# Trade off or pecking order - what drives the leverage of subsidiaries in high tax countries up?

by

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# Trade off or pecking order - what drives subsidiary leverage in high tax countries up?

**Abstract.** Subsidiary leverage increases with the tax rate. This is typically attributed to multinationals trading off the tax benefits of using debt and its costs. However, the pecking order provides an equally plausible explanation. Due to higher taxation, multinationals have less retained earnings in high tax countries. Since retained earnings enter the denominator of book leverage, this has a mechanical positive effect on the leverage. Only one third of the standard increase in subsidiary leverage with the tax rate is due to a trade off behavior of multinationals, whereas the remaining two thirds are due to the pecking order.

## 1. Introduction

Interest expenses are tax deductible, whereas dividend payments are not. Consequently according to the trade off theory of corporate finance firms balance tax savings and other benefits of debt against costs such as deadweight bankruptcy costs. As a result multinationals should use more debt finance in high tax countries. Consistent with this theoretical prediction several empirical studies document an increase of the leverage of multinationals' subsidiaries with the corporate tax rate and thus conclude, that multinationals indeed in line with the trade off theory prefer debt over equity in high tax countries.

However, this conclusion ignores the competing theory in corporate finance for explaining corporate capital structure choice. According to the pecking order theory introduced by Myers (1984), due to transaction and adverse selection costs, firms first look to retained earnings, then to debt, and only in extreme circumstances to equity for financing. Under the pecking order theory multinationals do not care about taxation and do not prefer debt over equity in high tax countries. Still also under the pecking order theory I expect to observe an increase of the leverage of multinationals' subsidiaries with the corporate tax rate, since corporate taxation reduces subsidiaries profits and thus available retained earnings. Since a decrease in retained earnings enters the denominator of book leverage, this has a mechanical positive effect on the latter driving the leverage up in high tax countries.

This paper investigates, which of the two effects drives multinationals' subsidiary leverage in high tax countries up: Does the leverage – consistent with the prediction of the trade off theory – increase because multinationals prefer debt over equity in high tax countries? Or does the leverage – consistent with the prediction of the pecking order theory – increase because multinationals have due to taxation less access to retained earnings in high tax countries?

I replicate the standard result in the literature finding a 4.5 percentage point increase in subsidiary leverage following a ten percentage point increase in the corporate tax rate. I then investigate, whether this observed increase could also be due to a pecking order behavior. Financial statements allow to distinguish external financing (classified as equity or debt in the financial statement) and internal financing (classified as retained earnings in the financial statement). Using this information I show, that as predicted under the pecking order theory, the ratio of

retained earnings with respect to the balance sheet total decreases with the corporate tax rate and consequently the leverage increases. The standard conclusion in the literature, that the observed increase in the leverage with corporate tax rates is due to multinationals trading off the tax benefits and costs of debt finance, is ambiguous. The pecking order theory provides a second equally plausible explanation for this empirical observation.

Following the procedure of Shyam-Sunder and Myers (1999) and Chang and Dasgupta (2009) I support this conclusion simulating data under the assumption of multinationals following random external financing. Using this simulated data I am still able to identify the standard increase of the leverage with the corporate tax rate. Being able to identify a significant effect of corporate taxation on firm leverage even in data simulated under the assumption of random financing makes an intuitively appealing case for standard leverage regressions overstating the importance of trade off considerations.

I carry out several empirical tests to disentangle, to which extent trade off or pecking order behavior drives the leverage in high tax countries up. I show, that following a ten percentage point increase in the corporate tax rate the ratio of retained earnings with respect to the balance sheet total decreases by 5.0 percentage points; based on simulations I conclude, that this translates into a 2.3 percentage points increase in subsidiary leverage, since retained earnings enter the denominator of book leverage. I find an additional increase in subsidiary leverage of 1.0 percentage points, because the lack of internal financing in high tax countries forces multinationals to rely more frequently on external financing in most cases provided as debt driving the leverage up further. Hence – given the overall increase in subsidiary leverage of 4.5 percentage points – approximately 3.3 percentage points or two thirds of the observed increase is due to a pecking order behavior (lacking retained earnings) and only the remaining third or 1.2 percentage points to a trade off behavior.

I then investigate, whether retained earnings could be part of trade off considerations of firms. However, I do not find evidence that firms increase distributions to shareholders in high tax countries to decrease available retained earnings there. I find very limited evidence for firms – given their target leverage and the availability of retained earnings – choosing external equity accordingly and thus retained earnings being part of an overall trade off optimization process with respect to equity. Given the target leverage determined under the assumption off a trade off behavior, a ten percentage point deviation from this target caused by a decrease in retained

earnings results in a one percentage point increase in external equity only. On the contrary following the trade off theory I expect to find a one to one adjustment in external equity following a deviation from the target leverage caused by retained earnings. Multinationals do not replace lacking retained earnings with additional external equity in order to achieve their target leverage one by one.

My results by no means question the trade off theory or the pecking order theory. On the contrary – consistent with Fama and French (2002), Fama and French (2005) and Byoun (2008) proposing to view both theories as complements – I provide empirical evidence for the validity of both theories. Both theories point to important factors for multinational capital structure choice.

The arguments put forward here are in line with the criticism of Chang and Dasgupta (2009) with respect to empirical studies evaluating the trade off theory. Based on simulated samples they conclude, that in standard leverage regressions it is unclear, whether firm characteristics affect the leverage primarily because they affect the financing deficit and retained earnings, or because they have an independent effect. Since corporate taxation affects the financing deficit, their general arguments hold also specifically with respect to taxation. Studies addressing the effect of host country taxation on subsidiaries' leverage are numerous. Recently Desai et al. (2004) have shown that the leverage increases with the host country tax rate for the case of US-American multinationals and Huizinga et al. (2008) for the case of European multinationals. Mintz and Weichenrieder (2010) and Buettner et al. (2009) find similar results for German multinationals using the same data as here. Graham (2003) provides a survey of related literature.

I add to this literature as follows. Firstly, my paper is the first to demonstrate, that the observed increase in the leverage with corporate tax rates is not necessarily due to multinationals trading off the tax benefits and costs of debt finance, but instead could be due to multinationals following the pecking order while not caring about taxation at all. Secondly, I disentangle the mechanical effect of taxation on the leverage through retained earnings and the independent effect of taxation on the leverage due to a trade off behavior of multinationals. Thirdly I verify, that the effect of taxation on the availability of retained is indeed mechanically and not driven by trade off considerations. Some studies identify the effect of tax incentives to use debt based on incremental financing decisions such as Mackie-Mason (1990). Since the results of these studies do not rely on leverage regressions, the arguments put forward here do not apply in such cases.

Following this introduction, section 2 of the paper develops testable hypotheses. Section 3 describes the data. Section 4 presents empirical results. Section 5 concludes.

## 2. MOTIVATION AND HYPOTHESES

2.1. **Taxation and the trade off theory of corporate finance.** Since interest payments to lenders usually are fully deductible from taxable income, while dividend payments to shareholders are not, the possibility to reduce tax payments when using debt is an important and widely cited benefit for firms determining their leverage (See among many other Modigliani and Miller (1963) and for an overview Graham (2003).). On the other hand there are costs of using debt, with bankruptcy costs (Kraus and Litzenberger (1973)) being the most prominent example. Firms then trade off the benefits and costs of using debt ending up with their target leverage (For a more rigorous discussion of the trade off theory and the costs and benefits of debt see Frank and Goyal (2008).). This view is the basis for most if not all empirical studies investigating the effect of taxation on corporate capital structure choice including Desai et al. (2004), Huizinga et al. (2008) and Buettner et al. (2009). Such studies typically hypothesize and show an increase of the leverage with the tax rate. I replicate this standard result regressing the book[1] leverage $Lev_{i,j,t}$ of parent $p$'s subsidiary $i$ resident in country $j$ in period $t$ on the statutory corporate tax rate $\tau_{j,t}$ .

$$(1) \qquad Lev_{i,j,t} = \frac{D_{i,j,t}}{A_{i,j,t}} = \beta_1 \tau_{j,t} + \boldsymbol{\beta_2}\boldsymbol{x_{i,j,t}} + \gamma_p + \eta_t + \epsilon_{i,j,t}$$

$D_{i,j,t}$ is total debt, $A_{i,j,t}$ total assets, $\boldsymbol{x_{i,j,t}}$ a vector of firm and country specific controls, $\beta_1$ and vector $\boldsymbol{\beta_2}$ coefficients, $\gamma_p$ a parent fixed effect and $\eta_t$ time fixed effects. Following the standard argument in the literature, I expect to find a positive and significant coefficient $\beta_1$. For a discussion of the controls included, see section 3.2.

