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The Effect from Loss Anticipation on Debt Shifting

Empirical Evidence from European Multinational Corporations

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Abstract

This thesis examines whether multinational companies consider the anticipation of losses when deciding upon their optimal capital structure and debt shifting strategies. It is important to understand how capital is optimally allocated since multinationals want to minimize their tax payments and tax authorities want to reduce the amount of tax avoidance. Several papers have studied debt shifting as an instrument to minimize tax payments. However, debt shifting strategies in loss-making affiliates have largely been ignored by both academics and policymakers. To study if loss anticipation matters for firms' capital structure, we adjust the model for optimal capital structure of a multinational firm proposed by Møen, Schindler, Schjelderup, and Tropina (2011), for a loss probability variable introduced in Hopland, Lisowsky, Mardan, and Schindler (2015). Our model contains three tax mechanisms and assumes inflexibility of firms to adjust their capital structure, meaning that they have to decide on their debt shifting strategies ex-ante (before financial outcomes are known). The model predicts that adjusting for loss probabilities should reduce the effect the tax mechanisms have on the total debt-to-asset ratio of an affiliate. The predictions of our model are then tested on a data sample of majority-owned affiliates of European multinationals over the time period (2004-2014). Our empirical results suggest that the standard debt tax shield is reduced when firms consider the likelihood of experiencing losses. Furthermore, we find no evidence of internal debt shifting, while external debt shifting increase. Our results show a substantial change in tax effects from including the loss probability in our regressions, indicating that anticipation of losses does matter when firms have to decide on their debt shifting strategies ex-ante.

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1. Introduction

Differences in corporate income tax systems across countries give rise to international tax planning or tax avoidance by multinational companies (hereafter MNCs) in order to minimize tax payments. Tax avoidance by income shifting between MNCs' affiliates has in recent years become a hotly debated topic amongst policymakers and academics (Hopland, Lisowsky, Mardan, & Schindler, 2015, p. 1). The issue poses a grey area where what firms consider legal tax planning, tax authorities may see as tax evasion. A growing concern is that governments lose substantial corporate tax revenues due to aggressive tax planning by MNCs aimed at shifting debt from affiliates in low-tax countries to affiliates located in high-tax countries. The Organization for Economic Co-operation and Development (hereafter OECD) states that "at stake is the integrity of the corporate income tax" in their report "Base Erosion and Profit Shifting" (OECD, 2013a, p. 8). Abusive transfer pricing and debt shifting are identified as the two major reasons for the tax revenue drain in high-tax countries. Both instruments are important and well-studied topics in academic literature (Hopland et al. 2015, p. 1).[1]

The main advantage of debt financing is that interest expenses are deductible for corporate tax purposes while dividends must be paid out of net-of-tax corporate income (Huizinga, Laeven, & Nicodeme, 2008, p. 81). Consequently, most tax systems favor debt financing over equity, depending on the dispersion in statutory tax rates. Domestic firms only consider the domestic tax system, while MNCs have the opportunity to exploit the debt tax shield more aggressively, as it can allocate debt between affiliates in different countries. Hence, the financial structure of an MNC is expected to reflect the tax systems of all its affiliates worldwide.

For multinationals, the use of international debt shifting as part of their financial strategy has recently been established in a string of papers. Huizinga et al. (2008) model the optimal allocation of external debt, and show that external debt shifting matters when a holding company guarantees to bail out affiliates in financial distress. Egger, Eggert, Keuschnigg, & Winner (2010) develop a theoretical model for internal debt shifting. Their results show that

[1] See Gresik (2001), Shackelford & Shevlin (2001), Göx & Schiller (2006), Hanlon & Heitzman (2010), and Mintz & Weichenrieder (2010) for a general overview of the topic.

multinationals have a significantly higher debt-to-asset ratio than purely domestic firms, and that this difference is larger in countries with higher corporate taxes. Both Huizinga et al. (2008) and Egger et al. (2010) base their empirical analysis on variation in total debt, namely the sum of internal and external debt. Møen, Schindler, Schjelderup, & Tropina (2011) were the first to show that it is optimal for MNCs to use both internal and external debt shifting to minimize global taxes. However, debt shifting strategies in MNCs with affiliates that incur losses have largely been ignored by both academics and policymakers.

Klassen, Lang, & Wolfson (1993) study American affiliates with net operating losses and argue that there is an incentive to shift income into such affiliates. However, the authors do not test for loss-making affiliates in their main sample. Furthermore, Gramlich, Limpaphayom, & Ghon Rhee (2004) and Onji & Vera (2010) analyze how domestic Japanese trusts shift income. Their results suggest that net operating losses in some Japanese affiliates are balanced by distributing in income from other Japanese affiliates (p. 28). Moreover, Büttner, Overesch, & Wamser (2011) analyze how corporate taxation affects the capital structure of subsidiaries belonging to German MNCs. Their results show that the loss probability significantly reduces the tax rate sensitivity of the debt-to-asset ratio (p. 118). However, the authors only look at how the standard debt tax shield affects the debt-to-asset ratio of affiliates considering losses, and do not include the international debt shifting mechanisms (internal and external debt shifting).

These studies do not consider the degree of intra-temporal flexibility available to MNCs to adjust their debt-shifting strategies in response to losses. The flexibility may be limited, because using debt shifting mechanisms can interfere with internal incentive systems for local management, lead to other transaction costs and alert tax authorities of suspicious activity (Hopland, Lisowsky, Mardan, & Schindler, 2014, p. 1). When MNCs are faced with inflexibility, they must decide on and commit to their debt-shifting strategies before observing financial performance outcomes for the year. This is referred to as ex-ante debt shifting. Moreover, previous studies on loss affiliates do not consider the specific debt mechanisms underlying the flexibility (internal and external debt) to shift debt when experiencing losses.

Hopland et al. (2015) are the first to study the flexibility of MNCs to adjust their income-shifting strategies using transfer pricing and internal debt during the tax year to react to losses. The authors develop a theoretical model where under full flexibility, MNCs can

adjust their capital structure between affiliates within the tax year. We refer to this term as ex-post debt shifting (pp. 2-3). In contrast, when faced with inflexibility, MNCs have to decide on their capital structure before output prices are realized, and cannot alter the decision later. Thus, the MNCs will be more conservative when allocating debt, and will only shift income to the financial coordination center if the producing affiliates obtain taxable income. Therefore, it is the expected tax rate, as opposed to the statutory tax rate, of an affiliate that matters when determining internal and external debt shifting ex-ante (p. 11). The authors find empirical evidence that under losses, transfer pricing provides flexibility to adjust income shifting ex-post, while they do not find evidence of flexibility in the use of internal debt to shift income ex-post. Consequently, internal debt shifting features inflexibility and must be decided ex-ante.

Based on this recent research, we try to do the next step and bring the implications of inflexibility and loss anticipation to the empirical test. Thus, our research question is:

Does the anticipation of losses impact European multinationals' capital structure and debt shifting strategies?

Our thesis contributes to existing literature in several ways. Firstly, there is a lack of literature that examines the anticipation of losses. Huizinga et al. (2008), Egger et al. (2010) and Møen et al. (2011) do not consider the probability of incurring a loss in their theoretical model of the optimal capital structure of MNCs. They also assume full flexibility for firms to decide on their debt shifting strategies ex-post. Hopland et al. (2015) adjust for loss probabilities and establish that internal debt shifting features inflexibility and must be decided ex-ante. However, they assume that there are no external capital markets for debt available, and their dataset does not allow testing for tax sensitivities either. Thus, our thesis contributes to existing literature by adjusting the model featuring the optimal capital structure of an MNC for the loss probability of each affiliate. Based on this, we investigate how inflexibility and loss anticipation affect the three tax mechanisms MNCs can use.

To answer the research question and address existing gaps in the academic literature, we set up a model that allows us to analyze the impact of loss anticipation, both theoretically and empirically, based on the inflexibility assumption from Hopland et al. (2015). We use the theoretical model proposed by Møen et al. (2011), which features the optimal capital structure of an MNC, accounting for costs and benefits of both internal and external debt

(pp. 8-14). According to the model, there exist three tax mechanisms that MNCs can use to minimize taxes: the standard debt tax shield (based on the statutory tax rate), external and internal debt shifting mechanisms, representing the international debt shifting mechanisms (Møen et al., 2011, pp. 2-3). External debt shifting, or the weighted tax difference is defined as the sum of asset-weighted differences between the host country tax rate and tax rates of other affiliates within the multinational group. Internal debt shifting or the maximum tax difference is defined as the difference between the host country tax rate and the tax rate of the lowest-taxed affiliate within the multinational group. We adjust the three tax mechanisms in the model for the loss probability variable introduced in Hopland et al. (2015, pp. 10-11) and Hopland et al. (2014, pp. 13-14). This leads to an expected tax rate (as opposed to the statutory tax rate of the producing affiliate) that matters for determining tax savings ex-ante.

The theoretical model predicts that the loss probability will have a negative effect on the standard debt tax shield as it reduces the tax rate faced by the affiliate, thus making it less attractive to hold debt for MNCs that have to decide on their capital structure ex-ante. Furthermore, the model predicts that external debt shifting will be reduced when affiliates consider the loss probability when choosing their external debt shifting strategies ex-ante. The loss probability will reduce the expected tax rate faced by affiliate i, thus making it more attractive to shift external debt out of this affiliate and into another affiliate j. Increased usage of debt in one affiliate will lead to increased bankruptcy risk for the whole group, thus discouraging debt financing in all other affiliates. In addition, the model predicts that affiliates will shift less internal debt when considering the probability of incurring losses, since the maximum tax difference variable decreases. These three predictions combined implies that, compared to previous studies that ignore loss probabilities, inflexible MNCs have reduced ability to adjust their debt shifting strategies in response to losses and reduce their indebtedness based on the loss anticipation. Standard models attribute debt shifting to the differential in actual statutory tax rates, and assume that the probability of incurring a loss is zero. This results in higher corporate tax rates compared to MNCs that react on the smaller differential of the expected statutory tax rates. The predicted debt-to-asset ratio of MNCs in empirical studies that do not consider the loss probability will thus be higher.

The adjusted model is tested on a data sample of majority-owned affiliates of European MNCs. The data is obtained from merging information on historical ownership structures from the Orbis database with financial data from the Amadeus database over the sample

period (2004-2014). The dependent variable in all regressions is the total debt-to-asset ratio of an affiliate. We also include industry and parent (group) fixed effects and year dummies in our model. To reduce potential omitted variable bias, we add firm-level and country-level control variables.

For the analysis, we construct interaction terms between the three regular tax mechanisms and the loss probability to isolate the effect the loss probability has on the different tax mechanisms, and compare by how much the mechanisms change when including the interaction terms. The results show that the domestic interaction term, between the regular statutory tax rate and the loss probability $[H(p_i^0)t_i]$, has a significantly negative effect on an affiliate's leverage. This is caused by a higher expectation of ending up with losses and thus being unable to exploit the standard debt tax shield, which ultimately decreases the incentive of using debt. Thus, the domestic loss expectation reduces the effect from the statutory tax rate on the use of debt, and the tax sensitivity.

The foreign interaction term, between the weighted tax difference and the loss probability $\left[\sum_{j\neq i}\rho_j t_j H(p_j^0)\right]$, is positive and statistically significant. Compared to the results before adjusting for the loss probability, we see that studying the foreign interaction term and the weighted tax difference jointly, increases the use of debt substantially in affiliate i as higher loss expectations in other affiliates reduce tax savings in these affiliates. The internal bank interaction and the maximum tax difference variable are both statistically insignificant and close to zero. The internal bank interaction is defined as $H(p_1^0)t_1$, where t_1 is denoted as the statutory tax rate of the internal bank. According to our model, the internal bank does not experience losses as it receives all the income from other affiliates in the multinational group. Accordingly, $H(p_1^0)$ equals zero, and the interaction term should be insignificant and close to zero, which is exactly what we find. Based on these results, the tax sensitivity of the maximum tax difference is significantly reduced. Our results are different from the findings by Møen et al. (2011, p. 24), who find a statistically significant coefficient of 0.120.

Based on the results presented above, our main findings indicate that MNCs do consider the probability of incurring a loss in the coming year when they have to decide on their debt shifting strategies ex-ante as all tax mechanisms are affected substantially by adjusting for the loss probability. Moreover, our empirical analysis of the interaction terms supports the predictions that follow from the theoretical model. However, we would expect the coefficients for the tax mechanisms to increase more after adjusting for the loss probability

than what we find. Thus, these findings are not in line with theory, suggesting that our model does not capture all relevant factors that may affect an affiliate's capital structure.

Several tests have been used to control for the robustness of our results. Firstly, to examine whether the effect from the interaction terms on the tax mechanisms is different for firms with intermediate loss probabilities, we run regressions on a subsample of affiliates with loss probability between 20 and 80 percent. The estimated coefficients on the tax mechanisms change for affiliates with an intermediate loss probability, where the statutory tax rate increases and remains statistically significant, the weighted tax difference turns negative and becomes insignificant and the maximum tax difference increases and becomes statistically significant. The only interaction term that has a noticeable change is the domestic interaction term, which remains significant and decreases. However, as more than 70 percent of the observations in the data sample are excluded when examining intermediate loss probabilities, we exert caution in interpreting these results.

Furthermore, we study if affiliates in loss positions act differently compared to profitable affiliates in terms of debt shifting strategies when considering their anticipation of losses. The results show that profitable firms reduce their total debt-to-asset-ratio less compared to the main data sample. An explanation might be that profitable firms face a lower loss probability, and thus have less incentive to reduce their debt usage. However, profitable firms seem to reduce their leverage, which suggests that the approach proposed in Klassen et al. (1993), where loss-making affiliates are excluded in the analysis, is invalid.

Thereafter, we examine whether purely domestic firms consider the anticipation of losses when deciding on their capital structure. By comparing the obtained results from domestic firms and MNCs after the loss probability adjustment, we find that while the coefficient of the statutory tax rate is positive for MNCs, domestic firms have a negative coefficient. The effect from the domestic interaction term is also different, as domestic firms have a positive coefficient of 0.209, while MNCs have a negative coefficient of -0.294. Hence, indicating that the total effect from the statutory tax rate and the domestic interaction term is positive for domestic firms. This suggests that an increase in the statutory tax rate will lead to an increased total debt-to-asset ratio for domestic firms, due to the standard debt tax shield.

Moreover, we study if firms respond differently to the loss probability adjustment, when having loss carryforwards. Our findings show that the effect from both the statutory tax rate

and the domestic interaction terms are insignificant. Affiliates with loss carryforwards can deduct the carryforwards from their taxes, thus reducing the effective statutory tax rate faced by these affiliates. The effect from the weighted tax difference variable turns statistically insignificant, while the coefficient for the foreign interaction term is reduced, but remains statistically significant. The affiliates will thus still shift some external debt. Furthermore, both the maximum tax difference and the internal bank interaction term remain statistically insignificant.

Lastly, we divide our data sample into large and small MNCs to examine whether differently-sized MNCs react differently to the tax mechanisms when adjusting for the loss probability. The results show that large MNCs are more responsive to changes in the external debt shifting mechanism than small MNCs. This can be explained by potentially large fixed costs associated with international debt shifting activities. The maximum tax difference and the internal bank interaction are statistically insignificant for all sizes of MNCs, supporting our main findings of no internal debt shifting when firms anticipate losses ex-ante.

The thesis is organized into eight parts and proceeds as follows: Section 2 reviews existing literature. Debt shifting and loss anticipation in theory are presented in Section 3, which also includes deduction of the theoretical model. Section 4 contains data and descriptive statistics, while the empirical strategy is presented in section 5. Thereafter, in Section 6, we display and analyze the obtained empirical results. Various samples and specification choices of the main results are examined in robustness tests in Section 7. Section 8 offers concluding remarks.

2. Literature review

Modigliani & Miller (1958) were the first to acknowledge the advantages of debt compared to equity. Their study establishes that when interest expenses on debt are tax deductible, firms' value increases with leverage. Despite highlighting the importance of tax's impact on firms' optimal capital structure, there has been limited empirical literature on different capital structures until the early 2000s. The study by Rajan & Zingales (1995) was one of the first to show that tax policies influence corporate debt structures. The authors use a dataset on internal debt positions of multinationals in seven countries, allowing for international variation in tax rates.

There are several studies demonstrating that taxes influence leverage decisions of MNCs. Aivazian, Demirgüc-Kunt, & Maksimovic (2001) use a dataset on ten developing countries and find a small impact on leverage from the tax variable used to measure the tax shield of debt financing. The study by Mills & Newberry (2004) finds evidence that non-U.S. multinationals from countries with relatively low average tax rates have more indebted foreign controlled corporations in the U.S. than firms with high average foreign tax rates. Ramb & Weichenrieder (2005) show that tax rate differentials impact the use of internal loans in the financing of foreign affiliates operating in Germany. Arena & Roper (2010) use a dataset on companies headquartered in 23 countries and find evidence that differences in international tax rates and tax regimes affect the location of multinational firms' debt. Their analysis shows that differences in personal and corporate tax rates, the presence of relief tax systems, the tax treatment of repatriated profits, and inter-country withholding taxes on dividends and interest significantly have an impact when deciding where to locate external debt and the proportion of debt located abroad (p. 637). Moreover, they find evidence that multinational corporations issue larger amounts of debt through subsidiaries operating in countries with a relatively greater tax advantage of debt than other affiliates.

Furthermore, several empirical studies quantify how changes in tax rates affect multinational corporations' leverage decisions. Using data on Italian companies, Alworth & Arachi (2001) find evidence that both corporate and personal income tax rates influence firms' debt level. Their results show that increasing the marginal corporate tax rate by 100 basis points leads to an increase in the ratio of growth of total debt to total assets by approximately 8 basis points (p. 375). Altshuler & Grubert (2003) provide evidence that foreign affiliates of U.S.

multinational firms in high-tax countries have a larger amount of debt than affiliates in low-tax countries. Furthermore, their results show that an increase in the foreign statutory tax rate by 1 percentage point is associated with an increase of approximately 0.4 percentage points in the total debt-to-asset ratio of the affiliate.[2] Desai, Foley, & Hines (2004) analyze the capital structure of U.S. multinational corporations. They find that a 10 percent increase in the corporate tax rate leads to a 2.8 percent increase in the debt-to-asset ratio of the affiliate experiencing a higher tax rate, with internal borrowing being particularly sensitive to taxes. The elasticity associated with the use of external debt with respect to the corporate tax rate is 0.19, while the tax elasticity of internal debt is 0.35 (p. 2452). Moore & Ruane (2005) examine the leverage of 8,500 subsidiaries within the EU. Their results suggest that leverage ratios of these subsidiaries are sensitive to the local corporate tax rate, unless there is a tax credit system in the home country. Specifically, they find that a 10 percent increase in the corporate tax rate leads to a 3.5 percent increase in subsidiary debt-to-asset ratios.

All the studies above provide evidence that financial structures of multinational companies comply with the purpose of tax minimization. However, empirical literature examining whether and to what extent debt is used for profit shifting is not very broad. It is well known that the standard debt tax shield is a key driver of the capital structure for both domestic and multinational companies. Several papers have also documented that multinational firms use international debt shifting (utilizing the internal and external debt shifting mechanisms) as part of their financial strategy, but disagree on to what extent the mechanisms are used.

Mintz & Smart (2004) were one of the first to study profit shifting of MNCs. They examine corporate income taxation when multinational firms can shift income by lending between affiliates operating in different jurisdictions. As pointed out by the authors, multinational firms should borrow in high-tax jurisdictions and declare interest income in low-tax countries to maximize the value of the tax deductible interest and minimize taxes paid on interest income within the group. This way, tax savings arising from deductions in high-tax

[2] Also see Hines & Hubbard (1990), Collins & Shackelford (1992), Froot & Hines (1994), and Grubert (1998) for more evidence that multinational firms' financial structure and the pattern of intra-firm interests are consistent with tax minimization goals.

countries will exceed the corresponding tax payments in low-tax countries. Debt shifting thus reduces the global tax bill. Their model is tested on Canadian data, and the findings support the hypothesis that this type of income shifting influences provincial tax bases. According to their estimates, the elasticity of taxable income with respect to taxes is 4.9 for firms engaging in income shifting, while the elasticity for comparable firms that do not shift income is 2.3 (p. 1163).

Findings by Büttner & Wamser (2009) conform to the study by Mintz & Smart (2004). Using a dataset on German multinational companies over ten years, the authors analyze internal debt as a mechanism for shifting profits to low-tax countries. Their findings show that differences in tax rates of affiliates located in different jurisdictions have a robust impact on the use of internal debt. Multinationals with affiliates in low-tax countries will increase their use of internal debt when the difference between the host country tax rate and tax rate faced by the lowest taxed affiliate increases. Still, the estimated effects are rather small. The authors attribute this to the fact that German firms do not actively engage in internal debt shifting, which is partly due to German controlled foreign corporation rules.

Egger et al. (2010) model debt shifting by the use of internal debt, and compare the debt-to-asset ratios of domestic and foreign-owned plants. The authors set up a model where domestic firms can choose to become a multinational firm and allocate debt between affiliates to be able to save tax payments. They estimate the average difference between a foreign and a domestically owned firm's debt ratio, using a dataset on 32,067 European firms. Their results show that foreign-owned firms on average exhibit a significantly higher debt ratio than domestically owned firms in the host country. Furthermore, the difference in debt ratio increases with the host country's statutory tax rate. The data used by Egger et al. (2010) does not contain data on internal debt on firm level, nor the overall ownership structures of multinational firms. Instead, they use total debt in their empirical analysis. In addition, the authors do not include overall bankruptcy costs on parent level in their analysis. They also omit the external debt mechanism.

Our study is similar to Huizinga et al. (2008) and Møen et al. (2011). Huizinga et al. (2008) were the first to examine the optimal allocation of external debt. The study introduces a model featuring a multinational firm's optimal external leverage allocation in response to international taxation. The authors use a data sample obtained from the Amadeus database on the financial structure of domestic and multinational firms operating in 32 European

countries, considering both the parent company and their subsidiaries. They also take into consideration tax systems of all the countries where the multinational firms operate, and assume that the parent firm provides credit guarantees for the debt of all its affiliates. This assumption implies that a change in tax policy optimally causes the firm to rearrange its external leverage in all the countries where it operates. Specifically, an increase in the corporate tax rate in one country will make debt financing more attractive in the affiliate located in that country. However, this increases the total debt-to-asset ratio and the bankruptcy risk of the entire group. To keep the overall indebtedness of the multinational in check, the multinational firm decreases the use of debt in other affiliates. The external debt shifting mechanism makes MNCs able to exploit the debt tax shield more aggressively than domestic firms, while keeping the risk of bankruptcy under control.

Huizinga et al. (2008) find that a 10 percent increase in the overall corporate tax rate increases the debt-to-asset ratio of a purely domestic firm by 1.8 percent (p. 81). By comparison, the authors consider a multinational firm operating in two separate countries. Increasing the corporate tax rate by 10 percent in one country increases the debt-to-asset-ratio in that country by 2.4 percent while the debt-to-asset-ratio in the other countries decreases by 0.6 percent. These estimations suggest that the debt-to-asset ratio of multinational firms is more sensitive to taxation on account of international debt shifting as multinational firms are affected by both national and international tax rates. Thus, multinational firms are more willing to engage in debt shifting activities. However, the results presented by Huizinga et al. (2008) may be biased due to the omission of the internal debt shifting mechanism, which is likely to influence the total debt of a multinational firm. The authors discuss the internal debt shifting mechanism in relation to their robustness tests, using a difference in tax rates between the parent company and its affiliates to capture the effect. They find that the effect is insignificant and conclude that the tax incentives to shift internal debt do not influence their main results.

