Corporate Structure, International Tax Spillovers, and Capital Structure

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Abstract

Do multinational groups exploit their capital structure in order to obtain tax benefits that stand alone domestic firms cannot obtain? To answer this question I build a novel dataset mapping the entire corporate group structure of a large sample of European multinationals. I document the existence of three distinct effects. First is the local income effect, corresponding to the standard trade-off theory. Second is the substitution effect, predicting that an increase in foreign tax rates leads to a decrease in domestic leverage. Third is the global income effect: in multinational groups the holding companies can provide capital and extend guarantees to firms lower in the hierarchical structure, reducing the probability and cost of bankruptcy, therefore allowing higher leverage. These effects have conflicting signs, and I show that which effect dominates in response to changes in foreign and domestic corporate tax rates depends on non-debt tax shields, the initial level of the tax rate, and profitability. I also discuss the policy implications of these results.

Keywords: Corporate Taxation, Capital Structure, Debt Shifting, Corporate Group Structures, Multinational Companies.
JEL codes: G32, H25, H32.

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1 Introduction

Multinational companies are interesting from a tax perspective as skillful use of the differences in tax codes between the countries they operate in can create competitive advantages for multinational companies compared to their purely domestic counterparts. Huizinga, Laeven, and Nicodeme (2008) show that multinational companies can shift debt between its group members, gaining an additional benefit compared to the effect predicted by trade-off theory. However, there is much about the capital structure of multinationals that is not understood. The complex international group structures of multinationals make it difficult to investigate the effects of taxation on their capital structure.

I build a database that maps the entire group structure of a large sample of private and public multinational companies, and use it to study how corporate income taxes affect the financial policy of these firms. I am the first to provide evidence on how different corporate structures of multinationals change the impact of corporate taxation on the leverage of multinationals. I document the existence of three separate effects of tax rate changes on the leverage of multinationals. The third effect is caused by the group structure of the multinational. The three effects combined can lead to results opposite to what was previously predicted in the literature. This causes a substantial degree of heterogeneity in how tax rates affect multinational companies depending on the corporate group structure of the multinational.

The three effects I investigate are the 'local income effect', the 'substitution effect' and the 'global income effect'. The 'local income effect', is the trade-off theory effect of taxes on leverage first analyzed by Kraus and Litzenberger (1973), who included bankruptcy costs into the Modigliani and Miller (1963) framework and show that a domestic increase in taxes should lead to a domestic increase in leverage. This effect exists for all firms, regardless of whether they are part of a multinational group. The 'substitution effect' was introduced by Huizinga et al. (2008), who showed that for a firm in a multinational group an increase in foreign taxes leads to a decrease in domestic leverage. This effect results from the fact that multinationals allocate debt to the country where it yields the highest net return. The 'global income effect' has been recently theorized by Luciano and Nicodano (2014). They show that firms in a corporate group structure can increase their leverage as a result of guarantees received from other firms in the multinational company. These guarantees reduce the bankruptcy probability of the firm and the multinational as a whole and thereby lower the expected cost of bankruptcy, causing an increase in the multinational's overall optimal leverage.

The local income effect only affects domestic leverage. The substitution effect holds that foreign leverage substitutes for domestic leverage, whereas the global income effect

affects a multinational's total leverage as well as its domestic leverage. Moreover, the global income effect can act in the opposite direction to the substitution effect. Ignoring the global income effect can lead to either an under- or an overestimation of the effect of foreign taxes on domestic leverage. Only by taking into account the entire corporate group structure of multinationals we can obtain a complete assessment of how corporate income taxation affects total leverage and its distribution across firms in the group.

I find evidence for all three effects and characterize under which conditions each effect dominates. Looking at multinational groups in their entirety is crucial for assessing the global income effect. Many multinational group structures consist of several hierarchical levels. At the top is the holding company, below this there can be several levels of subsidiaries, each level owning the firms in the level below it. Capital or guarantees provided between these levels can lead to tax-deductible losses if a capital receiving member of the group goes bankrupt. Since, companies in the levels high up in the group are more likely to provide capital and guarantees to the firms in the levels lower down, the potential tax benefit of debt is higher at these levels. As a result the total bankruptcy costs of the multinational group as a whole drops more strongly in this case. Therefore, there should be a larger leverage increase for an equal change in tax rates when it occurs high up in the group. The increase in debt capacity of the multinational group can then be used to reduce the tax costs at the firms in the structure that benefit the most. The increase in leverage will be concentrated at firms in countries where it yields the highest benefit. These are profitable firms with lower non-debt tax shields, facing higher domestic tax rates. For these firms the global income effect is stronger than the substitution effect. This effect is not observed for tax changes at the lower levels of the group structure, suggesting a weak global income effect, leading to the substitution effect dominating.

Ignoring the global income effect will lead one to always predict a negative effect of a foreign tax change, while I show the effect can also be positive. I find that the debt substituted within a multinational can be as much as 30% larger than previously found in the literature. Moreover, the distribution of leverage across firms in the multinational group can differ by more than 100% compared to previous findings. The distribution depends on the size of the tax benefit, the size of non-debt tax shields, and whether the firm is profitable or not. Only profitable firms are affected by the global income effect. The global income effect can dominate the substitution effect for firms facing a high tax rate and with low non-debt tax shields. These results cannot be explained by the non-linearities predicted by the Kraus and Litzenberger (1973) framework. I also show that these results cannot be explained by agglomeration economies, endogeneous entry of new firms, or changes to the tax base that are designed to counter debt shifting.

This paper is closely related to Huizinga et al. (2008) and Luciano and Nicodano

(2014). Huizinga et al. (2008) show that firms in multinational groups not only react to domestic taxes, but also to foreign taxes. The authors provide a theoretical explanation for the existence of such a substitution effect and provide empirical evidence using parent-subsidiary pairs. To add to this literature I generate a complete picture of the effects of corporate income taxes on both the leverage of the total multinational group, as well as the leverage of the individual firms in the multinational group. Firstly, I compile data on the entire group structure of the multinational, which allows me to observe the effect of all taxes faced by the multinational. I can observe leverage substitution within the multinational company even when it doesn't follow a direct up- or downstream path. This has a substantial impact on the size of the substitution effect. Secondly, the data allows me to investigate the effects of group structures on leverage (Luciano and Nicodano, 2014; Nicodano and Regis, 2018). This effect has not been empirically investigated before and turns out to be sizable.

Thirdly, as the global income effect and the substitution effect found by Huizinga et al. (2008) can work in opposite directions it is ex-ante unclear which effect will dominate. I investigate under what conditions the global income effect dominates the substitution effect. I show that it depends on the group structure and the place a firm facing the tax change takes in the group hierarchy. This is the first documented evidence showing that the group structures of multinationals have a direct impact on leverage and the use of tax shields and it suggests the group structure has a large impact on the distribution of debt across firms in the multinational group. Furthermore, it shows that apart from the domestic tax rate and the foreign tax rates, the level a firm takes in the hierarchy of the group structure can have a significant impact on how taxes affect the capital structure.

Lastly, I show evidence for non-linear changes of leverage as a result of changes in tax rates. While this result is a necessary condition for the trade-off theory to be true, it has been largely ignored in the empirical capital structure literature. The evidence provided in this paper casts new light on recent policy measures designed to curb the use of debt-tax shields. While a step in the right direction, these measures are inadequate to counter the benefits a multinational can obtain by using both its capital and its corporate structure.

The rest of the paper is structured as follows: Section 2 develops the hypotheses based on existing theories. Section 3 describes how I constructed the data sample. Section 4 details the identification strategy. Section 5 describes the main results of the paper. Section 6 subjects the results to robustness tests and discusses several extensions. Section 7 discusses the results in the context of recent policy developments. Section 8 concludes.

2 Literature and hypotheses

In this section I will briefly describe the literature on the effects of taxation on capital structure. I will then build on this literature to create my hypotheses.

2.1 Literature overview

Capital structure is irrelevant in a frictionless world (Modigliani and Miller, 1958), but when we introduce corporate tax rates into the story this changes (Modigliani and Miller, 1963). The introduction of bankruptcy costs into the framework led to the trade-off theory (Kraus and Litzenberger, 1973) which suggests that the benefits of debt, in the form of a tax shield, are traded off against the costs of debt, in the form of bankruptcy costs.[1] The tax shield exists because in most countries payments on debt are tax deductible while payments on equity are not.[2] The benefit of debt over equity will result in the company taking on more debt to lower the tax bill.

Many empirical studies have investigated the effects of corporate taxes on the capital structure of companies. Most of these studies focus on the effects of domestic taxes on domestic leverage. A comprehensive study by Rajan and Zingales (1995) investigated the determinants of leverage and showed a strong positive effect of taxes on leverage. Some recent examples include Faccio and Xu (2015) who use changes in corporate tax rates as natural experiments, Faulkender and Smith (2014) who show the trade-off theory also holds for multinationals and Heider and Ljungqvist (2015) who show the relation between tax and leverage using staggered corporate tax rate changes across US states. All of these studies show a strong positive relation, in line with trade-off theory. For a more complete overview of the effect of domestic taxes on domestic leverage I refer the reader to Graham (2006).

Multinationals face several tax jurisdictions, which allows them to use differences in these laws to reduce their tax costs. Desai, Foley, and Hines (2004) show that multinational firms increase their leverage in response to tax changes and can use internal capital markets if the local credit market is underdeveloped, thereby enabling the use of credit were purely domestic firms might not be able to.

Huizinga et al. (2008) are the first to address debt shifting effects in multinational com-

[1] Several other factors have been shown to be a cost of debt that can be strong enough to balance the benefit: personal taxes (Miller, 1977), agency costs (Jensen and Meckling, 1976; Huizinga et al., 2008), financial flexibility (Li, Whited, and Wu, 2016). However, very little has changed in the overall message: payments on debt can be deducted from taxes, payments on equity cannot.

[2] A notable exception is the Belgian Notional Interest Deduction. However, this is an exception to the rule. Panier et al. (2012); Kestens et al. (2012); van Campenhout and van Caneghem (2013) describe this rule and its effect in more detail.

panies. They show theoretically that multinational companies have an incentive to shift debt from low-tax to high-tax countries to increase the total tax shield of the multinational company. They also provide empirical evidence for their theory using parent-subsidiary pairs operating in two different countries. Luciano and Nicodano (2014) show theoretically that there is another reason why multinationals may have larger tax shields. They argue that within a hierarchical structure like a multinational it is possible for parent companies to provide guarantees for outside debt of subsidiaries. This reduces bankruptcy probability of a firm in a multinational group compared to a stand-alone firm and thereby increases the amount of debt a company can take on. The findings of Huizinga et al. (2008) as well as the predictions of Luciano and Nicodano (2014) suggest that the Kraus and Litzenberger (1973) does not fully describe the effects of tax rates on the capital structure of multinationals.