2.2. **Taxation and the pecking order theory of corporate finance.** According to the pecking order theory of corporate finance, adverse selection costs are the dominant factor in capital structure decisions (Myers and Majluf (1984)). As a result firms have a clear hierarchy of financing alternatives, preferring internal to

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[1]In the tax focused capital structure choice literature it is standard to rely on book leverage. Furthermore, when authors analyze both market and book leverage ratios, the results are generally comparable (See Flannery and Rangan (2006), p. 472.). Unfortunately, since the data used here does not provide market values of subsidiaries, a robustness check based on market leverage is not possible.

external financing and debt to equity if external financing is used (Myers (1984)). Although following the pecking order theory firms choose their capital structure irrespective of their tax rate, taxes still affect their capital structure choice. This is because taxation affects the availability of internal financing determined as after tax profits. The higher corporate taxation, the less internal financing is available and the sooner firms have to rely on external financing. Since firms prefer debt over equity when relying on external financing, the reduced access to internal financing results in an increasing leverage.

Retained earnings disclose to which extent firms rely on internal financing. I thus regress the retained earnings ratio $REr_{i,j,t} = \frac{REr_{i,j,t}}{A_{i,j,t}}$ on the statutory corporate tax rate $\tau_{j,t}$, on a vector of firm and country specific controls $\boldsymbol{x_{i,j,t}}$ , a parent fixed effect $\gamma_p$ and time fixed effects $\eta_t$.

$$(2) \qquad REr_{i,j,t} = \frac{RE_{i,j,t}}{A_{i,j,t}} = \beta_1 \tau_{j,t} + \boldsymbol{\beta_2} \boldsymbol{x_{i,j,t}} + \gamma_p + \eta_t + \epsilon_{i,j,t}$$

Following the pecking order, I expect a lower retained earnings ratio with increasing tax rates $\tau_{j,t}$ ($\beta_1 < 0$).

Given the balance sheet identity, the sum over external equity $EE$, retained earnings $RE$ and debt $D$ has to equal total assets $A$ ($EE + RE + D = A$). Leverage can alternatively be written as $Lev_{i,j,t} = \frac{D_{i,j,t}}{A_{i,j,t}} = \frac{D_{i,j,t}}{EE_{i,j,t} + RE_{i,j,t} + D_{i,j,t}}$. Any change in retained earnings enters the denominator of book leverage and thus has a mechanical effect on the latter. A negative significant coefficient of the tax rate coefficient $\beta_1$ in regression equation (2) provides an alternative explanation for the positive tax rate coefficient in the standard leverage regression (1). Also under the pecking order theory firms active in high tax countries will issue more debt, simply because they have less access to internal financing, and thus will exhibit a higher leverage.

2.3. **Do firms determine their target leverage, observe available retained earnings and adjust external equity accordingly?** Due to higher taxation I expect to observe less retained earnings in high tax countries driving the leverage mechanically up. This mechanical effect could still be consistent with the trade off theory, if firms determine their target leverage, observe available retained earnings and adjust external equity accordingly. Firms optimize their capital structure choosing equity – as the sum of external equity and retained earnings – as determined by their target leverage. Lacking internal equity (retained earnings) due to taxation is replaced with external equity and retained earnings are part of the trade off considerations of firms. Consistent with the pecking order theory I may observe

less retained earnings in high tax countries, but consistent with the trade off theory firms rebalance their capital structure towards their target leverage when forced to rely on external financing. Following this argument, I should – given the target leverage – observe an increase in external equity following a decrease in retained earnings in high tax countries.

Formally following the trade off theory firms have a target leverage $Lev^{\star}_{i,j,t}$ determined by equation (1). Under the trade off theory, given their target leverage $Lev^{\star}_{i,j,t}$ and the availability of retained earnings $\frac{RE_{i,j,t}}{A_{i,j,t}}$, firms decide on which source of external financing to rely – debt $D$ or external equity $EE$. Firms should adjust external equity according to

$$(3) \qquad \frac{EE_{i,j,t}}{EE_{i,j,t} + D_{i,j,t}} = \lambda_1 Lev^{\star}_{i,j,t} - \lambda_2 \frac{RE_{i,j,t}}{A_{i,j,t}}$$

Substituting equation (1) for $Lev^{\star}_{i,j,t}$ gives the estimable model

$$(4) \qquad \frac{EE_{i,j,t}}{EE_{i,j,t} + D_{i,j,t}} = \lambda_1 (\beta_1 \tau_{j,t} + \boldsymbol{\beta_2 x_{i,j,t}} + \gamma_p + \eta_t) - \lambda_2 \frac{RE_{i,j,t}}{A_{i,j,t}}$$

If following the trade off theory firms replace lacking retained earnings with external equity in order to achieve their target leverage, $\lambda_2$ should be close to one .

2.4. **Trade off explanations for reduced retained earnings in high tax countries?** The conclusion, that an increase in the leverage due to a mechanical effect caused by less retained earnings is not consistent with a trade off behavior of firms, is only correct, if no trade off explanation for the reduced availability of retained earnings in high tax countries can be found.

As pointed out by Hennessy and Whited (2005), firms trading-off the costs of internal finance and debt can use debt in order to finance distributions to shareholders. Following the standard argument, that interest payments lower taxable income, the incentive to use debt to finance distributions to shareholders should increase with the corporate tax rate. As a result of such a behavior I should - as under the pecking order - observe less retained earnings in high tax countries. However, whereas the reduced availability of retained earnings under the pecking order is due to lower after-tax profits, under the trade off theory it is due to increased distributions in high tax countries. This difference allows to empirically discriminate between the two explanations. I regress the ratio of dividends paid $Div_{i,j,t}$ to distributable funds $Dis_{i,j,t}$ on the statutory corporate tax rate $\tau_{j,t}$, on a vector of firm and country specific controls $\boldsymbol{x_{i,j,t}}$ , a parent fixed effect $\gamma_p$ and time fixed effects

$\eta_t$ to verify, whether increased distributions in high tax countries decrease available retained earnings there.

$$(5) \qquad \frac{Div_{i,j,t}}{Dis_{i,j,t}} = \beta_1 \tau_{j,t} + \boldsymbol{\beta_2 x_{i,j,t}} + \gamma_p + \eta_t + \epsilon_{i,j,t}$$

2.5. **Simulation.** Following the example of Shyam-Sunder and Myers (1999) and Chang and Dasgupta (2009), I generate simulated data in order to check, whether standard leverage regressions could still *seem* to work even when actual financing is driven by other forces. In order to generate this simulated data, I assume that firms do not optimize their financing decisions and hence to do not trade off the costs and benefits of debt. Whenever firms have to rely on external financing, I determine randomly to which extent firms finance their operations using external equity or debt.

Using this simulated data I am able to explore the explanatory power of standard leverage regressions. To this end I repeat standard leverage regression using the simulated data and compare the results with the results derived from standard leverage regressions using the actual data. Any significant effect of the corporate tax rate on the leverage in regressions based on data simulated under the assumption of random financing makes an intuitively appealing case for a possible overestimation of the effect of corporate taxation on firm leverage. Since financing is randomized, I should not expect to find an effect of the corporate tax rate on the leverage at all based on such simulated data.

## 3. DATA AND DESCRIPTIVE STATISTICS

3.1. **Data.** I rely on the MiDi-Database provided by Deutsche Bundesbank for my analysis, because this database has the unique feature to provide unconsolidated financial statements for each subsidiary within a multinational group. Commercial datasets such as Compustat on the contrary typically provide consolidated financial statements including assets of multinationals' subsidiaries active in different countries. For tax motivated studies the use of consolidated financial statements is difficult to justify, since the tax rate applicable to the assets shown in the financial statement is unknown. As a further valuable feature due to legal reporting requirements the database is close to complete and includes nearly all subsidiaries of German multinationals.

TABLE 1. Descriptive Statistics

| Variable | Mean | Std.Dev. | p5 | p95 |
|---|---|---|---|---|
| Leverage | 0.5500 | 0.3333 | 0.0179 | 1.0405 |
| Debt ratio | 0.6855 | 0.2846 | 0.0554 | 0.9968 |
| Retained Earnings ratio | 0.1143 | 0.4265 | -0.5832 | 0.7280 |
| Dividend ratio | 0.1594 | 0.3393 | 0.0000 | 1.0000 |
| Country Tax Rate | 0.3285 | 0.0634 | 0.2000 | 0.4069 |
| Profitability | | | | |
| Subsidiary Size | 9.6473 | 1.2666 | 8.1394 | 12.1796 |
| Tangibility | 0.2522 | 0.2652 | 0.0000 | 0.8351 |
| Subsidiary Growth | | | | |
| Industry Leverage | 0.5356 | 0.1265 | 0.2641 | 0.6975 |
| (Ln)Distance | 7.2757 | 1.0989 | 5.9584 | 9.1959 |
| Inflation | 2.6345 | 2.2826 | 0.5000 | 6.8402 |
| GDP Growth | 3.0655 | 1.9845 | 0.4540 | 6.7000 |
| Banking Credit | 132.4982 | 55.8702 | 38.4154 | 224.9528 |
| Property Rights | 78.3551 | 15.3658 | 50.0000 | 90.0000 |
| Political Risk | 0.7916 | 0.4626 | -0.1174 | 1.4622 |
| (Ln)Lending Rate | 1.8301 | 0.5110 | 1.1474 | 2.5514 |

See the appendix for variable definitions and sources.