Møen et al. (2011) try to reduce the omitted variable bias that is likely to be present in previous papers that have either omitted internal or external debt in their analyses. They are the first to model a multinational firm's choice between internal and external debt shifting. Their theoretical results show that firm value is maximized when multinationals use both international debt shifting mechanisms to save taxes. In their empirical analysis, Møen et al. (2011) use a dataset on 3,660 German MNCs that only have affiliates in Europe. They consider a hypothetical example of a multinational firm consisting of two affiliates of equal

size. If the affiliate located in the country with the highest tax rate experiences a 10 percentage point tax increase, its debt-to-asset ratio will increase by 4.6 percentage points while the affiliate located in the low-tax country will experience a decrease in debt-to-asset-ratio by 1.4 percentage points. A 4.6 percentage point increase in debt-to-asset ratio will imply an increase of 7.4 percent in leverage for an affiliate with an average debt-to-asset ratio (p. 4). Their findings suggest that about 40 percent of the increase in debt can be explained by the standard debt tax shield, which can be exploited by both national and multinational firms. The remaining 60 percent is due to international debt shifting, where shifting of internal and external debt is approximately equally important. When the authors omit the international debt shifting mechanisms from the regression, with only the standard debt tax shield remaining as a tax variable influencing the capital structure, the estimation bias becomes approximately 140 percent.

Only a few other papers discuss loss-making affiliates, although some studies include loss-making affiliates in their robustness analysis.[3] Klassen et al. (1993) study the change in income shifting behavior in response to worldwide tax rate changes, using a dataset on 191 U.S. multinational firms. The authors discuss affiliates with net operating losses and point out that there is an incentive to shift income into such affiliates. Moreover, they find evidence that differential changes in tax rates create incentives for income shifting by multinational firms. Nevertheless, the authors drop affiliates facing losses in their main sample. Subsequent literature on debt shifting has adopted this empirical strategy of dropping loss-making affiliates, to avoid the bias that may arise from reversed incentives under net operating losses.

Both Gramlich et al. (2004) and Onji & Vera (2010) analyze income-shifting between domestic Japanese trust (keiretsu) members. The studies show that net operating losses in some Japanese affiliates are balanced by shifting in income from other profitable member affiliates. Onji & Vera (2010) conclude that this is due to tax motives that arise because Japanese corporate income tax does not offer group provisions to consolidate trusts' overall taxable income. Similarly, De Simone, Klassen, & Seidman (2016) examine whether the unexpected profit of loss affiliates is correlated with tax-related factors. Their results suggest that MNCs change the distribution of reported income to exploit losses. Furthermore, they

[3] E.g. Dharmapala & Reidel (2013).

document a larger responsiveness to tax rates between profitable and unprofitable affiliates in high-tax jurisdictions. De Simone et al. (2016) do not, however, consider the degree of intra-temporal flexibility available to multinational firms to adjust their income-shifting strategies in the presence of losses. Also, they do not examine the mechanisms underlying the flexibility to shift income when a firm experience losses, whether due to internal debt or external debt.

Lastly, Büttner et al. (2011) examine how the capital structure of German MNCs and subsidiaries are affected by corporate taxation. The authors report a significantly smaller tax response of debt financing if subsidiaries face a higher probability of experiencing losses. This indicates that when subsidiaries have a higher loss probability, the importance of debt for tax planning seems relatively small. The authors argue that because of a reduction in the present value of interest deduction, the incentive for debt financing is smaller if a subsidiary faces a higher probability of experiencing losses (pp. 108-118). However, the authors are forced to rely on loss probabilities on industry and group level, and cannot derive affiliate-specific loss probabilities. In addition, it seems like the authors do not use loss anticipation, but estimate the loss probability based on losses occurring in the same year. Furthermore, the authors only look at how the standard debt tax shield affects the debt-to-asset ratio of affiliates experiencing losses, and do not include the international debt shifting mechanisms in their analysis.

The study by Hopland et al. (2015) examines the flexibility of multinational firms to adjust their income-shifting strategies using transfer pricing and internal debt during the tax year to react to losses. The authors develop a theoretical model where under full flexibility, multinational companies can adjust their payments between affiliates ex-post. The term "ex-post" is defined as the ability to adjust income shifting strategies after the financial outcomes are revealed, but before the end of the tax year. In contrast, lack of flexibility means that multinational firms must commit to their affiliates' income-shifting strategies before the financial outcomes are revealed, also referred to as "ex-ante." With uncertainty in the realization of the output price, the MNC is more conservative when allocating debt as the debt tax shield cannot be utilized when the affiliate incurs losses. The affiliate will only want to shift debt if it has taxable income, and this happens with the probability of $1 - H(p_i^0)$. Thus, it should be the expected tax rate (as opposed to the statutory tax rate) of an affiliate that matters when determining internal and external debt shifting. Using data on direct

transfer payments and internal debt of Norwegian MNCs and affiliates, Hopland et al. (2015) find empirical evidence that under losses, transfer pricing provides flexibility to adjust income shifting ex-post, while they do not find evidence for flexibility in the use of internal debt to shift income ex-post. Hence, internal debt shifting features inflexibility and must be decided ex-ante. The authors point out that as long as an affiliate face a non-zero probability of incurring a loss in the current year, multinational firms with inflexibility will shift less income out of this affiliate than theory predicts (Hopland et al., 2015).

Inflexible internal debt has its counterpart in rigid external leverage. Hopland et al. (2014) argue that also external leverage should feature inflexibility, as finance literature states that the capital structure is only adjusted when the deviations from the optimal leverage become large enough. This is due to high adjustment costs (Fischer, Heinkel, & Zechner (1989); Gilson (1997); Strebulaev (2007)). Furthermore, the estimated magnitudes of the effects from debt tax shields on external and internal debt shifting are quite low. Desai et al. (2004), Huizinga et al. (2008), Egger et al. (2010), Møen et al. (2011) and Büttner & Wamser (2013) report estimations for the semi-elasticity of internal debt between 0.69 and 1.3, and between 0.34 and 0.69 for external debt. Hopland et al. (2014) also point out that the reason why firms are underleveraged in both internal and external debt is that they want to avoid having debt if incurring losses. Thus, anticipating this year's possibility of experiencing losses and ex-ante debt shifting are explanations for underleveraging affiliates, even if they are profitable (p. 32).

3. Debt shifting and loss anticipation in theory

3.1 The model

The methodology part of our paper follows the model specifications proposed by Møen et al. (2011, pp. 8-14) and Hopland et al. (2015, pp. 4-11). We adjust the model by Møen et al. (2011) for the loss probability introduced in (Hopland et al., 2015, pp. 10-11), and test it on a data sample of European multinational firms. The aim is to study if the anticipation of losses has an impact on European multinationals' capital structure and debt shifting strategies.

The model assumes a setting where an MNC has majority-owned affiliates located in n countries with a parent company P. The affiliates are directly owned by the MNC, and there are no ownership chains. Country 1 is the country with the lowest tax rate so that $t_i > t_1, i = 2, \dots, n$.[4] We label country 1 as the "tax haven" and assume that this is where the financial coordination center is located.[5] Without loss of generality, we assume that the affiliate in the tax haven is a pure holding company, and therefore does not produce any goods. All other affiliates own fixed assets K_i, which is the necessary amount of capital to produce a homogenous good according to the production function $y_i = f(K_i)$. The price p_i of the final good is stochastic and drawn from a cumulative distribution function $H(p)$ with a lower level of $\underline{p}$ and an upper threshold of $\overline{p}$ (Hopland et al., (2015, p. 5); Møen et al., (2011, p. 8)).

The rental costs of capital are given exogenously according to a small country assumption and are equal to r. Capital K_i in affiliate i is financed either by equity E_i provided by the headquarters of the MNC, external (third party) debt D_i^E or internal debt D_i^I borrowed from the financial coordination center, so that $K_i = E_i + D_i^E + D_i^I$ is the balance sheet of affiliate i. For the MNC the balance sheet can be expressed as $\sum_{i \neq 1} E_i = E_1 + D_1^E + D_1^I$. The financial coordination center uses its equity E_1 to finance its internal lending to all other affiliates so that $E_1 = \sum_i D_i^I$, and provides the producing affiliates with the equity necessary to obtain both an optimal level of real capital and a tax efficient financing structure. Debt can

[4] All countries $i > 1$ will be referred to as "non-haven countries". Because $t_i > t_1, i > 1$ any country $i > 1$ will optimally shift debt towards the tax haven only; thus there is no need to differentiate between high-tax and low-tax countries (Hopland et al., 2015, p. 4).

[5] The financial coordination center is referred to as the internal bank, which lends funds to and receives interest income from related affiliates, and can be used to shift income within the MNC.

be classified as external debt D_i^E, or internal debt D_i^I. We define the internal leverage ratio of the producing affiliate i as $b_i^I = \frac{D_i^I}{K_i}$ and the external debt-to-asset ratio as $b_i^E = \frac{D_i^E}{K_i}$. Both types of financing are assumed to be free of risk and carry the world-market interest rate r (Hopland et al. (2015, p. 5); Møen et al. (2011, p. 9)). Based on Hopland et al. (2015), we will assume that the affiliates of the MNC have limited flexibility in changing their capital structure within a year, and must therefore decide on the capital structure at the beginning of the year (ex-ante).

The use of internal and external debt leads to different types of costs and benefits for an affiliate. These need to be considered before deriving the cost functions of internal and external debt. Internal debt holds many of the same properties as equity, but while the costs of equity are not tax deductible, interest expenses related to debt can be deducted from the corporate tax base. This creates a valuable tax shield which leads to a preference for debt financing since payments associated with equity are entirely appropriated from firms' profits (Graham (2000, pp. 1903-1904); Møen et al. (2011, p. 9)).

However, the costs of internal debt are associated with tax engineering expenses incurred in order to avoid or lessen thin capitalization rules or controlled foreign corporation rules (CFC) (Fuest & Hemmelgarn, 2005, p. 513). Designing strategies to circumvent anti-avoidance regulations, working around thin-capitalization rules, hiding transactions and exploiting loopholes will increase the cost of internal debt. This is especially the case when MNCs use specialized experts, lawyers and accountants' advice for manipulating internal debt (Schindler & Schjelderup (2016, p. 268); Ruf & Schindler (2015, pp. 6-7)). Many countries in Europe have implemented thin capitalization rules and CFC-rules that limit profit shifting to low-tax countries, and these rules also apply to foreign subsidiaries (Ruf & Schindler, 2015, p. 18).[6] The European Commission has agreed on an Anti-Tax Avoidance Directive (ATAD2) that requires the 14 member states in the EU without CFC-rules to introduce them (European Commission, 2017a) . The new rules will come into force in January 2020. Some countries in the European Union have also implemented thin

[6] Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Lithuania, Portugal, Spain, Sweden, and the United Kingdom are EU countries that have implemented the controlled foreign legislation rules, according to Deloitte (2014).

capitalization rules that limit the tax deductibility of interest (Schindler & Schjelderup (2016, p. 277); Webber (2010)).

Furthermore, the amount of consultation by tax advisors that is necessary to obtain a deduction for interest on internal debt from taxable income is likely to be convex in the level of internal debt (Fuest & Hemmelgarn, 2005, p. 513). This convexity is due to the fact that it is costlier to hide profit shifting if the firm is highly indebted and the taxable profits are low due to excessive interest deductions. Affiliates of multinational companies that are substantially more indebted than similar affiliates are thus more likely to be audited (Schindler & Schjelderup, 2016, p. 274).

External debt, on the other hand, can be beneficial in reducing information asymmetries between management and shareholders. External debt contracts usually require that managers must disclose relevant information to investors, who can monitor how well the managers follow agreements and assess whether they manage resources in the best interest of the external owners (Healy & Palepu, 2001, pp. 409-410). Accordingly, firms that experience high information asymmetries prefer not to issue equity due to large agency costs associated with equity and will instead choose to issue more debt. This is consistent with the pecking order theory (Jensen, 1986, p. 324). Debt reduces the agency costs of free cash flow by reducing the cash flow available for managers to spend. This helps discipline managers to implement profitable projects instead of overspending on perks for themselves (Jensen, 1986, p. 324). Furthermore, if owners are unable to finance new investments with equity, they may be inclined to issue external debt to finance new investments, to increase the total wealth of the firm. The owners will then face agency costs of debt, and may issue new debt as long as the marginal increase in wealth is larger than the marginal increase in agency costs (Jensen & Meckling, 1976, p. 321).

However, firms financed with external leverage also face several risks. Bankruptcy risk and risks related to equity increase proportionally to the amount of debt (Modigliani & Miller, 1958, p. 271). Owners are therefore facing a trade-off between increased wealth from new investment opportunities and increased agency costs and bankruptcy risk related to the increased amount of debt (Jensen & Meckling, 1976). On the one hand, managers of firms that are highly financed with debt may have incentives to invest in risky projects that provide high payoff if successful, even when the probability of failure is high. The managers will be willing to take this risk since they will capture most of the gain if the project is successful,

while the creditors will bear most of the costs given a failure (Jensen & Meckling, 1976, p. 334). Since the external lenders are aware of this risk, they will reduce their risk by imposing debt covenants on the borrowing firm. This leads to increased costs of external debt (Jensen & Meckling, 1976, p. 338). On the other hand, companies facing financial distress can act too risk-averse and choose not to invest in positive NPV-projects if new equity needs to be issued to carry out an investment (under-investment problem), since the investment will benefit the creditors, not the equity holders. This leads to suboptimal behavior, where the firm is unable to maximize its value (Myers, 1977, p. 154).

To derive the cost functions of internal and external leverage, we assume, in line with standard trade-off literature that the costs are proportional to the amount of capital employed, separable, and convex in the debt-to-asset ratios (Huizinga et al. (2008, p. 94); Møen et al. (2011, p. 9)). Cost functions are assumed to be additively separable due to differing costs and benefits of internal and external debt as discussed above. Internal debt can be seen as tax-favored equity since it neither affects bankruptcy risk nor reduces information asymmetry (Berk & DeMarzo, (2014); Chowdhry & Coval (1998)). Furthermore, external credit markets are assumed to be perfect, except for financial distress costs and the debt tax shield. The convexity associated with internal debt arises due to the fact that it is costly to conceal tax avoidance from tax authorities, while convexity of external debt is related to the higher premium that must be paid due to information asymmetry (Schindler & Schjelderup, 2012, p. 638).

Given these assumptions, the costs function of internal debt is as following:

$$C^I(b_i^I) = \frac{\eta}{2} \cdot (b_i^I)^2 \cdot K_i, \qquad if \qquad b_i^I > 0, \qquad and \qquad C^I(b_i^I) = 0 \; if \; b_i^I \leq 0, \qquad (1)$$

where $b_i^I = \frac{D_i^I}{K_i}$ reflects the internal debt-to-asset ratio in affiliate i, and η is a positive constant. The expression shows that the costs of internal debt are positive and proportional to capital employed.

Furthermore, the cost function of external debt can be written as:

$$C^E(b_i^E) = \frac{\mu}{2} \cdot (b_i^E - b^*)^2 \cdot K_i - \frac{\mu}{2} \cdot (b^*)^2 \cdot K_i, \qquad (2)$$

where μ is a positive constant, $b_i^E = \frac{D_i^E}{K_i}$ represents the external debt-to-asset ratio in affiliate i, and b^* reflects the optimal external debt-to-asset ratio in affiliate i in the absence of taxation. The costs of external debt are proportional to capital employed, positive and increase with the amount of external debt that the firm possesses, as observable from the expression.

Increased usage of external debt increases the chance of bankruptcy, consequently increasing the bankruptcy costs of the MNC. Huizinga et al. (2008) were the first to analyze the relation between bankruptcy costs and external debt shifting, assuming that the parent company is willing to bail out any affiliate at the verge of becoming bankrupt. The authors also assume that the parent company provides implicit or explicit credit guarantees for the debt of its affiliates. A survey by Stobaugh (1970) shows that no medium-sized or large MNC would allow their affiliates to default on debt, even if the parent had not guaranteed a loan (p. 52). Furthermore, Gopalan, Nanda, & Seru (2007) find evidence that multinational firms do in fact support affiliates that face certain risks that make it difficult to get access to external debt at favorable conditions. They also find that bankruptcy by one affiliate yields negative spillovers to other affiliates, such as an increase in the bankruptcy probability and a significant drop in external financing, investments and profits. The default of an affiliate could also damage the parent firm's reputation, or the affiliate might be crucial to other operations important to the MNC and thus impact the parent company's ability to operate. This may give multinationals sufficient incentives to bail out affiliates in the event of distress (Shapiro, 1978, p. 212). Following these studies, we assume that the parent company ensures credit guarantees for the debt of affiliates.

Hence, the bankruptcy costs of an MNC depends on its total external debt-to-asset ratio, defined as $b_f = \frac{\sum_i D_i^E}{\sum_i K_i}$. It can also be expressed as the asset-weighted average of affiliate-specific leverage ratios b_i^E or $\sum_i b_i^E \rho_i$ where $\rho_i = \frac{K_i}{\sum_i K_i}$ reflects the share of real capital employed in affiliate i in the total real capital employed by the MNC (Møen et al., 2011, p. 43). The overall bankruptcy costs at the parent level of the MNC can be denoted as C_f. Furthermore, following Huizinga et al. (2008, p. 94), we assume that overall bankruptcy costs are a convex function of the total debt-to-asset ratio of the entire firm, and proportional to its total assets. In addition, we assume that bankruptcy costs are not deductible from taxable corporate income, as they are incurred by loss-making affiliates.

The overall bankruptcy costs of a multinational firm are expressed as follows:

$$C_f = \frac{\gamma}{2} \cdot b_f^2 \cdot \sum_i K_i = \frac{\gamma}{2} \cdot \frac{\left(\sum_i D_i^E\right)^2}{\sum_i K_i}, \tag{3}$$

where γ is a positive constant.

The economic profit of an affiliate i is given by:

$$\pi_i^e = p_i y_i - r \cdot K_i - C^E(b_i^E) - C^I(b_i^I)$$

Taxable income differs from economic profit in that opportunity costs of equity and concealment costs are not tax deductible. Furthermore, without diminishing any insights, we assume, in line with Hopland et al. (2015), that no loss offset is granted when the affiliate is running taxable losses (p. 6). Following (Møen et al., 2011, p. 10) we also assume that the cost of debt is not tax deductible from taxable income. In addition, we assume that the rental costs of equity are not tax deductible as this is common in most tax systems.

We denote p_i^0 as the price for which the taxable income of affiliate i is zero. The taxable profit of an affiliate i can be stated as:

$$\pi_i^t = \begin{cases} p_i y_i - r \cdot (D_i^E + D_i^I), & if\ p_i > p_i^0 \\ 0 & if\ p \leq p_i^0 \end{cases}$$

We assume that the MNC must decide on the level of internal and external debt ex-ante, which means that it cannot reconsider these decisions after the output prices are revealed (Hopland et al., 2015, p. 11). Therefore, it can only adjust its debt-shifting strategies ex-ante, no later than at the beginning of the year. Hence, the MNC's headquarters face a decision under uncertainty where it cannot observe, only anticipate, the likelihood of experiencing losses by the end of the year. The MNC only wants to shift income to the financial coordination center if the producing affiliate has taxable income. Thus, it is the expected tax rate $[1 - H(p_i^0)]t_i$ (as opposed to the statutory tax rate t_i) of the producing affiliate that matters when determining the tax savings ex-ante. If the probability of being unprofitable, $H(p_i^0)$, increases, over-invoicing internal or external debt then becomes less attractive. In line with literature regarding MNCs, we assume that the MNC is risk neutral which means that the headquarters maximizes expected overall income (Ethier (1986, p. 812); Tirole (1988, pp. 35-36)).

The expected income of a non-haven affiliate after corporate taxation can written as:

$$E(\pi_i) = \int_{\underline{p}}^{\overline{p}} p_i h(p) dp \cdot y_i - rK_i$$

$$- t_i \int_{p_i^0}^{\overline{p}} p_i h(p) dp \cdot y_i + [1 - H(p_i^0)] \cdot t_i \cdot r \cdot (D_i^E + D_i^I)$$

$$- \frac{\eta}{2} \cdot (b_i^I)^2 \cdot K_i - \frac{\mu}{2} \cdot (b_i^E - b^*)^2 \cdot K_i - \frac{\mu}{2} \cdot (b^*)^2 \cdot K_i \quad (4)$$

The first line displays affiliates' economic profits; the size of the economic profits depends on the realization of p_i which is ex-ante uncertain. The second line states that affiliates have to pay taxes when there is a high enough output price. This happens only with the likelihood of $[1 - H(p_i^0)]$, i.e., the probability that the affiliate obtains a profit. Otherwise, tax payments in country i are zero. The third line shows the cost functions of internal and external debt.

In a static one-period model such as this, the MNC's after tax profit Π_P and the value of a leveraged MNC (V^L) are identical and can be calculated by taking the sum of all affiliates' profits. Repatriated dividends (π_i) that affiliates send back to the parent firm can be levied with a non-resident withholding tax, a parent tax on repatriated dividends and the corporate tax rate t_i (Møen et al., 2011, p. 11). If so, double tax relief may be provided for the previously paid non-resident withholding tax and corporate income. The tax costs of equity finance thus reflects tax rates and the double-tax relief convention used by the parent country (Huizinga et al., 2008, p. 81). However, European countries follow the exemption method where withholding taxes do not matter (Spengel & Wendt, 2007, p. 41). In line with Møen et al. (2011, p. 11) we have not accounted for these issues in the further analysis, as we focus on European countries in our empirical section. Consequently, the value of the multinational corporation can be stated as:

$$\Pi_P = V^L = \sum_i V_i^L - C_f = \sum_i \pi_i - C_f \quad (5)$$

To set up the profit maximization problem of a multinational corporation, maximizing equation (5), we apply equations (1) to (4). The objective function is maximized by

considering that the overall sum of lending and borrowing from related affiliates must equal zero ($\sum_i r \cdot D_i^I = 0$). Thus, the maximization problem of a multinational company is:

$$\begin{aligned}\max_{D_i^E, D_i^I} \Pi_P = \quad & \sum_i \Bigg\{ \int_{\underline{p}}^{\overline{p}} p_i h(p) dp \cdot y_i - rK_i \\ & - t_i \int_{p_i^0}^{\overline{p}} p_i h(p) dp \cdot y_i + [1 - H(p_i^0)] \cdot t_i [r \cdot (D_i^E + D_i^I)] \\ & - \frac{\eta}{2} \cdot (b_i^I)^2 \cdot K_i - \frac{\mu}{2} \cdot (b_i^E - b^*)^2 \cdot K_i - \frac{\mu}{2} \cdot (b^*)^2 \cdot K_i \Bigg\} \\ & - \frac{\gamma}{2} \cdot \frac{\left(\sum_i D_i^E\right)^2}{\sum_i K_i} \\ & s.t. \sum_i r \cdot D_i^I = 0\end{aligned}$$

The resulting first order conditions with respect to internal and external leverage are:

$$D_i^E: t_i [1 - H(p_i^0)] \cdot r - \mu \cdot \left(\frac{D_i^E}{K_i} - b^* \right) - \gamma \cdot \frac{\sum_i D_i^E}{\sum_i K_i} = 0 \tag{6}$$

$$D_i^I: t_i [1 - H(p_i^0)] \cdot r - \eta \cdot \frac{D_i^I}{K_i} - m \cdot r = 0, \tag{7}$$

where details on the first order conditions are given in Appendix A. The Lagrangian multiplier, m, reflects the shadow price of shifted interest expenses. In optimum, we have $m = min_i t_i$. This implies that the MNC should let the affiliate with the lowest effective tax rate operate as financial coordination center, conducting internal lending to other affiliates to maximize the internal debt tax shield. As stated earlier in this section, country 1 has the lowest tax rate, i.e., $min_i t_i = t_1$.

