Investments & alternative tax regulations

A study on the (adverse) effects on firm investments behavior following the introduction of an allowance on corporate equity or thin cap rules

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Abstract: By implementing thin cap rules (TCR) or an allowance for corporate equity (ACE), the distortive effects can be moderated that are related to the deductibility of debt payments and the resulting "debt-to-equity bias" that is created. Although both TCRs and ACE have been found to effectively decrease company leverage, based on economic theory they are assumed to have divergent effects on firms' investment behavior. Using a panel data set of 1.5 million firm-year observations from 28 European countries, the results of this study indicate that the introduction of a TCR has significant adverse effect on investments. But, contrary to the economic belief, the introduction of an ACE is also followed by a negative investment reaction. However, further analysis shows that this negative reaction is attributable to domestic firms, as firms that are part of a multinational organization increase investments by showing an increase in fixed asset value in the year of ACE introduction. Overall these findings indicate that regarding investments, an ACE cannot be easily preferred above a TCR – as suggested by economic theory – as not all firms benefit (equally) for the tax rule. In which a distinction have to be made between domestic and multinational firms.

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1. Introduction

"No strong externality would call for a bias in favor of debt and the recent financial crisis stressed rather the opposite" (European Commission, 2012). These words are presented in a working paper of the European Commission in 2013, which summarizes the distortive effects arising from the deductibility of interest payments when financing with debt, not coupled with such a measure for equity financing. Although the distortive effects of a separate treatment of debt and equity are clear and different solutions are available, the working paper concludes that most of the European tax systems still encourage the use of corporate debt over equity, which results in something better known as the "debt-to-equity bias".

But, as the debt bias is now widely recognized as a significant policy concern, countries have started to implement regulation to assess this problem (IMF, 2016). Countries assess the bias differently. Some (such as Belgium and Italy) have implemented an *Allowance for Corporate Equity* (or: ACE), which allows a notional return on equity to be deductible from corporate taxable income similar to debt payments. Other countries (such as Germany and France) implement a *thin-cap rule* (or: TCR), that limits (excessive) debt payments to be deductible. Also, the European Commission has been starting taken measures into its own hands by implementing interest deductibility restrictions (ATAD) (*Council Directive (EU), July 2016),* just as the OECD did (BEPS: Action 4) (OECD, 2016).

Prior academic literature has confirmed the effect of the debt-to-equity bias on firms' debt ratio, and the ability of ACE and TCR systems to lower this ratio. However, minor research has been performed on further effects of implementing these tax regimes. More specifically, almost no empirical research is found on the (adverse) effect on the level of investments from implementing an ACE or TCR system. This is remarkable, particularly because theoretically both alternative tax regimes have opposing effects on firms' investment behavior. Theoretically limiting interest deductibility will result in a higher cost of capital for an investing firm, which would lead to a lower level of investments in the hosting country. On the other hand adding a deductible allowance for equity will result in lower costs of capital, which would lead to higher investments – all other things being equal. To test whether these conjectures hold in practice,

they will be empirically tested in this study. Therefore, the research question of my master thesis is:

Do tax regulations that impact the fiscal deductibility of interest have an effect on firms' investments - and does this effect differ between countries implementing ACE or TCR systems?

To test the relation between ACE and TCR regimes and firms' investment behavior, the amount of investments - measured as the book-value of current year fixed assets - is calculated for a panel dataset containing the unconsolidated financial data of 1.5 million firm-year observations from 28 European countries. The appointed sample period is 2009 till 2016, a period in which various countries have implemented an ACE or TCR system. The investment effect following the introduction of an ACE or TCR will be empirically tested using a fixed effects regression on the panel dataset. To control for potential unobserved factors affecting the tested relation between alternative tax systems and investments, this study further investigates the potential impact of multinational organizations.

The results of the empirical analysis performed in this study, indicate a negative association between investment behavior and the introduction of both a TCR and an ACE system in the hosting country. Of which the second finding is a peculiar finding contrary to the main economic beliefs. However, when differentiation between domestic and multinational firms, this study shows that the negative investment reaction on ACE systems is actually borne by domestic firms (not part of a multinational organization), as companies' part of a multinational increase fixed asset value in the year following an ACE introduction. This indicates that a firm's reaction following the introduction of an ACE regime depends on the question whether a company is part of a multinational organization or not.

Following this introduction, the remainder of this study is organized as follows: chapter two provides a literature review regarding the effect of and solutions for the debt favoring in most tax systems, chapter three describes the made expectations in the form of hypotheses, chapter four describes the data and methodology, chapter five presents and interprets the results found in the empirical analysis and chapter six forms a conclusion based on the regression results by answering the research question.

2. Literature review

2.1 Introduction

This literature review is meant to provide background on all aspects relevant to this study. Consecutively this chapter will describe: financial decision making theories to relevant the tax deductibility of debt payments, its distortive impact, available policy alternatives and the effects from the introduction of these alternative tax regimes.

2.2 Financial decision making – a starting point

To understand the firm-level effect of the deductibility of debt payments - and to better understand the available solutions - this chapter will first briefly discuss the main financing decision making theories relevant to this topic to act as a neutral starting point for the further analysis. Note that this paragraph is only a brief summary, as a more detailed version of this section can be found in Appendix A.

At the foundation of modern day financing theory lays the theorem of Modigliani-Miller[1]. The theorem states that theoretically, firms are ought to be indifferent between the options of financing activities by issuing debt or financing activities by issuing equity, as a firm's debt-to-equity ratio does not affect company value. Under the theorem, the value of an unleveraged firm (V_U) will be equal to that of a leveraged firm (V_L), which is equal to the sum of debt (D) plus equity (E). This can be formulated as follows:

$$V = V_L = V_U = D + E \tag{1}$$

For this statement to be true, Modigliani and Miller assume a situation of well-functioning markets[2] and no (or neutral) taxes. However, this state of indifference does not hold when introducing "real world" tax systems. In most corporate tax systems, financing with debt is favored above financing with equity, because of the tax deductibility of interest payments from corporate taxable income not equally backed by matching tax deductibility for dividends. When

[1] The Modigliani Miller theorem actually consists of four distinct propositions, as is described in Appendix A.

[2] The assumption of "well-functioning markets" withholds equal access to credit markets for all participants, no information asymmetry and the absence of capital market frictions such as transaction costs, bankruptcy costs or trade restrictions.

interest payments are deductible, financing with debt instead of equity results in a higher after-tax return to debt and equity holders and therefore in a higher company value. When this tax benefit is taken into account the proposed indifference will no longer hold, as the value of leveraged firms will be higher than that of the unleveraged firms. This difference between leveraged and unleveraged firm value is augmented by the tax shield value of debt, which is calculated as the corporate tax rate (t) times the amount of corporate debt (D). This can be formulated into the previous equation (1) as:

$$V = D + E = V_L = V_U + tD \quad (2)$$

Hence, the indifference in the financing decision of a firm ceases to exist. When interest payments can be deducted from corporate taxable income and dividend payments cannot, firms are stimulated to finance activities with debt instead of equity. This is the case as long as the providers of debt and equity financing are not taxed equally. If the return on investments after taxes is equal for providers of both debt and equity financing, then the required return on investments before taxes will be higher for equity financing than for debt financing (van Strien, 2006). This way the tax authorities create a distortion in the financing decision, as the deductibility of debt payments creates a bias towards debt financing: the debt-to-equity bias.

From the Modigliani Miller theorem follows that, through the debt-to-equity bias, firm value is maximized when the debt ratio is as high as possible. However, there are costs related to debt financing. Here the tradeoff theory of Myers (1967) steps in. This theory suggests that a tradeoff takes place between the benefits of debt and the costs of debt, to end up in a point in which no better trade can be made: the optimal debt-to-equity ratio. A point in which marginal benefit of issuing one extra unit of debt equals the marginal costs of an extra unit of debt. The costs of debt can be divided into two categories: the costs of financial distress (bankruptcy costs) and the costs related to agency problems. Empirical prior research shows that both forms of debt-related costs are substantial for a firm. Hence, the debt bias stimulates firms to bear substantial agency and bankruptcy costs. However, as these costs are of no direct relevance for this study, I refer to Appendix A for a further description of the tradeoff theory, and the related agency costs and bankruptcy costs in particular.

2.3 Tax bias to debt financing

2.3.1 Rationale for discriminating between debt and equity?

As described in chapter 2.2.1, the indifference proposition of the Modigliani Miller Theorem does not hold in real life because of the tax shield value of debt created by the deductibility of debt payments.[3] Following the tradeoff theory companies increase their debt-to-equity ratio compared to that what it would have been if debt payments were not deductible, up to the point the benefits of issuing more debt balance out the costs and the optimal ratio is reached. The consequence is that firms increase company leverage to receive the tax benefit, which results in a similar increase of the costs of financial distress and agency costs.