2.2 Predictions

In this section, I derive from existing models of capital structure a set of predictions on how multinationals react to tax changes. I will these predictions in section 5.

Figure 1 provides an example of a typical multinational company. From here on in I will refer to the firms that form the multinational company as an entity. By local or domestic tax rates I refer to the corporate tax rate in the country the entity is located in. In Figure 1 this is the Dutch tax rate for entities A and B, while for entity C this is the Italian tax rate. By foreign tax rate I refer to the corporate tax rate of the countries the entity is not located in, but in which the multinational has a presence. For entities A and B this is the Italian tax rate and for entity C the Dutch tax rate.

The first prediction is based on the trade-off theory. The benefit of leverage is the difference between the tax-deduction of payments on debt over the tax-deduction of payments on equity.[3] While the cost of debt can take several forms (e.g. bankruptcy costs, agency costs), the origin of these costs is irrelevant for the local income effect. As long as the marginal costs of debt increases in leverage the local income effect will exist.[4] Under these assumptions an increase in taxes leads to an increase in leverage. The theory does not predict any different effects for multinationals or purely domestic firms, nor does it predict any changes as a result of foreign tax changes. I will refer to this 'traditional' effect

[3]Interesting to note is that the original implementation of the interest deduction in the US and its subsequent persistence were not the result of strong economic arguments (Bank, 2014), the existence of this different treatment is in itself contentious. Scheuer (2013a,b) provides several arguments why the differential treatment is not necessarily inefficient.

[4]If the marginal benefit is the statutory tax rate this is a constant, the marginal costs has to be increasing in leverage for there to be a solution apart from a corner solution. Note that this suggests that the effect is non-linear.

of taxes on leverage as the "local income effect". It predicts that an increase in domestic taxes causes a increase in domestic leverage. In Figure 1 it would refer to a Dutch tax change affecting entities A and B or an Italian tax change affecting entity C.

Prediction 1: "Local Income Effect", an increase in local corporate tax rates has a positive effect on local leverage

The second prediction builds on the fact that multinationals can make use of differences in tax codes across countries. A tax benefit can be obtained by shifting deductions and income to countries where these have the most beneficial tax treatment. Huizinga et al. (2008) show that between parent-subsidiary pairs the allocation of debt also depends on the tax rates faced by foreign subsidiaries. A multinational shifts debt from one country to another to minimize taxes. I call this the "substitution effect". It implies that a foreign corporate tax increase leads to a domestic leverage decrease as it becomes less beneficial to deduct the interest domestically. It also implies that a domestic tax increase yields not only a domestic leverage increase as a result of the local income effect, but also an additional increase in leverage as a result of the substitution effect. In Figure 1 this means a Dutch tax change affecting entity C or an Italian tax change affecting entities A and B. Note that the substitution effect can lead to higher leverage for a firm within a multinational compared to a similar stand-alone firm when the corporate tax rate is high, but also to lower leverage when the tax rate is low. It implies that when a multinational's leverage is in its global optimum it can be locally suboptimal.

Prediction 2: "Substitution Effect", an increase in domestic (foreign) corporate tax rates substitutes foreign (domestic) leverage for domestic (foreign) leverage

The third prediction builds on Luciano and Nicodano (2014). They argue that within a multinational company the entities can provide guarantees for one another. Guarantees reduce the probability of bankruptcy and thereby increase the optimum level of leverage. The benefit of a guarantee is that at the same debt level as a stand-alone firm the entity within a corporate structure is less likely to go into costly bankruptcy procedures. This can improve access to finance and reduces the cost of debt. I further argue that a second benefit exists. If the guarantor is called upon to pay on its guarantees, the guarantor can suffer a tax-deductible loss. Similarly, if instead of guarantees the parent company directly provides debt or equity to the subsidiary it can also lead to a tax deductible write-off on capital if the entity receiving the capital goes bankrupt. So not only does the probability of bankruptcy decrease (independent of tax rates), but the cost of bankruptcy is decreasing

in the corporate tax rate levied at the level of the capital provider or guarantor. I call this the "global income effect".

The above implies that the government shares in the risk of bankruptcy of the firm by creating a tax deduction for the parent firm. The size of this tax shield on bankruptcy is increasing in the amount of guarantees and capital provided by the holding, as this increases the amount of risk shared with the government.[5] Firms lower in the hierarchical structure (e.g. entity D in Figure 3(b)) will hold less equity in, and likely provide less debt and guarantees to other firms in the structure than companies high in the structure (e.g. entity A in Figure 3(b)).[6,7] The tax benefit for the multinational group as a whole is higher if a tax change occurs higher up in the hierarchical structure of the multinational (e.g. a tax change at entity A has a bigger effect than a tax change at entity D in Figure 3(b)). This implies there is a direct effect of the multinational's group structure on the tax benefits of debt.

Note that the global income effect does not imply anything about where the leverage will increase. The total bankruptcy costs of the multinational go down, allowing the multinational to increase leverage anywhere in its structure. The leverage change can occur anywhere in the multinational, but most likely there where it yields the biggest net tax benefit. In Figure 1 this would refer to a Dutch or Italian tax change affecting the leverage of the entities A through C beyond the local income effect and substitution effect. The extra leverage capacity this provides the multinational company is allocated to the entity with the highest benefit, the size of the benefit depends on the existing level of leverage and tax as an entity can already be at its optimum leverage. Showing when an effect dominates can provide policy makers with information on the expected average effect of a foreign tax change.

Prediction 3: "Global Income Effect", a local increase in corporate tax rates results in a total leverage increase, beyond that of predictions 1 and 2. The effect is lower for entities lower in the hierarchical structure[8]

[5] One could argue there are decreasing returns to scale, this is however not crucial to my identification strategy.

[6] For instance, in the corporate bonds market about one out of every three bonds issued by a subsidiary is guaranteed by the parent company (Kolasinski, 2009).

[7] For the local income effect and substitution effects any cost can take the place of bankruptcy costs in the trade-off theory, while this is not true for the global income effect. The cost needs to move in the same direction as the increase in the probability of being a guarantor. Bankruptcy costs are not necessarily the only option, but the most likely.

[8] Note that total leverage is created using the sum of all debt and assets of the multinational. This is not necessarily equal to consolidated leverage as consolidated leverage would exclude internal capital. The data does not allow me to distinguish between internal or external debt. However, internal debt also puts pressure on an entity if it has both internal and external debt. If the firm

Corollary 1: a domestic tax increase leads to a positive local income effect, a positive substitution effect and a non-negative global income effect. The overall effect of a domestic corporate tax rate change on domestic leverage is positive.

Due to the countervailing forces of the substitution and income effects the outcome of a foreign tax increase is ex-ante not clearly signed. Therefore, we should ask the question of under what circumstances which of the three effects dominates.

Corollary 2: a foreign tax increase leads to a negative substitution effect and a non-negative global income effect. The overall effect of a foreign corporate tax rate change on domestic leverage is ex-ante ambiguous.

While the local income effect and substitution effect have been shown before, I can show under what conditions the Kraus and Litzenberger (1973) and Huizinga et al. (2008) theories predict the right outcomes and when they will not. By showing when the global income effect dominates the substitution effect I can analyze the leverage distribution over the entities in the multinational corporate structure. This not only allows me to analyze leverage for the whole multinational, but also provide direct evidence for the effects of the corporate group structure itself on leverage.

3 Data

3.1 Tax data

Information on tax rates and tax base changes are hand-collected from Ernst & Young's "World Wide Corporate Tax Guides". Ernst & Young is a major accounting and advisory firm that creates summaries of the world wide tax systems on a yearly basis. All major changes are captured in these tax guides.

There are several ways of calculating and defining the corporate tax rates that can be used in research. I use the top statutory corporate tax rate. The tax benefit is gained over the next euro earned rather than the average euro earned, hence this marginal tax rate is the appropriate tax rate to use.[9] When looking at the effects of foreign taxes the

cannot pay the interest on the internal debt it is still costly to the entity providing the loan as capital will flow out of the firm, but not to the internal creditors. The multinational as a whole will want to prevent this. Especially if in bankruptcy the internal loan is junior to the external loans or credits.

[9]See Devereux and Griffith (1998) for a more extensive discussion of what tax rate to use in

tax rates are weighted by the multinational's sales in each country.

A bias would arise if companies have beneficial agreements or constructions in place which allow them to pay taxes at rates below the marginal tax rate (e.g. company specific 'tax holidays'). The underlying assumption in all research about tax effects on leverage, is that most companies do not have such arrangements. If these arrangements are prevalent, I should not find an effect of taxes, as the entity is not affected by changes in tax rates. It would bias against finding a result. Therefore, I do not further investigate the existence of tax arrangements.

3.2 Firm level data

One of the challenges in investigating the effects of corporate taxes on multinationals is the fact that most databases provide a consolidated account for the whole multinational. This makes it impossible to determine the tax regimes the multinational faces. I create a dataset which maps all the entities of the entire corporate structure of a multinational. I create the dataset using the Bureau van Dijk Orbis database.[10]

Orbis is continuously updated, but the majority of the data is only updated within a year of company filings and large parts only updated after two to three years. Orbis provides information about ownership links at the moment of download, while accounting information can be obtained for the past ten years. To obtain ownership information at different points in time I use the historical databases. These include snapshots of the data at a particular point in time commonly referred to as vintages. The ownership data I use is the lagged end of year ownership structure (effectively the start of year ownership), obtained yearly from the respective vintage. The accounting data is obtained from the 2008, 2012 and 2015 vintages. Each of these provides data for the previous ten years. In case of duplicate data I keep the most recent information.

Later vintages can update or correct data. I end the sample in 2011 to ensure all data is fully updated. I only include the European entities. This ensures the entities face a similar economic environment.[11] Data consistency and availability greatly improved after 2004, so my sample starts in 2005.

To obtain the entire structure of the multinationals I link each top holding company

analyzing corporate decisions.

[10]For more details about the Orbis database see: Kalemli-Ozcan et al. (2015). I make the suggested corrections, as well as several additional corrections for idiosyncrasies the authors were not faced with for their purposes.

[11]An added benefit is that within the European Union there are harmonized regulations on withholding taxes on interest and dividends, greatly reducing issues related to withholding taxes.

with its set of subsidiaries. These subsidiaries are then linked with their own subsidiaries.[12] I repeat this process up to six hierarchical levels deep. Lack of computational power makes it hard to expand the data beyond 6 levels. The information is then aggregated at the multinational-country level, creating one yearly observation for each multinational per country it is active in. This was done because the corporate structures of some multinationals are vast and using for instance a multinational-firm level observation would mean that particularly large multinationals could become a substantial part of the sample. A large multinational can contain hundreds of entities, while a small one only contains a handful.[13] For a more detailed discussion on the construction of the unit of observation see appendix A.

