Tax Avoidance, Capital Structure and Cost of Debt : Korean Evidence

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Abstract

This paper examines whether participating in tax avoidance activities is related to corporate debt policy and what the role of cost of debt is in this relation. Using the tax avoidance measure modified from Desai and Dharmapala (2006), we find the substitution effect of tax avoidance for the use of debt for a large sample of Korean firms, consistent with Graham and Tucker (2006). Further tests show that the substitution effect becomes stronger when the cost of debt is high. These results are robust to a variety of tests for alternative measures of tax avoidance and debt/asset ratios and endogeneity of tax avoidance. The overall results suggest that the tax avoidance as non-debt tax shields (NDTS) substitutes for the use of interest tax deductions and that the tax avoidance activities offer a partial explanation for the underleverage puzzle.

Keywords: Tax avoidance; Capital structure; Cost of debt; Underleverage puzzle; Korean evidence

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1. Introduction

The trade-off theory in capital structure and taxes suggests that an optimal leverage of firms is determined by balancing the benefits of debt against the costs of debt. While benefits of debt are mainly driven by tax shield from interest deductions, costs of debt are related to increasing possibility of bankruptcy and financial distress. However, Miller (1977) and Graham (2000) argue that the benefits of debt far outweigh the even liberally estimated costs of debt. This implies that many firms should be more highly levered than they actually are, which is known as underleverage puzzle.

DeAngelo and Masulis (1980) demonstrate that the existence of non-debt tax shields (NDTS), primarily depreciation and tax credits, substitutes for the tax advantage of debt, reducing the demand for debt. Graham (2000) argues that the average magnitude of debt usage appears to be small relative to the tax benefits of debt. Graham et al. (2004) analyze corporate stock options and find that these account for some of the unexplained underleverage phenomenon. Graham and Tucker (2006) examined 44 tax shelter cases that were issued a Notice of Deficiency by the Internal Revenue Service (IRS) and suggest that firms use less debt when they engage in tax sheltering. They argue that the tax shelter firms in the sample appear underlevered if tax shelters are ignored but the underleverage disappears once the shelters are considered.

We extend Graham and Tucker (2006) in two respects. First, Graham and Tucker (2006) examine a limited sample of actual tax shelter cases. We generalize their study by investigating a large set of sample in Korean setting using a tax avoidance measure modified from Desai and Dhamapala (2006). Secondly, we consider the effect of cost of debt on the substitution effect of tax avoidance[1] for the use of debt. Few empirical work provide an in-depth study of the effect of cost of debt on capital structure. Graham and Tucker (2006) document a substitution effect of tax shelter for the use of debt by showing a negative relation between the debt ratio and tax shelters. Based on the trade-off theory argument, we expect that cost of debt negatively affects the corporate debt policy. The examination of the cost of debt as missing variable would give an insight on the causality issue of the substitution effects of the tax avoidance for the use of debt.

Korea provides a good research setting to explore the research question, because, unlike in the U.S., taxable income data that is necessary to calculate the tax avoidance measure is directly available from annual reports and need not be estimated as in Manzon and Plesko

1 The tax avoidance we address is a general measure including both common tax reduction methods and tax shelters of questionable legality. Following Desai and Dharmapala (2006), we measure tax avoidance by isolating earnings management component from book-tax difference (BTD) as explained later. BTD is a book-tax difference which subtracts taxable income from financial income. We corroborate the tax avoidance measure by introducing tax aggressiveness (TAXAG) as in Lopez et al. (1998) to capture the tax-subsidies that the tax avoidance does not capture in section 5.3.3.

(2002) and Desai and Dharmapala (2006).[2]

The results support the substitution effect of tax avoidance for the use of debt. The substitution effect becomes stronger when the cost of debt is high, indicating that the cost of debt should be considered in examining the substitution effect. These results are robust to a wide variety of tests for alternative measures of tax avoidance and debt/asset ratios and endogeneity of tax avoidance. We also find that, for high tax avoidance firms, the substitution effects of the tax avoidance for the use of debt are stronger when the cost of debt is high, further confirming the substitution effect.

We believe that this research contributes to the literature on the tax avoidance activities and capital structure. We improve the tax avoidance measure used in Desai and Dharmapala (2006), generalize the existing studies for a large set of sample, and investigate the role of cost of debt in examining the substitution effects of tax avoidance for the use of debt.

The remainder of the paper is organized as follows. Section 2 further develops the motivation for the empirical tests. Section 3 describes the sample selection procedures. Section 4 provides regression variables used in the tests. Section 5 explains the test methodology and presents the results. Section 6 concludes with a summary and implications.

2 The taxable income data can be obtained from the annual reports in the electronic disclosure system (http://dart.fss.or.kr) of the Financial Supervisory Service from 2000.

2. Extant research and hypothesis development

DeAngelo and Masulis (1980) suggest that firms select a level of debt which is negatively related to the level of non-debt tax shields (NDTS) such as depreciation deductions or investment tax credits. However, early empirical studies on the determinants of capital structure failed to find consistent tax effects (Bradley et al. (1984), Titman and Wessels (1988)).

It is likely that NDTS have an impact sufficient to affect the marginal tax rate (MTR) and debt policy only for modestly profitable firms. MacKie-Mason (1990) and Dhaliwal et al. (1992) address the issue by interacting NDTS with a variable that identifies firms near "tax exhaustion" at which point the substitution between NDTS and interest becomes most important. They find that tax-exhausted firms substitute away from debt when NDTS are high.

Graham (2000) offers an empirical measure of the underutilization of debt by corporations, the kink[3], and argues that the average magnitude of debt usage appears to be small relative to the tax benefits of debt, because the ratio of interest deductions to expected income is small for many firms. Although Graham's kink measure is based on proper application of the tax code and simulated future earnings from public financial statements, the measure cannot account for all NDTS available to U.S. corporations that are not publicly reported.

3 Graham (2000) measures the kink as the maximum amount of interest deductions a firm could charge before any decline in the marginal tax benefit of debt relative to the actual interest charge the firm incurred given its current debt for debt conservatism.

Graham et al. (2004) analyze corporate stock options and find that they account for some of the unexplained underleverage phenomenon. The stock options account for about 20 percent of the mean value of kink in Graham (2000).

Schallheim and Wells (2006) propose a new and simple proxy for NDTS referred to as the tax spread (the difference between tax expenses and taxes paid) in an attempt to capture the effect of off-financial statement deductions such as accelerated depreciation, stock option deductions, tax shelters, and the like, Schallheim and Wells find that tax spread is positively related to Graham's kink, indicating that firms are finding alternatives to debt to reduce taxable income. They offer three reasons why firms prefer tax shelters to debt. First, debt usually requires costly interest payments. However, tax shelters generally do not require any additional outlays for the firm. Another reason is the transaction costs to the firm associated with debt covenants imposed the debt. Finally, tax shelters often exploit provisions in the accounting rules that allow the firm to reduce taxes without affecting the income statement (Kaznik (1999)).

Graham and Tucker (2006) empirically investigate whether tax shelters substitute for the use of debt. They construct a sample of firms involved in 44 corporate tax shelter cases over the period of 1975 through 2000. By comparing these firms with a matched sample of firms that are not involved in such litigation, they find that characteristics such as size and profitability are positively associated with the use of tax shelters, and argue that tax shelters serve as a

substitute for interest deductions in determining the capital structure.

These extant studies have some limitations, Graham and Tucker (2006) admit the disadvantage of examining 44 tax shelters cases of relatively small sample because of the difficulty of identifying firm-specific instances of sheltering. Manzon and Plesko (2002) and Desai and Dharmapala (2006) estimated the taxable income from financial statement.[4] In Korea, however, the taxable income data that is necessary to calculate the tax avoidance measure is directly available from the annual reports and need not be estimated, providing a good research setting to examine this issue in large sample.

Based on the above discussion, we derive the first hypothesis on whether companies appear to substitute between the non-debt tax shields (NDTS: in this case tax saving from tax avoidance) and use of debt, as predicted by DeAngelo and Masulis (1980) as below.

H_1: Tax avoidance substitutes for the use of debt.

Hypothesis 1 suggests a negative relation between tax avoidance and the use of debt. The second hypothesis examines the effect of cost of debt on the substitution effect. According to the trade-off theory between capital structure and taxes, firms trade-off between the benefits of debt such as tax savings against the costs of debt. The theory attempts to characterize the factors that reduce the tax benefits of debt. The main factor is the costs of bankruptcy and

4 Schallheim and Wells (2006) suggest that estimation procedure of taxable income could cause estimation errors due to differences in reporting entities and operating losses, etc.

financial distress which cause the costs of debt to increase. The tax benefit of debt coupled with the cost of debt creates an optimal leverage where the value of the firm is maximized. The trade-off theory suggests that the use of debt is a function of the cost of debt. If cost of debt is high, the incentive to use the debt becomes weak, increasing the substitution incentive of tax avoidance for the use of debt. This leads to the following second hypothesis.

H_2 : The substitution effect of tax avoidance for the use of debt increases with the cost of debt.

3. Sample selection

Sample firms are extracted from the listed companies in Korean Stock Exchange from 2000 to 2005.[5] Three thousand seven hundred and ten companies were initially obtained from the KIS value database.[6] We exclude 288 financial and insurance firms from the sample because of their different financial characteristics. Then we exclude non-December year-end firms, because their tax change effects could be different. Also we restrict the sample to those firms with unqualified audit opinions to enhance the credibility of the financial statements used in the tests. We also remove the firms whose financial information is not available during the 6 year sample period from 2000 through 2005. Firms with less than 6 firms in the same industry each year are also excluded because we estimate discretionary accruals for each industry each

5 We focused on this period to exclude the government regulation change effect. Korea experienced financial crisis during the 1997. IMF suggested that high leverage was an important reason of economic crisis in 1997. Korean government regulated corporate leverage below 200% during 1998 and 1999.