By reordering the first order condition of internal debt (equation (7)), we derive the optimal internal debt-to-asset ratio b_i^I:

$$\begin{aligned} b_i^I = \frac{r}{\eta} \cdot (\, t_i [1 - H(p_i^0)] - m) = \frac{r}{\eta} \cdot (t_i [1 - H(p_i^0)]) - t_1) > 0, \forall\, i > 1, \\ and\ b_i^I = 0\ if\ i = 1 \end{aligned} \tag{8}$$

The internal debt-to-asset ratio is zero for the internal bank ($i = 1$), since it is not optimal for this affiliate to hold any internal debt. The amount of debt L_1 that the financial coordination center lends to other affiliates is:

$$L_1 = \sum_{i>1} D_i^I \tag{9}$$

From equation (7) it is implied that the lowest-taxed affiliate should provide internal debt to other affiliates within the MNC in order to maximize profits (Møen et al., 2011, p. 12). Mintz & Smart (2004) were the first to name the location of the financial coordination center a "tax haven." They also refer to the variable $(t_i - t_1)$ as a "net tax advantage" (pp. 1152-1153). However, in the empirical part, we refer to this variable as the maximum tax difference.

Turning to the optimal external debt-to-asset ratio, D_i^E, by reordering equation (6) we obtain the expression:

$$b_i^E = \beta_0 + \beta_1 \cdot t_i[1 - H(p_i^0)] + \beta_2 \cdot \sum_{j \neq i} \rho_j \left(t_i[1 - H(p_i^0)] - t_j\left[1 - H\left(p_j^0\right)\right]\right) \tag{10}$$

where details are given in Appendix B. We have defined:

$$\beta_0 = \frac{\mu b^*}{\mu + \gamma}, \qquad \beta_1 = \frac{r}{\mu + \gamma}, \qquad \beta_2 = \frac{\gamma r}{(\mu + \gamma)\mu}$$

Furthermore, $\rho_j = \frac{K_j}{\sum_i K_i}$ reflects the share of total assets employed in affiliate *j* in total assets of the MNC.

The external debt-to-asset ratio (10) consists of two tax mechanisms; the standard debt tax shield and the external debt shifting mechanism. Both mechanisms are adjusted for the loss probability, $[1 - H(p_i^0)]$. The second term on the right-hand side represents the standard debt tax shield mechanism, which reflects the impact of taxation on the optimal external debt ratio that would occur for an affiliate located in country *i*. An implication of the standard debt tax shield is that a higher corporate tax rate in country *i* increases the external debt tax shield and the b_i^E, all else equal (Møen et al., 2011, p. 13). However, when we adjust the term for the loss probability, the overall effect is not clear. This tax mechanism can also be

exploited by purely domestic firms, and Huizinga et al. (2008) refer to the term as the "domestic effect of taxation on leverage".

The second tax mechanism, external debt shifting, is represented by the third term in the equation. This tax effect is referred to as the "international or debt-shifting mechanism" by Huizinga et al. (2008), while Møen et al. (2011) refer to it as the "weighted tax difference" as the term weights international tax differences $(t_i - t_j)$ by affiliates' asset shares ρ_j. This implies that for a given level of overall bankruptcy costs C_f, the external debt should be allocated to the affiliates facing the largest tax differentials to maximize tax savings. An increase in the tax rate of one affiliate will then lead to an international allocation of external debt into this affiliate. This increases the debt-to asset ratio in the affiliate experiencing a tax increase, while decreasing the debt-to-asset ratio in all other affiliates in order to keep the overall bankruptcy costs under control (all else equal). Accordingly, the optimal external debt-to-asset ratio in country i is negatively related to the statutory corporate tax rate t_j in country j.

By applying the definitions above, the overall debt-to-asset ratio of the financial coordination center is $b_1 = b_1^E + b_1^I = b_1^E, as\ b_1^I = 0$, and its debt-to-asset ratio is given by:

$$b_1 = \beta_0 + \beta_1 \cdot t_1 + \beta_2 \cdot \sum_{j \neq 1} \rho_j \left(t_1 - t_j\left[1 - H(p_j^0)\right]\right) if\ i = 1 \tag{11}$$

Finally, by combining equation (8) with equation (10) and defining $\beta_3 = \frac{r}{\eta}$, we obtain the total optimal debt-to-asset ratio of a productive affiliate $i > 1$:

$$b_i = \beta_0 + \underbrace{\beta_1 \cdot t_i[1 - H(p_i^0)]}_{(i)} + \underbrace{\beta_2 \cdot \sum_{j \neq i} \rho_j\left(t_i[1 - H(p_i^0)] - t_j\left[1 - H\left(p_j^0\right)\right]\right)}_{(ii)}$$

$$+ \underbrace{\beta_3 \cdot (t_i[1 - H(p_i^0)] - t_1)}_{(iii)}, \forall\ i > 1 \tag{12}$$

Equation (12) shows that the total debt-to-asset ratio of an affiliate *i* is affected by:

(i) the expected domestic corporate tax rate $t_i[1 - H(p_i^0)]$ due to the expected standard debt tax shield mechanism,

(ii) the expected weighted tax differential $\sum_{j\neq i}\rho_j\left(t_i[1-H(p_i^0)]-t_j\left[1-H\left(p_j^0\right)\right]\right)$ to all affiliates due to the overall bankruptcy costs and the expected external debt shifting mechanism; and

(iii) the expected maximum tax difference $(t_i[1-H(p_i^0)]-t_1)$ to the financial coordination center because of expected internal debt shifting.

However, it is important to note that in cases where the parent company does not guarantee for affiliates' debt and is not willing to bail out affiliates facing bankruptcy, it is not optimal to shift external debt. Thus, the external debt shifting mechanism (*ii*) is not activated. Under these circumstances, the internal debt shifting mechanism is the only component of international debt shifting (Møen et al., 2011, p. 14).

We assume in line with Hopland et al. (2015) that affiliates have limited flexibility in changing their capital structure within a year, and must therefore decide on the capital structure ex-ante. The taxable profit of an affiliate is ex-ante uncertain, and the affiliate must therefore consider the probability of incurring losses in order to allocate its debt optimally. To be able to study how leverage is affected by this inflexibility, we have differentiated equation (12) by the loss probability $H(p_i^0)$ and obtain:

$$\frac{\partial b_i}{\partial H\left(p_i^0\right)} = \qquad -\beta_1 t_i + \beta_2 \sum_{j\neq i} p_j(-t_i) - \beta_3 t_i \tag{13}$$

The first term on the right-hand side, $-\beta_1 t_i$, is the standard debt tax shield mechanism. An incremental increase in $H(p_i^0)$ leads to a reduction of the standard debt tax shield effect. This is in accordance with what we would expect based on the model developed by Møen et al. (2011), which state that "The higher the corporate tax rate in country i, the larger is the external debt tax shield and, all else equal, the higher is b_i^E" (p. 13). A loss or profit of zero will lead to an elimination of the tax shield, making it less attractive to allocate debt to country i. This explains the negative coefficient.

When it comes to the external debt shifting mechanism, we obtain $\beta_2 \sum_{j\neq i} p_j(-t_i)$, after deriving equation (12). The reduction in the tax rate caused by the loss probability adjustment reduces tax savings in affiliate t_i and makes the use of debt in other affiliates relatively more attractive due to the overall bankruptcy costs of the group. Furthermore, an increase in $H(p_i^0)$ will lead to a reduction in the external debt shifting of affiliate i and an

increase in the external debt shifting of affiliate j. This is in accordance with what we would expect based on theory, as an increase of external debt in one affiliate will lead to a decrease in debt of other affiliates in order to keep the bankruptcy risk in check.

We obtain $-\beta_3 t_i$, for the internal debt shifting mechanism. An incremental increase in $H(p_i^0)$ will lead to a reduction of internal debt as the maximum tax difference variable decreases. This implies that affiliate i will borrow less internal debt from the lowest-taxed affiliate according to the model by (Møen et al., 2011). When the probability of being unprofitable, $H(p_i^0)$, increases, the affiliate is more cautious in borrowing from the lowest-taxed affiliate and may want to make sure that it avoids having leverage when ending up with losses. Thus, it reduces internal debt when $H(p_i^0)$ increases.

Studies that ignore the loss probability implicitly assume $H(p_i^0) = 0$. Consequently, they assume that the debt-to-asset ratio increases with the domestic tax rate due to the standard debt tax shield, the weighted tax difference due to bankruptcy costs and external debt shifting, and the maximum tax difference due to internal debt usage (Møen et al., 2011, p. 14). However, our theoretical model suggests that loss anticipation has implications for firm behavior. Thus, previous studies that ignore loss probabilities will underestimate the true effect of tax rates and do not model the full picture of profit maximizing behavior.

3.2 Theoretical predictions of the model

There are several predictions of the model. Firstly, the model predicts that the loss probability will have a negative effect on the standard debt tax shield. The loss probability adjustment will reduce the tax rate faced by the affiliate, thus decreasing the value of the tax shield. Affiliates facing a high loss probability are less capable of exploiting this tax shield, thus making it less attractive to hold debt when having to decide on the capital structure at the beginning of the year.

Furthermore, the model predicts that the external debt shifting mechanism will be reduced when affiliates consider the loss probability when choosing their external debt shifting strategies ex-ante. The loss probability will reduce the expected tax rate faced by affiliate i, thus making it more attractive to shift external debt out of this affiliate and into another affiliate j. A change in tax policy in one country optimally causes the multinational firm to rebalance its debt in all countries where it operates. Specifically, an increase in the tax rate in one country will lead to an increase of debt in the affiliate located in that country. However, increased usage of debt in one affiliate will lead to a rise in bankruptcy risk for the whole group, thus discouraging debt financing in all other affiliates.

Lastly, the model predicts that affiliates will choose to shift less internal debt when they consider the probability of ending up in a loss position. A positive loss probability will reduce the amount of internal debt since the maximum tax difference variable will decrease.

These three predictions combined imply that firms do consider the anticipation of losses when deciding on their capital structure ex-ante. Compared to previous studies that ignore loss probabilities, inflexible MNCs have reduced ability to adjust their debt shifting strategies in response to losses and reduce their indebtedness based on the loss anticipation. Standard models attribute debt shifting to the differential in actual statutory tax rates, and assume that $H(p_i^0) = 0$. Consequently, this gives higher corporate tax rates compared to MNCs that react on the smaller differential of expected statutory tax rates. The debt-to-asset ratio of MNCs in studies that do not consider the loss probability will thus be higher. Hence, studies that omit the loss probability will not mirror the exact profit maximizing behavior of an MNC.

4. Data and descriptive statistics

4.1 Data sources and sample restrictions

In our thesis, we want to study how an affiliate's capital structure is affected by considering the anticipation of losses when deciding upon the amount of debt and debt shifting strategies. We have been provided with a merged dataset containing ownership structures of European parent firms including their majority-owned affiliates for the period 2003–2014, by Aija Polakova (2015). The historical ownership data is obtained from the Orbis database provided by Bureau van Dijk, and is essential since a constant ownership structure would lead to misclassification of relationships between subsidiaries and parents because these ownership structures usually change over time. Financial data is obtained from the Amadeus database, which also is provided by Bureau van Dijk.

We are unable to examine how tax differences between affiliates in Europe and affiliates located in other parts of the world influence leverage decisions, as the Amadeus database only provides information on European subsidiaries. However, the largest share of revenues of European MNCs usually originates from their operations in Europe. Other factors and country characteristics such as development of financial markets, corruption and financial stability are also likely to be of high importance for the capital structure of affiliates outside Europe, thus reducing the concern of solely focusing on European affiliates (Møen et al., 2011, p. 15).

We consider a firm as a subsidiary if 50 % or more of its shares belong to the parent firm. We define an MNC as a parent firm with ownership to one or more foreign subsidiaries. Both consolidated and non-consolidated financial statements are usually published by MNCs. Activities within both the parent firm and its subsidiaries are given in the consolidated financial statements, while the non-consolidated financial statements provide financial information based on local activities within each of the subsidiaries and the parent firm. Following Huizinga et al. (2008, pp. 95 - 96) we therefore use non-consolidated financial statements in our analysis. By using these financial statements, we both make the data easier to compare, since consolidation of the financial accounts of firms is not required in all European countries (Klapper, Laeven, & Rajan, 2004, p. 10), as well as avoid double counting of subsidiaries and firms. The financial data is reported in the local currency of the

subsidiaries. We therefore use exchange rate data on the financial reporting date to convert all the financial data into euros.

After performing several data trimming procedures, which can be seen in Table 1, we are left with our final data sample, which consists of 290,257 affiliate-year observations of European MNCs. This sample only reflects a small part of the majority-owned European subsidiaries of European parent firms that we initially found in the Orbis database. To obtain our final sample, we first excluded purely domestic firms.[7] Since both the parent firm and all affiliates are positioned in the same country, this will make the maximum tax difference and the weighted tax difference equal to zero. We dropped purely domestic firms since we want to study how the expected statutory tax rate affects the debt structure of multinational firms exclusively. To avoid double counting, we excluded affiliate-year observations that occurred more than once per parent within the same year. Furthermore, we excluded observations with extreme total debt-to-asset ratios (outside the interval [0;1]) and observations with missing firm-level or country-level control variables. Thereafter, we eliminated consolidated accounts, as they do not directly reflect the local activities that occur within each of the individual affiliates and the parent firm. Finally, we eliminated observations occurring in time-period t_1, to be able to estimate the probability of loss $H(p_i^0)$.

Table 1: Data trimming procedures

This table illustrates the trimming procedures and selection criteria that were used to get the final sample. The final sample consists of majority-owned affiliates of European multinational firms, where each unit is an affiliate of a European firm. The historical ownership data is obtained from the Orbis database, while the financial data is obtained from the Amadeus database. Step (3) to (6) display the data trimming procedures.

	Number of observations	Percentage
(1) All affiliate-year observations of financial and historical ownership data of European firms found by Orbis and Amadeus, based on Orbis BvD ID codes (2004-2014)	31,496,602	100 %
(2) Eliminate purely domestic firms	2,941,239	9.34 %
(3) Eliminate affiliate-year observations that occur more than once per parent firm in the same year	2,608,646	8.28 %
(4) Eliminate affiliate-year observations with extreme total debt-to-asset ratio	2,007,041	6.37 %
(5) Eliminate affiliate-year observations with missing firm-level or country level control variables	547,979	1.74 %
(6) Eliminate affiliate-year observations with consolidated accounts	522,819	1.66 %
(7) Observations lost because of lagged specification to estimate the loss probability	290,257	0.92 %
Final sample	290,257	0.92 %

[7] See section 7.2 for robustness test and further discussions on domestic firms.

4.2 Dependent variable

The dependent variable used in our regression is the total debt-to-asset ratio, which is expressed as the ratio of total liabilities to total assets. The sum of non-current liabilities and current liabilities are used to calculate total liabilities. Non-current liabilities include both long-term debt and other non-current liabilities, such as long-term lease obligations, product warranties, and bonds payable. Current liabilities include creditors, loans and other current liabilities such as short-term notes payable.

4.3 Tax variables

Our model consists of three tax mechanisms and three interaction terms. It is difficult to study the effect from the loss anticipation adjustment by adjusting the tax mechanisms directly for the loss anticipation. We have therefore constructed three interaction terms, to be able to isolate the effect the loss probability has on the debt shifting strategies.

The first tax mechanism is the standard debt tax shield, captured by the statutory tax rate t_i. Data on the European statutory corporate tax rates was collected from KPMG's indirect tax survey and corporate tax rates table (KPMG (n.d.); KPMG (2009)), and the OECD's economic surveys and corporate income tax tables (OECD (n.d); OECD (2013b). We assume that firms will choose to have more debt when the statutory tax rate increases, due to the standard debt tax shield.

The second tax mechanism is the external debt shifting mechanism, which is expressed by the weighted tax difference $\sum_{j \neq i} \rho_j (t_i - t_j)$. Huizinga et al. (2008) refer to this variable as a tax incentive to shift debt. The variable is defined as the weighted sum of differences between the statutory tax rate faced by an affiliate i and the statutory tax rates faced by all other affiliates belonging to the MNC, including the parent firm. Each affiliate's weight is expressed as the share of total assets belonging to the affiliate in the total assets of the MNC. When the weighted tax difference increases (caused by an increase in the statutory tax rate faced by either affiliate i or j), we assume that affiliates will choose to shift more external debt, thus implying that we expect this variable to be positive.

The final tax mechanism is the internal debt shifting mechanism, which is captured by the maximum tax difference $(t_i - t_1)$. This variable expresses the tax difference between an

affiliate i and the lowest-taxed affiliate within the MNC. Affiliates are expected to borrow more from the lowest-taxed affiliate when the maximum tax difference increases and the model therefore predicts that this variable is positive.

The first interaction term is the domestic interaction term, calculated between the statutory tax rate and the loss probability $H(p_i^0)t_i$. The loss probability is calculated based on information from year t_{-2}, since we assume that this is the information available to the affiliates when they adjust their capital structure ex-ante. By constructing this interaction term, we can isolate the effect the loss probability has on the standard debt tax shield. The model predicts that the loss probability has a negative effect on the affiliates' total debt-to-asset ratio. This is due to the reduction in the effective statutory tax rate caused by the loss probability adjustment.

To isolate the effect the loss probability has on the external debt shifting mechanism, we use the foreign interaction term, which is calculated between the external debt shifting mechanism and the loss probability $\sum_{j \neq i} \rho_j t_j H(p_j^0)$. The loss probability adjustment will most likely reduce the tax rate faced by affiliate j, thus reducing the incentive to hold debt in other affiliates. Accordingly, this will make it relatively more attractive to hold debt in affiliate i, thus implying that the foreign interaction term should be positive and that MNCs choose to shift more external debt into affiliate i.

Lastly, the internal bank interaction is used to isolate the effect from the internal debt shifting mechanism and is calculated between the maximum tax difference and the loss probability $H(p_1^0)t_1$. The internal bank should not incur losses as it receives all the income from other affiliates in the multinational group and does not engage in production activities. Therefore, $H(p_1^0)$ equals zero, and the interaction term should be insignificant and close to zero.

4.4 Control variables

Our theoretical model focuses on how different tax mechanisms adjusted for a loss probability affects the optimal capital structure of an MNC. However, there may be other relevant factors affecting a firm's optimal leverage that should be included in the analysis. To account for this, we include four firm-level and four country-level control variables, following Huizinga et al. (2008) and Møen et al. (2011), in addition, we include "Loss probability" as a firm-level control variable, based on Hopland et al. (2015). We also include time and industry fixed dummies and parent (group) fixed effects in the regressions to account for unobserved heterogeneity with respect to debt policy among firms, industries and time periods included in our dataset.

4.4.1 Firm-level control variables

Loss probability, $(\Pr(loss_t))$

The loss probability variable is estimated based on the probit model explained in Table 6.[8] The model contains information on affiliates from the time period t_{-2}, including a loss position dummy, maximum tax difference, loss carryforward, total debt-to-asset ratio and profitability (these variables are explained in the next paragraphs). The variable measures the probability that an affiliate experiences a loss within a given year.

The variable is included to control for the level of loss anticipation and the impact from being in an expected loss situation, thus enabling us to exclude non-tax related actions from the interaction terms. This should make us able to isolate the tax-driven effect that the loss probability adjustment has on the interaction terms.

Fixed asset ratio (tangibility)

The fixed asset ratio of an affiliate is measured as the ratio of fixed assets to total assets. Several empirical studies have established that different types of assets affect firms' leverage. However, evidence on whether the effect is positive or negative is inconclusive.

[8] See section 5 for further explanation of the probit model.

Tangible assets have higher liquidation value, are easier to value than intangible assets and are more easily deployable. Consequently, a larger fixed asset ratio decreases the risk of creditors, as it is easier to reclaim a bankrupt firm's tangible assets. Thus, the firm can use its assets as collateral, increasing the willingness of external lenders to provide loans (Rajan & Zingales (1995, p. 1451); Titman & Wessels (1988)). Evidence of a positive effect has been found by several authors. Findings by Drobetz & Fix (2003) support the prediction of the trade-off theory saying that the debt-capacity increases with the proportion of tangible assets on the balance sheet (p. 21). Furthermore, Campello & Giambona (2013) and Rajan & Zingales (1995) find a strong positive relation between asset tangibility and firms' leverage.

However, as pointed out by DeAngelo & Masulis (1980), depreciable assets carry tax deductible allowances that may be a substitute for the tax shield offered by debt (p. 4). Interest deductions create tax savings only if they can offset taxable income. When non-debt tax deductions increase, the smaller the remaining taxable income to claim interest deductions against, and the use of debt becomes less attractive (Cloyd, Limberg, & Robinson, 1997, p. 264). Moreover, according to the pecking order theory, low information asymmetry associated with tangible assets decreases costs of issuing equity. Hence, leverage ratios should be lower for firms with more tangible assets (Frank & Goyal, 2009, p. 9).

Firm size

The firm size variable is measured by an affiliate's sales and is expressed as the logarithm of sales. Empirical research suggests that firm size is correlated with firms' capital structures (Rajan & Zingales, 1995). Firms with higher sales tend to have more diversified financing sources and more stable cash flows. This makes them able to borrow at more favorable conditions and access capital markets more easily, which in turn may increase the use of debt (Booth, Aivazian, Demirguc-Kunt, & Maksimovic, 2001). In addition, firm size affects the risk of bankruptcy. Larger firms tend to have a lower possibility of bankruptcy, and therefore incur lower monitoring and agency costs (Booth et al., 2001, pp. 100-101).

However, large firms are claimed to have lower information asymmetry between the management of the firm and outside investors due to continuously monitoring by investors. This may affect costs of issuing debt and equity. The pecking order theory states that equity is relatively more sensitive towards information asymmetries than debt. Thus, large firms should be better positioned to issue equity than smaller firms, which implies that larger firms

are likely to have a stronger preference towards equity (Rajan & Zingales (1995, pp. 1456-1457); Fama & French (2002)). However, examinations by Rajan & Zingales (1995) suggest that net equity issuances by large firms in Canada, Japan, the United Kingdom, and the United States are significantly less than for smaller firms (p. 1457).

