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Tax incentives and capital structure choice: evidence from Germany

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Abstract: This paper provides new evidence that taxes affect capital structure choice, using a unique and comprehensive panel data set which covers 86,173 German non-financial firms over the years 1973–2008. Following the Graham methodology to simulate marginal tax rates, we find a statistically and economically significant positive relationship between the marginal tax benefit of debt (net and gross of investor taxes) and the debt ratio. A 10% increase in the net (gross) marginal tax benefit of debt causes a 1.5% (1.6%) increase in the debt ratio, ceteris paribus. The results are robust to various specifications like using changes in debt or debt to capital ratios. A significantly positive effect of taxes on the debt ratio can also be identified in a partial adjustment model.

JEL classification: G32, H20
Keywords: debt, capital structure, marginal tax rate, corporate taxes, personal taxes.

Non-technical Summary

Modigliani and Miller (1958) show in their seminal work that the capital structure is irrelevant to the value of the firm in a perfect, frictionless world without taxes. In the real economy the interest deductibility of debt at the corporate level encourages firms to use debt financing. On the other hand, personal income taxation provides a tax advantage of equity at the investor level because equity income (dividends and capital gains) is taxed at a lower rate than interest income. Thus, the overall effect remains unclear and depends on the country-specific tax law. Miller (1977) states that, at the margin, the tax disadvantage of debt at the investor level completely offsets the tax advantage at the corporate level; thus there is no tax advantage of debt at all.

In this paper, we examine the relationship between taxes, at both the corporate and the personal level, and the capital structure decision of firms resident in Germany. Germany is an excellent country to test Miller's hypothesis because neutrality with respect to different finance instruments played a central role in past major German tax reforms. Furthermore, recent empirical studies investigating the relationship between taxes and debt focus on large US companies with access to capital markets. Our empirical analysis is based on the unique and comprehensive Bundesbank's corporate balance sheet data set which covers over 80,000 German firms over the years 1973–2008. We use Graham's expected marginal tax rate approach for the identification of tax effects on the capital structure decision. We simulate various paths of future taxable income along which marginal tax rates are calculated that account for the carry forward and backward rules. This procedure accounts for the fact that firms may report losses and in this case, the tax shield cannot be used immediately and will offset future positive taxable income. Furthermore, we account for the endogeneity problem due to the reverse causality between debt and taxes. Recent studies using dichotomous tax rates based on net operating losses (see e.g., Byoun (2008)) or effective tax rates (see e.g., Antoniou et al. (2008)) arrive at a negative relation between tax rates and debt usage because they do not adequately take this issue into account.

This study is the first empirical analysis that shows a significant positive relationship between the marginal tax benefit of debt and the debt ratio for German firms using the Graham methodology to estimate marginal tax rates. In the empirical model, we control for various other determinants which are motivated by the existence of information asymmetries, bankruptcy costs and transaction costs. A 10% increase in the marginal tax benefit of debt at the corporate level (investor level) causes a 1.5% (1.6%) increase in the debt ratio, ceteris paribus. This positive relationship can also be found in various other specifications (like changes in debt levels or net increase of debt) and in a partial adjustment model.

Nicht-technische Zusammenfassung

Modigliani und Miller (1958) zeigen in ihrer grundlegenden Arbeit, dass der Unternehmenswert in einer perfekten, friktionslosen Welt ohne Steuern unabhängig von der Kapitalstruktur ist. In der realen Welt führt die steuerliche Abzugsfähigkeit der Fremdkapitalzinsen zu einem Steuervorteil für das Fremdkapital auf Unternehmensebene. Die persönliche Besteuerung auf Investorenebene verursacht dagegen einen Steuernachteil des Fremdkapitals auf Investorenebene, da der Steuersatz für Einnahmen aus Eigenkapital (Dividenden und Veräußerungsgewinne) geringer ist als der Steuersatz für Zinseinnahmen. Der Gesamteffekt ist somit unklar und hängt stark vom jeweiligen Steuersystem eines Staates ab. Miller (1977) behauptet sogar, dass sich im Gleichgewicht der Steuervorteil auf Unternehmensebene und der Steuernachteil auf Investorenebene ausgleicht und somit Steuern letzlich keine Rolle für die Kapitalstrukturentscheidung spielen.

Wir untersuchen in diesem Papier den Zusammenhang zwischen Steuern, sowohl auf Unternehmensebene also auch auf Investorenebene, und der Kapitalstruktur deutscher Unternehmen. Deutschland eignet sich ganz besonders, um Millers Hypothese der Irrelevanz der Besteuerung zu testen, da die deutsche Steuergesetzgebung bei ihren Steuerreformen stets um die Finanzierungsneutralität bemüht war. Außerdem untersuchen vorangehende Studien den Zusammenhang zwischen Steuern und Kapitalstruktur meist lediglich für große amerikanische Unternehmen mit Zugang zum Kapitalmarkt. Für die Auswertungen wurde die Unternehmensbilanzstatistik der Deutschen Bundesbank mit über 80.000 deutschen Firmen über die Jahre von 1973 bis 2008 verwendet. Für die Identifikation wird Grahams marginaler Steuersatz verwendet, bei dem anhand zukünftiger Einkommenspfade der erwartete marginale Steuersatz unter Berücksichtigung von Verlustvor- und rückträgen geschätzt wird. Damit wird der Tatsache Rechnung getragen, dass Unternehmen auch Verluste ausweisen können und somit der Steuerschild gar nicht oder erst in der Zukunft nutzbar wird. Darüberhinaus berücksichtigen wir die Endogenitätsproblematik aufgrund der umgekehrten Kausalität zwischen Fremdkapital und Steuern. Kürzlich erschienene Studien, welche auf Nettoverlustvorträge basierende dichotome Steuervariablen (see e.g., Byoun (2008)) oder effektive Steuervariablen (see e.g., Antoniou et al. (2008)) benutzen, finden einen negativen Zusammenhang zwischen Fremdkapital und Steuern, da sie diesen Sachverhalt nicht ausreichend beachten.

Das vorliegende Papier ist die erste empirische Analyse, die einen signifikant positiven Zusammenhang zwischen dem Steuervorteil des Fremdkapitals und der Fremdkapitalquote deutscher Unternehmen unter Verwendung von Grahams simulierten marginalen Steuersätzen nachweist. Das empirische Modell kontrolliert dabei für zahlreiche weitere Faktoren, die sich aus der Existenz von Informationsasymmetrien, Insolvenzkosten und Transaktionskosten ergeben. Ein Anstieg des marginalen Steuervorteiles auf Unternehmensebene (auf Investorenebene) um 10% führt ceteris paribus zu einem Anstieg der Fremdkapitalquote um 1,5% (1,6%). Dieser positive Zusammenhang zwischen Steuervorteil und Fremdkapitalhöhe lässt sich auch in zahlreichen anderen Spezifikationen (wie Veränderung der Fremdkapitalquote oder Nettofremdkapitalaufnahme) und in einem dynamischen Modell nachweisen.

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1 Introduction

It is widely held that the interest deductibility of debt at the corporate level encourages firms to use debt financing, whereas personal income taxation provides a tax advantage of equity at the investor level leading firms to use less debt. The overall effect remains unclear and depends on the country-specific tax law. In this paper, we examine the relationship between taxes, at both the corporate and the personal level, and the capital structure decision. We use a unique panel data set of firms resident in Germany.

Researchers face two general problems when they want to show that taxes affect capital structure choice. First, the lack of variation of statutory tax rates over time as well as in the cross-section of firms makes it difficult to identify tax effects. Second, a simultaneity bias might occur because firms which exhibit a high debt ratio have high interest payments, which lower the tax base and hence decrease the marginal tax rate. Thus, a regression of capital structure on a tax rate based on income *after* interest leads to spurious negative estimates (see Graham et al. (1998)). Despite this endogeneity problem, recent studies still use marginal tax rates based on income after interest payments and thus arrive at a negative relation between tax rates and debt usage (see e.g., Byoun (2008) and Antoniou et al. (2008)).

It is widely accepted in finance theory that the marginal tax rate is the relevant tax variable when analysing financing decisions (see King and Fullerton (1984)). The marginal tax rate is defined as the present value of taxes paid on one additional unit of income earned today (see Scholes and Wolfson (1992)). As long as the unit of income is sufficiently small, the marginal tax rate can be viewed as the present value of taxes shielded by one additional unit of income paid out as interest.

Our identification strategy relies on the Graham methodology to simulate marginal tax rates (see Shevlin (1990), Graham (1996a) and Graham et al. (1998)). The simulated marginal tax rate incorporates an important feature of the German tax code, namely the asymmetric treatment of gains and losses. Firms only pay taxes at the statutory rate as long as the taxable income is positive. In Germany, losses are allowed to be carried forward and backward in time. When the tax base of a firm is fully exhausted (e.g., because of high existing depreciation and interest payments) an additional unit of interest paid today does not shield taxes today; instead it shields taxes at the time in the future when the firm first generates positive taxable income again. Despite the fact that a considerable proportion of firms report losses and hence cannot exploit the full amount of potential tax deductions (marginal tax rates are below statutory tax rates in 30% of our sample), researchers often neglect the dynamic features of the tax code (e.g., Booth et al. (2001)). We simulate various paths of future taxable income along which marginal tax rates are calculated that account for the carry forward and backward rules. Averaging these marginal tax rates should mimic the managers' expectation of the marginal tax rate. Plesko (2003) and Graham (1996b) show that the simulation based approach is the best available proxy of the 'true' marginal tax rate. In particular, it is superior to just using variables that are assumed to be highly correlated with the marginal tax rates, such as statutory tax rates, dummies which indicate whether a firm is reporting losses or trichotomus variables, as used, for example, in Byoun (2008) or Gropp (2002).