6 The KIS value database is provided by Korea Investors Service, inc., which is affiliated with Moody's.

year using cross-sectional modified Jones model as used in Dechow et al. (1995) and Kothari et al. (2005). These procedures result in the unbalanced panels of 2373 firms. Finally, in order to maintain the same composition of sample firms during the sample period, we restrict the sample to those firms that survive 6 consecutive years of sample periods, resulting in the balanced panels of 1860 firms as reported in the panel A of table 1.

<Table 1>

Panel B of Table 1 describes the industry distribution of our sample firms according to the Korea National Statistical Office's 2-digit industry classification code. Although there are more firms in the industries of chemicals (20.9%), electronic devices (8.1%), general construction (8.1%), and basic metals (7.7%), firms are generally evenly distributed across all industries, suggesting no significant industry effects.

4. Regression variables

This section describes the dependent and the explanatory variables that are used in the empirical tests. We focus on the specification of three primary variables, tax avoidance, debt/asset ratio and cost of debt. We also explain other control variables.

4.1. Tax avoidance

We derive our measure of tax avoidance by extending Desai and Dhamapala (2006).

They use total accruals to isolate the component of the book-tax difference (BTD)[7] that is attributable to earnings management. The orthogonal component of $BTD_{i,t}$ which cannot be explained by earnings management is inferred to be a measure of tax avoidance activity. Unlike Desai and Dhamapala (2006), however, we use discretionary accruals rather than total accruals since it is a more refined earnings management proxy following Dechow et al. (1995) and Kothari et al. (2005).[8]

The procedure to calculate tax avoidance consists of two steps. The first step is to estimate discretionary accruals. We first calculate total accruals for each of the firms in our sample for each year over the sample period. Then, we obtain discretionary accruals $DACM_{i,t}$ for each firm i in each year t following Dechow et al. (1995). The discretionary accruals (DACM) are calculated as the residuals from Eq. (1).

$$Accruals_{ijt}/TA_{ijt-1} = \alpha_{jt}(1/TA_{ijt-1}) + \beta_{1jt}\{(\Delta SALE_{ijt} - \Delta A/R_{ijt})/TA_{ijt-1}\}$$

$$+\beta_{2jt}(PPE_{ijt}/TA_{ijt-1}) + e_{ijt} \quad (1)$$

Where $Accruals_{ijt}$ is total accruals of firm i in industry j at t calculated as ordinary income minus

7 The sources of book tax difference (BTD) consist of timing differences and permanent differences. Difference between financial and taxable income revenue and expense recognition policy gives rise to timing differences. In contrast, permanent differences arise when revenue or expense is recognized under one system but not the other. Lev and Nissim (2004) and Hanlon (2005) analyze the link between book tax difference and future returns in a further effort to understand if these gaps represent earnings management, finding that book-tax difference predicts future negative abnormal returns.

8 Following Desai and Dharmapala (2006), we also used total accruals as earnings management proxy. We denote the tax avoidance measure using total accruals as TS. However, the results are similar.

cash flow from operation; TA_{ijt-1} is total assets of firm i in industry j at t-1; $\Delta SALE_{ijt}$ is the change in sales of firm i in industry j at t; $\Delta A/R_{ijt}$ is the change in account receivables of firm i in industry j at t; PPE_{ijt} is property, plant and equipment of firm i in industry j at t.

We also used an alternative measure of discretionary accruals, performance matched discretionary accruals (DACP). Following Tucker and Zarowin (2005), it is calculated as residual from the Eq. (2) as regression based approach in Kothari et al. (2005).

$$Accruals_{ijt}/TA_{ijt-1} = \alpha_{jt}(1/TA_{ijt-1}) + \beta_{1jt}\{(\Delta SALE_{ijt} - \Delta A/R_{ijt})/TA_{ijt-1}\}$$

$$+\beta_{2jt}(PPE_{ijt}/TA_{ijt-1}) + \beta_{3jt}ROA_{ijt} + e_{ijt} \quad (2)$$

Where ROA_{ijt} is net income of firm i in industry j at t scaled by lagged total assets.

The second step is to isolate the component of the book-tax difference (BTD) that is not attributable to earnings management and identify the tax avoidance component. We run the following ordinary least squares (OLS) regression, Eq (3) below.

$$BTD_{i,t} = b_1 DACM(\text{or } DACP)_{i,t} + u_j + e_{i,t} \quad (3)$$

Where $BTD_{i,t}$ is book-tax difference for firm i in year t scaled by lagged total assets; $DACM(\text{or } DACP)_{i,t}$ is discretionary accruals for firm i in year t scaled by lagged total assets; u_j is the average value of the residual for firm i over the sample period, 2000-2005; $e_{i,t}$ is the deviation in year t from firm i's average residual u_j.

The residual from the Eq. (3) is the component of $BTD_{i,t}$ that cannot be explained by

variations in discretionary accruals (earnings management). This can be interpreted as a measure of tax avoidance.[9] We denote this measure as TSmod(or TSper)$_{i,t}$ as in Eq (4) below.

$$\text{TSmod(or TSper)}_{i,t} = u_j + e_{i,t} \quad (4)$$

Where TSmod is obtained from discretionary accruals using Eq. (1); TSper is obtained from performance-matched discretionary accruals using Eq. (2).

In the analysis below, we use the estimate of TSmod(or TSper)$_{i,t}$ from Eq. (4) as our test variable representing the tax avoidance. According to Desai and Dhamapala (2006), TSmod(or TSper)$_{i,t}$, as a residual, is constrained by the regression procedure to sum to zero over all firms and all years. Meanwhile, $e_{i,t}$ is constrained to sum to zero for firm i over all years. Therefore, neither TSmod(or TSper)$_{i,t}$ nor its components u_j and $e_{i,t}$, can be interpreted as the dollar amount of tax avoidance by firm i in year t. Since we use panel data regressions with firm fixed effects, we only need a measure that adequately proxies for variations in tax avoidance within a firm over time.

4.2. Debt/asset ratio

The dependent variable in the regressions is debt/asset ratio (book leverage) calculated as total debts divided by total assets following Graham and Tucker (2006).[10]

9 Because we exclude the earnings management component in book-tax difference (BTD), we believe that our tax avoidance measure is more accurate than the tax spread used in Schallheim and Wells (2006) which measure the non debt tax shields (NDTS).

10 We also used a market leverage as dependent variable. The results are reported in the section 5.3.1

4.3. Cost of debt[11]

Cost of debt (COD) is the ex-post cost of debt measured as the interest rate on the firm's debt, calculated as interest expense for the year divided by average short-and long-term debts during the year as in Pittman and Fortin (2004).[12]

4.4. Control variables

We use control variables that are known to affect the capital structure following Graham and Tucker (2006) and Frank and Goyal (2004). MacKay and Phillips (2003) provide an analysis of industry effects on leverage. We include a median industry leverage (Inddebt/asset) to control for the industry effect on leverage. Because Leary and Roberts (2005) show that companies have a tendency to adjust toward target debt ratios, we include a lagged debt ratio as a control variable. We include lag5(debt/asset) to capture some element of normal debt policy. Firm size is included to capture any economies of scale when debts are used or issued. The market-to-book ratio controls for the differences in investment opportunities. Easterbrook (1984) argues that dividend-paying firms have lower agency costs of equity, and this allows

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which is similar as book leverage.

11 Studies by Altman (1984) and Weiss (1990) find that direct bankruptcy costs are only 3 percent of total assets and 20 percent of equity. Indirect financial distress costs, such as lost sales, agency costs (Jensen and Meckling (1976)), earnings variability (Bradley, et al.(1984)), or underinvestment costs (Myers (1977)) are difficult to quantify. The cost of debt we use is a general measure including both direct and indirect costs.

12 Because our sample selection procedures reduce outlier effects, we do not truncate the outliers outside the 5th or 95th percentiles of the pooled distribution as in Pittman and Fortin (2004).

firms to raise more equity than the firm that do not pay dividend. If so, dividend paying firms should have lower leverages and less debt capacity. We include dividend paying status, DIVpay which takes 1 if a firm pays dividends and otherwise 0 to control for the effect of dividend paying ability on the debt ratio. Myers (1993) suggests that profitable firms use less debt, reflecting the pecking-order behavior in which internal funds are used before external funding sources such as debt are sought. We include ROA as a control for the effect of profitability on the use of debt. Also, according to the evidence that firms with highly collateralizable assets such as inventory, property, plant, and equipment use more debts, we include a Collateral variable, the proportion of assets that are collateralizable as a control. All of the independent variables except for Inddebt/asset and lag5(debt/asset) are lagged by one period because their current year values are potentially jointly determined with the debt policy.

5. Test methodology and results

This section explains the research design to test the hypotheses and the test results.

5.1. Descriptive statistics

First, we show the trends of leverage ratios and tax avoidance activities during the sample period. Panel A of Figure 1 shows a pattern of leverages. Both book leverage and market leverage decreased gradually from 2000 to 2005. The market leverage declined more rapidly the than book leverage. In contrast, tax avoidance activities (TSmod, TSper and

TAXAG[13]) increased for the same period as shown in Panel B. TSmod and TSper have more fluctuation than TAXAG.