The dataset allows me to determine in which countries a multinational company operates. Each multinational-year observation includes information of the multinational at the country level for up to a maximum of 26 countries. Since I am interested in the reaction of domestic leverage to changes in both domestic and foreign taxes, each of these multinational-country-year observations is included as a separate observation. It means that in the case of Figure 1 the multinational company is once included as observation A Italy and once as observation A Netherlands. Observation A Italy consists of the data of Entity C, while observation A Netherlands consists of the aggregated data of Entity A and Entity B. This allows me to see how the Dutch entities react to Dutch and Italian taxes, but at the same time how the Italian entity reacts to Italian and Dutch taxes. I can include both domestic and weighted foreign-entity-level characteristics. Despite the aggregation I can still see whether a multinational company set up additional entities in the country or expanded current operations.

I put no restriction on the minimum ownership percentage as Orbis does not consistently report these percentages for many entities. The availability of this information is increasing in the size of the entities. Using it to filter entities with smaller or unknown shareholdings would create a bias towards larger firms. The bias created by including

[12] In constructing the data I first made several corrections. The most important correction was a cross validation of information. When entity A is the shareholder of entity B, entity B by definition has to be the subsidiary of entity A. This is verified and corrected when necessary. The discrepancy is the result of different reporting requirement. Differences exist in reporting requirements across countries. On top of that, some countries require more disclosure on subsidiaries than on shareholders or vice versa. Orbis is not automatically corrected for these discrepancies.

[13] Note that (fiscal) consolidation is not an issue. All accounting information comes from unconsolidated statements. Fiscal consolidation is only allowed within a country. This would lead to a similar aggregation as the one I employ. Purely domestic inter-company transactions are irrelevant as they would either be taxed and deductible at the same rate (if no consolidation) or not taxed at all (if consolidation). It eliminates the effect of guarantees in a purely domestic setting. However, I can still observe it internationally. This makes the estimated global income effect a lower bound to the actual effect.

entities which are only partially held works against finding a result. A multinational is unlikely to shift debt to an entity in which it only holds a minority stake, as they only partially reap the benefits.

Accounting data is winsorized at the 1% level to ensure results are not driven by outliers. Observations with missing leverage, tangible fixed assets, sales, EBIT, total assets or non-equity liabilities were dropped from the sample. These variables are used to construct the dependent and independent variables. As a result, there are missing subsidiaries for some multinationals, which can create a bias as leverage may be shifted towards entities I do not observe or it may be shifted due to tax changes I do not observe. This will create noise in the data, making it harder to obtain significant results. For it to cause my results there should be consistent non-reporting of entities across 26 countries, in such a way that those who do not shift debt are excluded from the sample. Furthermore, the factor causing such a bias must not be captured by the controls or fixed effects. No such obvious mechanism comes to mind. Only multinational companies with accounting information in at least two countries are kept in the database. If a multinational company is present in three countries, but only one country provides accounting information, it is not included in the database (this drops 711 multinational-country-year observations). The final sample includes 43,724 multinational-country-year observations of 12,178 multinational-years from 26 countries.[14]

Various entity, multinational company and country-level control variables are included in the regressions. These are based on prior work by Rajan and Zingales (1995) and Huizinga et al. (2008). At the entity level I control for tangibility, profitability, sales and depreciation.

At the country-level I control for GDP-growth and interest rates. Table 1 shows the definitions of the main variables used in the rest of the paper. Country-level macroeconomic controls were obtained from the World Bank and Thomson Reuters Datastream.

3.3 Summary statistics

Panel A of Table 2 provides information on the observations per year, number of countries for a given multinational company and the country distribution of the sample. The largest multinational company is present in twenty six countries. Most multinationals (70%) are only present in two or three countries. Note that two-country multinationals can still

[14]The sample contains the EU-28 minus Malta, Croatia and Cyprus as none of the multinationals are located in these countries. Norway, as part of the European Economic Area (EEA) is included in the sample as many of the benefits and rules of the EU are also extended to the EEA.

consist of many firms.[15]

Panel B of Table 2 shows the location of holding companies and total entities. Total entities are the total number of multinational-country-year observations for which accounting information is available, while holding companies indicates the location of the holding company, regardless of availability of accounting information. We can see that Eastern European countries have relatively few holding companies compared to total entities. Considering the relative sizes of the economies some countries like Germany seem underrepresented compared to for instance Spain, while a country like Estonia seems overrepresented if compared to Lithuania and Latvia. This can be the result of the fact that multinationals don't establish in some countries or due to differences in reporting requirements which lead to missing information. It is important to rule out that the misrepresentation is due to tax induced location choice. Such endogeneous entry would cause a bias against my results if tax rates in these countries decreases. However, a tax increase would cause a bias in favor of my results. No tax increase is observed for any of the over- or underrepresented countries, alleviating the concern of sample bias driving the results. In order to ensure endogenous location choice does not drive my results I exclude these countries in a robustness test.

Table 3 Panel A shows the summary statistics for the multinational-country-year-level data. The average leverage is 0.539 in my sample. Leverage is defined as all non-equity liabilities over total assets. It includes trade credit which is important to include in the definition as it can affect potential bankruptcy costs. Furthermore, it is consistently defined and reported across countries.[16] The minimum leverage is close to zero, while the maximum is close to being a fully levered entity.

Previous studies use different definitions of leverage and consequently find a wide range of values for leverage. My values are comparable to those in Huizinga et al. (2008) and Rajan and Zingales (1995), who use the same definition of leverage. Faccio and Xu (2015) find a lower value, but use a narrower definition of leverage. Note that the Kraus and Litzenberger (1973) framework and the Huizinga et al. (2008) framework suggest only interest-carrying debt should be affected by corporate tax rates. Note that even though non-interest bearing debt carries no tax benefit, it does increase the costs of debt for the firm. Moreover, the global income effect works through lowering the costs of debt, not

[15]Of the multinationals present in only two countries the vast majority has entities at multiple levels in these countries. 24% has only one level in a country, they could still consist of multiple entities at that level.

[16]Information on provisions is limited. Only Germany and Norway consistently present data on this. In 16 of the 26 countries the difference between excluding or including the provisions in the definition will lead to less than 1% difference in the numerator. While in the other 10 the difference is sizable. This is driven by reporting requirements and labeling. Excluding provisions is therefore likely to create a bigger bias than including them.

increasing the benefit of debt. Therefore using this definition which includes all debt is the most appropriate measure of leverage.

Both depreciation and tangibility are skewed to the left. This suggests that on average the entities do not have abnormally high intangible assets. Sales show significant variation across entities, as one would expect. A substantial fraction of the entities has negative return on assets. This could affect the impact of taxation as negative returns imply no tax has to be paid. Excluding these multinational-country-years could omit relevant information as a entities optimization takes into account expected, not actual, profitability. Furthermore, tax and accounting profits can differ significantly and most countries in the sample have generous tax loss carry-over options. These companies are kept in the sample. It could create a downward bias, but uses all available information.

Table 3 Panel B shows the correlations between the main variables. In Figure 2 the correlation between tax and leverage is graphically represented. Both the table and the graph show a high degree of correlation between leverage and tax. Tangibility shows the expected positive correlation with leverage. The drop in leverage seen in Figure 2 is not caused by the economic downturn as in the figure I adjust leverage for trends in the macroeconomic controls, by using the residual of a regression of leverage on macro variables. Table 4 shows the country by country breakdown of taxes and leverage. It shows suggestive evidence that countries with higher tax rates also have higher leverage.

4 Methodology

4.1 Identification

Prediction 1 has been tested repeatedly and my methodology for this effect is similar to that in previous studies.[17] I run the following regression:[18]

$$Leverage_{ict} = \beta_1 Tax_{ct} + \beta_2 X_{ict} + \beta_3 Z_{ct} + \gamma_t + \zeta_{ic} + \epsilon_{ict} \qquad (1)$$

Where i indicates the multinational, c the country and t time. The main variable of interest is the statutory tax rate. X is a vector of entity-level controls and Z contains the country-level controls. I include a year and a multinational-country fixed effect. These control for year specific Europe-wide factors and entity specific time-invariant unobserved heterogeneity. Throughout I will cluster standard errors at the multinational level. I also

[17]For instance Faccio et al. (2011); Rajan and Zingales (1995); Heider and Ljungqvist (2015); Faulkender and Smith (2014).

[18]Note that, if the other effects exist this strategy will capture all of them in one parameter, rather than isolating the effect

clustered by country-industry at the 2-digit industry level, the results are similar. I also use a first differences estimator to see how changes in tax lead to changes in leverage.

A multinational company can chose where to locate its entities. A first-difference regression alleviates endogeneous entry concerns, because it shows how an entity reacts to changes in taxes and drops the observation at entry into a new country. Thereby, it looks directly at the effects of changes in tax rates on changes in leverage, rather than looking at levels that could have been endogeneously set at entry. In section 4.2 I discuss this issue further. Note that all my first difference equations include a year and firm fixed effect as well. The equation is first differenced and then the fixed effects are included. The interpretation of the fixed effects is slightly different. They capture the non-time-varying leverage growth of a firm and the cross-sectionally invariant effect of time periods.

If the substitution and global income effects exist then Equation 1 will not isolate the local income effect, as it captures all effects simultaneously. If only the local income effect and the substitution effect exist then the estimation strategy for Prediction 2 is similar to that of Huizinga et al. (2008). Here the benefit of my new dataset is seen as I can identify substitution across all entities of the multinational company. I estimate the following regression:

$$Leverage_{ict} = \beta_1 Tax_{ct} + \beta_2 \, Tax \ difference_{ict} + \beta_3 X_{ict} + \beta_4 Z_{ct} + \gamma_t + \zeta_{ic} + \epsilon_{ict} \tag{2}$$

Where $Tax\ difference_{ict} = Weight_{ict} Tax_{ict} - \sum_{k \neq c}^{C} Weight_{ikt} Tax_{ikt}$. This is the same as the tax difference in Huizinga et al. (2008), but adjusted for the data structure. I take the difference between the weighted domestic tax rate and all the weighted foreign tax rates.

One of the contributions of this paper comes from the new effect predicted by Prediction 3. The intuition behind Prediction 3 is that a multinational company can increase its leverage as a result of internal guarantees. Identifying this new effect is not trivial. Running a regression of a multinational's total leverage on the total weighted tax rate will not identify the effect. The coefficient on the total weighted tax rate could simply be capturing the sum of the local income effects. In section 2.2 I argued that the benefit of the hierarchical structure is increasing in tax rates and the amount of guarantees and internal capital provided by the entity. I also argued that entities higher in the hierarchical structure will provide more internal capital and guarantees, which implies that the tax benefit increases in the entity's hierarchical level in the multinational's structure. Tax changes affecting entities higher up in the hierarchy should have a bigger effect than changes at the bottom level. To identify this effect I have to take the group structure of the multinational into account.

