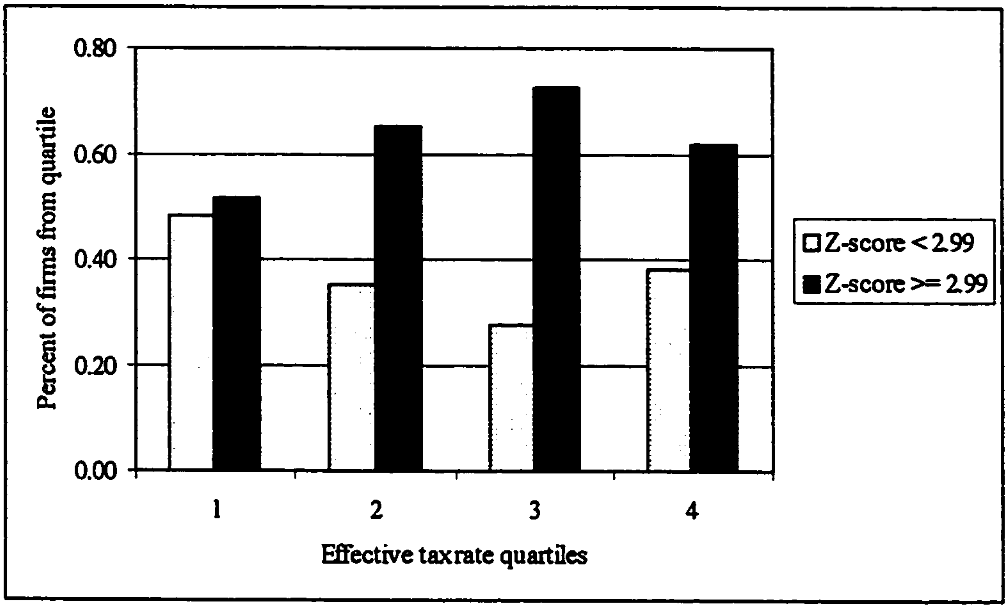
Figure 1.2
Effective tax rates of low and high Z-score firms – 2.99 cutoff



Firms are partitioned into two groups using Altman's (1968) Z-score.[a] The figure shows the percent of firms from each quartile of the effective tax rate distribution with a Z-score less than 1.81, or greater than or equal to 1.81. The effective tax rate is defined as total income tax expense divided by pretax income. For example, approximately 21% of the firms in the first quartile of the effective tax rate distribution have Z-scores less than 1.81.

[a] Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).

Figure 1.3
Z-scores of firms from each effective tax rate quartile – 1.81 cutoff



Firms are partitioned into two groups using Altman's (1968) Z-score.[a] The figure shows the percent of firms from each quartile of the effective tax rate distribution with a Z-score less than 2.99, or greater than or equal to 2.99. The effective tax rate is defined as total income tax expense divided by pretax income. For example, 48% of the firms in the first quartile of the effective tax rate distribution have Z-scores less than 2.99.

[a] Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).

Figure 1.4
Z-scores of firms from each effective tax rate quartile – 2.99 cutoff

Study 2: Taxes, Financial Distress, and Capital Structure in Japan

1. Introduction

DeAngelo and Masulis (1980) predict that in a cross-sectional analysis, firms with lower non-debt, non-cash tax shields will employ greater debt in their capital structures (i.e., debt will be negatively related to non-debt tax shields).[12] In this study, I examine whether Japanese firms' proximity to financial distress, keiretsu membership, and proximity to tax exhaustion affect whether they substitute.

Scholes and Wolfson (1992) stress that effective tax planning requires a firm to consider both the tax and non-tax costs of its financing decisions. Financial distress costs are a non-tax cost of debt financing. If they are high enough, the non-tax costs of debt will outweigh the tax benefit of debt, and a financially distressed firm with low non-debt tax shields should not employ greater debt in its capital structure. The results in Study 1 support this argument. I find a negative relation for only non-financially distressed U.S. firms, which suggests that—because the costs of financial distress outweigh the tax benefit of debt—financially distressed firms do not substitute.

In Japan, all financially distressed firms are not alike. A firm that is a member of a keiretsu should have lower financial distress costs than one that is not a member of a keiretsu, ceteris paribus. If keiretsu firms do have lower financial distress costs, one

[12] Because DeAngelo and Masulis (1980) argue that non-debt tax shields "provide firms with substitutes for the corporate tax shield attributes of debt," Dhaliwal, Trezevant, and Wang (1992) and Trezevant (1992) call this hypothesis the *substitution* hypothesis. Similarly, the negative relation between debt and non-debt tax shields is the *substitution* effect, and firms *substitute* if debt is negatively related to non-debt

should also account for keiretsu membership when examining whether Japanese firms substitute.

Finally, MacKie-Mason (1990) argues it is important to take a firm's proximity to tax exhaustion into account when examining whether taxes affect its financing decisions. A firm reaches tax exhaustion when its tax shields, debt and non-debt, are greater than its taxable income. He predicts that a dollar of non-debt tax shields will crowd out an additional dollar of debt tax shields only when a firm is close to tax exhaustion. If his prediction is correct, debt should be negatively related to non-debt tax shields for only firms that are close to tax exhaustion.

I examine the financing decisions of Japanese firms for two reasons. First, their financing decisions are important in their own right because Japan is the world's second largest economy. Second, it provides an opportunity to extend Study 1. The results in Study 1 suggest that financial distress costs affect whether U.S. firms substitute. I extend the study by examining two groups of Japanese firms—keiretsu and non-keiretsu—for which financial distress costs should be different. If financial distress costs are lower for keiretsu firms, financial distress should have a smaller effect on their financing decisions when compared to non-keiretsu firms, ceteris paribus.

I first examine whether Japanese firms substitute, regardless of their proximity to financial distress, keiretsu membership, and proximity to tax exhaustion. Contrary to prior studies that find a negative relation between debt and non-debt tax shields, I find that the

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tax shields. I also use this terminology.

relation is positive.[13] The positive relation suggests that Japanese firms do not substitute.

In the second and third sets of empirical tests, I examine whether Japanese firms' proximity to financial distress, keiretsu membership, and proximity to tax exhaustion affect whether they substitute. I use Ko's (1982) Z-$score_j$ to measure a firm's proximity to financial distress and assume that a firm with a negative (standardized) Z-$score_j$ is close to financial distress. I measure a firm's proximity to tax exhaustion using the effective tax rate, total income taxes divided by pretax income and assume that a firm with a low effective tax rate is close to tax exhaustion. Even after taking financial distress, keiretsu membership, and tax exhaustion into consideration, I still find that the relation between debt and non-debt tax shields is positive. Thus the results suggest that Japanese firms do not substitute, regardless of financial distress, keiretsu membership, and tax exhaustion.

Before concluding the study, I investigate why I find a positive (not negative as predicted) relation between debt and non-debt tax shields in Japan. A possible explanation is that a debt securability effect, which overwhelms the substitution effect, exists in Japan. I also examine why the results are inconsistent with prior studies that do find a negative relation.

The remainder of the study proceeds as follows. In section 2, I develop the hypotheses to be tested. In section 3, I describe the methodology that I use to test the hypotheses. In section 4, I describe the sample and report summary statistics. In section 5, I report the results of the empirical tests. In section 6, I examine why the results in sections 5 are

[13] Prowse (1990), Hirota (1999), Wald (1999).

inconsistent with the section 2 hypotheses and prior studies; I also investigate why the relation between debt and non-debt tax shields is positive. In section 7, I examine the robustness of the results presented in section 5.

2. Hypotheses

DeAngelo and Masulis' (1980) predict that in a cross-sectional analysis, firms with lower non-debt, non-cash tax shields will employ greater debt in their capital structures. Their analysis is also applicable in Japan because (1) interest payments by Japanese firms are tax-deductible, and (2) non-debt tax shields are available to Japanese firms. Similar to the U.S., depreciation and amortization expense is tax deductible in Japan.[14] Transfers to normal and special reserves are also tax deductible if they are recorded in the books of account and reflected in the financial statements. Normal reserves are created to account for estimated expenses or losses that are chargeable against income. They are prescribed by the Corporation Tax Law and include the bad debt reserve and the retirement allowance reserve. Special reserves are permitted as tax incentives by the Special Taxation Measures Law and include the reserve for losses on overseas investment and the reserve for special depreciation. Several tax credits are also available to Japanese firms. For example, a tax credit for research and development expenses is available if the amount of research and development expenses incurred during a business year exceeds the largest

[14] Either the straight-line method or the declining-balance method may be used to compute depreciation of tangible fixed assets; intangible assets must be amortized by the straight-line method. The depreciation and amortization allowable for tax purposes must be computed in accordance with the rates corresponding to the useful lives provided in the Ministry of Finance Ordinance (Kuboi, 1996).

of such amounts during each of the preceding years. The tax credit is equal to 20% of the excess or 10% of the corporate tax before the tax credit. Other tax credits are the investment tax credit for specified equipment and the credit for import promotion.

The U.S. and Japanese tax codes treat tax losses differently. The different treatment is important because tax loss carryforwards and carrybacks can affect the relation between debt and non-debt tax shields. Liberal carryforward and carryback rules reduce the likelihood that debt will be negatively related to non-debt tax shields. Losses may be carried back for 3 years or forward for 15 years in the U.S. In Japan they may be carried back for only 1 year or forward for only 5 years. Thus a simple comparison of tax loss rules suggests that the relation between debt and non-debt tax shields is more likely to be negative in Japan.

Several studies test whether debt is negatively related to non-debt tax shields in Japan. Allen and Mizuno (1989) find an insignificantly negative relation between debt and non-debt tax shields; Prowse (1990), Hirota (1999), and Wald (1999) find a significantly negative one. In order to foster comparisons with these studies, I first examine whether Japanese firms substitute—regardless of their proximity to financial distress, keiretsu membership, and proximity to tax exhaustion. I do so by testing the null hypothesis that debt is not related to non-debt tax shields against the following alternative hypothesis.

Hypothesis 1: Debt is negatively related to non-debt tax shields.

In Study 1, I find a negative relation for only non-financially distressed U.S. firms. The finding suggests that financially distressed firms do not substitute because the costs of financial distress outweigh the tax benefit of debt. If financial distress costs in Japan are substantial, it is also important to account for Japanese firms' proximity to financial distress when examining whether they substitute.

The results in several studies suggest that financial distress costs in Japan are substantial. Hoshi, Kashyap, and Scharfstein (1990) find that the sales growth and investment rates of financially distressed firms are lower than the industry average. Hall and Weinstein (2000) find a positive relation between the amount of financing that a financially distressed firm receives from its largest creditor and the creditor's share of the firm's debt, which suggests that free-rider problems among creditors lowers investment by a financially distressed firm.[15]

Therefore I examine whether Japanese firms' proximity to financial distress affects whether they substitute by testing the following alternative hypothesis.

Hypothesis 2: Debt is negatively related to non-debt tax shields for only non-financially distressed firms.

In Japan all financially distressed firms are not alike. The results of several studies suggest that financial distress costs are lower for firms that are members of a keiretsu (Hoshi, Kashyap, and Scharfstein, 1990; Sheard, 1994). There are two distinct features of these large industrial groups (Nakatani, 1984). First, each keiretsu has a main bank that is the major lender to the keiretsu firms. A main bank, however, does more than simply lend

[15] A concentrated creditor is more willing to finance a positive NPV project because it will receive a greater portion of the incremental cash flows. Thus, if free-rider problems among creditors exist, the amount of financing that a financially distressed firm receives from its largest creditor should be positively related to the creditor's share of the firm's debt.

money. It is the central clearinghouse for information about member firms and the coordinator for the group's activities. It also monitors the performance of the keiretsu, holds equity in most of the core firms, and provides management assistance (Miyashita and Russell, 1994). Second, keiretsu firms are shareholders of other firms within the same keiretsu. In fact, a keiretsu firm's largest shareholder is usually a financial institution or firm that belongs to the same group (Nakatani, 1984). These two features—main bank relationships and cross-shareholdings—should lower financial distress costs for keiretsu firms.

There are many direct and indirect financial links between a financially distressed keiretsu firm and its customers and suppliers. Customers and suppliers are often members of the same keiretsu and thus have an equity stake in the firm, and vice versa. In addition, the firm's main bank is sometimes the main bank for its customers and suppliers. The links can make customers more willing to purchase from the firm, and suppliers more willing to extend trade credit and invest in long-term supply relations (Nakatani, 1984; Hoshi, Kashyap, and Scharfstein, 1990). Hoshi, Kashyap, and Scharfstein find that firms that are members of the six largest keiretsu have lower financial distress costs than non-keiretsu firms; specifically, they find that keiretsu firms have higher sales growth than non-keiretsu firms in the years following the onset of financial distress.

Furthermore, free-rider problems could be less severe for a keiretsu firm because the main bank holds a large financial stake in the firm and it has fewer creditors (Hoshi, Kashyap, and Scharfstein, 1990, 1991). Hoshi, Kashyap, and Scharfstein (1990) find that keiretsu firms invest more than non-keiretsu firms in the years following the onset of financial distress. Hall and Weinstein (2000), however, find that financially distressed non-keiretsu firms receive just as much bank financing as financially distressed keiretsu firms.

If financial distress costs are lower for a keiretsu firm, they are less likely to outweigh the tax benefits of debt. In this case, a financially distressed keiretsu firm with low non-debt tax shields is more likely to employ greater debt in its capital structure than a financially distressed non-keiretsu firm, ceteris paribus. I examine whether keiretsu membership affects the extent to which financially distressed Japanese firms substitute by testing the following alternative hypothesis.

Hypothesis 3: Among financially distressed firms, the relation between debt and non-debt tax shields is stronger for firms that are members of a keiretsu.