<Figure1>

Panel A of table 2 provides descriptive statistics for the variables used in our analysis. The mean (median) BTD is -0.009 (-0.007), suggesting that the taxable income is greater than the financial income on average.[14] The mean (median) value of the book leverage is 0.462 (0.461) and the market leverage is 0.604 (0.635), respectively. The mean (median) TS[15], TSmod and TSper is 0 (0.003), 0 (0.002) and 0 (0.002) respectively, which confirms that TSmod(or TSper) is constrained by the regression procedure to sum to zero over all firms and all years as a residual (Desai and Dhamapala (2006)).

Panel B of Table 2 provides correlations among debt/asset, tax avoidance and other control variables. The negative correlation between debt/asset and tax avoidance measures (TS, TSmod and TSper) is consistent with hypothesis 1 that firms that use tax avoidance activities

13 We use an alternative tax avoidance measure, tax aggressiveness (TAXAG) used in Lopez et al. (1998) as in Eq (11). The more detail information is provided in section 5.3.2.

14 Jung et al. (2006) report that the BTD of Korean companies is negative on average is for the sample period (1993-2002) in contrast to U.S. corporations showing positive BTD overall. They conjecture that Korea would confront less financial market pressure to enhance financial earnings and intent to lower taxable income than U.S. We also tested the sample consisting of positive BTD. The results for each hypothesis (unreported) are more robust than negative BTD subsample. Therefore, we could interpret the main results robustly.

15 Following Desai and Dharmapala (2006), we used total accruals as earnings management proxy and denote the tax avoidance measure using total accruals as TS.

use less debts.[16] Consistent with prior evidence (Frank and Goyal (2004) and Graham and Tucker (2006), we find that a significant positive correlation between debt/asset and Inddebt/asset (0.382), lag5(debt/asset) (0.508), Size (0.096), Mkt/book (0.207), and Collateral (0.104) variables. In contrast, there are significant negative correlations between debt/asset and DIVpay (-0.336), and debt/asset and ROA (-0.313).[17]

<Table2>

[16] We provide the anecdotal evidence of the case of Hyundai Automotive Group. One of the major Korean daily newspaper, Chosun Iibo (Hyundai Accused of Fraudulent Accounting, 2006.4.17) reported the Hyundai Automotive Group case as follows. *The Hyundai Automotive Group faces allegations that it created massive slush funds by unusual method of deflating its operating profit and inflating losses. In fraudulent accounting practice, the opposite - inflating profits and deflating losses to lure investors - is more common. The prosecution official said Monday, "We're investigating to determine the overall scale of slush funds the Hyundai Automotive Group established by adopting such accounting measures. If our probe into the group reveals that it did not pay taxes, used the money for business purposes, or used the money for lobbying purposes, it will face additional charges of tax evasion, appropriating company money in the conduct of business or bribery." Investigators are combing mountains of documents for evidence.* We try to confirm this anecdotal evidence using our dataset. In our dataset, there are 3 firms affiliated with Hyundai Automotive Group, which are Hyundai Motors, Kia Motors and Hyundai Mobis. We find that both book leverage and market leverage decreased from 2000 to 2005 and that tax avoidance activities (TSmod, TSper and TAXAG) increased for the period in all three firms. For example, Book leverage and market leverage of Hyundai Motors has changed from 0.58 (2000) to 0.44 (2005) and from 0.77 (2000) to 0.31 (2005) respectively. Tax avoidance (TSmod, TSper and TAXAG) increased from -0.003 (2000) to 0.050 (2005), from -0.006 (2000) to 0.051 (2005) and from 0.002 (2000) to 0.003 (2005), respectively. This provides an indirect evidence for the fraudulent accounting of Hyundai Automotive Group to pursue tax avoidance activities and confirms our tax avoidance measure. We conjecture that the tax avoidance is used for business purposes to reduce the leverage.

17 The high correlations among Debt/asset, lag5(debt/asset), and cost of debt variables are likely to cause multicollinearity problems. For all regression, we check multicollinearity problem using variance inflation factors (VIF).

5.2. Test results

5.2.1. Does tax avoidance substitute for the use of debt?

We use both pooled ordinary ordinary least square model and two-way fixed effects model to examine the hypothesis 1 that the tax avoidance substitute for the use of debt. The pooled ordinary least square model is expressed as follows;

$$\text{Pooled OLS: Debt/asset}_{i,t} = a1 + a2\text{TSmod(or TSper)}_{i,t} + a3\text{IndDebt/asset}_{i,t} + a4\text{Lag5(debt/asset)}_{i,t} + a5\text{Size}_{i,t-1} + a6\text{Mkt/book}_{i,t-1} + a7\text{DIVpay}_{i,t-1} + a8\text{ROA}_{i,t-1} + a9\text{Collateral}_{i,t-1} + b\text{Industry dummy} + c\text{Year dummy} \quad (5)$$

Where Debt/asset is the book value of debt divided by book value of total assets; TSmod(or TSper) is tax avoidance measure modifying Desai and Dharmapala (2006); IndDebt/asset is industry-median debt/asset ratio based on 2-digit SIC code of the Korea National Statistical Office; Lag5(debt/asset) is the debt/asset ratio five years ago; Size is Sales revenue divided by book value of total assets; Mkt/book is the market value of total asset (market equity plus book debt) divided by book value of total assets; DIVpay is one if the firm pays dividends, and 0 otherwise; ROA is net income divided by book value of total assets; Collateral is inventory, plant, property, and equipment divided by book value of total assets; Industry dummy is firm's two-digit SIC code of the Korea National Statistical Office; Year dummy is the calendar year

We test the model using ordinary least squares under the assumption that the error term in Eq. (5) is independent of the explanatory variables. Ordinary least squares regressions are used instead of tobit regression because every observation in the main regressions has nonzero debts (Graham and Tucker (2006)). This test is comparable with prior research on capital structure and provides a cross-sectional evidence on whether tax avoidance affects the use of debt. The results are reported in column 1 of Table 3.

<Table3>

The coefficient of our main variable, tax avoidance, is negative and significant, consistent with the hypothesis 1 that firms with more tax avoidance use less debt.[18] The results are consistent for all the models that use TS, TSmod or TSper as tax avoidance measures.

The estimated coefficients for all the control variables have expected signs. Consistent with Mackay and Phillips (2003) and Leary and Roberts (2005), the coefficients of IndDebt/asset and lag5(debt/asset) have positive signs. Firm size is positive and significant. The market-to-book ratio is positive, suggesting that, all else equal, high market-to book firms in our sample use more debts. Dividend-paying firms use less debts than nondividend paying firms. The coefficients also indicate that profitable firms use less debts and that firms with collateralizable

18 The results do not present the causality between tax avoidance and use of debt. The significantly negative correlation between tax avoidance and leverage also suggest that firms with less tax avoidance use more debt. We address the causality issue through incorporating the cost of debt in hypothesis 2 later.

assets use more debts as expected. In this main specification, the adjusted R-squares range from 45.2% to 45.5%, indicating a good fit. The largest variance inflation factor (VIF) is 7.6, which suggest no significant multicollinearity problem (Gujarati (1995)).

The results reported in Table 3 are consistent with those reported in prior cross-sectional studies (Frank and Goyal (2004) and Graham and Tucker (2006)). However, since these results may be driven by an omitted variable problem that firm-specific correlated omitted variables could be in the explanatory variables. To alleviate the concern for the omitted variable problem, we include an intercept term for each firm, $a1_i$ as in Eq. (6) below. This will eliminate the time-invariant portion of the error term in Eq. (5), thereby yielding consistent coefficient estimates:

$$\text{Fixed effects model: Debt/asset}_{i,t} = a1_i + a2\text{TSmod(or TSper)}_{i,t} + a3\text{IndDebt/asset}_{i,t} + a4\text{Lag5(debt/asset)}_{i,t} + a5\text{Size}_{i,t-1} + a6\ \text{Mkt/book}_{i,t-1} + a7\text{DIVpay}_{i,t-1} + a8\text{ROA}_{i,t-1} + a9\text{Collateral/asset}_{i,t-1} + \text{Firm fixed effect} + \text{Year fixed effect} \quad (6)$$

The fixed effect results are reported in column 2 of Table 3. It shows a two-way fixed effects model with correction for unspecified heteroscedasticity. The F-test rejects the null hypothesis that the constant terms (the fixed firm effects) are all identical. The fixed effects results, which preserve the time-series variation and individual firm heterogeneity, also provide evidence consistent with the pooled OLS results that tax avoidance substitutes for the use of

debt.

Panel B of table 3 provides the unbalanced panel results to examine the hypothesis 1. We find the negative correlation between tax avoidance and use of debt in pooled ordinary least squares model. However, the results are not consistent in the two-way fixed effects model.

In sum, we conclude that the results generally support the hypothesis 1 that tax avoidance firms use less debt.

5.2.2. Does the substitution effect of tax avoidance for the use of debt increase with the cost of debt?

The hypothesis 2 proposed that that high cost of debt would accentuate the substitution effect of the tax avoidance for the use of debt. This is tested using an interaction variable between tax avoidance and cost of debt as in Eq. (7) and (8) below. The cost of debt variable is also included as a control variable.