In Section 2 I predicted that a tax rate change faced by entities higher up in the corporate structure should have a different effect than one lower faced by an entity lower in the corporate structure. So, the way to take the effect of the group structure into account is by creating a weighted tax rate for higher and lower hierarchical levels. A single multinational-country-year observation contains multiple firms which can be present at multiple levels. In Figure 3(b) Italy is both present at the second and third level, while the Netherlands is present on the first and second levels. To define high an low levels I use the highest hierarchical level the multinational-country-year observation is present at. So in Figure 3(b) Italy would be at the second level and the Netherlands at the first and while the multinational company has three levels, no multinational-country-year observation is deemed to be a level three observation. I then compare the highest level to the mean level in the multinational company (in the case of Figure 3(b) (1+2+2+3)/4=2). Any multinational-country-year observation for which the level is strictly smaller than the mean is a high level observation. So Italy is level 2 in the hierarchy, which is equal to the mean. Therefore it is a low hierarchy entity. The Netherlands is level 1, which is strictly smaller than the mean and therefore it is high hierarchy. The method ensures that if a multinational has an entity which can get the benefits associated with being high in the hierarchical structure it will always be marked as benefiting in the data, even if it also has bottom level entities present in that country (e.g. Italy is also at level 3, but is marked as level 2). By calculating a weighted tax rate for the bottom and top level observations I can verify whether the top level observations do indeed show a positive effect on total leverage. While the bottom level observations show a smaller or even negative effect. I estimate the following regression:

$$Leverage_{it} = \beta_1 Top\ levels\ tax\ rate_{it} + \beta_2 Total\ tax\ rate_{it} + \beta_3 X_{it} + \beta_4 Z_{ct} + \gamma_t + \zeta_i + \epsilon_{it} \tag{3}$$

Corollary 2 suggests the global income effect could dominate the effects shown in Huizinga et al. (2008). It suggests that when a foreign country increases its tax the domestic leverage shifts away to this country. However, if the foreign country is high in the hierarchy the global income effect could increase total leverage capacity of the firm. The firm can then allocate the additional leverage where it is most profitable. This suggests that a foreign tax change in countries where the multinational has entities high in its hierarchy can actually lead to a positive shift (e.g. a change in the Netherlands could positively affect Italian leverage in Figure 3(b)). Which entities benefit the most is not ex-ante clear. While the multinational company would most likely allocate any excess

leverage capacity to those countries where it is most profitable (i.e. high tax countries), these are also likely to be the countries where leverage is already at its local optimum (see Table 4). It is therefore very likely that the entities that face the highest tax rate might not see a reaction or even a negative reaction to foreign high level tax changes.[19] Entities with slightly lower tax rates, which are not yet in their optimum will then show the positive reaction. However, on average the benefit should be higher for entities facing higher (although not necessarily the highest) tax rates. Similarly, an entity that is not profitable or has high non-debt tax shields like depreciation will not be allocated the leverage.

$$Leverage_{ict} = \beta_1 Top\ levels\ tax\ rate_{i-ct} + \beta_2 Tax\ difference_{i-ct} + \beta 3\, Tax\ rate_{ict} + \beta_4 X_{it} + \beta_5 Z_{ct} + \gamma_t + \zeta_i + \epsilon_{it} \quad (4)$$

Note that ideally speaking one would include the tax rates for each of the 6 levels separately. However, due to the large amount of firms having only 2 or 3 levels the amount of zeros at the lower levels will make the rates for these lower levels strongly collinear.

4.2 Endogeneity and measurement issues

4.2.1 Reverse causality

A potential concern is reverse causality: tax rates change as a result of leverage ratios of companies. The argument is that governments, facing lower incomes as a result of leverage-based tax avoidance, increase tax rates to maintain steady income. However a logical argument can alleviate this concern. A government facing a drop in income as a result of debt shields does not fully benefit from increasing tax rates, as companies would increase the debt shield accordingly to counteract the higher taxes. This will push bankruptcy risk up and increase the risk-sharing that is implicit in the tax code (Cullen and

[19] A single subsidiary still faces a trade-off of costs and benefits, which could lead a subsidiary to be at the optimum leverage while the entire group is not. Alternatively, one can think of this from a benefits perspective in the sense of Graham (2000). The author shows that as the leverage of the entity increases the expected marginal tax rate drops due to possible states of the economy in which the firm will suffer losses in the future. In these states the firm would not pay any taxes, making the expected tax rate lower than the statutory tax rate.

Gordon, 2007). Instead, countries could limit the deductibility of interest by using thin-capitalization rules, fully eliminating the problem. [20] Additionally, while government's tax revenue has decreased, only one country (Greece) has responded with an increase in its corporate taxes. The relation between government revenue shortfalls and tax rate changes is not positive, let alone dependent on the leverage of firms in the way the reverse causality argument suggests it would be.

4.2.2 Location selection bias

A second concern arises because multinational companies might simultaneously decide on location and the leverage they take up in the country. The location choice may depend on tax rates as well, which would create a bias (Faulkender and Smith, 2014). The problem can be mitigated by estimating all equations in first differences. The change in leverage as a result of changing taxes cannot be influenced by the initial location choice. I conduct further robustness tests in section 6.1. I test whether the observed effects are robust to using the initial weights, rather than the yearly updated weights. This ensures that shifts in the weights due to entry do not affect the results.

While I formally test for entry related endogeneity problems, I take a moment to convince the reader with a logical argument. My argument relies on the nature of the debt shield. The debt shield is a deduction from taxable income based on interest paid on debt. It does not provide a direct benefit to the firm by lowering the tax rate, but indirectly by reducing the taxable income. For a multinational company to benefit from the deduction it first has to have a taxable income to deduct the debt shield from. The multinational company would chose to move its taxable activities to a country where it is costly to conduct these activities, just so it can reduce the unnecessarily high tax bill by shifting debt to the same country. A more logical action would be for the multinational company to simply produce in a low-tax country and not take on debt. Despite this argument I will run the aforementioned weights corrected test to ensure no simultaneity issue drives the result.

4.2.3 Variable weighting

Foreign variables are a weighted average of all the foreign entities of the multinational company. Weighting is necessary as a smaller presence in a country might cause weaker reactions to a tax change than a larger presence. Huizinga et al. (2008) use total assets as a weighting variable, as this follows from their theory. Faulkender and Smith (2014)

[20] Many countries have introduced such rules. The reverse causality argument would imply governments take the most inefficient and naive route to keep fiscal revenues.

use sales. While total assets proxies for size of assets, it does not proxy for the size of the taxable base. On top of that, the dependent variable is leverage, which is defined as debt over total assets. Weighting the independent variables by total assets could create a mechanical correlation which is not necessarily indicative of an actual relation between the dependent and independent variables. For the same reason, using the size of the debt shield as a weighting variable is not satisfactory. So while theoretically total assets would be a logical variable to weight by, econometrically this could bias in favor of finding a result and from an institutional point of view it could bias against finding a result.

On the income statement there are two potential proxies for the actual tax base of an entity. One is profit the other is sales. Profit is closest to actual taxable profit if the taxable profit is the same as accounting profit. However, accounting profits can be negative, creating a negative weight for some countries. Sales, though a crude proxy, is indicative of actual taxable activities in a country. Moreover, it is always positive and does not suffer from any of the problems with creating artificial correlation between the dependent and independent variables. Throughout this paper I use sales as the weighting variable.

5 Results

5.1 Local leverage effects

I start by testing the previously established results from the literature in Table 5. I use Equations 1 and 2. Columns 1 and 2 show the results for the trade-off theory, which predicts a positive effect of taxes on leverage. This is what I find. The coefficient implies that a one standard deviation increase in the corporate tax rate leads to a 0.014 increase in leverage. Huizinga et al. (2008) find a higher effect, but Faccio and Xu (2015) find a lower effect. Furthermore, I find that profitability is one of the major determinants of leverage. A one standard deviation increase in profitability leads to a 0.024 decrease in leverage. Another important determinant is sales, whose coefficient is comparable to those found by Faccio and Xu (2015); Huizinga et al. (2008). Tangibility and sales show the expected positive effect on leverage, while profitability has a negative effect. The macroeconomic variables have a small effect on the results. This might be the result of the fact that most countries are part of the EU, a highly integrated economic area. Year and multinational-country fixed effects are highly significant. The model explains about 77% of the variation in leverage, which is comparable to regressions in Faccio and Xu (2015). Column 2 shows that these results also hold in first differences, which implies that changes in tax rates have a similar effect to level differences in tax rates. This alleviates

endogeneity concerns related to the location choice affecting leverage. The results in the first two columns provide strong evidence for the trade-off theory and provide a baseline for the rest of the paper.

Columns 3 and 4 test the substitution effect. I use the methodology of Huizinga et al. (2008) using the incentive to shift debt, defined as the sales weighted difference between domestic and foreign taxes. I expect to find opposite effects for foreign and domestic control variables. As in Huizinga et al. (2008) I find an effect of the incentive to shift debt on leverage in levels. However, I don't find the effect in first differences. This could indicate that it is important to control for endogeneous entry. Foreign control variables coefficients are barely significant, but show the expected opposite signs of the domestic controls. The R-squared remains similar across specifications.

5.2 Total leverage effects

The results from Table 5 suggest that predictions 1 and 2 hold true and confirm earlier findings in the literature. Next, I turn to the global income effect. My dataset is ideal for investigating the effect as it directly allows me to observe the entire corporate structure.

In columns 1 and 2 of Table 6 I establish that total leverage is indeed affected by total weighted taxes. As before I use level and difference specifications. Total leverage is the leverage of the multinational company as a whole and taxes are once again weighted by the sales in a country. A strong positive coefficient is observed in both levels and first differences. A one standard deviation increase in total taxes leads to a 0.06 increase in total leverage, which is about twice the average effect of domestic tax changes on domestic leverage (0.027).

Total leverage increases as a result of increases in total taxes. However, the global income effect suggests an additional benefit that only groups of companies can obtain. So the increase would have to be bigger than the sum of the local income effects that the entities of the multinational would obtain if they were not part of a multinational group.

To show that this is the case further tests on the global income effect are shown in columns 3 through 6. I include the bottom level and top level tax rates. We expect that the bottom level tax rates have a smaller, possibly negative effect and the higher level rates have a positive effect and that is exactly what I find. Top level tax rates have an almost 50% higher effect. In section 6 I rule out that any of these results are driven by location choice .

Furthermore, it is important to rule out that the effect is caused by the fact that the tax rates in the high hierarchy countries are simply higher. Table 7 Panel A shows that entities at higher levels in the corporate structure indeed have a higher tax rate.