The database contains information on a yearly basis on balance sheet items such as the amount of fixed and intangible assets invested, the balance sheet total, equity, retained earnings and liabilities (For a detailed description of the database see Lipponer (2008)). It allows to trace subsidiaries over time. The current version provides firm-level panel data on a yearly basis for the period from 1996 to 2007. Table 1 provides descriptive statistics for all regression variables.

3.2. **Controls.** The vector of controls $x_{i,j,t}$ includes the following variables supposed to affect the leverage following the arguments of Frank and Goyal (2008) and Frank and Goyal (2009)[2]. The signs in brackets show the expected signs of the coefficients.

- Profitability (+/-). Profitability is profit divided by equity. Since the MiDi-database provides only profits after interest, I relate profit to equity only in order to avoid endogeneity[3]. Profitable firms may be perceived to be relatively riskless, which would facilitate their access to credit. This would suggest a positive relationship between profitability and leverage. On the other hand, if investments and dividends are fixed, more profitable firms will become less levered over time. The overall effect is ambiguous.

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[2]I repeat their arguments for the expected effect of the controls. For a more thorough discussion of theses effects the reader is referred to Frank and Goyal (2008) and Frank and Goyal (2009).
[3]Profits after interest should decrease with the leverage. This effect should not arise, if profitability is measured with respect to equity only giving the return on equity.

- Subsidiary Size (+/-). Subsidiary Size is log of total assets. Larger firms may have easier access to credit because they tend to be more diversified and less prone to bankruptcy (Rajan and Zingales (1995)). Thus, I expect a positive relationship between subsidiary size and firm leverage. On the other hand large firms are typically mature firms having had more opportunities to accumulate retained earnings. This should result in a negative effect on leverage. The overall effect of subsidiary size is ambiguous.

- Tangibility (+/-). Tangibility is the ratio of fixed and intangible assets over total assets. Since fixed assets can serve as a collateral, I expect a positive relationship between tangibility and leverage.

- Subsidiary Growth. Subsidiary Growth is the yearly change in the log of total assets. Growing firms are firms with more investments accumulating more debt over time. I expect a positive effect on leverage.

- Industry Leverage (+). Industry leverage is the yearly median leverage by industry. Industry leverage reflects a number of otherwise omitted common factors and should affect leverage positively.

- Inflation (+). Taggart (1985) argues that features of the tax code suggest a positive relation between debt and expected inflation.

- GDP Growth (+/-). If firms borrow against collateral, leverage should be procyclical. On the other hand leverage could decline during expansions since internal funds increase during expansions, all else equal. The overall effect of GDP Growth is ambiguous.

The controls discussed above focus on a sample of national firms, whereas I use a sample of international firms. Therefore I add some further controls used in international samples to explain multinational leverage.

- Political Risk (+/-). Firms in countries with high political risk may be more likely to be credit constrained because banks are less willing to lend in uncertain environments. On the other hand, high political risks may encourage borrowing from local creditors, as this is a way to reduce a multinationals value at risk in a country. Overall, the relationship between political risk and leverage is ambiguous (Huizinga et al. (2008).).

- Lending Rate (-). Since the lending rate gives the price for using debt, leverage should decrease with increasing lending rates (Buettner et al. (2009)).

- Distance (+). Debt disciplines managers and mitigates agency problems of free cash flow since debt must be repaid to avoid bankruptcy. I add distance

as a indicator for principal agents problem in multinational groups. The larger the distance of the headquarter of the multinational group and the subsidiary is, the larger the agency problems and the leverage should be.

3.3. **Simulated Data.** Following the procedure of Shyam-Sunder and Myers (1999) and Chang and Dasgupta (2009), I generate data imposing assumptions about financing behavior in order to investigate further the role of retained earnings in explaining the impact of taxation on the leverage. I use the actual sample of firms as described in section 3.1, but I randomize the initial debt ratio as well as all following decisions on the provision of capital to the subsidiary. I do not randomize the financing deficit or retained earnings, since the purpose of the simulation is to show that the financing deficit or the amount of retained earnings available drives the leverage up even if multinationals do not follow a trade off behavior.

I take the initial need for external financing (external equity and debt) from MiDi. I generate a random number in order to apportion external financing into external equity and debt. In any subsequent period I determine the change in external financing and again randomly determine to which extent an increase or decrease in external financing is allotted to external equity or debt.

I generate three different simulation samples based on different probabilities $p$ for randomizing external financing.

- For generating simulation sample 1, I assume that the firm chooses external equity or debt with equal probability ($p = 0.5$).
- For generating simulation sample 2, I assume a higher probability for choosing debt ($p = 0.6854$). This probability corresponds exactly to the observed probability in the actual sample of firms choosing debt when relying on external financing. The mean ratio of debt to external financing is 0.6854 (See descriptive statistics table (1), debt ratio).
- For generating simulation sample 3, I assume that the firm prefers debt over equity when relying on external financing with probability $p = 0.8$.

As a result the simulated data is nearly equal to the actual sample. Even external financing as the sum over external equity and debt in the simulation sample is equal to external financing in the actual data for each subsidiary-year observation. Only the apportionment of external financing in external equity and debt differs in the simulated data from the actual sample.

4. Empirical Evidence

4.1. **Tax effects on subsidiary leverage – trade off or pecking order?**
Columns (1) to (3) in table 2 present the results of standard leverage regressions.
Following the procedure of previous literature, I estimate a model in a panel setting
using parent fixed effects as in Desai et al. (2004), Huizinga et al. (2008) and Buet-
tner et al. (2009). Additionally I use year-fixed effects in all specifications and as a
robustness check industry fixed effects in some specifications as indicated. I use the
set of controls proposed by Frank and Goyal (2008) and Frank and Goyal (2009) as
discussed in section 3.2. I complement these controls with an indicator for political
risk as used in Huizinga et al. (2008), the lending rate as used in Buettner et al.
(2009) and distance as a proxy for principal agent problems within multinational
groups.

The dependent variable in specifications (1) to (3) is the leverage defined as the
ratio of subsidiary total debt to the subsidiary's balance sheet total. The estimated
coefficient on the corporate tax rate in column (1) of 0.445 is statistically significant
and indicates a 4.45 percentage points increase in subsidiary leverage following a
ten percentage point increase in the statutory tax rate. This is equivalent to a
8.09 % increase of the leverage (semielasticity) given its mean of 0.55 following
the ten percentage points increase in the tax rate. Given the sample mean tax
rate of 0.3285 the corresponding elasticity is 0.29. This elasticity is close[4] to the
elasticities reported by Desai et al. (2004) for subsidiary leverage varying between
0.18 and 0.42 depending on the specification (Table II, specifications (1) to (5)) and
Buettner et al. (2009) varying between 0.18 and 0.24 (Table 2)[5]. The results are
robust to the inclusion of industry fixed effects in specification (2) and subsidiary
growth in specification (3)[6].

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[4]On the contrary the elasticities reported by Huizinga et al. (2008) are lower, ranging between 0.09
and 0.15 (Table 8, specifications (1) to (3)). This could be due to the fact that European multi-
nationals on average react less sensitive to tax incentives as German or American multinationals.
It could also be due to the different set of controls used here including the controls proposed by
Frank and Goyal (2009). Finally this could reflect the bad quality of the data they use (Amadeus).
Amadeus does not include important tax havens, since it only includes data on European firms.
Furthermore the amount of unconsolidated accounts (consolidated accounts can not be used for
tax purposes in an international setting) available in Amadeus is very limited.
[5]Buettner et al. (2009) do report results for external and internal leverage separately only. I
computed the elasticities reported here as the sum of the tax effect on external and internal
leverage.
[6]Since subsidiary growth is calculated using the lagged balance sheet total, the sample size de-
creases.