MacKie-Mason (1990) argues that it is important to account for a firm's proximity to tax exhaustion when examining whether taxes affect its financing decisions. A firm reaches tax exhaustion when its tax shields are greater than its taxable income and thus faces a zero marginal tax rate on any additional interest deductions. A firm with tax shields—debt and non-debt—that are far from exhausting its taxable income can issue additional debt without affecting the expected marginal tax rate on interest deductions. On the contrary, a firm with tax shields that are close to exhausting its taxable income does not have the same tax incentives. If it issues debt, the additional tax shields could exhaust all of its taxable income and as a result lower the expected marginal tax rate on interest deductions to zero. MacKie-Mason predicts that a dollar of non-debt tax shields will crowd out an additional dollar of debt tax shields only when a firm is close to tax exhaustion. Thus, if his prediction is correct, debt should be negatively related to non-debt tax shields for only firms that are close to tax exhaustion. I examine whether Japanese firms' proximity to financial distress affects whether they substitute—after accounting for their proximity to tax exhaustion—by testing the following two alternative hypotheses.

Hypothesis 4: Among firms that are close to tax exhaustion, debt is negatively related to non-debt tax shields for only non-financially distressed firms.

Hypothesis 4a: Among firms that are close to tax exhaustion, debt is negatively related to non-debt tax shields for both financially distressed and non-financially distressed firms.

Lastly, I examine whether keiretsu membership affects the extent to which financially distressed Japanese firms substitute—after accounting for their proximity to tax exhaustion—by testing the following alternative hypothesis.

Hypothesis 5: Among financially distressed firms that are close to tax exhaustion, the relation between debt and non-debt tax shields is stronger for firms that are members of a keiretsu.

Before describing the methodology that I use to test the hypotheses, I note that many non-keiretsu firms also have main banks. Thus I could also examine whether a firm's main bank relationship affects whether it substitutes. I focus on keiretsu membership because doing so results in more powerful tests. Because cross-shareholdings also reduce financial distress costs, a keiretsu firm has lower financial distress costs than a non-keiretsu firm with a main bank relationship, ceteris paribus. Therefore keiretsu membership should have a larger effect on a financially distressed firm's financing decisions than a main bank relationship.

3. Methodology

Prior studies find that the relations between the dependent and control variables are different for keiretsu and non-keiretsu firms. Therefore, with one exception, I estimate the empirical models, equations (2), (3), and (4) presented below, separately for keiretsu and non-keiretsu firms.[16] In the first set of tests, I initially examine whether all firms substitute in order to promote comparisons with prior studies that do not distinguish between keiretsu and non-keiretsu firms.[17] I next separately examine whether keiretsu and non-keiretsu firms substitute. In the second set of tests, I divide firms into four groups: (1) non-financially distressed, keiretsu, (2) non-financially distressed, non-keiretsu, (3) financially distressed, keiretsu, and (4) financially distressed, non-keiretsu. I then separately examine—for keiretsu and non-keiretsu firms—whether financial distress affects whether they substitute after controlling for various factors that can also influence their financing decisions. In the fourth and fifth sets of tests, I divide each of the previous four groups into two groups, depending on whether they are close to tax exhaustion. I

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[16] Alternatively, I could pool the observations and use a dummy variable to distinguish between keiretsu and non-keiretsu firms. I do not do so because separately estimating equations (2), (3), and (4) yields results that are easier to interpret and present.
[17] Allen and Mizuno (1989), Prowse (1990), Hirota (1999), Wald (1999).

then separately examine—for keiretsu and non-keiretsu firms—whether financial distress and tax exhaustion affect whether they substitute after controlling for various factors that can also influence their financing decisions.

3.1. Financial distress

I use Ko's (1982) Z-score$_j$ to classify a Japanese firm as financially or non-financially distressed. Z-score$_j$ is defined as

$$0.868\ X_1 + 0.198\ X_2 + 0.048\ X_3 + 0.436\ X_4 + 0.115\ X_5, \qquad (1)$$

where

X_1 = earnings before interest and taxes divided by earnings before interest, taxes, depreciation, and amortization,

X_2 = inventory turnover two years prior divided by inventory turnover three years prior,

X_3 = standard error of net income measured over four years,

X_4 = working capital divided by total debt,

X_5 = market value of equity divided by total debt.

The model is based on a sample of Japanese firms that went bankrupt between 1960 and 1980. Ko concludes that a (standardized) Z-score$_j$ greater than zero indicates a healthy situation, with a probability of bankruptcy less than 0.5, and a probability greater than 0.5 for a negative Z-score$_j$.[18] The model correctly identifies 91% of the firms that go

[18] For the remainder of the study, Z-score$_j$ refers to the standardized value of equation (1). The standardization is based on the 2,527 observations that are not missing any of the variables in the empirical modes, equations (2), (3), and (4) presented below. See section 4 below for details regarding how I select the sample.

bankrupt.

I account for a firm's proximity to financial distress using a dummy variable. The dummy variable, DISTRESS, is equal to one if the firm's Z-score$_j$ is negative and zero otherwise. In Section 7.1, I show that using alternative cutoffs of the Z-score$_j$ distribution does not significantly change the results.

3.2. Keiretsu membership

Because keiretsu membership is not clearly defined, I separate firms into three groups, keiretsu, hybrid, and non-keiretsu. I classify firms using the 1996 and 1998 editions of *Industrial Groupings in Japan*; I use only the 1996 and 1998 editions because the sample period runs from 1995 to 1999. The *Industrial Groupings in Japan* classification scheme takes five factors into account when calculating a four-point scale—nucleus, strong, inclined, and weak—that measures a firm's involvement with a keiretsu. The factors are (1) the characteristics and historical background of the keiretsu and firm, (2) the sources and amounts of bank loans, (3) the number of board directors sent by and sent to other keiretsu firms, (4) the firm's attitude towards the keiretsu, and (5) the firm's connections with other groups and non-keiretsu firms.

Consistent with Dewenter and Warther (1998), I classify a firm as a keiretsu firm if it is a member of one of the six largest horizontal keiretsu—DKB, Fuyo, Mitsubishi, Mitsui, Sanwa, and Sumitomo—and its involvement is nucleus, strong, or inclined. Prior studies also focus on only the six largest horizontal keiretsu.[19] I classify a firm as a hybrid firm if

[19] Nakatani (1984), Hoshi, Kashyap, and Scharfstein (1990, 1991), Prowse (1990), Fukuda and Hirota

it is (1) a member of one of the six largest horizontal keiretsu and its involvement is weak, (2) a member of the IBJ or Tokai horizontal keiretsu, or (3) a member of a vertical keiretsu. Vertical keiretsu consist of one or more nucleus companies and their subsidiaries and affiliates, which are concentrated in the nuclei's business area; for example, Hitachi, Nippon Steel, Nissan, and Toyota are vertical keiretsu. The remaining firms are classified as non-keiretsu firms. Nakatani (1984) and Hoshi, Kashyap, and Scharfstein (1990, 1991) classify firms that switch keiretsu as non-keiretsu firms; however, I do not do so because *Industrial Groupings in Japan* accounts for switches when calculating its four-point scale. In section 7.2, I confirm that the results are not significantly different if I use alternative methods to classify firms.

3.3. Tax variables

The empirical models presented below contain variables designed to measure a firm's level of non-debt tax shields and proximity to tax exhaustion. I define a firm's non-debt tax shields as depreciation and amortization expense plus transfers to reserves. I divide non-debt tax shields by earnings before interest, taxes, depreciation, and amortization to control for scale effects. In section 7.3, I show that defining non-debt tax shields in alternative ways does not significantly change the results.

The definition of non-debt tax shields does not include tax credits. I do not include tax credits in the definition because my database, Datastream, does not contain them. Thus, to the extent that I inaccurately measure (i.e., underestimate) non-debt tax shields, the

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(1996).

coefficients in equations (2), (3), and (4) are biased.

I account for a firm's proximity to tax exhaustion using a dummy variable. The dummy variable, ETR_{high}, is based on the effective tax rate, which I define as total income tax expense divided by pretax income. I exclude observations with zero or negative pretax income from the sample because of the difficulty of interpreting a tax rate variable with a zero or negative denominator. I assume that firms in the first quartile of the effective tax rate distribution are close to tax exhaustion. ETR_{high} is equal to one if the firm's effective tax rate is in the second, third, or fourth quartile of the effective tax rate distribution, and zero otherwise. In section 7.3, I confirm that the results are not significantly different if I include the observations with zero or negative pretax income.

The effective tax rate is based on income tax expense and thus is retrospective in nature. A simulated marginal tax rate such as the one in Graham (1996) would be more appropriate because this study examines a firm's incentives to issue debt. Thus the results of the fourth and fifth sets of tests are inaccurate if a firm's effective tax rate does not accurately measure its marginal tax rate.

3.4. Dependent and control variables

The dependent variable is the book value of long-term debt divided by the book value of total assets. In Section 7.4, I show that the results do not significantly change when I define the dependent variable in alternative ways.

Many other factors in addition to financial distress and taxes can also influence a firm's financing decisions. Prior studies, however, suggest that they influence keiretsu and non-keiretsu firms differently. I include several variables to control for these factors. The control variables are consistent with prior Japanese and international studies.[20]

A firm's debt should be positively related to the collateral value of its assets. Jensen and Meckling (1976) argue that information asymmetries between shareholders and bondholders of a levered firm provide shareholders with an opportunity to invest suboptimally in order to expropriate wealth from bondholders. Because shareholders are less likely to do so if the firm's debt is secured, a firm with many securable assets should have lower borrowing costs than a firm with less securable assets, ceteris paribus. The results in Prowse (1990) and Hwang and Kim (1998) suggest that the conflict is less likely to occur in keiretsu firms, most likely because financial institutions hold debt and equity positions in the same firm. Prowse (1990) finds that keiretsu firms' debt is insignificantly negatively related to the percent of their assets not in fixed plant and equipment (1 – gross fixed assets/total assets). Hwang and Kim (1996) find a significantly negative relation between both keiretsu and non-keiretsu firms' debt and the percent of their assets not in fixed plant and equipment, but the relation is weaker for keiretsu firms. The empirical models contain three variables, net property, plant, and equipment divided by total assets, net intangible assets divided by total assets, and inventory divided by total assets, to control for the collateral value of a firm's assets.

A firm's debt can be positively or negatively related to its profitability. Jensen (1986)

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[20] Japanese studies: Kester (1986), Allen and Mizuno (1989), Fukuda and Hirota (1996), Hwang and Kim (1998), Anderson and Makhija (1999), Hirota (1999). International studies: Rajan and Zingales (1995), Wald (1999).

argues that managers can engage in activities that are not beneficial to shareholders. Debt reduces these non-beneficial activities because it reduces the amount of free cash flow available to managers. In this case, a firm's debt and profitability should be positively related. The conflict is less likely to occur in keiretsu firms because, in addition to being shareholders, banks and core keiretsu firms often place their former employees in management at firms within the same keiretsu.[21] The keiretsu employment patterns facilitate the flow of information between managers and shareholders and thus reduce the potential for managers to engage in activities that are not beneficial to shareholders.

Myers (1984) and Myers and Majluf (1984) argue that a firm can reduce the costs resulting from information asymmetries between current shareholders and new investors by following a pecking order of financing. In this case, a firm's debt and profitability should be negatively related. The results in Prowse (1990) and Hwang and Kim (1998) suggest that the conflict is less likely to occur in keiretsu firms. Prowse (1990) finds an insignificantly negative relation between keiretsu firms' debt and their profitability. Hwang and Kim (1996) find a significantly negative relation between both keiretsu and non-keiretsu firms' debt and profitability, but the relation is weaker for keiretsu firms. On the contrary, the results in Dewenter, Novaes, and Pettway (2001) suggest that this conflict is more likely to occur in keiretsu firms because the complexity of keiretsu related transactions makes it difficult for the market to infer an opportunistic act. They examine initial public offerings of keiretsu and non-keiretsu firms and find that keiretsu firms had

[21] Prowse (1990), Hoshi, Kashyap, and Scharfstein (1991), Miyashita and Russell (1994).

higher initial returns than non-keiretsu firms. To the extent that higher initial returns are associated with higher levels of uncertainty about the value of the firm, their results suggest that the complexity of the keiretsu increases the uncertainty about the value of the firm. The empirical models contain a variable, the four-year average of earnings before interest and taxes divided by total assets, to control for a firm's profitability. I measure profitability over four years because, according to the pecking order theory, a firm's first source of capital is retained earnings, which are accumulated over more than one year.

A firm's debt should be negatively related to its growth. Myers (1977) argues that information asymmetries between shareholders and bondholders of a levered firm provide shareholders with an incentive to forgo positive NPV projects if bondholders will receive the benefits. The opportunity to forgo positive NPV projects is likely to be greater in a growing firm because it has more flexibility regarding future investments. The results in Prowse (1990) and Hwang and Kim (1998) suggest that shareholder-bondholder conflicts are less likely to occur in keiretsu firms. Stultz (1990) argues that managers can invest all available cash even if paying it out is better for shareholders. Debt reduces the opportunities for managers to act in such ways because it reduces free cash flow. Because the conflict is less likely to occur in a high-growth firm with an abundance of positive NPV projects, a high-growth firm should have less debt than a mature, slow-growth firm, ceteris paribus. The conflict is also less likely to occur in keiretsu firms. Managers in keiretsu firms are less likely to engage in activities that are not beneficial to shareholders because keiretsu employment patterns facilitate the flow of information between managers and shareholders. The empirical models contain a variable, the four-year average of the percent change in sales, to control for a firm's growth.

A Japanese firm's debt should be positively related to the strength of its main bank relationship. Fukuda and Hirota (1996) argue that that main bank relationships—not keiretsu membership per se—reduce conflicts between shareholders and bondholders. If main bank relationships do reduce the conflict, firms with main bank relationships should have higher debt. The results in Fukuda and Hirota and Hirota (1999) suggest the conflict is less likely to occur in firms with strong main bank relationships; both studies find that firms with strong main bank relationships have higher debt. Data limitations, however, prevent me from including a main bank control variable.[22] Appendix C contains the Datastream data item numbers used to create the dependent and independent variables.