The trade-off theory suggests that at higher tax rates the effects of a change should be lower, due to the fact that the marginal benefit is constant (it is simply the marginal tax rate), while the marginal cost is increasing (as bankruptcy costs are considered convex in leverage). To verify this I show in Table 7 Panel B the different effects of low and high tax rates on domestic leverage. As can be seen the high tax has a negative effect compared to the baseline. The opposite would have to be true for it to explain the effects described in Table 6.

If the local income effect drives the increase in total leverage at different hierarchical levels, the higher tax rates should have a stronger effect on leverage than the low tax rates. As we saw, this is not the case. The substitution effect only substitutes leverage between countries, so it cannot explain the different effects at different levels either.

5.3 Dominance of the effects

Now I turn to establishing when, if ever, the global income effect dominates the substitution effect. This will shed light on the interaction between the various effects and provide heterogeneous policy implications.

We have observed that foreign tax changes lead to a shift towards that country and away from the domestic entity. If there is a global income effect the impact of a foreign tax change should be smaller or even positive if the change occurred in a country where the multinational has an entity high in its structure, whereas it should be negative in other cases. This is due to the fact that the global income effect predicts an increase in overall leverage as a result of an increase in tax rates in countries higher in the hierarchy. The leverage increase can be allocated to any entity in the multinationals structure, resulting in a reduced negative effect of foreign tax changes. So while foreign low-level taxes should show a negative effect on domestic leverage, foreign-high level taxes should show a less negative or even positive effect.

To interpret the results it is important to note that foreign high tax is defined as the high level sales weighted tax rate in a country, while tax difference is defined as the total sales weighted tax rate for the whole multinational. The dominance depends on the weight the foreign entity takes in each of these samples. By definition the weight will be weakly larger for the high level than the total sales weighting. If the coefficient is positive the global income effect can dominate the substitution effect.

Table 8 shows the results on the dominance of the effects. As mentioned before, it is hard to make a prediction on which entities in the structure should benefit more. In columns 4 through 9 I test several predictions based on Graham (2000). The author suggests that the marginal benefit of the tax-shield does not only depend on the tax rate,

but is decreasing in other tax deductible costs and in the expected tax deductibility of the additional interest. Therefore, I test whether the positive effect of a foreign tax change is stronger for entities facing a higher domestic tax rate and which are profitable. I also test if it is weaker for entities with higher depreciation. This is an important non-debt tax shield.

To ensure that the size of the multinationals does not affect the estimation I standardize the depreciation. I take an entities depreciation and subtract the average depreciation for that multinational-year and divide by the standard deviation of depreciation for that multinational-year. This ensures that I capture the effect of being an entity with high non-debt tax shields, compared to the alternatives within the multinational. For the tax rate I take the difference between the domestic tax rate and the average tax rate for the multinational. This captures the benefit compared to the alternatives within the multinational. Profitability is a dummy for whether or not the entity is profitable. The tax deductibility of interest depends on whether or not there is profit to deduct the interest from, not the size of this profit.

The results suggest that the low domestic tax rate entities don't benefit, but the benefit is increasing in the tax rate. The effect of the domestic tax is even negative for tax changes at foreign low level entities. This is indicative of the fact that the entities facing the highest tax rates already have high leverage (as seen in Table 4). We expect that the effect of a foreign change at the low level entities will affect the entities which are not profitable and the benefit of a high level change will accrue to those that are profitable. In columns 6 and 7 we can see that the positive effect of high level entities is completely concentrated in the profitable entities. Similarly, we see that for the low level entities the negative effect is strongly mitigated for the profitable entities, although it does persist. Lastly, we can see that entities with significant non-debt tax shields, in the form of depreciation, show a negative effect. Suggesting that the entities first exhaust non-debt options to reduce taxes. This is exactly what we would expect. Entities with high depreciation are not affected by a foreign tax change at a high level entity, whereas those with low depreciation are.

6 Extensions and robustness

In this section I discuss several extensions and robustness tests.

6.1 Incorporation

One of the main concerns is that companies incorporate in countries with high tax rates to use their debt structure more efficiently. I provided logical arguments against this and

have shown that the results also hold for first differences. First differences are arguably not affected by the concern as the change is not taken into account at the moment of incorporation. An argument can be made that introducing new subsidiaries in a country that one is already established in can be part of a larger strategy of shifting debt to that country. To ensure the results are not driven by endogeneous entry or expansion I follow Faulkender and Smith (2014) and use the initial level of the sales contribution of the subsidiary to the total company to ensure the location choice is not endogenous. Table 10 shows the results are qualitatively unchanged. However, the interaction with the domestic tax rate is considerably stronger. For the lower levels the tax rate even has a negative effect. This could be due to the fact that those low level firms facing high tax rates will already have the higher leverage.

6.2 Tax base changes

A problem pointed out by Kawano and Slemrod (2012) is that many changes in tax rates are associated with changes in the tax base, which can bias results. Generally speaking a decrease in tax rates is accompanied by a broadening of the tax base. This should limit the effects of a tax change on a governments income. More importantly, such a change would mean that companies don't benefit from a decrease in taxes. As the base is broadened taxable income goes up, while tax paid goes down due to the lower rate. The incentive to use debt would go opposite to predictions made by classic trade-off theory. Therefore it biases against finding a result.

Ideally speaking I would also explicitly control for thin-capitalization rules. These rules limit interest deductibility, which likely affects the leverage of high-leverage companies. One could include dummies, a count dummy or a weighted count dummy to take into account the existence of thin-capitalization in multiple countries. However, including dummies by country will not be very informative and will over-fit the model. In addition, a dummy does not capture the differences that exist in these rules across countries. Ignoring these rules would result in underestimating any result as the rules reduce the incentive to act when a tax rate change occurs. I check for large tax changes coinciding with thin-capitalization changes in that country to alleviate concerns related to thin-capitalization rules. I find that Germany changed its thin-capitalization rules and concurrently decreased its tax rate by 10%. Therefore, I formally test if omitting multinational-country-year observations after the change of a thin-capitalization rule changes my results. By excluding observations after a change I ensure that the effect before the change will be captured by the fixed effects. The excluded countries are Belgium after the 2006 introduction of the Notional Interest Deduction, Italy and Germany after the change to their Thin-

capitalization rules in 2008, and Greece and the United Kingdom after the introduction of new Thin-capitalization rules in 2010. In Table 11 we can see that the results are unchanged.

6.3 Weighting

Though the asset weighting structure creates a mechanical correlation between the dependent variable and the variables of interest, there was a good theoretical reason why Huizinga et al. (2008) used assets as a weighting variable. The theoretical model produced these asset weights as a result of optimizing the leverage structure of the whole multinational. To ensure my results do not conflict with this theoretical reasoning I also run the tests using asset weights. The results are unaffected as can be seen in Table 12.

6.4 Agglomeration

As mentioned before, the countries in which holdings are situated differ from those were bottom level subsidiaries are situated. The channel could be that the firms in high-tax countries are substantially different for other reasons than taxes. Here, I investigate the prime reason why they are different.

Baldwin and Krugman (2004) show that countries considered to be core countries can charge higher tax rates than countries in the periphery without losing capital. In section 6.1 we saw that there is selection in high-tax countries, which are also core countries. This is also supported by evidence in panel B of Table 2, which shows that most holdings are located in core countries. The companies higher in the hierarchy are also those in core countries. If core countries have a stronger reaction to domestic tax changes the results in Table 8 could also be explained by this effect. The fact that core countries don't lose their ability to attract capital as a result of high tax rates can lead to two contrary predictions. On the one hand companies could offset the higher tax rate with higher debt, making the core-periphery decision tax neutral. Alternatively the benefits of being located in a core country could simply outweigh the costs and the entity is willing to pay a premium.

To my knowledge the effect of agglomeration on leverage has never been tested. Therefore, I test the effect and run regressions similar to those in Table 5, but I include an interaction between the tax rate and a dummy for core countries. Core countries are defined using lists from Chase-Dunn et al. (2000) and Wallerstein (1976). Regardless of the definition I use, I find a negative effect. This suggests core countries respond less to a domestic tax change. Companies are less reactive in core countries suggesting there are other benefits in these countries that outweigh the cost. However, for it to explain my

results I would require the opposite sign to be observed, as companies in core countries would have to react more strongly.

7 Discussion

Multinationals can shift the location where profits are taxed, or lower their tax base altogether. As a result, governments face declining income due to this tax optimization, calling into question both the fairness and the sustainability of government finance. I have shown that multinationals can reduce their tax bill by shifting their debt to high-tax countries which makes their debt tax shields more valuable as the interest cost is deducted at a higher tax rate. Apart from straining government finances the use of debt-shields can create substantial bankruptcy risks (White House and Treasury, 2012) and otherwise inefficient capital structures are sustained by the tax system.

In recent years the European Union and OECD have launched programs that make the topic of debt shifting especially relevant. The OECD has been on the charge against base erosion by companies in their Base Erosion and Profit Shifting (BEPS) initiative. The European Commission has put forth a new proposal on a Common Consolidated Corporate Tax Base (CCCTB) to reduce the discrepancies between countries, in an effort to curb avoidance behavior.

The OECD has created a guideline for thin-capitalization rules that will not allow the deduction of interest when the interest expenses exceed a certain percentage of the entity's EBIT. This would reduce the problems described in this paper as it ties tax shields to profit rather than capital structure, however it does not affect firms with sufficient profit. The Trump Tax Bill (Tax Cuts and Jobs Act, 2017) includes such a rule. This will mitigate, but not fully overcome the problem of interest based Tax Base Erosion. It will likely increase the importance of profitability and non-debt tax shields for the size of the effect. Making the profitability itself important rather than just a zero-one measure for a firm being profitable, as deductibility is directed linked to the size of the profit.

The CCCTB would reduce exploitable gaps as a result of mismatches in the laws of several countries. However, as shown, it is not only important to ensure that the tax base of countries matches, but also the tax rates. The introduction of a common tax base reduces the ability of countries to compete on the bases of less broad tax bases and only allows competition on tax rates. As can be seen, this still creates substantial spillovers and can create ways for companies to avoid taxes. The limits to interest deduction reduce, but do not eliminate the problem all together.

With companies capable of shifting debt from country to country on a moments notice the need for international cooperation is larger than ever. While the OECD's BEPS

framework and the EC's CCCTB are steps in the right direction, these are still not capable of fully counteracting the effects described in the previous sections. Attempts, by for instance Belgium, to treat equity and debt the same way have so far not curbed the problem, but could be a future solution.

8 Conclusions

In this paper, I investigated the effects of foreign and domestic taxes on leverage. This is an important issue, because finding effects of foreign taxes would imply that multinationals can gain a competitive edge as a result of different tax systems. Furthermore, it increases our understanding of leverage decisions by companies and yield relevant policy implications for governments.