Pooled OLS: $\text{Debt/asset}_{i,t}$ =a1+a2TSmod(or TSper) $_{i,t}$ +a3$\text{COD}_{i,t}$

+a4TSmod(or TSper) $_{i,t}$ *$\text{COD}_{i,t}$ +a5IndDebt/asset $_{i,t}$ +a6Lag5(debt/asset)$_{i,t}$

+a7$\text{Size}_{i,t-1}$ +a8 $\text{Mkt/book}_{i,t-1}$ +a9$\text{DIVpay}_{i,t-1}$ +a10$\text{ROA}_{i,t-1}$ +a11$\text{Collateral}_{i,t-1}$

+bIndustry dummy+cYear dummy (7)

Fixed effects model: $\text{Debt/asset}_{i,t}$ =a1 $_{i,t}$ +a2TSmod(or TSper) $_{i,t}$ +a3$\text{COD}_{i,t}$

+a4TSmod(or TSper) $_{i,t}$ *$\text{COD}_{i,t}$ +a5IndDebt/asset $_{i,t}$ +a6Lag5(debt/asset)$_{i,t}$

$$+a7Size_{i,t-1} +a8\ Mkt/book_{i,t-1} +a9DIVpay_{i,t-1} +a10ROA_{i,t-1} +a11Collateral_{i,t-1}$$

+Firm fixed effect+Year fixed effect (8)

Where COD is the ex-post cost of debt, which is the interest rate on the firm's debt, calculated as its interest expense for the year divided by its average short- and long-term debt during the year

The results for total sample are reported in Panel A of Table 4. The coefficient on the cost of debt (COD) is positive and significant, consistent with Graham (2000) who report that the firms using debt conservatively face low ex ante costs of distress. The coefficient on the interaction variable between tax avoidance and cost of debt is negative and significant after controlling for COD on capital structure. This implies that the substitution effects of tax avoidance for the use of debt are stronger when the cost of debt is high. The results are similar whether pooled OLS or two-way fixed effects panel analysis is used. In summary, the evidence reported in Panel A of Table 4 suggests that cost of debt affects the corporate debt policy separately and jointly with the tax avoidance.

<Table4>

However, the effect of cost of debt on the substitution effect of the tax avoidance for the use of debt is not unilateral. According to the results of Table 3, negative correlation between tax avoidance and leverage suggest that firms with more tax avoidance use less debt, and that

firms with less tax avoidance also use more debt. When the tax avoidance is used to substitute the debt, the incentive for the substitution will become stronger when the cost of debt is high. On the other hand, when the firms use debt as a substitute for the tax avoidance, its incentive will become weaker when the cost of debt is high. This means that effect of cost of debt on the substitution effect is different according to whether the substitution is for the use of debt or for tax avoidance, and therefore the negative coefficient for the interaction variable observed in Table 4 above is difficult to interpret.[19]

To clarify this issue, we partition the sample into high and low tax avoidance groups. While the interaction variable has a negative coefficient for the high tax avoidance firms, the variable has positive coefficient for the low tax avoidance firms. If high tax avoidance firms evidence dominates, the results support that the tax avoidance substitutes for the use of debt. We divide the sample according to the median value of tax avoidance.[20] Panel B and C of Table 4 report the results for each of the subsamples of high tax avoidance and low tax avoidance firms separately.[21] For the high tax avoidance firms, the coefficients on interaction of tax

19 The presumption is that for the high tax avoidance group, the substitution is toward the tax avoidance from the use of debt while the opposite is true the low tax avoidance group. In this case, we expect to find a negative coefficient on the interaction variable between tax avoidance and cost of debt for high tax avoidance group, while a positive coefficient is expected for the low tax avoidance group.

20 We also partitioned the sample using 3-quantiles and quartile. The results are almost identical to those using the median and reported in section 5.3.1.

21 High (low) tax avoidance firms are defined as those for which the tax avoidance measured as TSmod(or TSper) is above (below) the median of the sample.

avoidance with cost of debt are -7.155, -6.744, -3.904 and -3.921 in two methodologies which are negative and significant. The corresponding coefficient for the low tax avoidance firms, however, is not statistically different from zero. Furthermore, the coefficients (-7.155, -6.744, -3.904 and -3.921) on interaction of tax avoidance with cost of debt are more negative and significant for the high tax avoidance firms than those (-2.620, -2.488, -2.592 and -2.692) reported in Panel A of Table 4 for the total sample. Therefore, the coefficient for the interaction variables reported in Table 4 is mainly driven by the substitution effect of tax avoidance for the use of debt and the substitution effect toward the use of debt is not supported when cost of debt is considered. This indicates that the tax avoidance substitutes for the use of debt and that the substitution increases with the cost of debt.

In sum, we conclude that the substitution effect of tax avoidance for the use of debt increases with the cost of debt, supporting hypothesis 2. The results corroborate the hypothesis 1 that tax avoidance substitutes for the use of debt, indicating that firms prefer tax avoidance to the use of debt.

5.3. Sensitivity analysis

5.3.1. Robust test of hypothesis 2

In order to test the robustness of hypothesis 2, we examine whether the substitution effects of tax avoidance for the use of debt are stronger according to the different cutting point of

tax avoidance. We also divide the sample using the 3-quantiles or quartile value of tax avoidance. Table 5 reports the results for the subsamples of high tax avoidance and low tax avoidance respectively.[22] The coefficient on interaction of tax avoidance with cost of debt is the most negative and significant (-9.501, -8.851) for the higher tax avoidance firms using quartile of those (-7.802, -7.264) using 3-quantiles and those (-7.155, -6.744) using median reported in Table 4 for the high tax avoidance. Still, the corresponding coefficient for the low tax avoidance firms is not statistically different from zero. This robustly confirms that the substitution effect of tax avoidance for the use of debt is the stronger, the higher the cost of debt as hypothesis 2 expects.

<Table5>

5.3.2. Market leverage as debt/asset ratio

The leverage measure we use is book leverage, defined as the book value of debt divided the book value of assets following Graham and Tucker (2006). Rajan and Zingales (1995) consider both book leverage and market leverage measures of capital structure and find that they give similar results in their cross-sectional analysis. For robustness, we also report results using market leverage, defined as the book value of debt divided by the sum of the market value of equity and the book value of debt. The use of alternative debt ratio for

22 In this case, high (low) tax avoidance firms are defined as those for which the tax avoidance measured as TSmod(or TSper) is above (below) the 3-quantiles or quartile of the sample.

hypothesis 1 and 2 does not qualitatively change the results as reported in Table 6.

<Table6>

5.3.3. Alternative measures of debt/asset ratio and tax avoidance

We use an alternative independent variable of Debt/asset variable which adjusts for the industry median of Debt/asset as in Eq. (9) below. The industry-adjusted Debt/asset variable can be considered as a proxy for the underleverage. We previously argued that the substitution effect of the tax avoidance for the use of debt. The industry-adjusted Debt/asset variable could offer a possible explanation of the underleverage puzzle that leverage in general underutilized.

Pooled OLS: IndadjustedDebt/asset $_{i,t}$ =a1+a2TSmod(or TSper) $_{i,t}$ +a3COD $_{i,t}$

+a4TSmod(or TSper) $_{i,t}$ *COD $_{i,t}$ +a5Lag5(debt/asset) $_{i,t}$ +a6Size $_{i,t-1}$

+a7 Mkt/book $_{i,t-1}$ +a8DIVpay $_{i,t-1}$ +a9ROA $_{i,t-1}$ +a10Collateral/asse $_{i,t-1}$

+bIndustry dummy+cYear dummy (9)

Where IndadjustedDebt.asset is Debt/asset variable subtracted from the industry median of Debt/asset

<Table7>

The results reported in column A of the Table 7 shows that the tax avoidance variable is significant at the 1% level with a negative sign. This indicates that the underleverage phenomenon becomes stronger as tax avoidance increases, further confirming DeAngelo and

Masulis (1980) and Schallheim and Wells (2006) who measure debt conservatism using the kink measure of Graham (2000).[23]

The second alternative measure relates to the tax avoidance. We previously used the tax avoidance measure modified from Desai and Dhamapala (2006) in the tests. We now use an alternative tax avoidance measure, tax aggressiveness (TAXAG) used in Lopez et al. (1998) as in Eq (10).

Pooled OLS: Debt/asset$_{i,t}$ =a1+a2TAXAG$_{i,t}$ +a3IndDebt/asset$_{i,t}$

+a5Lag5(debt/asset)$_{i,t}$ +a6Size$_{i,t-1}$ +a7 Mkt/book$_{i,t-1}$ +a8DIVpay$_{i,t-1}$

+a9ROA$_{i,t-1}$ +a10Collateral/asse$_{i,t-1}$ +bIndustry dummy+cYear dummy (10)

The tax aggressiveness (TAXAG) is based on the tax subsidy measure developed in Wilkie (1992) that captures the notion that aggressive tax-minimizing firms have relatively higher explicit tax subsidies than other firms. Tax aggressiveness (TAXAG) corroborates the tax avoidance measure by introducing the tax subsidies as additional non-debt tax shields (NDTS).

Tax aggressiveness (TAXAG) is measured as an average of tax aggressiveness (tax saving) from t-3 to t-1, scaled by the ending value of total assets at t-1. Tax aggressiveness

23 In Panel A of Figure 1, the cost of debt and market interest rate such as prime rate and BAA-rate decreased from 2000 to 2005. However, the debt/asset ratio also decreased. Following market timing theory in capital structure, firms try to time the market by using debt when it is cheap and equity when it seems cheap. This is consistent with the underleverage phenomenon in Korea in this theory.

each year is measured as pre-tax income (PTI) multiplied by the highest statutory rate (Tax), minus the current tax expense scaled by lagged total assets. Tax aggressiveness (TAXAG) is calculated in Eq. (11) below.

$$\frac{\sum_{t-3}^{t-1}(PTI * Tax - currenttax\exp ense)/3}{Totalasset_{t-1}} \quad (11)$$

The results reported in the column B of Table 7 are similar to those previously reported for hypothesis 1.[24]

5.3.4. The endogeneity for tax avoidance

DeAngelo and Masulis (1980) assume that tax shields (debt and non-debt) and capital structure decisions are simultaneously chosen. In an attempt to alleviate possible endogeneity problem, we use lagged explanatory variables.