3.5. *Empirical models*

I use equation (2) to test Hypothesis 1. Because the hypothesis does not make predictions regarding a firm's proximity to financial distress or tax exhaustion, equation (2) contains only one tax variable, non-debt tax shields (NDTS), in addition to the control variables.

$$\text{DEBT} = \alpha_0 + \alpha_1 \text{ FIXED} + \alpha_2 \text{ INTANGIBLE} + \alpha_3 \text{ INVENTORY} + \alpha_4 \text{ PROFITABILITY} + \alpha_5 \text{ GROWTH} + \alpha_6 \text{ NDTS}, \quad (2)$$

where

[22] Fukuda and Hirota (1996) use the ratio of main bank loan debt to total debt to measure the strength of the main bank relationship. Hirota (1999) uses two measures. The first is similar to the one in Fukuda and Hirota. The second is based on (1) main bank loan debt, (2) main bank shareholding, and (3)

DEBT = book value of long-term debt divided by book value of total assets,

FIXED = net property, plant, and equipment divided by book value of total assets,

INTANGIBLE = net intangible assets divided by book value of total assets,

INVENTORY = inventory divided by book value of total assets,

PROFITABILITY = four-year average of earnings before interest and taxes divided by book value of total assets,

GROWTH = four-year average of the percent change in sales,

NDTS = sum of depreciation and amortization expense, bad debt reserve transfer, and special reserves transfer, divided by earnings before interest, taxes, depreciation, and amortization.

In order to foster comparisons with prior studies that do not distinguish between keiretsu and non-keiretsu firms when testing the substitution hypothesis, I initially estimate equation (2) for all (i.e., keiretsu, non-keiretsu, and hybrid) firms. I next estimate it separately for keiretsu and non-keiretsu firms because the control variable coefficients should be different for keiretsu and non-keiretsu firms. A negative sign on α_6 would be consistent with Hypothesis 1 and suggest that firms substitute.

I use equation (3) to test Hypotheses 2 and 3. Because the hypotheses make predictions regarding a firm's proximity to financial distress—but not tax exhaustion—equation (3) contains only two tax variables, non-debt tax shields (NDTS) and the financial distress dummy variable multiplied by non-debt tax shields (DISTRESS ×

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whether the main bank has sent a director to the firm.

NDTS), in addition to the control variables.

$$\begin{aligned} \text{DEBT} = \beta_0 &+ \beta_1 \text{ FIXED} + \beta_2 \text{ INTANGIBLE} + \beta_3 \text{ INVENTORY} \\ &+ \beta_4 \text{ PROFITABILITY} + \beta_5 \text{ GROWTH} + \beta_6 \text{ NDTS} \\ &+ \beta_7 \text{ DISTRESS} \times \text{NDTS}, \end{aligned} \tag{3}$$

where

DISTRESS = 1 if the firm's Z-score$_j$ is negative and zero otherwise.

I estimate equation (3) separately for keiretsu and non-keiretsu firms because the control variable coefficients and (according to Hypothesis 3) the sum of β_6 plus β_7 should be different for keiretsu and non-keiretsu firms.

I first use equation (3) to test Hypothesis 2. A negative sign on β_6 and a non-negative sign on the sum of β_6 plus β_7 would be consistent with Hypothesis 2 and suggest that only non-financially distressed firms substitute. Next I use equation (3) to test Hypothesis 3. The results would be consistent with Hypothesis 3 if the sum of β_6 plus β_7 is lower for keiretsu firms.

Equation (2) is equal to equation (3) with the restriction that β_7 equals zero. Thus another way to test whether financial distress affects the relation between debt and non-debt tax shields is to compare the unrestricted model, equation (3), with the restricted model, equation (2), using an F-test. A significant F-statistic would suggest that financial distress does affect the relation.

I use equation (4) to test Hypotheses 4, 4a, and 5. Because the hypotheses also make predictions regarding a firm's proximity to tax exhaustion, I multiply the two tax variables from equation (3) by the high effective tax rate dummy variable, ETR_{high}.

$$\begin{aligned} DEBT = \delta_0 &+ \delta_1\, FIXED + \delta_2\, INTANGIBLE + \delta_3\, INVENTORY \\ &+ \delta_4\, PROFITABILITY + \delta_5\, GROWTH + \delta_6\, NDTS \\ &+ \delta_7\, DISTRESS \times NDTS + \delta_8\, ETR_{high} \times NDTS \\ &+ \delta_9\, ETR_{high} \times DISTRESS \times NDTS, \end{aligned} \tag{4}$$

where

EFFECTIVE TAX RATE = total income tax expense divided by pretax income,

ETR_{high} = 1 if the firm is in the second, third, or fourth quartile of the effective tax rate distribution, and zero otherwise.

I estimate equation (4) separately for keiretsu and non-keiretsu firms because the control variable coefficients and (according to Hypothesis 5) the sum of δ_6 plus δ_7 should be different for keiretsu and non-keiretsu firms.

I first use equation (4) to test Hypotheses 4 and 4a. A negative sign on δ_6 and a non-negative sign on the sum of δ_6 plus δ_7 would be consistent with Hypothesis 4 and suggest that, among firms close to tax exhaustion, only non-financially distressed firms substitute. On the contrary, a negative sign on δ_6 and the sum of δ_6 plus δ_7 would be consistent with Hypothesis 4a and suggest that all firms close to tax exhaustion substitute. Next I use equation (4) to test Hypothesis 5. The results would be consistent with Hypothesis 5 if the sum of δ_6 plus δ_7 is lower for keiretsu firms. Table 2.1 contains the predictions for the tax and control variable coefficients from equations (2), (3), and (4).

Equation (3) is equal to equation (4) with the restriction that δ_8 and δ_9 equal zero. Thus another way to test whether tax exhaustion affects the relation between debt and non-debt tax shields is to compare the unrestricted model, equation (4), with the restricted model, equation (3), using an F-test. A significant F-statistic would suggest that tax exhaustion does affect the relation.

4. Sample selection and descriptive statistics

I collect the data from Datastream. Datastream contains a depreciation and amortization expense data item, but it is not available for most Japanese firms until 1995. Thus the sample period runs from 1995 to 1999. The initial sample includes the 1,417 firms listed on the Tokyo Stock Exchange First Section in 2000 (Datastream equity list *fjap*) and the 37 First Section firms delisted between 1995 and 2000. I obtain the names of the delisted firms from the 1995 to 2000 editions of the *Japan Company Handbook*.

I apply several screens that reduce the sample size. First, I exclude firms from the banking, financial services, insurance, and related industries because their capital structures can be affected by government rules and regulations.[23] Second, I exclude utilities and firms from the transportation and communications industries.[24] Prowse (1990) excludes utilities and transportation firms to avoid distortions caused by

[23] Datastream global indices (number of firms excluded): ASSET (11), BANKS (95), CNFIN (10), INSNL (16), INVBK (12), MISFI (16), and RLDEV (25).
[24] Datastream global indices (number of firms excluded): AIRLN (4), BRCAS (5), ELECT (9), GASDS (9), RROAD (35), SHPNG (18), TELFL (7), TELWR (2), and WASTE (1).

government regulations. Anderson and Makhija (1999) exclude utilities and communications firms because they receive special treatment from Japanese authorities, and commonly used bond financing prior to the financial deregulation of the 1980s. This leaves 1,155 listed and 24 delisted firms, but Datastream contains data on only 18 of the 24 delisted firms. Third, I exclude observations if any of the variables in equations (2), (3), or (4) are missing. This leaves 745 firms and 2,527 observations. Missing values of the depreciation and amortization expense data item used in calculating the non-debt tax shields variable are responsible for most of the excluded observations. Fourth, I exclude observations with zero or negative pretax income. The final sample contains 691 firms and 2,007 firm-year observations. 744 observations are classified as keiretsu observations, and 1,000 are classified as non-keiretsu.

Panel A of Table 2.2 contains the descriptive statistics about all 2,007 observations in the final sample. Panel B contains separate descriptive statistics about the keiretsu and non-keiretsu observations. Keiretsu firms have higher debt and non-debt tax shields than non-keiretsu firms.[25] Panels C and D contain separate descriptive statistics about financially distressed and non-financially distressed keiretsu and non-keiretsu firms, respectively. In both panels, the group with higher debt also has higher non-debt tax shields. Thus a simple comparison of the descriptive statistics suggests that debt is positively related to non-debt tax shields.

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[25] Hirota (1999) also finds that keiretsu firms have higher debt than non-keiretsu firms. He classifies a firm as a keiretsu firm if it participates in a presidential club. He defines debt as total debt divided by the sum of total debt plus equity.

Because this study examines whether financial distress, keiretsu membership, and tax exhaustion affect whether debt is negatively related to non-debt tax shields, I discuss briefly the Z-score$_j$s and effective tax rates of keiretsu and non-keiretsu firms. Keiretsu firms are more likely to be in financial distress; approximately 17% of keiretsu firms and 13% of non-keiretsu firms have negative Z-score$_j$s. They also have lower average Z-score$_j$s than non-keiretsu firms. Keiretsu firms are less likely to be tax exhausted; approximately 21% of keiretsu firms and 28% of non-keiretsu firms have effective tax rates in the first quartile of the effective tax rate distribution of all 2,007 observations in the final sample. In addition, they have higher average effective tax rates than non-keiretsu firms.

If all financially distressed firms are close to tax exhaustion, and vice versa, it is not important to account for a firm's proximity to both financial distress and tax exhaustion. Figures 2.1 and 2.2 are based on all 2,007 observations in the final sample. According to Figure 2.1, approximately 16% of the firms with negative Z-score$_j$s have effective tax rates in the fourth quartile of the effective tax rate distribution (i.e., some financially distressed firms are not close to tax exhaustion). Furthermore, according to Figure 2.2, approximately 75% of the firms with effective tax rates in the first quartile of the distribution have positive Z-score$_j$s (i.e., most firms that are close to tax exhaustion are not financially distressed). Thus the descriptive statistics suggest neither that all financially distressed firms are close to tax exhaustion nor that all firms that are close to tax exhaustion are financially distressed.

5. Empirical results

The results reported in this section are estimated using ordinary least squares. The standard errors are adjusted using White's (1980) method. Annual dummy variables are included in the regressions to control for unmodeled macroeconomic effects. In section 7.5, I show that the results are mostly unchanged if I account for influential observations, residual correlation, and endogeneity.

The signs of the control variable coefficients are mostly inconsistent with the predictions in Table 2.1. In equations (2), (3), and (4), the FIXED and INVENTORY coefficients are never significantly positive. The FIXED variable, which is based on net property, plant, and equipment, may not accurately measure collateral asset value because Japanese firms are eligible to depreciate tangible fixed assets at accelerated rates. (In section 6.1, I show that using gross property, plant, and equipment does not significantly change the results.) The INVENTORY coefficients in equations (3) and (4) are significantly negative at the 1% level for keiretsu firms.[26] The INTANGIBLE coefficients are significantly positive at the 5% level or better, which suggest that intangible assets may also have collateral value. The GROWTH coefficients are significantly positive at the 1% level, which suggests that high-growth firms use debt to finance their growth. The PROFITABILITY coefficients, which are all significantly negative at the 1% level, are the

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[26] Wald (1999) also finds a significantly negative inventory coefficient. He infers that the Japanese practice of term matching of assets and liabilities reduces conflicts between shareholders and creditors because "creditors are assured that funds are being used productively, and cash borrowed to finance inventories cannot be diverted to more risky long-term projects."

only ones whose signs are consistent with the predictions in Table 2.1.

Column (3a) of Table 2.3 reports the results from estimating equation (2) for all firms. α_6, which measures the relation between debt and non-debt tax shields, is significantly positive at the 5% level and thus inconsistent with Hypothesis 1 and prior studies that find a significantly negative relation. Furthermore, it suggests that Japanese firms do not substitute.

Columns (3b) and (3c) of Table 2.3 report the results from estimating equation (2) for keiretsu and non-keiretsu firms, respectively. The results are also inconsistent with Hypothesis 1. α_6 is significantly positive at the 5% level for both keiretsu and non-keiretsu firms, which suggests that neither keiretsu nor non-keiretsu firms substitute.

Table 2.4 reports the results from estimating equation (3), which are inconsistent with Hypotheses 2 and 3. Column (4a) reports the results for keiretsu firms. β_6, which measures the relation between debt and non-debt tax shields for non-financially distressed firms, is significantly positive at the 5% level. The sum of β_6 plus β_7, which measures the relation for financially distressed firms, is also significantly positive at the 1% level. Column (4b) reports the results for non-keiretsu firms. β_6 is significantly positive at the 1% level, and the sum of β_6 plus β_7 is insignificantly positive. Thus, although equation (3) accounts for financial distress, I still find that debt is positively related to non-debt tax shields for both keiretsu and non-keiretsu firms. The results suggest that neither keiretsu nor non-keiretsu firms substitute, regardless of their proximity to financial distress.

I also test whether financial distress affects the relation between debt and non-debt tax shields by comparing equation (3) with equation (2) using an F test. The F-statistic for keiretsu (non-keiretsu) firms is 57.283 (7.664), which is significant at the 1% level. The significant F-statistic suggests that financial distress does affect the relation. However, according to the results in Table 2.4, neither financially nor non-financially distressed firms substitute. Therefore, although financial distress has a statistically significant effect on the relation between debt and non-debt tax shields, the effect is not economically meaningful in the sense that it does not affect whether firms substitute.

Table 2.5 reports the results from estimating equation (4), which are inconsistent with Hypotheses 4, 4a, and 5. Column (5a) reports the results for keiretsu firms. δ_6, which measures the relation between debt and non-debt tax shields for non-financially distressed firms that are close to tax exhaustion, is significantly positive at the 5% level. The sum of δ_6 plus δ_7, which measures the relation for financially distressed firms that are close to tax exhaustion, is significantly positive at the 1% level. Column (5b) reports the results for non-keiretsu firms. δ_6 is significantly positive at the 1% level, and the sum of δ_6 plus δ_7 is insignificantly positive. Thus, although equation (4) accounts for tax exhaustion (in addition to financial distress), I still find that debt is positively related to non-debt tax shields for both keiretsu and non-keiretsu firms. The results suggest that firms do not substitute, regardless of their proximity to financial distress, keiretsu membership, and proximity to tax exhaustion.