We circumvent the endogeneity problem as our marginal tax rate measure is based on income *before* the relevant financing decision. In the debt ratio analysis, we use marginal tax rates based on earnings *before interest* and taxes. Since the debt ratio contains debt issued in the current period and in the past, we add all interest back to taxable income. In the changes in debt analysis, where the amount of debt issued (or repurchased) only in the current period is examined, we rely on *lagged* marginal tax rates based on earnings before taxes.

Although there is increasing evidence of tax effects on capital structure choices in the USA (see MacKie-Mason (1990), Graham (1996a), Graham (1999)), evidence outside the USA is rare. Alworth and Arachi (2001) simulate marginal tax rates following the Graham methodology for a panel of Italian firms and find evidence that corporate and personal taxes affect the debt usage of Italian firms. However they focus on the net increase of debt as the explanatory variable and do not show if taxes also influence debt ratios. Since the marginal tax benefit of debt depends heavily on country-specific tax laws, existing results from other countries cannot be directly transfered to Germany. Using the variation of top local tax rates across municipalities, Gropp (2002) shows that local taxes influence the capital structure choice of German firms. However, he neglects the dynamic features of the tax code and the effect of federal and personal taxes. We incorporate the dynamic local and federal German tax code to accurately estimate marginal tax rates and show that the marginal tax benefit of debt has a statistically and economically significant positive effect on the debt ratio of firms resident in Germany, both at the corporate level and the investor level (i.e., including personal income taxes). A significantly positive effect of taxes on the change in debt ratio and the net increase of debt is also identified. Recent empirical capital structure studies argue that transaction costs deter firms from immediately adjusting to their optimal capital structure (see e.g., Flannery and Rangan (2006)). For instance, firms could be reluctant to exploit the full marginal tax advantage of debt when they face issuing costs of debt that outweigh the additional tax advantage of debt. As a robustness check we use a partial adjustment model to account for transaction costs and to rule out dynamic endogeneity concerns. We still find a significantly positive effect of taxes on the debt ratio. Several additional robustness checks are performed, such as alternative specifications of the dependent variable.

The rest of the paper is organized as follows. We present our identification strategy in Section 2. Section 3 shows some summary statistics and investigates the variation of the simulated marginal tax rates. In Section 4, we discuss the main results of the paper, which are tested for robustness in Section 5. Section 6 contains the conclusion.

2 Measuring Tax Effects on Debt Usage

In this section, we explain the identification strategy for measuring tax effects on the debt-equity choice. First, we describe the theoretical background for the empirical analysis, then we explain the simulation procedure for the marginal tax rates, which is crucial for the empirical model illustrated in the last part of this section.

2.1 The Theoretical Model

In Germany (as in most other countries), interest payments are deductible from taxable income, whereas such a deduction is not allowed for equity. This provides a tax advantage of debt at the corporate level (Modigliani and Miller (1963)). However, if interest income is taxed at a higher personal tax rate than income in the form of dividends or capital gains, investors will demand a higher pre-tax return for debt investments than for equity investments. This leads to a tax advantage of equity at the investor level. Miller (1977) states that, at the margin, the tax disadvantage of debt at the investor level completely offsets the tax advantage at the corporate level; that is, tax-induced optimal capital structures do not exist in equilibrium. Neutrality with respect to different finance instruments played a central role in past major German tax reforms. Thus Germany is an excellent country to test Miller's hypothesis. We measure the marginal tax advantage of debt, net of personal taxes, as the difference between the after-tax value of a dollar invested in debt and a dollar invested in equity (see Miller (1977)):

$$(1-\tau_i)-(1-\tau_c)\,(1-\tau_e)\,, \tag{1}$$

where τ_i is the personal tax rate on interest income, τ_c is the corporate tax rate and τ_e is the personal tax rate on equity income. The tax rate on equity income covers the tax systems that were inherent in Germany during the observation period. To separate the effect of corporate taxes and personal taxes, the above equation can be transformed to

$$\tau_c - [\tau_i - (1 - \tau_c)\,\tau_e]\,. \tag{2}$$

So the net tax advantage of debt equals the tax advantage of debt at the corporate level τ_c (gross tax advantage of debt) minus the tax disadvantage of debt at the personal level. As long as the term in square brackets is positive, the net tax advantage of debt is smaller than the tax advantage of debt at the corporate level. The next section deals with the empirical measurement of the corporate tax rate τ_c.

2.2 The Simulated Marginal Tax Rate

It is often implicitly assumed that firms are profitable in every state of nature and hence the corporate tax rate τ_c is equal to the top statutory tax rate. However, this disregards the possibility that firms report losses or that tax loss carry forwards exceed taxable income. In that case the carry back and carry forward provisions of the German tax code have to be considered and τ_c can vary between 0 and the top statutory tax rate. For instance, consider a firm with a tax loss carry forward in t and positive taxable income in $t+1$ exceeding the time t tax loss carry forward. For this firm, an additional unit of income in t lowers the tax loss carry forward provision in t and thus leads to additional tax payments in $t+1$. Discounting the (additional) tax payments in $t+1$ yields a marginal tax rate below the top statutory tax rate. This view is consistent with the marginal tax rate (MTR) defined as the present value of current and future taxes to be paid on an extra unit of time t income. Our measure of the MTR has two essential properties. First, it incorporates important features of the German tax code, such as the treatment of net operating losses and non-debt tax shields. Second, it reflects managers' expectations of the MTR at time t when the debt decision is made. To account for the ability to carry losses forward in time we derive a forecasted stream of taxable income. Following Shevlin (1990) and Graham (1996a) we use a random walk with drift model to forecast taxable income:

$$\Delta TI_{i,t} = \mu_{i,t} + \epsilon_{i,t}, \tag{3}$$

where ΔTI is the first difference of taxable income, μ is the (at least 3 and at most 7-year) moving average of historical ΔTI, with the moving average restricted to being non-negative, and ϵ is a normally distributed random variable with mean 0 and variance equal to the variance of historical ΔTI.[1] Blouin et al. (2010) argue that the random walk approach is flawed because it does not account for mean reversion in taxable income, thus leading to extreme paths of future taxable income. Instead, they propose a nonparametric approach where future income is forecasted by draws from bins of firms that are grouped by profitability and assets size. However, Graham and Kim (2009) argue that using firm-specific information is important and show that the nonparametric approach produces too centralized distributions of marginal tax rates within the bins. Comparing the distribution of marginal tax rates using the random walk approach with the distribution of perfect-foresight marginal tax rates, Graham and Kim (2009) find that the random walk approach performs very well in predicting marginal tax rates. They further develop an AR(1) process which outperforms the bin and the random walk model. However, as using an AR(1) process would markedly reduce our sample size and the performance differences are small, we rely on the random walk approach to forecast taxable income.

When estimating the MTR for firm i at time t, we first use the above random walk with drift model to forecast a path of taxable income for the years $t+1, ..., t+20$ (the allowed carry forward period at time t is assumed to be unlimited in this example).[2] Along this path we calculate the present value of the tax bill from $t-1$ through $t+20$ (the allowed carry back period is assumed to be one year in this example). Then we add €1000 (the smallest unit of income in our database) to time t income and calculate the present value of the tax bill again. The difference between the two tax bills yields one single MTR for the specific path of taxable income. We run this procedure for 50 different paths of taxable income and compute the average of these single MTRs.[3] The output is the (expected) simulated MTR for firm i at time t. Averaging over the 50 different scenarios of future taxable income and the corresponding marginal tax rates should reflect the managers' expectation about the marginal tax rate. In the following, we call this tax rate the simulated marginal tax rate (SMTR).

[1] Graham (1996b) shows that setting the mean μ to 0 if it would be negative yields a better estimate of the 'true' marginal tax rate. To model potential differences between trade balance sheets and tax balance sheets, taxable income is adjusted for latent taxes. The precise definition of taxable income depends on the choice of the dependent variable and is provided in the next section.

[2] We restrict the carry forward period to 20 years; loss carry forwards at $t+21, ...$ are negligible due to discounting.

[3] Using more than 50 paths does not significantly alter the estimates of the average marginal tax rates.