Loss carryforward

Loss carryforward is a dummy variable that equals 1 if an affiliate has losses to be carried forward that reduce their future tax liabilities, and 0 otherwise. Previous studies show that the effect of loss carryforwards on leverage is negative. Loss carryforwards reduce future tax payments. If there are non-debt tax shields available, the demand for debt tax shields may be lower (Mackie-Mason, 1990). Thus, we expect to find a negative relationship between the loss carryforward dummy and both internal and external debt-to-asset ratios, following Møen et al. (2011). MacKie-Mason (1990) find that U.S. firms with high loss carryforwards are much less likely to use debt. The author argues that this is expected since firms with loss carryforwards are unlikely to be able to use interest deductions (p. 1472).

Profitability

The profitability variable is computed as the ratio of an affiliate's earnings before interest, tax, depreciation and amortization (EBITDA) to total assets. Academic research has developed two theories on how profitability impact firms' optimal leverage ratio. These are the static trade-off theory and the pecking order theory.

According to the trade-off theory, firms weigh the benefits of debt resulting from shielding cash flows from taxes against the costs of financial distress associated with debt when deciding on its optimal debt-to-equity ratio. Leverage should be positively related to profitability as higher profits lead to more income to use for debt payments and more taxable profits to protect from taxation. By increasing debt and thereby creating a debt tax shield, a company can achieve valuable tax savings. Furthermore, expected bankruptcy costs and risks decrease when profitability rises; therefore, firms' ability to obtain credit rises and the optimal level of leverage increases (Fama & French (2002, p. 6); Myers (1989, p. 84)).

Moreover, the pecking order theory predicts that information asymmetry between managers and investors creates a preferential ranking of financing sources. Initially, a firm would want to finance their investments entirely by retained earnings or internal debt. If the firm also

needs external funding, they first apply for a bank loan, then public debt, and only issues new equity as a last resort (Leary & Roberts, 2010). Thus, according to the pecking order theory debt is negatively related to profitability because internal funding is less expensive than external funding, and firms with higher profitability are expected to have lower leverage due to their ability to finance their investments through retained earnings rather than debt and to repay their existing liabilities (Fama & French (2002); Orihara (2015, p. 9). Profitable firms also have more internal financing available while less profitable firms require external financing, and consequently accumulate more debt (Myers, 2001).

4.4.2 Country-level control variables

Corruption

The corruption variable is defined as the logarithm of the annual corruption index in each country. The data is obtained from the Worldwide Governance Indicators database by the World Bank (n.d.a). In this database, countries are assigned to a corruption index from -2.5 to 2.5 where -2.5 indicates a very high level of corruption. However, the index is adjusted to range between 0 and 10 in our dataset, where 0 indicates a country facing a very high level of corruption. The corruption variable measures the abuse of public office for private gain and the risk of investors' expropriation by management or by public officials.

The corruption variable can be expected to have a negative effect on a firm's debt-to-asset ratio, as it may be more difficult to obtain credit in corrupt countries. Firms may also consider it less safe to borrow money in countries characterized by high corruption. Interest rates would also be higher in countries with weak legal efficiency, where creditors would bear higher risk and lower negotiation power in the event of default (Aggarwal & Kyaw, 2008).

However, several studies have found that firms operating in highly corrupt countries are more indebted, suggesting a positive relationship between corruption and debt. One explanation might be the contractual nature of debt as it better limits the expropriation of investors compared to equity. Fan, Titman, & Twite (2012) find that the legal environment influence capital structure choices. Firms that operate in countries characterized by being more corrupt tend to be more leveraged and use more short-term debt (p. 47). Findings by Fan, Rui, & Zhao (2008) also suggest that contact with corrupt bureaucrats provides firms with an advantage in obtaining access to debt. Bureaucrats seeking private gains might find

it easier to channel funds as loans through banks that they control, instead of using the equity market, which is typically harder to influence.

Furthermore, corruption may cause firms to choose external debt over internal debt. When facing the risk of expropriation, parent companies will prefer to risk external parties' debt instead of their own debt (Aggarwal & Kyaw, 2008, p. 416).

Creditor rights

The creditor rights variable is defined as the logarithm of the annual strength of legal rights index of a country. The legal rights index data is obtained from the World Development Indicators of the World Bank (n.d.b). The index is a measure of how well collateral and bankruptcy regulations protect the rights of lenders and borrowers within a country and ranges from 0 to 12, where 12 indicates strong creditor rights. The index has been adjusted to range from 0 to 10 in our dataset, where high values indicate high creditor protection and increased access to credit. Previous literature finds that creditor rights influence corporate decisions. However, they disagree on whether stronger creditor rights should be associated with higher or lower leverage, which has resulted in two conflicting views.

The first view, which focuses on the supply side of the financial market, takes the perspective of debt investors. The view claims that creditor protection has a positive influence on the use of debt, as it is easier and less costly for lenders to enforce debt contracts and gain control of a firm in case of bankruptcy. This results in lenders providing credit at more favorable terms and firms adopting higher leverage (Cho, El Ghoul, Guedhami, and Suh, 2014, p. 41). In line with this view, several studies show that strong creditor protection supports development of credit markets (Djankov, McLiesh, & Shleifer (2007); Haselmann, Pistor, & Vig (2010)). Porta, Lopez-De-Silanes, Shleifer, & Vishny (1997) predict that countries with higher credit protections should have more external finance, as better legal protection enables lenders to offer entrepreneurs financing at more favorable terms (p. 1132). Blouin, Huizinga, Laeven, & Nicodeme (2014) point out that as external debt markets become more available, the need for internal financing may decrease. Therefore, better creditor rights may increase the amount of total leverage but reduce the portion of internal leverage (p. 14).

In contrast, the demand side view claims that creditor protection makes managers and shareholder more unwilling to use large amounts of debt because they want to avoid losing

control in the case of financial distress. In countries characterized by strong creditor protection, managers can be removed from their position if the firm faces bankruptcy. Consequently, strong creditor rights create an incentive for self-interested managers to avoid debt (Cho et al., 2014, p. 41). Rajan & Zingales (1995) argue consistent with the demand side view that strong creditor protection commits creditors to penalize management if the firm gets into financial distress, thus giving the management strong incentives to stay clear of it (p. 1444). Hence, the demand side view explains why the relationship between creditor rights and leverage can be negative.

Growth opportunities

Based on Huizinga et al. (2008, p. 100) and Møen et al. (2011, p. 18), the growth opportunities variable is constructed as a measure of the median annual growth in sales per industry and country. Previous research suggests that growth opportunities are one of the factors that determine a company's capital structure, but the research disagree on the relationship.

The literature generally favors the negative relationship suggesting that leverage is negatively associated with growth opportunities (Jensen & Meckling (1976); Stulz (1990)). According to Myers (1977) firms expecting high future growth use less debt. An explanation is that increased growth opportunities lead to agency problems when there is more flexibility in future investments. Stockholders may make sub-optimal decisions in order to benefit over debtholders. This happens because shareholders who control investment decisions bear the whole cost of the projects but must share incoming returns with debt holders. Thus, shareholders only receive a fraction of the increase in the value of the firm. The result is underinvestment in future growth opportunities and a preference for equity over debt when financing growth opportunities (Rajan & Zingales (1995); Myers (1977)). To resolve the potential conflicts regarding future growth opportunities, firms can reduce debt levels or include restrictive debt covenants in agreements (Myers (1977, p. 161); Jensen (1986)).

Titman & Wessels (1988) also find a negative relationship between leverage and growth. The authors discuss that despite being value-adding to a company, growth opportunities cannot be collateralized to increase companies' borrowing capacity and do not generate current taxable income. Therefore, growth opportunities are likely to lower debt usage as borrowing may be difficult for firms with low current income or low tangible assets (p. 4).

However, as argued by Harris & Raviv (1991), growth opportunities indicate future profitability and thereby the ability to borrow. This suggests a positive relationship between growth opportunities and leverage. Furthermore, Awan, Bhatti, Ali, & Qureshi (2010) also find a positive relationship between the growth opportunities and debt levels of firms in Pakistan. They point out that owners may look at the available growth opportunities as unsustainable and riskier, and wish to pass on the risk to debtholders, resulting in a high debt level. The authors also claim that there is a general tendency of the credit market, having limited options for profitable credit, to finance companies with better future growth expectations (p. 96).

Inflation

The inflation variable is measured as the annual percentage change in the consumer price index, provided by the World Development Indicators of the World Bank (n.d.c), the World Economic Outlook Database of the International Monetary Fund (2014) and the Consumer Prices Database of the OECD (2015). Inflation is an economic indicator that reflects the stability of a country. However, there are conflicting views on how inflation affects firms' leverage.

On the one hand, inflation may reduce the real value of deductible interest payments, especially if interest rates are fixed, and payments are based on debt valued at historical costs, resulting in a reduction of the tax advantage of debt (Mintz & Weichenrieder, 2010). Furthermore, countries with high inflation often have higher risk premiums and nominal interest rates, something which discourages debt financing (Huizinga et al., 2008, p. 100). Therefore, inflation may have a negative effect on the debt-to-asset ratio.

On the other hand, several studies find that leverage is positively related to expected inflation. Higher nominal interest rates due to inflation increase the value of the debt tax shield as firms can deduct their entire nominal interest expense. This may encourage the use of debt by lowering real-borrowing costs (Gu, Mooji, & Poghosyan (2015, p. 184); Blouin et al. (2014, p. 11)). Furthermore, Hochman & Palmon (1985) examine the effect inflation has on firms' capital structure. The authors conclude that inflation enhances debt financing as it increases the real tax gains of debt financing.

4.5 Descriptive statistics

In this section, we will analyze our data sample and present the main descriptive statistics that are relevant for our study. To estimate the probability of loss $H(p_i^0)$, we had to eliminate observations occurring in time-period t_{-1}. Further discussion on the loss probability estimation is provided in section 5.

4.5.1 Parent firms and subsidiaries by country

Data on the number of parent firms and subsidiaries by home and host country is provided in Table 2. Our data sample consists of firms located in Europe, as the Amadeus database does not provide financial data on firms located on other continents.[9] The total number of parent firms is 41,820 over the sample period of 12 years, while the total number of subsidiaries is 248,412. The data sample does not include data on all parent firms over the sample period because of data trimming procedures and removal of parent firm-year observations with missing or extreme data from the final sample. Also, while examining the probability of incurring a loss, we delete one year from the sample because we require a lag to capture previous performance. Overall, there are 290,232 affiliate-year observations in the main data sample, representing 41,820 parent-year observations and 248,412 subsidiary-year observations.

Moreover, the table lists the number of parent firms by home country and the number of subsidiaries by home and host country. For each subsidiary of a multinational company, the home country is denoted as the country where its parent firm is domiciled, and the host country is denoted as the country where the subsidiary operates. This implies that home country and host country is the same for a domestic subsidiary, as both the subsidiary and the parent firm operate in the same country.[10] As observable in the table, Belgium, Estonia, France, Germany, and Italy have the highest number of parent firms. The table also reveals

[9] The Amadeus database only contains information on European firms and we therefore only cover the European operations of the multinationals in our sample. Accordingly, we cannot consider how tax differences between European countries and other parts of the world affect the capital structure of subsidiaries in Europe. In line with Huizinga et al. (2008) we do not see this as a major limitation of our analysis because European multinationals typically earn a large part of their revenues from operations in Europe rather than other parts of the world.

[10] We do not include purely domestic firms in our main data sample.

that Estonia, France, Germany, and Italy are the host countries with relatively many subsidiaries, with more than 20,000 subsidiaries each in the data sample.

Huizinga et al. (2008) also discuss the number of parent firms and subsidiaries in their data sample (pp. 96-97). One difference arises when comparing their data sample to ours. The total number of subsidiaries in the data sample by Huizinga et al. (2008) is equal by home and host countries, while it is not equal in our data sample. This is caused by a difference in the ownership data. While our data sample is adjusted for ownership changes over time, the empirical results and descriptive statistics from Huizinga et al. (2008) show that the authors assume that the ownership structure is constant over their entire sample period. They do not explicitly state this assumption, but they do not state that the ownership structure is adjusted for historical ownership changes either. From the assumption, it follows that subsidiaries are owned by the same parent over the sample period and that the number of subsidiaries by home and host countries are the same.[11] However, due to the changing historical ownership structure in our data sample, the number of subsidiaries by home country is higher compared to the number of subsidiaries by host country. The home country of the parent firm is likely to change over time, resulting in more home country observations than host country observations per subsidiary.

Table 2: Parent firms and subsidiaries

This table shows the number of parent firms and subsidiaries sorted by home and host country in the final sample. "Number of parent firms by home country" describe only parent firms while "Number of subsidiaries by host country" exclude parent firms and describe only subsidiaries in the final sample.

	Number of parent firms	Number of subsidiaries	
Country	by home country	by home country	by host country
Austria	1647	7008	5361
Bosnia-Herzegovina	27	535	508
Belgium	4692	23793	19101
Bulgaria	315	2402	2087
Switzerland	14	164	150
Czech Republic	1065	11439	10374
Germany	4652	26026	21374
Estonia	5216	30144	24928
Finland	491	2978	2487
France	9045	63364	54319
Greece	353	5138	4785
Hungary	123	2028	1905
Italy	7352	52250	44898
Luxemburg	330	1924	1594

[11] See Table 7, panel A in the study by Huizinga et al. (2008, p. 97) for comparison.

Country	Number of parent firms by home country	Number of subsidiaries by home country	Number of subsidiaries by host country
Latvia	13	298	285
Netherlands	2	7	5
Norway	769	6566	5797
Poland	1028	11008	9980
Portugal	1124	16653	15529
Romania	420	4225	3805
Serbia	225	1365	1140
Russian Federation	-	4	4
Sweden	2210	13376	11166
Slovenia	236	1955	1719
Slovakia	245	4058	3813
Ukraine	226	1524	1298
Number of observations	41820	290232	248412

4.5.2 Financial coordination centers and other affiliates by host country

Table 3 provides information on the number of potential financial coordination centers and the number of other affiliates (all other affiliates) by home and host country. According to the theoretical model, we assume that the potential financial coordination center of an MNC is the affiliate with the lowest tax rate in the corporate group. However, not all MNCs choose the optimal tax efficient financing structure when deciding on a location for the financial coordination center. Thus, the financial coordination centers reported in the table might not reflect the actual financial coordination center of European multinational groups.

The table reveals that a large share of the financial coordination centers is located in Italy, France, and Estonia. Location of financial coordination centers in Estonia can be explained by its relatively low expected corporate tax rate (on average 22%).[12] Note that we have calculated expected tax rates aggregated on country level, where the results can be found in appendix G. These expected taxes on country level are added for comparison reasons and are only used in this section. Loss probabilities predicted on affiliate level are used in our regressions. Furthermore, the location of the financial coordination centers in Italy and France might be explained by the large number of subsidiaries located in these countries, which can be seen in Table 2, and the relatively lower expected statutory tax rates in these countries, compared to other countries which hosts relatively many subsidiaries.[13] It is

[12] The expected tax rates are adjusted by the loss probability $[1 - H(p_i^0)]$.

[13] Italy is host to more than 44,000 subsidiaries, France is host to more than 54,000 and Estonia is host to more than 20,000 subsidiaries. As compared to Germany that also hosts more than 20,000 subsidiaries and has an average expected tax rate of 27 %, Italy, and Estonia's average expected tax rates are approximately 22% and

therefore likely that many subsidiaries located in Italy, France, and Estonia are classified as financial coordination centers in the data sample. Furthermore, France, Italy, and Germany are the countries hosting most affiliates that do not act as financial coordination centers in the data sample. This can also be explained by the relatively many affiliates that are located in these countries, as observable in Table 3.[14]

Lastly, the total number of potential financial coordination centers is larger than the total number of other affiliates in the main data sample. This reflects the tendency of multinational firms to establish several affiliates in the country with the lowest statutory tax rate. Since all affiliates operating in the lowest-taxed country are automatically labeled as a potential financial coordination center, the total number of financial coordination centers is likely to be large. Furthermore, based on the minimum tax rate within the multinational group, the same affiliate may be counted twice as both a financial coordination center and other affiliate in different years. However, it is unlikely that multinational companies own more financial coordination centers than other affiliates on average. Hence, a higher number of financial coordination centers than other affiliates should not be realistic.

Table 3: Number of financial coordination centers and other affiliates by host country

This table shows the financial coordination centers (the lowest taxed affiliates) and other affiliates sorted by host country in the final sample. The notation "-" implies that the given observation is missing from our dataset.

	Financial coordination centers	Other affiliates
Country	by host country	by host country
Austria	3391	3617
Bosnia-Herzegovina	535	-
Belgium	11249	12544
Bulgaria	2402	-
Switzerland	130	34
Czech Republic	8903	2536
Germany	10883	15143
Estonia	17445	12699
Finland	1968	1010
France	23878	39486
Greece	3387	1751
Hungary	1141	887

25% respectively. On the other hand, France faces the same average expected corporate tax rate as Germany. The large number of financial coordination centers located in France compared to Germany can be explained by the relatively large difference in the number of subsidiaries located in the two countries.

[14] France, Germany and Italy are host countries for more than 20,000 subsidiaries each in the data sample.

Country	Financial coordination centers by host country	Other affiliates by host country
Italy	36525	15725
Luxemburg	1382	542
Latvia	285	13
Netherlands	6	1
Norway	3247	3319
Poland	9281	1727
Portugal	14096	2557
Romania	3648	577
Serbia	1306	59
Russian Federation	3	1
Sweden	8727	4649
Slovenia	1175	780
Slovakia	2615	1443
Ukraine	869	655
Number of observations	168477	121755

4.5.3 Financial leverage and tax mechanisms

Table 4 shows summary statistics for financial leverage, the expected tax mechanisms and the regular tax mechanisms sorted by country in our final sample. Financial leverage is measured as the ratio of total liabilities to total assets.[15] The average debt-to-asset ratio in our sample is 0.630, varying from 0.494 in Ukraine to 0.708 in the Netherlands. The average expected statutory tax rate varies from 0.073 in Bosnia-Herzegovina to 0.267 in Belgium, while the average regular tax rates varies from 0.100 in Bosnia-Herzegovina to 0.343 in France. The average lowest tax rate decreases by almost 3 percent while the average highest tax rate decreases by almost 8 percent when we adjust for the loss probability.[16] The average expected tax rate is approximately 6 percent lower compared to the average regular tax rate.

The expected weighted tax difference is the external tax mechanism and indicates if an affiliate is willing to shift external debt. If the variable is positive, this indicates that affiliates within the MNC are willing to shift external debt into affiliates within the given country, while a negative expected weighted tax difference indicates that the MNC is willing to shift external debt out of affiliates in the given country. As seen from the table, MNCs should be most willing to shift external debt into Belgium and out of Bulgaria if they consider the anticipation of losses. Comparing to the regular weighted tax difference, MNCs should be most willing to shift external debt into Belgium and out of Hungary. The average expected

[15] See Appendix C for definitions of variables and data sources.
[16] See Appendix G for detailed information on regular and expected statutory tax rates.

weighted tax difference and the average regular weighted tax difference are almost equal in size.

The expected maximum tax difference expresses the difference between the expected statutory tax rate and the lowest taxed affiliate within the MNC. This variable is negative for all countries, which indicates that the MNC should be unwilling to shift internal debt based on the expected maximum tax difference. However, should the MNC shift internal debt, it would most likely shift internal debt to affiliates located in Germany. In addition, it would be least willing to shift external debt to affiliates located in Portugal. In contrast, all of the regular maximum tax difference variables are positive. As observable from the table, affiliates located in Bosnia-Herzegovina and Bulgaria are likely to attract the least internal debt, while affiliates located in France and Germany are likely to attract the most internal debt.

Table E.1 in Appendix E shows year-by-year summary statistics of the total debt-to-asset ratio and the expected tax mechanisms. The financial leverage ratio and its standard deviation decrease slightly during the sample period. The expected statutory tax rate decreases during the sample period, while its standard deviation has a slight increase. The expected weighted tax difference is relatively stable, despite an increase in the standard deviation. The expected maximum tax difference decreases over time.

Table 4: Financial leverage (total debt-to-asset ratio) and tax mechanisms

This table shows the average total debt-to-asset ratio and the expected tax mechanisms in the final sample, sorted by host country. The regular statutory tax rates are found in our original dataset, before excluding the observations occurring in period t_{-1}. These tax rates are used to estimate the regular tax mechanisms, which are added for comparison reasons. The tax mechanisms are calculated as follows; Regular statutory tax rate: t_i, Expected statutory tax rate: $t_i[1 - H(p_i^0)]$, Regular weighted tax difference: $\sum_{j \neq i} \rho_j (t_i - t_j)$, Expected weighted tax difference: $\sum_{j \neq i} \rho_j \left(t_i[1 - H(p_i^0)] - t_j\left[1 - H\left(p_j^0\right)\right]\right)$, Regular maximum tax difference: $(t_i - t_1)$, and Expected maximum tax difference: $(t_i[1 - H(p_i^0)] - t_1)$.

Country	Total debt-to-asset ratio	Regular statutory tax rate	Expected statutory tax rate	Regular weighted tax difference	Expected weighted tax difference	Regular maximum tax difference	Expected maximum tax difference
Austria	0.625	0.250	0.197	-0.014	-0.008	0.039	-0.615
Bosnia-Herzegovina	0.610	0.100	0.073	-0.009	-0.010	0.000	-2.673
Belgium	0.603	0.340	0.267	0.011	0.012	0.051	-1.201
Bulgaria	0.509	0.100	0.079	-0.053	-0.049	0.000	-2.139
Switzerland	0.625	0.208	0.187	-0.020	-0.012	0.010	-0.488
Czech Republic	0.552	0.196	0.153	-0.026	-0.022	0.009	-2.701
Germany	0.680	0.314	0.242	0.008	0.006	0.055	-0.269
Estonia	0.601	0.306	0.234	0.002	0.000	0.031	-2.864
Finland	0.658	0.246	0.186	-0.013	-0.010	0.019	-3.264
France	0.632	0.343	0.266	0.012	0.011	0.055	-1.099
Greece	0.637	0.246	0.187	-0.018	-0.017	0.026	-2.391

Country	Total debt-to-asset ratio	Regular statutory tax rate	Expected statutory tax rate	Regular weighted tax difference	Expected weighted tax difference	Regular maximum tax difference	Expected maximum tax difference
Hungary	0.649	0.192	0.148	-0.054	-0.046	0.022	-1.580
Italy	0.673	0.287	0.219	-0.002	-0.004	0.022	-3.930
Luxemburg	0.560	0.290	0.224	-0.006	-0.004	0.020	-3.986
Latvia	0.553	0.150	0.121	-0.022	-0.018	0.001	-2.705
Netherlands	0.708	0.271	0.227	-0.019	-0.001	0.012	-1.920
Norway	0.654	0.278	0.222	0.000	0.003	0.027	-2.119
Poland	0.559	0.190	0.152	-0.042	-0.028	0.007	-2.826
Portugal	0.629	0.279	0.224	-0.003	-0.002	0.008	-4.833
Romania	0.583	0.166	0.129	-0.022	-0.031	0.003	-2.306
Serbia	0.610	0.105	0.085	-0.050	-0.043	0.001	-2.261
Russian Federation	0.531	0.207	0.177	-0.006	0.004	0.001	-2.059
Sweden	0.656	0.258	0.193	-0.010	-0.009	0.019	-3.495
Slovenia	0.543	0.192	0.148	-0.025	-0.024	0.023	-1.323
Slovakia	0.596	0.213	0.164	-0.018	-0.021	0.012	-2.100
Ukraine	0.494	0.237	0.171	0.001	-0.006	0.041	-1.778
Mean	0.630	0.283	0.224	-0.003	-0.002	0.031	-2.313

4.5.4 Dependent and independent variables

Summary statistics for the lowest-taxed affiliates and other affiliates

Panel A of Table 5 presents summary statistics for the dependent variable and independent variables used in the analysis. The table distinguishes between the affiliate with the lowest tax rate within the multinational corporation and other affiliates (all other affiliates than the lowest-taxed). The table reveals that the lowest-taxed affiliates make up 58 percent of the data sample, which is a relatively large portion. According to our model, the lowest taxed affiliates act as financial coordination centers that lend out money to the other affiliates within the MNC. To examine whether the model's predictions hold for the data sample, we compare characteristics of the lowest-taxed affiliates and other affiliates.