I also test whether tax exhaustion affects the relation between debt and non-debt tax shields by comparing equation (4) with equation (3) using an F test. The F-statistic for keiretsu (non-keiretsu) firms is 66.145 (13.987), which is significant at the 1% level. The significant F-statistic suggests that tax exhaustion does affect the relation. However, according to the results in Table 2.5, all non-financially distressed firms do not substitute. Therefore, although tax exhaustion has a statistically significant effect on the relation between debt and non-debt tax shields, the effect is not economically meaningful (i.e., it does not affect whether firms substitute).

I estimate equations (2), (3), and (4) separately for keiretsu and non-keiretsu firms because the coefficients on the control variables and some of the tax variables (according to Hypotheses 3 and 5) should be different for keiretsu and non-keiretsu firms. Using the Chow test, I reject the hypothesis that the coefficients are equal at the 1% level for all three equations. In addition, I confirm that the control variables affect the capital structures of keiretsu and non-keiretsu firms differently using a Wald test.[27] The results of the Chow and Wald tests are therefore consistent with prior studies which find that the determinants of capital structure for keiretsu firms differ from the ones for non-keiretsu firms.[28] The difference is intriguing because it exists in spite of the financial deregulation in the 1980s—which could have reduced the influence of main banks—and the weakening

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[27] In order to conduct the Wald test, I first combine keiretsu and non-keiretsu firms. Next, I create a dummy variable, KEIRETSU, that is equal to one if the firm is a keiretsu firm and zero otherwise; I then interact KEIRETSU with all of the variables in equations (2), (3), and (4). Lastly, I estimate the modified versions of equations (2), (3), and (4). The Wald test checks whether all five coefficients on the interacted control variables—FIXED × KEIRETSU, INTANGIBLE × KEIRETSU, INVENTORY × KEIRETSU, PROFITABILITY × KEIRETSU, GROWTH × KEIRETSU—are simultaneously equal to zero. The F-statistic is significant at the 5% level in all three equations, which suggests that the control variables affect the capital structures of keiretsu and non-keiretsu firms differently.

[28] Prowse (1990), Hwang and Kim (1998), Hirota (1999).

of keiretsu ties in the late 1990s.[29]

In summary, I do not find any of the predicted negative relations between debt and non-debt tax shields. The results therefore suggest that Japanese firms do not substitute, regardless of their proximity to financial distress, keiretsu membership, and proximity to tax exhaustion. In fact, they strongly imply that in Japan debt is positively related to non-debt tax shields. Even after accounting for financial distress, keiretsu membership, tax exhaustion, I find a significantly positive relation between debt and non-debt tax shields. (In the next section, I discuss possible explanations for the inconsistent results and positive relations.) Finally, I find that the determinants of capital structure for keiretsu firms differ from the ones for non-keiretsu firms.

6. Discussion of inconsistent results

In this section, I discuss possible explanations for why the results in sections 5 and 6 are inconsistent with Hypotheses 1 to 5 and prior studies that find a negative relation between debt and non-debt tax shields. I also consider potential explanations for why the relation is positive. Table 2.6 reports the coefficients and significance levels for only the tax-based variables from equations (2), (3), and (4). (The tax-based variables are α_6, β_6, $\beta_6 + \beta_7$, δ_6, $\delta_6 + \delta_7$, δ_8, and $\delta_8 + \delta_9$.) All unreported results are available upon request.

6.1. Debt securability effect

[29] For example, in October 1998, Mitsui & Co. and Mitsubishi Corp. announced that they had formed an alliance to sell and distribute steel and other metal products. In December 1998, Sumitomo Chemical and Mitsui Chemicals announced that they would jointly establish a chemical production company.

A debt securability effect, which overwhelms the negative relation between debt and non-debt tax shields, could explain the results.[30] Jensen and Meckling (1976) argue that a firm's debt should be positively related to the collateral value of its assets. Because the collateral value of a firm's assets is positively related to its fixed asset depreciation, a firm's debt should also be positively related to its depreciation expense. The positive relation (i.e., the debt securability effect) can obscure, and in some cases, overwhelm the negative relation predicted by DeAngelo and Masulis (1980). The results in section 5 suggest that the positive debt securability effect may be overwhelming the substitution effect. For example, in Table 2.3, α_6 is significantly positive at the 5% level in all three regressions; similarly, in Table 2.4, β_6 is significantly positive at the 5% level in both regressions. Therefore an overwhelming debt securability effect could explain not only the inconsistent results, but also the positive relations between debt and non-debt tax shields reported in the previous two sections.

One question, however, still remains; namely, why does the debt securability effect appear to overwhelm the substitution effect? One possible answer is that the FIXED variable in equations (2), (3), and (4) does not control for the collateral value of a firm's assets. For example, in Tables 3, 4, and 5, the FIXED coefficients (α_1, β_1, and δ_1) are never significantly positive. Thus debt could be positively related to non-debt tax shields because fixed asset depreciation expense is controlling for collateral asset value. In order to investigate this explanation, I redefine the FIXED variable as *gross* property plant and

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[30] Bradley, Jarrell, and Kim (1984), who find a significantly positive relation between debt and non-debt

equipment divided by total assets. The FIXED coefficients are now significantly positive at the 5% level in all of the regressions, which suggests that the (redefined) FIXED variable controls for the collateral value of a firm's assets. However, the results for the tax-based variables, which are reported in rows (6c) and (6d) of Table 2.6, still support the finding that debt is positively related to non-debt tax shields.[31] Therefore a failure to control for the collateral value of a firm's assets does not seem to explain why the debt securability effect overwhelms the substitution effect.

The results in Study 1 imply a second possible answer. In general, Tanimura finds a significantly positive relation between debt and non-debt tax shields for financially distressed U.S. firms. The finding suggests that for financially distressed firms, the debt securability effect overwhelms the substitution effect. Analogously, in Japan the debt securability effect could be overwhelming the substitution effect because (1) the sample contains an unusually large number of financially distressed firms and (2) the firms are not identified as such.

The two conditions are met in this study. Japan was in a recession from 1997 to 1998. Real GNP growth was –0.1% in 1997 and –1.9% in 1998, and unemployment increased from 3.4% in 1997 to 4.1% in 1998. Thus the sample, which runs from 1995 to 1999, may contain a large number of financially distressed firms. Furthermore, the financial distress dummy variable might not identify all of the financially distressed firms because it

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tax shields in the U.S., offer a similar explanation.

[31] I interpret the results as supporting the finding if at least half of the tax-based variable coefficients are significantly positive at the 5% level or better.

is based on the *standardized* values of Ko's (1982) Z-$score_j$.

In order account for the possible underidentification of financially distressed firms, I assume that a large number of firms are financially distressed. Specifically, I assume that firms in the lower 50% or 75% of the Z-$score_j$ distribution are financially distressed. The cutoffs are arbitrary, but I do not have any reason to believe that one will work better than another. Rows (6e) to (6h) of Table 2.6 report the results for the tax-based variables, which still support the finding that debt is positively related to non-debt tax shields. Therefore underidentification of financially distressed firms also does not appear to explain why the debt securability effect overwhelms the substitution effect.

6.2. Sample selection

Different sample periods and firms could explain why the results are inconsistent with Prowse (1990). Because his sample is comprised of 133 keiretsu firms for the year 1984—a time of robust growth and low unemployment in Japan—it is unlikely to contain many financially distressed firms. Furthermore, any financially distressed firm in his sample is likely to have low financial distress costs because it is a keiretsu member. Therefore, in his sample, debt should be negatively related to non-debt tax shields.

In order to investigate this explanation, I estimate the empirical models for a period when the Japanese economy was healthy, 1988 to 1991. The period starts in 1988 because the growth control variable in equations (2), (3), and (4) is measured over five years, and Datastream contains Japanese data starting in 1984. The period ends in 1991 because real GNP growth fell from 2.9% in 1991 to 0.4% in 1992; unemployment also increased from 2.1% in 1991 to 2.2% in 1992. Because the depreciation and amortization expense data item is not available from Datastream for most Japanese firms until 1995, I use the first difference of balance sheet fixed asset depreciation to approximate depreciation and amortization expense. I drop negative values of the approximation to avoid interpretation problems. Rows (6i) and (6j) of Table 2.6 report the results for the tax-based variables. Most importantly, the results for keiretsu firms in row (6i) are still inconsistent with Prowse (1990); the combined results also support the finding that debt is positively related to non-debt tax shields. Therefore different sample periods and firms do not explain this inconsistency.

6.3. Measurement error

Measurement error could explain why the results are inconsistent with Wald (1999). Wald underestimates non-debt tax shields because his definition of non-debt tax shields includes only depreciation. Furthermore, the summary statistics suggest that Wald does not use depreciation expense to measure depreciation; the mean of depreciation divided by total assets in his sample is 0.279. The unusually high mean, together with the descriptive statistics from this study, suggest that Wald uses balance sheet accumulated depreciation to measure depreciation. In this study, the mean of accumulated (fixed asset) depreciation divided by total assets is 0.353; however, the mean of depreciation and amortization expense divided by total assets is only 0.033. In order to investigate whether measurement error explains the inconsistency, I redefine the non-debt tax shields variable as accumulated (fixed asset) depreciation divided by total assets. Rows (6k) and (6l) of

Table 2.6 report the results for the tax-based variables, which are still inconsistent with Wald; they also support the finding that debt is positively related to non-debt tax shields. Therefore measurement error does not explain this inconsistency.

Measurement error could also explain why the results are inconsistent with Hirota (1999). Hirota underestimates non-debt tax shields because he (1) uses pretax income instead of earnings before interest, taxes, depreciation, and amortization (EBITDA) in his approximation of non-debt tax shields, and (2) doesn't subtract interest payments from his approximation.[32] In order to investigate whether measurement error explains the inconsistency, I estimate equations (2), (3), and (4) using an approximation of non-debt tax shields that is consistent with Hirota. Rows (6m) to (6o) of Table 2.6 report the results for the tax-based variables, which are different from the ones in sections 5 and 6. Most importantly, the coefficient in Row (6m) suggests that debt is negatively related to non-debt tax shields for all firms. Therefore measurement error seems to explain why Hirota finds a significantly negative relation between debt and non-debt tax shields.

[32] Consider the following firm:

Earnings before interest, taxes, depreciation, and amortization (EBITDA)	1000
Depreciation and amortization expense	200
Earnings before interest and taxes (EBIT)	800
Interest payment	100
Other non-debt tax shields	50
Pretax income	650
Income taxes (40% tax rate)	260
After tax income	390

The firm has non-debt tax shields equal to 250. The following approximation, which uses EBITDA, produces an accurate measure of the firm's non-debt tax shields: EBITDA – interest payment – (income taxes/tax rate) = 1000 – 100 – (260/0.40) = 250. This is the same approximation that I use in section 6.3. However, the following approximation, which uses pretax income and doesn't subtract interest payments, underestimates the firm's non-debt tax shields: pretax income – (income taxes/tax rate) = 650 –

7. Robustness tests

In this section, I examine the robustness of the results presented in section 5. Table 2.7 and 2.8 report the coefficients and significance levels for only the tax-based variables from equations (2), (3), and (4). In general, the results are inconsistent with Hypotheses 1 to 5 and supportive of the section 5 finding that debt is positively related to non-debt tax shields. All unreported results are available upon request.

7.1. Financial distress

First, I use the percentiles of the Z-score$_j$ distribution to identify financially distressed firms because the original cutoff of zero is no longer valid if there have been significant structural changes since 1982. I assume that firms in the lower 10% or 25% of the Z-score$_j$ distribution are financially distressed, and create two sets of dummy variables. DISTRESS is equal to one if the firm's Z-score$_j$ is in the lower 10% or 25% of the distribution and zero otherwise. The cutoffs are arbitrary, but I do not have any reason to believe that one will work better than another. Rows (7c) to (7f) of Table 2.7 report the results for the tax-based variables, which are little changed from the ones in section 5.[33]

Second, I exclude the capital structure variable, X_5 in equation (1), when calculating Z-score$_j$. An endogeneity problem might exist in equations (3) and (4) because a firm's capital structure affects both the dependent and financial distress dummy variables. I

(260/0.40) = 0.

[33] I interpret the results as being little changed (different) if the sign and significance level of one or zero (more than one) of the tax-based variable coefficients are different from the ones in section 5.

assume that firms in lower 10% or 25% of the modified Z-score distribution are financially distressed. Rows (7g) to (7j) of Table 2.7 report the results for the tax-based variables, which are little changed from the ones in section 5.

7.2. Keiretsu membership

First, I expand the classification scheme so that a firm is classified as a keiretsu firm if it is a member of one of the eight largest horizontal keiretsu and its involvement is nucleus, strong, or inclined. The two additional keiretsu are IBJ and Tokai. Row (7k) of Table 2.7 reports the results for the tax-based variables for only keiretsu firms; the number of non-keiretsu firms does not change. The results are little changed from the ones in section 5.

Second, I contract the classification scheme so that a firm is classified as a keiretsu firm if it is a member of one of the six largest horizontal keiretsu and its involvement is nucleus or strong. Row (7l) of Table 2.7 reports the results for tax-based variables for only keiretsu firms; the number of non-keiretsu firms does not change. Although the results are different from the ones in section 5, they are still inconsistent with Hypotheses 1 to 5; in addition, they no longer support the finding that debt is positively related to non-debt tax shields. Interestingly, two of the three coefficients that differ, β_6 and δ_6, measure the relation for non-financially distressed firms; the third coefficient, α_6, measures the relation for financially distressed and non-financially distressed firms. This is important because it suggests that financially distressed and non-financially distressed firms act differently. The results also suggest that keiretsu membership is not a clearly defined concept, which supports the rationale for separating firms into keiretsu, hybrid, and non-keiretsu groups.