The signs of the controls are in line with the expectations formulated in section 3.2. Profitability[7] affects leverage positively. This is consistent with the trade off theory, since more profitable firms have a lower risk of bankruptcy. Subsidiary size enters negatively reflecting that large firms are typically mature firms having had more opportunities to accumulate retained earnings. Tangibility has a positive effect on leverage, since tangible assets are easier to collateralize and suffer a smaller loss of value when firms go into distress. The coefficient of industry leverage is significantly positive. The inclusion of industry leverage allows to control for a number of otherwise omitted factors. It remains significant even when including industry fixed effects, since industry leverage is determined on a yearly basis. (Ln)distance has a positive influence on leverage. Since principal agent problems are more severe for more distant subsidiaries, multinationals increase leverage there. Inflation has no significant effect on leverage, GDP growth a positive effect in specification (2) and (3) only indicating the availability of more internal funds during expansions. Political risk enters negatively. Since a higher index by definition of the World Bank indicates lower risks, multinationals increase borrowing in risky countries in order to reduce value at risk. (Ln)lending rate has a negative effect on leverage, since with increasing prices for debt subsidiaries rely less on debt. The positive and significant coefficient of subsidiary growth in specification (3) indicates, that growing firms having more investments exhibit a higher leverage.

In order to investigate, to which extent the effect of the tax rate on the leverage could be due to a lack of retained earnings in high tax countries as argued in section 2.2, I run the regressions presented in column (4) to (6) in table 2. The dependent variable retained earnings ratio is the ratio of retained earnings to the balance sheet total. As expected this ratio decreases with the tax rate. The -0.502 coefficient in specification (4) indicates a 5.02 percentage points decrease of this ratio following a ten percentage point increase in the tax rate. Given the sample mean of the retained earnings ratio of 0.1143, this is equivalent to an elasticity of 1.44. Compared to the elasticity of the leverage with respect to the tax rate of 0.29, this effect is much stronger.

Since retained earnings enter the denominator of book leverage, the reduction of retained earnings due to corporate taxation has a mechanical effect on the leverage and drives it up. Given the sample mean leverage of 0.550, a ten percentage point

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[7]In order to avoid endogeneity, profitability is defined as return on equity here; see section 3.2.

increase in the tax rate reduces the retained earnings ratio of 0.1143 by 0.0502 percentage points down to 0.0641. This effect drives the leverage up[8] by 2.90 percentage points to 0.579. This result is robust to the inclusion of industry fixed effects in specification (5) and to the inclusion of subsidiary growth in specification (6). Out of the 4.45 percentage point increase in leverage following a ten percentage point increase in the tax rate, 2.90 percentage points are due to less retained earnings. As to be expected following the pecking order theory, firms active in high tax countries issue more debt, simply because they have less access to internal financing and thus exhibit a higher leverage.

The dependent variable in specification (7) to (9) is the debt ratio, defined as the ratio of total debt to external financing. Column (7) to (9) thus inform on how the tax rate and the controls affect the subsidiary's choice between external equity and debt when forced to rely on external financing. The coefficient on the tax rate in column (7) is significantly positive 0.168. Consequently, following a ten percentage point increase in the tax rate the debt ratio increases by 1.68 percentage points. Given the sample mean of the ratio of external financing to the balance sheet total of 0.849, this translates into an effect of $1.68 \times 0.849 = 1.43$ on the leverage. Also this result is robust to the inclusion of industry fixed effects in specification (8) and subsidiary growth in specification (9).

Following a ten percentage point increase in the tax rate, the leverage increases by 4.45 percentage points. Around two third of this increase or 2.90 percentage points is caused by lacking retained earnings in high tax countries and only around one third or 1.43 percentage points are due to subsidiaries preferring debt over external equity when relying on external financing.

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[8]The sample mean leverage is $0.55 = \frac{0.55}{0.8857 + 0.1143}$ before the increase in the tax rate and $0.579 = \frac{0.55}{0.8857 + 0.0641}$ afterwards.

Table 2: Corporate Taxation and Subsidiary Leverage, Debt Ratio and
Retained Earnings Ratio

| | Subsidiary Leverage | | | Subsidiary Retained Earnings Ratio | | | Subsidiary Debt Ratio | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Country Tax Rate | 0.445*** | 0.455*** | 0.467*** | -0.502*** | -0.508*** | -0.552*** | 0.168*** | 0.178*** | 0.184*** |
| | (0.046) | (0.046) | (0.050) | (0.080) | (0.080) | (0.086) | (0.045) | (0.043) | (0.045) |
| Profitability | 0.00684*** | 0.00694*** | 0.000948 | 0.0490*** | 0.0484*** | 0.0500*** | 0.0258*** | 0.0256*** | 0.0217*** |
| | (0.0022) | (0.0022) | (0.0026) | (0.0030) | (0.0030) | (0.0034) | (0.0013) | (0.0013) | (0.0014) |
| Subsidiary Size | -0.00944*** | -0.0102*** | -0.0105*** | 0.0390*** | 0.0412*** | 0.0393*** | 0.0132*** | 0.0129*** | 0.0121*** |
| | (0.0013) | (0.0013) | (0.0015) | (0.0016) | (0.0017) | (0.0020) | (0.0014) | (0.0013) | (0.0015) |
| Tangibility | 0.0580*** | 0.0948*** | 0.110*** | -0.153*** | -0.166*** | -0.180*** | -0.0594*** | -0.0328*** | -0.0278*** |
| | (0.0083) | (0.0082) | (0.0086) | (0.0083) | (0.0082) | (0.0090) | (0.0089) | (0.0092) | (0.010) |
| Industry Leverage | 0.573*** | 0.464*** | 0.435*** | 0.126*** | -0.212*** | -0.171*** | 0.859*** | 0.268*** | 0.270*** |
| | (0.014) | (0.034) | (0.038) | (0.020) | (0.044) | (0.045) | (0.015) | (0.030) | (0.033) |
| (Ln)Distance | 0.0124*** | 0.0117*** | 0.0135*** | -0.0320*** | -0.0326*** | -0.0329*** | -0.00969*** | -0.0113*** | -0.0101*** |
| | (0.0023) | (0.0023) | (0.0025) | (0.0045) | (0.0044) | (0.0047) | (0.0024) | (0.0022) | (0.0023) |
| Inflation | 0.000973 | 0.00102 | 0.00111 | 0.00600*** | 0.00592*** | 0.00427* | 0.00389*** | 0.00397*** | 0.00350** |
| | (0.0014) | (0.0014) | (0.0013) | (0.0019) | (0.0019) | (0.0024) | (0.0013) | (0.0013) | (0.0014) |
| GDP Growth | -0.00203 | -0.00229* | -0.00282** | 0.00357* | 0.00386** | 0.00317 | -0.00213* | -0.00240** | -0.00268** |
| | (0.0013) | (0.0012) | (0.0013) | (0.0019) | (0.0018) | (0.0019) | (0.0012) | (0.0011) | (0.0012) |
| Political Risk | -0.0333*** | -0.0334*** | -0.0360*** | 0.0792*** | 0.0786*** | 0.0831*** | 0.0268*** | 0.0276*** | 0.0280*** |

Table 2: Corporate Taxation and Subsidiary Leverage, Debt Ratio and
Retained Earnings Ratio continued

| | Subsidiary Leverage | | | Subsidiary Retained Earnings Ratio | | | Subsidiary Debt Ratio | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| (Ln)Lending Rate | (0.0058) | (0.0058) | (0.0064) | (0.013) | (0.013) | (0.014) | (0.0083) | (0.0079) | (0.0081) |
| | -0.0214*** | -0.0224*** | -0.0276*** | -0.0440*** | -0.0429*** | -0.0424*** | -0.0440*** | -0.0460*** | -0.0515*** |
| Subsidiary Growth | (0.0057) | (0.0055) | (0.0060) | (0.010) | (0.010) | (0.011) | (0.0063) | (0.0060) | (0.0059) |
| | | | 0.0484*** | | | 0.103*** | | | 0.0891*** |
| | | | (0.0052) | | | (0.0086) | | | (0.0039) |
| Parent and year fixed effects? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industry fixed effects? | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ |
| Observations | 137697 | 137697 | 106944 | 137697 | 137697 | 106944 | 137689 | 137689 | 106938 |
| $R^2$ | 0.36 | 0.37 | 0.39 | 0.32 | 0.32 | 0.35 | 0.40 | 0.42 | 0.45 |

The dependent variable in column (1) to (3) is the ratio of liabilities to the balance sheet total (Leverage). The dependent variable in column (4) to (6) is the ratio of retained earnings to the balance sheet total (retained earnings ratio). The dependent variable in column (7) to (9) is the ratio of total debt to external financing (debt ratio). Country Tax Rate is the corporate tax rate varying over time and by country. Profitability is the ratio of profit and loss for the financial year (after interest and taxes, prior to profit distribution, and offsetting of losses carried forward) to shareholders equity. Subsidiary Size is the logarithm of the balance sheet total. Tangibility is the ratio of fixed and intangible assets to the balance sheet total. Industry Leverage is the median of leverage by industry and year. (Ln)Distance is the logarithm of the distance between Germany and the host economy of the subsidiary. Inflation is inflation in consumer prices (annual %). GDP Growth is GDP per capita growth (annual %). Political Risk is the political stability & absence of violence/terrorism indicator. A higher value indicates lower risk by definition of the World Bank. (Ln)Lending Rate is the logarithm of the lending interest rate. Subsidiary Growth is the annual percentage change between the balance sheet total this year and the balance sheet total of the previous year. For data sources see the appendix. All regressions are estimated using OLS and include parent and year fixed effects; some specifications include industry fixed effects as indicated. Standard errors in parentheses are corrected for clustering across year-country cells and for heteroscedasticity. Sample consists of subsidiaries of German multinationals in MiDi for the period from 1996 to 2007. * denotes significance at the 10 %-level, ** at the 5 %-level and *** at the 1 %-level respectively.