The question is whether there is a governmental rationale that compensates for these effects - is there an argumentation for the unequal treatment of debt and equity that justifies the associated increased agency costs and costs of financial distress? The European Commission (2012) sees no reason for this occurrence, as described in the introduction. Also Devereux & Gerritsen (2010) find no valuable answer to the question. The authors conclude this after addressing the determination of both the comprehensive income tax and the consumption or expenditure tax. The income tax, which in its concept taxes the taxpayer on his worldwide income, does not differ between different sorts of income and therefore finds no justification for the unequal treatment of debt income. The consumption or expenditure tax taxes the taxpayer on his current expenditure (or: income minus savings). Also this sort of taxation makes no difference between the expenditures that are done with income generated by different sorts of income. Hence, Devereux & Gerritsen (2010) show that the concept of the general tax base provides no justification of the distinct treatment of debt income.

Another explanation for the debt-to-equity bias could be the distinct legal basis that characterizes debt and equity. Tax laws in general largely use the following distinction between debt and equity, as stated by Devereux & Gerritsen (2010) and de Mooij (2011):

[3] When assuming relevant personal tax rates are negligible in relation to corporate income tax rates, and therefore the explanation of Miller (1977) does not hold.

- Debt holders have a legal right to receive a fixed return on their issued debt, where equity holders receive a variable return that is related to the performance of the company.
- Debt holders have a prior claim to the assets of the borrowing company in case the firm becomes insolvent. Equity holders have a residual claim in case of insolvency, which are the remaining assets when the debt holders are paid off.
- Typically, debt holders have no control over the company, holders of equity do.

However, this still leaves substantive room for interpretation, especially due to the development of hybrid financial instruments. As a result, there are multiple financial instruments that contain one or more but not all characteristics attributable to debt. Preference shares for example, on which fixed dividend payments have to be made – similar to debt payments – but do not entitle the holder to prior claim in case of insolvency. The existence of these hybrid instruments has made tax laws increasingly complex, as rules have to be established to determine whether payments relating to these financial instruments are deductible from corporate income or not (de Mooij, 2011).

The increasing tax regulation has resulted in a waiver of in tax systems to determine whether a financial instrument is to be regarded as debt or equity – as every country has their own definition (and legislation) for debt and equity. The existence of various tax systems and therefore the difference in debt definitions over countries makes room for tax arbitrage (Schon, 2009). This way multinational organizations can exploit these tax arbitrage opportunities by using financial hybrids to optimally make use of the deductibility of debt payments to lower the overall corporate income.

De Mooij (2011) adds that the difference between equity and debt is even harder to define in the situation of a multinational corporation. A parent entity that wholly owns a subsidiary has control over the subsidiary and has the residual claim on its assets in case of a default. Nonetheless, the parent entity has the possibility to provide capital to the subsidiary in the form of a debt. One might argue that that the transfer of capital to an entity over which the parent has total control should work out equally, irrelevant of the decision of debt or equity

financing. After all, the prior claim and the residual claim are held in the same hands. A motivation for intercompany debt financing by the parent company could be in order to control the free cash flow available to the manager. However, the availability to supply intercompany-debt gives the multinational organization as a whole the opportunity to exploit arbitrage opportunities.

Overall, no explanation in the relevant academic literature can be found that justifies the debt bias. One might argue that the dissimilar treatment is generated by the fact that debt payments represent the costs of doing business and payments on equity reflect business income – as is also reflected in accounting principles. However, as both payments in essence represent a return on capital, a priori no reason exists to tax one payment different from the other (de Mooij, 2011).

2.3.2 Effects of discriminating between debt and equity

Although no rationale can be found for bias in favor of debt in prior literature, plenty empirical studies have been performed to point out the various economic effects of the debt bias. The most obvious effect, on a theoretical basis already broadly discussed in the first part of this chapter, is the increasing effect on firm leverage.

As tax rules encourage companies to finance their activities excessively with debt, this makes them more vulnerable to bankruptcy in economical harder times. Excessive debt financing increases the bankruptcy costs as described in chapter 2.2. A study of Shaviro (2011) states that tax rules that encourage high leveraging have contributed to the financial crisis of 2008. Although no significant causal link is found in this study, Shaviro argues that tax rules not only fell short of classic neutrality benchmarks but also leaned in the "wrong" direction by allowing and encouraging excessive corporate leverage. Or as Shaviro (2011) describes it: *'the general consensus that taxation did not play a primary role in causing the crisis exists, even tough, in many respects, the tax system's "fingerprints" were all over the "crime scene"'*.

As described in chapter 2.3.1, the debt-to-equity bias has led to the issuance of increasingly complex financial instruments that blend the characteristics of debt and equity. This has contributed to the reduction in transparency and accountability of financial arrangements

(Fatica et al, 2012). On the other hand, the existence of the hybrid instruments partly offsets the increasing risk of bankruptcy when increasing the debt-to-equity ratio (Devereux & Gerritsen, 2010). As the usage of financial hybrids allow companies to issue securities with low risk equity characteristics that qualify as debt and therefore receive the debt-related tax benefit. An example is the issuance of convertible bonds. This way the company can benefit from the tax bias to debt financing, without the relating increase of (bankruptcy) risk.

Another effect of the debt bias of corporate tax systems is that it stimulates debt-shifting activities by multinational organizations. As laid down by the study of de Mooij (2011), companies are responsive to the level of the corporate income tax, as a higher tax rate increase the debt benefit of financing activities with debt. Hence, it can be expected that this is also the case in a multinational situation. In the situation of a multinational active in a high-taxed country (a country with a high level of corporate income tax) and a low-taxed country (vice versa) a company will be motivated to shift its debt as much as possible to the high-taxed country - as the debt-benefit will be the highest in the high-taxed country. As a result, by shifting debt to high-taxed countries the multinational company can manipulate its group profit. Evidence for this behavior is found in the study of Huizinga et al (2008). For a large sample of European companies on firm-level basis[4] during the 1994-2003 period, this study shows that international corporate tax rate differences, as well as national corporate tax rates, affect the leverage of a firm. The results present a 1.8% increase in the debt-to-equity ratio against a 10% increase in overall tax rate[5] in case of a domestic “stand-alone” firm. However the reaction in an organizations debt policy is estimated larger in case of a multinational organization, due to the existence of debt-shifting possibilities. This can be represented for a multinational organization consisting of two equally-sized firms in two distinct countries A & B. A 10% increase in the overall tax rate in country A is followed up by a 2,4% increase in the debt-

[4] A database on a firm-level basis – or unconsolidated basis – differs between a parent company and its subsidiaries. As a result the (financial) information of the parent company and its subsidiaries can be individually assessed.

[5] The overall tax rate is represented by a corporate income tax and a non-resident dividend withholding tax.

to-asset ratio of country A and a 0,6% decrease in country B. This indicates the existence of debt shifting activities by multinational organizations.

The debt bias also has an impact on the overall welfare costs. When assuming that capital markets are efficient in the absence of taxes, the bias regarding debt financing would create a deadweight loss – as investors will take on debt-to-equity ratios that are inefficiently high. This deadweight loss represents the marginal welfare cost of the debt bias. The study of Weichenrieder & Klautke (2008), which focuses on the efficiency costs that result from disturbed capital structures, estimates marginal welfare costs of between 0.05% and 0.15%. When assuming a national GDP of 1.5 times the capital stock, this welfare loss is expected to be 0.08 to 0.23 of GDP when compared to financially neutral tax system. Weichenrieder & Klautke (2008) abstracted from external costs of distorted capital structures and therefore assumed that all costs are internalized by the investing companies. In other words: the authors assume no externalities or other preexisting financial distortions exist in the non-tax situation. However de Mooij (2011) points out that total welfare costs could be much larger because of the existence of these externalities. Financial institutions, for instance, have the tendency to choose too high levels of debt due to moral hazard, which results in excessive risk taking. Further, high levels of debt increase the probability of bankruptcy. But higher levels of debt also increase the probability and the depth of a financial crisis – of which the impact on total welfare will clearly be considerably. Finally, the arbitrage opportunities created by the debt bias result in welfare costs, due to the tax competitions between countries that follows as well as the relating administrative and compliance costs. In the end de Mooij (2011) – to my idea correctly – concludes that possible welfare costs of the debt bias are substantial when not ignoring the relating external effects.

Overall, most countries in the world allow interest to be deductible from corporate income, but do not recognize equity payments to be deductible from corporate income. However no rationale can be found in prior academic literature to support the divergence between debt and equity. While on the other hand the negative effects are clear, both theoretically and empirically. This is remarkable, especially because alternatives are available. These will be discussed in the following paragraph.

2.4 Possible policy alternatives

Policy makers have several options available to them to reduce the unequal treatment of debt compared to equity present in most countries' tax systems. However, to fully neutralize the debt bias this can only be achieved by going in one of two directions. An equal treatment between debt and equity can only be achieved by either disallowing the current deduction of debt payments (CBIT), or by allowing a notional return on equity to be deductible from corporate income (ACE) so equity payments becomes deductible alongside debt payments. Although both alternatives abolish the distortion between debt and equity financing, they have different economic implications, which will be discussed below.