7.3. Tax variables

First, I redefine a firm's non-debt tax shields as

depreciation and amortization expense + transfers to reserves

+ (deferred taxes/τ_c), (5)

where

τ_c equals the national corporate tax rate.

Deferred taxes are a surrogate for timing differences between book and tax expense. I gross up the deferred taxes figure so that, similar to depreciation and amortization expense, it measures the amount of income that is shielded from taxation. I exclude 2 observations because the deferred taxes data item is missing. Rows (7m) and (7n) of Table 2.7 report the results for the tax-based variables, which are little changed from the ones in section 5.

Second, I redefine a firm's non-debt tax shields as

earnings before interest, taxes, depreciation, and amortization – interest payments

– (total income tax expense/τ_c), (6)

where

τ_c equals the national corporate tax rate.

Prior studies use similar approximations of non-debt tax shields.[34] I divide non-debt tax

[34] Allen and Mizuno (1989) define non-debt tax shields as (EBIT × τ_c) – (I × τ_c) – T, where EBIT = earnings before interest and taxes, τ_c = effective corporate tax rate, I = interest payment, and T = income taxes payable. Prowse (1990) defines non-debt tax shields as OI – I – T/τ_c, where OI = operating income, I = interest expense, T = total taxes paid, and τ_c = average corporate tax rate (0.433). Hirota (1999) defines non-debt tax shields as PROFIT – T/τ_c, where PROFIT = net profits before tax, T = tax payment,

shields by earnings before interest, taxes, depreciation, and amortization to control for scale effects. Rows (7o) and (7p) of Table 2.7 report the results for the tax-based variables, which are little changed from the ones in section 5.

Third, I scale non-debt tax shields—as defined in equation (2)—by the book value of total assets. Rows (7q) and (7r) of Table 2.7 report the results for the tax-based variables, which are little changed from the ones in section 5.

Fourth, I assign firms with zero pretax income a zero effective tax rate. I scale non-debt tax shields by the book value of total assets because of the difficulty of interpreting a non-debt tax shield variable with a positive numerator and a negative denominator. (215 observations have negative earnings before interest, taxes, depreciation, and amortization.) Furthermore, depending on whether the denominator is positive or negative, the non-debt tax shield coefficients have two interpretations. The sample increases to 2,527 observations; 935 are classified as keiretsu, and 1,239 are classified as non-keiretsu. Rows (7s) and (7t) of Table 2.7 report the results for the tax-based variables, which are little changed from the ones in section 5.

7.4. Dependent variable

First, I redefine the dependent variable as the book value of long-term debt divided by the book value of equity. I exclude 15 observations with zero or negative book value of equity because of the difficulty of interpreting a debt ratio with a zero or negative denominator. I also exclude 3 observations because the book value of equity data item is

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and τ_c = corporate tax rate (0.50).

missing. Rows (7u) and (7v) of Table 2.7 report the results for the tax-based variables, which are different from the ones in section 5. A closer examination, however, reveals that only the results for keiretsu firms are different. The results therefore support the finding that the determinants of capital structure for keiretsu firms differ from the ones for non-keiretsu firms.

Second, I redefine the dependent variable as the book value of short and long-term debt, divided by the book value of total assets. In Japan, banks traditionally make short-term loans and then continuously renew them to effectively provide long-term financing (Hodder and Tschoegl, 1985). Rows (7w) and (7x) of Table 2.7 report the results for the tax-based variables. Although the results are different from the ones in section 5, they are still inconsistent with Hypotheses 1 to 5; in addition, they no longer support the finding that debt is positively related to non-debt tax shields. The debt securability effect offers a potential explanation for the different results. If firms have considerable short-term debt and only long-term debt is secured by fixed assets, the coefficients for the tax-based variables may not be positive when total debt, which is comprised of long-term and short-term debt, is the dependent variable.

7.5. Econometric issues

7.5.1. Influential observations

I examine whether the results are significantly different if I remove influential observations from the sample. Two statistics that are widely used for checking whether an observation is influential are DFBETA and DFFITS (Kennedy, 1998). DFBETA measures the difference between the coefficient when the i^{th} observation is included and excluded, the difference being scaled by the estimated standard error of the coefficient. I remove an observation if the absolute value of one of its DFBETAs is greater than 2/sqrt(n), where n equals the number of observations (Belsley, Kuh, and Welsch, 1980). Rows (7y) and (7z) of Table 2.7 report the results for the tax-based variables, which are little changed from the ones in section 5.

DFFITS is the scaled difference between the predicted values for the i^{th} case when the regression is estimated with and without the i^{th} observation. I remove an observation if its DFFITS is greater than 2sqrt(k/n), where k-1 equals the number of independent variables and n equals the number of observations (Belsley, Kuh, and Welsch, 1980). Rows (7aa) and (7bb) of Table 2.7 report the results for the tax-based, which are little changed from the ones in section 5.

7.5.2. Residual correlation

I examine whether the results are significantly different if I account for residual correlation. The standard errors are biased if the residuals are serially or cross-sectionally correlated. In order to address this issue, I run four additional tests. In the first test, I assume that the residuals for a given firm—not among firms—are correlated and adjust the variance-covariance matrix accordingly.[35] Rows (7cc) and (7dd) of Table 2.7 report

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[35] The adjusted variance-covariance matrix is equal to $V = (X'X)^{-1} \sum_{j=1}^{N} u_j' u_j (X'X)^{-1}$, where

N = number of firms, $u_j = \sum_{i=1}^{n} e_i x_i$, with

n = number of observations for firm j

e_i = ith residual for firm j,

the results for the tax-based variables, which are little changed from the ones in section 5.

In the second test, I separately estimate equations (2), (3), and (4) for each year from 1995 to 1999. Panels A and B of Table 2.8 report the results for the tax-based variables for keiretsu and non-keiretsu firms, which are consistent with the ones in section 5.

In the third test, I calculate the mean of the annual tax variable coefficients from equations (2), (3), and (4). Because the coefficients from successive annual regressions are unlikely to be independent, it is important to account for serial correlation in the coefficients when estimating the standard error of their mean. I adjust the standard errors using the method in Abarbanell and Bernard (2000), who assume that the annual coefficients are first-order autocorrelated. They multiply the standard error by the square root of $[(1+\rho)/(1-\rho)] - [2\rho(1-\rho^n)/n(1-\rho)^2]$, where ρ is the estimated first-order autocorrelation of the annual coefficients and n equals the number of years. The last three rows of Panels A and B of Table 2.8 report the results, which are consistent with the ones in section 5.

In the fourth test, I estimate equations (2), (3), and (4) with industry dummy variables because the residuals could exhibit a systematic pattern associated with industry differences if debt ratios differ according to industry. The dummy variables are based on Datastream global indices. See Appendix D for details about how I create the industry dummy variables. Rows (7ee) and (7ff) of Table 2.7 report the results for the tax-based variables, which are different from the ones in section 5. A closer examination, however,

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x_i = ith row of X for firm j.

reveals that only the results for keiretsu firms are different. The results therefore support the finding that the determinants of capital structure for keiretsu firms differ from the ones for non-keiretsu firms.

7.5.3. Other econometric issues

First, consistent with Rajan and Zingales (1995), I lag the independent variables one year to reduce the problem of endogeneity. The sample decreases to 1,568 observations. Rows (7gg) and (7hh) of Table 2.7 report the results for the tax-based variables, which are little changed from the ones in section 5.

Second, I estimate equations (3), (4), and (5) using a fixed effects model to account for the effects of any unknown, omitted variables that are specific to individual firms but stay constant over time. Rows (7ii) and (7jj) of Table 2.7 report the results for the tax-based variables. Although the results are different from the ones in section 5, they are still inconsistent with Hypotheses 1 to 5; in addition, they no longer support the finding that debt is positively related to non-debt tax shields. Thus firm specific, time invariant factors affect the capital structures of Japanese firms. This is important because it provides a starting point from which to search for omitted variables that can explain why I do not find a negative relation between debt and non-debt tax shields.

7.7. Summary of robustness tests

Rows (7kk) to (7ll) of Table 2.7 summarize the results in rows (7c) to (7jj). The summary statistics confirm the robustness of the results in section 5; for example, the α_6 coefficient from equation (3) is significantly positive at the 5% level in 15 of the 26 regressions and never significantly negative. Therefore the summary statistics are not only inconsistent with Hypotheses 1 to 5, but also supportive of the finding in section 5 that debt is positively related to non-debt tax shields.

8. Conclusion

The results in this study suggest that in Japan debt is positively related to non-debt tax shields. I find a significantly positive relation between debt and non-debt tax shields for all firms. Furthermore, even after accounting for firms' proximity to financial distress, keiretsu membership, and proximity to tax exhaustion, I still find a significantly positive relation.

This study contributes to the tax and finance literature in four ways. First, it shows that the relation between debt and non-debt tax shields in Japan is positive, not negative as predicted, and thus illustrates an important difference between U.S. and Japanese firms. Although the U.S. and Japanese tax codes both provide for debt and non-debt tax shields, the results in this study—combined with the ones in Study 1—suggest that only non-financially distressed U.S. firms substitute. Second, it investigates explanations for why I find a positive relation in Japan. Third, it discusses explanations for why the results are inconsistent with Prowse (1990), Hirota (1999), and Wald (1999), and in the process, illustrates possible errors in their methodologies. Fourth, it adds to a group of studies which show that the financial decisions of keiretsu and non-keiretsu firms are different.

This study also suggests two directions for future research. The first is to investigate the effect of other non-tax factors that can also influence a Japanese firm's financing decisions. For example, until 1996, a firm had to clear several hurdles before it was allowed to issue equity.[36] The second—which is related to the first—is to further investigate why I find a positive relation between debt and non-debt tax shields in Japan.

[36] According to Hirota (1999), until April 1996, a company could publicly issue new equity only if it satisfied three conditions: (1) its dividends were equal to or greater than 5 yen per share in the previous year, (2) its ordinary (after-tax) profits were equal to or greater than 10 yen per share in the previous year, and (3) ordinary profits (after-tax) after a new stock issue were expected to increase.

Table 2.1
Predictions

This table contains the predictions for the control and tax variable coefficients from equations (2), (3), and (4). H1 to H5 refer to Hypotheses 1 to 5, respectively. K and NK refer to keiretsu and non-keiretsu, respectively. * corresponds to a non-negative predicted sign. A double negative sign (– –) corresponds to a larger negative value than a single negative sign (–).

		Control variables	H1 K/NK	H2 K/NK	H3 K	H3 NK	H4 K/NK	H4a K/NK	H5 K	H5 NK
FIXED	$\alpha_1/\beta_1/\delta_1$	+								
INTANGIBLE	$\alpha_2/\beta_2/\delta_2$	–								
INVENTORY	$\alpha_3/\beta_3/\delta_3$	+								
PROFITABILITY	$\alpha_4/\beta_4/\delta_4$	+/–								
GROWTH	$\alpha_5/\beta_5/\delta_5$	–								
NDTS	$\alpha_6/\beta_6/\delta_6$		–	–			–	–		
	$\beta_6 + \beta_7$			*	– –	–				
	$\delta_6 + \delta_7$						*	–	– –	–

Table 2.2
Descriptive statistics

Panel A: All firms

	Mean	Standard deviation	Median
Long-term debt[a]	0.126	0.097	0.116
Fixed[b]	0.645	1.780	0.227
Intangible[c]	0.006	0.013	0.002
Inventory[d]	0.115	0.070	0.107
Profitability[e]	0.037	0.036	0.031
Growth[f]	0.021	0.054	0.014
NDTS[g]	0.494	0.332	0.482
Effective tax rate[h]	0.712	3.485	0.520
Z-score$_j$[i]	0.060	0.852	0.267
N	2007		

Panel B: Keiretsu and non-keiretsu firms[j]

	Keiretsu			Non-keiretsu		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Long-term debt[a]	0.143	0.095	0.134	0.116	0.101	0.097
Fixed[b]	0.751	2.438	0.212	0.609	1.276	0.250
Intangible[c]	0.006	0.010	0.002	0.006	0.015	0.002
Inventory[d]	0.121	0.066	0.110	0.112	0.074	0.102
Profitability[e]	0.033	0.026	0.028	0.040	0.043	0.034
Growth[f]	0.019	0.046	0.013	0.020	0.056	0.011
NDTS[g]	0.503	0.257	0.512	0.465	0.299	0.444
Effective tax rate[h]	0.881	5.398	0.536	0.564	0.581	0.510
Z-score$_j$[i]	0.081	0.535	0.258	0.165	0.428	0.278
N	744			1000		

See next page for variable definitions.

Table 2.2 continued
Descriptive statistics

Panel C: Keiretsu firms.[j] The firms are partitioned into two groups using the standardized values of Ko's (1982) Z-score$_j$.[i]

	Financially distressed (Z-score$_j$ < 0)			Non-financially distressed (Z-score$_j \geq 0$)		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Long-term debt[a]	0.199	0.103	0.210	0.132	0.089	0.122
Fixed[b]	0.147	0.248	0.039	0.871	2.652	0.247
Intangible[c]	0.007	0.009	0.003	0.005	0.011	0.002
Inventory[d]	0.143	0.074	0.131	0.116	0.064	0.107
Profitability[e]	0.036	0.035	0.028	0.032	0.024	0.028
Growth[f]	0.024	0.055	0.018	0.018	0.044	0.012
NDTS[g]	0.514	0.209	0.521	0.500	0.266	0.510
Effective tax rate[h]	0.660	1.026	0.503	0.925	5.896	0.542
Z-score$_j$[i]	-0.748	0.928	-0.378	0.247	0.081	0.278
N	124			620		

Panel D: Non-keiretsu firms.[j] The firms are partitioned into two groups using the standardized values of Ko's (1982) Z-score$_j$.[i]

	Financially distressed (Z-score$_j$ < 0)			Non-financially distressed (Z-score$_j \geq 0$)		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Long-term debt[a]	0.137	0.108	0.117	0.113	0.100	0.095
Fixed[b]	0.268	0.587	0.080	0.660	1.342	0.278
Intangible[c]	0.010	0.021	0.004	0.006	0.014	0.002
Inventory[d]	0.132	0.080	0.113	0.109	0.072	0.100
Profitability[e]	0.031	0.045	0.022	0.042	0.042	0.034
Growth[f]	0.033	0.059	0.024	0.018	0.055	0.009
NDTS[g]	0.518	0.495	0.483	0.457	0.256	0.436
Effective tax rate[h]	0.402	0.231	0.449	0.588	0.614	0.519
Z-score$_j$[i]	-0.480	0.944	-0.221	0.262	0.072	0.291
N	131			869		

[a] Book value of long-term debt divided by book value of total assets.
[b] Net property, plant, and equipment divided by book value of total assets.
[c] Net intangible assets divided by book value of total assets.
[d] Inventory divided by book value of total assets.
[e] Four-year average of earnings before interest and taxes divided by book value of total assets.
[f] Four-year average of the percent change in sales.
[g] Sum of depreciation and amortization expense plus bad debt reserve transfer plus special reserves transfer, divided by earnings before interest, taxes, depreciation, and amortization.
[h] Total income taxes divided by pretax income.