4.2. **Simulations.** I review my above conclusions using regressions based on simulated data. Table 3 gives the results. I simulated data as described in section 3.3 and randomized the subsidiary's choice between external equity and debt when forced to rely on external financing. I conducted 50 regressions based on 50 repetitions of the simulation procedure. The coefficients shown in table 3 are the average coefficients over this 50 repetitions. The 95 % confidence interval based on the 50 repetitions is given in square brackets underneath each coefficient.

The results presented in table 3 differ with respect to the probability assumed when simulating the data. In specifications (1) to (3) I simulated data under the assumption of $p = 0.5$. If forced to rely on external financing, firms choose external equity and debt with equal probability. This assumption is consistent with the pecking order, since firms choose debt only when having a financial deficit[9]. It is not consistent with the pecking order, because I assume an equal probability to choose external equity or debt, whereas following the pecking order firms should be more likely to choose debt. On the contrary in specifications (4) to (6) I assume a probability of $p = 0.6854$ for choosing debt. This probability is equal to the sample mean ratio of debt to external financing. In specifications (7) to (9) I assume a probability $p = 0.8$ for choosing debt. Both assumptions are consistent with the pecking order, since in both cases firms prefer debt over external equity as predicted by the pecking order.

The regressions presented in table 3 are identical to the regressions presented in columns (1) to (3) in table 2. The only difference is the underlying data, which is the actual data in table 2 and simulated data in table 3. All tax rate coefficients in table 3 are positive, and the 95 % confidence interval does not cover zero in any of the specifications. Even when external financing is randomized, I find a significant positive effect of the tax rate on subsidiary leverage. This supports the conclusion drawn above – even if subsidiaries do not trade off the costs and benefits of debt, subsidiary leverage will increase with the tax rate. Taxation reduces the availability of retained earnings driving the leverage mechanically up in high tax countries.

The effect of the tax rate on subsidiary leverage increases with increasing probability $p$ for preferring debt over external equity. Whereas the tax rate coefficient is 0.24 on average in specifications (1) to (3) assuming $p = 0.5$, it is 0.34 on average in specifications (4) to (6) under the assumption of $p = 0.6854$ and 0.40 on average

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[9]Subsidiary financial deficit is not simulated, but instead taken from the actual data; see section 3.3.

in specifications (7) to (9) with $p = 0.8$. This points to a second effect driving the leverage mechanically up following a lack of retained earnings in high tax countries. Firstly, as stated before, since a decrease in retained earnings enters the denominator of book leverage, this has a mechanical positive effect on the latter. Secondly, due to a lack of retained earnings, firms have to rely more frequently on external financing. If firms consistent with the pecking order prefer debt over external equity, the more frequent use of external financing drives the leverage up additionally. As the with $p$ increasing coefficient on the tax rate shows, this effect is the stronger, the more pronounced firms preference for debt over external equity is.

Consequently, the tax rate coefficients in specifications (1) to (3) show the first effect of taxation driving the leverage mechanically up following a lack of retained earnings in high tax countries, since the underlying data is simulated under the assumption of $p = 0.5$ (Subsidiaries choose debt or external equity with equal probability). Following a ten percentage point increase in the tax rate, subsidiary leverage increases by 2.349 percentage points in specification (1). Specifications (4) to (6) show the second effect of taxation driving the leverage mechanically up following a lack of retained earnings in high tax countries. The tax rate coefficient of 0.3305 presented in column (4) indicates a 3.305 increase in subsidiary leverage following a ten percentage point increase in the tax rate. The difference between the 2.349 increase in subsidiary leverage observed in specification (1) and the 3.305 increase observed in specification (4) is 0.955. This additional increase in subsidiary leverage is due to the second effect. Since simulations in columns (4) to (6) are based on the observed probability $p = 0.6854$ for firms to prefer debt over equity, I expect to find a similar mechanical effect of taxation on the leverage in the actual data.

Out of the 4.5 percentage points increase in subsidiary leverage following a ten percentage point increase in the tax rate identified in the standard leverage regression in table 2, approximately 2.349 percentage points are due to a decrease in retained earnings entering the denominator of book leverage and driving mechanically up the latter following specification (1). Another 0.955 follow from the more frequent occurrence of financial deficits in high tax countries and subsidiary preference for debt over external equity. Only the remaining 1.2 percentage points are necessarily due to a trade off behavior of firms. This figure is close to the predicted effect of taxation on subsidiary debt ratio following specifications (7) to (9) in table 2. As argued before, the 0.168 tax rate coefficient in specification (7) of table 2 translates

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into a 1.43 percentage points increase of the leverage following a ten percentage point increase in the tax rate.

As a further validation of my results I compare the tax rate coefficient of 0.2349 in specification (1) presented in table 3 based on the simulated data with the predicted mechanical effect of taxation due to lacking retained earnings computed following specification (4) in table 2 based on the actual data. The two standard deviations confidence interval of the 0.502 tax rate coefficient in table 2 is [0.342; 0.662] and the resulting confidence interval for the mechanical increase in the leverage in percentage points is[10] [1.92; 3.90]. The tax rate coefficient of 0.2349 in specification (1) in table 3 indicates a 2.349 percentage point increase in subsidiary leverage following a ten percentage points increase in the tax rate. This is well within the confidence interval [1.92; 3.90]. As before this result is robust to the inclusion of industry fixed effects in specification (2) and subsidiary growth in specification (3).

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[10]The sample mean leverage is $0.55 = \frac{0.55}{0.8857+0.1143}$ before the increase in the tax rate and $0.569 = \frac{0.55}{0.8857+(0.1143-0.0342)}$ or $0.589 = \frac{0.55}{0.8857+(0.1143-0.0662)}$ afterwards.