2.4.1 Restricting or eliminating interest deductibility (CBIT/TCR)

The comprehensive business income tax, or CBIT, eliminates the unequal treatment of debt and equity by disallowing the deduction of interest payment from corporate income. The CBIT was first introduced in a proposition of the US Treasury in 1992 (US Treasury, 1992). By disallowing the deduction of debt payments, the CBIT system broadens the tax base of the corporate income tax. The disallowance transforms the corporate income tax into a broad tax on capital (Mooij & Devereux, 2009), as the profits that are generated by both sources of capital (debt and equity) will be equally taxed on the firm level. Because of the broader tax base, an advantage of the CBIT system is that it allows implementing countries to lower the corporate tax rate. However the disadvantage is that it raises the cost of capital of future investments, as debt payments are no longer deductible which raise the costs of financing with debt. When assuming that companies only invest in projects with a positive net present value (NPV), total investments will decline as the costs of capital of these projects increase as a result of the CBIT. However, this effect is (partly) alleviated because of the broadening of the tax base and the resulting (possibility of a) decrease of the corporate tax rate. For each investment project, a tradeoff will have to be made whether the effect of implementing a CBIT will be beneficial or not. Investments financed largely with debt with a low yield will decrease because the cost of capital of these forms of investment will increase as the disadvantage of interest deductibility restrictions outweighs the advantage of the lower corporate tax rate. On the other hand, high-yielding investments mostly financed with equity will expand, as the advantage of a lower tax

rate outweighs the disadvantage of the CBIT. The implementation of CBIT therefore, in the wordings of Devereux & Gerritsen (2010), exacerbates the distortion to the marginal investment decisions. So, although the implementation of a CBIT regime would eliminate the distortion in the financing decision by disallowing the tax benefit of debt, the regime would intensify the investment decision.

No real-world example can be observed of a country that has implemented a pure CBIT system and therefore fully abolished deductibility of debt payments. According to de Mooij & Hebous (2017), such a system would create significant difficulties in international transactions such as double taxation or double non-taxation, plus it would result in major transitional complications. Instead of a full disallowance, various countries have implemented partial restrictions of interest deductibility in which interest is only deductible up until a certain threshold. These partial restrictions of interest deductibility are called thin capitalization rules (TCRs). Therefore this study does not empirically tests CBIT systems, but TCRs. TCRs are now widely recognized in western countries. In a study on European countries in 2005, a 2018 study by Buettner, Overesch & Wamser (further: Buettner & Wamser; 2018) find that already 60% had implemented some form of a TCR. With the recent efforts by to European Commission on the Anti-Tax Avoidance Directive (ATAD), TCRs will be implemented in the law of all European Countries starting from January 1th, 2019.

Overall, implementation of a CBIT system neutralizes the financial structuring distortion. Debt is no longer favored in the financing decision. However, a CBIT system exacerbates the marginal investments decision as it raises the overall cost of capital for debt-financed investments, but lowers the overall cost of capital for mostly equity-financed investments.

2.4.2 Allowing a notional return on equity (ACE)

An allowance for corporate equity (ACE) system allows a notional return on equity to be deducted from taxable income, to neutralize the distortion between debt and equity. The Capital Taxes Committee of the Institute first proposed the ACE system for Fiscal Studies (IFS, 1991). As the amount that can be deducted from taxable income is not the actual return on equity but a notional return, the tax benefit will be certain in advance, irrelevant of the

performance of the company and will therefore be received without additional risk. As a result the appropriate notional amount that is to be received under an ACE system is apposed to be equal to the risk-free nominal interest rate, for example the rate on government bonds (Bond & Devereux, 1995). The implementation of an ACE system will resolve the distortion of the marginal investment decision, as it obtains neutrality between investing with equity or debt based capital. Hence, introducing an ACE resolves the debt-to-equity bias regarding the financing decision. Moreover, where the CBIT system is a tax on (all) capital income due to the disallowance of any capital deduction, the ACE system leaves the normal (or non-premium) return on capital untaxed by allowing a deduction for both debt and equity payments. Instead of a tax in capital income, the ACE regime can therefore be regarded as a tax in economic rent (Mooij & Devereux, 2009), as the returns on investment projects that match the cost of capital remain untaxed. Such a tax will "on the margin" have no effect on the investment decision as the effective marginal tax rate will be zero, therefore an ACE system will not distort investments. Or, as described by Devereux & Freeman (1991), an ACE system achieves neutrality regarding the investment decision, as it equates the investment's before-tax payoff with the after-tax payoff. Hence, where the "regular" system of debt biased financing distorts investments, an ACE system abolishes this distortion where the CBIT system does not. Therefore, as described by Hebous (2017), the idea of an ACE is not only to influence corporate debt policy but also to stimulate investments.

However, due to the allowance of both debt and equity returns, implementation of an ACE system will narrow the corporate tax base. To maintain a neutral government budget the policy makers might have to increase the statutory corporate tax rate. First of all, an increase of the corporate income tax rate will increase the cost of capital for investing firms. But furthermore, due to this increase, de Mooij & Devereux (2009) point out that this will have an effect on investments in the way that it affects a company's discrete choices. When a multinational organization has the choice to establish a new part of its company in country A or B, a higher statutory corporate tax rate in A will – negatively – affect the choice of the multinational for country A and that way affect investment volume in this country. As a result, differences in the statutory corporate tax rates among countries incentivize organizations to shift profit (and

activities) to the lowest-taxed countries. To limit the profit-shifting effect, the ACE-implementing country can choose not to increase the statutory rate of the corporate income tax but widen the tax base in another manner.

Implementation of an ACE system would eliminate both the financing as the marginal investment distortion (de Mooij & Devereux, 2011).. Therefore, the ACE-system is traditionally favored by economist above the alternative of a CBIT. However, when the implementation of an ACE is accompanied by an increase in statutory corporate tax rate, this will increase profit-shifting activities by multinationals, which might negatively affect overall welfare.

2.4.3 Combining ACE & CBIT (ACC)

As the ACE and CBIT systems are the two most extreme alternatives in order to reform the debt bias, one could argue for a combination of the two. This is given by a variant of the ACE in the form of the Allowance for Corporate Capital (ACC). The ACC was actually a predecessor of the ACE system and therefore also proposed by the Capital Taxes Committee of the Institute for Fiscal Studies (IFS, 1991). The ACC allows for a notional return on capital to be deductible from corporate income, irrelevant whether this return is generated by debt or capital investments. As a result, the ACC mitigates the discrimination between equity and debt. Further, an ACC also has a neutralizing effect on government's revenue (Fatica et al, 2012). This can be explained by the fact that an ACC is a reform that combines the ACE and CBIT and thus also combines the effect both systems have on a government's tax revenue; the ACE system widens the tax base by limiting interest deductibility and therefore increases tax revenue, where a CBIT narrows the tax base by allowing a proportion of equity to be deductible and therefore decreases corporate tax revenue. A combination of an ACE and CBIT combines both effects, which could result in a regime that is tax revenue-neutral for the government, and still neutralizes the debt-to-equity bias regarding the financing decision for companies.

To study the effects of potential reforms in Europe in the direction of ACE and/or CBIT, Mooij & Devereux (2009) have created a simulation model to observe efficiency effects[6] and welfare

[6] Illustrated by the distortions in investment and financial structures

effects of implementing an ACE, a CBIT or a combination of the two (an ACC). Given that ACE and CBIT systems are not neutral to governmental budget, the authors find that the introduction of a revenue neutral ACC system would improve efficiency as it (also) reduces the debt-to-equity bias. As a result to the increase in efficiency of capital structures without the need to increase tax rate or widen the tax base, this would have a positive effect on country welfare. Therefore Mooij & Devereux (2009) conclude that by implementing a combination of an ACE and CBIT model, a country can restore equality in the capital structure decision (just as a single implementation of an ACE or CBIT), but also improve country welfare. However, as no country have attempted to implement such a system, the ACC is (still) only a theoretical model, therefore it cannot be empirically tested in this study.

2.4.4 ACE & TCR systems in Europe

2.4.4.1 TCR

No real-world examples of CBIT systems can be observed (de Mooij, 2008). However, various countries have implemented regulation that limits interest deductibility from corporate tax income in the form of TCRs. Thin cap regimes cap the maximum amount of debt for which interest is deductible from corporate taxable income, they are generally presented in the form of a maximum ratio of debt with respect to equity or assets ("safe harbor rule"), or interest with respect to profit ("interest stripping rule"). If the threshold established by the specific ratio is exceeded, debt payments cannot longer be deducted from taxable corporate income. Further, TCRs might be targeting all debt, or only focus on debt to related companies to only cover for the debt-shifting opportunities of multinationals as discussed in chapter 2.3.2.