Theory suggests that foreign taxes would have a significantly negative effect on leverage. While domestic taxes would have a significantly positive effect. I confirm these results. However, I also predicted the existence of a global income effect. This effect implies that the increase in total leverage is larger than the sum of the local income effects of the multinational. I find supportive evidence for this effect. I show the group structure of the multinational has a direct effect on whether the global income effect or the substitution effect dominates. The global income effect dominates the substitution effect when foreign high-hierarchical-level entities face a change to their taxes. Moreover, the effect is larger for entities facing high domestic tax rates. It shows that countries should use caution when unilaterally changing tax rates, as there could be spillovers. This is especially the case for countries with many higher level entities within their borders. I showed that the effect is not driven by agglomeration effects. These would work in the opposite direction of my results. The effect can also not be explained by endogenous entry or specific measures targeting leverage.

My results imply that a foreign country increasing its tax rate can not only increase leverage in that country, but also in foreign countries. While the country initiating the tax change may be compensated for the lowered taxable base as a result of the higher tax rate, foreign countries will not. The existence of these spillovers stress the need for further cooperation on the taxation of firms. Recent moves to increase international cooperation only partially address these problems.

Future research will have to show whether these capital structure changes lead to any real investment changes. If no real economic activity changes, then no country benefits. Future research also has to point out whether the effects run mostly through internal or external capital markets.

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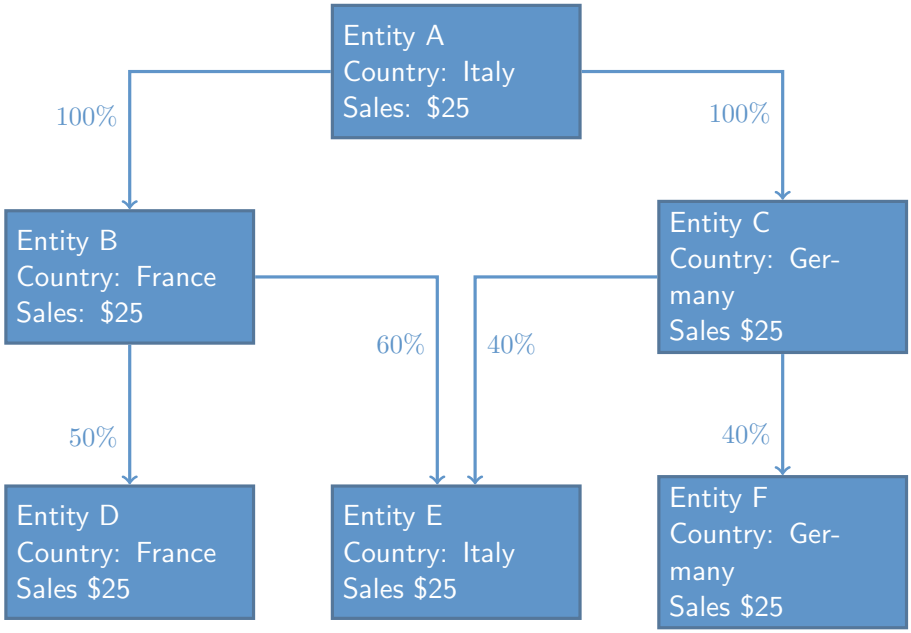
White House and U.S. Treasury (2012), "The president's framework for business tax reform." *White House and U.S. Department of the Treasury, Washington, D.C.*

Appendix

Consider the following corporate structure for the year 2005.



Entity A is considered to be the parent company. The owners can be either natural people or an investment firm. Investment firms, pension funds and natural persons are not considered to be part of the corporate structure of the multinational. These usually provide initial funds but are not expected to be part of the optimization of the corporate debt structure in any other way than as an outside 'bank'. Companies B, C and D are all fully owned by the parent, either directly or indirectly and as such are included as part of the multinational. Entity E is partially owned by B and C. Entity D is a 50% owned subsidiary of entity B and as such is included in the structure. Entity F is partially owned by entity C and is also part of the structure. The corporate structure consists of six entities in a total of four countries. In the dataset they will be observed as follows:

Identifier Number	Year	Sales France	Sales Ger.	Sales Italy
1	2005	$25 + 25 = 50$	$25 + 25 = 50$	$25 + 25 = 50$

As can be seen the information of the two French and the two Italian companies is aggregated into one multinational-country data point. The observation in the above table is a multinational year observation. However, this is not the unit of measurement used in the regressions as no relevant way of determining what to regress on what can be made on the basis of this observation. The regressions use a multinational-country-year observation.

This means:

Id. Nr.	Year	own country	Sales own country	Sales France	Sales Ger.	Sales Italy	Total sales
1	2005	France	50	$25+25=50$	$25+25=50$	$25+25=50$	150
1	2005	Germany	50	$25+25=50$	$25+25=50$	$25+25=50$	150
1	2005	Italy	50	$25+25=50$	$25+25=50$	$25+25=50$	150

As can be seen, each country of the multinational's structure enters into the data as a separate data point. Since changes in foreign entity policy will simultaneously affect the domestic decisions a way of weighting these effects has to be introduced.

So if I now want to see how the leverage reacts to tax in other countries I create a weighted average of the tax rates in the foreign countries. The weights(Wt) are calculated as follows:

Id. Nr.	Year	Own count.	Sales own	Sales Fra.	Wt. Fra.	Sales Ger.	Wt. Ger.	Sales Italy	Wt. Italy	Tot. sales other
1	2005	France	50	50	0	50	$\frac{50}{100}$	50	$\frac{50}{100}$	$50+50=100$
1	2005	Ger.	50	50	$\frac{50}{100}$	50	0	50	$\frac{50}{100}$	$50+50=100$
1	2005	Italy	50	50	$\frac{50}{100}$	50	$\frac{50}{100}$	50	0	$50+50=100$

As can be seen the weight a certain country has depends on the total sales in the countries not being the own country. This dataset lets me not only measure effects of Entity A lending to Entity B and vice versa, but also of Entity B lending to Entity C or Entity A to Entity F. This uses less assumptions about how the firm will structure its internal capital market.

Tables and figures

Figure 1: Multinational corporate structure

An example of a multinational company located in two countries. Entity A is the holding company, so it is part of the top hierarchical level within the multinational company. Entities B and C are the subsidiaries and are part of the lowest hierarchical level.

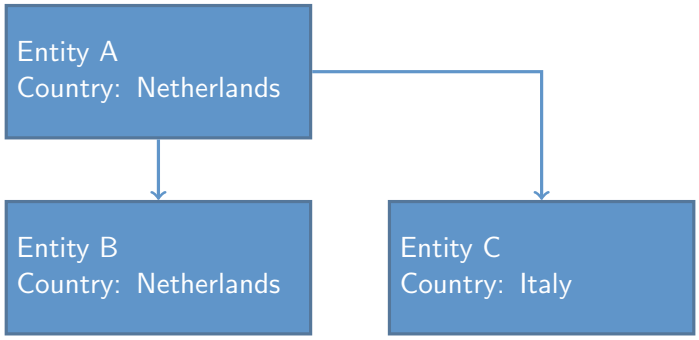


Figure 2: Leverage and tax rates

On the left axis the average tax rate across countries is displayed. On the right axis average leverage is displayed. Leverage has been adjusted for the effect of GDP-growth and interest differences across countries.

Figure 3: Multinational corporate structures

Figure (a) consists of two hierarchical levels, Figure (b) consists of three. The left structure displays a case in which Italy is only present at the lowest hierarchical level. The right structure displays a case in which it is present at both the second and the lowest level within the hierarchy of the multinational company.

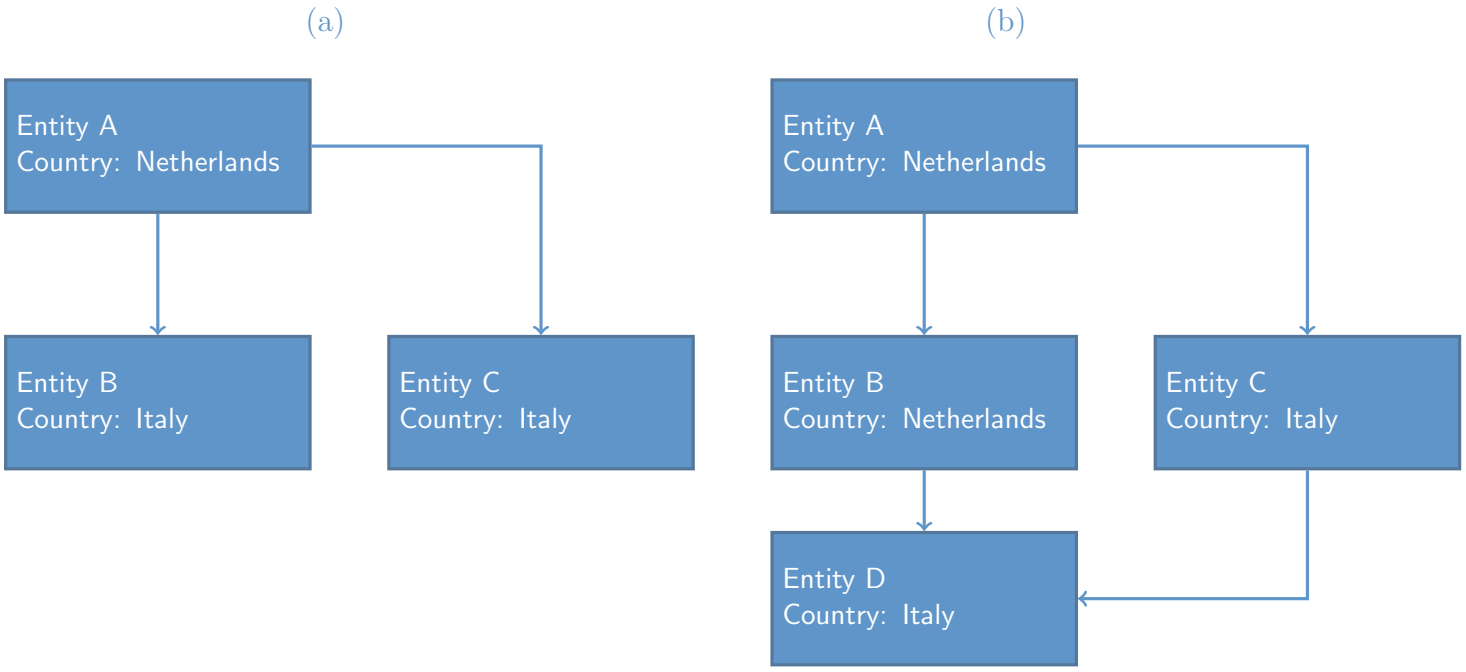


Table 1: Variable definitions

This table provides an overview of the variables used throughout this paper. Accounting data is obtained from the Orbis database, tax information is obtained from Ernst & Young World Wide Corporate Tax Guides. The country level variables are obtained from World Bank Data and Datastream. i indicates the multinational company, c indicates the country and t indicates time.