Korean government regulated corporate leverage below 200% during 1998 and 1999. Korea experienced financial crisis during the 1997. IMF suggested that high leverage was an important reason of economic crisis in 1997. Korea provides an environment for firms to enhance tax avoidance activities to adjust the government regulation of leverage.[25] For address this causality, we also use two-stage analyses in which the predicted tax avoidance variable is

24 The results using an indicator variable that coded one for the 50 percent of the sample with the highest scaled TAXAG are identical to those reported in column B of Table 7.

25 We minimize the leverage regulation effect on tax avoidance and capital structure by defining the sample period from 2000 to 2005 in main tests.

created using the 1st stage regression and used as explanatory variable in the 2nd stage regression. The 1st stage regression that creates the predicted tax avoidance variables is explained in Eq. (12) below following Mills and Newberry (2001).

$$1^{ST} \text{ stage reg: } TSmod(\text{or } TSper)_{i,t} = a1 + a2Longdebt/asset_{i,t-1} + a3Size_{i,t-1} + a4CAPINT_{i,t-1} + a5Foreign_{i,t-1} + a6BICHGPOS_{i,t-1} + a7BONUSU_{i,t-1} + a8BONUSL_{i,t-1} + bindustry\ dummy + cyear\ dummy \quad (12)$$

Where Londdebt/asset is the ratio of long-term debt to total assets at the beginning of the year; Size is the natural log of total asset; CAPINT is the ratio of total property, plant, and equipment to total assets at the beginning of the year; Foreign is the ratio of foreign sales to total sales; BICHPOS is a dummy variable coded 1 if the firm reports an increase in book income from the prior year and 0, otherwise; BONUSU is the distance from the upper bonus threshold (10 percent of market value of equity), conditional on meeting the lower bonus threshold following Bartov (1993); BONUSL is a dummy variable coded 1 if the firm is below the lower bonus threshold (5 percent of market value of equity) and 0 otherwise following Bartov (1993).

The two-stage analyses results reported in the Table 8 indicate that the predicted tax avoidance leads to lower debt ratios and that the substitution effect becomes stronger when the cost of debt is high, corroborating our main results.

<Table8>

6. Conclusion

This paper examines whether participating in tax avoidance activities is related to the corporate debt policy and what the role of cost of debt is in this relation. We use tax avoidance measure modified from Desai and Dharmapala (2006) who decompose book tax difference (BTD) into earnings management component and tax avoidance one.

We find that the firms use less debt when they engage in tax avoidance activities in a large sample of Korean firms, consistent with Graham and Tucker (2006). Further tests show that the substitution effect becomes stronger when the cost of debt is high. These results are robust to a variety of tests for alternative measures of tax avoidance and debt/asset ratios, and endogeneity of tax avoidance. We also find that substitution effects of tax avoidance for the use of debt increases with cost of debt and that the effects are stronger when the cost of debt is high for high tax avoidance firms.

The overall results suggest that the tax avoidance as non-debt tax shields (NDTS) substitutes for the use of interest tax deductions and that the tax avoidance activities offer a partial explanation for the underleverage puzzle.

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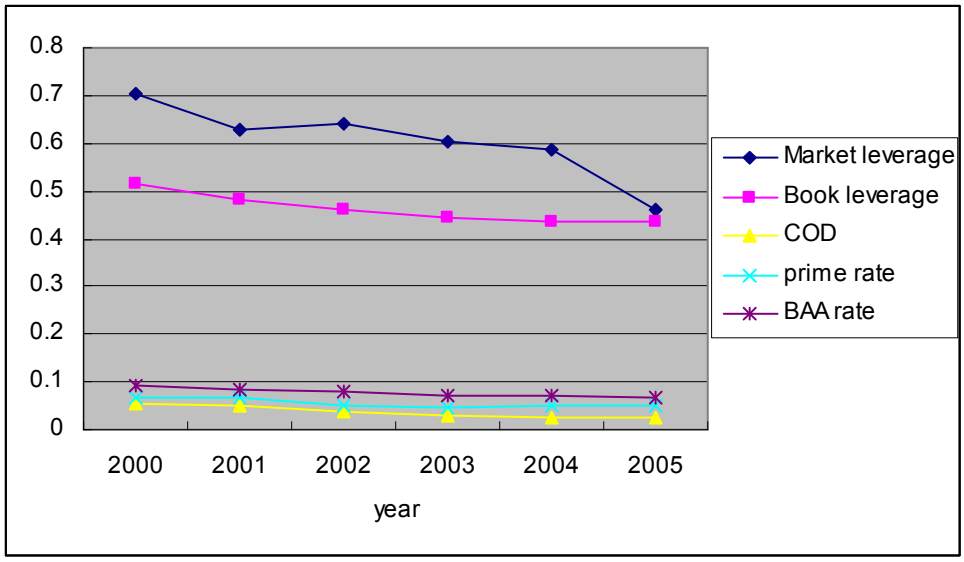
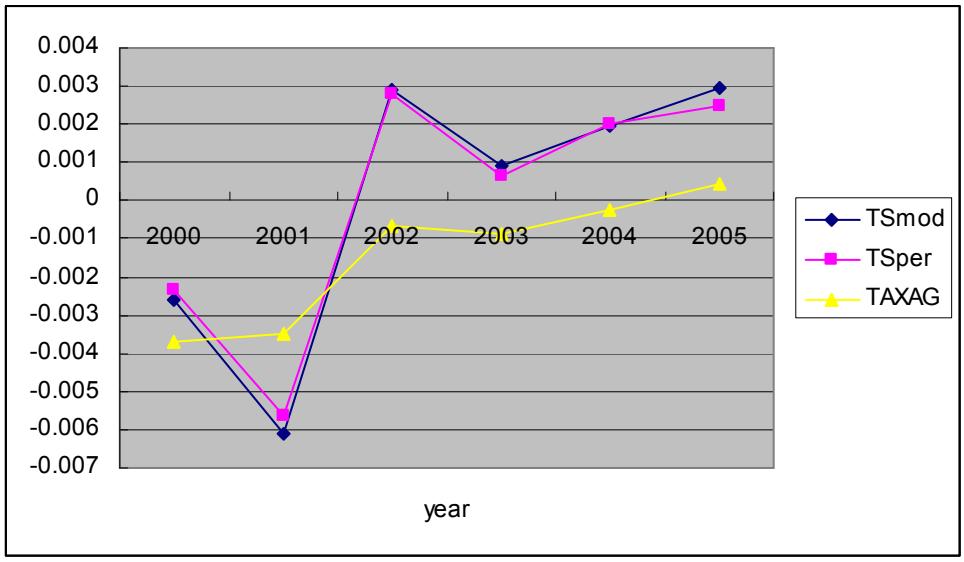
Figure 1

Panel A: Debt/asset ratios



Panel B: Tax avoidance



Notes: Figure 1 presents time series of debt/asset ratios and tax avoidance for balanced panels Panel A plots book leverage and market leverage. Book leverage is total book debt divided by total book assets. Market leverage is total book debt divided by market value of asset (total book debt plus market equity). COD is ex-post cost of debt of the interest rate on the firm's debt, which is calculated as its interest expense for the year divided by its average short- and long-term debt during the year. Prime rate is the yield on 10-year government bonds for the year. BAA rate is the yield on 10-year BAA-rated corporate bonds for the year. Panel B plots tax avoidance as means of TSmod, TSper and TAXAG. TSmod(or TSper) is the tax avoidance measure modifying Desai and Dharmapala (2006). TAXAG is the tax-aggressive measure following Lopez et al. (1998).

Table 1

Panel A: Sample selection summary

Number of listed firms in Korea Stock Exchange	3710
Financial and insurance firms	(288)
Non-December year-end firms	(265)
Firms with unclean audit opinions	(62)
Firms without financial data	(447)
Firms with less than 6 firms in a industry each year	(275)
Unbalanced panels	2373
Firms that did not survive for the whole sample period	(513)
Total sample: Balanced panels	1860

Panel B: Industry distribution of sample

Two-digit SIC code	Industry description	Number	Percentage
25	Manufacture of Rubber and Plastic Products	66	3.5
29	Manufacture of Other Machinery and Equipment	90	4.8
31	Manufacture of Electrical Machinery and Apparatuseses n.e.c.	78	4.2
51	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	84	4.5
18	Manufacture of Sewn Wearing Apparel and Fur Articles	60	3.2
26	Manufacture of Other Non-metallic Mineral Products	108	5.8
17	Manufacture of Textiles, Except Sewn Wearing apparel	42	2.3
52	Retail Trade, Except Motor Vehicles and Motorcycles	42	2.3
60	Land Transport ; Transport Via Pipelines	42	2.3
15	Manufacture of Food Products and Beverages	126	6.8
33	Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	126	6.8
40	Electricity, Gas, Steam and Hot Water Supply	36	1.9
74	Professional, Scientific and Technical Services	36	1.9
32	Manufacture of Electronic Components, Radio, Television and Communication Equipment and Apparatuses	150	8.1
27	Manufacture of Basic Metals	144	7.7
28	Manufacture of Fabricated Metal Products, Except Machinery and Furniture	42	2.3
45	General Construction	150	8.1
21	Manufacture of Pulp, Paper and Paper Products	48	2.6
24	Manufacture of Chemicals and Chemical Products	390	20.9
	Total	1860	100

Notes: The industry classification is based on 2-digit SIC code of the Korea National Statistical Office.

