Tax Status and Tax Response Heterogeneity of Multinationals' Debt Finance *

Thiess Buettner**
(FAU and CESifo)

Michael Overesch
(University of Mannheim)

Georg Wamser
(ETH Zurich)

2nd Revised Version, April 2010

Abstract: This paper analyzes how corporate taxation affects the capital structure of subsidiaries of multinational companies. Our investigation particularly emphasizes firm characteristics that proxy for the tax status of a subsidiary, because the tax status determines crucially the tax responsiveness of firms. Our empirical results, based on a comprehensive panel of German multinationals, suggest that a higher corporation tax rate has the expected positive impact on financial leverage. Moreover, we find evidence that the tax sensitivity of the capital structure is significantly affected by several firm characteristics. Our results imply that well-known non-debt tax shields such as depreciation allowances and loss carryforwards reduce the tax sensitivity of the debt-to-capital ratio. We also find that a higher probability of experiencing losses reduces the tax rate sensitivity of debt financing.

Key Words: Non-Debt Tax Shields, Corporate Taxation, Debt Finance, Firm-level Data

JEL Classification: H25; G32

---

*We thank two anonymous referees for helpful comments and the Deutsche Bundesbank for granting access to the MiDi database. Financial support by the German Science Foundation (DFG) is acknowledged gratefully. The usual disclaimer applies.

**Corresponding author. Friedrich Alexander University, Lange Gasse 20, D-90403 Nuremberg, Germany, thiess.buettner@wiso.uni-erlangen.de

1 Introduction

While interest payments for debt usually are deductible from taxable profits, the return on equity is not. Therefore, the corporate finance literature points out that corporations may use debt as a tax shelter. In the case of multinational firms, the financial decision is part of international tax-planning considerations. Since corporation tax rates vary significantly between different countries, firms can reduce global tax payments by issuing debt primarily in high-tax countries. This is confirmed by several empirical studies investigating the financial decisions of subsidiaries of multinational firms, showing that higher taxes are associated with higher debt-to-capital ratios. However, the magnitudes of tax effects found are rather small. For example, the results of Desai, Foley, and Hines (2004) suggest that a one percentage point increase of the host-country tax rate leads to 0.471 percent higher debt-to-asset ratios for subsidiaries of US multinationals. Using data on European subsidiaries, Huizinga, Laeven, and Nicodème (2008) report a similar semi-elasticity of about 0.435.[1]

Although existing studies find conclusive evidence that taxes affect the debt policy of multinational firms, the magnitudes of tax effects seem to vary substantially across firms. Anecdotal evidence provided by tax practitioners, for example, suggests that tax effects on debt financing might be very high. This is also the perception by tax legislators, who argue that debt financing is a significant and flexible channel through which profits are shifted from high- to low-tax countries and devise anti-avoidance regulations.[2] The small tax effects found in empirical studies, however, seem to stand in contrast to the practical relevance.

[1]Further studies include, *e.g.*, Altshuler and Grubert (2003); Mintz and Weichenrieder (2009); Ramb and Weichenrieder (2005); Buettner and Wamser (2009); Buettner *et al.* (2008).

[2]For example, during the last decades, the number of countries that restrict the tax deductibility of interest payments associated with debt financing has significantly increased (Buettner *et al.*, 2008).

This paper takes into account the heterogeneity between firms and provides empirical evidence that the magnitude of tax effects varies significantly with the tax status of firms. The empirical investigation contributes to the literature by combining different approaches that have been used separately in the previous literature. While one strand of the existing literature considers the cross-country variation in statutory corporation tax rates to identify tax effects, another strand exploits the fact that firms differ in their tax status, and therefore, in their incentives to use debt finance. In their seminal theoretical work, De Angelo and Masulis (1980) demonstrate that incentives to use debt may be reduced by so-called non-debt tax shields. Non-debt tax shields may crowd out the tax benefits of deductible interest payments by reducing the expected value of interest deduction, and thus, substitute for debt finance. As a consequence, without taking account of non-debt tax shields, the tax-rate sensitivity of debt finance may be significantly underestimated.

Since the theoretical contribution of De Angelo and Masulis (1980), several studies have tested the crowding-out hypothesis empirically.[3] In an influential study, MacKie-Mason (1990) finds evidence that firms near *tax exhaustion* use less debt when non-debt tax shields are high. MacKie-Mason models incremental financial decisions and uses loss carryforwards and investment tax credits as measures for non-debt tax shields. Later studies confirm this result using similar approaches (see, *e.g.*, Trezevant, 1992; Bernasconi *et al.*, 2005). In another study, Newberry and Dhaliwal (2001) analyze the location of international bond offerings of US multinationals. They find that the location of bond offerings significantly depends on the tax status of the parent company. The probability of a bond offering by a foreign subsidiary significantly increases, if the US parent company has a loss carryforward or an excess tax credit position.

More recent papers use different identification strategies. Graham and Tucker (2006), for example, find evidence that non-debt tax shields associated with tax shelters act as

[3]For reviews see Graham (2003) and Weichenrieder (2010).

a substitute for the use of debt. In their sample consisting of 76 firms, the 38 firms using tax shelters have debt ratios that are more than 5 percent lower than those of their matches. Overesch and Voeller (2010) have shown for European firms - that are not part of multinational groups - that the tax-sensitivity of capital structures is affected by the amount of tangible assets and the existence of a loss carryforward. Furthermore, several papers consider firm-specific simulated marginal tax rates and show that the firm-specific tax rates significantly affect financial decisions (see Graham, 1996; Alworth and Arachi, 2001).