VARIABLE	DESCRIPTION	SOURCE
$Leverage_{ict}$	Measures the liabilities compared to total assets of the entity. $\frac{\text{non-equity liabilities}_{ict}}{\text{total assets}_{ict}}$	Bureau van Dijk's Orbis Database
Total leverage$_{it}$	$\sum_{c=1}^{N} \frac{\text{non-equity liabilities}_{ict}}{\text{total assets}_{ict}}$	Bureau van Dijk's Orbis Database
$Tangibility_{ict}$	Measures the tangible assets of an entity. Proxies for collateral and financing needs. $\frac{\text{tangible fixed assets}_{ict}}{\text{total assets}_{ict}}$	Bureau van Dijk's Orbis Database
$Depreciation_{ict}$	Measures a companies depreciation normalized by sales. It proxies the size of non-debt tax-shields. $\frac{\text{depreciation}_{ict}}{\text{sales}_{ict}}$	Bureau van Dijk's Orbis Database
Sales$_{ict}$	The log of sales. Proxies for the size of companies. $\ln \text{sales}_{ict}$	Bureau van Dijk's Orbis Database
$Profitability_{ict}$	Measures entity profitability, defined as return on assets. $\frac{\text{EBIT}_{ict}}{\text{total assets}_{ict}}$	Bureau van Dijk's Orbis Database
$Interest_{ct}$	Country level risk free interest rate.	Thomson Reuters Datastream
$GDPgrowth_{ct}$	Annual GDP growth.	World Bank Data
Tax_{ct}	Marginal corporate tax rate.	E&Y Worldwide Corporate Tax Guide
Tax difference$_{ict}$	Weighted domestic tax minus weighted foreign tax. $\text{Tax}_{ct} * \frac{1}{\text{total sales}_{it}} - \sum_{k=1,k\neq c}^{N} \frac{\text{sales}_{ikt}}{\text{total sales}_{it}} * \text{tax}_{kt}$	E&Y Worldwide Corporate Tax Guide
Top levels	Country year observations where the highest level in that country exceeds the average level for the whole multinational. In Figure 3(a) Italy is at the bottom level, while in (b) Italy is at the second level. In both cases Italy is below the average.	Bureau van Dijk's Orbis Database

Table 2: Country and year distribution

Panel A shows the distribution of multinationals by year and number of countries they are located in. Panel B shows where the holding companies and subsidiaries are located

Panel A: Number of countries and year distribution

Number of countries	Observations	Percentage of total	Year	Observations	Percentage of total
2	6,637	54.50%	2005	7,244	16.57%
3	1,811	14.87%	2006	9,562	21.87%
4	953	7.83%	2007	3,136	7.17%
5	588	4.83%	2008	6,468	14.79%
5<countries<=10	1,034	8.49%	2009	7,426	16.98%
11<countries<=15	429	3.52%	2010	5,980	13.68%
16<countries<=20	165	1.35%	2011	3,908	8.94%
countries>20	561	4.61%			
Total	12,178	100%	Total	43,724	100%

Panel B: Country distribution

	Holding companies	Percentage of total holdings	Total companies	Percentage of total companies
Austria	170	1.41%	753	1.72%
Belgium	861	7.07%	2,490	5.69%
Bulgaria	14	0.11%	590	1.35%
Czech Republic	50	0.41%	890	2.04%
Germany	1,002	8.23%	2,518	5.76%
Denmark	439	3.60%	986	2.26%
Estonia	60	0.49%	1,422	3.25%
Spain	2,950	24.22%	5,614	12.84%
Finland	635	5.21%	2,002	4.58%
France	997	8.19%	4,167	9.53%
United Kingdom	294	2.41%	3,081	7.05%
Greece	61	0.50%	695	1.59%
Hungary	27	0.22%	474	1.08%
Ireland	11	0.09%	188	0.43%
Italy	1,877	15.41%	3,803	8.70%
Lithuania	12	0.10%	447	1.02%
Luxembourg	33	0.27%	485	1.11%
Latvia	23	0.19%	389	0.89%
Netherlands	229	1.88%	949	2.17%
Norway	190	1.56%	1,955	4.47%
Poland	33	0.27%	2,047	4.68%
Portugal	184	1.51%	3,112	7.12%
Romania	8	0.07%	1,889	4.32%
Sweden	1,305	10.72%	2,332	5.33%
Slovenia	2	0.02%	53	0.12%
Slovakia	12	0.10%	393	0.90%
Rest of Europe	147	1.21%		
South and Central America	18	0.15%		
Canada	32	0.26%		
United States	495	4.06%		
Russia	7	0.06%		
Total	12,178	100%	43,724	100%

Table 3: Summary statistics

Panel A shows the means, standard deviations and distributional characteristics of the main variables. Variables are defined as in Table 1. All variables are winsorized at the 1% level. Panel B shows the correlations between the main variables. ***, **, and * indicate statistical significance at 1%, 5%, and 10% statistical significance levels, respectively.

Panel A: Summary Statistics

	Mean	Std. dev.	Median	Max	Min	10th perc.	25th perc.	75th perc.	90th perc.
Leverage	0.539	0.254	0.568	0.981	0.010	0.166	0.345	0.741	0.860
Tangibility	0.178	0.220	0.088	0.939	0.000	0.000	0.016	0.262	0.496
Profitability	0.055	0.142	0.039	0.534	-0.549	-0.041	-0.001	0.104	0.211
Depreciation	0.047	0.117	0.007	0.817	0.000	0.000	0.000	0.040	0.120
Sales	9.493	3.677	8.832	18.930	2.303	5.599	6.991	10.984	15.970
Tax rate	0.274	0.061	0.280	0.361	0.100	0.179	0.254	0.325	0.344

Panel B: Correlation

	Leverage	Tangibility	Profitability	Depreciation	Sales	Tax rate
Leverage	1					
Tangibility	0.0472***	1				
Profitability	-0.0869***	-0.0136**	1			
Depreciation	-0.134***	0.220***	-0.169***	1		
Sales	0.260***	0.0999***	0.110***	-0.173***	1	
Tax rate	0.188***	-0.0559***	-0.0623***	-0.0317***	0.122***	1

Table 4: Country-level leverage and tax rates

Leverage and tax are averaged over the companies and years in a country. Values are sorted by leverage from low to high. Variables are defined as in 1. Both leverage and tax are averaged over multinational-country years

	Leverage	Tax
Czech Republic	.339	.204
Poland	.392	.190
Austria	.415	.250
Luxembourg	.419	.237
Slovakia	.421	.190
Hungary	.427	.180
Denmark	.433	.273
Slovenia	.454	.201
Netherlands	.456	.274
Bulgaria	.460	.103
Estonia	.467	.277
Lithuania	.469	.151
Romania	.503	.160
United Kingdom	.507	.290
Latvia	.512	.150
Finland	.522	.260
Ireland	.529	.125
Sweden	.545	.274
Belgium	.550	.340
Spain	.557	.322
France	.557	.346
Germany	.619	.255
Portugal	.584	.262
Norway	.631	.280
Italy	.667	.312
Greece	.668	.259
Total	.539	.274

Table 5: Local leverage effect

This table reports results for regression models 1 and 2. Columns 1 and 2 show the effect of domestic taxes on domestic leverage. Columns 3 and 4 show the effects of foreign taxes on domestic leverage. Colums 2 and 3 are results in first differences. Tax rate is defined as the top statutory tax rate. Foreign taxes are weighted by a countries sales contribution. The tax difference is the weighted difference between domestic and foreign taxes. The other variables are defined as in Table 1. Year and multinational-country fixed effects are included. Standard errors are clustered at the multinational level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% statistical significance levels, respectively.

	(1)	(2)	(3)	(4)
	Leverage	ΔLeverage	Leverage	ΔLeverage
Domestic variables				
Tax rate	0.224**	1.026***	0.171*	0.940***
	(0.098)	(0.205)	(0.099)	(0.213)
Tangibility	0.028**	0.041**	0.029**	0.042**
	(0.012)	(0.017)	(0.012)	(0.018)
Profitability	-0.209***	-0.149***	-0.212***	-0.150***
	(0.011)	(0.021)	(0.011)	(0.021)
Depreciation	-0.073***	-0.092***	-0.073***	-0.091***
	(0.014)	(0.020)	(0.014)	(0.020)
Log sales	0.023***	0.022***	0.023***	0.022***
	(0.001)	(0.001)	(0.001)	(0.001)
GDP growth	0.000	0.000	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Interest rate	-0.004***	-0.013***	-0.005***	-0.013***
	(0.001)	(0.004)	(0.001)	(0.004)
Foreign variables				
Tax difference			0.082***	0.062
			(0.027)	(0.044)
Tangibility			0.000	-0.032**
			(0.011)	(0.016)
Profitability			0.009	0.030
			(0.014)	(0.023)
Depreciation			0.009	0.008
			(0.024)	(0.031)
Sales			-0.002**	-0.002
			(0.001)	(0.001)
GDP growth			0.002**	-0.001
			(0.001)	(0.001)
Interest rates			0.014***	0.003
			(0.002)	(0.003)
Year FE	Yes	Yes	Yes	Yes
Subsidiary FE	Yes	Yes	Yes	Yes
Observations	43,475	12,353	43,473	12,353
R-squared	0.771	0.323	0.772	0.324

Table 6: Total leverage effect

This table reports the results for a regression of total leverage on taxes. The dependent variable in all regressions is the total leverage of the multinational. Columns 2 and 4 show results in first differences. Variables are defined as in Table 1. Year and multinational fixed effects are included. Standard errors are clustered at the multinational level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% statistical significance levels, respectively.

	(1) Total leverage	(2) ΔTotal leverage	(3) Total leverage	(4) ΔTotal leverage
Total tax rate	0.325**	0.569**	0.348***	0.598***
	(0.132)	(0.224)	(0.131)	(0.224)
Bottom levels tax rate			-0.201***	-0.377***
			(0.043)	(0.088)
Tangibility	-0.023	-0.107**	-0.021	-0.105**
	(0.025)	(0.044)	(0.025)	(0.043)
Profitability	-0.299***	-0.346***	-0.302***	-0.344***
	(0.032)	(0.060)	(0.032)	(0.060)
Depreciation	-0.170***	-0.121	-0.180***	-0.142*
	(0.057)	(0.080)	(0.057)	(0.077)
Sales	0.026***	0.024***	0.025***	0.024***
	(0.002)	(0.003)	(0.002)	(0.003)
GDP growth	-0.004***	-0.003	-0.004***	-0.003*
	(0.001)	(0.002)	(0.001)	(0.002)
Interest rate	-0.005	-0.011	-0.004	-0.011
	(0.004)	(0.008)	(0.004)	(0.008)
Year FE	Yes	Yes	Yes	Yes
Multinational FE	Yes	Yes	Yes	Yes
Observations	12,006	2,756	12,006	2,756
R-squared	0.811	0.343	0.812	0.356

Table 7: Non-linear effects

This table presents the results for non-linear effects. Panel A first shows the tax rate for each level. Level 1 indicates the top holding, level 6 is the lowest level. Panel B then shows that the effect of high and low tax rates on domestic leverage. High tax is a dummy for the 10% highest tax rates faced by the multinational interacted with the tax rate, Low tax is similarly defined for the lowest 10%. Year and multinational-country fixed effects are included. Standard errors are clustered at the multinational level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% statistical significance levels, respectively.