The studies of de Mooij & Hebous (2017) and Blouin (2014) have summarized the various TCRs yet implemented by countries in the year 2016. This information has been validated using the Worldwide Corporate Tax Guide published by EY (EY, 2018). All countries that are part of the

sample[7] are stated in the table below. This table provides a summary of the countries that have implemented (some sort of) a general TCR.[8]

Table 1: *implemented thin cap rules in Europe*

	Country	TCR	Year of implementation[9]	TCR applicable to
1	Austria[10]	NO	-	
2	Belgium[11]	YES	2012	Related party debt
3	Bulgaria	YES	2006	Total debt
4	Croatia	YES	2005	Related party debt
5	Cyprus	NO	-	
6	Czech Republic	YES	1993	Related party debt
7	Denmark	YES	1999	Total debt
8	Estonia	NO	-	
9	Finland [12]	YES	2013	Related party debt
10	France[13]	YES	2007	Related party debt
11	Germany[14]	YES	1994	Total debt
12	Greece	YES	2010	Related party debt
13	Hungary	YES	1993	Total debt
14	Ireland[15]	NO	-	
15	Italy	YES	2004	Total debt

[7] All European Union countries plus Switzerland, Liechtenstein, Cyprus and Turkey
[8] Special rules that apply to holdings or financial institutions are not reported.
[9] The TCR might have been altered after the year of implementation, or another TCR might have been added. Examples are Germany, Portugal and the Netherlands that abolished previous TCR rules in the form of debt-equity ratios in favour of interest stripping rule. An additional analysis is performed on these countries.
[10] General anti-abuse rules apply.
[11] Up until 2012, Belgium applied a TCR only in very specific cases. A general TCR regarding intercompany debt was entered in force on 1 July 2012.
[12] Deductibility of interest expenses for intra-group loans is restricted to 25% of fiscal EBIDTA. Excess interest can be carried forward to future years.
[13] France applied some form of TCR since 1979. However, only from 2007 these rules were restricted and applied to the interest paid to all related parties. Therefore this year is taken as year of implementation.
[14] Effective from 1 January 2008, the former debt-to-equity rule was abolished in favor of an interest-stripping rule.
[15] General anti-abuse rules apply. Reclassification of interest to dividend in specific cases, however no general thin cap rule is applied.

16	Latvia	YES	2003	Total debt
17	Liechtenstein	NO		
18	Lithuania	YES	2004	Related party debt
19	Luxembourg	NO	-	
20	Malta	NO	-	
21	Netherlands[16]	YES	2004	Related party debt
22	Poland[17]	YES	1999	Related party debt
23	Portugal[18]	YES	1996	Total debt
24	Romania	YES	2006	Total debt
25	Slovakia[19]	YES	2015	Related party debt
26	Slovenia	YES	2004	Related party debt
27	Spain	YES	1992	Total debt
28	Sweden	NO	-	
29	Switzerland	YES	1997	Related party debt
30	Turkey	YES	2006	Related party debt
31	United Kingdom[20]	NO	-	

The above summary shows that almost all EU countries have now implemented a TCR. However the overview also shows that every country has its own design and own pace to limit the deductibility of interest payments - therefore various forms of TCR can be observed. First the various rules differ in its form; most countries implement a “classic” TCR in the form of a safe harbor rule, however an increasing amount of countries implement a TCR in the form of an

[16] Effective from 1 January 2013, the Dutch TCR rules were abolished. As of the same date, the deductibility on excessive interest on loans to related parties were restricted.
[17] Effective from 1 January 2018, new TCR rules limit deductibility of the excess of financing costs over interest income to 30% of the adjusted tax base. The limitation applies also to financing provided by third parties (total debt).
[18] Effective from 2013, Portugal abolished its TCR rules (fixed D/E to related parties). As of the same date a general interest limitation rule was implemented (on total debt).
[19] A TCR was introduced in 1993 but abolished from 2004.
[20] Up to 2017 UK only applied an arm's-length rule. From 1 April 2017 the amount of relief for interest is capped at 30% EBITDA.

earnings-stripping rule. An example of the first is Croatia, which only allows interest payments to be deductible from corporate income as long as the company's capital structure does not exceed that 4:1 debt-to-equity ratio. An example of the latter is Portugal, since 2013 Portugal applies an interest stripping rule that allows interest payments to be deductible only up to the greater of EUR 1 million or 30% EBITDA. Next to the various TCR forms also different thresholds are observed, as debt-to-equity ratios differ from a strict 3:1 (several countries) to a more relaxed rate of 5:1 (Belgium), and maximum interest thresholds differ from 25% (Slovakia, Finland) to 40% (Greece).

2.4.4.1 ACE

Various European countries have been experimenting by applying some form of an ACE-system, of which all applications have had their own special properties. All known observations of ACE implementations by European companies that are found in prior studies of de Mooij (2008), Klemm (2007) and Hebous (2016) are discussed below. This information has been validated using the Worldwide Corporate Tax Guide published by EY (EY, 2018).

Croatia

The first European attempt was made by Croatia in 1994. The notional return on equity was equal to 5% plus inflation over the book value of equity. Most remarkable of the Croatia-version is that it allowed a national return on the full (book) value of equity to be deductible from corporate taxable income, and therefore comes the closest to the "textbook version" of an ACE system. For this reason, Croatia's ACE system can also be defined as a "hard" ACE system. Croatia abolished the ACE system when it implemented a decrease of the statutory rate of their corporate income tax, in 2000.

Italy

In 1997 Italia implemented a so-called "dual income tax" system. In this system a separate corporate income tax rate was applied to a notional return of book-value new equity[21]. This notional return of 7% (6% upward of 2000) was taxed against a lower corporate tax rate of 19%, instead of the statutory rate of 37%. Although no return on equity is really deductible from tax income, Italia's dual income tax has the features of an ACE-system - as the effect of the system is a lower effective tax rate on equity returns. Nonetheless it's not equal to the hard ACE system of Croatia, as no proportion of the full equity value can be deducted from corporate income. Therefore the Italian method is described as soft ACE. Italy applied many modifications to the dual income tax during its appliance. For example, the size of new-equity allowed to partake in the system was changed from 100% to 120% to 140%. In 2003, Italy abolished the system and replaced due to a reduction in the statutory rate of the corporate income tax of 37% to 24%. Since 2012 Italy re-installed its ACE-system. The notional return rate is currently 4%.

Austria

Austria applied an ACE in 2000 that was broadly similar to the dual income tax of Italy. An alternative corporate tax rate of 25% (instead of 34%) was applied on the national return over the book value of new equity.[22] The applicable notional return was calculated by the average return on government bonds plus 0.8%. The system was abolished in 2000, when Austria reduced the statutory rate of its corporate income tax.

Belgium

Belgium implemented an ACE system in 2006 and the system is still applied. This system, called the "notionele interest aftrek", allows a notional return over the book value of equity to be deductible from corporate tax income. The notional return is calculated by the average monthly government bond rate with a max of 6.5%. The Belgium system has a special rate for small and

[21] In which "new equity" is equity that is issued after the implementation of the reform (i.e.: after 1997). By not including all equity Italy could temper the short-term impact on the government revenue of the dual income tax system.
[22] Ibidem for Austria.

medium-sized firms, which is 0.5% higher than the average bond rate. The Belgium variant is a hard ACE system, as the notional return is tax deductible equal to the system of Croatia.

Latvia

In 2009 Latvia implemented an ACE system. The allowed notional reduction was a specified percentage over the retained earnings. This percentage was equal the WACC of interest on loans made to non-financial companies. The rate was 5.05% in 2010. Latvia abolished its ACE system in 2013.

Liechtenstein

Liechtenstein embraced a hard ACE system in 2012, in which a notional return on equity can be deducted from the corporate tax income. The percentage of the notional return is currently 4% and is to be adjusted annually depending on the market developments.

Portugal

Portugal implemented an ACE between 2010 and 2013. In these years companies could – after an equity investment – benefit from corporate income deduction equal to 3% of the contribution. The deduction is allowed for three years. In 2013 the previous ACE was abolished and the system was only allowed for small and medium-sized companies, which were allowed a deduction of 5% of the equity contribution.

Cyprus

Cyprus implemented an ACE in 2015. New equity is allowed a notional deduction from tax income equal to the interest rate of a 10-year government yield of the country in which the company is located in which the equity is invested, increased by 3%.

Turkey

Turkey implemented an ACE in 2015. Here the system allowed a notional deduction over the cash-capital increase of the paid-in capital. The rate of the notional deduction is calculated as 50% of the weighted-average interest rate applied to Turkish Lira-denominated loans that are provided by banks.

The European countries that have implemented some sort of an ACE system can be summarized as follows[23]:

Table 2: *implemented ACE systems in Europe*

	Country	Period	Type
1	Croatia	1994-2000	Hard
2	Italy	1997–2003	Soft
		Since 2012	Soft
3	Austria	2000-2004	Soft
4	Belgium	Since 2006	Hard
5	Latvia	2009-2014	Soft
6	Liechtenstein	Since 2011	Hard
7	Portugal	2010-2013	Soft
8	Cyprus	Since 2016	Soft
9	Turkey	Since 2016	Soft
10	Malta	Since 2018	Hard

2.4.5 Empirical analysis on the impact of ACE & TCR Systems

2.4.5.1 TCR

A large string of literature has assessed the empirical effects of CBIT, or more specifically: TCR systems. Studies on the effect of implemented TCRs in Germany shows that for both native and foreign affiliates located in Germany the implementation of general thin cap rules reduced internal borrowing (Overesch & Wamser, 2010) (Weichenrieder & Windischbauer, 2008) and reduced debt-ratios by companies (Buslei & Simmler, 2012). The same effects are found in a study for foreign affiliates from US multinationals (Blouin et al, 2014). Because these studies focus on internal financing within the group, the unconsolidated data of firms is used to

[23] Note that table functions as an overall summery. For the empirical analysis of this study, solely the ACE systems are used that were implemented in their hosting country during the sample period 2009-2016

perform these studies. As a result, these studies cannot observe changes with respect to the multinational organization as a whole.