2.3 The Empirical Model

The SMTR is not only the best available proxy for the 'true' marginal tax rate (see Graham (1996b) and Plesko (2003)), it also contains enough variation to identify tax effects. Furthermore, as our identification strategy does not solely rely on tax rate or tax system changes over time, other overlapping time effects should not induce a major bias. However, since the SMTR relies on pre-tax income, an endogeneity bias may occur. Consider a firm with a high initial marginal tax rate. The high tax advantage of debt encourages the firm to use interest payments to shield taxes. Since interest payments are deductible from taxable income, the pre-tax income decreases. Thus the probability increases that the firm does not pay taxes in every state of nature, which leads to a low marginal tax rate. Hence, firms with a high tax advantage of debt have low (after financing) marginal tax rates and use a high level of debt, leading to a spurious negative relation between taxes and the use of debt.
We use two strategies to avoid this endogeneity problem. First, we examine debt ratios (book financial debt, both short term and long term, divided by total book assets) and use SMTRs based on earnings after non-debt tax shields *before* interest deductions (EBIT). Given that debt ratios reflect cumulative historical financing decisions, all interest (I) has to be added back to pre-tax income (EBT) to eliminate the simultaneity bias. Second, we investigate incremental financing choices, mostly used in past tax research, measured by the change in debt ratio (the first difference of debt divided by total book assets) as one specification and the net increase of debt (the first difference of debt, the difference divided by lagged total book assets) as another specification.[4] To circumvent simultaneity in these specifications we use *lagged* SMTRs based on earnings after non-debt tax shields and *after* interest payments (EBT), so that the tax variable is calculated before the time t financing decision is made but after historical financing choices.
Studying debt ratios has two drawbacks with respect to incremental debt analysis. First, tests based on current financing decisions should have greater power since debt ratios contain aggregate past financing decisions. Second, no (implicit) assumption of an optimal capital structure is needed (more on that in Section 5.2). However, balance sheet data contain no information about actual security issues. The difference of book debt in consecutive years can be 0 or even negative (if the firm is paying down debt) for a high marginal tax rate firm, but this does not mean for sure that tax incentives are irrelevant for this firm. Instead, it could be the case that this firm is simply not in need of external funds (see Graham (1999)). Additionally, statistical and economic significance of taxes for the incremental financing choice

[4]See Appendix A for details on the variable construction.

cannot be carried over to debt ratios. Since most of the empirical capital structure research tries to explain existing debt ratios rather than incremental financing decisions, we focus on debt ratio analysis. We address the above caveats as we also use incremental debt as the dependent variable in Section 4 and a partial adjustment model to cover dynamic effects in Section 5.

2.3.1 The Gross Tax Advantage of Debt

German firms pay corporate taxes at the federal level and local taxes at the municipality level, which were deductible from taxable income at the federal level until 2007. The local tax rate is calculated as the product of a base rate, which is constant through municipalities and changed once in the observation period, and a multiplicative coefficient, which differs among municipalities. Since we have no information about the locations of the firms in our sample and the key to which taxes are allocated among different locations, we use the average multiplicative coefficient of the Federal Statistical Office (Statistisches Bundesamt).[5] Interest payments are fully deductible at the federal level, but only partially deductible (most of the sample years, 50%) at municipality level. We therefore implement a multiplicative factor h which corrects for this special feature of the German tax code and the fact that local taxes have not been deductible at the federal level since 2008. Thus, the corporate tax rate τ_c can be written as

$$\tau_c = \tau_{fed} + h \cdot \tau_{loc} \cdot (1 - \tau_{fed}) \,, \tag{4}$$

where τ_{fed} is the federal corporate tax rate and τ_{loc} is the local corporate tax rate. Before 2001, corporate profits in form of retained earnings were taxed at a higher rate than dividends, which provided partial relief from the double taxation of dividends at the corporate and personal level. We use the corporate tax rate for retained earnings in our simulation method.[6] To account for uncertainty of income and the asymmetries in the local tax code, we multiplicate the local tax rate τ_{loc} with the SMTR divided by the top tax rate for retained earnings.[7] In a nutshell, the tax advantage of debt at corporate level BEN^{Gross} (gross of

[5] See Gropp (2002) for an approach using cross-sectional variation in the multiplicative coefficient to identify tax effects.

[6] The results remain essentially the same if we use a tax rate weighted by the dividend payout ratio.

[7] In Germany, it is permitted to carry local tax losses forward in time (with the duration and volume being equal to that of federal tax losses), but not backward in time (see section 10a of the German Trade Tax Act (Gewerbesteuergesetz).

personal taxes) is calculated by

$$BEN^{Gross} = SMTR + h \cdot \tau_{loc} \cdot \frac{SMTR}{\tau_{fed,re}} (1 - SMTR), \tag{5}$$

where $\tau_{fed,re}$ is the top statutory tax rate for retained earnings.

2.3.2 The Net Tax Advantage of Debt

To derive BEN^{Net}, the tax advantage of debt net of personal taxes, we insert the gross tax advantage of debt into Equation (1):

$$BEN^{Net} = (1 - \tau_i) - \left(1 - BEN^{Gross}\right)(1 - \tau_e). \tag{6}$$

The tax rate on interest income τ_i equals the personal income tax rate during the period under review. The taxes paid on equity income depend on the tax system and on the fraction of income paid out as dividends. Let d denote the dividend payout ratio, α the benefit from the deferral of capital gains and θ the imputation credit of taxes paid at the corporate level allowed by the tax system (see King (1977)).[8] We assume that the 'marginal investor' is in the highest tax bracket and that capital gains are taxable.[9] Since dividends and capital gains are taxed at the same rate τ_d in Germany, we can write

$$(1 - \tau_e) = d\theta (1 - \tau_d) + (1 - d)(1 - \alpha\tau_d). \tag{7}$$

From 1971 to 2008, the period under review, there exist three different tax systems. From 1971 to 1976, a classical tax system similar to that in the US with different corporate tax rates for dividends and retained earnings was in place. This tax system was followed by a full imputation system again with a split rate of corporate tax. In 2001, the government introduced a shareholder relief system, under which only half of the equity income was taxed at the personal level. These different tax systems are reflected in the parameter θ and in the tax rate τ_d.

In our capital structure analysis throughout this paper we run each regression model, first, by using the BEN^{Gross} variable as one specification, which only represents the tax advantage of debt at the corporate level, and second, by using the BEN^{Net} variable as another specification, which also incorporates investor taxes. Hereafter, we refer to BEN^{Gross} and

[8] In the empirical analysis the dividend payout ratio is lagged one year to avoid simultaneity bias.

[9] We run the analysis with tax-free capital gains, but the results are qualitatively the same.

BEN^{Net} as the BEN variables.

2.3.3 Control Variables

We control for various other factors beside the tax advantage of debt that influence financing decisions. DeAngelo and Masulis (1980) argue that the interest induced tax shield competes with non-debt tax shields like depreciation allowances. However, the BEN variables already incorporate non-debt tax shields, since the taxable income used for the tax rate calculations is based on pre-tax income after depreciation. Within the simulation of the marginal tax rate, non-debt tax shields are modeled according to the random walk with drift model described in Section 2.2.

The trade-off theory postulates that managers balance the benefits and costs of debt when they make financing decisions. However, the costs of debt are difficult to measure directly. For example, financial distress costs are difficult to separate from economic distress costs (which occur due to other reasons than high debt ratios and thus are irrelevant for the financing decision) and researchers are still searching for accurate estimates of financial distress costs for single firms (see Graham and Kim (2009), Korteweg (2010) and Van Binsbergen et al. (2010)). Following Graham et al. (1998), we use two proxies for the ex post financial distress costs of debt depending on firm characteristics. First, we include the modified Altman's Z-score, which is measured as (see Altman (1968) and MacKie-Mason (1990)):

$$\text{Z-score} = \frac{3.3\text{EBIT} + \text{Sales} + 1.4\text{Retained Earnings} + 1.2\text{Working Capital}}{\text{Total Assets}}. \tag{8}$$

We expect the corresponding coefficient to have a negative sign. The lower the *Z-score*, other things being equal, the more likely the firm is in financial distress, leading to deterioration of equity. Second, we use *I(NEGEQ)*, a dummy variable which is equal to 1 if equity is negative. For the same reason as noted above, *I(NEGEQ)* should be positively related to debt usage. Another proxy indicates whether an industry is likely to suffer from ex ante financial distress costs. When firms that produce unique products enter into liquidation, they impose large costs on suppliers and costumers (e.g., lack of repair service and spare parts). A high proportion of debt in the capital structure induces a high probability of liquidation, leading to high (expected) financial distress costs, e.g. because costumers may be reluctant to buy products of these firms. Consequently, these firms should use less debt than other firms, ceteris paribus. To gauge product uniqueness, we follow Titman (1984) and use a dummy variable *I(Sensitive)* which includes industries related to SIC codes between 3400 and 4000.

The effects of profitability on debt usage are ambiguous. On the one hand, from the perspective of the trade-off theory, profitable firms should use a high amount of debt to shield taxes since they are unlikely to go bankrupt. An additional argument for profitable firms using higher debt ratios than unprofitable firms is given by the free cash flow hypothesis stated by Jensen (1986). This theory claims that interest payments discipline managers to not divert funds into their own pockets (e.g., empire building) and thus mitigate moral hazard problems between managers and stockholders. On the other hand, according to the pecking order theory (see Myers and Majluf (1984)), firms use first internal equity and when internal funds do not suffice, debt financing is preferred over equity financing. Thus, this theory implies that profitable firms use less debt in their capital structure since they are more likely to be not in need of external funds. We measure profitability by the variable ROA, which is defined as operating cash flow divided by total assets.