Panel A: Average tax rate per level	
Level	Tax rate
1	0.293
2	0.282
3	0.261
4	0.262
5	0.261
6	0.257

Panel B: Non-linear effects			
	(1)	(2)	(3)
	Leverage	Leverage	Leverage
High tax	-0.137***		-0.136***
	(0.023)		(0.023)
Low tax		0.253	0.247
		(0.161)	(0.161)
Entity controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Multinational FE	Yes	Yes	Yes
Observations	40,951	40,951	40,951
R-squared	0.775	0.774	0.775

Table 8: Dominance of effects

This table presents the results for correlary 2. The dependent variable in all regressions is the local leverage. Variables are defined as in Table 1. Columns 3 and 4 use an interaction with the standardized tax difference for the multinational, defined as the domestic tax rate minus the average tax rate for the multinational divided by the standard deviation of the tax rate. Columns 5 and 6 use an interaction with a dummy for profitability. Columns 7 and 8 use an interaction with the standardized depreciation difference, defined similarly to the standardized tax difference, but using depreciation in Euros. Standard errors are clustered at the multinational level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% statistical significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Leverage	Leverage	Leverage	Leverage	Leverage	Leverage	Leverage	Leverage
Foreign high	0.019*		0.021**		-0.026		0.026**	
levels tax	(0.010)		(0.010)		(0.018)		(0.011)	
Foreign low		-0.049***		-0.050***		-0.108***		-0.049***
levels tax		(0.015)		(0.015)		(0.026)		(0.016)
High levels interacted			0.711***					
with domestic tax			(0.207)					
Low levels interacted				-0.418				
with domestic tax				(0.268)				
High levels interacted					0.056***			
with domestic profitable					(0.018)			
Low levels interacted						0.075***		
with domestic profitable						(0.025)		
High levels interacted							-0.024***	
with domestic depreciation							(0.009)	
Low levels interacted								-0.001
with domestic depreciation								(0.011)
Domestic tax rate	0.168*	0.171*	0.084	0.215**	0.155	0.165*	0.213**	0.187*
	(0.099)	(0.098)	(0.105)	(0.102)	(0.099)	(0.099)	(0.106)	(0.104)
Tax difference	0.085***	0.081***	0.084***	0.081***	0.084***	0.084***	0.094***	0.079***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.030)	(0.030)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsidiary FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43,473	43,473	43,473	43,473	43,473	43,473	34,796	34,796
R-squared	0.772	0.772	0.772	0.772	0.772	0.772	0.740	0.740

Table 9: Local leverage and agglomeration effects

This table is similar to Table 5, but contains an interaction for the country being a core or periphery country. Columns 1 and 2 use the Chase-Dunn et al. (2000) definition of a core country. Columns 3 and 4 use the Wallerstein (1976) definition. The dependent variable in all regressions is the local leverage of the subsidiary. Tax rate is defined as the weighted average marginal tax rate. The core country dummy is equal to 1 if a country is considered a core country. Control variables are defined as in Table 1. Year and multinational-country fixed effects are included. Standard errors are clustered at the multinational level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% statistical significance levels, respectively.

	(1) Leverage	(2) Leverage	(3) Leverage	(4) Leverage
Domestic				
Domestic tax rate	1.207***	1.077***	0.959***	0.924***
	(0.257)	(0.258)	(0.147)	(0.146)
Core country	-1.160***	-1.072***	-1.283***	-1.298***
interacted with tax	(0.284)	(0.284)	(0.183)	(0.184)
Tangibility	0.028**	0.029**	0.027**	0.028**
	(0.012)	(0.012)	(0.012)	(0.012)
Profitability	-0.209***	-0.212***	-0.206***	-0.209***
	(0.011)	(0.011)	(0.011)	(0.011)
Depreciation	-0.073***	-0.073***	-0.070***	-0.070***
	(0.014)	(0.014)	(0.013)	(0.014)
Sales	0.023***	0.023***	0.023***	0.023***
	(0.001)	(0.001)	(0.001)	(0.001)
GDP growth	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Interest rate	-0.002	-0.003**	-0.002	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
Foreign				
Tax difference		0.087***		0.070**
		(0.027)		(0.027)
Tangibility		0.000		0.000
		(0.011)		(0.011)
Profitability		0.008		0.006
		(0.014)		(0.014)
Depreciation		0.006		0.005
		(0.024)		(0.024)
Sales		-0.002**		-0.002***
		(0.001)		(0.001)
GDP growth		0.002**		0.002**
		(0.001)		(0.001)
Interest rates		0.014***		0.014***
		(0.002)		(0.002)
Year FE	Yes	Yes	Yes	Yes
Subsidiary FE	Yes	Yes	Yes	Yes
Observations	43,475	43,473	43,475	43,473
R-squared	0.771	0.772	0.772	0.773

Table 10: Dominance of effects - Weights robust

This table shows the same regressions as columns 4 through 9 of Table 8, but using the weights at the first observation. The dependent variable in all regressions is the local leverage. Variables are defined as in table 1. Columns 1 and 2 use an interaction with the standardized tax difference for the multinational, defined as the domestic tax rate minus the average tax rate for the multinational divided by the standard deviation of the tax rate. Columns 3 and 4 use an interaction with a dummy for profitability. Columns 5 and 6 use an interaction with the standardized depreciation difference, defined similarly to the standardized tax difference, but using depreciation in Euros. Standard errors are clustered at the multinational level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% statistical significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Leverage	Leverage	Leverage	Leverage	Leverage	Leverage
Top levels	0.019*		-0.032*		0.025**	
tax rate	(0.010)		(0.018)		(0.011)	
Bottom levels		-0.025**		-0.068***		-0.021*
tax rate		(0.011)		(0.021)		(0.012)
High levels interacted	0.636***					
with domestic tax	(0.209)					
Low levels interacted		-0.888***				
with domestic tax		(0.207)				
High levels interacted			0.061***			
with domestic profitable			(0.018)			
Low levels interacted				0.058***		
with domestic profitable				(0.021)		
High levels interacted					-0.028***	
with domestic depreciation					(0.009)	
Low levels interacted						-0.020**
with domestic depreciation						(0.009)
Domestic tax rate	0.137	0.321***	0.197**	0.218**	0.255**	0.236**
	(0.103)	(0.100)	(0.097)	(0.097)	(0.106)	(0.104)
Tax difference	0.121***	0.090***	0.120***	0.096***	0.148***	0.118***
	(0.027)	(0.028)	(0.027)	(0.028)	(0.031)	(0.032)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Subsidiary FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43,303	43,303	43,303	43,303	34,677	34,677
R-squared	0.772	0.772	0.772	0.772	0.739	0.739

Table 11: Dominance of effects - Thin-capitalization robust

This table shows the same regressions as Table 10, but excluding all observations after the introduction or change of thin-capitalization rules in that country. The dependent variable in all regressions is the local leverage. Variables are defined as in table 1. Columns 1 and 2 use an interaction with the standardized tax difference for the multinational, defined as the domestic tax rate minus the average tax rate for the multinational divided by the standard deviation of the tax rate. Columns 3 and 4 use an interaction with a dummy for profitability. Columns 5 and 6 use an interaction with the standardized depreciation difference, defined similarly to the standardized tax difference, but using depreciation in Euros. Standard errors are clustered at the multinational level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% statistical significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Leverage	Leverage	Leverage	Leverage	Leverage	Leverage
Top levels	0.018*		-0.032*		0.024**	
tax rate	(0.010)		(0.018)		(0.011)	
Bottom levels		-0.025**		-0.068***		-0.022*
tax rate		(0.011)		(0.021)		(0.012)
High levels interacted	0.643***					
with domestic tax	(0.210)					
Low levels interacted		-0.889***				
with domestic tax		(0.207)				
High levels interacted			0.060***			
with domestic profitable			(0.018)			
Low levels interacted				0.057***		
with domestic profitable				(0.021)		
High levels interacted					-0.029***	
with domestic depreciation					(0.009)	
Low levels interacted						-0.021**
with domestic depreciation						(0.009)
Domestic tax rate	0.134	0.319***	0.195**	0.216**	0.253**	0.234**
	(0.103)	(0.100)	(0.097)	(0.097)	(0.106)	(0.104)
Tax difference	0.118***	0.086***	0.116***	0.092***	0.144***	0.113***
	(0.027)	(0.028)	(0.027)	(0.028)	(0.031)	(0.032)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Subsidiary FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43,208	43,208	43,208	43,208	34,584	34,584

Table 12: Dominance of effects - Asset weighting robust

This table shows the same regressions as Table 10, but using the weights based on total assets. The dependent variable in all regressions is the local leverage. Variables are defined as in table 1. Columns 1 and 2 use an interaction with the standardized tax difference for the multinational, defined as the domestic tax rate minus the average tax rate for the multinational divided by the standard deviation of the tax rate. Columns 3 and 4 use an interaction with a dummy for profitability. Columns 5 and 6 use an interaction with the standardized depreciation difference, defined similarly to the standardized tax difference, but using depreciation in Euros. Standard errors are clustered at the multinational level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% statistical significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Leverage	Leverage	Leverage	Leverage	Leverage	Leverage
Top levels	0.019*		-0.032*		0.025**	
tax rate	(0.010)		(0.018)		(0.011)	
Bottom levels		-0.025**		-0.068***		-0.021*
tax rate		(0.011)		(0.021)		(0.012)
High levels interacted	0.636***					
with domestic tax	(0.209)					
Low levels interacted		-0.888***				
with domestic tax		(0.207)				
High levels interacted			0.061***			
with domestic profitable			(0.018)			
Low levels interacted				0.058***		
with domestic profitable				(0.021)		
High levels interacted					-0.028***	
with domestic depreciation					(0.009)	
Low levels interacted						-0.020**
with domestic depreciation						(0.009)
Domestic tax rate	0.137	0.321***	0.197**	0.218**	0.255**	0.236**
	(0.103)	(0.100)	(0.097)	(0.097)	(0.106)	(0.104)
Tax difference	0.121***	0.090***	0.120***	0.096***	0.148***	0.118***
	(0.027)	(0.028)	(0.027)	(0.028)	(0.031)	(0.032)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Subsidiary FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43,303	43,303	43,303	43,303	34,677	34,677
R-squared	0.772	0.772	0.772	0.772	0.739	0.739