Table 3: Simulations – Corporate Taxation and Subsidiary Leverage

| | p=0.5 | | | p=0.6854 | | | p=0.8 | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Country Tax Rate | 0.2349 | 0.2374 | 0.2539 | 0.3305 | 0.3333 | 0.3575 | 0.3861 | 0.3893 | 0.4178 |
| | [ 0.2264 ; 0.2433 ] | [ 0.2291 ; 0.2458 ] | [ 0.2440 ; 0.2639 ] | [ 0.3298 ; 0.3312 ] | [ 0.3326 ; 0.3340 ] | [ 0.3566 ; 0.3583 ] | [ 0.3855 ; 0.3867 ] | [ 0.3887 ; 0.3899 ] | [ 0.4171 ; 0.4186 ] |
| Profitability | -0.0208 | -0.0205 | -0.0215 | -0.0295 | -0.0292 | -0.0307 | -0.0346 | -0.0342 | -0.0360 |
| | [ -0.0213 ; -0.0202 ] | [ -0.0210 ; -0.0200 ] | [ -0.0221 ; -0.0210 ] | [ -0.0296 ; -0.0295 ] | [ -0.0292 ; -0.0291 ] | [ -0.0308 ; -0.0306 ] | [ -0.0347 ; -0.0346 ] | [ -0.0342 ; -0.0341 ] | [ -0.0361 ; -0.0360 ] |
| Subsidiary Size | -0.0214 | -0.0221 | -0.0231 | -0.0307 | -0.0316 | -0.0330 | -0.0359 | -0.0369 | -0.0384 |
| | [ -0.0220 ; 0.0208 ] | [ -0.0227 ; -0.0214 ] | [ -0.0239 ; -0.0224 ] | [ -0.0308 ; -0.0307 ] | [ -0.0316 ; 0.0315 ] | [ -0.0330 ; -0.0329 ] | [ -0.0359 ; 0.0358 ] | [ -0.0369 ; 0.0368 ] | [ -0.0385 ; -0.0384 ] |
| Tangibility | 0.0800 | 0.0929 | 0.1012 | 0.1105 | 0.1282 | 0.1388 | 0.1292 | 0.1497 | 0.1620 |
| | [ 0.0767 ; 0.0833 ] | [ 0.0893 ; 0.0965 ] | [ 0.0971 ; 0.1053 ] | [ 0.1103 ; 0.1107 ] | [ 0.1279 ; 0.1284 ] | [ 0.1385 ; 0.1391 ] | [ 0.1290 ; 0.1294 ] | [ 0.1494 ; 0.1499 ] | [ 0.1618 ; 0.1623 ] |
| Industry Leverage | -0.1247 | 0.1296 | 0.1090 | -0.1713 | 0.1848 | 0.1574 | -0.1994 | 0.2157 | 0.1838 |
| | [ -0.1294 ; -0.1201 ] | [ 0.1186 ; 0.1405 ] | [ 0.0962 ; 0.1218 ] | [ -0.1718 ; -0.1709 ] | [ 0.1841 ; 0.1854 ] | [ 0.1566 ; 0.1582 ] | [ -0.1999 ; -0.1990 ] | [ 0.2152 ; 0.2162 ] | [ 0.1832 ; 0.1844 ] |
| (Ln)Distance | 0.0168 | 0.0172 | 0.0177 | 0.0234 | 0.0240 | 0.0246 | 0.0274 | 0.0281 | 0.0288 |
| | [ 0.0159 ; 0.0177 ] | [ 0.0163 ; 0.0181 ] | [ 0.0168 ; 0.0187 ] | [ 0.0233 ; 0.0234 ] | [ 0.0239 ; 0.0240 ] | [ 0.0245 ; 0.0246 ] | [ 0.0273 ; 0.0274 ] | [ 0.0280 ; 0.0281 ] | [ 0.0287 ; 0.0288 ] |
| Inflation | -0.0016 | -0.0016 | -0.0008 | -0.0024 | -0.0024 | -0.0013 | -0.0028 | -0.0028 | -0.0015 |
| | [ -0.0019 ; -0.0013 ] | [ -0.0019 ; 0.0013 ] | [ -0.0012 ; -0.0005 ] | [ -0.0024 ; -0.0024 ] | [ -0.0024 ; -0.0024 ] | [ -0.0013 ; -0.0013 ] | [ -0.0028 ; 0.0028 ] | [ -0.0028 ; 0.0028 ] | [ -0.0015 ; -0.0014 ] |
| GDP Growth | -0.0001 | -0.0002 | -0.0003 | -0.0002 | -0.0003 | -0.0004 | -0.0003 | -0.0004 | -0.0005 |
| | [ -0.0004 ; 0.0002 ] | [ -0.0005 ; 0.0001 ] | [ -0.0006 ; 0.0001 ] | [ -0.0003 ; -0.0002 ] | [ -0.0004 ; -0.0003 ] | [ -0.0004 ; -0.0004 ] | [ -0.0003 ; -0.0003 ] | [ -0.0005 ; -0.0004 ] | [ -0.0005 ; -0.0005 ] |
| Political Risk | -0.0458 | -0.0462 | -0.0488 | -0.0642 | -0.0647 | -0.0684 | -0.0751 | -0.0756 | -0.0799 |

Table 3: Simulations – Corporate Taxation and Subsidiary Leverage
continued

|  | p=0.5 | | | p=0.6854 | | | p=0.8 | | |
|---|---|---|---|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| (Ln)Lending Rate | [ -0.0471 ; -0.0445 ] | [ -0.0475 ; -0.0448 ] | [ -0.0504 ; -0.0472 ] | [ -0.0643 ; -0.0641 ] | [ -0.0648 ; -0.0645 ] | [ -0.0685 ; -0.0682 ] | [ -0.0752 ; -0.0750 ] | [ -0.0757 ; -0.0755 ] | [ -0.0801 ; -0.0798 ] |
|  | 0.0166 | 0.0168 | 0.0162 | 0.0238 | 0.0241 | 0.0232 | 0.0274 | 0.0278 | 0.0266 |
|  | [ 0.0148 ; 0.0184 ] | [ 0.0150 ; 0.0186 ] | [ 0.0141 ; 0.0182 ] | [ 0.0236 ; 0.0239 ] | [ 0.0240 ; 0.0243 ] | [ 0.0230 ; 0.0234 ] | [ 0.0273 ; 0.0275 ] | [ 0.0277 ; 0.0279 ] | [ 0.0265 ; 0.0268 ] |
| Subsidiary Growth | 0.0800 | 0.0929 | 0.1012 | 0.1105 | 0.1282 | 0.1388 | 0.1292 | 0.1497 | 0.1620 |
|  | [ 0.0767 ; 0.0833 ] | [ 0.0893 ; 0.0965 ] | [ 0.0971 ; 0.1053 ] | [ 0.1103 ; 0.1107 ] | [ 0.1279 ; 0.1284 ] | [ 0.1385 ; 0.1391 ] | [ 0.1290 ; 0.1294 ] | [ 0.1494 ; 0.1499 ] | [ 0.1618 ; 0.1623 ] |
| Parent and year fixed effects? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industry fixed effects |  | ✓ | ✓ |  | ✓ | ✓ |  | ✓ | ✓ |
| Observations | 137697 | 137697 | 106944 | 137697 | 137697 | 106944 | 137697 | 137697 | 106944 |
| $R^2$ | .20550431 | .20793127 | .22296171 | 0.25623221 | 0.26015608 | 0.27396958 | 0.2605621 | 0.2645405 | 0.27980562 |

The dependent variable in column (1) to (9) is the ratio of liabilities to the balance sheet total (Leverage). The dependent variable in column (4) to (6) is the ratio of retained earnings to the balance sheet total (retained earnings ratio). The dependent variable in column (7) to (9) is the ratio of total debt to external financing (debt ratio). Country Tax Rate is the corporate tax rate varying over time and by country. Profitability is the ratio of profit and loss for the financial year (after interest and taxes, prior to profit distribution, and offsetting of losses carried forward) to shareholders equity. Subsidiary Size is the logarithm of the balance sheet total. Tangibility is the ratio of fixed and intangible assets to the balance sheet total. Industry Leverage is the median of leverage by industry and year. (Ln)Distance is the logarithm of the distance between Germany and the host economy of the subsidiary. Inflation is inflation in consumer prices (annual %). GDP Growth is GDP per capita growth (annual %). Political Risk is the political stability & absence of violence/terrorism indicator. A higher value indicates lower risk by definition of the World Bank. (Ln)Lending Rate is the logarithm of the lending interest rate. Subsidiary Growth is the annual percentage change between the balance sheet total this year and the balance sheet total of the previous year. For data sources see the appendix. All regressions are estimated using OLS and include parent and year fixed effects; some specifications include industry fixed effects as indicated. Standard errors in parentheses are corrected for clustering across year-country cells and for heteroscedasticity. Sample consists of subsidiaries of German multinationals in MiDi for the period from 1996 to 2007 using simulations as described in section 3.3. For the simulations I assume, that the firm chooses external equity or debt with probability $p = 0.5$ in specifications (1) to (3), with probability $p = 0.6854$ in specifications (4) to (6) and with probability $p = 0.8$ in specification (7) to (9). * denotes significance at the 10 %-level, ** at the 5 %-level and *** at the 1 %-level respectively.

4.3. **Do firms determine their target leverage, observe available retained earnings and adjust external equity accordingly?** The dependent variable in table 4 is the external equity ratio defined as the ratio of external equity to external financing. The coefficient on the retained earnings ratio is -0.0826 in specification (1). Following an increase of the ratio of retained earnings to the balance sheet total by ten percentage points, the external equity ratio decreases by 0.00826 percentage points only. Firms do adjust external equity following a variation in retained earnings to a very limited extent only. I find no evidence, that firms optimize their capital structure choosing equity – as the sum of external equity and retained earnings – as determined by their target leverage, since lacking internal equity (retained earnings) due to taxation is not replaced with external equity one by one.

This result is robust to the inclusion of industry fixed effects in specification (2) and subsidiary growth in specification (3). In specification (4) I do not use the controls for determining the target leverage, but instead the predicted target leverage using specification (2) in table 2 for each subsidiary and year. Still the coefficient on the retained earnings ratio does not change materially.

In specifications (7) to (9) of table 2 I find some evidence for a trade off behavior of subsidiaries, since they prefer debt over external equity in high tax countries. On the contrary, the results presented in table 4 are not consistent with a trade off behavior, since subsidiaries following a trade off behavior should determine their target leverage, observe available retained earnings and adjust external equity accordingly as argued in section 2.3.

When interpreting these contradictory results one should keep in mind, that regression analysis provides average effects for the variables of interest. Thus in a sample of 138.000 subsidiary-year observations as used here, some subsidiaries trade off the tax benefits of debt and its costs, others follow a pecking order and others do not even follow any systematic financing pattern. Some subsidiaries trading off the benefits and costs of debt is sufficient to identify empirical effects consistent with the trade off theory on average as in specifications (7) to (9) of table 2, even if not all subsidiaries do so.