Our empirical investigation reconsiders the tax elasticity of debt financing of multinational firms by paying particular attention to differences in subsidiaries' tax statuses. The empirical results confirm the basic finding of the existing literature that a higher host-country corporation tax rate is associated with a higher debt-to-capital ratio. If we take into account firm characteristics, however, we find a significantly higher tax rate elasticity for subsidiaries that cannot make use of non-debt tax shields. The results indicate that depreciation allowances and the existence of a loss carryforward adversely affect the tax rate elasticity of the debt-to-capital ratio. We also find a significantly smaller tax response of debt financing if subsidiaries have a higher probability of experiencing losses.

The paper is organized as follows. Section 2 discusses how firm characteristics affect the tax sensitivity of financial decisions of multinational firms. The empirical investigation approach is presented in Section 3. Thereafter, in Section 4, we describe the data used for the empirical analysis. Section 5 presents the empirical results. Section 6 concludes.

2 Theoretical Background

The firm-value relevance of the capital structure choice and the impact of taxation on financing and investment decisions have been subject to extensive discussion in the corporate finance literature. Although the rationale of Modigliani and Miller (1958), who suggest the irrelevance of the capital structure in perfect capital markets, has been generally accepted, the presence of financial innovation and the cost of corporate financial decision making seem to conflict with the perfect capital market assumption, and, hence, with the irrelevance theorem (Ross, 1977; Myers, 2001). Therefore, a more general approach to the tax effects on the capital structure emphasizes not only the benefits but also the cost of debt finance that arise with imperfect capital markets. The major benefit of debt financing is that interest expenses are deductible from corporate profits, while retained earnings or dividend payments to equity holders are not. Thus, debt can act as a tax shield because taxable profits are reduced. The value of this tax shield obviously depends on the corporation tax rate: the higher the tax rate, the higher is the value of the debt tax shield. The cost of debt finance may be related to the cost of financial distress (see Kraus and Litzenberger, 1973) or may arise as agency costs, due, for instance, to potential conflicts between equity and debt claimants (see Jensen and Meckling, 1976; Myers, 1977). Other papers emphasize that governance considerations matter for the firm's choice of the capital structure (*e.g.*, Aghion and Bolton, 1989). Hence, tax induced debt finance might result in inefficiencies.

However, the sensitivity of debt finance with respect to taxation not only depends on the statutory tax rate but also depends on firm-specific characteristics that affect the tax status of a subsidiary. Consider a firm j that optimizes its capital structure by taking into account the trade-off between the costs and benefits of debt finance. Let the profit

function be

$$\pi_j = \left(f\left(k_j\right) - i\lambda_j k_j\right)\left(1 - t_j\right) - \rho\left(1 - \lambda_j\right)k_j - c\left(\lambda_j\right)k_j,$$

where t_j is the effective tax rate, i is the interest rate, ρ is the required rate of return on equity, and k_j is the stock of capital. The share of debt finance is depicted by $0 \leq \lambda_j \leq 1$. The cost of debt finance in addition to the interest is captured by the function $c\left(\lambda_j\right)$, which is assumed to be convex in λ_j such that the additional costs of debt finance are increasing in the debt share.[4] The optimal capital structure obeys the following first-order condition

$$-\left(1 - t_j\right)i + \rho - c'\left(\lambda_j\right) = 0.$$

Suppose the effective tax rate t_j is a function of the statutory tax rate τ and the firm characteristics x_j that affect the tax status of the firm

$$t_j = t\left(\tau, x_j\right).$$

Then, the tax rate sensitivity of the capital structure is

$$\frac{\partial \lambda_j}{\partial \tau} = \left(\frac{i}{c''\left(\lambda_j\right)}\right)\varphi_j, \quad \text{where} \quad \varphi_j \equiv \frac{\partial t\left(\tau, x_j\right)}{\partial \tau}.$$

Accordingly, the impact of the statutory tax rate on the debt ratio depends on the firm-specific characteristics that affect the tax status of a subsidiary. Suppose φ_j is unity such that a change in the statutory tax rate has a 1:1 effect on the effective tax rate. In this case, an empirical estimate of the effect of the statutory tax rate on the share of debt finance depends on the interest rate and on the degree to which additional cost of debt are increasing. If these cost are quickly increasing with the debt ratio, c'' is large, and

[4]The current specification generates comparative static predictions which are equivalent to a more elaborate specification which takes account of a positive effect of debt finance on the required return on equity.

tax reasons would play a minor role for the capital structure choice. Alternatively, a small empirical tax sensitivity could reflect a value of φ_j below unity: the effective tax rate might simply be not much affected by the statutory tax rate.

The role of the firm-specific tax status has been emphasized by De Angelo and Masulis (1980). They develop a theoretical explanation for the existence of a firm-specific optimal debt-to-capital ratio by taking into account alternative opportunities to reduce the corporate tax burden apart from debt. In essence, their argument is that the tax incentive to use debt significantly decreases if the amount of non-interest tax deductions, *i.e.* non-debt tax shields, is relatively large. Examples of such non-debt tax shields include depreciation allowances, investment tax credits, or loss carryforwards. In other words, the marginal tax benefit from using debt is a decreasing function of depreciation allowances or investment tax credits.

Since we consider multinational companies in our empirical investigation, tax-planning opportunities other than debt finance may have similar effects as the non-debt tax shields mentioned above. Alternative profit-shifting channels, for example transfer pricing or other non-financial intercompany transactions, may as well substitute for debt finance (see, *e.g.*, Graham and Tucker, 2006). Recently, Ruf (2011) suggests that the tax sensitivity of debt finance is significantly reduced if international transfer pricing schemes do not allow an effective reduction of taxable income by means of interest expenses. From a conceptual point of view, however, other profit-shifting instruments may differ from financial strategies. While debt financing can be used to shift profits corresponding to normal returns (at levels similar to the interest rate), transfer pricing can be employed to shift economic rents, because the scope for setting tax-optimal transfer prices is wider if the profitability is relatively high.[5] From this perspective, transfer price strategies are no close substitute for

[5]The conventional method to assess transfer prices follows the arm's length principle. For example, transfer prices are compared to prices of transactions between unrelated parties. In cases where the

debt financing.