The table shows that the lowest-taxed affiliates have lower sales and total assets. As observable from the table, other affiliates are approximately 2.57 times larger than the lowest-taxed affiliates in terms of total asset. Thus, showing that the financial coordination center primarily lends out money to other affiliates within the group, and are therefore unlikely to engage in production activities itself. In addition, when comparing leverage ratios, long-term and short-term debt, financial expenses, and interest paid, the lowest-taxed affiliates appear to borrow less and pay less interest than other affiliates. By studying our data, we see that the lowest-taxed affiliates are less leveraged than other affiliates.

Moreover, the average expected statutory tax rate in the data sample is 0.239, with a standard deviation of 0.062 for other affiliates. The lowest-taxed affiliates have a lower average expected statutory tax rate of 0.213. When compared to other affiliates, the average expected statutory tax rate is approximately 2.6 percentage points higher for other affiliates. The expected tax rates for both the lowest-taxed affiliate and other affiliates are lower compared to the regular tax rate of the lowest taxed affiliate and for other affiliates. Furthermore, the expected weighted tax difference in the sample equals -0.002, while the average expected maximum tax difference is -0.023. The average expected weighted tax difference is negative for the lowest-taxed affiliates, but positive for other affiliates. This can be explained by the lower expected statutory tax rates of the lowest-taxed affiliates. The average expected maximum tax difference is -0.062 for the lowest-taxed affiliates, while it is positive for other affiliates. This can also be explained by the lower expected statutory tax rates that the lowest-taxed affiliates face.

Summary statistics for parent companies and other affiliates

Summary statistics for the dependent variable and independent variables used in the analysis, specifically for parent firms and other affiliates, are presented in Panel B of Table 5. Panel B displays financial data on 41,820 parent firms, which represents approximately 14 percent of the total affiliate-year observations in the data sample. Compared to other affiliates, parent firms are approximately 3.7 times larger and carry 3.6 times more debt. Accordingly, interest paid and financial expenses are also much higher.

Furthermore, parent firms have substantially larger net lending than other affiliates, despite their slightly larger expected statutory tax rate. This observation suggests that parent firms perform substantial lending activities even though they are not likely to be the lowest-taxed affiliate in the corporate group. According to the model, this behavior is sub-optimal and can be explained by lower borrowing costs of external debt at the headquarters' level. Debt from the parent can then be transferred as internal debt to other subsidiaries, as a substitute for external debt. This is beneficial if subsidiaries face an adverse institutional environment or possess unfavorable characteristics. Our observations are supported by Dischinger, Knoll, & Riedel (2014a) who find that the income distribution is skewed in favor of the headquarters' location. Their results indicate that the headquarters plays a unique role in MNCs. Moreover,

they discuss theory that suggests substantial agency costs and moral-hazard problems between the headquarters and the financial center.[17]

Summary statistics for affiliates in and not in a loss position

Panel C shows summary statistics for affiliates that are in and not in a loss position. The distribution of the observations based on the loss probability is shown in Appendix F. The affiliates in a loss position have a higher total debt-to-asset ratio, compared to the full sample and the profitable affiliates. They also face a lower expected statutory tax rate, due to the adjustment caused by the loss probability. The expected weighted tax difference is lower for the loss affiliates, since they have a lower expected statutory tax rate, thus making it less attractive to shift external debt to these affiliates. It will be more attractive to shift external debt to profitable affiliates, which have a positive expected weighted tax difference, thus making it possible to take advantage of the tax shield in these countries. The expected maximum tax difference is also lower for the affiliates in a loss position, meaning that it is less attractive to shift internal debt for loss affiliates than profitable ones. Moreover, the loss affiliates have a larger mean value of both total assets and long- and short-term debt. The regular tax mechanisms are fairly similar for both affiliates in and not in a loss position.

Table 5: Summary statistics

Panel A shows summary statistics where we separate the lowest-taxed and other affiliates from the final sample. Panel B shows summary statistics where we separate parent firms and other affiliates from the final sample. Panel C shows summary statistics where we distinguish between affiliates in and not in a loss position. Panel A-C all have total debt-to-asset ratio as the dependent variable. This variable is measured as the ratio of total liabilities to total assets. There are several independent variables. The variables are: (1) the statutory tax rate of the host country from KPMG's corporate and indirect tax rate survey and corporate tax rate table and OECD´s economic surveys and corporate income tax rates table; (2) weighted tax difference, measured as the weighted sum of differences between the corporate tax rate that an affiliate face and the tax rates faced by the other affiliates belonging to the MNC; (3) maximum tax difference is measured as the difference between the tax rate faced by an affiliate's host country and the tax rate of the affiliate within the MNC with the lowest tax rate; (4) expected statutory tax rate, statutory tax rate adjusted for the loss probability; (5) expected weighted tax difference, weighted tax difference adjusted for the loss probability; (6) expected maximum tax difference, maximum tax difference adjusted for the loss probability. The firm-level control variables are: (1) fixed asset ratio (tangibility), expressed as the ratio of an affiliate's fixed assets to total assets; (2) firm size, measured as the logarithm of the affiliate's sales; (3) loss carryforward, a dummy variable equal to 1 if an affiliate has losses to be carried forward, 0 otherwise; (4) profitability, measured as the ratio of earnings before interest, tax, depreciation and amortization (EBITDA) to total assets. Moreover, the country-level control variables are: (1) inflation, measured as the annually measured percentage change in the consumer price index, reported by the World Development Indicators of the World Bank, World Economic Outlook Database of the Internal Monetary Fund and the Consumer Prices database of the OECD; (2) corruption, measured as the logarithm of

[17] See Dischinger, Knoll, & Riedel (2014b), O'Donnell (2000), and Chang & Taylor (1999) for further discussion.

the annual corruption index in every country, where a higher index denote a lower level of corruption, reported by the Worldwide Governance Indicators of the World Bank; (3) growth opportunities, measured as the median annual growth in sales per country and industry; (4) creditor rights, measured as the logarithm of annual strength of legal rights index, where a higher index denote higher creditor rights, reported by the World Development Indicators of the World Bank. Lastly, several variables have been added to test the model's predictions concerning the lowest-taxed affiliates, these variables are expressed in millions of euros; (1) total assets; (2) long-term debt; (3) short-term debt; (4); financial expenses; (5) interest paid; (6) net lending (debtors minus creditors). The summary statistics cover our final sample of European MNCs, including both parent firms and their subsidiaries, based on up to 11 years of data from the period 2004 – 2014 for every parent firm and subsidiary.

Panel A: Summary statistics for the lowest-taxed affiliates and other affiliates

Variable	Full sample		Lowest-taxed affiliates		Other affiliates	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Total debt-to-asset-ratio	0.630	0.242	0.623	0.244	0.639	0.238
Statutory tax rate	0.287	0.055	0.275	0.058	0.304	0.044
Weighted tax difference	-0.003	0.035	-0.011	0.030	0.008	0.037
Maximum tax difference	0.040	0.062	0.000	0.000	0.096	0.062
Expected statutory tax rate	0.224	0.065	0.213	0.066	0.239	0.062
Expected weighted tax difference	-0.002	0.041	-0.007	0.033	0.006	0.050
Expected maximum tax difference	-0.023	0.079	-0.062	0.050	0.030	0.080
Fixed asset ratio	0.336	0.293	0.345	0.298	0.323	0.287
Log(Sales)	16.203	2.200	15.613	2.215	17.020	1.899
Loss carryforward	0.246	0.431	0.261	0.439	0.224	0.417
profitability	0.320	3.489	0.371	3.671	0.250	3.219
Inflation	1.660	1.507	1.705	1.605	1.598	1.358
Log(Corruption index)	1.708	0.414	1.640	0.434	1.801	0.364
Growth opportunities	-0.404	230.037	-0.709	301.924	0.018	1.067
Log(Creditor rights index)	1.343	0.420	1.315	0.464	1.380	0.347
Total assets(mln)	107.061	808.463	64.489	621.214	165.968	1009.000
Long-term debt (mln)	12.000	190.000	6.500	95.000	19.000	260.000
Short-term debt (mln)	5.200	110.000	2.700	32.000	8.700	170.000
Financial expenses (mln)	2.800	50.000	1.600	28.000	4.500	69.000
Interest paid (mln)	1.400	20.000	0.816	18.000	2.100	22.000
Net lending	3.200	72.000	1.800	47.000	5.100	96.000
Number of observations	290232		168477		121755	

Panel B: Summary statistics for parent firms and other affiliates

Variable	Main sample		Parent firms		Other affiliates	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Total debt-to-asset-ratio	0.630	0.242	0.611	0.243	0.633	0.241
Statutory tax rate	0.287	0.055	0.294	0.051	0.286	0.055
Weighted tax difference	-0.003	0.035	-0.001	0.030	-0.004	0.035
Maximum tax difference	0.040	0.062	0.050	0.066	0.039	0.061
Expected statutory tax rate	0.224	0.065	0.225	0.065	0.224	0.065
Expected weighted tax difference	-0.002	0.041	-0.001	0.040	-0.002	0.041
Expected maximum tax difference	-0.023	0.079	-0.019	0.084	-0.024	0.078
Fixed asset ratio	0.336	0.293	0.411	0.288	0.323	0.292
Log(Sales)	16.203	2.200	17.311	2.129	16.017	2.157
Loss carryforward	0.246	0.431	0.246	0.431	0.246	0.431
profitability	0.320	3.489	0.202	2.294	0.340	3.652
Inflation	1.660	1.507	1.684	1.470	1.656	1.513
Log(Corruption index)	1.708	0.414	1.750	0.408	1.700	0.415
Growth opportunities	-0.404	230.037	0.016	0.389	-0.475	248.648
Log(Creditor rights index)	1.343	0.420	1.372	0.389	1.338	0.425
Total assets(mln)	107.061	808.463	283.662	1418.950	77.330	646.963
Long-term debt (mln)	12.000	190.000	32.000	340.000	8.200	140.000
Short-term debt (mln)	5.200	110.000	12.000	130.000	4.100	110.000

Panel B: Summary statistics for parent firms and other affiliates						
Variable	Main sample		Parent firms		Other affiliates	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Financial expenses (mln)	2.800	50.000	7.100	64.000	2.100	47.000
Interest paid (mln)	1.400	20.000	3.600	31.000	0.980	17.000
Net lending	3.200	72.000	5.800	120.000	2.700	60.000
Number of observations	290232		41820		248412	

Panel C: Summary statistics for affiliates in and not in a loss position						
Variable	Main sample		In a loss position		Not in a loss position	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Total debt-to-asset-ratio	0.630	0.242	0.674	0.255	0.617	0.236
Statutory tax rate	0.287	0.055	0.289	0.053	0.287	0.055
Weighted tax difference	-0.003	0.035	-0.002	0.033	-0.004	0.035
Maximum tax difference	0.040	0.062	0.039	0.061	0.041	0.062
Expected statutory tax rate	0.224	0.065	0.187	0.070	0.234	0.060
Expected weighted tax difference	-0.002	0.041	-0.016	0.047	0.002	0.038
Expected maximum tax difference	-0.023	0.079	-0.063	0.083	-0.012	0.074
Fixed asset ratio	0.336	0.293	0.372	0.297	0.326	0.291
Log(Sales)	16.203	2.200	15.745	2.374	16.333	2.131
Loss carryforward	0.246	0.431	0.819	0.385	0.084	0.278
profitability	0.320	3.489	-0.488	3.935	0.549	3.317
Inflation	1.660	1.507	1.636	1.539	1.667	1.498
Log(Corruption index)	1.708	0.414	1.690	0.438	1.713	0.407
Growth opportunities	-0.404	230.037	0.018	2.497	-0.524	260.492
Log(Creditor rights index)	1.343	0.420	1.319	0.423	1.349	0.419
Total assets(mln)	107.061	808.463	129.663	1009.420	100.679	741.814
Long-term debt (mln)	12.000	190.000	13.000	170.000	11.000	190.000
Short-term debt (mln)	5.200	110.000	9.500	220.000	4.000	55.000
Financial expenses (mln)	2.800	50.000	5.000	95.000	2.200	25.000
Interest paid (mln)	1.400	20.000	1.700	17.000	1.200	20.000
Net lending	3.200	72.000	2.600	110.000	3.300	56.000
Number of observations	290232		63902		226330	

5. Empirical strategy

5.1 Ordinary least squares regression

In section 3.2 we presented the theoretical predictions of our model. To test whether these predictions hold, we have constructed an ordinary least squares (OLS) model based on the theoretical equations (11) and (12) in section 3.1, and the interaction terms presented in section 4.3. This gives the following regression specification for our empirical analysis:

$$
\begin{aligned}
b_{Pit} = \quad & \beta_0 + \beta_1 \cdot t_{Pit} + \beta_2 \cdot \sum\nolimits_{j \neq i} \rho_{Pjt}\left(t_{Pit} - t_{Pjt}\right) + \beta_3 \cdot (t_{Pit} - t_{P1t}) + \\
& \beta_4 \cdot H(p_i^0) t_{Pit} + \beta_5 \cdot \sum_{j \neq i} \rho_{Pjt} t_{Pjt} H\left(p_j^0\right) + \beta_6 \cdot H(p_1^0) t_1 + \\
& \gamma \mathrm{X}_{Pit} + \delta_t + \sigma_{\mathrm{I}} + \alpha_P + \varepsilon_{Pit}
\end{aligned} \tag{14}
$$

where the dependent variable b_{Pit} is the total debt-to-asset ratio of an affiliate i, as a part of a multinational company, P, in year t. The optimal debt-to-asset ratio consists of both optimal external and internal leverage ratios; therefore, it is determined by all three previously discussed tax mechanisms. The right-hand side of the specification consists of several independent variables. The first line of the specification features the regular tax mechanisms. The host country corporate tax rate, t_{Pit}, affects the optimal level of external leverage. $\sum_{j \neq i} \rho_{Pjt}\left(t_{Pit} - t_{Pjt}\right)$ is the weighted tax difference variable. This variable reflects external debt shifting and affects the optimal level of external leverage. $(t_{Pit} - t_{P1t})$ is the maximum tax difference variable. This variable reflects internal debt shifting and affects the optimal level of internal leverage. The second line of the specification contains interaction terms between the tax mechanisms and the loss probability. Including these in the regression specification enables us to isolate the effect loss probability has on the different tax mechanisms. The interaction terms are calculated by adjusting the three regular tax mechanisms by the loss probability, providing us with the terms; Domestic interaction, $H(p_i^0) t_{Pit}$, Foreign interaction, $\sum_{j \neq i} \rho_{Pjt} t_{Pjt} H\left(p_j^0\right)$, and Internal bank interaction, $H(p_1^0) t_1$. The domestic interaction term affects the standard debt tax shield mechanism, the foreign interaction term affects the external debt shifting mechanism, while the internal bank interaction affects the internal debt shifting mechanism.

Furthermore, motivated by earlier literature we control for several affiliate and country characteristics in vector X_{Pit}. In addition, all regressions include a vector δ_t of time dummies, vectors σ_{I} and α_P representing industry and parent fixed effects, and an error term ε_{Pit}.[18] The affiliate-specific control variables and industry, year and parent (group) fixed effects have been added to the regression specification to control for unobserved heterogeneity in the data. Year fixed effects capture aggregate shocks occurring over the sample period, while affiliate-specific control variables capture heterogeneity in borrowing costs across affiliates. Since borrowing costs might vary across industries, we also include industry fixed effects to the specification (Büttner & Wamser, 2013). Finally, parent fixed effects seize the group-specific risk that can affect costs of borrowing (Desai et al., 2004). Moreover, parent fixed effects also control for the international location structure of a multinational group.[19] The main parameters of interest are β_1, β_2, β_3, β_4, β_5, and β_6 as we want to study the effect that the three tax mechanisms adjusted for a loss probability have on the optimal total leverage ratio.

We assume, in line with Hopland et al. (2015), that the MNC must decide on the level of internal and external debt ex-ante, which means that it cannot reconsider these decisions after the output prices are revealed. Therefore, it can only adjust its debt shifting strategies before the beginning of the year. Hence, the MNC's headquarters face a decision under uncertainty where it cannot observe, only anticipate, the likelihood of experiencing losses by the end of the year. Hopland et al. (2015) find that earlier year's performance is an important control for expectations on performance in year t as there is substantial autocorrelation in losses. If losses in previous years predict the probability of running losses in the current year, MNCs can adjust their strategies based on past performance. As a result, it is possible for companies to form expectations of future profitability ex-ante. Data from period t_{-2} is most relevant when anticipating next year's losses, as performance in year t_{-1} is still uncertain when deciding on the capital structure ex-ante.

To predict the loss probability variable, we construct a probit regression model assuming a normal cumulative density function. Loss probability is the dependent variable, y. After running different types of explanatory variables, our final probit model include; loss in year

[18] Discussion of control variables is provided in section 4.4.
[19] The importance of including group fixed effects is discussed further in section 5.2.

t_{-2}, loss carryforward in year t_{-2}, total debt-to-asset ratio in year t_{-2}, maximum tax difference in year t_{-2}, and profitability in year t_{-2}. As discussed above, we include data from period t_{-2} since it is most realistic that firms only have information from period t_{-2} when anticipating next year's losses ex-ante as performance and other financial information in year t_{-1} is still uncertain. The profitability variable constitutes a measure of performance and is calculated as earnings before interest and taxes (EBIT) divided by total assets, using data from year in t_{-2}. The results are presented in Table 6, and show that all variables are statistically significant.[20]

Table 6: Output from probit regression

This table shows the output from the probit regression used to estimate the loss probability. All variables are lagged. The variable loss is a binary variable taking the value 1 if an affiliate is in a loss position, 0 otherwise. Maximum tax difference is expressed as the tax difference between affiliate i and the lowest-taxed affiliate within the MNC. Loss carryforward is a binary variable taking the value 1 if an affiliate has loss carryforwards, 0 otherwise. Total debt-to-asset ratio is measured as the sum of total liabilities to total assets. Profitability is measured as the ratio of EBIT to total assets.

Probit regression			Number of observations	=	290,257
			Affiliates in a loss position (in percent)	=	0.282
			Average loss probability, $H(p_i^0)$	=	0.220
			Wald chi2(700)	=	42090.080
			Prob > chi2	=	0.000
Log pseudolikelihood = -130834.49			Pseudo R2	=	0.145

Pr($loss_t$)	Coefficient	Robust standard error	z	P>|z|	[95% Confidence interval]	
Loss (t_{-2})	0.964	0.009	108.570	0.000	0.947	0.981
Maximum tax difference (t_{-2})	-0.206	0.048	-4.310	0.000	-0.299	-0.112
Loss carryforward (t_{-2})	0.242	0.009	27.280	0.000	0.225	0.260
Total debt-to-asset ratio (t_{-2})	-0.126	0.012	-10.380	0.000	-0.150	-0.102
Profitability (t_{-2})	-0.013	0.001	-8.930	0.000	-0.016	-0.010

[20] The distribution of the observations in our dataset, based on the loss probability can be found in Appendix F.

5.2 Endogeneity issues

In order to examine the unbiasedness of the obtained regression results, endogeneity issues should be considered. The theoretical model implicitly assumes that variation in all three tax mechanisms is exogenous with respect to the firms' internal and external debt-to-asset ratios (Møen et al., 2011, p. 20). However, there are several sources of variation identifying the effects on firms' capital structure.

Firstly, corporate tax rates vary across countries and within countries over time, which is relevant for all tax mechanisms. An endogeneity concern arises if large multinational firms lobby for favorable tax regimes by pervasive debt shifting, consequently influencing countries to change their tax regimes over time. However, it is more likely that countries respond to multinational firms' debt shifting by changing tax rates on their own initiative. Huizinga et al. (2008) control for this potential endogeneity issue by reconstructing the effective tax rate variable using the populations of the subsidiary and the parent countries as larger countries tend to have higher tax rates. Their results for the variables regressions are close to their baseline regression, thus finding little evidence of this endogeneity issue (p. 109). Therefore, it is reasonable to assume that corporate statutory tax rates are exogenous with respect to the leverage decisions of firms.

Secondly, variation in the location patterns of multinational groups will generate variation in the international debt shifting variables (maximum and weighted tax difference variables). Also, additional variation in the weighted tax difference is created by differences in the allocation of capital across affiliates within multinational firms. Potential endogeneity issues arise because investment decisions are made simultaneously with capital structure decisions, determining both the location patterns of multinationals and their assignment of capital across affiliates within the group. An example of such endogeneity problems is that a firm using internal debt only for non-tax reasons may also establish financial coordination centers in low-tax countries. To control for this problem, we follow Huizinga et al. (2008) and Møen et al. (2011) and include both a set of affiliate specific control variables and a parent (group) fixed effect.

Büttner & Wamser (2013) discuss an example of a multinational firm that initially does not have an affiliate located in a country that has a tax rate above the lowest tax rate within the group. When that country lowers its tax rate below the current minimum tax rate of the

group, the multinational firm will establish an affiliate there in response to the tax change. Consequently, the change in location structure increases the maximum tax difference variable for all other affiliates in the group. The authors claim that this is an endogenous change in the incentive to engage in debt shifting that may bias their results even when parent (group) fixed effects are included (pp. 70-71, 78). However, Møen et al. (2011) point out that even though the change in the location pattern is clearly an endogenous decision, the resulting change in the maximum tax difference variable occurs due to an exogenous change in the tax rate. An issue may arise if the sensitivity of the location structure with respect to changes in tax rates differs among multinational firms; however, such differences are likely to be permanent and should be absorbed by the parent fixed effects (p. 22). When using parent fixed effects, we only utilize variation in the tax mechanisms within each multinational firm, as it controls for any cross-sectional variation among multinational groups.

Based on the discussion above, we assume in our theoretical model that the variation in the tax mechanisms is exogenous with respect to firms' internal and external debt-to-asset ratios.

6. Empirical results

In this section, we test if the predictions of our model hold for European multinational firms and their majority-owned European affiliates in the sample period (2004-2014). First, we start out analyzing how the total debt-to-asset ratio is affected by the anticipation of losses. Interaction terms between the different tax mechanisms and the loss probability have been created to isolate the effect loss probability has on the different tax mechanisms. We also compare our main results to regression results based on regular tax mechanisms. Moreover, we examine obtained results on tax mechanisms that are adjusted for the loss probability directly, referred to as expected tax mechanisms. Thereafter, we focus on the statutory tax rate specifically and compare our results to findings by Büttner et al. (2011).Finally, we discuss how the control variables affect the dependent variable (total debt-to-asset ratio).