However, the message of this paper is, that even firms following the pecking order or random external financing exhibit an increasing leverage with the corporate tax rate since they have less retained earnings in high tax countries. This effect drives the average effect of taxation on the leverage up. In order not to overstate the effect of tax driven trade off considerations, it is important to distinguish the effects of

taxation on the leverage following from trade off and pecking order behavior. The results in table 4 ensure, that the lack of retained earnings in high tax countries can not be regarded as the result of firms optimizing their capital structure choosing equity as the sum of external equity and retained earnings determined by their target leverage as they should under the trade off theory.

TABLE 4. External Equity Ratio and Retained Earnings

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Retained Earnings Ratio (-) | -0.0826*** | -0.0804*** | -0.0834*** | -0.106*** |
| | (0.0032) | (0.0031) | (0.0031) | (0.0042) |
| Target Leverage (-) | | | | -0.904*** |
| | | | | (0.026) |
| Country Tax Rate (+) | -0.210*** | -0.219*** | -0.252*** | |
| | (0.042) | (0.040) | (0.086) | |
| Profitability (+/-) | -0.0218*** | -0.0217*** | 0.0500*** | |
| | (0.0013) | (0.0013) | (0.0034) | |
| Subsidiary Size (+/-) | -0.0100*** | -0.00955*** | 0.0393*** | |
| | (0.0013) | (0.0013) | (0.0020) | |
| Tangibility (+/-) | 0.0467*** | 0.0194** | -0.180*** | |
| | (0.0086) | (0.0090) | (0.0090) | |
| Industry Leverage (+) | -0.849*** | -0.285*** | -0.171*** | |
| | (0.014) | (0.029) | (0.045) | |
| (Ln)Distance (+) | 0.00704*** | 0.00863*** | -0.0329*** | |
| | (0.0022) | (0.0020) | (0.0047) | |
| Inflation (+) | -0.00339*** | -0.00350*** | 0.00427* | |
| | (0.0013) | (0.0012) | (0.0024) | |
| GDP Growth (+/-) | 0.00243** | 0.00270** | 0.00317 | |
| | (0.0011) | (0.0011) | (0.0019) | |
| Political Risk (+/-) | -0.0203*** | -0.0213*** | 0.0831*** | |
| | (0.0076) | (0.0073) | (0.014) | |
| (Ln)Lending Rate (-) | 0.0404*** | 0.0425*** | -0.0424*** | |
| | (0.0058) | (0.0054) | (0.011) | |
| Subsidiary Growth (+) | | | 0.103*** | |
| | | | (0.0086) | |
| Parent and year fixed effects? | ✓ | ✓ | ✓ | |
| Industry fixed effects? | | ✓ | ✓ | |
| Observations | 137689 | 137689 | 106944 | 137689 |
| $R^2$ | 0.41 | 0.42 | 0.35 | 0.11 |

The dependent variable in column (1) to (4) is the ratio of external equity to external financing (external equity ratio). Retained Earnings Ratio is the ratio of retained earnings to the balance sheet total. Target Leverage is the predicted target leverage for each subsidiary and year using the regression results of specification (2) in table 2. Country Tax Rate is the corporate tax rate varying over time and by country. Profitability is the ratio of profit and loss for the financial year (after interest and taxes, prior to profit distribution, and offsetting of losses carried forward) to shareholders equity. Subsidiary Size is the logarithm of the balance sheet total. Tangibility is the ratio of fixed and intangible assets to the balance sheet total. Industry Leverage is the median of leverage by industry and year. (Ln)Distance is the logarithm of the distance between Germany and the host economy of the subsidiary. Inflation is inflation in consumer prices (annual %). GDP Growth is GDP per capita growth (annual %). Political Risk is the political stability & absence of violence/terrorism indicator. A higher value indicates lower risk by definition of the World Bank. (Ln)Lending Rate is the logarithm of the lending interest rate. Subsidiary Growth is the annual percentage change between the balance sheet total this year and the balance sheet total of the previous year. For data sources see the appendix. All regressions are estimated using OLS and include parent, year and industry fixed effects as indicated. Standard errors in parentheses are corrected for clustering across year-country cells and for heteroscedasticity. Sample consists of subsidiaries of German multinationals in MiDi for the period from 1996 to 2007. * denotes significance at the 10 %-level, ** at the 5 %-level and *** at the 1 %-level respectively.

4.4. **Trade off explanations for reduced retained earnings in high tax countries?** Table 5 examines dividend distributions. The dependent variable is the dividend ratio defined as the ratio of dividends paid to retained earnings. I use retained earnings to scale dividends paid, since following legal standards the possibility to pay dividends typically is restricted by the availability of previous profits summing up to retained earnings.

The coefficient on the tax rate in all specifications (1) to (3) in table 5 is significantly negative. Firms do not pay more dividends in high tax countries, on the contrary they even pay less dividends there. This result is consistent with the standard argument, that net income is the most important determinant of dividend payout (Lintner (1956), Desai et al. (2007) and Leibrecht et al. (2009)). Since taxation reduces net income, the tax rate has a negative effect on dividend distributions. Thus I do not find evidence for firms paying out more dividends in high tax countries in order to increase their leverage. The reduced availability of retained earnings is not the consequences of a trade off driven incentive to pay out more dividends in high tax countries as argued in section 2.4.

TABLE 5. Taxation and Dividend Distributions

|  | (1) | (2) | (3) |
|---|---|---|---|
| Country Tax Rate (+) | -0.122*** | -0.122*** | -0.119*** |
|  | (0.041) | (0.040) | (0.042) |
| Profitability (+/-) | 0.0520*** | 0.0516*** | 0.0536*** |
|  | (0.0028) | (0.0027) | (0.0028) |
| Subsidiary Size (+/-) | 0.00864*** | 0.0102*** | 0.0155*** |
|  | (0.0014) | (0.0014) | (0.0015) |
| Tangibility (+/-) | -0.0620*** | -0.0699*** | -0.0733*** |
|  | (0.0061) | (0.0073) | (0.0073) |
| (Ln)Distance (+) | -0.0160*** | -0.0163*** | -0.0171*** |
|  | (0.0018) | (0.0018) | (0.0019) |
| Inflation (+) | -0.00277** | -0.00269** | -0.00169 |
|  | (0.0011) | (0.0011) | (0.0011) |
| GDP Growth (+/-) | 0.00235 | 0.00234 | 0.00423*** |
|  | (0.0015) | (0.0015) | (0.0015) |
| Political Risk (+/-) | 0.000642 | 0.000293 | 0.00252 |
|  | (0.0058) | (0.0058) | (0.0060) |
| (Ln)Lending Rate (-) | -0.000331 | -0.000969 | 0.00155 |
|  | (0.0046) | (0.0046) | (0.0048) |
| Subsidiary Growth (+) |  |  | -0.101*** |
|  |  |  | (0.0058) |
| Parent and year fixed effects? | ✓ | ✓ | ✓ |
| Industry fixed effects? |  | ✓ | ✓ |
| Observations | 105102 | 105102 | 105102 |
| $R^2$ | 0.19 | 0.19 | 0.19 |

The dependent variable in column (1) to (3) is the ratio of dividends paid to retained earnings (Dividend Ratio). Country Tax Rate is the corporate tax rate varying over time and by country. Profitability is the ratio of profit and loss for the financial year (after interest and taxes, prior to profit distribution, and offsetting of losses carried forward) to shareholders equity. Subsidiary Size is the logarithm of the balance sheet total. Tangibility is the ratio of fixed and intangible assets to the balance sheet total. (Ln)Distance is the logarithm of the distance between Germany and the host economy of the subsidiary. Inflation is inflation in consumer prices (annual %). GDP Growth is GDP per capita growth (annual %). Political Risk is the political stability & absence of violence/terrorism indicator. A higher value indicates lower risk by definition of the World Bank. (Ln)Lending Rate is the logarithm of the lending interest rate. Subsidiary Growth is the annual percentage change between the balance sheet total this year and the balance sheet total of the previous year. For data sources see the appendix. All regressions are estimated using OLS and include parent and year fixed effects; some specifications include industry fixed effects as indicated. Standard errors in parentheses are corrected for clustering across year-country cells and for heteroscedasticity. Sample consists of subsidiaries of German multinationals in MiDi for the period from 1996 to 2007. * denotes significance at the 10 %-level, ** at the 5 %-level and *** at the 1 %-level respectively.