Table 2.2 continued
Descriptive statistics

[i] Standardized value of Ko's (1982) Z-score$_j$. Z-score$_j$ = 0.868 (earnings before interest and taxes/sales) + 0.198 (inventory turnover two years prior/inventory turnover three years prior) + 0.048 (standard error net income measured over four years) + 0.436 (working capital/total debt) + 0.115 (market value of equity/total debt). The standardization is based on the 2,527 observations that are not missing any of the variables in equations (2), (3), and (4).
[j] Firms are classified as keiretsu or non-keiretsu using the 1996 and 1998 editions of *Industrial Groupings in Japan*. A firm is classified as a keiretsu firm if it is a member of one of the six largest horizontal keiretsu—DKB, Fuyo, Mitsubishi, Mitsui, Sanwa, and Sumitomo—and its keiretsu involvement is nucleus, strong, or inclined. A firm is classified as a non-keiretsu firm if it is not a member of a horizontal or vertical keiretsu.

Table 2.3
Pooled cross-sectional time-series regressions – Equation (2)

This table contain the results from estimating equation (2). The dependent variable is the book value of long-term debt divided by the book value of total assets. Annual dummy variables are included in the regression, but the coefficients are not reported. White's (1980) standard errors are in parenthesis.

		(3a) All firms	(3b) Keiretsu[a]	(3c) Non-keiretsu
Intercept	α_0	0.136**	0.149**	0.118**
		(0.016)	(0.020)	(0.023)
Fixed[b]	α_1	-0.003**	-0.001	-0.007**
		(0.001)	(0.001)	(0.002)
Intangible[c]	α_2	0.618**	1.186**	0.417*
		(0.211)	(0.338)	(0.245)
Inventory[d]	α_3	-0.014	-0.076	-0.010
		(0.030)	(0.047)	(0.043)
Profitability[e]	α_4	-0.731**	-1.164**	-0.557**
		(0.133)	(0.142)	(0.165)
Growth[f]	α_5	0.206**	0.264**	0.303**
		(0.051)	(0.075)	(0.065)
NDTS[g]	α_6	0.042*	0.052*	0.066*
		(0.019)	(0.024)	(0.034)
Number of observations		2007	744	1000
F statistic		10.92**	17.84**	7.31**
R^2		0.130	0.172	0.143
Chow test statistic[h]			4.405**	

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests.

[a] Firms are classified as keiretsu or non-keiretsu using the 1996 and 1998 editions of *Industrial Groupings in Japan*. A firm is classified as a keiretsu firm if it is a member of one of the six largest horizontal keiretsu—DKB, Fuyo, Mitsubishi, Mitsui, Sanwa, and Sumitomo—and its keiretsu involvement is nucleus, strong, or inclined. A firm is classified as a non-keiretsu firm if it is not a member of a horizontal or vertical keiretsu.
[b] Net property, plant, and equipment divided by book value of total assets.
[c] Net intangible assets divided by book value of total assets.
[d] Inventory divided by book value of total assets.
[e] Four-year average of earnings before interest and taxes divided by book value of total assets.
[f] Four-year average of the percent change in sales.
[g] Sum of depreciation and amortization expense plus bad debt reserve transfer plus special reserves transfer, divided by earnings before interest, taxes, depreciation, and amortization.
[h] Tests the hypothesis that the coefficients are the same in the keiretsu and non-keiretsu regressions.

Table 2.4

Pooled cross-sectional time-series regressions – Equation (3)

This table contain the results from estimating equation (3). The dependent variable is the book value of long-term debt divided by the book value of total assets. Annual dummy variables are included in the regression, but the coefficients are not reported. White's (1980) standard errors are in parenthesis.

		(4a) Keiretsu[a]	(4b) Non-keiretsu
Intercept	β_0	0.148**	0.112**
		(0.019)	(0.019)
Fixed[b]	β_1	0.000	-0.007**
		(0.001)	(0.002)
Intangible[c]	β_2	1.096**	0.454*
		(0.316)	(0.239)
Inventory[d]	β_3	-0.116**	0.000
		(0.047)	(0.044)
Profitability[e]	β_4	-1.154**	-0.534**
		(0.133)	(0.152)
Growth[f]	β_5	0.231**	0.315**
		(0.075)	(0.066)
NDTS[g]	β_6	0.038*	0.083**
		(0.021)	(0.021)
DISTRESS[h] × NDTS	β_7	0.114**	-0.038
		(0.015)	(0.028)
	$\beta_6 + \beta_7$	0.152**	0.044
		(0.023)	(0.038)
Number of observations		744	1000
F statistic		27.11**	9.46**
R^2		0.232	0.149
Chow test statistic[i]		8.589**	

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests.

[a] Firms are classified as keiretsu or non-keiretsu using the 1996 and 1998 editions of *Industrial Groupings in Japan*. A firm is classified as a keiretsu firm if it is a member of one of the six largest horizontal keiretsu—DKB, Fuyo, Mitsubishi, Mitsui, Sanwa, and Sumitomo—and its keiretsu involvement is nucleus, strong, or inclined. A firm is classified as a non-keiretsu firm if it is not a member of a horizontal or vertical keiretsu.

[b] Net property, plant, and equipment divided by book value of total assets.

[c] Net intangible assets divided by book value of total assets.

[d] Inventory divided by book value of total assets.

[e] Four-year average of earnings before interest and taxes divided by book value of total assets.

[f] Four-year average of the percent change in sales.

[g] Sum of depreciation and amortization expense plus bad debt reserve transfer plus special reserves transfer, divided by earnings before interest, taxes, depreciation, and amortization.

Table 2.4 continued
Pooled cross-sectional time-series regressions – Equation (3)

[h] Dummy variable based on the standardized values of Ko's (1982) Z-score$_j$. Z-score$_j$ = 0.868 (earnings before interest and taxes/sales) + 0.198 (inventory turnover two years prior/inventory turnover three years prior) + 0.048 (standard error net income measured over four years) + 0.436 (working capital/total debt) + 0.115 (market value of equity/total debt). The standardization is based on the 2,527 observations that are not missing any of the variables in equations (2), (3), and (4). DISTRESS is equal to one if the firm's standardized Z-score$_j$ is negative and zero otherwise.
[i] Tests the hypothesis that the coefficients are the same in the keiretsu and non-keiretsu regressions.

Table 2.5
Pooled cross-sectional time-series regressions – Equation (4)

This table contain the results from estimating equation (4). The dependent variable is the book value of long-term debt divided by the book value of total assets. Annual dummy variables are included in the regression, but the coefficients are not reported. White's (1980) standard errors are in parenthesis.

		(5a) Keiretsu[a]	(5b) Non-keiretsu
Intercept	δ_0	0.147**	0.103**
		(0.019)	(0.018)
Fixed[b]	δ_1	0.000	-0.007**
		(0.001)	(0.002)
Intangible[c]	δ_2	1.079**	0.474*
		(0.316)	(0.227)
Inventory[d]	δ_3	-0.116**	-0.008
		(0.047)	(0.043)
Profitability[e]	δ_4	-1.103**	-0.513**
		(0.128)	(0.148)
Growth[f]	δ_5	0.228**	0.323**
		(0.074)	(0.065)
NDTS[g]	δ_6	0.049*	0.110**
		(0.023)	(0.022)
DISTRESS[h] × NDTS	δ_7	0.156**	-0.084**
		(0.022)	(0.029)
	$\delta_6 + \delta_7$	0.205**	0.026
		(0.026)	(0.030)
ETR_{high}[i] × NDTS	δ_8	-0.013	-0.023
		(0.016)	(0.015)
ETR_{high} × DISTRESS × NDTS	δ_9	-0.066*	0.114**
		(0.029)	(0.036)
	$\delta_8 + \delta_9$	-0.079**	0.091**
		(0.024)	(0.033)
Number of observations		744	1000
F statistic		26.67**	10.00**
R^2		0.241	0.161
Chow test statistic[j]		7.855**	

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests.

[a] Firms are classified as keiretsu or non-keiretsu using the 1996 and 1998 editions of *Industrial Groupings in Japan*. A firm is classified as a keiretsu firm if it is a member of one of the six largest horizontal keiretsu—DKB, Fuyo, Mitsubishi, Mitsui, Sanwa, and Sumitomo—and its keiretsu involvement is nucleus, strong, or inclined. A firm is classified as a non-keiretsu firm if it is not a member of a horizontal or vertical keiretsu.
[b] Net property, plant, and equipment divided by book value of total assets.
[c] Net intangible assets divided by book value of total assets.
[d] Inventory divided by book value of total assets.
[e] Four-year average of earnings before interest and taxes divided by book value of total assets.

Table 2.5 continued
Pooled cross-sectional time-series regressions – Equation (4)

[f] Four-year average of the percent change in sales.
[g] Sum of depreciation and amortization expense plus bad debt reserve transfer plus special reserves transfer, divided by earnings before interest, taxes, depreciation, and amortization.
[h] Dummy variable based on the standardized values of Ko's (1982) Z-score$_j$. Z-score$_j$ = 0.868 (earnings before interest and taxes/sales) + 0.198 (inventory turnover two years prior/inventory turnover three years prior) + 0.048 (standard error net income measured over four years) + 0.436 (working capital/total debt) + 0.115 (market value of equity/total debt). The standardization is based on the 2,527 observations that are not missing any of the variables in equations (2), (3), and (4). DISTRESS is equal to one if the firm's standardized Z-score$_j$ is negative and zero otherwise.
[i] ETR_{high} is a dummy variable based on the effective tax rate, total income taxes divided by pretax income. Firms with both negative total income taxes and positive pretax income are assigned a zero effective tax rate. ETR_{high} is equal to one if the firm's effective tax rate is in the second, third, or fourth quartile of the distribution and zero otherwise.
[j] Tests the hypothesis that the coefficients are the same in the keiretsu and non-keiretsu regressions.

Table 2.6

Tests of explanations for inconsistent results

This table contains the tax variable coefficients from the tests in section 6. Annual dummy variables are included in the regressions. The standard errors are adjusted using White's (1980) method. K and NK refer to keiretsu and non-keiretsu, respectively. Underlined (boldface) indicates that the sign (significance level) is different from the section 5 regressions. Underlined and boldface indicates that both the sign and significance level are different.

		Equation (2) α_6	Equation (3) β_6	Equation (3) $\beta_6 + \beta_7$	Equation (4) δ_6	Equation (4) $\delta_6 + \delta_7$	Equation (4) δ_8	Equation (4) $\delta_8 + \delta_9$
	Section 5 regressions							
(6a)	Keiretsu	0.052*	0.038*	0.152**	0.049*	0.205**	-0.013	-0.079**
(6b)	Non-keiretsu	0.066*	0.083**	0.044	0.110**	0.026	-0.023	0.091**
	Section 6 regressions							
(6c)	GPPE[a] – K	0.038*	**0.026**	0.137**	**0.029**	0.187**	-0.002	-0.075**
(6d)	GPPE – NK	0.058*	0.071**	0.042	0.101**	0.026	**-0.027***	0.082**
(6e)	50[th] percentile Z-score$_j$ distribution[b] – K		**0.019**	0.100**	**0.027**	0.117**	-0.009	**-0.025**
(6f)	50[th] percentile Z-score$_j$ distribution – NK		**0.065***	**0.066***	0.076**	0.052	-0.011	**0.033**
(6g)	75[th] percentile Z-score$_j$ distribution[b] – K		**0.001**	0.067**	**0.052**	0.088**	**-0.058***	**-0.026**
(6h)	75[th] percentile Z-score$_j$ distribution – NK		**0.052***	**0.068***	**0.027**	0.060	0.032	**0.017**
(6i)	1988-1991 sample period[c] – K	**0.097****	**0.074****	0.162**	**0.095****	0.188**	-0.032	**-0.048**
(6j)	1988-1991 sample period – NK	**0.107****	0.092**	**0.175****	0.105**	**0.216****	-0.017	**-0.060***
(6k)	Balance sheet depreciation[d] – K	**0.093****	**0.067****	0.175**	**0.064****	0.197**	<u>0.002</u>	**-0.047**
(6l)	Balance sheet depreciation – NK	**0.097****	0.099**	**0.089****	0.086**	**0.073***	<u>0.020</u>	**0.031**
(6m)	NDTS approximated with pretax income[e] – All	-0.406**						
(6n)	NDTS approximated with pretax income – K	0.550**	0.765**	-0.189	-0.098	0.505	1.570**	-0.701
(6o)	NDTS approximated with pretax income – NK	-0.510**	-0.512**	-0.357	0.039	-0.238	-0.585*	-0.345

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests. See next page for test definitions.