6.1 Main variables of interest

In this section, we examine the empirical predictions of our model. Table 7 presents the main results for testing whether loss anticipation matters for MNCs' capital structure and debt shifting strategies. Regression (3) presents results of our OLS-model, and will also be used in all robustness analyses. The specification contains three tax mechanisms and three interaction terms, constructed for each tax mechanism. The interaction terms are included to better isolate the effect loss probability has on the different tax mechanisms, and are calculated by adjusting the three regular tax mechanisms by the loss probability. In addition, the effect from the specific tax mechanisms, with and without interaction terms, can be found in Table 8. All regressions control for the level of industry, year, and parent (group) fixed effects. The reported R-squared values in all regressions are not adjusted for variance explained by the fixed effects variables (industries, parent and years). Thus, the overall effect of fixed effects variables on the fit of the model is not quantified. This leads to rather low R-squared values.

Table 7: Main regressions

The dependent variable in the regressions is the total debt-to-asset ratio. Detailed definitions of variables can be found in Table 5. Regression (1) shows the results from running a regression on the dataset before adjusting for the loss probability $H(p_i^0)$. Regression (2) shows our main specification without control variables, including the three regular tax mechanisms and the three interaction terms. The three regular tax mechanisms are calculated as follows: Statutory tax rate: t_{Pit}, Weighted tax difference: $\sum_{j\neq i}\rho_{Pjt}\left(t_{Pit}-t_{Pjt}\right)$ and Maximum tax difference: $(t_{Pit}-t_1)$ While the three interaction terms are calculated as: Domestic interaction: $H(p_i^0)t_{Pit}$, Foreign interaction: $\sum_{j\neq i}\rho_{Pjt}t_{Pjt}H\left(p_j^0\right)$ and Internal bank interaction: $H(p_1^0)t_1$. Regression (3) includes control variables to our main specification in regression (2). In regression (4), we adjust the tax mechanisms for the loss probability directly and run regressions on the expected tax mechanisms. All regressions are estimated by OLS and contain parent, industry, and year fixed effects. The sample contains information on European majority owned MNCs over 11 years (2004-2014). Heteroskedasticity-robust standard errors by White (1980) are reported in the brackets.

	(1) Sample before loss probability adjustment	(2) Main specification without control variables	(3) Main sample with control variables		(4) Expected tax mechanisms
Statutory tax rate	0.143*** (0.017)	0.298*** (0.026)	0.143*** (0.027)	Expected statutory tax rate	0.184*** (0.024)
Weighted tax difference	0.050** (0.021)	0.115*** (0.030)	0.086*** (0.029)	Expected weighted tax difference	0.005 (-0.016)
Maximum tax difference	0.048*** (0.013)	-0.030 (0.020)	0.011 (0.020)	Expected maximum tax difference	0.031** (-0.015)
Domestic interaction		-0.247*** (0.062)	-0.294*** (0.060)		
Foreign interaction		-0.045** (0.020)	0.145*** (0.019)		
Internal bank interaction		-0.195*** (0.048)	0.012 (0.046)		
Pr($loss_t$)		0.220*** (0.016)	0.161*** (0.015)		0.141*** (-0.007)
Log(Sales)	0.017*** (0.000)		0.022*** (0.000)		0.021*** (0.000)
Fixed asset ratio	-0.095*** (0.002)		-0.107*** (0.003)		-0.108*** (0.003)
Inflation	0.000 (0.000)		0.002*** (0.001)		0.002*** (0.001)
Log(Corruption index)	-0.008*** (0.002)		0.001 (0.003)		0.001 (0.003)
Growth opportunities	-0.000* (0.000)		-0.000*** (0.000)		-0.000** (0.000)
Loss carryforward	0.093*** (0.001)		0.092*** (0.001)		0.092*** (0.001)
Log(Creditor rights index)	-0.018*** (0.002)		-0.026*** (0.002)		-0.026*** (0.002)
Profitability	-0.001* (0.000)		-0.000*** (0.000)		-0.001*** (0.000)
R-squared	0.094	0.056	0.115		0.093
Number of observations	522,819	290,232	290,232		290,232

* p<0.1; ** p<0.05; *** p<0.01

We have also run regressions on the data sample before creating the probit model and adjusting for the loss probability. These results are presented in Table 7, regression (1). As observable, the results using regular tax rates are fairly similar to the findings by Huizinga et al. (2008) and Møen et al. (2011).[21] All three estimated coefficients are statistically significant at the one percent level as expected. The significance of all three tax mechanisms implies that our data sample is representative for European MNCs and comparable to findings by Møen et al. (2011) and Huizinga et al. (2008).

Firstly, regression (2) in Table 7 includes only the tax mechanisms and the three interaction terms. The results show that all the estimated coefficients of interest are statistically significant except for the maximum tax difference. Regression (3) also includes the firm-level and country-level control variables. The coefficient of the statutory tax rate decreases by 0.155 percentage points, the coefficient of the weighted tax difference decreases by 0.029 percentage points, while the coefficient of the maximum tax difference turns positive, but remains statistically insignificant. The domestic interaction term is reduced by 0.047 percentage points, the foreign interaction term increases substantially by 0.19 percentage points, while the internal bank interaction turns statistically insignificant and close to zero. This indicates that there exists subsidiary heterogeneity characterizing MNCs leverage decisions, which is captured by the subsidiary-specific control variables.

To examine the effect from the loss probability on the different tax mechanisms, we compare our results before adjusting for the loss probability to the results where we include the interaction terms and control for the loss probability. As observable from regression (3) in Table 7, we find that the effect from the regular statutory tax rate is positive and statistically significant at the one percent level, with a coefficient of 0.143. When the statutory tax rate increases by one percentage point, affiliates' total debt-to-asset ratio increases by 0.143 percentage points. The domestic interaction term is also statistically significant at the one percent level, but has a negative coefficient of 0.294. Hence, the domestic loss expectation significantly reduces the tax sensitivity of debt. As a higher expectation of losses leads to an increase in the possibility of ending the period without profits, and thus being unable to

[21] For a comparison of main results, see Table III in Møen et al. (2011, p. 24) and Table 8 in Huizinga et al. (2008, p. 101).

exploit the debt tax shield, there is no incentive to increase the use of debt. This is in line with our derivation of the theoretical model in section 3.1.

The negative coefficient of the domestic interaction term is as expected based on our theoretical model. This coefficient will reduce the effect the standard debt tax shield has on the total debt-to-asset ratio, potentially making it negative. We therefore expect that the combined effect from these variables is smaller compared to the results found by Huizinga et al. (2008) and Møen et al. (2011) for the standard debt tax shield. They obtain coefficients of 0.184 and 0.197 respectively.[22]

Moreover, the two international debt shifting variables featured in regression (3) in Table 7, capture effects which are only relevant for MNCs. Firstly, the estimated size of the weighted tax difference, 0.086, shows the effect of the expected weighted tax difference on affiliates' total leverage. When the weighted tax difference increases by one percentage point, affiliates' total debt-to-asset ratio increases by 0.086 percentage points. Considering the foreign interaction term, we observe that it also has a positive effect on the total debt-to-asset ratio of affiliate i, with a positive coefficient of 0.145 percentage points. An explanation for the positive coefficient is that a higher loss expectation in other affiliates reduces expected tax savings in other affiliates, and makes external debt shifting less attractive. This in turn, fosters the use of debt in affiliate i. These implications coincide with the derivations of our theoretical model.[23] Our derivation shows that an increase in $H(p_i^0)$ leads to a reduction in the tax rate caused by the loss probability adjustment, reducing tax savings in affiliate t_i and making the use of debt in other affiliates relatively more attractive. Our analysis supports these calculations, the only difference being that our analysis focuses on an increase in the loss probability of affiliate j instead of affiliate i.

The second international debt shifting mechanism, internal debt shifting, shows how the maximum tax difference affects affiliates' total debt. As observable from regression (3) in Table 7, the coefficient of both the maximum tax difference and the internal bank interaction are statistically insignificant and close to zero in our main analysis. In contrast, the

[22] Huizinga et al. (2008) refer to the variable as the "domestic" effect, since the coefficient of the statutory corporate tax rate impact both domestic and multinational firms (p. 95).
[23] See section 3.1 for an example where a higher loss probability in affiliate i decreases the use of debt while increasing the use of debt in affiliate j.

coefficient of the maximum tax difference is positive and statically significant at the one percent level in our results before the loss probability adjustment (regression (1), Table 7). This implies that the effect from the internal debt shifting mechanism on the debt-to-asset ratio is significantly reduced when one controls for the anticipation of losses. Based on our model, this is not what we would expect since firms should still shift internal debt when they adjust their capital structure ex-ante. As mentioned earlier, the internal bank interaction is defined as $H(p_1^0)t_1$, where t_1 is denoted as the statutory tax rate of the financial coordination center or the internal bank. According to our model, the internal bank should not experience losses as it receives all the income from other affiliates within the multinational group and does not engage in production activities itself. Therefore, $H(p_1^0)$ equals zero, and the interaction term should be insignificant and close to zero, which is exactly what we find. This is in line with findings from Büttner & Wamser (2013), which indicate that tax effects only have minor impacts on internal debt (p. 84). Our result for the maximum tax difference is different from the findings by Møen et al. (2011, p. 24), who obtain a coefficient of 0.120, which is statistically significant at the one percent level. However, our results before adjusting for loss probabilities is similar to the findings of Møen et al. (2011) as observable from regression (1), Table 7.

Our estimated results on the three interaction terms are in line with our theoretical model. However, we expected to find higher coefficients for the tax mechanisms in the regression including interaction terms, based on theory. The explanation is that in regressions that do not control for loss probabilities, the coefficients should include both the direct tax effect and the effect from the loss anticipation. Since theory shows that firms have fewer incentives to use debt when expecting losses, and the domestic interaction term is significantly negative, loss expectations that are not controlled for should have a negative effect on the coefficient in regression (1) where interaction terms are excluded. The coefficients of the tax mechanisms in the regression where we include interaction terms (regression (3)) should therefore be higher compared to the coefficients in regression (1). Our results show that the coefficient for the statutory tax rate is the same in regression (1) and (3), thus the results do not change when adjusting for the loss probability. These findings therefore seem strange. Moreover, the coefficient for the external debt mechanism increases after adjusting for the loss probability. However, based on theory, we would expect a larger increase in the coefficient. Lastly, the internal debt shifting mechanism is reduced and becomes insignificant. Consequently, our obtained results indicate that our model does not include all

relevant factors that may impact an affiliate's total debt-to-asset ratio. Thus, there seems to exist an open puzzle that needs to be solved through further research.

The substantial change in tax effects from adding interaction terms suggests that firms do consider the probability of incurring a loss in the next period when they have to decide on debt shifting strategies ex-ante. These findings are in line with the theoretical predictions of our model. Thus, previous studies that examine firms' leverage responses to tax and ignore loss probabilities in their analyses will not model the exact profit maximizing behavior of MNCs. However, the findings indicate that our model does not capture all relevant factors that may affect an affiliates' total debt-to-asset ratio, since the coefficients of the regular tax mechanisms do not increase as we would expect. Thus, further research is needed on the topic.

6.2 Expected tax mechanisms

In addition to our main specification we have run regressions without interaction terms, where instead the three tax mechanisms are adjusted for the loss probability directly. The results are presented in Table 7, regression (4). Compared to our main results with regular tax mechanisms and interaction terms (presented in regression (3)), the isolated effect from the loss probability becomes difficult to interpret when studying the expected tax mechanisms. The effect from the expected statutory tax rate is positive and the coefficient increases by 0.041 percentage points compared to the results before adjusting for the loss probability in regression (1). This indicates that an increase in the statutory tax rate will increase the amount of debt more when the anticipation of losses is considered, which is illogical based on economic theory. We would expect a reduction in the use of debt when adjusting for loss probabilities since the tax advantage related to the debt tax shield should be reduced.

When directly adjusting for the loss probability, the expected weighted tax difference comes out statistically insignificant and close to zero. This indicates that affiliates will choose not to shift external debt when considering their loss probability. This is not in line with our theoretical model, and seems strange. We would expect a reduction in the weighted tax difference mechanism compared to the results before adjusting for the loss probability shown in regression (1), but we would not expect it to become statistically insignificant.

The maximum tax difference and the internal bank interaction in our main sample (regression (3)) are both insignificant and close to zero. In contrast, the expected maximum tax difference is positive and statistically significant at the five percent level. Comparing to the results before adjusting for the loss probability in regression (1), the coefficient indicates that firms will choose to still shift internal debt, also when considering anticipation of losses. However, the amount is reduced. This is what we would expect based on our theoretical model.

6.3 Specific tax mehcanism: The statutory tax rate

We have also run regressions on the specific tax mechanisms as presented in Table 8. In this part, we will focus on the statutory tax rate and compare the results to findings by Büttner et al. (2011). The authors also use an interaction term between the statutory tax rate and the loss probability to study the tax sensitivity of the total debt-to-asset ratio. They do however estimate loss probabilities only based on industry and group averages. (pp. 112-113).[24] Seemingly, they do not use loss anticipation, but estimate the loss probability based on losses occurring in the same year. The results obtained in regression (3) and (4) in Table 8, where the international debt shifting mechanisms are excluded, are comparable to their findings. Based on these results we find that the coefficient of the statutory tax rate increases after including the domestic interaction term in regression (4), compared to the results in regression (3), where the domestic interaction term is excluded. Büttner et al. (2011) also find the same results, however they report a larger increase in the statutory tax rate. By comparing the domestic interaction terms, we see that they also obtain negative coefficients, using both industry and group loss probabilities. The authors also find that the negative effect from the interaction term, estimated on industry level, dominates the statutory tax rate.

[24] The industry average is estimated based on the percentage of loss-making subsidiaries within each industry, while the group average is estimated based on the percentage of loss-making subsidiaries per parent company (pp. 112-113).

Table 8: Extended version of main regressions

The dependent variable in the regressions is the total debt-to-asset ratio. Detailed definitions of variables can be found in Table 5. Regression (1) shows the results from running a regression on the dataset before adjusting for the loss probability $H(p_i^0)$. Regression (2) shows the results from our main specification, where the interaction terms are included. The three interaction terms are calculated as follows: Domestic interaction: $H(p_i^0)t_{Pit}$, Foreign interaction: $\sum_{j\neq i}\rho_{Pjt}t_{Pjt}H(p_j^0)$ and Internal bank interaction: $H(p_1^0)t_1$. Regression (3), (5), and (7) show the results after excluding two of the tax mechanisms and corresponding interaction terms from the regression. Regression (4), (6), and (8) show the results after excluding two of the tax mechanisms from the regression. All regressions are estimated by OLS and contain parent, industry, and year fixed effects. The sample contains information on European majority owned MNCs over 11 years (2004-2014). Heteroskedasticity-robust standard errors by White (1980) are reported in the brackets.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Statutory tax rate	0.143***	0.143***	0.214***	0.219***				
	(0.017)	(0.027)	(0.012)	(0.020)				
Weighted tax difference	0.050**	0.086***			0.207***	0.162***		
	(0.021)	(0.029)			(0.013)	(0.017)		
Maximum tax difference	0.048***	0.011					0.140***	0.091***
	(0.013)	(0.020)					(0.010)	(0.013)
Domestic interaction		-0.294***		-0.299***				
		(0.060)		(0.052)				
Foreign interaction		0.145***				0.151***		
		(0.019)				(0.019)		
Internal bank interaction		0.012						-0.004
		(0.046)						(0.037)
Pr($loss_t$)		0.161***		0.164***		0.080***		0.079***
		(0.015)		(0.015)		(0.003)		(0.010)
Log(Sales)	0.017***	0.022***	0.017***	0.021***	0.017***	0.022***	0.017***	0.022***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fixed asset ratio	-0.095***	-0.107***	-0.095***	-0.108***	-0.095***	-0.107***	-0.095***	-0.108***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.0029	(0.003)	(0.002)	(0.003)
Inflation	0.000	0.002***	0.000	0.002***	0.001*	0.002***	0.000	0.002***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Log(Corruption index)	-0.008***	0.001	-0.008***	0.002	-0.004**	0.004	0.001	0.009***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)
Growth opportunities	-0.000*	-0.000***	-0.000*	-0.000**	-0.000*	-0.000***	-0.000*	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Loss carryforward	0.093***	0.092***	0.093***	0.092***	0.094***	0.092***	0.094***	0.092***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log(Creditor rights index)	-0.018***	-0.026***	-0.018***	-0.027***	-0.021***	-0.028***	-0.026***	-0.033***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Profitability	-0.001*	-0.000***	-0.001*	-0.000***	-0.001*	-0.001***	-0.001*	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.0009	(0.000)
R-squared	0.094	0.115	0.094	0.115	0.094	0.115	0.094	0.115
Number of observations	522,819	290,232	522,819	290,232	522,819	290,232	522,819	290,232

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

6.4 Control variables

This section considers the implications that the obtained coefficients of firm-level and country-level control variables have on the total debt-to-asset ratio in Table 7.[25] All the estimated coefficients are statistically significant, except the coefficient of the corruption variable. When it comes to firm-level variables, the probability of loss variable enters the regression positively. This variable might capture non-tax related actions since it controls for the level of loss anticipation and the effect from being in a loss position. Thus, this variable seems to have a positive effect on affiliates' debt. The logarithm of sales is positively related to affiliates' leverage ratio. This aligns with the argument that large firms can borrow at more favorable financing conditions due to easier access to capital markets, and lower risk of bankruptcy.[26] Fixed asset ratio enters the regression negatively, which can be explained by depreciation deductions of tangible assets that may substitute for the tax shield offered by debt.[27] Loss carryforward affects leverage positively, which is the opposite of what we would expect based on previous studies on loss carryforward. This finding suggests that tax shields from the presence of loss carryforwards do not necessarily serve as a substitute for debt tax shields. Profitability seems to have no impact on leverage in our analysis as the estimated coefficient is zero, which seems strange. However, previous literature on how profitability affects leverage is ambiguous, and the expected effect is thus not clear.[28]

When it comes to country-level control variables, inflation enters the regression positively. Higher nominal interest rates due to inflation increase the value of the debt tax shield and reduce borrowing costs. Inflation also increases the real tax gains of debt financing.[29] Log of corruption index has an estimated coefficient that is statistically insignificant. This suggests that log of corruption does not impact leverage decisions in our analysis. An explanation might be that we only examine European MNCs and affiliates, which are regulated by the EU.[30] Growth opportunities seem to have no impact on leverage, as the estimated coefficient is zero. As found in previous research, the impact of growth opportunities on firms' leverage

[25] More discussion on firm-level and country-level variables and their impact on leverage is presented in section 4.4.
[26] Findings consistent with Booth et al. (2001).
[27] Findings consistent with DeAngelo & Masulis (1980) and Cloyd et al. (1997).
[28] See discussion of profitability and its impact on leverage decisions in section 4.4.1.
[29] Findings consistent with Gu et al. (2015), Blouin et al.(2014) and Hochman & Palmon (1985).
[30] See discussion of Corruption and its impact on debt levels in section 4.4.2.

is ambiguous, and the coefficient is therefore not unexpected.[31] Finally, the log of creditor rights index enters the regression negatively, suggesting that firms in countries with strong creditor rights use less debt. This is in line with the demand side view, claiming that creditor protection makes managers and shareholders more unwilling to use large amounts of debt because they want to avoid losing control in case of bankruptcy. Strong creditor rights create an incentive for self-interested managers to avoid debt, as they can be removed from their position if the firm experiences financial distress.[32]

[31] See discussion of growth opportunities and its impact on firms' indebtedness in section 4.4.2.
[32] Findings consistent with Cho et al. (2014) and Rajan & Zingales (1995).

7. Robustness tests and extensions

In this section, we extend our analysis and perform several robustness tests. We start by splitting our data sample into loss probability intervals to see if the estimated coefficients change for intermediate loss probabilities. Next, we examine whether affiliates in a loss position act differently than profitable affiliates. Thereafter, we look at whether purely domestic firms consider the anticipation of losses when deciding on their capital structure, and compare the results to the full sample of MNCs. Moreover, we study if firms with loss carryforwards respond differently to the loss probability adjustment. Lastly, we split the data sample according to the size of MNCs to explore whether large and small MNCs react differently to the loss probability adjustment.

7.1 Loss probability intervals

As observable from the table presented in Appendix F, 55 percent of all affiliates in our data sample face a loss probability between 10 and 20 percent.[33] To examine whether the effect from the interaction terms on the tax mechanisms changes for firms with an intermediate loss probability, we run regressions on a subsample of affiliates with a loss probability between 20 and 80 percent. The results are presented in regression (3) in Table 9. We have also run regressions on firms with loss probabilities between 10 and 90 percent and between 25 and 75 percent (regression (2) and (4), respectively). Furthermore, to check whether affiliates in loss positions act differently than profitable affiliates in terms of debt shifting strategies when anticipating their loss probability, we split the data sample into affiliates in a loss position and profitable affiliates.[34] The results are reported in regression (5) and (6). For an easier comparison, we also include the original specification of regression (3) from Table 7.

Regression (3) in Table 9 shows that the estimated coefficients change for affiliates with an intermediate loss probability between 20 and 80 percent. However, the statutory tax rate is still statistically significant and positive, while the corresponding domestic interaction term is significant and negative. Both coefficients are larger compared to the main sample (regression (1)), thus the effect on the total debt-to-asset ratio is larger for this interval. The

[33] See Appendix F for a full distribution of observations based on the loss probability.
[34] Discussion on domestic firms in loss positions is provided in section 7.2.

weighted tax difference variable becomes insignificant while the foreign interaction term is still statistically significant. As more than 70 percent of the observations in the data sample are excluded when examining intermediate loss probabilities, we exert caution in interpreting the results. The insignificance of the weighted tax difference variable can be explained by a potentially large measurement error while calculating the weighted tax difference variable, which depends on financial data on all affiliates that belong to the MNC. According to standard theory, MNCs should want to shift debt from high-taxed affiliates to low-taxed affiliates. Thus, excluding affiliates with the lowest and highest loss probabilities might affect the results and significance of the weighted tax difference variable, indicating that debt shifting from high-tax countries to low-tax countries occurs. However, we remain critical to interpreting the results presented in regression (3). Furthermore, the maximum tax difference turns statistically significant while the internal bank interaction is still insignificant. Since we exclude firms with the highest probability of incurring a loss, the remaining firms might shift some internal debt, thus leading to a statistically significant maximum tax difference in regression (3).

The results from the sample where firms with loss probabilities under 10 and over 90 percent are excluded, are very similar to the main results. However, when firms with loss probabilities under 25 and over 75 percent are excluded from the sample, the regression results change substantially (see regression (4) in Table 9). The maximum tax difference is the only significant tax mechanism, while the domestic interaction term is statistically significant at the ten percent level, the foreign interaction term is statistically significant at the one percent level, and the internal bank interaction is statistically significant at the five percent level. An explanation for why the statutory tax rate coefficient is insignificant for the loss probability interval between 25 to 75 percent is that a smaller sample may lead to larger standard errors as we exclude nearly 80 percent of the observations from the main data sample. The insignificance of the weighted tax difference can be explained by measurement errors, as discussed in the previous paragraph. Moreover, the significance of the three interaction terms suggests that adjusting for loss probabilities influences the tax mechanisms.