## 5. Conclusion

The empirical literature on the impact of taxation on multinationals' capital structure choice identifies an increase in the leverage with the corporate tax rate and concludes, that this effect is due to multinationals trading off the costs and benefits of debt. I show, that this conclusion is at least ambiguous. The pecking order theory provides an equally plausible explanation for this empirical observations. Taxation reduces profits and thus available retained earnings. This drives the leverage in high tax countries up for two reasons: Firstly, retained earnings enter the denominator of book leverage and thus have a mechanical effect on the latter. Secondly, because taxation lowers available profits, subsidiaries have to rely more frequently on external financing in high tax countries. Since consistent with the pecking order subsidiaries prefer debt over external equity, the more frequent occurrence of financing deficits drives the leverage up additionally.

Consistent with prior literature I find a 4.45 percentage points increase in subsidiary leverage following an ten percentage point increase in the tax rate. Based on simulations I show, that 2.35 percentage points of this increase are due to the first effect following from the pecking order on subsidiary leverage stated above, namely the reduced availability of retained earnings in high tax countries. Another 0.96 percentage point is due to the second effect following from the pecking order on subsidiary leverage stated above, namely the more frequent occurrence of financial deficits in high tax countries and subsidiaries preference for debt over external equity. Only the remaining 1.14 percentage points are due to subsidiaries trading off the costs and benefits of debt.

I find no evidence, that the reduced availability of retained earnings in high tax countries could be seen as the outcome of trade off considerations of multinationals. Subsidiaries in high tax countries do neither pay more dividends in order to reduce available retained earnings, nor do they determine their target leverage, observe available retained earnings and adjust external equity accordingly.

These results point to the importance of the conclusions of Mackie-Mason (1990) and Chang and Dasgupta (2009) for identifying target behavior. Mackie-Mason (1990) argues, that most researchers look at leverage ratios, which are the cumulative result of years of separate decisions. Tests based on a single aggregate of different decisions are likely to have a low power for identifying effects at the margin and may be subject to specification biases. He proposes to rely on incremental financing

decisions instead. Chang and Dasgupta (2009) conclude, that looking at leverage ratios is not enough and even may be possibly misleading. Instead researchers should look at financing behavior, that is, debt versus equity choices.

The insights presented here have direct policy implications. Firstly, when evaluating the effects of tax reforms, there is no reason to expect an immediate change in multinational capital structure choice as far as a predicted variation in subsidiary leverage with the tax rate is due to the pecking order. Lower tax rates will affect subsidiary leverage only in the long run, because it allows subsidiaries to retain more earnings over time. However, such an immediate change can be expected as far as a predicted variation is due to a trade off behavior. Multinationals should then respond to a lower tax rate immediately and adjust their leverage, the only limitation being adjustment costs. Secondly, the justification of anti abuse rules in tax law with respect to an extensive use of debt finance ("thin capitalization rules") is questionable, if the observed increase in leverage in high tax countries is due to the reduced availability of retained earnings as predicted following the pecking order. Multinationals do not abuse debt shifting, but simply suffer from taxation reducing their profits.

## References

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*(3), 309–311.

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

Chang, H. X. and S. Dasgupta (2009). Target Behavior and Financing: How Conclusive Is the Evidence? *Journal of Finance 64*(4), 1767 – 1796.

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*(6), 2451–2487.

Desai, M. A., C. F. Foley, and J. R. Hines, Jr. (2007). Dividend Policy Inside the Multinational Firm. *Financial Management 36*(1), 5–26.

Fama, E. and K. French (2002). Testing tradeoff and pecking order predictions about dividends and debt. *Review of Financial Studies 15*.

Fama, E. F. and K. R. French (2005). Financing decisions: Who issues stock?. *Journal of Financial Economics 76*, 549 – 582.

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

Frank, M. Z. and V. K. Goyal (2008). Tradeoff and Pecking Order Theories of Debt. In B. E. Eckbo (Ed.), *Handbook of Corporate Finance – Empirical Corporate Finance*, Volume 1, Chapter 12, pp. 141–204. North-Holland.

Frank, M. Z. and V. K. Goyal (2009). Capital Structure Decisions: Which Factors Are Reliabiy important? *Financial Management*, 1–37.

Graham, J. (2003). Taxes and corporate finance: A review. *Review of Financial Studies 16*(4), 1075 – 1129.

Hennessy, C. A. and T. M. Whited (2005). Debt dynamics. *Journal of Finance 60*(3), 1129 – 1165.

Huizinga, H., L. Laeven, and G. Nicodeme (2008). Capital structure and international debt shifting. *Journal of Financial Economics 88*(1), 80–118.

Kraus, A. and R. H. Litzenberger (1973). A state-preference model of optimal financial leverage. *Journal of Finance 28*(4), 911 – 922.

Leibrecht, M., C. Bellak, and M. Wild (2009). Does lowering dividend tax rates increase dividends repatriated? Evidence of intra-firm cross-border dividend repatriation policies by German Multinational Enterprises. *Deutsche Bundesbank Discussion Paper Series 2009*(19).

Lintner, J. (1956). Distribution of Incomes of Corporations Among Dividends, Retained Earnings, and Taxes. *American Economic Review 46*(2), 97–113.

Lipponer, A. (2008). Microdatabase direct investment - midi a brief guide. *Deutsche Bundesbank Economice Research Center*, mimeo.

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

Mintz, J. M. and A. Weichenrieder (2010). *The Indirect Side of Direct Investment–Multinational Company Finance and Taxation*. Cambridge MA: MIT Press, forthcoming.

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

Myers, S. (1984). The capital structure puzzle. *Journal of Finance 39*(July).

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

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

Shyam-Sunder, L. and S. Myers (1999). Testing static tradeoff against pecking order models of capital structure. *Journal of Financial Economics 51*.

Taggart, R. A. J. (1985). Secular patterns in the financing of u.s. corporations. In B. M. Friedman (Ed.), *Corporate Capital Structures in the United States*, pp. 13–80. University of Chicago Press.

Appendix

Table 6: Variable Definitions and Data Sources

| Variable | Definition | Source |
|---|---|---|
| Leverage | is the ratio of liabilities (MiDi-item p33) to the balance sheet total (MiDi-item p40). | MiDi |
| Debt ratio | is the ratio of liabilities (MiDi-item p33) to capital provided to the subsidiary from outside (equity without retained earnings and liabilities; MiDi-item p23-p08+p29+p33) | MiDi |
| Retained Earnings ratio | is the ratio of retained earnings (MiDi-item p30+p31+p32) to the balance sheet total (MiDi-item p40). | MiDi |
| Dividend ratio | is the ratio of dividends paid (MiDi-item p30+p31 ./. lagged MiDi-item p30+p31+p32) to retained earnings. | MiDi |
| Country Tax Rate | is defined as the corporate tax rate varying over time and by country. | Institute for Fiscal Studies, KPMG, Ross school of business of the university of Michigan and Mintz and Weichenrieder (2010) |
| Profitability | is the ratio of profit and loss for the financial year (after interest and taxes, prior to profit distribution, and offsetting of losses carried forward; MiDi-item p32) to shareholders equity (MiDi-items p23-p08+p29+p30+p31). | MiDi |
| Subsidiary Size | is the logarithm of the balance sheet total (MiDi-item p40). | MiDi |
| Tangibility | is the ratio of fixed and intangible assets (MiDi-item p11) to the balance sheet total (MiDi-item p40). | MiDi |
| Subsidiary Growth | is the annual percentage change between the balance sheet total (MiDi-item p40) this year and the balance sheet total of the previous year. | MiDi |
| Industry Leverage | is the median of leverage by industry (MiDi-item br2) and year. | MiDi |
| (Ln)Distance | is the logarithm of the distance between Germany and the host economy. | CEPII |
| Inflation | is inflation in consumer prices (annual %). | World Bank |

Table 6: Variable Definitions and Data Sources continued

| Variable | Definition | Source |
|---|---|---|
| GDP Growth | is GDP per capita growth (annual %). | World Bank |
| Political Risk | is the political stability & absence of violence/terrorism indicator. | World Bank |
| (Ln)Lending Rate | is the logarithm of the lending interest rate. | World Bank and OECD |

MiDi is the Mircodatabase Direct Investment provided by Deutsche Bundesbank and described in detail in Lipponer (2008). Since the threshold levels above which reporting is mandatory vary over time, the current study consistently employs a uniform threshold level. Thus an observation is only included in the estimation sample, if the reported investment position is above all the various definitions of the threshold during all periods from 1996 to 2007. Since the tax motivated use of debt in multinational groups needs a high degree of integration, I exclude all affiliates of multinationals having a participation of less than 99 %. I exclude FDI in the financial sector, since such FDI serves special economic purposes specifically with respect to leverage decisions. I also exclude investments made in branches or partnerships, since in such cases other statutory tax rates apply rather than in the standard case of corporations as affiliates. I am interested in the use of tax planning strategies of German multinationals in order to shelter their business activities abroad from taxation. Therefore I limit my sample to the 30 countries responsible for the largest part of German FDI measured in terms of fixed and intangible assets during the sample period from 1996 to 2007.