Finally, the tax status of a subsidiary depends on the current profitability. Although the vast majority of countries impose linear corporation tax rates, the tax status significantly differs if taxable profits are negative. In this case, additional deductions do not immediately reduce the tax bill but may only be carried forward into subsequent fiscal years. Due to the reduction in the present value of interest deductions, the incentive for debt financing is smaller if a subsidiary faces a higher probability to incur losses.

3 Investigation Approach

The empirical analysis below is concerned with the tax-sensitivity of the debt-to-capital ratio of foreign subsidiaries of multinational companies. Using a subsidiary-level dataset, which is described in Section 4 in more detail, we estimate equations of the following type:

$$\begin{aligned} DCR_{i,j,t} \;=\; \alpha_0 \;&+\; \alpha_1\, STR_{j,t} + \alpha_2\, STR_{j,t}\, Z_{i,j,t} \\ &+\; \alpha_3\, X_{i,j,t} + \delta_{k(i)} + \gamma_t + \epsilon_{i,j,t}. \end{aligned} \tag{1}$$

The debt-to-capital ratio (DCR) of subsidiary i in country j in year t is the dependent variable. Explanatory variables include the country-j specific statutory tax rate (STR) and interactions between STR and certain firm characteristics (Z) that proxy for the tax status of the subsidiaries. By adding interaction terms, we can test the hypothesis that tax sensitivities differ, depending on the availability of non-debt tax shields or other firm

standard methods to evaluate transfer prices (like the comparable uncontrolled price method) cannot be applied, profit based methods (like the transactional net margin method) may be used. The latter compares the profitability of intrafirm transactions with a profitability observed between unrelated companies. The scope to shift profits is probably wider if no comparable benchmark profitabilities are available.

characteristics affecting a subsidiary's tax status.[6]

All estimations additionally condition on a set of standard control variables (X) as well as year-specific (γ_t) and parent- or group-specific effects ($\delta_{k(i)}$), where $k\,(i)$ denotes the index of parent k associated with subsidiary i. In further specifications, we take account of industry as well as country effects to control for unobserved heterogeneity between industries and for unobserved country characteristics. By using parent-specific and industry-specific effects, we control for determinants such as product and customer characteristics analyzed in recent empirical studies (*e.g.*, Kale and Shahrur, 2007), provided that they remain constant over time.

We expect that a subsidiary's debt usage is positively related to the local statutory tax rate. For this reason, α_1 is predicted to be positive. We test potential asymmetries concerning the tax response of firms by considering interaction terms between firm characteristics and the local tax rate. Variables Z capture characteristics which are associated with the tax status of the foreign subsidiary. Thus, if Z measures the availability of non-debt tax shields that crowd out the standard debt tax shield, the coefficients (α_2) for the interaction terms are expected to be negative. The estimate for α_1 (conditional on $STR \times Z$), then, refers to firms which do not enjoy the existence of corresponding non-debt tax shields. The variables included in the vector Z are described in more detail in Section 4.

4 Data and Descriptive Statistics

In our empirical analysis we use, basically, the MiDi (Microdatabase Directinvestment) database provided by the *Deutsche Bundesbank*. This is a comprehensive annual micro

[6]By relying on interaction terms it is implicitly assumed that the effect of other control variables does not vary with the tax status. To check for robustness, we also estimated separate equations for sub-samples with differences in the tax status and obtained qualitatively similar results.

database of investment positions of German enterprises held abroad, as well as of investment positions held in Germany by foreign companies.[7] However, we employ only data on German outbound FDI. MiDi includes information about the investment object's balance sheet and limited further information on the type of investment and on the investor. An advantage of the data is the possibility of tracing company groups and their subsidiaries over time. The annual panel starts in 1996 and for the purposes of the current analysis we use the time-period until 2006. The data collection is mandated by German law which requires firms to report about certain international transactions and positions.[8] This aspect of MiDi is worth emphasizing: we are able to observe virtually all German outbound investments.[9]

In our analysis we focus on majority-owned, directly-controlled and incorporated subsidiaries located in 36 host countries, that are OECD member states or European countries.[10] We restrict our sample to directly-held subsidiaries because more complex ownership structures might be associated with enhanced tax planning opportunities, changing the tax incentives. Indirectly-held subsidiaries are not considered because the capital structure of such subsidiaries might be determined differently. Mintz (2004) and Ruf (2011), for instance, demonstrate that intermediate entities may be established because they provide additional opportunities for internal debt financing. Subsidiaries from the financial sector, holding companies, and subsidiaries which may have specific taxing conditions are also

[7] Lipponer (2008) provides a detailed description of MiDi.

[8] Sec. 26 of Foreign Trade and Payments Act (Aussenwirtschaftsgesetz) in connection with Foreign Trade and Payments Regulation (Aussenwirtschaftsverordnung). Since 2002, FDI has to be reported if the participation is 10% or more and the balance-sheet total of the respective foreign investment in Germany exceeds 3 million Euros. For details see Lipponer (2008). Though previous years showed lower threshold levels, we apply this threshold level uniformly for all years in the panel.

[9] A drawback of the dataset is that no national firms are included.