Table 2: Descriptive statistics

Panel A: Variable distributions

Variable	N	Mean	Median	Standard deviation	Min	Max
BTD	1860	-0.009	-0.007	0.059	-0.712	0.756
Financial income	1860	0.057	0.050	0.082	-0.503	0.533
Taxable income	1860	0.066	0.056	0.086	-0.739	1.077
TA(total accrual)	1860	-0.011	-0.012	0.087	-0.809	0.468
Dismod	1860	0.002	0.003	0.072	-0.422	0.431
Disper	1860	0.001	0.001	0.062	-0.359	0.431
Book leverage	1860	0.462	0.461	0.186	0.017	1.525
Market leverage	1860	0.604	0.635	0.223	0.008	0.992
TS	1860	0.000	0.003	0.057	-0.687	0.772
TSmod	1860	0.000	0.002	0.058	-0.691	0.776
TSper	1860	0.000	0.002	0.059	-0.698	0.767
TAXAG	1857	-0.001	0.000	0.017	-0.236	0.091
Inddebt/asset	1860	0.465	0.448	0.083	0.278	0.688
Lag5(debt/asset)	1860	0.606	0.605	0.197	0.078	2.017
Size	1860	0.956	0.872	0.621	0.000	11.987
Mkt/book	1860	0.794	0.743	0.302	0.213	3.803
DIVpay	1860	0.782	1.000	0.413	0.000	1.000
ROA	1860	0.036	0.035	0.074	-0.948	0.725
Collateral	1860	0.486	0.490	0.182	0.005	0.955
COD	1860	0.037	0.035	0.025	0.000	0.204

Panel B: Pearson correlations

	Debt/asset	TS	TSmod	TSper	TAXAG	Inddebt/asset	Lag5debt/asset	Size	Mkt/book	DIVpay	ROA	Collateral	COD
Debt/asset	1.000	-0.046	-0.058	-0.087	-0.329	0.382	0.508	0.096	0.207	-0.336	-0.313	0.104	0.562
		(0.047)	(0.012)	(0.000)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
TS		1.000	0.991	0.983	0.027	-0.002	0.092	-0.007	0.039	0.004	-0.025	0.082	0.020
			(<.0001)	(<.0001)	(0.238)	(0.918)	(<.0001)	(0.778)	(0.096)	(0.875)	(0.289)	(0.000)	(0.390)
TSmod			1.000	0.991	0.036	-0.014	0.074	0.004	0.032	0.017	-0.007	0.050	-0.005
				(<.0001)	(0.116)	(0.552)	(0.002)	(0.863)	(0.164)	(0.472)	(0.753)	(0.030)	(0.845)
TSper				1.000	0.056	-0.009	0.063	0.004	0.037	0.033	0.018	0.039	-0.029
					(0.016)	(0.690)	(0.006)	(0.862)	(0.110)	(0.156)	(0.440)	(0.094)	(0.209)
TAXAG					1.000	-0.049	-0.061	0.033	-0.084	0.297	0.465	-0.036	-0.280
						(0.036)	(0.009)	(0.150)	(0.000)	(<.0001)	(<.0001)	(0.123)	(<.0001)
Inddebt/asset						1.000	0.333	0.107	0.111	-0.071	-0.030	-0.116	0.165
							(<.0001)	(<.0001)	(<.0001)	(0.002)	(0.194)	(<.0001)	(<.0001)
Lag5debt/asset							1.000	0.073	0.185	-0.278	-0.100	0.136	0.365
								(0.002)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
Size								1.000	0.071	0.082	0.086	-0.124	-0.076
									(0.002)	(0.000)	(0.000)	(<.0001)	(0.001)
Mkt/book									1.000	-0.104	0.102	-0.151	0.042
										(<.0001)	(<.0001)	(<.0001)	(0.069)
DIVpay										1.000	0.211	-0.080	-0.318
											(<.0001)	(0.001)	(<.0001)
ROA											1.000	-0.130	-0.321
												(<.0001)	(<.0001)
Collateral												1.000	0.185
													*<.0001)
COD													1.000

Notes: This table presents summary statistics for the 1860 firm-year observations over the period 2000–2005 used in the hypotheses tests on the balanced panel. Panel A presents the distributional statistics for the variables. Panel B reports correlations for the regression variables, with Pearson correlations; related probability values are presented in below. BTD is the book tax difference which subtracts tax income from financial income. Financial income is the pretax book income from income statement. Taxable income is the income derived by Korean corporate tax code reported in notes of annual reports. TA is the total accrual which is calculated as ordinary income minus cash flow from operation. Dismod is the discretionary accrual measured as Dechow et al. (1995). Disper is the performance-matched discretionary accrual measured as Kothari et al. (2005). Book leverage is the book debt divided by book assets which is mainly used as debt/asset. Market leverage is the book debt divided by market value of asset (book debt plus market equity). TS is the tax avoidance measure as in Desai and Dharmapala (2006). TSmod(or TSper) is the tax avoidance measure modifying Desai and Dharmapala (2006). TAXAG is the tax-aggressive measure as in Lopez et al. (1998). IndDebt/asset equals industry-median debt/asset ratio based on 2-digit SIC code of the Korea National Statistical Office. Lag5(debt/asset) is the debt ratio from five years. Size is sales revenue divided by book assets. Mkt/book is the market value of total assets (market equity plus book debt) divided by book assets. DIVpay equals one if the firm pays dividends and 0 otherwise. ROA is net income divided by book assets. Collateral equals inventory, plant, property, and equipment divided by book assets. COD is the ex-post cost of debt of the interest rate on the firm's debt, which is calculated as its interest expense for the year divided by its average short- and long-term debt during the year.

Table 3: Regression analysis of the effect of tax avoidance on corporate debt policy- H_1

Pooled OLS: $\text{Debt/asset}_{i,t}$ =a1+a2TSmod(or TSper)$_{i,t}$ +a3IndDebt/asset$_{i,t}$ +a4Lag5(debt/asset)$_{i,t}$

+a5Size$_{i,t-1}$ +a6Mkt/book$_{i,t-1}$ +a7DIVpay$_{i,t-1}$ +a8ROA$_{i,t-1}$ +a9Collateral$_{i,t-1}$

+bIndustry dummy+cYear dummy (5)

Fixed effects model: $\text{Debt/asset}_{i,t}$ =a1$_i$ +a2TSmod(or TSper)$_{i,t}$ + a3IndDebt/asset$_{i,t}$

+a4Lag5(debt/asset)$_{i,t}$ +a5Size$_{i,t-1}$ +a6 Mkt/book$_{i,t-1}$ +a7DIVpay$_{i,t-1}$ +a8ROA$_{i,t-1}$

+a9Collateral/asset$_{i,t-1}$ +Firm fixed effect +Year fixed effect (6)

Panel A: Balanced panel

	prediction	Pooled OLS			Fixed-effects		
Intercept	?	0.022	0.023	0.021	0.000	0.001	0.000
TS	-	-0.297***			-0.145***		
TSmod	-		-0.291***			-0.148***	
TSper	-			-0.341***			-0.169***
Inddebt/asset	+	0.337***	0.337***	0.338***	0.410***	0.410***	0.410***
Lag5(debt/asset)	+	0.318***	0.318***	0.318***	-0.137***	-0.137***	-0.134***
Size	+	0.023***	0.023***	0.023***	0.004	0.004	0.004
Mkt/book	+	0.102***	0.103***	0.103***	0.007	0.008	0.008
DIVpay	-	-0.073***	-0.073***	-0.073***	-0.009	-0.008	-0.009
ROA	-	-0.648***	-0.646***	-0.640***	-0.150***	-0.149***	-0.149***
Collateral	+	0.086***	0.083***	0.083***	0.130***	0.128***	0.127***
Ind dummy		Included	Included	Included			
Year dummy		included	included	included			
Fixed effect					Included	Included	Included
Year effect					Included	Included	Included
F-value		50.460***	50.420***	51.100***	14.150***	14.200***	14.160***
Adj R-squ		0.452	0.452	0.455	0.859	0.859	0.859
N		1860	1860	1860	1860	1860	1860

Panel B: Unbalanced panel

	prediction	Pooled OLS			Fixed-effects		
Intercept	?	-0.031	-0.030	-0.032	0.232***	0.228***	0.222***
TS	-	-0.096***			0.011		
TSmod	-		-0.104***			0.003	
TSper	-			-0.128***			-0.012
Inddebt/asset	+	0.660***	0.654***	0.653***	0.570***	0.569***	0.569***
Lag5(debt/asset)	+	0.141***	0.141***	0.141***	-0.135***	-0.135***	-0.133***
Size	+	0.011***	0.011***	0.011***	-0.001	0.000	0.000
Mkt/book	+	0.107***	0.108***	0.112***	-0.007	-0.005	-0.002
DIVpay	-	-0.107***	-0.107***	-0.106***	-0.009	-0.010	-0.010
ROA	-	-0.069***	-0.069***	-0.071***	-0.022***	-0.023***	-0.025***
Collateral	+	0.140***	0.139***	0.138***	0.184***	0.183***	0.182***
Ind dummy		Included	Included	Included			
Year dummy		Included	Included	Included			
Fixed effect					Included	Included	Included
Year effect					Included	Included	Included
F-value		40.130***	40.260***	40.720***	10.120***	10.100***	10.050***
Adj R-squ		0.338	0.339	0.342	0.811	0.811	0.811
N		2373	2373	2373	2373	2373	2373

Notes: This table presents regression results for the models using pooled ordinary least square regression model and two-way fixed effects estimation. The balanced sample is compiled by discarding the entire time-series of firms if any missing observations are encountered in the 6 years. The unbalanced panel is compiled by discarding only the firm year when missing observations are encountered. The dependent variable is debt/asset, which is book leverage. TSmod(TSper) is the tax avoidance measure modifying Desai and Dharmapala (2006). IndDebt/asset equals industry-median debt-asset ratio based on 2-digit SIC code of the Korea National Statistical Office. Lag5(debt/asset) is the debt ratio before five years. Size is sales revenue. Mkt/book is the market value of total assets (market equity plus book debt) divided by book assets. DIVpay equals one if the firm pays dividends and 0 otherwise. ROA is net income divided by book assets. Collateral equals inventory, plant, property, and equipment divided by book assets. The industry dummy identifies the firm's two-digit SIC code. Time trend equals the calendar year. The righthand side variables are all lagged one year, except for tax avoidance, IndDebt/asset, Lag5(debt/asset) and the time trend. The superscript asterisks indicate explanatory variable coefficient significance at p-values less than 0.10 (*), 0.05 (**) and 0.01 (***).