A study that focuses on the consolidated data is the recent published working paper of de Mooij & Hebous (2017). Because of the consolidated data all intragroup transactions are excluded and debt ratios represent the ratio of external debt within the organization. The study focuses on 60 studies that have or have not implemented some sort of TCR within the sample period 2005 and 2014. The objective of the study is to test whether TCRs also have an effect on the debt-to-equity ratio on an organization-level, which is important with respect to the stability implications of high leveraged organizations. The results of de Mooij & Hebous (2017) show that TCRs that only restrict debt supplied by related parties do not affect the overall debt-to-equity ratio of the organization. Hence, related-party TCRs do not effectively neutralize stability implications - although most TCRs are applied in this format (as can be observed in chapter 2.4.1). TCRs on total debt however are effective in decreasing organization's debt-to-equity ratio. De Mooij & Hebous (2017) observe a decrease in the consolidated debt ratio of an average 5 percentage points. This effect is even more severe in industries with a high share of tangible assets. Therefore, de Mooij & Hebous (2017) conclude that the scope of TCRs should be broadened so it covers all debt to neutralize tax systems with respect to the financing decision.

2.4.5.2 ACE

As stated in chapter 2.4.2, implementation of an ACE system would eliminate both the financing as the marginal investment distortion – however when for the narrowed tax base as a result of the ACE is compensated by increasing the tax rate this will have a negative effect on a country's overall welfare. Some empirical evidence for the implementation of country specific ACE regimes is given: the ACE system decreases leverage in Italy (Staderini, 2001) and introduction of the ACE system in Croatia did not decrease government revenue (Keen & King,

2013).[24] However, as country's ACE systems are very specific the results from these studies cannot be generalized to all ACE regimes.

The only found study that recognizes this problem is the working paper of Hebous & Ruf (2017), as the paper focuses on several ACE systems. The authors study the effect of adopting an ACE system on the debt-bias in the financing decision and the investment decision for multinational organizations based in Germany. Hebous & Ruf (2017) recognizes the possible increasing tax-planning opportunities for multinationals resulting from a country's implementation of an ACE system, by distinguishing between passive and active investments. This can be visualized by the following example. Assume country X that has implemented an ACE regime and let country Y be a country with a high corporate tax rate (but no ACE system). When a multinational is located in both X and Y it can make an equity investment in the country X, this entity can forward the capital in the form of a loan (debt) to the entity located in Y. This way the company in X benefits from the notional deduction of the ACE regime and the company in Y benefits from the interest deduction, which it can deduct against its high tax rate. Using this inter-group financing structure and receiving a tax benefit from both the deduction of equity and debt payments, the organization as a whole can benefit as it essentially deducts a proportion of the same capital twice ("double dip"). Hebous & Ruf (2017) characterize this form of inter-group financing in which an initial investment is made as a passive investment, as (mostly) no increase in production or tangible assets are involved.

The results of the study show that ACE regimes effectively lower the total debt ratio of the German multinational affiliates located in ACE countries with 3 to 5 percentage points on average. This finding confirms that ACE systems effectively affect the debt bias with respect to the financing decision. Second, Hebous & Ruf (2017) show that – following the expectations – the volume of passive investments[25] increases in ACE introduced countries. More specifically,

[24] This is actually a very remarkable finding and might show that other features of the tax system compensate for the ACE implementation and therefore no increase in statutory tax rate is needed. However Keen & King (2013) admit this cannot be concluded as more detailed (macro-economic) information is needed.

[25] To measure passive investments in their study, Hebous & Ruff (2017) define two variables; (i) equity financed lending calculated as loans to related entities minus total liability, and (ii) passive assets calculated as financial assets minus shares in related companies and loans to shareholders.

the introduction of an ACE is followed by an increase in passive investments of 29.6 percent. This confirms the above-mentioned argument that multinationals increasingly make use of tax planning opportunities created by the ACE system. Regarding active investments on the other hand, no effect can be observed. From which one could argue that active or "real" investments, such as investments in production facilities, do not benefit from the decreased cost of capital for investments. Something that will by further tested in this thesis, as this studies the effect on active investments. The study of Hebous & Ruf (2017) confirms the credibility of an ACE system by effectively decreasing the debt-to-equity ratio. However, Hebous & Ruf (2017) add that the findings also underscore the importance of well-designed anti-abuse provisions to tackle the increased tax opportunities for multinationals.

Overall, these paragraphs show that alternative tax regimes are available to neutralize the debt equity bias, in the form of ACE and CBIT (TCR) tax systems. Although, from a theoretical point of view, both regimes equalize the financing decision, they have various effects on the investment decision for companies. Whether these theoretical assumptions hold in practice will be researched in chapter 5.

2.5 Empirical analysis on investments

The effect of taxes on investments has been studied for many years. Not strange, as tax devices has been used in various ways to stimulate investments ever since the post-war era (Hall & Johnson 1967). As the most noticeable element of a tax system, the effect of the tax rate on investment behavior has been studied substantially in prior economic literature. From which an overview of studies concluded that (the increase of) a corporate income tax has a significant negative effect on the inflow of foreign investments (Commission of the European Communities, 1992). In a more recent study, de Mooij & Ederveen (2003) focused on creating an overview of prior literature by translating the results of 25 empirical studies into comparable elasticities. Of which the studies examine different sample countries applying various types of analytical approaches. By comparing the prior studies, de Mooij & Ederveen (2003) find a median value of the tax rate elasticity of 3.3 percent. In other words: a 1 percentage point increase in the tax rate of the hosting country is followed by a 3.3 percent decrease of foreign

investments. However, substantial variation between studies (and therefore countries) is observed.

When turning to other aspects of a tax system, a recent study of Zwick & Mahon (2017) estimates the effect of temporary tax incentives on investments in the form of an accelerated depreciation. They find, when analyzing data for 120.000 firms, that when tax policy allowed accelerated depreciation on asset value this raised investments on qualified assets compared to unqualified assets by 10.4% between 2001 and 2004, and 16.9% between 2008 and 2010. This implies a not-to-be-forgotten role of tax policy on investments in a country. Which confirms the relevance of a study for the adverse effects on investments, following from the introduction of tax regulations such as ACE or TCR systems.

Another study to assess the effect of tax regulations on investments is a study of de Mooij & Liu (2018). This study specifically studies the impact on investments of transfer pricing regulations to mitigate tax avoidance by multinational companies (as a result the OECD-BEPS project). The study shows that, on average, the introduction of transfer pricing regulations reduced investments by multinational affiliates by more than 11 percent. However, regressions based on consolidated statements show that aggregated multinational investments are not affected by transfer pricing regulation. The authors conclude that multinationals relocate investments toward affiliates in other countries rather than to cut global investments. This suggests that transfer pricing regulations – and therefore tax regulations – have a substantial impact on the investments in a country. Largely undiscovered is the effect of tax regulations regarding the limitation of tax deductibility. This is again emphasized by De Mooij & Hebous (2017), as they conclude their study by stating that the effect of TCRs on investments is still unknown.

The study of Hebous & Ruf (2017) tests the effect of ACE systems on investments, as described in chapter 2.4.5, the authors find a 29.6 percent increase in investments, following an ACE introduction for a sample of German multinationals. However, the authors conclude that this investment reaction is rather associated with an increase in passive investments than in active (production) investments. Further, to the best of my knowledge, the only other found empirical study that fills this gap is that of Buettner & Wamser (2018). These authors study the effect of

tax regulations aimed at restricting multinationals tax planning activities on foreign direct investments. In which the authors divide these tax regulations into tax rules that limit interest deductibility (TCRs) and tax rules that regulate the transfer pricing possibilities of multinationals. Buettner & Wamser (2018) study the effect of the tax regulations on multinational investments for a sample of German multinational subsidiaries (on an unconsolidated level). The authors find that the introduction of thin cap rules intensifies the tax effect, as TCRs are found to be associated with a stronger response on tax rate changes in the hosting countries. More precise, for countries with a tax rate that is one standard deviation above average, the investments of the German-owned multinational subsidiaries are found to decline by about 2.5%. Contrary to the findings of de Mooij & Liu (2018), Buettner & Wamser (2018) do not find any significant effect on investments from the introduction of transfer pricing regulations.

Although extensive research has been performed on the effect of (changes in) tax regulations on firms' investment behavior, limited attention has gone to the specific effect of ACE systems and TCRs. A reason for this might be that firm-level data to perform this kind of study was until recently not broadly available. The only found studies that explores this field of research is the before mentioned study of of Buettner & Wamser (2018) and Hebous & Ruf (2017). Though these studies only focuses on a sample (foreign subsidiaries of) German multinationals. As a result, the relevance for a cross-sectional study on the implication of ACE and TCR systems is further confirmed.

2.6 Conclusion

This literature review is meant to describe all relevant economic aspects concerning the interest deductibility from corporate taxable income, its effects and its solutions. First, relevant financing decision making theories are presented. Starting point was the Modigliani Miller Theorem, which describes that under the assumption of well-functioning markets and neutral taxes the financing decision of a company does not affect its total value. However, when adding to the equation the non-neutral tax regimes that favor debt above equity, the irrelevance proposition no longer holds and the debt financing bias is formed. Here the tradeoff theory

steps in, which states that firms increase their leverage up to the point the marginal benefits of issuing an extra unit of debt balance out against the marginal costs.