[10] All EU and OECD member states are included, except Romania, because no lending rates were available for this country, and Iceland, because no subsidiaries of German multinationals are reported in our dataset. Additionally, we consider Croatia. Germany is not included as the country of the parent companies.

excluded.[11]

Our firm-level dataset used for the regression analysis contains 78,020 observations of 15,118 subsidiaries. These subsidiaries belong to 6,476 multinationals with a German parent. The number of observations slightly increases during the considered time period. In 1996, 5,152 observations are considered, while in 2006, the number of observations is 7,663. The most important host countries of German subsidiaries included in our sample are France (11.23 percent of all observations), the USA (9.94 percent), Austria (9.60 percent), and the United Kingdom (9.59 percent).

We consider the debt-to-capital ratio of the subsidiaries as the dependent variable for the analysis of the capital structure. The debt-to-capital ratio is defined as the ratio of total liabilities to total capital. Descriptive statistics of all variables are shown in Table 1. A correlation matrix of the variables is provided in Table A-1 (see appendix).

Explanatory variables include the statutory tax rate (STR) of the host country. The STR is the corporate income tax rate adjusted for surcharges, local profit taxes, and interest deductibility. The effect of statutory tax rates on debt ratios is expected to be positive, because the incentive to deduct interest expenses should rise with an increasing STR. As discussed in Section 2, we expect the effect of the statutory tax rate to differ with the firm's tax status. The potential differences in the tax sensitivity are explored by interaction terms of firm characteristics and the variable STR.

We use five variables to proxy for differences in subsidiaries' tax statuses. First, we consider the differences in depreciation allowances by means of the variable *Tangibility*. This variable refers to the ratio of fixed assets to total assets. The idea of non-debt tax shields proposed

[11] We exclude observations from mining, agriculture, non-profit and membership organizations, because special tax regimes may be available. Furthermore, we exclude observations whose German parent is not an incorporated and legally independent entity, as well as subsidiaries which are not legally independent.

Table 1: Descriptive Statistics

	Mean	Std. Dev.
Dependent Variable:		
Debt-to-Capital Ratio	.601	.260
Explanatory Variables:		
Sales	48,139	303,028
Tangibility	.265	.250
Loss Carryforward	.295	.456
Loss Probability (Industry)	.246	.044
Loss Probability (Group)	.246	.206
STR	.266	.070
Lending Rate	.075	.055
GDP Growth	.003	.002
R&D Intensity	.056	.034

Statistics refer to 78,020 observations. Firm-level variables are taken from the MiDi database provided by the Deutsche Bundesbank. The *Debt-to-Capital Ratio* is defined as the subsidiary's total liabilities divided by total capital (consisting of nominal capital, capital reserves, profit reserves, and total debt). *Sales* refers to subsidiary sales in €1,000. *Tangibility* is a subsidiary's ratio of fixed assets to total assets. *Loss Carryforward* is a binary variable which is one if a subsidiary has a loss carryforward. *Loss Probability (Industry)* is the share of loss making subsidiaries in the total sample per industry. *Loss Probability (Group)* is the share of loss making subsidiaries per German parent company. *STR* is the statutory corporation tax rate adjusted for surcharges, local profit taxes, and restrictions on interest deductibility. The tax data is collected from databases provided by the International Bureau of Fiscal Documentation (IBFD) and tax surveys provided by Ernst&Young, PwC, and KPMG. *Lending Rate* refers to private sector debt, which is taken from the IMF International Financial Statistics Yearbook (2007) and augmented by OECD figures. *GDP Growth* is the annual growth in GDP taken from the World Bank's World Development Indicators. The *R&D Intensity* is defined as the industry-specific ratio of R&D expenditures to firm sales. The *R&D* data is taken from a survey provided by the Stifterverband für die Deutsche Wissenschaft (2006).

by De Angelo and Masulis (1980) refers to allowances due to the depreciation of fixed assets. Accordingly, the value of additional interest deduction is smaller for subsidiaries heavily investing in fixed assets, as the value of interest deduction may be crowded out by the non-debt tax shields generated by depreciation and investment tax credits related to fixed assets. Hence, in accordance with the literature on non-debt tax shields, the interaction term $STR \times Tangibility$ is expected to affect negatively the debt-to-capital ratio of the

subsidiary. We also control for the non-interacted tangibility and expect that this variable impacts debt usage positively. A higher share of fixed assets may imply improved external borrowing conditions, because the fixed assets could serve as collateral.[12]

The binary variable *Loss Carryforward* indicates subsidiaries with a loss carryforward. Because subsidiaries can offset current profits, incentives for tax planning are reduced if a subsidiary carries forward any losses.[13] For this reason, we expect that the interaction between the statutory tax rate and loss carryforward impacts debt ratios negatively.[14] With regard to the level, a positive effect might be expected, since the loss carryforward possibly reflects poor performance in previous periods, where the ability to retain earnings was low. Gopalan, Nanda and Seru (2007) show that intercompany loans are used to prevent subsidiaries from going bankrupt. Also from this perspective, we should predict a positive effect for the control variable *Loss Carryforward*. However, creditors may expect a higher risk of going bankrupt if a subsidiary had losses in the past, and, hence, are offering unfavorable terms of credit. Therefore, a negative impact seems also plausible.

To capture asymmetries associated with non-financial profit-shifting opportunities available to the multinational firm, we follow the previous literature and use the *R&D Intensity* of the parent company's industry. This measure is intended to capture firms from R&D-intensive industries, which may enjoy enhanced opportunities to shift profits using royalty fees or other transfer prices (see Harris, 1993; Harris *et al.*, 1993; Grubert, 2003). The manipulation of transfer prices is easier when trade within the multinational firm is spe-

[12]More collateral may make a liquidation less costly for shareholders as well as for debt holders who can resort to liquidation in order to attain a more effective management control. Harris and Raviv (1990) find a positive correlation between companies' liquidation value (proxied by the fraction of tangible assets) and the optimal debt level.