Table 4: Regression analysis of the effect of tax avoidance on corporate debt policy- H_2

Pooled OLS: $Debt/asset_{i,t}$ =a1+a2TSmod(or TSper) $_{i,t}$ +a3$COD_{i,t}$ +a4TSmod(or TSper) $_{i,t}$ *$COD_{i,t}$

+a5IndDebt/asset $_{i,t}$ +a6Lag5(debt/asset) $_{i,t}$ +a7Size $_{i,t-1}$ +a8 Mkt/book $_{i,t-1}$ +a9DIVpay $_{i,t-1}$

+a10ROA $_{i,t-1}$ +a11Collateral $_{i,t-1}$ +bIndustry dummy+cYear dummy (7)

Fixed effects model: $Debt/asset_{i,t}$ =a1 $_{i,t}$ +a2TSmod(or TSper) $_{i,t}$ +a3$COD_{i,t}$ +a4TSmod(or TSper) $_{i,t}$ *$COD_{i,t}$

+a5IndDebt/asset $_{i,t}$ +a6Lag5(debt/asset) $_{i,t}$ +a7Size $_{i,t-1}$ +a8 Mkt/book $_{i,t-1}$ +a9DIVpay $_{i,t-1}$

+a10ROA $_{i,t-1}$ +a11Collateral $_{i,t-1}$ +Firm fixed effect+Year fixed effect (8)

Panel A: Total sample

	prediction	Pooled OLS				Fixed-effects			
Intercept	?	-0.079*	-0.077	-0.080*	-0.078*	0.004	0.011	0.004	0.010
TSmod	-	-0.296***	-0.153*			-0.152***	-0.006		
TSper	-			-0.322***	-0.188**			-0.166***	-0.014
COD	+	3.662***	3.672***	3.642***	3.651***	1.980***	2.021***	1.967***	2.008***
TSmod* COD	-		-2.620**				-2.592***		
TSper* COD	-				-2.488*				-2.692***
Inddebt/asset	+	0.242***	0.238***	0.244***	0.240***	0.345***	0.339***	0.346***	0.340***
Lag5(debt/asset)	+	0.210***	0.208***	0.211***	0.209***	-0.110***	-0.113***	-0.108***	-0.112***
Size	+	0.029***	0.030***	0.029***	0.029***	0.006	0.006	0.006	0.006
Mkt/book	+	0.099***	0.100***	0.100***	0.100***	0.016	0.017	0.016	0.017*
DIVpay	-	-0.037***	-0.037***	-0.036***	-0.036***	-0.003	-0.003	-0.003	-0.003
ROA	-	-0.353***	-0.360***	-0.349***	-0.357***	-0.084***	-0.095***	-0.084***	-0.097***
Collateral	+	0.049***	0.048***	0.049***	0.048***	0.117***	0.118***	0.116***	0.118***
Ind dummy		Included	Included	Included	Included				
Year dummy		Included	Included	Included	Included				
Fixed effect						Included	Included	Included	Included
Year effect						Included	Included	Included	Included
F-value		83.490***	81.200***	84.130***	81.790***	12.800***	12.850***	12.770***	12.830***
Adj R-squ		0.587	0.587	0.589	0.589	0.872	0.873	0.872	0.873
N		1860	1860	1860	1860	1860	1860	1860	1860

Panel B: High tax avoidance firms

	prediction	Pooled OLS				Fixed-effects			
Intercept	?	-0.093	-0.091*	-0.090	-0.087	0.197***	0.195***	0.199***	0.197***
TSmod	-	-0.320***	0.063			-0.091	0.122		
TSper	-			-0.369***	-0.01			-0.117*	0.094
COD	+	3.786***	4.131***	3.774***	4.088***	2.123***	2.423***	2.126***	2.411***
TSmod*COD	-		-7.155***				-3.904**		
TSper*COD	-				-6.744***				-3.921*
Inddebt/asset	+	0.371***	0.343***	0.367***	0.341***	0.299***	0.283***	0.298***	0.282***
Lag5(debt/asset)	+	0.196***	0.185***	0.198***	0.189***	-0.121***	-0.132***	-0.119***	-0.130***
Size	+	0.022***	0.023***	0.022***	0.023***	0.018	0.018	0.018	0.018
Mkt/book	+	0.097***	0.100***	0.098***	0.100***	0.010	0.013	0.010	0.013
DIVpay	-	-0.043***	-0.043***	-0.043***	-0.044***	0.005	0.006	0.004	0.005
ROA	-	-0.258***	-0.273***	-0.258***	-0.276***	-0.010	-0.031	-0.010	-0.032
Collateral	+	0.009	0.006	0.004	0.001	0.098**	0.096**	0.094**	0.093**
Ind dummy		Included	Included	Included	Included				
Year dummy		Included	Included	Included	Included				
Fixed effect						Included	Included	Included	Included
Year effect						Included	Included	Included	Included
F-value		37.76***	37.420***	38.17***	37.72***	7.64***	7.61***	7.61***	7.60***
Adj R-squ		0.559	0.564	0.562	0.566	0.8916	0.893	0.8918	0.893
N		930	930	930	930	930	930	930	930

Panel C: Low tax avoidance firms

	prediction	Pooled OLS				Fixed-effects			
Intercept	?	-0.072	-0.075	-0.075	-0.077	0.005	0.012	0.002	0.009
TSmod	-	-0.300***	-0.384**			-0.294	-0.145		
TSper	-			-0.325***	-0.390**			-0.316***	-0.153
COD	+	3.513***	3.570***	3.488***	3.530***	2.042***	1.890***	2.010***	1.849***
TSmod*COD	+		1.379				-2.495		
TSper*COD	+				1.070				-2.718
Inddebt/asset	+	0.145	0.145	0.151	0.150	0.356***	0.355***	0.361***	0.359***
Lag5(debt/asset)	+	0.212***	0.211***	0.211***	0.211***	-0.111***	-0.113***	-0.107***	-0.109***
Size	+	0.035***	0.035***	0.035***	0.035***	0.003	0.003	0.002	0.003
Mkt/book	+	0.110***	0.110***	0.110***	0.110***	0.024	0.023	0.024	0.023
DIVpay	-	-0.027***	-0.026***	-0.026**	-0.026**	-0.008	-0.008	-0.008	-0.008
ROA	-	-0.566***	-0.561***	-0.557***	-0.553***	-0.190***	-0.196***	-0.189***	-0.197***
Collateral	+	0.074***	0.076***	0.077***	0.078***	0.162***	0.161***	0.167***	0.165***
Ind dummy		Included	Included	Included	Included				
Year dummy		Included	Included	Included	Included				
Fixed effect						Included	Included	Included	Included
Year effect						Included	Included	Included	Included
F-value		53.85***	52.20***	54.16***	52.48***	7.95***	7.97***	7.98***	8.00***
Adj R-squ		0.646	0.645	0.647	0.647	0.9089	0.909	0.9095	0.910
N		930	930	930	930	930	930	930	930

Notes: This table presents regression results for hypothesis 2 that the substitution effect of tax avoidance for the use of debt increases with the cost of debt for total sample, high tax avoidance firms and low tax avoidance ones. This tests use both pooled ordinary least square regression model and two-way fixed effects estimation Eq. (7) and (8). High tax avoidance firms are defined as those for which tax avoidance, which is measured as TSmod(TSper)is above the median for the sample. Low tax avoidance firms are defined as those with TSmod(TSper) that is shorter than the median for the sample. The variables are specified in Table 2. The superscript asterisks indicate explanatory variable coefficient significance at p-values less than 0.10 (*), 0.05 (**) and 0.01 (***).