Amihud and Murgia (1997) show that dividends are informative about values of listed German companies (although dividends are not tax-disadvantaged by German tax law). Thus, it could be argued that dividend-paying firms do not suffer from a large 'lemons' premium when issuing new equity. Vice versa, firms that do not pay dividends may be subject to large informational asymmetries, perhaps causing them to prefer debt over equity financing (see Sharpe and Nguyen (1995)). To capture the amount of information asymmetries with respect to the information content of dividends, a no dividend dummy *I(NODIV)* is included into the regression. We expect the sign of *I(NODIV)* to be positive. Moreover, regulated firms are likely to be less levered because the regulatory agency may provide investors with relevant information and thus reduce signaling costs (see MacKie-Mason (1990)). We therefore include the industry dummy variable *I(Regulated)* for the energy and water supply industry and the railroad industry.

Large firms are likely to be well diversified and should therefore face low ex ante costs of financial distress. In addition, large firms often have lower informational costs and lower transaction costs when issuing securities. Therefore, larger firms are more likely to have a high debt ratio, other things being equal. We measure *Size* by the natural logarithm of real sales, where sales, expressed in millions of euro, are deflated by the implicit price deflator.[10]

Firms with a high proportion of collateral should borrow on favorable terms and are expected to issue more debt. *Collateral* is defined as net property, plant and equipment divided by total assets. Year dummies are also included to control for unobserved time effects such as macroeconomic effects.

[10] As a robustness check, we replace sales by total assets; the results are qualitatively unchanged.

3 Data and Summary Statistics

Our empirical analysis is based on the balance sheet database *Unternehmensbilanzstatistik* of the Deutsche Bundesbank; it is one of the most comprehensive databases for German non-financial firms. The database was established for the Deutsche Bundesbank's rediscount business in 1971. The Bundesbank was required to purchase bills that were backed by parties known to be solvent (see Stöss (2001)). German firms used as collateral in this business had to submit their complete financial statements to the Bundesbank to check their creditworthiness; these financial statements are collected in the *Unternehmensbilanzstatistik*. Thus, missing data are not a big issue for the database.

The database consists of annual data for over 100,000 corporations (mostly limited liability companies) over the period from 1971 to 2008. Since 1998, the number of balance sheets per year in the sample has decreased by about two-thirds, reaching a level of approximately 20,000 in 2008. This drop is connected to the fact that the discount credit facility in the context of bill-based lending was not included in the European Central Bank's set of monetary policy instruments (see Deutsche Bundesbank (2001)). This implies that, since 1999, the requirements with respect to the creditworthiness of the companies included in the database were strengthened (Article 18.1 of the Statute of the European System of Central Banks). The reduced sample size leads to a reduction of the statistical power of the dataset. Moreover, due to the collection mechanism, a certain quality bias may occur.

Table 1 presents statistics of selected variables that describe the structure and quality of the dataset used in this study. The statistics of *Employees*, *Sales* and *Total assets* show that the dataset contains small, medium sized and large companies. Our analysis may be favored with respect to the identification and the magnitude of tax affects if financially distressed firms are underrepresented in the dataset. We therefore provide statistics for the proxies *Z-score* and *I(NEGEQ)* which indicate if firms suffer from (ex post) financial distress. The distribution of the *Z-score* variable suggests that the main part of firms included in the dataset are financially healthy (75% of the *Z-score* values are higher than 1.5). However, the mean values of *I(NEGEQ)* show that firms report negative equity in a substantial part of the observations, which indicates that the datset contains also financially distressed firms. The increase in the statistics of the *Z-score* and the size variables and the decrease of the mean value of *I(NEGEQ)* from 1995 to 2005 reflect the change in the collection mechanism after the beginning of the monetary union. Central to the identification strategy in this paper is that the sample contains enough firms with pre-tax losses. Table 1 reports statistics of $I(NOL)_{EBIT}$, a dummy variable which is equal to one if the firm has accumulated a tax

Table 1: The Structure of Panel Data

The sample consists of all non-financial corporations in the *Unternehmensbilanzstatistik* of the Deutsche Bundesbank with at least three consecutive observations. Variables are winsorized at the 1st percentile and the 99th percentile, respectevely. *Total assets* and *Sales* are expressed in €million and are deflated by the implicit price deflator. Variable descriptions of *Z-score*, *I(NEGEQ)* and $I(NOL)_{EBIT}$ are provided in the appendix.

	Year	Mean	Std.Dev.	25th perc.	Median	75th perc.
Employees	1975	567.80	2056.54	15.00	75.00	300.00
	1985	229.47	1399.85	4.00	21.00	75.00
	1995	236.46	1231.90	12.00	32.00	93.00
	2005	322.82	1338.26	17.00	51.00	169.00
Total assets	1975	19.20	68.27	0.57	1.80	6.67
	1985	9.10	47.60	0.25	0.61	2.00
	1995	10.32	48.88	0.33	0.78	2.50
	2005	31.81	89.11	1.06	3.34	14.42
Sales	1975	23.06	75.10	1.09	3.23	10.80
	1985	12.79	56.79	0.55	1.38	4.18
	1995	13.27	55.92	0.70	1.72	4.81
	2005	35.75	94.25	2.04	6.03	20.93
Z-score	1975	2.54	1.73	1.52	2.20	3.07
	1985	2.89	1.82	1.75	2.56	3.59
	1995	2.73	1.75	1.57	2.43	3.51
	2005	2.79	1.79	1.60	2.57	3.66
I(NEGEQ)	1975	0.25	0.43	0.00	0.00	1.00
	1985	0.29	0.45	0.00	0.00	1.00
	1995	0.12	0.33	0.00	0.00	0.00
	2005	0.04	0.19	0.00	0.00	0.00
$I(NOL)_{EBIT}$	1975	0.16	0.37	0.00	0.00	0.00
	1985	0.08	0.27	0.00	0.00	0.00
	1995	0.13	0.34	0.00	0.00	0.00
	2005	0.13	0.34	0.00	0.00	0.00

loss carry forward based on EBIT. As our main analysis studies the effect of taxes on debt ratios, EBIT based tax losses are accumulated within the simulation of the marginal tax rate to circumvent endogeneity problems. The amount of firms with EBIT based tax loss carry forwards (13%) remains unchanged from 1995 to 2005. To examine possible selection bias, we run additional robustness checks (see Section 5.1).

The simulation method of the marginal tax rate requires at least three consecutive observations. This requirement leads to 623,780 observations (86,173 firms) for the years 1973 to 2008. Table 2 reports some summary statistics for the dependent and explanatory variables. To remove outliers from the sample, variables are winsorized at the 1st percentile and the 99th percentile, respectevely. The debt ratio has a sample mean (median) of 30.59%

Table 2: Summary Statistics

The sample consists of all non-financial corporations in the *Unternehmensbilanzstatistik* of the Deutsche Bundesbank from the years 1973 to 2008 with at least three consecutive observations. Variables are winsorized at the 1st percentile and the 99th percentile, respectevely; that is, the minimum (maximum) values shown in this table are equal to the 1st (99th) percentiles. Variable descriptions are provided in the appendix.

	Obs.	Mean	Std.Dev.	Median	Minimum	Maximum
Debt/Assets	623780	0.3059	0.2359	0.2776	0.0000	0.8804
BEN_{EBIT}^{Net}	623780	-0.0100	0.1078	0.0290	-0.4477	0.1064
$\text{BEN}_{EBIT}^{Gross}$	623780	0.4691	0.1351	0.5253	0.0000	0.5937
BEN_{t-1}^{Net}	536139	-0.0404	0.1287	0.0158	-0.4477	0.1064
BEN_{t-1}^{Gross}	536139	0.4316	0.1578	0.4931	0.0000	0.5937
SUBST	536139	0.0315	0.0503	0.0174	-0.1005	0.3619
ROA	623780	0.0738	0.1125	0.0585	-0.3277	0.5020
Size	623780	0.9656	1.8135	0.7739	-3.5870	6.1868
Collateral	623780	0.2043	0.2074	0.1349	0.0000	0.8871
Z-score	623780	2.7872	1.7907	2.4791	-0.3969	10.3764
I(NEGEQ)	623780	0.1415	0.3485	0.0000	0.0000	1.0000
I(NODIV)	623780	0.7520	0.4319	1.0000	0.0000	1.0000
I(Regulated)	623780	0.0135	0.1153	0.0000	0.0000	1.0000
I(Sensitvie)	623780	0.2313	0.4217	0.0000	0.0000	1.0000

(27.76%) with a standard deviation of 23.59%. All variables exhibit substantial variation. In the following, we analyze the variation in the BEN variables in more detail, which is crucial for the identification of tax effects.