[13]In some countries, a loss carryback is available and additional deductions may result in some tax refunding. However, note that a loss carryback is mostly limited.

[14]MiDi only provides financial accounting data. We use the information on the existence of a loss carryforward taken from financial accounting as a proxy for the existence of a tax loss carryforward.

cific. Since more research and development tends to result in more specific goods, assets, or services the scope for tax planning by means of transfer prices is higher for R&D intensive firms and industries. Therefore, we use data on R&D intensity taken from a survey among German firms. The reported R&D intensity is measured by the ratio of the R&D expenditures to a firm's sales.[15] Note that our measure is unaffected by the actual allocation of intangible assets and R&D activities within multinational groups since we use the R&D intensity of the parent company's industry. If profit shifting by means of transfer pricing and debt financing are substitutes, we expect a negative effect of the interaction term between the R&D intensity and the tax rate.

Furthermore, we test for an impact of the probability of losses on the tax rate sensitivity of the debt ratio. Unfortunately, profitability measures like EBIT or EBITDA, which are not directly affected by current debt ratios, are not available in MiDi. Therefore, we construct measures of the probability of losses per industry and per German parent company.[16] The variable *Loss Probability (Industry)* is the probability that a subsidiary experiences losses in a certain industry. *Loss Probability (Group)* is the corresponding measure at the level of the multinational group, *i.e.* the probability of experiencing losses for subsidiaries belonging to the same German parent firm. Again, we expect adverse effects of the interaction terms between tax rates and loss probabilities. The reason is that, if a subsidiary expects to be in a loss situation with a relatively high probability, the expected value of an interest deduction for tax purposes is relatively low since additional interest deductions may only result in a loss carryforward but not immediately in lower taxes.

Apart from characteristics that capture non-debt tax shields or generally describe the tax

[15]The intensities range from 0.1 percent to 40.3 percent. Particularly high R&D intensities are reported for the manufacture of pharmaceutical products, the manufacture of transport equipment, the manufacture of radio, television and communication equipment, the manufacture of aircraft and spacecraft, as well as in case of specific R&D companies.

[16]We do not consider a measure at the subsidiary level, because this variable is likely to be endogenous

status of subsidiaries, we consider additional control variables. Financing decisions may be determined by firms' sales, as this is an indicator of the size and of the cash flow of a subsidiary. In both cases, higher sales are associated with favorable lending conditions (*e.g.*, Graham and Harvey, 2001). While the easier access to bank loans may point at a positive effect on debt finance, higher sales may also imply that a firm is more able to retain earnings. In this case, the impact on the debt ratio would be negative.

We further consider the local lending rate for credit to the private sector. This variable captures several aspects of the local credit market.[17] A high local lending rate means higher cost in terms of external borrowing in the host-country's capital market. However, in case of multinational firms, the negative effect of higher costs of external lending may be circumvented by internal capital markets, *i.e.* internal debt may substitute for external borrowing. In addition, GDP growth is included to control for the dynamics of the local market. Since they affect how foreign income is taxed at the level of the parent firm, also double taxation treaties may have an impact on the capital structure choice of foreign subsidiaries. Since, in our data, the parent firm is always located in Germany, the impact of German tax treaties is of particular importance. However, during the period under consideration, Germany had tax treaties with almost all countries included in the sample (including former Yugoslavia). As a consequence, in our sample, intrafirm dividends basically are tax exempt at the level of the German parent company (exemption method), whereas intercompany interest received usually is subject to taxation. In the latter case, for foreign taxes paid, the firm receives a tax credit (credit system).

[17] While previous papers often consider several measures for credit market conditions such as creditor rights, we only consider the lending rate for credit to the private sector. Buettner *et al.* (2006) show that the lending rate is a sufficient proxy for the conditions of the local capital market. The advantage of using the lending rate, thus, is the fact that this variable captures information on several relevant credit-market conditions and also time-series information for the countries considered in our sample.

5 Results

The regression results are shown in Table 2. The estimations follow the approach presented in Section 3. Standard errors are clustered within country-year cells. In specification (1), we consider firm-specific and year-specific effects as well as a basic set of additional explanatory variables. We add industry dummies in specifications (2) - (9) and host-country dummies in specifications (10) - (12). While the country-specific effects in the last three specifications control for unobserved heterogeneity across countries, the country dummies also eliminate much of the cross-country variation in the tax rates. Note, however, that this variation explains a substantial part of the allocation of debt within multinational firms. For this reason, the findings with country effects are only reported as additional robustness tests and the corresponding estimates should not be used to evaluate the magnitudes of the empirical effects.[18]

All regressions in Table 2 confirm the expected positive effect of the statutory tax rate (STR) on the debt-to-capital ratio. This highlights the role of debt for multinationals' tax planning. The point estimator for the statutory tax rate of the basic specification (2) suggests that a one percentage point higher statutory tax rate is associated with a 0.27 percentage point higher debt-to-capital ratio. Taking into account the mean debt-to-capital ratio of about 0.6, the semi-elasticity of the debt ratio amounts to 0.45. This effect is very similar to the results of previous studies.[19]

[18]To test for the robustness of the basic estimation approach, further specifications have been estimated. This includes specifications accounting for subsidiary-specific effects and specifications including indirectly-held subsidiaries. Furthermore, estimations have been carried out based only on OECD or EU countries. In all these tests, the basic regression results have been confirmed. The detailed results of these additional regressions are available from the authors upon request.