Lastly, regression (5) and (6) split the data sample into affiliates in a loss position and profitable affiliates. Regression (6) of firms that are not in a loss position shows similar results as the main sample. The coefficients of the statutory tax rate, the weighted tax difference, the domestic interaction and foreign interaction term remain significant, while the maximum tax difference and the internal bank interaction remain statistically insignificant.

The only apparent difference is that profitable firms reduce their total debt-to-asset-ratio less compared to the main data sample. The effect from adding the interaction term is lower compared to the main sample, as the coefficient of the domestic interaction term decreases by 0.108 percentage points. An explanation is that profitable firms face a lower loss probability based on their performance, and thus are less afraid of ending the period with no profits and no tax savings. Consequently, they have less incentive to reduce their debt usage. Nonetheless, the results still show a reduction in the debt-to-asset ratio for profitable firms, which would invalidate the approach proposed in Klassen et al. (1993), where loss-making affiliates are dropped from the main sample instead of controlling for their features.

For firms in a loss position (see regression (5)), similar results are found for the statutory tax rate and the effect from domestic interaction term compared to the main sample. Secondly, the weighted tax difference variable becomes statistically insignificant for affiliates in a loss position, while the foreign interaction term remains significant. However, the effect from the foreign interaction term is smaller than for the main sample. An explanation for why firms in loss positions shift less external debt is that changes to the capital structure carry high costs. Especially financially distressed firms face high costs of adjusting their external debt-to-asset ratios and operate longer with suboptimal capital structures (Gilson (1997, p.169); Strebulaev (2007)). However, we remain critical to the results due to potential measurement errors, as the sample of firms in a loss position is very small. For the maximum tax difference, the estimated coefficient becomes statistically significant at the ten percent level, while the internal bank interaction is still insignificant since $H(p_1^0)$ equals zero. The results indicate a low presence of internal debt shifting.

Table 9: Loss probability intervals

The dependent variable in the regressions is the total debt-to-asset ratio. Detailed definitions of variables can be found in Table 5. Regression (1) shows the results from the original specification of regression (3) in Table 7. Regression (2) excludes MNCs that have less than 10% and more than 90 % probability of incurring a loss. Regression (3) excludes MNCs that have less than 20% and more than 80 % probability of incurring a loss. Regression (4) excludes MNCs that have less than 25% and more than 75 % probability of incurring a loss. For comparison, we include regression (5) and regression (6) that separate MNCs that are in and not in a loss position. All regressions are estimated by OLS and contain parent, industry and year fixed effects. The sample contains information on European majority owned MNCs over 11 years (2004-2014). Heteroskedasticity-robust standard errors by White (1980) are reported in the brackets.

	(1) Main sample (All MNCs)	(2) 10 – 90 %	(3) 20 – 80 %	(4) 25 – 75 %	(5) In a loss position	(6) Not in a loss position
Statutory tax rate	0.143***	0.134***	0.181**	0.114	0.146*	0.108***
	(0.027)	(0.031)	(0.085)	(0.134)	(0.082)	(0.031)
Weighted tax difference	0.086***	0.084**	-0.013	-0.007	-0.089	0.124***
	(0.029)	(0.033)	(0.068)	(0.078)	(0.077)	(0.033)
Maximum tax difference	0.011	0.01	0.156***	0.220**	0.102*	0.004
	(0.020)	(0.023)	(0.060)	(0.095)	(0.055)	(0.022)
Domestic interaction	-0.294***	-0.277***	-0.455***	-0.458*	-0.291**	-0.186**
	(0.060)	(0.065)	(0.142)	(0.241)	(0.126)	(0.083)
Foreign interaction	0.145***	0.148***	0.149***	0.158***	0.083*	0.132***
	(0.019)	(0.021)	(0.037)	(0.042)	(0.044)	(0.023)
Internal bank interaction	0.012	-0.034	0.139	0.341**	0.112	0.023
	(0.046)	(0.050)	(0.104)	(0.171)	(0.092)	(0.065)
$\Pr(loss_t)$	0.161***	0.179***	0.172***	0.063	0.117***	0.133***
	(0.015)	(0.017)	(0.037)	(0.065)	(0.033)	(0.021)
Log(Sales)	0.022***	0.023***	0.023***	0.022***	0.023***	0.021***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
Fixed asset ratio	-0.107***	-0.112***	-0.146***	-0.154***	-0.167***	-0.092***
	(0.003)	(0.003)	(0.006)	(0.007)	(0.007)	(0.003)
Inflation	0.002***	0.002***	-0.001	-0.001	-0.001	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log(Corruption index)	0.001	0.003	-0.002	-0.003	-0.006	0.003
	(0.003)	(0.003)	(0.006)	(0.007)	(0.007)	(0.003)
Growth opportunities	-0.000***	-0.000***	0.000	0.000	0.000	-0.000**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Loss carryforward	0.092***	0.092***	0.084***	0.081***	0.075***	0.098***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)
Log(Creditor rights index)	-0.026***	-0.028***	-0.017***	-0.012*	-0.007	-0.029***
	(0.002)	(0.003)	(0.006)	(0.006)	(0.007)	(0.003)
Profitability	-0.000***	-0.001***	-0.001***	-0.001**	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.115	0.124	0.156	0.166	0.149	0.105
Number of observations	290,232	243,512	84,624	66,356	63,902	226,330

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

7.2 Domestic firms

The two international debt shifting mechanisms can only be exploited by MNCs, as purely domestic firms face no variation in affiliates' corporate tax rates. Hence, our main analysis focuses on multinational firms, which is in line with Møen et al. (2011) who examine only multinational firms in their analysis. However, Huizinga et al. (2008) also include purely domestic firms in their main data sample. The authors exclude domestic firms from the data sample and test the regression on only multinational firms in a robustness test. Their findings from the robustness test are very similar to their main findings, run on all European companies (p. 102).

To examine whether purely domestic firms consider the anticipation of losses when deciding on their capital structure, we use a sample of medium and large domestic firms from the sample period (2004 – 2014).[35] We estimate the probability of losses for domestic firms using the probit model presented in section 5.1. However, we exclude the maximum tax difference variable since this is an international tax mechanism. The results are presented in Table 10. Regression (2) and (3) includes purely domestic firms in Europe before and after the loss probability adjustment, while regression (4) and (5) include purely domestic firms that are in and not in a loss position. For an easier comparison, we also include the original specification of regression (3) in Table 7 (Regression (1) in Table 10).

The obtained results show that the statutory tax rate has a statistically significant positive effect when studying domestic firms before the loss probability adjustment. The coefficient is however 0.02 percentage points lower than our results obtained from studying MNCs before the loss probability adjustment (regression (1) of Table 7), which indicates that domestic firms are less affected than MNCs to changes in the statutory tax rate. This suggests that domestic firms tend to have specific characteristics or other non-debt tax shields that reduce their incentives to exploit the standard debt tax shield mechanisms compared to MNCs.

[35] We were unable to run regressions on the entire dataset containing all purely domestic firms, due to limitations in time and data programs available to us. Thus, we excluded micro-sized and small domestic firms from the data sample, and ran the regressions on medium and large MNCs.

By comparing the obtained results from domestic firms and MNCs after the loss probability adjustment, we find that while the coefficient for the statutory tax rate is positive for MNCs, domestic firms have a negative coefficient of -0.066, which is statistically significant at the five percent level. The negative coefficient of the statutory tax rate is illogical from an economic point of view, and is difficult to interpret. The effect from the domestic interaction term is also different, where MNCs have a negative coefficient of -0.294 and domestic firms have a positive coefficient of 0.209. By studying the statutory tax rate and the domestic interaction term for domestic firms jointly, the total effect on the debt-to-asset ratio seems to be positive, while the effect is negative for MNCs. This suggests that an incremental increase in the statutory tax rate will lead to an increased total debt-to-asset ratio for domestic firms.

Loss-making affiliates that are close to financial distress may consequently alter their debt policy. By separating loss-making affiliates from profitable affiliates, we can examine whether the exclusion of loss-making domestic firms changes the estimated coefficients on the statutory tax rate and the domestic interaction term. To do this, we run regressions (4) and (5) including domestic firms in and not in a loss position. Our results show that the statutory tax rate turns insignificant, while the coefficient of the domestic interaction term increases and remains statistically significant for domestic firms in a loss position. Firms facing losses are unable to exploit the debt tax shield, and the insignificance of the statutory tax rate coefficient is thus as expected. In contrast, the statutory tax rate coefficient is negative and statistically significant for profitable domestic forms, while the domestic interaction term is insignificant. These results are difficult to interpret and can indicate that domestic firms rely on other non-tax mechanisms when deciding on their total-debt-to-asset ratio, which are not included in our model.[36]

[36] Our results for purely domestic firms are likely to be biased since we were unable to run regressions on the entire dataset, due to limitations in time and data programs available to us.

Table 10: Domestic firms

The dependent variable in the regressions is the total debt-to-asset ratio. Detailed definitions of variables can be found in Table 5. Regression (1) is the original sample of only MNCs from regression (3), Table 7. Regression (2) is run on a sample of domestic firms before the loss probability adjustment with total assets of more than or equal to 10 mln euros (in accordance with the definitions by the European Commission). Regression (3) is run on a sample of domestic firms after the loss probability adjustment with total assets of more than or equal to 10 mln euros. Regression (4) is run on domestic firms in a loss position, while regression (5) is run on domestic firms with profits equal to or above zero. All regressions are estimated by OLS and contain parent, industry and year fixed effects. The sample contains information on European majority owned MNCs over 11 years (2004-2014). Heteroskedasticity-robust standard errors by White (1980) are reported in the brackets.

	(1)	(2)	(3)	(4)	(5)
	Main sample (all MNCs)	Domestic firms before loss probability adjustment	Domestic firms after loss probability adjustment	In a loss position	Not in a loss position
Statutory tax rate	0.143***	0.123***	-0.066**	-0.086	-0.107***
	(0.027)	(0.015)	(0.032)	(0.127)	(0.034)
Weighted tax difference	0.086***				
	(0.029)				
Maximum tax difference	0.011				
	(0.020)				
Domestic interaction	-0.294***		0.209***	0.359**	0.137
	(0.060)		(0.080)	(0.164)	(0.103)
Foreign interaction	0.145***				
	(0.019)				
Internal bank interaction	0.012				
	(0.046)				
$\Pr(loss_t)$	0.161***		-0.053**	-0.090*	-0.034
	(0.015)		(0.023)	(0.048)	(0.030)
Log(Sales)	0.022***	0.016***	0.020***	0.010***	0.022***
	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)
Fixed asset ratio	-0.107***	-0.094***	-0.056**	-0.139***	-0.039*
	(0.003)	(0.021)	(0.025)	(0.013)	(0.021)
Inflation	0.002***	0.001***	0.001**	-0.002	0.002***
	(0.001)	(0.000)	(0.000)	(0.002)	(0.001)
Log(Corruption index)	0.001	0.001	0.012***	0.016	0.016***
	(0.003)	(0.003)	(0.005)	(0.017)	(0.005)
Growth opportunities	-0.000***	0.000	0.000	0.001	0.003*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Loss carryforward	0.092***	0.057***	0.051***	0.048***	0.049***
	(0.001)	(0.001)	(0.001)	(0.004)	(0.002)
Log(Creditor rights index)	-0.026***	0.008***	0.001	0.008	0.006
	(0.002)	(0.003)	(0.006)	(0.019)	(0.006)
Profitability	-0.000***	-0.002	-0.010***	-0.008**	-0.012***
	(0.000)	(0.002)	(0.001)	(0.004)	(0.002)
R-squared	0.115	0.107	0.115	0.199	0.120
Number of observations	290,232	532,525	209,677	40,622	169,055

* p<0.1; ** p<0.05; *** p<0.01

7. 3 Loss carryforwards

The findings from section 6.3 show that the dummy variable loss carryforward has a positive effect on total debt-to-asset ratio after the loss probability adjustment. MacKie-Mason (1990) finds that companies close to debt fatigue use less debt when their non-debt tax shields are large, where loss carryforward is a measurement of non-debt tax shields. Büttner et al. (2011), point out that affiliates with loss carryforwards are less likely to engage in tax avoidance activities since taxable profits are offset when loss carryforwards act as a non-debt tax shield (pp. 111-112).

To study if firms respond differently to the loss probability adjustment, when they have loss carryforwards, we have divided our sample into affiliates with loss carryforwards and affiliates without loss carryforwards. Regression (1) in Table 11 is added for comparison and include the regression results from our main specification of regression (3) in Table 7.

Regression (2) shows how affiliates that have loss carryforwards respond to the different tax mechanisms while considering their expectations of losses. The coefficient of both the statutory tax rate and the domestic interaction term turns insignificant. Affiliates with loss carryforwards can deduct the carryforwards from their taxes, thus reducing the tax payments. The carryforwards will therefore act as a non-debt tax shield. Consequently, it seems reasonable that affiliates with loss carryforwards will be unaffected by an incremental increase in the statutory tax rate, also while taking the anticipation of losses into account.

The weighted tax difference variable turns statistically insignificant and negative, while the coefficient for the foreign interaction term is reduced, but remains statistically significant at the one percent level. The affiliates will therefore still shift some external debt, even if the amount is reduced by more than 50 percent compared to the results from our main sample. It can still be profitable to shift external debt, even if the value of the standard debt tax shield is reduced to zero, due to the loss carryforwards. The effective tax rate faced by the affiliates will differ due to differences in both corporate statutory tax rates and loss probabilities. This will impact the value of the loss carryforwards, thus making it attractive to allocate external debt to the affiliates that are best positioned to exploit this tax advantage.

Furthermore, both the maximum tax difference and the internal bank interaction term remain positive but statistically insignificant when studying affiliates with loss carryforwards. This is in line with Büttner et al. (2011) who find that affiliates with loss carryforwards are less

likely to engage in tax avoidance activities (pp. 111-112). Thus, this could imply that anti-tax avoidance rules such as earnings stripping rules and thin capitalization regulations could be relaxed during a financial downturn since these regulations assume that MNCs extensively use debt to avoid taxes.

Regression (3) shows the results from studying only affiliates without loss carryforwards. The coefficient of the statutory tax rate is reduced while the coefficient for the domestic interaction term is increased, compared to our main sample (regression (1)). The increase in the domestic interaction term is larger than the reduction in the statutory tax rate, making the total effect on the debt-to-asset ratio from these two variables less negative. This implies that affiliates do consider the loss probability also in situations without loss carryforwards, but that an incremental increase in the statutory tax rate will lead to a smaller reduction in external debt for affiliates without loss carryforwards, compared to the full sample of MNCs. It is likely that affiliates without loss carryforwards will choose to hold more debt since they are better positioned to exploit the advantage of the standard debt tax shield.

Furthermore, the coefficient of the weighted tax difference increases, while the effect from the foreign interaction term is reduced, compared to the sample of all MNCs. The increase in the weighted tax difference indicates that affiliates without loss carryforwards choose to shift more external debt compared to the full sample of all MNCs.

Lastly, the coefficient of both the maximum tax difference and the internal bank interaction is still positive but statistically insignificant. This implies that affiliates choose not to shift internal debt, even in situations without loss carryforwards.

Table 11: Loss carryforwards

The dependent variable in the regressions is the total debt-to-asset ratio. Detailed definitions of variables can be found in Table 5. Regression (1) shows the results from the original specification of regression (3) in Table 7. Regression (2) is the run on the affiliates in our sample with loss carryforwards, while regression (3) is run on the affiliates without loss carryforwards. All regressions are estimated by OLS and contain parent, industry and year fixed effects. The sample contains information on European majority owned MNCs over 11 years (2004-2014). Heteroskedasticity-robust standard errors by White (1980) are reported in the brackets.

	(1) Main sample (all MNCs)	(2) Affiliates with loss carryforwards	(3) Affiliates without loss carryforward
Statutory tax rate	0.143***	0.035	0.137***
	(0.027)	(0.072)	(0.032)
Weighted tax difference	0.086***	-0.02	0.119***
	(0.029)	(0.070)	(0.034)
Maximum tax difference	0.011	0.029	0.014
	(0.020)	(0.051)	(0.022)
Domestic interaction	-0.294***	-0.187	-0.259***
	(0.060)	(0.118)	(0.083)
Foreign interaction	0.145***	0.113***	0.140***
	(0.019)	(0.042)	(0.023)
Internal bank interaction	0.012	0.046	0.034
	(0.046)	(0.088)	(0.064)
$\Pr(loss_t)$	0.161***	0.087***	0.148***
	(0.015)	(0.030)	(0.022)
Log(Sales)	0.022***	0.019***	0.023***
	(0.000)	(0.001)	(0.001)
Fixed asset ratio	-0.107***	-0.126***	-0.104***
	(0.003)	(0.007)	(0.003)
Inflation	0.002***	0.001	0.002***
	(0.001)	(0.001)	(0.001)
Log(Corruption index)	0.001	0.003	0.002
	(0.003)	(0.007)	(0.003)
Growth opportunities	-0.000***	0.000	-0.000**
	(0.000)	(0.001)	(0.000)
Loss carryforward	0.092***		
	(0.001)		
Log(Creditor rights index)	-0.026***	-0.023***	-0.027***
	(0.002)	(0.006)	(0.003)
Profitability	-0.000***	0.000	-0.000*
	(0.000)	(0.000)	(0.000)
R-squared	0.115	0.096	0.097
Number of observations	290,232	71,375	218,857

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

7.4 Large and small MNCs

In this section, we divide our data sample into large and small MNCs to examine whether different sized MNCs react differently to the tax mechanisms when adjusting for the loss probability. This may determine potential heterogeneity between large and small firms. We use the definitions of small, medium-sized and large companies provided by the European Commission, and split according to total assets of the group (European Commission, 2017b). For an easier comparison, we include the regression results from our main specification of regression (3) in Table 7 (regression (1) in Table 12).

As observable from Table 12, the estimated coefficients of the statutory tax rate are positive and statistically significant for all specifications, except large MNCs. The domestic interaction term is negative and statistically significant for small and medium-sized affiliates. Due to the reduction in the present value of interest deductions, the incentive for debt financing is reduced if an MNC considers the probability of incurring losses, explaining why the overall effect from the domestic interaction term is negative and significant for small and medium-sized MNCs.

However, the coefficient of the statutory tax rate increases substantially for medium-sized firms compared to the results before we adjust for the loss probability (see regression (1) in Table 7), while the coefficient of the domestic interaction term is approximately the same as in the main sample. Based on theoretical model we would expect the coefficient of the statutory tax rate to increase, while the coefficient of the domestic interaction term should be negative, though it should not dominate the effect from the statutory tax rate. This is exactly what we find when studying medium-sized MNCs. Moreover, it seems strange that the statutory tax rate and domestic interaction term are insignificant for the largest MNCs.

Secondly, only large and micro-sized MNCs have statistically significant coefficients of the weighted tax difference. However, the foreign interaction term is only significant for large firms, which suggests that these firms are more responsive to changes in the external debt shifting mechanism, which can be explained by the potentially large fixed costs associated with international debt shifting activities. Consequently, only firms that have reached a certain size are able to overcome the prohibitive costs and shift debt across countries. Furthermore, the effect from the weighted tax difference on the debt-to-asset ratio increases substantially while the foreign interaction term is only slightly reduced compared to the

estimated effect of the entire data sample. This may suggest that large MNCs are more responsive to changes in the expected weighted tax difference than the rest of the sample. However, we find it strange that the estimated coefficient of the weighted tax difference is statistically significant for micro-sized MNCs.

Finally, the estimated coefficients of the maximum tax difference and the internal bank interaction are statistically insignificant for all sizes of MNCs. This supports our main findings that no internal debt shifting occurs when firms anticipate losses ex-ante.

Table 12: Large and small MNCs

This table splits the data sample into micro (regression (2)), small (regression (3)), medium (regression (4)) and large (regression (5)) MNCs according to total assets of the group. The size intervals are based on the European Commission's definitions of small and medium-sized enterprises. Regression (1) is the original sample of only MNCs from regression (3), Table 7. Detailed variable definitions are given in Table 5. All regressions are estimated by OLS and contain parent, industry and year fixed effects. The sample contains information on European majority owned MNCs over 11 years (2004-2014). Heteroskedasticity-robust standard errors by White (1980) are reported in the brackets.

	(1) Main sample (all MNCs)	(2) Micro <=2 mil	(3) Small >2 mil, <=10 mil	(4) Medium >10 mil, <=50 mil	(5) Large >50 mil
Statutory tax rate	0.143***	0.112**	0.132**	0.325***	-0.026
	(0.027)	(0.054)	(0.055)	(0.054)	(0.064)
Weighted tax difference	0.086***	0.208**	0.037	0.051	0.163***
	(0.029)	(0.086)	(0.053)	(0.052)	(0.063)
Maximum tax difference	0.011	-0.048	0.029	-0.025	0.008
	(0.020)	(0.078)	(0.038)	(0.032)	(0.032)
Domestic interaction	-0.294***	-0.018	-0.217*	-0.214**	-0.185
	(0.060)	(0.208)	(0.116)	(0.102)	(0.123)
Foreign interaction	0.145***	0.045	0.038	0.025	0.133***
	(0.019)	(0.056)	(0.035)	(0.033)	(0.038)
Internal bank interaction	0.012	-0.243	-0.084	-0.024	-0.054
	(0.046)	(0.182)	(0.094)	(0.078)	(0.084)
$\Pr(loss_t)$	0.161***	0.142***	0.180***	0.143***	0.114***
	(0.015)	(0.040)	(0.027)	(0.027)	(0.035)
Log(Sales)	0.022***	0.033***	0.035***	0.038***	0.025***
	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)
Fixed asset ratio	-0.107***	0.009	-0.037***	-0.083***	-0.152***
	(0.003)	(0.011)	(0.007)	(0.006)	(0.005)
Inflation	0.002***	0.000	0.003***	0.003***	0.002
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Log(Corruption index)	0.001	-0.014	0.007	-0.007	0.006
	(0.003)	(0.011)	(0.006)	(0.005)	(0.006)
Growth opportunities	-0.000***	0.004*	0.000	-0.000**	0.000
	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
Loss carryforward	0.092***	0.064***	0.087***	0.094***	0.086***
	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)
Log(Creditor rights index)	-0.026***	-0.060***	-0.061***	-0.004	-0.010*
	(0.002)	(0.010)	(0.006)	(0.004)	(0.005)
Profitability	-0.000***	-0.001**	0.000	0.000	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.115	0.139	0.141	0.147	0.192
Number of observations	290,232	56,857	82,856	86,485	64,034

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

8. Conclusion

An important issue for both multinational companies and tax authorities is to understand how capital is optimally allocated since multinationals want to minimize their tax payments and tax authorities want to reduce the amount of tax avoidance. Several studies have previously shown that multinationals use both internal and external debt, and consider tax factors, bankruptcy- and agency costs when deciding upon their capital structure. These studies have been based on regular statutory tax rates and neglect that firms might anticipate losses for the next year when deciding upon an optimal leverage ratio ex-ante. Affiliates in a loss position are unable to exploit their debt tax shield. Consequently, firms with a high loss probability may act risk averse and choose to reduce the amount of debt to avoid ending up with debt if experiencing losses.