Figure 2 shows the time variation in the mean values of the tax variables. The mean values of the BEN variables exhibit some time-series variation. Most of the time-series variation stems from tax reforms which changed the top statutory corporate tax rates and personal tax rates. The remaining variation in the BEN^{Gross} variables over time can be mainly explained by the change in the treatment of tax losses due to carry forward and carry back provisions. The BEN^{Net} variables additionally vary with the dividend payout ratio. The tax advantage of debt slightly increases 1983 due to the fact that interest payments were the first time deductible from the local tax base. The two larger declines in 2001 and 2008 can be mainly explained by the decrease in top federal corporate tax rates. The fact that the tax rate for equity payments is markedly smaller than the tax rate for interest payments explains the wide spread between the gross tax advantage of debt and the net tax advantage of debt. Since we use the top statutory tax rate for the marginal personal income tax rate, the net tax advantage of debt can be interpreted as a lower bound.

Figure 1 presents the cross-sectional variation in the BEN^{Gross} variables. BEN^{Gross} values

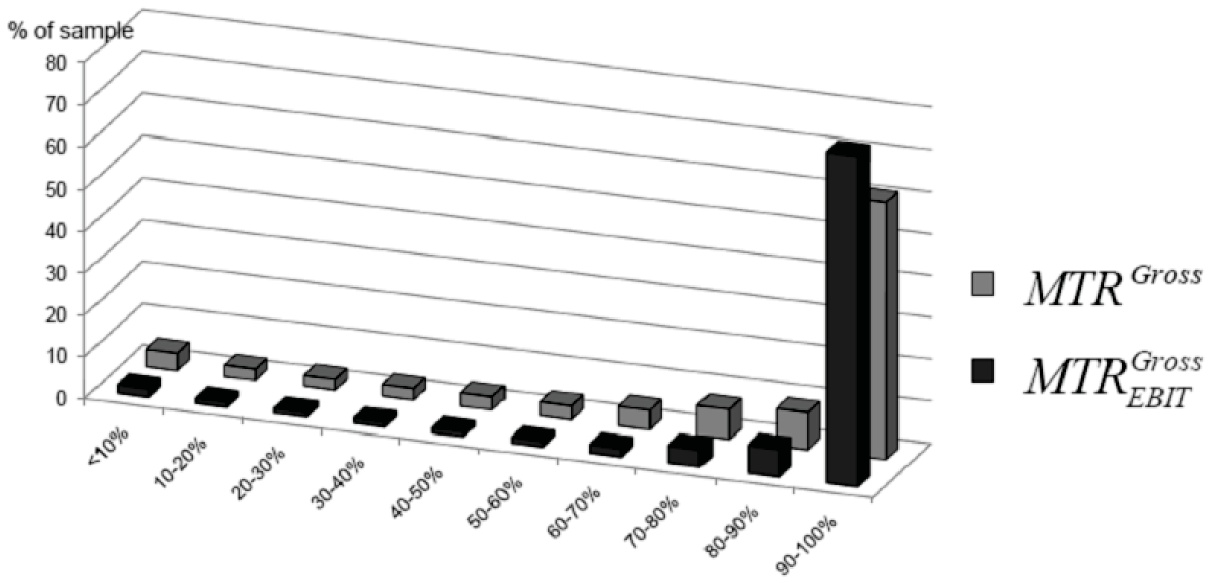

Figure 1: The cross-sectional distribution of the marginal tax benefit of debt, gross of investor taxes. The BEN^{Gross} variables are divided by the top statutory tax rate to fade out time-series changes. The construction of the BEN^{Gross} variables is provided in Section 2.3.1.

are divided by the top statutory tax rate to blank out time-series changes in the top statutory tax rates. The BEN variables based on EBIT measure the tax advantage of the first euro of interest payments, whereas the BEN variables based on EBT measure the tax advantage of the last euro of interest payments. Since interest payments lower taxable income, the values for the tax benefit of debt based on EBIT exhibit less variation than the tax rates based on EBT and a higher percentage of EBIT based tax benefits are equal to the top statutory tax rate (70% versus 60%).[11]

Figure 3 shows that our measure of the tax benefit of debt exhibits substantial variation when both the time-series and cross-sectional dimension are considered. Once personal taxes are taken into account, the sample distribution of the gross tax benefit of debt moves to the left. Thus, the higher personal tax rate on interest income with respect to equity income reduces the tax benefit of debt at the corporate level. Comparing the tax benefit of debt before and after interest, the Figures 1–3 reflect the endogenous relation between debt and the marginal tax rate.

[11]The cross-sectional variation shown in Figure 1 changes only slightly through time.

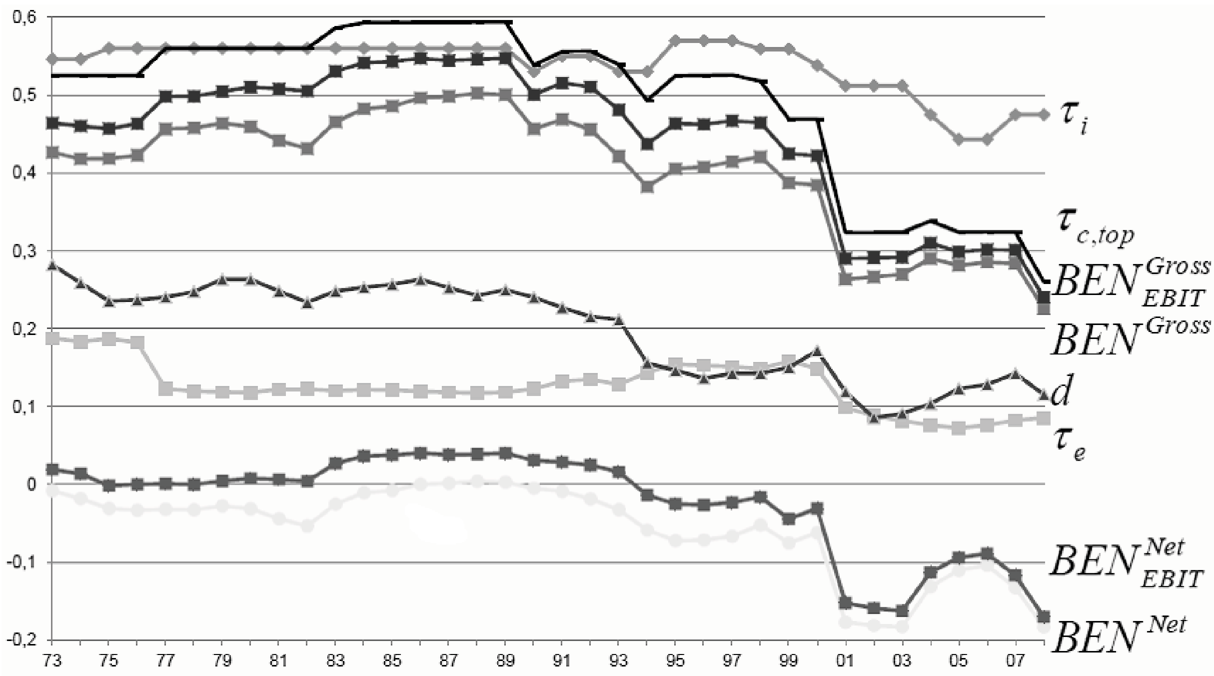

Figure 2: This figure shows the mean annual values for several tax variables and the dividend payout ratio d over the years 1973–2008. τ_i is the personal tax rate on interest income, which is equal to the top personal income tax rate. $\tau_{c,top}$ is a combination of the top statutory federal and local tax rate (see Equation (4)). For details of the construction of t_e, the personal tax rate on equity income, and BEN^{Net} (BEN^{Gross}), the tax benefit of debt net (gross) of investor taxes, see Section 2.3.

4 Taxes and Static Capital Structure

Table 3 presents the main results of our estimations. Throughout this paper (unreported) year dummies are included to control for any unmodeled time effects. Standard errors are robust to within firm correlation, as we cluster the standard errors by firm, and are robust to heteroscedasticity using the technique of White (1980). Columns (1) and (2) of Table 3 show the estimates for the dependent variables using pooled OLS, with Column (1) including the net tax benefit of debt and Column (2) covering the gross tax benefit of debt.[12] The tax benefit of debt has a statistically and economically significant positive effect on the debt ratio, both gross and net of personal taxes. A 10% increase in the marginal tax benefit of debt follows a 1.5-1.6% incease in the debt ratio, ceteris paribus. The coefficients of the control variables are statistically significant and have the expected sign, except *Size*.

[12]Since the debt ratio is winsorized we also run a Tobit regression. The results essentially remain the same.