[19]The magnitude of the estimated coefficient is remarkably close to that of other studies. Desai, Foley, and Hines (2004) find a slightly smaller semi-elasticity of 0.471; the analysis of Huizinga, Laeven, and Nicodème (2008) suggests a semi-elasticity of 0.435.

The results shown in columns (3) - (9) confirm significant heterogeneity in the tax rate sensitivity of debt financing. Column (3) considers an interaction term between the tax rate and the asset tangibility of the subsidiary. In accordance with the theoretical expectation, we find a significant adverse effect of tangibility on the tax rate elasticity. This is in line with the literature on non-debt tax shields as a higher amount of fixed assets usually is associated with more depreciation allowances. At the same time, the standard tax effect for a firm without tangible assets increases.

In column (4) we consider further differences that may arise from the existence of a loss carryforward. In accordance with our theoretical expectation, the results confirm a significant adverse effect of a loss carryforward on the tax elasticity of the debt-to-capital ratio. The point estimate suggests that the tax incentive to use debt financing is reduced by more than half if a subsidiary has a loss carryforward. This finding seems to be particularly relevant considering that approximately 30% of the subsidiaries in our sample report a loss carryforward and, consequently, should respond significantly less to variations in the statutory tax rate.[20]

In column (5) we investigate how non-financial tax-planning instruments affect the tax sensitivity. We introduce an interaction term between the tax rate and the R&D intensity of the parent company. As described in Section 4, the R&D intensity is expected to be positively associated with the potential to manipulate transfer prices. The regression results, however, do not support the view that alternative tax planning opportunities reduce the tax incentives of debt financing. This suggests that the different channels of tax planning are not substitutive but may be used independent of each other. This interpretation

[20]Since the group of observations with a loss carryforward is large, we checked for the robustness of the interaction by decomposing the sample into subsamples where one subsample comprises all firms with a loss carryforward. The results (available upon request) support our findings for the tax elasticity of the debt-to-capital ratio, since a positive tax effect is only found for the subsample comprising firms without a loss carryforward.

Table 2: Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
STR	.281***	.270***	.348***	.325***	.289***	.599***	.353***	.587***	.454***	.148***	.356***	.262***
	(.043)	(.043)	(.059)	(.046)	(.049)	(.103)	(.051)	(.099)	(.070)	(.043)	(.100)	(.059)
STR x Tangibility			-.290***					-.215**	-.244***		.033	.014
			(.088)					(.084)	(.084)		(.073)	(.073)
STR x Loss Carryforward				-.188***				-.171***	-.161***		-.143***	-.133***
				(.043)				(.041)	(.041)		(.036)	(.035)
STR x R&D Intensity					-.329			-.335	-.419		-.559	-.627
					(.375)			(.373)	(.375)		(.384)	(.385)
STR x Loss Prob. (Industry)						-1.35***		-.781**			-.580**	
						(.337)		(.311)			(.295)	
STR x Loss Prob. (Group)							-.346***		-.201**			-.173*
							(.105)		(.101)			(.101)
ln(Sales)	.006***	.011***	.011***	.011***	.011***	.011***	.011***	.011***	.011***	.014***	.014***	.014***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Tangibility	-.102***	-.053***	.040	-.053***	-.053***	-.053***	-.053***	.015	.025	-.034***	-.045*	-.038*
	(.008)	(.008)	(.028)	(.008)	(.008)	(.008)	(.008)	(.027)	(.027)	(.008)	(.024)	(.023)
Loss Carryforward	.060***	.061***	.061***	.123***	.061***	.061***	.061***	.118***	.114***	.064***	.112***	.108***
	(.003)	(.003)	(.003)	(.015)	(.003)	(.003)	(.003)	(.014)	(.014)	(.003)	(.013)	(.012)
ln(Lending Rate)	.006	.009**	.009**	.009**	.009**	.009**	.009**	.009**	.009**	.009*	.009*	.009*
	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)	(.005)	(.005)	(.005)
GDP Growth	-.275*	-.276*	-.276*	-.276*	-.276*	-.276*	-.276*	-.276*	-.276*	.035	.035	.035
	(.149)	(.147)	(.147)	(.147)	(.147)	(.147)	(.147)	(.147)	(.147)	(.100)	(.100)	(.100)
R&D Intensity					.128			.132	.159		.199	.220
					(.144)			(.143)	(.144)		(.145)	(.146)
Observations	78,020	78,020	78,020	78,020	78,020	78,020	78,020	78,020	78,020	78,020	78,020	78,020
Adj. R^2	.4623	.4689	.4692	.4693	.4689	.4691	.4691	.4696	.4696	.4854	.4857	.4857
Industry Dummies	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes

Dependent variable is the debt-to-capital ratio. Estimations include time-specific and firm-specific effects. Robust standard errors, clustered within country-year cells, are in parentheses. *,**,*** denote significance at the 10%, 5%, and 1% level.

seems reasonable, because the two channels of tax planning are rather distinct. While debt finance provides a tax shield for normal rates of return, transfer pricing may be more suited to shift above-normal rates of return into low-tax countries. However, since the R&D intensity is a rather crude measure for the opportunity to manipulate transfer prices, our empirical finding should be interpreted with some caution.