In the form of agency costs and increased probability of bankruptcy for companies, the costs of the debt bias are clear. For both the firm and the economy. However, one might question what the economic benefits are, from a government point of view. As described in chapter 2.3.1, no rationale can be found in the academic literature for the discriminating between debt and equity. Nonetheless, various effects can be observed resulting from the debt bias. Most obvious is the increase in company leverage, but the debt bias also results in increased profit shifting activities and lower overall welfare.

Policy alternatives are available; by restricting interest deductibility (CBIT, TCR), allowing a notional return on equity (ACE) or a combination (ACC). Although debt payments remain deductible - as no CBIT has yet been implemented - different European countries have implemented a TCR or ACE system. Prior academic literature showed that both systems are found to effectively reduce firms' debt-to-equity ratios and therefore neutralize firms' financing decision. However, less empirical evidence is known about the relation between firms' investment and the introduction of an ACE or TCR. Which is remarkable as both alternative tax regimes have different expected investment effects. The only found studies that test this association find for a sample of German multinationals that an ACE regime increases (passive) investments (Hebous & Ruf 2017) and the introduction of a thin cap rules decreases company's investments (Buettner & Wamser; 2018). However, the association for non-German owned organizations is unknown. Just as the effect on non-multinationals (domestic companies). Therefore, the remaining part of this study will attempt empirically test the relation between ACE and TCR regimes and company investment behavior for sample of companies headquartered in 28 countries, both multinational and domestically owned.

3. Hypothesis development

3.1 Introduction

In most tax systems, the deductibility of interest payments creates a bias towards debt financing that results in (among other things) high debt-to-equity ratios. Alternative tax regimes are available, prior literature has shown that implementing alternatives in the form of a TCR or ACE systems can decrease debt-ratios. However, the effect on the volume of investments in the countries that implemented these alternative regimes is largely unknown – as on a cross-sectional level only limited prior literature is found. Although the need for this kind of study is emphasized (de Mooij & Hebous, 2017). In this chapter the hypotheses are presented regarding this topic, backed up by argumentations and expectations based on the prior literature research as presented in chapter 2.

3.2 TCR systems & investments

Intuitively, as the adoption of a TCR will limit the benefit of deducting debt payments from taxable income, the cost of debt financing will increase and therefore the overall cost of capital for a company will increase. Because of the higher costs of capital for companies after the implementation of the interest deductibility restrictions, a subsequent reduction is to be expected in the level investments of these firms.

In formula (c) in Appendix A in which the Modigliani Miller theorem is described in more detail, the cost of capital (or WACC) is defined in the situation of no (or neutral) taxes under the Modigliani Miller theorem. When introducing taxes, the following formula is obtained[26]:

$$WACC = r_A = \frac{(1-\varphi t) r_D D}{D+E} + \frac{r_E E}{D+E} \quad (8)$$

In this formula, the bias toward debt financing is presented by the tax shield $(1 - \varphi t)$, in which φ presents the degree to which debt payments are deductible from taxable corporate income. If no limitations regarding interest deductibility are in place, then $\varphi = 1$ and debt payments are fully deductible from taxable income. For example, in a situation of no thin cap rules ($\varphi = 1$), a

[26] To make the formula clearer and in line with presently applied WACC formulas, I've replaced company value (V) as presented by Modigliani & Miller for company value in terms of the sum of debt and equity ($D + E$).

10% cost of debt (r_D) and a corporate tax rate of 25% result in a cost of debt after the tax adjustment of 7.5%.[27] As long as $\varphi > 0$, debt payments remain deductible which lowers the (after-tax) costs of debt, and therefore the overall cost of capital.

Assume a situation in which nothing changes except for the introduction of a TCR ($0 < \varphi < 1$)[28]. The return that is expected by the debt holders – interest payments over issued debt - has remained unchanged. However, due to the introduction of the TCR, the tax shield has been limited (as $\varphi < 1$), therefore the after-tax costs on debt (interest expense minus tax shield) for the company will increase. As a result, the introduction of a thin cap rule in a country is expected to increase the cost of capital for companies in that country, ceteris paribus.

Then, when assuming companies only invest in projects that have a positive NPV, a project that was on the margin ($NPV \approx 0$) before introduction of the TCR will no longer be carried out as the cost of capital (r_a) increased:

$$NPV = -C_0 + \frac{C_1}{1+r_a} + \frac{C_2}{(1+r_a)^2} + \cdots + \frac{C_n}{(1+r_a)^n} \quad (9)$$

Therefore, it is to be expected that the introduction of a thin cap rule will decrease the volume of investments due to the increased cost of capital in that country, all else being equal.

Further, as the introduction of the TCR results broadens the tax base (de Mooij & Devereux, 2009), this is expected to result into higher corporate tax revenue for the government. Therefore, the TCR might be implemented in combination with a decrease of the statutory corporate tax rate. This will have a decreasing effect on the cost equity - as an equal amount of after-tax return to equity holders, can be achieved with a smaller amount of pre-tax returns.

Hence, when expecting a TCR to be jointly introduced with a decrease of the statutory corporate tax rate, the effect on the investments is double-sided and therefore the overall effect on the investment volume is unknown. A trade-off has to be made for each investment to test whether the introduction of TCRs is beneficial (Devereux & Gerritsen, 2010).

[27] (10% * (1-0.25*1) = 7.5%).

[28] Because a thin cap rule only partly limits interest deductibility, the value of φ has to remain above zero. As otherwise deductibility will be fully abolished and effectively a CBIT will be in place.

Investments financed largely with debt with a low profit will decrease because the cost of capital of these forms of investment will increase as the disadvantage of TCRs outweighs the advantage of the lower corporate tax rate. On the other hand, high-yielding investments largely financed with equity will expand, as the advantage of a lower tax rate outweighs the disadvantage of the CBIT. To control for the possible decrease of the statutory tax rate associated with the introduction of a thin cap rule, the tax rate will be introduced as a control variable into the empirical analysis.

In the end, it is empirically confirmed that firms' adjust their investment level following changes in tax regulation. As the sole introduction of a TCR increases the costs of capital of investments, this is expected to decrease the level of investments. Consequently, this results in the following hypothesis:

H1: the implementation of a TCR in a country results in lower investments due to higher costs of capital.

3.3 ACE systems & investments

The effect on the level of investments in a country after the introduction of an ACE system is very much contrary to the effect on investments after introduction of a TCR. As an ACE system allows a notional return on equity to be deducted from corporate income, this decreases the costs of equity and therefore the overall costs of capital will decrease. The lower cost of capital can be expected to have a positive effect on investments in that country.

In addition to the debt payments that can be deducted, an ACE system allows a notional return on equity to be deducted from corporate taxable income. The ACE system can be introduced into the after-tax formula of the cost of capital as follows:

$$WACC = r_A = \frac{(1-\varphi t)r_D D}{D+E} + \frac{(1-t_e)r_E E}{D+E} \quad (10)$$

Here, in addition to the tax shield of debt, the tax shield of equity is included $(1 - t_e)$ by allowing the notional return on equity to be deducted from a corporate income against a

notional return rate.[29] Again, assume a country with a common tax system (debt payments fully deductible, thus $\varphi = 1$), with no changes except for the sole introduction of an ACE system $(1 - t_e)$. Then, the return that equity suppliers expect to receive on their investment is equal to the after-tax costs of equity for the company. Although this amount does not change after introduction of the ACE, the pre-tax costs of equity for the company will decrease, as a part of the return on equity can be deducted from the taxable income. As a result of the decrease in the cost of equity, the overall cost of capital will decrease. Hence, the sole introduction of an ACE system in a country is expected to decrease the cost of capital in a country.

The lower cost of capital associated with the ACE system is expected to stimulate companies' investments. As following the introduction of the ACE system projected cash flows are discounted with a lower cost of capital. Investment projects that had a negative present value before ACE ($NPV < 0$) and were not to be executed might have a positive present value after ACE ($NPV > 0$). Therefore, the introduction of an ACE system in a country will be followed by an increase in investments due to the increased cost of capital in that country – all other factors being equal.

As described in the prior chapter, under an ACE system both debt and equity-financed investments are taxed equally.[30] Instead of a TCR or CBIT that exacerbates the investment decision, an ACE system neutralizes the investment decision as it equates the investment's before-tax payoff with the after-tax payoff (Devereux & Freeman, 1991). However, because of the narrowed tax base due to the deductibility of equity payments, the introduction of an ACE might be accompanied with a higher statutory corporate tax rate in order for the government to maintain a neutral budget. Policy of such can be observed in countries that have implemented an ACE.[31] When the ACE is abolished this is often followed by a reduction of the

[29] Note that in most ACE systems this rate is not equal to the statutory corporate tax rate, therefore the notional rate is presented as t_e.
[30] At least theoretically, as in practice the notional return on equity rate is often tot equal to the corporate tax rate (to which debt payments are deductible)
[31] Examples are Italy, Croatia and Austria.

corporate tax rate, indicating that in the time of the ACE the statutory rate was relatively high to compensate for the narrow tax base. A high statutory rate will discourage (multinational) organization to invest in new operations in that country (de Mooij, & Devereux; 2009), and therefore decrease the level of investments. Even more, as multinational organizations are found to relocate global investments rather than cut investments (de Mooij & Liu; 2018), it can be expected that multinationals shift investments to the most beneficial location. Therefore, an increase in the statutory rate will have a negative effect on investments. Again, to control for the possible effect of a change in the statutory tax rate associated with an ACE introduction, the tax rate is implemented into the regression. By doing so, the effect of an ACE on the investment behavior of firms can be tested, given a certain tax rate.