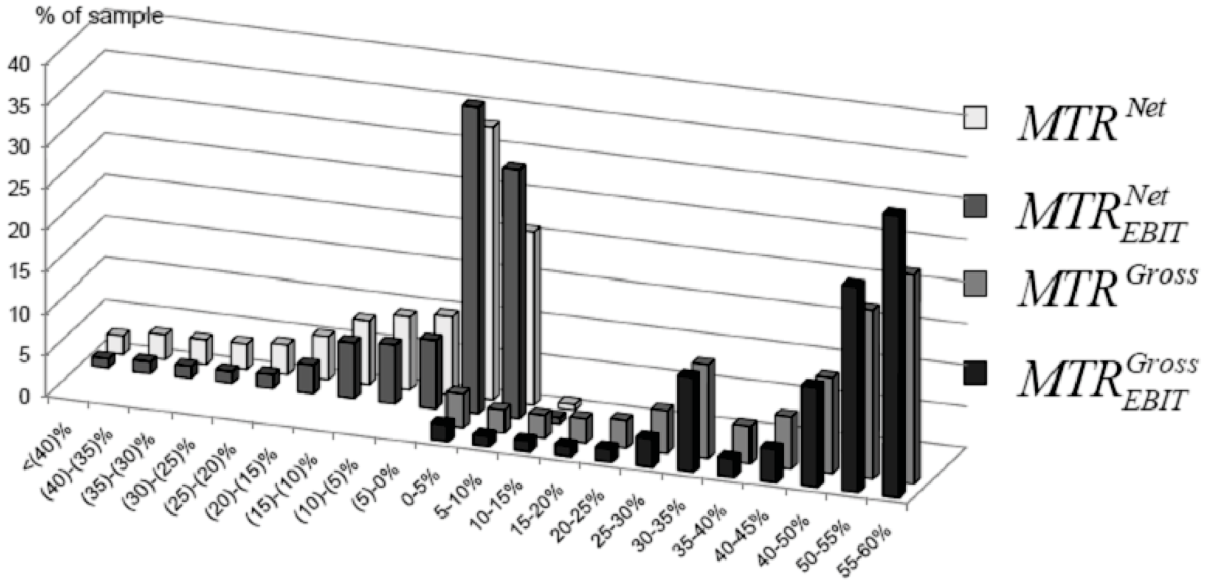

Figure 3: The panel distribution of the marginal tax benefit of debt variables. The construction of the BEN variables, net and gross of investor taxes, can be found in Section 2.3.

The negative relation between size and the debt ratio is, however, a common finding in the literature about the capital structure in Germany (see e.g., the cross-country analysis of Rajan and Zingales (1995)).

The panel structure of our data allows us to control for unobserved time constant heterogeneity by including firm fixed effects. This means that we solely rely on the within firm variation to estimate the coefficients of the regression model. Column (3) and (4) present the regression results of the firm fixed effects specifications. The industry control variables *I(Regulated)* and *I(Sensitive)* are not included since firms often remain in the same industry during their sample life. The other control variables exhibit enough within firm variation. Their coefficients are statistically significant and have the same sign as in Columns (1) and (2), except *Size*. Under the firm fixed effects specification the coefficients of the BEN variables are no longer significant (and even become slightly negative). Our identification strategy for the tax advantage of debt is strongly based on the cross-sectional variation of marginal tax rates (see Section 3). Including firm dummies removes the cross-sectional variation and hence it is no longer possible to identify tax effects on the debt ratio (see Griliches and Mairesse (1995) and Lemmon et al. (2008) for a critical discussion of firm fixed effects estimations). Moreover, the simulated marginal tax rates are highly correlated over

Table 3: Static Debt Ratio Regressions

This table shows the coefficients of panel regressions on debt ratios. The sample consists of all non-financial corporations in the *Unternehmensbilanzstatistik* of the Deutsche Bundesbank from the years 1973 to 2008 with at least three consecutive observations. Variables are winsorized at the 1st percentile and the 99th percentile, respectevely. All regressions include (unreported) year dummies. The standard errors are corrected for heteroscedasticity and within firm correlation, with the standard errors shown in parentheses. Coefficients significant at the 5%, 1% and 0.1% levels are marked with ^{c}, ^{b} and ^{a}, respectively. Reported R^2 numbers for models including firm fixed effects are 'within' R^2 statistics. Variable descriptions are provided in the appendix.

	(1)	(2)	(3)	(4)
BEN_{EBIT}^{Net}	0.1478^a		-0.0086^c	
	(0.0063)		(0.0043)	
$\text{BEN}_{EBIT}^{Gross}$		0.1607^a		-0.0006
		(0.0055)		(0.0039)
ROA	-0.1652^a	-0.1811^a	-0.1408^a	-0.1435^a
	(0.0055)	(0.0056)	(0.0047)	(0.0047)
Size	-0.0063^a	-0.0064^a	0.0194^a	0.0193^a
	(0.0005)	(0.0005)	(0.0011)	(0.0011)
Collateral	0.2145^a	0.2141^a	0.2136^a	0.2135^a
	(0.0038)	(0.0038)	(0.0053)	(0.0053)
Z-score	-0.0105^a	-0.0104^a	-0.0271^a	-0.0270^a
	(0.0004)	(0.0004)	(0.0005)	(0.0005)
I(NEGOE)	0.1201^a	0.1232^a	0.0491^a	0.0495^a
	(0.0017)	(0.0017)	(0.0013)	(0.0013)
I(NODIV)	0.0554^a	0.0563^a	0.0316^a	0.0316^a
	(0.0012)	(0.0012)	(0.0008)	(0.0008)
I(Regulated)	-0.1645^a	-0.1640^a		
	(0.0066)	(0.0066)		
I(Sensitive)	-0.0395^a	-0.0391^a		
	(0.0016)	(0.0016)		
Firm Fixed Effects	No	No	Yes	Yes
Observations	623780	623780	623780	623780
Adjusted R^2	0.1930	0.1944	0.1494	0.1494

time. Graham (1999) obtains similar results in his debt ratio analysis, which implies that the simulated marginal tax rate approach does not provide enough within firm variation to identify tax effects on the debt ratio in a firm fixed effects model. Rather, the cross-sectional variation of the SMTRs helps to identify tax effects on the capital structure. We estimate the (unreported) coefficients for each cross-section of the years 1973–2008. Almost all of the tax benefit of debt coefficients are positive and significant.

We run additional (unreported) regressions to check for any unmodeled time-series effects. First, we calculate the time-series means for each firm and hence solely rely on between firm variation. The coefficients of the BEN variables in this specification are positive and significant with coefficients being slightly higher than in the pooled OLS model. Second, we interact the BEN variables with year dummies to allow for time changes of the tax effects. Again, most of the coefficients are positive and significant.

To further investigate if the shown relationship between the tax advantage of debt and the debt ratio might be spurious due to omitted time constant variable bias, we use the change in debt ratio (the first difference of *Debt/Assets*) and the net increase of debt $((Debt_t\text{-}Debt_{t-1})/Assets_{t-1})$ as other specifications. As mentioned in Section 2.3, using the lagged SMTR based on EBT solves the endogeneity problem. However, when we use the lagged SMTR in the incremental financing analysis, an increase in the usage of debt could also be caused by an increase in non-debt tax shields. We therefore include the variable $\Delta NDTS$, which is defined as the first difference of book depreciation divided by total assets. When examining incremental debt financing we use the first difference of *Size* and *Collateral* to be consistent with the dependent variable and to be comparable with earlier studies (e.g., MacKie-Mason (1990), Graham (1996a), Alworth and Arachi (2001)). Columns (1)–(4) of Table 4 present the results for the change in debt ratio analysis and Columns (5)–(8) for the net increase of debt analysis. The BEN variables are positive and significant for both specifications, even if firm fixed effects are included. Firms with a high marginal tax benefit issue significantly more debt and increase (lower) their debt ratio significantly more (less) than low marginal tax rate firms. A 10% increase in the BEN variables follows a 0.7-0.9% (0.13-0.18%) increase in the use of net debt (change in debt ratio), other things being equal. The non-debt tax shield proxy $\Delta NDTS$ and the other control variables, except $\Delta Size$, have the expected signs and are significant. Overall, the incremental debt analysis shows that unobserved time constant heterogeneity does not drive the results.

5 Robustness Checks

We carry out several additional robustness checks. First, we address the statistical issue of selection bias and reduced sample size. Second, we analyze the effect of taxes on the debt ratio in a dynamic setting. The last part of this section deals with different specifications of the dependent variable.

Table 4: Changes in Debt Regressions

This table shows coefficients of panel regressions on changes in debt. The sample consists of all non-financial corporations in the *Unternehmensbilanzstatistik* of the Deutsche Bundesbank from the years 1973 to 2008 with at least three consecutive observations. Variables are winsorized at the 1st percentile and the 99th percentile, respectevely. All regressions include (unreported) year dummies. The variables *I(Regulated)* and *I(Sensitive)* are estimated in the models without firm fixed effects (also unreported). The standard errors are corrected for heteroscedasticity and within firm correlation, with the standard errors shown in parentheses. Coefficients significant at the 5%, 1% and 0.1% levels are marked with ^{c}, ^{b} and ^{a}, respectively. Reported R^2 numbers for models including firm fixed effects are 'within' R^2 statistics. Variable descriptions are provided in the appendix.