The last two measures refer to expectations about the future tax status of firms. More specifically, we investigate how the probability of losses affect the tax sensitivity of debt financing. As discussed in Section 4, we do not have sufficient information on the subsidiary's profitability before interest deduction. Therefore, we consider the probability of losses aggregated at the industry and the group level, respectively. The regression results, shown in columns (6) and (7), reveal that the loss probability significantly affects the tax rate elasticity of the debt-to-capital ratio.[21]

Columns (8) and (9) provide results where the different interaction terms are entered jointly. While the interaction with the R&D intensity still proves insignificant, all other interaction terms show significant effects. This is reassuring about the identification of the different types of firm-heterogeneity. Besides supporting the tax implications the results point at a high tax rate sensitivity once firm heterogeneity is taken into account. In other words, if a subsidiary cannot make use of non-debt tax shields, its tax rate sensitivity is significantly higher as compared to the average effect. If we consider specification (9), for example, and take into account sample means of the firm characteristics, the total effect of a one percentage point higher tax rate amounts to a 0.292 percent higher debt ratio. Note, though, that the tax effect is significantly smaller for a subsidiary with a loss carryforward and values for tangibility and loss probability (group) that are one standard deviation

[21]Note that we cannot identify a separate effect of the time-invariant firm-specific and industry-specific loss probability, respectively, in a model using firm-specific and industry-specific effects. For this reason, we add only interactions with the statutory tax rate. Note also that we do not use a measure of the current profitability after interest deduction, as this would most probably be endogenous in our regressions.

higher than their respective sample means. In this case, a one percentage point higher tax rate results only in a 0.08 percentage point higher debt ratio. In contrast, consider a subsidiary without a loss carryforward and with tangibility as well as group-specific loss probability one standard deviation below sample mean. In this case, a one percentage point higher tax rate is associated with a 0.44 percentage point higher debt ratio. The semi-elasticity of the debt ratio with respect to the tax rate is then 0.735 (evaluated at the mean debt-to-asset ratio).

The specifications shown in columns (10) - (12) control for country-specific effects. However, the results of these additional specifications should be interpreted with caution, because country-specific effects entirely eliminate cross-country variation in tax rates. As a result, the estimated coefficients for the tax effects are significantly smaller if country effects are added. Nevertheless, the basic findings can be confirmed and results prove to be robust. But, we are unable to identify any statistically significant effect of tangibility and of R&D intensity on the tax rate elasticity of debt financing. In contrast, the adverse tax effects of a loss carryforward and of the group- or specific probability to experience a loss are confirmed.

Finally, let us briefly discuss the effects of the non-tax determinants of debt financing. Our results confirm that higher sales are associated with a higher debt-to-capital ratio. This supports the view that size and cash flow of subsidiaries improve external borrowing conditions. Moreover, we find a positive effect of a higher local lending rate on debt financing of German subsidiaries, suggesting that subsidiaries of multinationals can compensate less attractive local financing conditions by using internal credit markets.[22] If fixed assets are used as collateral, we expect a positive effect of tangibility. In fact, the

[22]This effect might be driven by internal debt usage (see Buettner *et al.*, 2009). Additional regressions (available from the authors upon request) support this view. While the lending rate is negative and significant in the case of external third-party debt, it is positive and significant in the case of intercompany loans.

estimated coefficient is positive, but no longer significant once we include the interaction term between tangibility and the tax rate. The dummy variable indicating the existence of a loss carryforward is positively related to the share of debt. This is in line with our argument that firms reporting a loss carry-forward have not been able to retain profits in previous periods. Consequently, these subsidiaries should have comparatively less equity capital. For the growth opportunities, measured by GDP growth in the host country, we find a negative effect. Finally, the results show that the $R\&D$ intensity is not significantly related to the debt-to-capital ratio.

6 Conclusions

The paper contributes to the literature on the capital structure of multinationals by examining whether the tax sensitivity differs systematically with individual firm characteristics. While we confirm the findings of previous studies with respect to the average statutory corporate tax rate effect, we identify significant differences in the tax sensitivity associated with the respective tax status of the subsidiaries.

Our empirical tests investigate various non-debt tax shields. We find that the tax rate sensitivity of the debt ratio is lower for firms with high levels of tangibility, which is a proxy for the value of depreciation allowances of subsidiaries. Similarly, the tax sensitivity is lower for subsidiaries with a loss carryforward. We also find that a higher probability of experiencing losses reduces the tax rate sensitivity of the debt-to-capital ratio. Additionally, we take into account tax-planning strategies of multinational firms other than debt financing. However, our results show no statistically significant impact of enhanced transfer-pricing opportunities on the tax rate elasticity of debt. With the caveat that the room for transfer-pricing manipulations is only captured indirectly, this supports the view

that debt financing and transfer pricing are independently used for tax planning purposes.

While our results confirm an average tax effect on debt financing similar to findings of previous studies, our results also suggest that firms are affected asymmetrically by tax reforms. Our results support the view that the response of multinationals' debt policy to taxes significantly depends on the tax status of the subsidiaries. If subsidiaries cannot make use of non-debt tax shields or do not expect to experience losses, our results suggest a significantly higher tax sensitivity compared with results of previous studies. However, depending on their tax status, some subsidiaries do hardly respond to taxes. For instance, when subsidiaries have a loss carryforward or have a higher probability to experience losses, the importance of debt for tax planning seems relatively small.

References

Aghion, P. and P. Bolton (1989), The financial structure of the firm and the problem of control, *European Economic Review* 33, 286-293.

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

Altshuler, R. and H. Grubert (2003), Repatriation taxes, repatriation strategies and multinational financial policy, *Journal of Public Economics* 87, 73-107.

Bernasconi, M., A. Marenzi and L. Pagani (2005), Corporate financing decisions and non-debt tax shields: evidence from Italian experiences in the 1990s, *International Tax and Public Finance* 12, 741-773.

Buettner, T., M. Overesch, U. Schreiber and G. Wamser (2006), *Taxation and capital structure choice - Evidence from a panel of German multinationals*, CESifo Discussion Paper 1841, Munich.