As an ACE system allows the deduction of both debt and equity payments, the sole introduction of an ACE systems lowers the cost of capital and is therefore expected to decrease the level of investments. This results in the following hypothesis:

H2: the implementation of an ACE in a country will result in higher investments due to lower costs of capital.

3.4 Multinational organization & investments

Although all firms are assumed to react on the alternative tax regimes due to the changes in cost of capital, all prior academic literature studying thin cap rules focuses purely on (the subsidiaries of) multinational organizations. This can be explained, as the effect on investments is expected to be more pronounced for multinational organizations due to shifting opportunities, which are not available for domestic organizations.

The study of de Mooij & Liu (2018) showed that tax regulations in general impact the global investment behavior of multinational organizations, as they shift investments to another entity elsewhere in the organization to avoid the tax rules. The study of Huizinga et al (2008) showed that multinational organizations use shifting activities to shift debt between low and high taxed countries to benefit from tax rate differences. However, entities with no or no foreign related parties do not have this shifting opportunity. Therefore, it is to be expected that the effect of

the introduction of new tax regulations on investments is more pronounced for entities part of a multinational organization.

Thin cap rules can be expected to be followed by a “more negative” investment reaction, if firms are part of a multinational organization, compared to domestic organized companies. As these companies have the opportunity to avoid the restrictions of implemented thin cap rules by shifting investments to more advantageous tax jurisdictions. In an equal manner, ACE systems are expected to be followed by a “more positive” investment reaction for firms that are part of a multinational organization, compared to their domestic counterparties. As ACE systems, via a lower cost of capital on investments as presented earlier in this chapter, create investment opportunities of which the multinational organization will increasingly benefit from by shifting investments into the ACE-implementing jurisdiction.

Hence, as firms that are part of a multinational organization have the possibility to shift investments to and from foreign affiliated companies – an opportunity not available to their domestic counterparties – multinational firms are expected to show a more profound investment reaction following the introduction of an ACE or TCR regime.

H3: the investment reaction following the implementation of an ACE or TCR will be more pronounced for firms that are part of a multinational organization.

3.5 Conclusion

In this chapter described the hypotheses created from the literature review in chapter 2. Overall TCRs are hypothesized to be associated with a negative investment reaction, ACE systems with a positive investment reaction, and firms’ part of a multinational with a more severe investment reaction. These hypotheses will be tested using the empirical analysis in the remainder of this study.

4. Methodology

4.1 Introduction

This chapter covers the methodology used for the empirical research that is performed in the remainder of this study. This chapter contains the procedure of the sample selection and further preparation of the data, the creation and description of the variables used and the research design for the empirical analysis.

4.2 Sample selection and data preparation

Firm-level data

The primary database of this study is a cross-sectional time-series (panel) dataset of 217 thousand individual entities, containing a total of 1.5 million company-year observations. The firm-level financial and ownership information for this research is derived from the Orbis database, created by Bureau van Dijk. Orbis is chosen above other databases because of its large record of non-US firms. Moreover, the choice is made because the Orbis database provides the possibility to identify ownership data, which is essential to determine whether or not entities are part of a multinational organization, to answer the third hypothesis.

The sample period is chosen from the year 2009 up to 2016 – a period in which various countries have implemented alternative tax rules. Furthermore, the beginning period of the sample is 2009, as this is this earliest year made possible in the Orbis database. The latest year in the sample period is 2016, as for the following years firm-level financial information in the Orbis database is not yet extensively available. The initial sample selection is performed on the firm-level data of 31 European countries.[32] The decision is made to focus on European countries as the comparability between countries is high, however each country has their individual fiscal policy and hence various implementations of ACE and TCR systems can be observed (see chapter 2.4 for all implemented ACE and TCR systems in every individual country).

[32] More specifically, the 28 European Union countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark Estonia, Finland, France, Germany Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain Sweden, Switzerland, United Kingdom, plus Switzerland, Turkey and Liechtenstein.

The search for firm-level data is initiated by a search in Orbis for corporate entities that (i) are located in a sample country and have: (ii) unconsolidated accounts available (C2/U2 or U1), (3) fixed assets information for all years in the sample period 2009-2016, (iii) depreciation & amortization information for all years of the sample period 2009-2016 and (iv) ownership information available. Following prior research, financial institutions are excluded as different tax regulations might apply for this sector. Based on the firm-level financial information firms' book-value of fixed assets can be stated, which serves as the main indicator of investment behavior. Further, the financial information from the Orbis database is used to create the firm-level control variables of sales growth, cash flow and profit margin. Based on ownership data from the Orbis database dependent dummy variable for multinational organizations can be created. All firm-level financial information extracted from the Orbis database is presented in thousands of Euros.

Country level data

This study aims to tests the effect on investments following the introduction of an ACE or TCR system. Hence, the primary variables of interest are country-level dummy variables that indicate the existence of some form of an ACE system or a thin-cap rule. Tax information regarding the TCR dummy variable has been taken from the studies of de Mooij & Hebous (2017) and Blouin (2014) that summarized the various implemented TCRs. Information regarding the ACE systems is found in the studies of de Mooij (2008), Klemm (2007) and Hebous (2016). Both the information on ACE and TCR systems has been validated using the Worldwide Corporate Tax Guide published by EY (EY, 2018). Further, to create the control variable for the statutory corporate tax rate in the hosting country, country-level data on tax rates is provided by the Oxford University Centre for Business Taxation. This is appended using the KPMG Corporate Tax Rates Table (2018) for missing countries. Last, regarding country-level control variables, data on the macroeconomic characteristics of the countries in the sample are from the April 2018 edition of the World Economic Outlook database provided by IMF. This includes information on countries': population, unemployment, national GDP, GDP per capita and inflation. To be able to compare the observations of different countries containing different

currencies, all collected financial information from the IMF database is presented in (PPP corrected) international dollars.[33]

4.3 Variable Description

Dependent variable

As this study aims to test the effect of ACE and TCR regimes on investments, the primary topic of interest in this research design is the level of investments by a company in a given year. For the main regressions of this study, following Buettner & Wamser (2018), the current year book value of fixed assets is used as a proxy for investments. Hence, dependent variable FA_{tci} presents the unconsolidated book value of fixed assets for an entity i, located in a country c at (the ending of) year t. The variable is presented as a logarithmic value to control for large observations (right skewness) in the sample. Company fixed asset value is chosen as a proxy for investment behavior as it comprises both mobility and substitution investment effects (Buettner & Wamser; 2018). Substitution effects are presented when firms substitute capital-intensive production (associated with large investments) for labor-intensive production (associated with low investments), for example when following the introduction of an alternative tax regime. Mobility effects arise when, following the introduction of an alternative tax regime, organizations relocate (or shift) investments to entities in other countries. Note that the mobility effect on a firm's investments is only relevant for companies that are part of a multinational organization, as domestic firms do not have this opportunity.

Independent variable

The main explanatory variables of interest in this study are formed by the answer on the question whether in a given year, a company has introduced regulation against the tax deductibility of debt payments in the form of allowing a notional return on equity (ACE) or a general thin-cap rule (TCR). Hence, explanatory variables TCR_{ct} and ACE_{ct} are formulated as dummy variables that take the value 1 in all the years t a country c has implemented

[33] Values are presented in international dollars to avoid currency differences. The term "international dollars" could also be described as "local currency per U.S. dollar", and presents a hypothetical currency that has the same purchasing power as a U.S. dollar in the United States for a given time.

respectively an interest deductibility limitation ($TCR_{ct} = 1$) or an allowance for corporate equity ($ACE_{ct} = 1$), and 0 otherwise (($TCR_{ct} = 0$ / $ACE_{ct} = 0$).

As entities part of a multinational organization have the opportunity to relocate production (and therefore investment) to related entities in other countries, it is to be expected that multinational firms increasingly react on the introduction of ACE or TCR systems. Hence, a firms' investment reaction on introduced tax regulation can be partly explained by the question whether this firm is part of a multinational. Therefore, a dummy variable is created that defines whether firms are part of a multinational (MNE_{cti}). The dummy takes the value of 1 if the entity i is part of a multinational organization (MNE_{cti}=1) and takes the value of 0 otherwise ($MNE_{cti} = 0$). An entity is defined as part of a multinational if its meets one of the following requirements: (i) its ultimate parent company is located in foreign country (owning a minimum of 51% of the shares), (ii) the entity has foreign subsidiaries (owning a minimum of 51% of the shares).

To test the increased investment reaction for multinationals following the introduction of tax reforms, interaction variables are computed between the multinational-dummy and respectively countries in which a TCR system was introduced ($TCR_{ct} * MNE_{cti}$), and countries that implemented an ACE regime ($ACE_{ct} * MNE_{cti}$). As the interaction terms consists of dummy variables, the regression coefficient will have a value of 0 if no alternative tax regime is implemented ($ACE_{ct} = 0$ / $TCR_{ct} = 0$) or the firm is not part of a multinational ($MNE_{ct} = 0$). Given that both MNE_{cti} and ACE_{ct} / TCR_{ct} are also solely present in the regression, and assuming the effect on investments following changes in tax regulation is more pronounced for multinationals; the coefficient of the interaction variables can be interpreted as a sort of "premium effect" for entities that are part of a multinational organization.