	Change in debt levels				Net Increase of debt			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BEN^{Net}_{t-1}	0.0775^a		0.0897^a		0.1505^a		0.1750^a	
	(0.0015)		(0.0020)		(0.0023)		(0.0029)	
BEN^{Gross}_{t-1}		0.0681^a		0.0801^a		0.1323^a		0.1570^a
		(0.0013)		(0.0017)		(0.0020)		(0.0025)
ΔNDTS	-0.0597^a	-0.0606^a	-0.0502^a	-0.0514^a	-0.6004^a	-0.6024^a	-0.5292^a	-0.5317^a
	(0.0071)	(0.0071)	(0.0074)	(0.0074)	(0.0106)	(0.0106)	(0.0107)	(0.0107)
ROA	-0.1132^a	-0.1148^a	-0.1475^a	-0.1484^a	-0.1587^a	-0.1618^a	-0.1419^a	-0.1437^a
	(0.0019)	(0.0020)	(0.0032)	(0.0032)	(0.0028)	(0.0028)	(0.0044)	(0.0044)
ΔSize	-0.0110^a	-0.0108^a	-0.0049^a	-0.0046^a	0.1047^a	0.1049^a	0.1085^a	0.1091^a
	(0.0009)	(0.0009)	(0.0011)	(0.0011)	(0.0016)	(0.0016)	(0.0017)	(0.0017)
ΔCollateral	0.2135^a	0.2132^a	0.2045^a	0.2040^a	0.2326^a	0.2320^a	0.2024^a	0.2014^a
	(0.0044)	(0.0044)	(0.0047)	(0.0047)	(0.0074)	(0.0074)	(0.0075)	(0.0075)
Z-score	-0.0021^a	-0.0021^a	-0.0108^a	-0.0109^a	-0.0093^a	-0.0093^a	-0.0437^a	-0.0438^a
	(0.0001)	(0.0001)	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0006)	(0.0006)
I(NEGEQ)	0.0124^a	0.0131^a	0.0084^a	0.0091^a	0.0178^a	0.0192^a	-0.0001	0.0015
	(0.0005)	(0.0005)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0011)	(0.0011)
I(NODIV)	0.0029^a	0.0032^a	0.0044^a	0.0051^a	0.0059^a	0.0064^a	0.0027^a	0.0040^a
	(0.0003)	(0.0003)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0007)	(0.0007)
Firm Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Observations	536139	536139	536139	536139	536139	536139	536139	536139
Adjusted R^2	0.0378	0.0382	0.0451	0.0455	0.0643	0.0649	0.0927	0.0937

5.1 Issues Related to Data Selection

In this section, we investigate whether the reduced sample size, the collection mechanism or the higher requirements of the creditworthiness after 1999 induce a bias (see Section 3). We pursue two strategies to illustrate that our results are not biased by selection or reduced sample size. First, we separate our data into two subsets, with one part covering the years until 1999 and the other part covering the years after 1999. We rerun the regressions on these two datasets and compare the results. The (unreported) coefficients of the BEN variables of both subsets are positive and significant, with the coefficients being in the same magnitude. Second, we use the dataset *Jahresabschlussdatenpool* of the Deutsche Bundesbank, which was created due to the decrease in observations of the *Unternehmensbilanzstatistik*. The *Jahresabschlussdatenpool* contains over 100,000 observations starting in the year 1997. This dataset is not based on the collection method of the *Unternehmensbilanzstatistik* used in this paper. The (unreported) results using the *Jahresabschlussdatenpool* are essentially the same. This implies that the presented results are not biased by selection or reduced sample size.

5.2 Taxes and Dynamic Capital Structure

In this section we perform additional tests to address dynamic endogeneity concerns. If adjustment to target capital structure is costly, firms may not shift to their optimal capital structure immediatley. Hence, recent studies in the field of capital structure research focus on partial adjustment models (see Flannery and Rangan (2006), Lemmon et al. (2008) and Huang and Ritter (2009)). A standard partial adjustment model can be written as:

$$Debt\,Ratio_{i,t} - Debt\,Ratio_{i,t-1} = \lambda(Target\,Debt\,Ratio_{i,t} - Debt\,Ratio_{i,t-1}) + \epsilon_{i,t}. \qquad (9)$$

We model the $Target\,Debt\,Ratio_{i,t}$ by $\beta X_{i,t}$, where $X_{i,t}$ is a vector including the tax variables and control variables introduced in Section 2. Hence, Equation (9) can be estimated by

$$Debt\,Ratio_{i,t} - Debt\,Ratio_{i,t-1} = (\lambda\beta)X_{i,t} - \lambda Debt\,Ratio_{i,t-1} + \epsilon_{i,t}. \qquad (10)$$

By adding the lagged debt ratio on both sides of Equation (10), one can see that this estimation technique is identical to including the lagged dependent variable in the static regression model estimated in Section 4 with the coefficient of the lagged dependent variable changing to $1 - \lambda$. Table 5 shows that including the lagged dependent variable does not alter

Table 5: Dynamic Debt Ratio Regressions

This table shows the regression coefficients of Equation (10) using pooled OLS. The sample consists of all non-financial corporations in the *Unternehmensbilanzstatistik* of the Deutsche Bundesbank from the years 1973 to 2008 with at least three consecutive observations. Variables are winsorized at the 1st percentile and the 99th percentile, respectevely. All regressions include (unreported) year dummies. The variables *I(Regulated)* and *I(Sensitive)* are estimated in the models without firm fixed effects (also unreported). The standard errors are corrected for heteroscedasticity and within firm correlation, with the standard errors shown in parentheses. Coefficients significant at the 5%, 1% and 0.1% levels are marked with ^{c}, ^{b} and ^{a}, respectively. Reported R^2 numbers for models including firm fixed effects are 'within' R^2 statistics. Variable descriptions are provided in the appendix.

	(1)	(2)	(3)	(4)
BEN_{EBIT}^{Net}	0.0224^a		-0.0041	
	(0.0024)		(0.0031)	
$\text{BEN}_{EBIT}^{Gross}$		0.0188^a		-0.0056^c
		(0.0021)		(0.0028)
Debt Ratio_{t-1}	-0.1961^a	-0.1962^a	-0.5120^a	-0.5122^a
	(0.0012)	(0.0012)	(0.0023)	(0.0023)
ROA	-0.1183^a	-0.1185^a	-0.1480^a	-0.1470^a
	(0.0022)	(0.0022)	(0.0034)	(0.0035)
Size	-0.0011^a	-0.0011^a	0.0162^a	0.0162^a
	(0.0001)	(0.0001)	(0.0007)	(0.0007)
Collateral	0.0444^a	0.0444^a	0.1400^a	0.1400^a
	(0.0011)	(0.0011)	(0.0034)	(0.0034)
Z-score	-0.0036^a	-0.0036^a	-0.0199^a	-0.0199^a
	(0.0001)	(0.0001)	(0.0004)	(0.0004)
I(NEGEQ)	0.0251^a	0.0252^a	0.0251^a	0.0250^a
	(0.0006)	(0.0006)	(0.0009)	(0.0009)
I(NODIV)	0.0113^a	0.0114^a	0.0178^a	0.0178^a
	(0.0004)	(0.0004)	(0.0005)	(0.0005)
Firm Fixed Effects	No	No	Yes	Yes
Observations	623739	623739	623739	623739
Adjusted R^2	0.7185	0.7184	0.3674	0.3674

our main results. The long run coefficient of BEN_{EBIT}^{Net} is equal to 0.1142 (= 0.0224/0.1962) and significant. This number is slightly smaller than 0.1478, the estimated coefficient of Table 3 in the static setting. Again, when firm fixed effects are included, tax effects can no longer be identified. However, these results have to be used with caution. Whereas the dynamic OLS estimations do not account for unobserved time constant heterogeneity, the results of the dynamic fixed effects estimations may also be biased (see Arellano and Bond (1991)). In the fixed effects model, the time demeaned lagged dependent variable is correlated with the error term and thus endogeneous. The bias declines with the length of the observed time period, but increases with the persistence of the dependent variable (see Wooldridge

(2010)). Although our sample period covers over 30 years, the debt ratio is highly correlated over time. Huang and Ritter (2009) conduct several Monte Carlo simulations to show that dynamic panel estimators relying on first differences of the debt ratio are also flawed due to the weak instruments problem. Moreover, Chang and Dasgupta (2009) find that parameter estimates of λ in partial adjustment models suffer from mechanical mean reversion. Overall, further research needs to be done to obtain an adequate estimator in the dynamic setting. In the main part of this paper, we therefore rely on the well established static estimation techniques.

5.3 Alternative Debt Ratio Definitions

Some researchers argue that firms rather optimize their long term financial structure and use short term funds to meet current financial needs (see e.g., Graham (1996a)). We therefore restrict the numerator of our dependent variable to include only long term financial debt. The (unreported) results do not qualitatively alter.

Welch (2010) argues that the denominator total assets leads to wrong results. Total assets reflect several other simultaneous decisions that are not related to the financial debt-equity choice. For instance, an increase in accounts payables causes an increase in total assets but is likely to be unrelated to the decision between financial debt and equity. Since right-hand-side variables are also divided by total assets, using a left-hand-side variable which is divided by total assets might lead to wrong results. In the context of our tax advantage of debt analysis, a firm with a high BEN variable might have high accounts payables due to non-tax related reasons, which may deteriorate the estimation of tax effects on debt usage. To rule out this possibility we use financial debt divided by capital (financial debt plus equity) as the dependent variable (results are not reported due to space limitations) and compare the results with the financial debt divided by assets specification. Sign and significance of the BEN variables remain the same, although the coefficients double up. Overall, the results therefore become clearer when using debt to capital ratios.