Based on a model proposed by Møen et al. (2011) and the inflexibility assumption from Hopland et al. (2015) where MNCs have to decide on their capital structure at the beginning of the year, we have developed a model that allows us to examine whether loss anticipation matters for European multinationals' capital structure and their debt shifting strategies. The model allows us to analyze the impact of loss anticipation on the tax sensitivity of debt, both theoretically and empirically. In the model, we adjust the regular statutory tax rates by the loss probability of each affiliate. The loss probability is estimated on affiliate level, using a probit model based on financial data from the time period t_{-2}. Furthermore, we create interaction terms between the different tax mechanisms and the loss probability, which enables us to isolate the effect the loss probability has on the different tax mechanisms.

By studying the tax mechanisms separately using financial data on European multinationals and affiliates over the 2004-2014 period, we estimate the effect from the regular statutory tax rate to be positive and statistically significant at the one percent level. The domestic interaction term is also statistically significant, but has a negative coefficient. This can be explained by a higher expectation of losses leading to an increase in the possibility of ending up without profits, and thus being unable to exploit the standard debt tax shield. Consequently, there is no incentive to increase the use of debt. This indicates that the tax sensitivity of debt is reduced based on the effect from the loss anticipation adjustment on the standard debt tax shield. By studying the statutory tax rate and the domestic interaction term jointly, the total effect seems to be negative, thus reducing the debt-to-asset ratio of the

affiliate. This result seems strange, as an incremental increase in the statutory tax rate should not lead to a decrease in the debt-to-asset ratio.

Furthermore, the two international debt shifting mechanisms capture effects only relevant to MNCs. Firstly, the estimated coefficient of both the weighted tax difference and the foreign interaction term is positive and significant. An explanation for the positive coefficient is that higher loss expectations in other affiliates reduce expected tax savings in other affiliates, making it more attractive to shift external debt into affiliate i. This in turn fosters the use of debt in affiliate i. By comparing these results to our regression results before adjusting for the loss probability, we see that adding the foreign interaction term increases the use of debt substantially in affiliate i.

The coefficients of both the maximum tax difference and the internal bank interaction are statistically insignificant and close to zero in our main analysis, which indicates no internal debt shifting. The coefficient of the internal bank interaction term is in accordance with our model, which indicates that the financial coordination center should not experience losses as it receives all the income from other affiliates in the group. Therefore, the internal bank interaction should equal zero. In contrast, the coefficient of the maximum tax difference is positive and statically significant at the one percent level in our results before the loss probability adjustment. Based on the findings above, we can conclude that our theoretical predictions of the model are supported for the interaction terms.

However, the obtained results on the tax mechanisms are not in line with theory. We would expect the coefficients of the tax mechanisms to increase more after including the interaction terms than what we observe. This could imply that other factors not included in our model may influence the total debt-to-asset ratio of the affiliates, which indicates that more research is needed on this topic.

Results from our main sample show a substantial change in tax effects from adding the interaction terms, in line with our theoretical model, indicating that firms do consider the probability of incurring a loss in the next period when they have to decide on debt shifting strategies ex-ante. Thus, previous studies that examine firms' leverage responses to tax and ignore loss probabilities in their analysis will not model the full picture of an MNCs profit maximizing behavior. Lastly, these studies do not capture the true tax sensitivity across all tax mechanisms when firms consider the anticipation of losses while deciding on their

capital structure.

Overall, based on our obtained results, we can answer the research question of the thesis – loss anticipation does matter for capital structures and debt shifting strategies of European multinational firms.

Our findings show that MNCs consider loss anticipation when deciding upon their capital structure and debt shifting strategies. Tax authorities should therefore not only focus on profitable affiliates, but also study loss-making affiliates when trying to combat tax avoidance. Furthermore, our results indicate that anti-tax avoidance rules such as earnings stripping rules and thin capitalization regulations could be relaxed during a financial downturn since these regulations assume that MNCs use debt extensively for tax avoidance purposes.

A further extension to our thesis would be to study the entire sample of domestic firms, both individually and combined with MNCs, which we were unable to do due to limitations in time and data programs. Secondly, using a dataset which contains data on affiliates' internal and external debt would allow for examining how the anticipation of losses affect both internal and external debt levels in an affiliate.

Appendix

A. Derivation of the first-order conditions for ex-ante tax-planning

Below we report the first-order conditions for internal and external debt given that the firm must make all debt-shifting decisions ex-ante (meaning before the true sales price, p, is revealed). [37]

The first-order conditions for internal and external debt are given by:

$$\frac{\partial Max\ \Pi_P}{\partial D_i^I} = [1 - H(p_i^0)]t_i \cdot r - \eta \cdot \frac{D_i^I}{K_i} - m \cdot r + h(p_i^0)t_i p_i^0 y_i \frac{\partial p_i^0}{\partial D_i^I} - h(p_i^0)t_i \cdot r \cdot (D_i^E + D_i^I) \cdot \frac{\partial p_i^0}{\partial D_i^I} = 0 \quad \text{(A.1)}$$

$$\frac{\partial Max\ \Pi_P}{\partial D_i^E} = [1 - H(p_i^0)]t_i \cdot r - \mu \cdot \left(\frac{D_i^E}{K_i} - b^*\right) - \gamma \cdot \frac{\sum_i D_i^E}{\sum_i K_i} + h(p_i^0)t_i p_i^0 y_i \frac{\partial p_i^0}{\partial D_i^E} - h(p_i^0)t_i \cdot r \cdot (D_i^E + D_i^I) \cdot \frac{\partial p_i^0}{\partial D_i^E} = 0 \quad \text{(A.2)}$$

As stated in the methodology chapter, the price p_i^0 is defined as the price where the taxable income of the affiliate is zero, meaning that $p_i^0 y_i - r(D_i^E + D_i^I) = 0$. Therefore, will the terms including $\frac{\partial p_i^0}{\partial D_i^E}$ and $\frac{\partial p_i^0}{\partial D_i^I}$ in the equations above vanish, and we are left with the first order conditions (equation (6) and (7)) as stated in the methodology chapter.

[37] Derivations following Hopland et al. (2015, p. 26).

B. Optimal external debt-to-asset ratio

To derive the optimal external debt-to-asset ratio in affiliate i, b_i^E, we reorder the first-order condition for external debt (equation (6)) to:

$$\mu \cdot b_i^E = \mu \cdot b^* + t_i[1 - H(p_i^0)] \cdot r - \gamma \cdot b_i^E \cdot \rho_i - \gamma \sum_{j \neq i} b_j^E \cdot \rho_j \tag{B.1}$$

where $\rho_i = \frac{K_i}{\sum_i K_i}$ denote the real capital employed by affiliate i as a part of the total real capital employed by the MNC. The equations on this page follow Møen et al. (2011, p. 43).

Adjusting the corporate tax rate of affiliate t_j by the loss probability $H(p_j^0)$ leads to $t_j\left[1 - H(p_j^0)\right]$, which is the effective corporate tax rate of affiliate j. By subtracting equation (6) assessed for affiliate j from equation (6) assessed for affiliate i gives:

$$b_j^E = b_i^E - \frac{t_i[1 - H(p_i^0)] - t_j\left[1 - H(p_j^0)\right]}{\mu} \cdot r \tag{B.2}$$

We enter equation (B.2) into equation (B.1) and obtain:

$$\mu \cdot b_i^E = \mu \cdot b^* + t_i[1 - H(p_i^0)] \cdot r - \gamma \cdot b_i^E \cdot \rho_i$$

$$-\gamma \cdot b_i^E \cdot \sum_{j \neq i} p_j + \gamma \sum_{j \neq i} \frac{t_i[1 - H(p_i^0)] - t_j\left[1 - H\left(p_j^0\right)\right]}{\mu} \cdot r \cdot \rho_j \tag{B.3}$$

Based on Huizinga et al. (2008) and Møen et al. (2011), these rearrangements require that withholding taxes are identical in all countries. This is valid for our modeling since:

$$\sum_{j \neq i} \rho_j = \sum_{j \neq i} \frac{K_j}{\sum_i K_i} = \frac{\sum_i K_i - K_i}{\sum_i K_i} = 1 - \rho_i \tag{B.4}$$

Furthermore, we can insert equation (A.6) into equation (A.5) and assemble all terms with b_i^E on the left-hand side. By rearranging, we obtain the optimal external debt-to-asset ratio as expressed in equation (10).

C. Definitions of variables and data sources

Table C1: Definitions of variables and data sources

Variable:	Definition:	Source of data:
Total debt-to-asset ratio	Ratio of total liabilities (measured as the sum of current and non-current liabilities) to total assets.	Amadeus database.
Loss probability	Probability that an affiliate i incurs a loss within a given year.	Predicted based on Hopland et al. (2015), data from Amadeus database.
$Loss_t$	Loss position dummy equal to one if a firm incurs losses in year t.	Amadeus database.
$Loss_{t-2}$	Loss position dummy equal to one if a firm incurs losses in year t_{-2}.	Amadeus database.
Statutory corporate tax rate (standard debt tax shield mechanism)	Statutory corporate tax rate belonging to the host country of an affiliate i.	KPMG's corporate tax rates table and indirect tax rate survey; OECD's corporate income tax rates table and economic surveys.
Weighted tax difference (external debt shifting mechanism)	Asset-weighted tax differential between affiliate i and all other affiliates within the MNC, including the parent firm.	KPMG's corporate tax rates table and indirect tax rate survey; OECD's corporate income tax rates table and economic surveys.
Maximum tax difference (internal debt shifting mechanism)	Difference in corporate tax rate between an affiliate i and the financial coordination center.	KPMG's corporate tax rates table and indirect tax rate survey; OECD's corporate income tax rates table and economic surveys.
Expected statutory corporate tax rate (standard debt tax shield mechanism)	Statutory corporate tax rate belonging to the host country of an affiliate i adjusted for the loss probability of the affiliate.	KPMG's corporate tax rates table and indirect tax rate survey; OECD's corporate income tax rates table and economic surveys.
Expected weighted tax difference (external debt shifting mechanism)	Asset-weighted tax differential between affiliate i and all other affiliates within the MNC, including the parent firm, adjusted for the loss probability of the affiliate.	KPMG's corporate tax rates table and indirect tax rate survey; OECD's corporate income tax rates table and economic surveys.

Variable:	Definition:	Source of data:
Expected maximum tax difference (internal debt shifting mechanism)	Difference in corporate tax rate between an affiliate i and the financial coordination center, adjusted for the loss probability of the affiliate.	KPMG's corporate tax rates table and indirect tax rate survey; OECD's corporate income tax rates table and economic surveys.
Domestic interaction term	Interaction term between the statutory corporate tax rate variable and the loss probability.	Amadeus database.
Foreign interaction term	Interaction term between the weighted tax difference variable and the loss probability.	Amadeus database.
Internal bank interaction	Interaction term between the maximum tax difference variable and the loss probability.	Amadeus database.
Firm size	Logarithm of sales Firms in Denmark, Ireland, Russia and the United Kingdom: Logarithm of operating revenue.	Amadeus database.
Fixed asset ratio	Ratio of fixed assets to total assets.	Amadeus database.
Profitability	Ratio of EBITDA to total assets. Firms in Russia: Ratio of EBIT to total assets.	Amadeus database.
Loss carryforward	Dummy variable equal to 1 if an affiliate incurs losses that can be carried forward.	Amadeus database.
Inflation	Annual change in the consumer price index, measured in percentage.	World bank: World development Indicators; International Monetary Fund: World economic outlook; OECD: Consumer Prices Database.
Corruption	Logarithm of the corruption index, measured annually. The index is in the interval [0;10],	Worldwide Governance Indicators of the World Bank.

Variable:	Definition:	Source of data:
	where 0 indicates a very high corruption level.	
Growth opportunities	Median of the annual growth in sales per country and industry.	Amadeus database.
Creditor rights	Logarithm of the legal rights index, measured annually. The index ranges from [0;10], where a high number (10) indicates very high creditor protection.	World Development Indicators of the World Bank.

D. Regression on regular statutory tax rates

Table D1 shows the results after performing regressions on our main specification using regular statutory tax rate, excluded the interaction terms. Regression (1) shows the results from running a regression where the three regular tax mechanisms are included in the specification. Regression (2) adds control variables to the specification from regression (1). Regressions (3) and (4) show the results after excluding either the weighted tax difference or the maximum tax difference from the specification. Regressions (5) to (7) show the results after including only one of the tax mechanisms in the regression. All regressions are estimated by OLS and contain parent, industry and year fixed effects. The sample contains information on European majority owned MNCs over 11 years (2004-2014). Heteroskedasticity-robust standard errors by White (1980) are reported in the brackets.

Table D1: Regular statutory tax rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Statutory tax rate	0.220***	0.143***	0.151***	0.170***	0.213***		
	(0.016)	(0.017)	(0.017)	(0.014)	(0.012)		
Weighted tax difference	0.085***	0.050**	0.085***			0.205***	
	(0.021)	(0.021)	(0.018)			(0.013)	
Maximum tax difference	0.033**	0.048***		0.061***			0.140***
	(0.014)	(0.013)		(0.011)			(0.010)
Log(Sales)		0.017***	0.017***	0.017***	0.017***	0.017***	0.017***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fixed asset ratio		-0.095***	-0.095***	-0.095***	-0.095***	-0.095***	-0.095***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Inflation		0.000	0.000	0.000	0.000	0.001*	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log(Corruption index)		-0.008***	-0.009***	-0.008***	-0.008***	-0.004**	0.001
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Growth opportunities		-0.000*	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Loss carryforward		0.093***	0.093***	0.093***	0.093***	0.094***	0.094***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log(Creditor rights index)		-0.018***	-0.018***	-0.018***	-0.019***	-0.021***	-0.026***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Profitability		-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.0428	0.0941	0.0941	0.0941	0.0940	0.0939	0.0937
Number of observations	522,459	522,459	522,459	522,459	522,459	522,459	522,459

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

E. Year-by-year summary statistics

This table shows year-by-year summary statistics of total debt-to-asset ratio and the expected tax mechanisms.

Table E1: Year-by-year summary statistics

Variable	Year	Mean	Standard deviation	Observations
Total debt-to-asset ratio	2004	0.766	0.185	14
Total debt-to-asset ratio	2005	0.651	0.238	210
Total debt-to-asset ratio	2006	0.641	0.233	2008
Total debt-to-asset ratio	2007	0.654	0.226	7041
Total debt-to-asset ratio	2008	0.644	0.230	17643
Total debt-to-asset ratio	2009	0.627	0.237	27405
Total debt-to-asset ratio	2010	0.630	0.235	31077
Total debt-to-asset ratio	2011	0.630	0.238	40416
Total debt-to-asset ratio	2012	0.634	0.243	45967
Total debt-to-asset ratio	2013	0.625	0.247	58812
Total debt-to-asset ratio	2014	0.624	0.248	59664
Statutory corporate tax rate	2004	0.301	0.063	14
Statutory corporate tax rate	2005	0.243	0.095	210
Statutory corporate tax rate	2006	0.292	0.080	2008
Statutory corporate tax rate	2007	0.318	0.053	7041
Statutory corporate tax rate	2008	0.294	0.047	17643
Statutory corporate tax rate	2009	0.290	0.052	27405
Statutory corporate tax rate	2010	0.291	0.052	31077
Statutory corporate tax rate	2011	0.284	0.055	40416
Statutory corporate tax rate	2012	0.289	0.053	45967
Statutory corporate tax rate	2013	0.283	0.056	58812
Statutory corporate tax rate	2014	0.283	0.058	59664
Expected statutory tax rate	2004	0.281	0.057	14
Expected statutory tax rate	2005	0.194	0.077	210
Expected statutory tax rate	2006	0.245	0.077	2008
Expected statutory tax rate	2007	0.268	0.063	7041
Expected statutory tax rate	2008	0.238	0.058	17643
Expected statutory tax rate	2009	0.214	0.062	27405
Expected statutory tax rate	2010	0.230	0.064	31077
Expected statutory tax rate	2011	0.223	0.066	40416
Expected statutory tax rate	2012	0.220	0.065	45967
Expected statutory tax rate	2013	0.219	0.066	58812
Expected statutory tax rate	2014	0.224	0.066	59664
Weighted tax difference	2004	0.001	0.028	14
Weighted tax difference	2005	-0.008	0.036	210
Weighted tax difference	2006	-0.008	0.045	2008
Weighted tax difference	2007	-0.004	0.041	7041
Weighted tax difference	2008	-0.003	0.033	17643
Weighted tax difference	2009	-0.003	0.034	27405
Weighted tax difference	2010	-0.003	0.036	31077
Weighted tax difference	2011	-0.004	0.035	40416

Variable	Year	Mean	Standard deviation	Observations
Weighted tax difference	2012	-0.004	0.034	45967
Weighted tax difference	2013	-0.003	0.034	58812
Weighted tax difference	2014	-0.003	0.034	59664
Expected weighted tax difference	2004	0	0	14
Expected weighted tax difference	2005	0.000	0.011	210
Expected weighted tax difference	2006	-0.002	0.023	2008
Expected weighted tax difference	2007	-0.002	0.030	7041
Expected weighted tax difference	2008	-0.002	0.035	17643
Expected weighted tax difference	2009	-0.001	0.039	27405
Expected weighted tax difference	2010	-0.001	0.042	31077
Expected weighted tax difference	2011	-0.002	0.042	40416
Expected weighted tax difference	2012	-0.002	0.042	45967
Expected weighted tax difference	2013	-0.002	0.042	58812
Expected weighted tax difference	2014	-0.002	0.043	59664
Maximum tax difference	2004	0.016	0.044	14
Maximum tax difference	2005	0.023	0.056	210
Maximum tax difference	2006	0.051	0.071	2008
Maximum tax difference	2007	0.057	0.072	7041
Maximum tax difference	2008	0.045	0.062	17643
Maximum tax difference	2009	0.043	0.062	27405
Maximum tax difference	2010	0.044	0.063	31077
Maximum tax difference	2011	0.041	0.062	40416
Maximum tax difference	2012	0.038	0.061	45967
Maximum tax difference	2013	0.037	0.061	58812
Maximum tax difference	2014	0.037	0.061	59664

F. Distribution of observations, based on the loss probability

This table shows how the observations are distributed among the different loss probability intervals, where each interval is 10 percentage points. The very right column of the table shows the percentage of the observations within each interval that incur a loss.

Table F1: Distribution of observations, based on the loss probability

Probability of loss	In a loss position	Not in a loss position	Number of observations	Percentage of observations in a loss position
< 10 %	3552	43132	46684	0.076
>= 10 % < 20 %	22342	136381	158723	0.141
>= 20 % < 30 %	5572	17777	23349	0.239
>= 30 % < 40 %	2104	3283	5387	0.391
>= 40 % < 50 %	8035	9033	17068	0.471
>= 50 % < 60 %	13801	12292	26093	0.529
>= 60 % < 70 %	7020	4001	11021	0.637
>= 70 % < 80 %	1298	418	1716	0.756
>= 80 % < 90 %	145	32	177	0.819
>= 90 %	33	6	39	0.846
Number of observations	63902	226355	290257	

G. Regular and expected statutory tax rates

Table G1 shows the statutory tax rates used in our final sample, reported in percentage and denoted as t in Table G1. The table also includes the expected statutory tax rates aggregated on country level, reported in percentage and denoted as $t(x)$ in the table. Please note that the loss probability was calculated on affiliate level in our final sample, thus the expected statutory tax rates in Table G1 are not the ones used in our final sample. The first column under each year shows the statutory corporate tax rates (t), while the second column shows the expected statutory tax rate aggregated on country level $[t(x)]$, where x reflects the loss probability adjustment $[1 - H(p_i^0)]$. The data on the tax rates was obtained from KPMG's corporate and indirect tax rate survey and corporate tax rates table (KPMG (n.d.); KPMG (2009)), and the OECD's economic surveys and corporate income tax rates table (OECD (n.d); OECD(2013b)).

Table G1: Regular and expected statutory tax rates

	2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014	
Country/year	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*
Austria	34	33	25	20	25	21	25	21	25	20	25	19	25	20	25	21	25	20	25	20	25	20
Bosnia-Herzegovina	30	28	30	27	10	7	10	8	10	7	10	8	10	8	10	8	10	7	10	7	10	8
Belgium	34	18	34	28	34	28	34	28	34	27	34	26	34	27	34	27	34	27	34	26	34	27
Bulgaria	20	19	15	8	15	13	10	9	10	8	10	8	10	7	10	8	10	8	10	8	10	8
Switzerland	-	-	-	-	21	21	21	20	21	20	21	21	21	21	21	21	21	21	21	20	18	18
Czech Republic	28	27	26	22	24	20	24	20	21	17	20	15	19	15	19	15	19	15	19	15	19	16
Germany	39	27	39	32	39	32	39	33	30	25	30	23	30	24	30	25	30	24	30	24	30	24
Estonia	35	28	35	29	35	29	33	27	30	24	30	21	30	23	30	23	30	22	30	22	30	23
Finland	-	-	26	20	26	22	26	22	26	21	26	19	26	20	26	20	25	18	25	18	20	15
France	35	28	35	28	34	28	34	29	34	28	34	25	34	27	34	27	34	26	34	27	33	26
Greece	-	-	32	26	29	24	25	21	25	21	25	19	24	17	20	13	20	13	26	18	26	19
Hungary	16	16	16	12	17	13	20	16	20	14	20	14	19	14	19	14	19	14	19	14	19	15

	2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014	
Country/year	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*	*t*	*t(x)*
Italy	33	26	33	26	33	26	33	26	28	21	28	19	28	20	28	21	28	20	28	20	31	23
Luxemburg	-	-	30	22	30	23	30	26	30	25	29	21	29	22	29	23	29	22	29	23	29	23
Latvia	-	-	-	-	15	13	15	12	15	12	15	10	15	12	15	13	15	12	15	12	15	12
Netherlands	-	-	32	27	30	26	26	23	26	23	-	-	-	-	-	-	-	-	-	-	-	-
Norway	28	27	28	24	28	24	28	24	28	23	28	22	28	23	28	23	28	23	28	22	27	21
Poland	19	16	19	16	19	16	19	16	19	15	19	15	19	16	19	15	19	15	19	16	19	16
Portugal	28	20	28	23	28	23	27	22	27	21	27	20	27	22	27	21	32	23	32	24	23	18
Romania	25	22	16	14	16	14	-	-	-	-	-	-	16	13	16	13	16	12	16	13	16	13
Serbia	12	4	10	8	10	9	10	8	10	8	10	7	10	7	10	8	10	7	15	11	-	-
Russian Federation	-	-	-	-	-	-	24	18	-	-	20	19	-	-	20	15	-	-	20	16	-	-
Sweden	28	27	28	20	28	23	28	23	28	22	26	19	26	20	26	20	26	19	22	16	22	17
Slovenia	-	-	-	-	25	24	23	21	22	20	21	17	20	17	20	17	20	16	17	14	17	15
Slovakia	19	18	19	14	19	17	19	16	19	15	19	14	19	15	19	15	19	15	23	19	22	18
Ukraine	30	28	25	23	25	19	25	19	25	17	25	17	25	17	25	18	-	-	19	14	-	-

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