Table 2.6 continued

Tests of explanations for inconsistent results

[a] The FIXED control variable is gross property, plant, and equipment divided by the book value of total assets.
[b] The financial distress dummy variable, DISTRESS, is calculated using Ko's (1982) Z-score. DISTRESS is equal to one if the firm's Z-score is in the lower 10% or 25% of the distribution and zero otherwise. Z-score = 1.2 (working capital/total assets) + 1.4 (retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6 (market value of equity/book value of total liabilities) + 1.0 (sales/total assets).
[c] The sample period runs from 1988 to 1991. Depreciation and amortization expense is approximated using the first difference of balance sheet fixed asset depreciation. Negative values are dropped to avoid interpretation problems.
[d] The non-debt tax shields variable is accumulated fixed asset depreciation divided by the book value of total assets.
[e] The non-debt tax shields variable is [pretax income – (total income tax expense/τ_c)] + total assets, where τ_c equals the basic corporate tax rate.

Table 2.7
Robustness tests

This table contains the tax variable coefficients from the robustness tests in section 7. Annual dummy variables are included in the regressions. The standard errors are adjusted using White's (1980) method. K and NK refer to keiretsu and non-keiretsu, respectively. Underlined (boldface) indicates that the sign (significance level) is different from the section 5 regressions. Underlined and boldface indicates that both the sign and significance level are different.

		Equation (2) α_6	Equation (3) β_6	Equation (3) $\beta_6 + \beta_7$	Equation (4) δ_6	Equation (4) $\delta_6 + \delta_7$	Equation (4) δ_8	Equation (4) $\delta_8 + \delta_9$
	Section 5 results							
(7a)	Keiretsu	0.052*	0.038*	0.152**	0.049*	0.205**	-0.013	-0.079**
(7b)	Non-keiretsu	0.066*	0.083**	0.044	0.110**	0.026	-0.023	0.091**
	Financial distress							
(7c)	10th percentile Z-score$_j$ distribution[a] – K		0.043*	0.170**	**0.054****	0.241**	-0.014	-0.115**
(7d)	10th percentile Z-score$_j$ distribution – NK		**0.064***	**0.135****	**0.054**	**0.129****	0.019	**0.019**
(7e)	25th percentile Z-score$_j$ distribution[a] – K		0.036*	0.132**	0.046*	0.161**	-0.011	-0.043*
(7f)	25th percentile Z-score$_j$ distribution – NK		0.067**	0.065	0.086**	0.045	-0.014	0.075*
(7g)	10th percentile modified Z-score$_j$[b] – K		0.042*	0.170**	0.053*	0.241**	-0.014	-0.112**
(7h)	10th percentile modified Z-score$_j$ – NK		**0.064***	**0.134****	**0.054**	**0.130****	0.019	**0.016**
(7i)	25th percentile modified Z-score$_j$[b] – K		0.036*	0.132**	0.045*	0.161**	-0.010	**-0.044***
(7j)	25th percentile modified Z-score$_j$ – NK		0.067**	0.065	0.087**	0.045	-0.015	**0.075***
	Keiretsu membership							
(7k)	Expanded classification[c] – K	0.056*	0.041*	0.157**	0.049*	0.211**	-0.008	-0.081**
(7l)	Contracted classification[d] – K	**-0.001**	**-0.001**	0.114**	**-0.001**	0.150**	0.007	**-0.057***

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests. See next page for test definitions.

Table 2.7 continued
Robustness tests

		Equation (3) α_6	Equation (4) β_6	Equation (4) $\beta_6+\beta_7$	Equation (5) δ_6	Equation (5) $\delta_6+\delta_7$	Equation (5) δ_8	Equation (5) $\delta_8+\delta_9$
	Tax variables							
(7m)	Deferred taxes[e] – K	0.050*	0.035*	0.141**	0.043*	0.194**	-0.009	-0.081**
(7n)	Deferred taxes – NK	0.060*	0.078**	0.039	0.104**	0.023	-0.023	0.077**
(7o)	NDTS approximation[f] – K	0.075**	0.061**	0.153**	0.033**	0.169**	0.044**	-0.043
(7p)	NDTS approximation – NK	0.066**	0.066**	0.063**	0.053**	0.044*	0.025	0.081*
(7q)	Scale by total assets[g] – K	1.011**	0.817**	2.065**	0.847**	2.837**	-0.050	-1.214**
(7r)	Scale by total assets – NK	0.545*	0.940**	0.193	1.162**	0.045	-0.197	0.784**
(7s)	Negative pretax income[h] – K	0.793**	0.546**	1.942**	0.353	2.286**	0.286	-0.612*
(7t)	Negative pretax income – NK	0.601**	0.748**	0.497	0.809**	0.510	-0.094	-0.077
	Dependent variable							
(7u)	Book value equity[i] – K	5.618	-3.956	73.542**	-5.242	88.384**	1.761	-22.547
(7v)	Book value equity – NK	1.818*	0.582	3.368	1.858	1.042	-0.293	11.312
(7w)	Total debt[j] – K	0.337	0.382	0.005	1.690	-0.093	-1.569*	0.267*
(7x)	Total debt – NK	-0.015	0.010	-0.046	0.125	-0.088*	-0.115	0.225
	Econometric issues							
(7y)	DFBETA[k] – K	0.106**	0.096**	0.183**	0.115**	0.219**	-0.040**	-0.069**
(7z)	DFBETA – NK	0.105**	0.110**	0.009	0.169**	-0.012	-0.058**	0.044*
(7aa)	DFFITS[l] – K	0.052*	0.047*	0.097**	0.066**	0.157**	-0.022	-0.084**
(7bb)	DFFITS – NK	0.044	0.078**	-0.000	0.106**	-0.010	-0.028	0.039*

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests. See next page for test definitions.

Table 2.7 continued
Robustness tests

		Equation (3) α_6	Equation (4) β_6	Equation (4) $\beta_6 + \beta_7$	Equation (5) δ_6	Equation (5) $\delta_6 + \delta_7$	Equation (5) δ_8	Equation (5) $\delta_8 + \delta_9$
(7cc)	Adjusted variance/covariance[m] – K	0.052	0.038	0.152**	0.049	0.205**	-0.013	-0.079**
(7dd)	Adjusted variance/covariance – NK	0.066*	0.083**	0.044	0.110**	0.026	-0.023	0.091*
(7ee)	Industry dummy variables[n] – K	0.015	-0.005	0.109**	-0.000	0.147**	-0.003	-0.054**
(7ff)	Industry dummy variables – NK	0.038	0.050**	0.023	0.064**	0.011	-0.009	0.063*
(7gg)	Lagged independent variables[o] – K	0.042	0.028	0.151**	0.038	0.202**	-0.011	-0.082**
(7hh)	Lagged independent variables – NK	0.073*	0.095**	0.048	0.121**	0.035	-0.023	0.081*
(7ii)	Fixed effects[p] – K	0.009	0.008	0.012	0.014	-0.004	-0.007	0.025
(7jj)	Fixed effects – NK	-0.009	0.000	-0.013*	0.010	-0.015*	-0.003	0.033*
	Summary (Rows 6c to 6jj)							
(7kk)	Significantly negative at 5% level or better – K	0/14	0/18	0/18	0/18	0/18	2/18	14/18
(7ll)	Significantly negative at 5% level or better – NK	0/12	0/16	1/16	0/16	2/16	1/16	0/16
(7mm)	Significantly positive at 5% level or better – K	7/14	11/18	16/18	10/18	16/18	1/18	1/18
(7nn)	Significantly positive at 5% level or better – NK	8/12	13/16	3/16	11/16	3/16	0/16	11/16

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests.

[a] The financial distress dummy variable, DISTRESS, is calculated using Ko's (1982) Z-score$_j$. DISTRESS is equal to one if the firm's Z-score$_j$ is in the lower 10% or 25% of the distribution and zero otherwise. Z-score$_j$ = 0.868 (earnings before interest and taxes/sales) + 0.198 (inventory turnover two years prior/inventory turnover three years prior) + 0.048 (standard error net income measured over four years) + 0.436 (working capital/total debt) + 0.115 (market value of equity/total debt).

[b] The financial distress dummy variable is equal to one if the firm's modified Z-score is in the lower 10% or 25% of the modified Z-score distribution and zero otherwise. Modified Z-score = 0.868 (earnings before interest and taxes/sales) + 0.198 (inventory turnover two years prior/inventory turnover three years prior) + 0.048 (standard error net income measured over four years) + 0.436 (working capital/total debt).

[c] A firm is classified as a keiretsu firm if it is a member of one of the eight largest horizontal keiretsu—DKB, Fuyo, IBJ, Mitsubishi, Mitsui, Sanwa, Sumitomo, and Tokai—and its keiretsu involvement is nucleus, strong, or inclined.

Table 2.7 continued
Robustness tests

[d] A firm is classified as a keiretsu firm if it is a member of one of the six largest horizontal keiretsu—DKB, Fuyo, Mitsubishi, Mitsui, Sanwa, and Sumitomo—and its keiretsu involvement is nucleus or strong.
[e] The non-debt tax shields variable is [depreciation and amortization expense + bad debt reserve transfer + special reserves transfer + (deferred taxes/τ_c)] + earnings before interest, taxes, depreciation, and amortization, where τ_c equals the national corporate tax rate.
[f] The non-debt tax shields variable is [earnings before interest, taxes, depreciation, and amortization – interest payments – (total income tax expense/τ_c)]
+ earnings before interest, taxes, depreciation, and amortization, where τ_c equals the national corporate tax rate.
[g] The non-debt tax shields variable is (depreciation and amortization expense + bad debt reserve transfer + special reserves transfer) + book value of total assets.
[h] Firms with zero or negative pretax income are assigned a zero effective tax rate. The non-debt tax shields variable is (depreciation and amortization expense + bad debt reserve transfer + special reserves transfer) + book value of total assets.
[i] The dependent variable is the book value of long-term debt divided by the book value of equity.
[j] The dependent variable is the book value of short and long-term debt, divided by the book value of total assets.
[k] Observations are eliminated if the absolute value of one of its DFBETAs is greater than 2/sqrt(n), where n equals the number of observations.
[l] Observations are eliminated if its DFFITS is greater than 2sqrt(k/n), where k-1 equals the number of independent variables and n equals the number of observations.

[m] The adjusted variance-covariance matrix is equal to $V = (X'X)^{-1} \sum_{j=1}^{N} u_j' u_j (X'X)^{-1}$, where

N = number of firms, $u_j = \sum_{i=1}^{n} e_i x_i$, with
n = number of observations for firm j
e_i = ith residual for firm j,
x_i = ith row of X for firm j.
[n] The empirical models contain industry dummy variables based on Datastream global indices.
[o] The independent variables are lagged one year.
[p] The empirical models are estimated using a fixed effects model.

Table 2.8
Annual regressions

Panel A: Keiretsu firms.[a]

Year	N	Equation (2) α_6	Equation (3) β_6	Equation (3) $\beta_6 + \beta_7$	Equation (4) δ_6	Equation (4) $\delta_6 + \delta_7$	Equation (4) δ_8	Equation (4) $\delta_8 + \delta_9$
1995	39	-0.066**	-0.070**	0.101	-0.054	0.124	-0.020	-0.020
1996	192	0.004	-0.005	0.099**	0.025	0.182**	-0.030	-0.117**
1997	189	0.099**	0.077*	0.188**	0.086*	0.219**	-0.012	0.057
1998	171	0.123**	0.098**	0.215**	0.098**	0.247**	-0.000	-0.052
1999	153	-0.001	-0.015	0.074*	-0.022	0.102	0.013	-0.029
Significantly negative at 5% level or better		1/5	1/5	0/5	0/5	0/5	0/5	1/5
Significantly positive at 5% level or better		2/5	2/5	4/5	2/5	3/5	0/5	0/5
Mean		0.032	0.017	0.135**	0.027	0.175**	-0.010	-0.032**
Standard error[b]		0.016	0.014	0.012	0.013	0.012	0.003	0.013
Adjusted standard error[c]		0.017	0.015	0.011	0.013	0.009	0.008	0.007

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests. See next page for variable definitions.