Table 5: Regression analysis of the effect of tax avoidance on corporate debt policy-robust test of H_2

Pooled OLS: Debt/asset$_{i,t}$ =a1+a2TSmod(or TSper) $_{i,t}$ +a3COD$_{i,t}$ +a4TSmod(or TSper) $_{i,t}$ *COD$_{i,t}$ +a5IndDebt/asset$_{i,t}$ +a6Lag5(debt/asset)$_{i,t}$ +a7Size$_{i,t-1}$ +a8 Mkt/book$_{i,t-1}$ +a9DIVpay$_{i,t-1}$ +a10ROA$_{i,t-1}$ +a11Collateral$_{i,t-1}$ +bIndustry dummy+cYear dummy (7)

	prediction	High tax avoidance firms				Low tax avoidance firms			
Intercept	?	-0.153*	-0.146*	-0.141	-0.131	0.053	0.047	0.025	0.019
TSmod	-	0.127		0.232		-0.129		-0.158	
TSper	-		0.029		0.124		-0.159		-0.179
COD	+	4.451***	4.367***	4.814***	4.694***	3.382***	3.338***	3.617***	3.551***
TSmod* COD	-/+	-7.802***		-9.501***		-0.387		0.251	
TSper* COD	-/+		-7.264***		-8.851***		-0.730		-0.238
Inddebt/asset	+	0.525***	0.519***	0.453**	0.444**	0.003	0.013	0.060	0.072
Lag5(debt/asset)	+	0.154***	0.161***	0.139***	0.146***	0.214***	0.215***	0.192***	0.193***
Size	+	0.016**	0.015**	0.048***	0.047***	0.023***	0.023***	0.027*	0.028*
Mkt/book	+	0.076***	0.077***	0.075***	0.077***	0.103***	0.102***	0.105***	0.103***
DIVpay	-	-0.041***	-0.042***	-0.036**	-0.037**	-0.027**	-0.025*	-0.029**	-0.028*
ROA	-	-0.190***	-0.195***	-0.173***	-0.180***	-0.719***	-0.707***	-0.668***	-0.654***
Collateral	+	0.004	-0.002	-0.017	-0.024	0.062*	0.065**	0.029	0.032
Ind dummy		Included	Included	Included	Included	Included	Included	Included	Included
Year dummy		Included	Included	Included	Included	Included	Included	Included	Included
F-value		26.12***	26.36***	17.95***	18.10***	37.10***	37.35***	25.72***	25.90***
Adj R-squ		0.573	0.575	0.547	0.549	0.658	0.660	0.637	0.639
N		620	620	465	465	620	620	465	465

Notes: This table reports regression results for hypothesis 2 using pooled OLS of Eq. (7). The variables are specified in Table 2. The superscript asterisks indicate explanatory variable coefficient significance at p-values less than 0.10 (*), 0.05 (**) and 0.01 (***).

Table 6: Regression analysis of the effect of tax avoidance on corporate debt policy - Market leverage as debt/asset ratio

		Pooled OLS					
		Hypothesis 1		Hypothesis 2			
	prediction			High tax avoidance firms		Low tax avoidance firms	
Intercept	?	0.349***	0.349***	0.252***	0.259***	0.301***	0.298***
TSmod	-	-0.280***		0.038		-0.229	-0.293
TSper	-		-0.336***		-0.084		
COD	+			4.385***	4.306***	3.939***	3.941***
TSmod* COD	-/+			-8.865***		0.159	
TSper*COD	-/+				-7.816***		0.705
Inddebt/asset	+	0.364***	0.360***	0.356***	0.352***	0.094	0.095
Lag5(debt/asset)	+	0.286***	0.287***	0.169***	0.174***	0.151***	0.150***
Size	+	0.025***	0.025***	0.026***	0.025***	0.038***	0.038***
Mkt/book	+	-0.183***	-0.183***	-0.185***	-0.185***	-0.170***	-0.170***
DIVpay	-	-0.045***	-0.044***	-0.019	-0.019	0.008	0.009
ROA	-	-0.765***	-0.759***	-0.418***	-0.419***	-0.633***	-0.623***
Collateral	+	0.167***	0.167***	0.057*	0.052	0.175***	0.178***
Ind dummy		Included	Included	Included	Included	Included	Included
Year dummy		Included	Included	included	included	Included	Included
F-value		55.980***	56.540***	41.20***	41.45***	45.47***	45.63***
Adj R-squ		0.478	0.481	0.588	0.590	0.6124	0.613
N		1860	1860	930	930	930	930

Notes: This table presents regression results for the hypothesis 1 and 2 using market leverage rather than book leverage. The market leverage is defined as the book value of debt divided by the sum of the market value of equity and the book value of debt. Inddebt/asset is calculated by market leverage. The variables are specified in Table 2. The superscript asterisks indicate explanatory variable coefficient significance at p-values less than 0.10 (*), 0.05 (**) and 0.01 (***).

Table 7: Regression analysis of the effect of tax avoidance on corporate debt policy -Alternative measures of debt ratio and tax avoidance

Pooled OLS: IndadjustedDebt/asset $_{i,t}$ =a1+a2TSmod(or TSper) $_{i,t}$ +a3Lag5(debt/asset) $_{i,t}$ +a4Size $_{i,t-1}$ +a5 Mkt/book $_{i,t-1}$ +a6DIVpay $_{i,t-1}$ +a7ROA $_{i,t-1}$ +a8Collateral/asse $_{i,t-1}$ +bIndustry dummy+cYear dummy (9)

Pooled OLS: Debt/asset $_{i,t}$ =a1+a2TAXAG $_{i,t}$ +a3IndDebt/asset $_{i,t}$ +a4Lag5(debt/asset) $_{i,t}$ +a5Size $_{i,t-1}$ +a6 Mkt/book $_{i,t-1}$ +a7DIVpay $_{i,t-1}$ +a8ROA $_{i,t-1}$ +a9Collateral/asse $_{i,t-1}$ +bIndustry dummy+cYear dummy (10)

		Pooled OLS					
		IndadjustedDebt/asset				TAXAG	
		Book leverage		Market leverage		Book leverage	Market leverage
	prediction						
Intercept	?	-0.270***	-0.271***	-0.056*	-0.057*	0.006	0.349***
TSmod	-	-0.284***		-0.256***			
TSper	-		-0.335***		-0.314***		
TAXAG	-					-1.914***	-0.702***
Inddebt/asset	+					0.358***	0.368***
Lag5(debt/asset)	+	0.316***	0.317***	0.288***	0.290***	0.322***	0.282***
Size	+	0.022***	0.021***	0.025***	0.025***	0.022***	0.025***
Mkt/book	+	0.102***	0.103***	-0.180***	-0.179***	0.088***	-0.191***
DIVpay	-	-0.075***	-0.074***	-0.045***	-0.044***	-0.059***	-0.041***
ROA	-	-0.635***	-0.630***	-0.740***	-0.736***	-0.455***	-0.690***
Collateral	+	0.080***	0.079***	0.161***	0.161***	0.083***	0.165***
Ind dummy		Included	Included	Included	Included	Included	Included
Year dummy		Included	Included	Included	Included	Included	Included
F-value		34.060***	34.630***	27.35***	27.74***	53.020***	55.210***
Adj R-squ		0.348	0.352	0.298	0.301	0.465	0.475
N		1860	1860	1860	1860	1857	1857

Notes: This table reports regression results for alternative measures of debt ratio and tax avoidance using Eq. (9) and (10) through pooled OLS. In column 1, we use an alternative independent variable of Debt/asset variable which adjusts for the industry median of Debt/asset. In column 2, we use an alternative tax avoidance measure, tax aggressiveness (TAXAG) used in Lopez et al. (1998). The superscript asterisks indicate explanatory variable coefficient significance at p-values less than 0.10 (*), 0.05 (**) and 0.01 (***).

Table 8: Regression analysis of the effect of tax avoidance on corporate debt policy - Endogeneity for tax avoidance

	prediction	2SLS					
		TSmod			TSper		
		(11)	(5)	(6)	(11)	(5)	(6)
		TSmod	Debt/asset	Debt/asset	TSper	Debt/asset	Debt/asset
Intercept	?	-0.090***	-0.039	-0.106*	-0.089***	-0.036	-0.101*
Longdebt/asset	-	-0.016			-0.028**		
CAPINT	?	0.016*			0.016*		
Foreign	+	0.006			0.006		
BICHPOS	+	0.010***			0.010***		
BONUSU	+	0.003			0.002		
BONUSL	-	-0.022***			-0.028***		
TSmod	-		-2.631***	-1.608***			
TSper	-					-2.516 ***	-1.492***
COD	+			3.498***			3.441***
TSmod*COD	-			-3.643***			
TSper*COD	-						-3.727***
Inddebt/asset	+		0.330**	0.224**		0.326**	0.225**
Lag5(debt/asset)	+		0.370***	0.248***		0.364***	0.245***
Size	+	0.005***	0.022***	0.029***	0.005***	0.021***	0.028***
Mkt/book	+		0.115***	0.108***		0.117***	0.109***
DIVpay	-		-0.061***	-0.030***		-0.058***	-0.029***
ROA	-		-0.661***	-0.387***		-0.619***	-0.365***
Collateral	+		0.116***	0.070***		0.109***	0.066***
Ind dummy		Included	Included	Included	Included	Included	Included
Year dummy		Included	Included	Included	Included	Included	Included
F-value		4.320***	27.020***	53.77***	5.31***	29.12***	57.26***
Adj R-squ		0.051	0.303	0.484	0.065	0.320	0.500
N		1860	1860	1860	1860	1860	1860

Notes: This table presents regression results of controlling endogeneity of tax avoidance to the main specification for the balanced panel. We perform two-stage analyses (2SLS) in which we use predicted tax avoidance as an explanatory variable in 2nd stage regression. Predicted tax avoidance is created through the 1st stage regression modifying Mills and Newberry (2001). The second-stage regression indicates that

predicted tax avoidance leads to lower debt ratios and the substitution effect of tax avoidance for the use of debt increases with the cost of debt, corroborating our main result. The superscript asterisks indicate explanatory variable coefficient significance at p-values less than 0.10 (*), 0.05 (**) and 0.01 (***).