Buettner, T., M. Overesch, U. Schreiber and G. Wamser (2008), *The impact of thin-capitalization rules on multinationals' financing and investment decisions*, Bundesbank Discussion Paper 03/2008, Frankfurt.

Buettner, T., M. Overesch, U. Schreiber and G. Wamser (2009), Taxation and capital structure choice - Evidence from a Panel of German multinationals, *Economics Letters* 105, 309-311.

Buettner, T. and G. Wamser (2009), *Internal Debt and Multinationals' Profit Shifting - Empirical Evidence from Firm-Level Panel Data*, Oxford University Centre for Business Taxation Working Paper 09/18, Oxford.

De Angelo, H. and R.W. Masulis (1980), Optimal capital structure under corporate and personal taxation, *Journal of Financial Economics* 8, 3-29.

Desai, M.A., C.F. Foley and J.R. Hines (2004), A multinational perspective on capital structure choice and internal capital markets, *Journal of Finance* 59, 2451-2487.

Gopalan, R., R. Nanda and A. Seru (2007), Affiliated firms and financial support - evidence from Indian business groups, *Journal of Financial Economics*, 86, 759-795.

Table A-1: Correlation Matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
STR	(1)	1.000								
ln(Sales)	(2)	0.400	1.000							
Tangibility	(3)	-0.138	-0.159	1.000						
Loss Carryforward	(4)	0.038	-0.081	0.123	1.000					
ln(Lending Rate)	(5)	0.007	-0.069	0.150	0.087	1.000				
GDP Growth	(6)	-0.267	-0.027	0.117	0.027	0.217	1.000			
Loss Prob. (Industry)	(7)	-0.075	-0.040	0.357	0.104	0.050	0.051	1.000		
Loss Prob. (Group)	(8)	0.029	-0.085	0.130	0.331	0.066	0.009	0.180	1.000	
R&D Intensity	(9)	-0.022	0.048	0.009	-0.034	-0.037	-0.015	0.035	-0.040	1.000

Correlation matrix corresponds to the set of (untransformed) right-hand side variables.

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

Graham, J.R. (2003), Taxes and corporate finance: A review, *Review of Financial Studies* 16, 1075-1129.

Graham, J.R. and C.R. Harvey (2001), The theory and practice of corporate finance: Evidence from the field, *Journal of Financial Economics* 60, 187-243.

Graham, J.R. and A. Tucker (2006), Tax shelters and corporate debt policy, *Journal of Financial Economics* 81, 563-594.

Grubert, H. (2003), Intangible income, intercompany transactions, income shifting, and the choice of location, *National Tax Journal* 56, 221-242.

Harris, D.G. (1993), The impact of U.S. tax law revision on multinational corporations' capital location and income shifting decisions, *Journal of Accounting Research* 31 (Supplement), 111-140.

Harris, D.G., R. Morck, J. Slemrod, and B. Yeung (1993), Income shifting in U.S. multinational corporations, in: Giovannini, A., R.G. Hubbard and J. Slemrod (eds.), *Studies in International Taxation*, Chicago, 277-302.

Harris, M. and A. Raviv (1990), Capital structure and the informational role of debt, *Journal of Finance* 45, 321-349.

Huizinga, H., L. Laeven and G. Nicodème (2008), Capital structure and international debt shifting, *Journal of Financial Economics* 88, 80-118.

Jensen, M. and W.H. Meckling (1976), Theory of the firm: managerial behavior, agency costs and ownership structure, *Journal of Financial Economics* 42, 159-185.

Kale, J.R. and H. Shahrur (2007), Corporate capital structure and the characteristics of suppliers and customers, *Journal of Financial Economics* 83, 321-365.

Kraus, A. and R.H. Litzenberger (1973), A state-preference model of optimal financial leverage, *Journal of Finance* 28, 911-922.

Lipponer, A. (2008), Microdatabase Direct Investment - MiDi. A brief guide, Bundesbank Working Paper, Frankfurt.

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

Mintz, J. (2004), Conduit entities: implications of indirect tax-efficient financing structures for real investment, *International Tax and Public Finance* 11, 419-434.

Mintz, J. and A. Weichenrieder (2009), The indirect side of direct investment – multinational company finance and taxation, The MIT Press, 128-140.

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

Myers, S. (1977), Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147-175.

Myers, S. (2001), Capital structure, *Journal of Economic Perspectives* 15, 81-102.

Newberry, K. and D.S. Dhaliwal (2001), Cross-jurisdictional income shifting by U.S. multinationals: evidence from international bond offerings, *Journal of Accounting Research* 39, 643-662.

Overesch, M. and D. Voeller (2010), The impact of personal and corporate taxation on capital structure choices, *FinanzArchiv* 66, 263-294.

Ramb, F. and A. Weichenrieder (2005), Taxes and the financial structure of German inward FDI, *Review of World Economics* 141, 670-692.

Ross, S. (1977), The determination of financial structure: The incentive-signalling approach, *Bell Journal of Economics* 8, 23-40.

Ruf, M. (2011), Why is the response of multinationals' capital structure choice to tax incentives that low? Some possible explanations, *FinanzArchiv*, forthcoming.

Stifterverband für die Deutsche Wissenschaft (2006), Forschung und Entwicklung in der Wirtschaft – Bericht über die FuE-Erhebungen 2003 und 2004, Essen.

Trezevant, R. (1992), Debt financing and tax status: tests of the substitution ef- fect and the tax exhaustion hypothesis using firms' response to the economic recovery tax act of 1981, *Journal of Finance* 47, 1557-1568.

Weichenrieder, A. (2010), Steuern und die Empirie der Unternehmensfinanzierung, *Schriften des Vereins für Socialpolitik*, forthcoming.