6 Conclusion

We show in this paper that our measure of the marginal tax benefit of debt has a significant and positive influence on the capital structure of German firms, both net and gross of personal taxes. A 10% increase in the marginal net (gross) tax benefit of debt increases the debt ratio by about 1.5% (1.6%), ceteris paribus. This result has an important implication for

studies investigating tax effects on debt policy and for researchers controlling for tax effects. Moreover, with respect to recent tax policy debates about the deductibility allowance of interest payments in Germany, the findings in this paper provide evidence that this tax incentive encourages German firms to use more debt in their capital structures, other things being equal. However, the recent introduction of an upper-bound deduction of interest after 2008 reduces the tax advantage of debt in some cases. It would be interesting to use this tax rule to yield a new approach for the identification of tax effects on financing policy if the relevant data is available. Furthermore, to what extent German firms exploit the tax benefits of debt in consideration of the costs of debt and how much they contribute to firm value is beyond the scope of this paper. These tasks may be a valuable area for future research.
The results are robust to different definitions of the dependent variables, such as changes in debt, and various other specifications. We also find a significantly positive relation between taxes and debt usage in a partial adjustment model. As static and dynamic debt ratio regressions including firm dummies show, the simulated marginal tax rate approach does not provide enough within firm variation to prove the effects of taxes on debt usage in a firm fixed effect model. The results in this paper imply that the cross-sectional variation of marginal tax rates is crucial for identifying tax effects on debt ratios in a single-country analysis.

Appendix A. Variable Description

This appendix details the variable construction for the analysis in this paper. Economic descriptions of the variables are provided in Section 2.3.

Debt	=	short term financial debt + long term financial debt
Debt/Assets	=	Debt/book assets
Change in debt ratio	=	the first difference of Debt/Assets
Net increase of debt	=	($Debt_t$-$Debt_{t-1}$)/book $assets_{t-1}$
BEN^{Net}_{EBIT}	=	marginal net tax advantage of debt with the simulated marginal tax rate based on EBIT (see Section 2.3.2)
BEN^{Gross}_{EBIT}	=	marginal gross tax advantage of debt with the simulated marginal tax rate based on EBIT (see Section 2.3.1)
BEN^{Net}	=	marginal net tax advantage of debt with the simulated marginal tax rate based on EBT (see Section 2.3.2)
BEN^{Gross}	=	marginal gross tax advantage of debt with the simulated marginal tax rate based on EBT (see Section 2.3.1)
ΔNDTS	=	the first difference of depreciation/book assets
ROA	=	operating income after depreciation/book assets
Size	=	sales/book assets, where sales are deflated by the implicit price deflator
ΔSize	=	the first difference of Size
Collateral	=	net property, plant and equipment/book assets
ΔCollateral	=	the first difference of Collateral
Z-score	=	(3.3∗EBIT + sales+1.4∗retained earnings + 1.2∗(current assets - current liabilities))/book assets
I(NEGEQ)	=	dummy variable equal to 1 if the firm has negative equity
I(NODIV)	=	dummy variable equal to 1 if the firm does not pay dividends
I(Regulated)	=	dummy variable equal to 1 if the firm belongs to a regulated industry
I(Sensitive)	=	dummy variable equal to 1 if the firm belongs to a sensitive industry
$I(NOL)_{EBIT}$	=	dummy variable equal to 1 if the firm has an EBIT based tax loss carry forward (calculated within the simulation of the marginal tax rate based on EBIT)

References

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance*, 23(4):589–609.

Alworth, J. and Arachi, G. (2001). The effect of taxes on corporate financing decisions: Evidence from a panel of Italian firms. *International Tax and Public Finance*, 8(4):353–376.

Amihud, Y. and Murgia, M. (1997). Dividends, taxes, and signaling: Evidence from Germany. *Journal of Finance*, 52(1):397–408.

Antoniou, A., Guney, Y., and Paudyal, K. (2008). The determinants of capital structure: Capital market-oriented versus bank-oriented institutions. *Journal of Financial & Quantitative Analysis*, 43(1):59–92.

Arellano, M. and Bond, S. (1991). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *Review of Economic Studies*, 58(2):277–297.

Blouin, J., Core, J. E., and Guay, W. (2010). Have the tax benefits of debt been overestimated?. *Journal of Financial Economics*, 98(2):195–213.

Booth, L., Aivazian, V., Demirguc-Kunt, A., and Maksimovic, V. (2001). Capital structures in developing countries. *Journal of Finance*, 56(1):87–130.

Byoun, S. (2008). How and when do firms adjust their capital structures toward targets?. *Journal of Finance*, 63(6):3069–3096.

Chang, X. and Dasgupta, S. (2009). Target behavior and financing: How conclusive is the evidence? *Journal of Finance*, 64(4):1767–1796.

DeAngelo, H. and Masulis, R. W. (1980). Optimal capital structure under corporate and personal taxation. *Journal of Financial Economics*, 8(1):3–29.

Deutsche Bundesbank (2001). West German enterprises' profitability and financing in 1999. *Monthly Report*, 53(3):19–43.

Flannery, M. J. and Rangan, K. P. (2006). Partial adjustment toward target capital structures. *Journal of Financial Economics*, 79(3):469–506.

Graham, J. R. (1996a). Debt and the marginal tax rate. *Journal of Financial Economics*, 41(1):41–73.

Graham, J. R. (1996b). Proxies for the corporate marginal tax rate. *Journal of Financial Economics*, 42(2):187–221.

Graham, J. R. (1999). Do personal taxes affect corporate financing decisions? *Journal of Public Economics*, 73(2):147–185.

Graham, J. R. and Kim, H. (2009). Simulating corporate marginal income tax rates and implications for corporate debt policy. *Duke University working paper*.

Graham, J. R., Lemmon, M. L., and Schallheim, J. S. (1998). Debt, leases, taxes, and the endogeneity of corporate tax status. *Journal of Finance*, 53(1):131–162.

Griliches, Z. and Mairesse, J. (1995). Production functions: The search for identification. *NBER Working Paper*, (5067).

Gropp, R. (2002). Local taxes and capital structure choice. *International Tax and Public Finance*, 9(1):51–71.

Huang, R. and Ritter, J. R. (2009). Testing theories of capital structure and estimating the speed of adjustment. *Journal of Financial & Quantitative Analysis*, 44(2):237–271.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review*, 76(2):323–329.

King, M. A. (1977). *Public Policy and the Corporation*. London: Chapman and Hall.

King, M. A. and Fullerton, D. (1984). *The Taxation of Income from Capital: A Comparative Study of the United States, United Kingdom, Sweden and West Germany*. University of Chicago Press.

Korteweg, A. (2010). The net benefits to leverage. *Journal of Finance*, 65(6):2137–2170.

Lemmon, M. L., Roberts, M. R., and Zender, J. F. (2008). Back to the beginning: Persistence and the cross-section of corporate capital structure. *Journal of Finance*, 63(4):1575–1608.

MacKie-Mason, J. K. (1990). Do taxes affect corporate financing decisions? *Journal of Finance*, 45(5):1471–1493.

Miller, M. H. (1977). Debt and taxes. *Journal of Finance*, 32(2):261–275.

Modigliani, F. and Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *American Economic Review*, 48(3):261–297.

Modigliani, F. and Miller, M. H. (1963). Corporate income taxes and the cost of capital: A correction. *American Economic Review*, 53(3):433–443.

Myers, S. C. and Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2):187–221.

Plesko, G. A. (2003). An evaluation of alternative measures of corporate tax rates. *Journal of Accounting & Economics*, 35(2):201.

Rajan, R. G. and Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *Journal of Finance*, 50(5):1421–1460.

Ramb, F. (2006). Corporate marginal tax rate, tax loss carryforwards and investment functions - empirical analysis using a large German panel data set. *SSRN working paper*.

Scholes, M. and Wolfson, M. (1992). *Taxes and Business Strategy: A Planning Approach*. Prentice Hall, Englewood Cliffs, NJ.

Sharpe, S. A. and Nguyen, H. H. (1995). Capital market imperfections and the incentive to lease. *Journal of Financial Economics*, 39(2):271–294.

Shevlin, T. (1990). Estimating corporate marginal tax rates with asymmetric tax treatment of gains and losses. *Journal of the American Taxation Association*, 11(2):51–67.

Stöss, E. (2001). Deutsche Bundesbank's corporate balance sheet statistics and areas of application. *Schmollers Jahrbuch Journal of Applied Social Science Series*, 121(1):131–137.

Titman, S. (1984). The effect of capital structure on a firm's liquidation decision. *Journal of Financial Economics*, 13(1):137–151.

Van Binsbergen, J. H., Graham, J. R., and Yang, J. (2010). The cost of debt. *Journal of Finance*, 65(6):2089–2136.

Welch, I. (2010). Common problems in capital structure research: The financial-debt-to-asset ratio, and issuing activity vs. leverage changes. *Brown University working paper.*

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48(4):817–838.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data.* MIT Press.

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