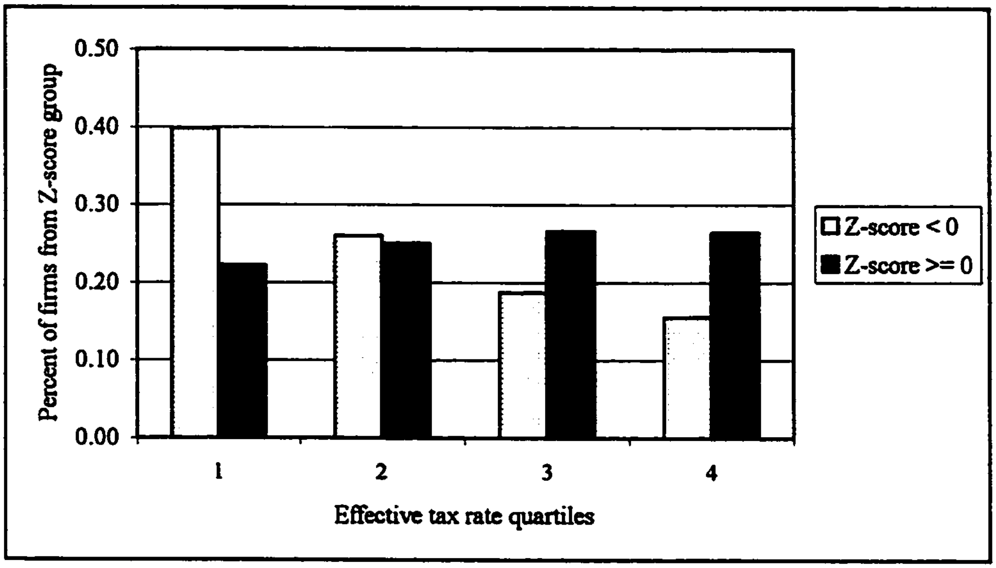
Table 2.8 continued
Annual regressions

Panel B: Non-keiretsu firms.[a]

Year	N	Equation (2) α_6	Equation (3) β_6	Equation (3) $\beta_6 + \beta_7$	Equation (4) δ_6	Equation (4) $\delta_6 + \delta_7$	Equation (4) δ_8	Equation (4) $\delta_8 + \delta_9$
1995	81	0.136**	0.148**	0.108*	0.124**	0.067	0.095	0.060
1996	248	0.138**	0.137**	0.201**	0.172**	0.217**	-0.042	-0.032
1997	260	0.013	0.036	0.002	0.081*	0.001	-0.044	0.044
1998	212	0.160**	0.159**	0.174**	0.171**	0.141*	-0.019	0.072
1999	199	0.071*	0.072*	0.060	0.059	-0.000	0.010	0.072
Significantly negative at 5% level or better		0/5	0/5	0/5	0/5	0/5	0/5	0/5
Significantly positive at 5% level or better		4/5	4/5	3/5	4/5	2/5	0/5	0/5
Mean		0.104**	0.110**	0.109**	0.121**	0.085**	0.000	0.043**
Standard error[b]		0.012	0.011	0.016	0.010	0.019	0.011	0.009
Adjusted standard error[c]		0.007	0.006	0.008	0.005	0.009	0.010	0.008

** and *, statistically significant at the 1 and 5 percent levels, one tailed tests.

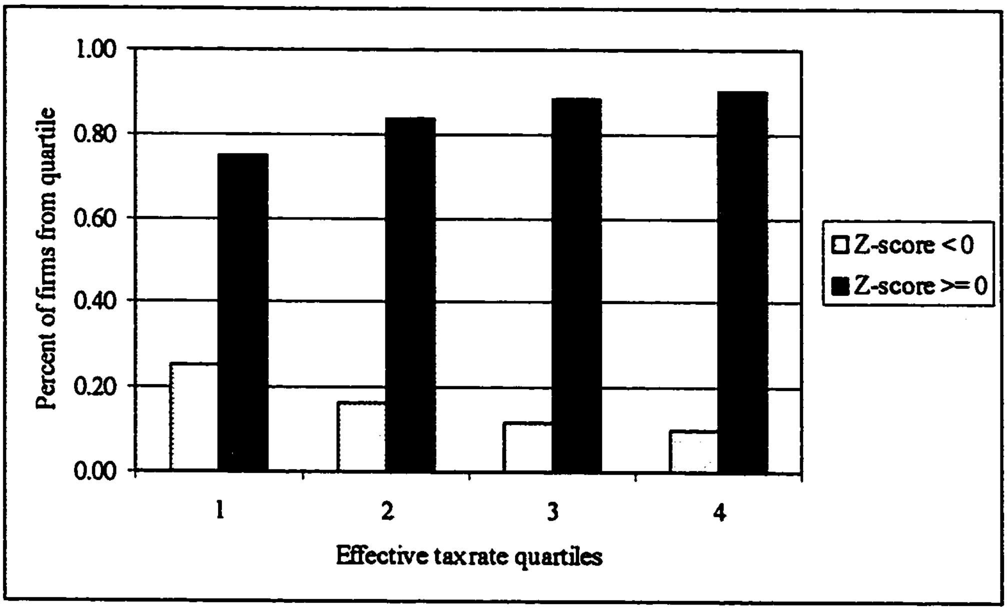
[a] Firms are classified as keiretsu or non-keiretsu using the 1996 and 1998 editions of *Industrial Groupings in Japan*. A firm is classified as a keiretsu firm if it is a member of one of the six largest horizontal keiretsu—DKB, Fuyo, Mitsubishi, Mitsui, Sanwa, and Sumitomo—and its keiretsu involvement is nucleus, strong, or inclined. A firm is classified as a non-keiretsu firm if it is not a member of a horizontal or vertical keiretsu.
[b] Standard deviation of the annual coefficients divided by the number of years.
[c] The standard errors are adjusted using the method in Abarbanell and Bernard (2000). They multiply the standard error times the square root of $[(1+\rho)/(1-\rho)] - [2\rho(1-\rho^n)/n(1-\rho)^2]$, where ρ is the estimated first-order autocorrelation of the annual coefficients and n = 5.



Firms are partitioned into two groups using the standardized values of Ko's (1982) Z-score$_j$.[a] The figure shows the percent of firms from each group that has an effective tax rate, total income tax expense divided by pretax income, that falls in a particular quartile of the effective tax rate distribution. For example, approximately 40% of the firms with a Z-score$_j$ less than zero have effective tax rates that fall in the first quartile of the effective tax rate distribution.

[a] Z-score$_j$ = 0.868 (earnings before interest and taxes/sales) + 0.198 (inventory turnover two years prior/inventory turnover three years prior) + 0.048 (standard error net income measured over four years) + 0.436 (working capital/total debt) + 0.115 (market value of equity/total debt).

Figure 2.1
Effective tax rates of low and high Z-score$_j$ firms



Firms are partitioned into two groups using the standardized values of Ko's (1982) Z-score$_j$.[a] The figure shows the percent of firms from each quartile of the effective tax rate distribution with a Z-score$_j$ less than zero, or greater than or equal to zero. The effective tax rate is defined as total income tax expense divided by pretax income. For example, approximately 25% of the firms in the first quartile of the effective tax rate distribution have Z-scores$_j$ less than zero.

[a] Z-score$_j$ = 0.868 (earnings before interest and taxes/sales) + 0.198 (inventory turnover two years prior/inventory turnover three years prior) + 0.048 (standard error net income measured over four years) + 0.436 (working capital/total debt) + 0.115 (market value of equity/total debt).

Figure 2.2
Z-scores$_j$ of firms from each effective tax rate quartile

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Appendix A

In the empirical part of his study, MacKie-Mason (1990) examines firms' incremental financing decisions. The dependent variable in his empirical model is equal to one if the firm issues debt and zero if it issues equity. He uses a modified version of Altman's (1968) Z-score to measure a firm's proximity to tax exhaustion, and assumes that a firm with a low modified Z-score (Z) is close to tax exhaustion.[37] His empirical model contains three tax-theory-based dependent variables—tax loss carryforwards (TLCF), investment tax credits (ITC), and ITC/Z. He includes the ITC/Z variable because he predicts that investment tax credits should have a larger negative effect on a firm's decision to issue debt when it is closer to tax exhaustion (i.e., when Z is small). The model also contains variables to control for non-tax factors—financial distress costs, moral hazard costs, and signaling costs—that may also influence a firm's financing decisions. Using a probit model to estimate the coefficients, he finds a significantly negative TLCF coefficient, a significantly positive ITC coefficient, and a significantly negative ITC/Z coefficient.

MacKie-Mason interprets the significantly negative ITC/Z coefficient as suggesting that the negative relation between ITC and debt issuance is stronger for firms that are closer to tax exhaustion. However, Altman's (1968) Z-score—and thus the modified Z-

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[37] MacKie-Mason (1990) modifies Altman's (1968) Z-score by excluding the capital structure variable. This is the same modification that I make in section 6.1.1. The modified Z-score, Z, is defined as

$$1.2\,X_1 + 1.4\,X_2 + 3.3\,X_3 + 1.0\,X_4,$$

where

X_1 = working capital divided by total assets,
X_2 = retained earnings divided by total assets,
X_3 = earnings before interest and taxes divided by total assets,
X_4 = sales divided by total assets.

score—is a predictor of firm bankruptcy; it also measures a firm's proximity to financial distress because firms with a high probability of bankruptcy are similar to ones that are close to financial distress. MacKie-Mason therefore accounts for a firm's probability of bankruptcy and proximity to financial distress, but not necessarily its proximity to tax exhaustion. Therefore his results are more properly interpreted as suggesting that the negative relation is stronger for firms that are closer to financial distress—an interpretation that is clearly inconsistent with the results in sections 5 and 6.

However, MacKie-Mason overlooks a problem caused by negative values of Z. The negative ITC/Z coefficient is misleading because it has two implications, depending on whether Z is positive or negative. The sign of the relation between ITC and debt issuance equals the sign of the ITC/Z coefficient divided by the sign of the denominator. For positive Z firms, the sign of the relation is negative (–/+). For negative Z firms, the sign is positive (–/–). Thus, depending on whether Z is positive or negative, the negative ITC/Z coefficient has two implications.

MacKie-Mason also tests for nonlinear effects by adding an ITC/Z^2 variable to his original model (see footnote 28). He finds an insignificantly negative ITC/Z coefficient and a significantly negative ITC/Z^2 coefficient. He interprets the results as reinforcing the ones from his original model. The interpretation is also incorrect because he overlooks negative values of Z. Moreover, including the ITC/Z^2 variable creates another problem, which the following example illustrates. Take two firms: firm A with ITC equal to 100 and Z equal to – 5, and firm B with ITC equal to 100 and Z equal to + 5. Both ITC/Z^2s are equal to 4, but the equality is misleading because there is no distinction between firm A, which is in extreme financial distress, and firm B, which is not in financial distress.

MacKie-Mason's sample likely contains a number of negative values of Z. The mean and standard deviation of 1/Z are 0.489 and 0.554, respectively; the mean and standard deviation of ITC/Z are 0.00306 and 0.00597, respectively. The results therefore do not necessarily imply that the negative relation between investment tax credits and debt issuance is stronger for firms that are closer to financial distress. Furthermore, the results are not inconsistent with the ones in sections 5 and 6.

Appendix B

This appendix contains the Compustat annual data items used to create the U.S. variables.

	Compustat annual data item numbers
Current assets	4
Current liabilities	5
Deferred taxes	50
Depreciation and amortization expense	14
Earnings before interest and taxes	172 + 15 + 16
Earnings before interest, taxes, depreciation, and amortization	172 + 15 + 16 + 14
Equity – book value	216
Equity – market value	(24 × 25) + 130
Funds provided by operations	13
Inventory	3
Investment tax credits	51
Long-term debt – book value	9
Net income	172
Net intangible assets	33
Net property, plant, and equipment	8
Pretax income	170
Retained earnings	36
Sales – net	12
Short-term debt – book value	44 + 206
Total assets – book value	6
Total liabilities – book value	181
Totai income tax expense	16

Appendix C

This appendix contains the Datastream data items used to create the Japanese variables.

	Datastream data item number
Bad debt reserve transfer	615
Current assets	376
Current liabilities	389
Deferred taxes	161
Depreciation and amortization expense	696
Earnings before interest and taxes	154 + 153
Earnings before interest, taxes, depreciation, and amortization	154 + 153 + 696
Equity – book value	307
Equity – market value	MV
Fixed asset depreciation – balance sheet	338
Gross property, plant, and equipment	327 + 328
Interest expense	153
Inventory turnover	104 ÷ [(364 + 1 year lag 364) ÷ 2]
Long-term debt – book value	321
Net income	154 – 203
Net intangible assets	344
Net property, plant, and equipment	339
Pretax income	154
Sales	104
Short-term debt – book value	635 + 636
Special reserve transfer	616
Total assets – book value	389 + 391
Total debt	321 + 635 + 636
Total taxes	203

Appendix D

This appendix contains the industry groupings and Datastream global indices used to create the Japanese industry dummy variables.

Agriculture
FMFSH: Farming and fishing

Forestry
FORST: Forestry

Mining
GOLD: Gold mining
MINES: Other mineral extractors and mines

Oil and gas
OILIN: Oil – integrated
OILIP: Oil and gas – exploration and production
OILSV: Oil – services

Construction
HOUSE: House building
OTHCN: Other construction

Foods
BREWS: Brewers
DISTV: Distillers and vintners
FDPRD: Food processors
SOFTD: Soft drinks

Tobacco
TOBAC: Tobacco

Textiles and leather goods
TEXOT: Other textiles and leather goods

Apparel
CLTHG: Clothing and footwear

Furnishings
FURFL: Furnishings and floor coverings

Paper and packaging
PAPER: Paper
PCKGN: Packaging

Printing and publishing
PUBLS: Printing and publishing

Chemicals
CHEMS: Chemicals, commodity
CHMAV: Chemicals, advanced materials
CHMSP: Chemicals, specialty
HSEPR: Household products
PHARM: Pharmaceuticals
PRNSL: Personal products

Rubber
TYRES: Tyres and rubber

Materials
BMATS: Building and construction materials

Metal industries
STEEL: Steel
NOFMS: Non-ferrous metals

Fabricated metal
ENGFA: Engineering fabricators

Machinery
COMMV: Commercial vehicles and trucks
COMPH: Computer hardware
ENGCO: Engineering – contractors
SEMIC: Semiconductors

Electrical equipment
ELEQP: Electrical equipment
ELETR: Electronic equipment
HAPPL: Household appliances and housewares
TELEQ: Telecommunications equipment

Transportation equipment
AEROS: Aerospace
AUTOS: Automobiles
AUPRT: Auto Parts
DEFEN: Defense

Precision instruments
MEDEQ: Medical equipment and supplies
PHOTO: Photography

Misc. manufacturing
ENGIN: Engineering – general
LSREQ: Leisure equipment
OTHBU: Other business

Wholesale
BMERC: Builders merchants

DCOMP: Distributors of industrial components and equipment
DSOTH: Distributors – other

Retail
DSCST: Discount and warehouse superstores
DSVHL: Vehicle distribution
FDRET: Food and drug retailers
GASDS: Gas distributors
HARDL: Retailers – hardlines
MULTI: Retailers – multidepartment
SOFTG: Retailers – soft goods

Restaurants
RESTS: Restaurants

Hotels
HOTEL: Hotels

Personal services
GAMNG: Gaming
HOMEN: Home entertainment
INTNT: Internet
LEISR: Leisure facilities

Business services
BUSUP: Business support services
CMPSV: Computer services
MEDAG: Media agencies
SECAL: Security and alarm services
SOFTW: Producers of computer software

Healthcare
HMORG: Health maintenance organizations
HOSPM: Hospital management and long-term care
OTHCR: Other health care

Diversified industrials
DIVIN: Diversified industrials

Vita

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