Control variables

Next to the explanatory variables, control variables are included. Control variables are added to the regression to prevent that the relationship between the level of investments (the dependent variable) and the independent variables can be alternatively explained by other,

omitted factors. Hence, in order to correctly test the relative relationship between the independent variables and the level of investments control variables are added.

A higher corporate tax rate is expected to have a negative effect on the level of investments in a country, as it increases the costs of capital. This is also found in prior literature (Buettner & Wamser; 2018). In addition, the introduction of an ACE is often associated with a high(er) statutory rate to compensate for the effect on government budget (Devereux & Gerritsen, 2011). Hence, the statutory corporate tax rate is introduced to control for these effects. The variable is created following the study of Buettner & Wamser (2018), although this research uses the variable as an explanatory variable. Control variable Tax_{ct} represents the statutory corporate tax rate in country c in the year t and is calculated by the statutory tax rate divided by 100. It must be kept in mind that this variable is not a perfect tax measurement for firms that are active in more than one country and therefore are subject to corporation taxes other than that of its domestic corporate tax system (and rate). However, as this study makes use of unconsolidated data and therefore focus on local entities this is not as much of a problem as for studies using consolidated data focusing on organizations[34].

Further, the characteristics of a company in terms of its performance and size can influence its investment behavior. Therefore a number of company characteristics are added to control for possible company-related effects on the level of investments that might distract the relation between dependent and independent variable. First, it can be expected that a firm's investments increase when its revenue increase, for example to increase the production capacity. Therefore control variable $Sales\ Growth_{tci}$ is introduced, this variable is calculated as the ratio between the current-year and previous-year operating revenue subtracted with 1. Second, highly profitable entities are expected to have higher and increasing investments compared to low profitable firms. Therefore control variable $Profit\ Margin_{tci}$ is included, this variable is calculated as the EBIT divided by the operating revenue. Third, a firm with a relatively large amount of cash flow available could potentially use this to increase its level of investments. To control for this factor a control variable is introduced, $Cash\ Flow\ Rate_{tci}$ is

[34] As is the case in de Mooij & Liu (2018).

computed by the current-year cash flow divided by the lagged fixed tangible assets. These three firm-level performance indicators are also present as control variables in the study of de Mooij & Liu (2018).

It is not difficult to understand that the absolute investments of a firm are positively associated to the firm's size. Larger firms are expected to have higher investments than smaller firms and therefore – in absolute numbers – also expected to react more on the introduction of an ACE or TCR regime. As a result, following the study of Buettner & Wamser (2018), control variable $Sales_{tci}$ is included to control for potential factors related to the size of an entity. $Sales_{tci}$ presents the current year operational revenue in thousands of Euros, presented in logarithmic values.

Next to company characteristics, characteristics of the host-country might affect the investment behavior of a firm. Following the study of Buettner & Wamser (2018) control variable $GDP_{tc}$is introduced to control for the size of the country's market formulated in billions of international dollars, $Inflation_{tc}$ controls for potential inflation of prices in the host-country formulated as an index value, $GDP\ Per\ Capita_{tc}$to control for the productivity of labor in the host country in thousands of international dollars and $GDP\ PC\ Growth_{tc}$ to control for the dynamics of the host-country's market formulated as current GDP divided by lagged GDP times 100. All monetary control variables not presented as ratios are recalculated as logarithmic values. Moreover, non-economic characteristics of the host-country can potentially influence the level of investments. Therefore, as used by de Mooij & Liu (2018), country-level non-economic country characteristics are introduced, including $Unemployment_{tc}$ which is the rate of unemployed population divideds by the country's total labor force.

Last, fixed effects are introduced. Year-fixed effects are included (λ_t), these control for year-specific effects that have an impact on the sample as a whole, including macroeconomic shocks such as the economic regression that took place in the beginning of the sample period. To conclude, firm-level fixed effects (α_i) are added to control for any time-invariant firm-specific characteristics that effect the tested relation. Notice that this way we automatically control for country-level fixed effects, as firm-level fixed effects control for all fixed effects present among

firms, including country-level characterizations that do not change over time. Hence, it can be stated that firm fired effects “nest” country-level fixed effects.

4.4 Data preparation

The calculation with respect to the variables is yet described in chapter 4.2, so this section only provides information on the preparation of the variables in order to be correctly formulated for the regression analysis. First, all firm-year observations are excluded from the sample that do not have information on all control variables available. The concluding sample is a panel-dataset of 217,847 individual entities from 28 countries, containing a total of 1,501,792 firm-year observations - an average of 6.9 yearly observations per firm. Since the sample period is 7 years (2010-2016), this indicates that nearly all entities are present for the full sample period.

An investigation of the firm-level data as obtained from the Orbis database shows that the data contains a few extreme - possibly incorrect - firm-year observations. Regression estimates can be highly influenced by extremely high or low observations (Veenman, 2013). To control for extreme outliers all continuous firm-level variables in this study are formulated as ratios ($Salesgrowth_{tci}$, $Cashflow_{cti}$, $Profitmargin_{cti}$) or scaled by their natural logarithm (FA_{tci}, $Sales_{tci}$). To control for the effect of the possible incorrect observations all financial firm-level data is winsorized at the top and bottom 1 percentile, which has also been done in the study of de Mooij & Liu (2018). I understand that the winsorizing of observation replaces the “true” values of extreme observations with “untrue” values formed by the collected data itself, where the extreme observations could also have been dropped (trimmed). However, to not lose the condition that observations are present for the full sample period for (almost) all firms, the extreme values have been winsorized instead of trimmed.

The Hausman test is performed on the main regression to test whether fixed effects are to be implemented into this study. The null hypothesis of no fixed effects has been rejected and therefore fixed effects are implemented on the year and firm-level (which are already described in chapter 4.3). Next, by performing the Pagan Lagrange-multiplier test for random effects I confirmed that a fixed effects linear model [xtreg] is to be used in the empirical analysis.

The panel data in this study could potentially suffer from heteroscedasticity, which can be explained as a change in the variance of the error terms. This variance could affect the standard errors and therefore affect t-values and p-values of the regression estimates. To control for the heteroscedasticity concern, all regressions are based on heteroscedasticity-robust standard errors.

Last, related to the heteroscedasticity concern is the problem of heterogeneity. Heterogeneity appears when the error terms from a regression are not independent and stable, but are in fact correlated among each other. When not controlling for these correlations these could potentially inflate or deflate the reported coefficient of the explanatory variables in the regression. We can control for the heterogeneity concerns by identifying correlations in the panel-dataset and implementing them into the regression. When implemented into the regression, the (no longer omitted) correlations cannot inflate or deflate variable coefficients. To identify potential correlations, or heterogenic responses, in the database interaction terms are introduced. Further, to control for correlation in the error terms the (heteroscedasticity-robust) standard errors are clustered on the company level in the main regressions.

4.5 Descriptive statistics

Table 3 describes the descriptive statistics for al variables that are relevant for the empirical analysis. A first interesting finding when investigating the data is that of all 28 countries present in the sample, the largest number of firms is headquartered in Spain (43,661 companies) or Italy (63,695 companies). Both countries are responsible for around 50 percent of all firms in the sample. This is not a wrong finding per se and could be explained in several ways. The tax systems of these countries might make it beneficial to organize a corporation over several juridical entities (several observed companies) instead of one entity (one observed company). It could also be that information on firms' fixed asset value and other firm financials is more available in these jurisdictions. The firm-country distribution of all countries can be found in appendix B. When observing the statistics of the dependent variable fixed asset value (FA_{ict}), the mean (median) provides a value of 8.59 (08.27). This logarithmic value can be interpreted as an average fixed assets book value of 5.386 million euro. The observed variation is substantial, with a lowest fixed asset value of around 990 thousand euros and a highest

observed fixed asset value of 466 million euros. The study of Buettner & Wamser (2018) measures a substantially higher fixed asset value, with a mean value of 17 million euros. However this can be explained, as Buettner & Wamser (2018) use a different database and focus on exclusively on a sample of foreign owned entities held by German multinationals. Hence, Buettner & Wamser (2018) focused only on companies (subsidiaries) that are part of a multinational organization. In contrast, this research also includes non-multinational companies, which might be smaller in asset size. This assumption is confirmed by the descriptive statistics. When differentiating entities part of a multinational organization ($MNE_{cti} = 1$) from domestic entities ($MNE_{cti} = 0$), multinational firms are found the have an average fixed asset value of 8.769 million, compared to 4.359 million for their domestic counterparties. This indicates that the average multinational company in the dataset is twice as large as a domestic company, measured in fixed asset size.

Explanatory dummy variable ACE_{ct} has a mean (median) value of 0.23 (0). Which shows that most countries do not have an ACE system implemented into their tax systems during the years 2009-2016. In fact only 23 percent of all firm-year observations have implemented an ACE regime. Dummy variable TCR_{ct} shows a mean (median) value of 0.85 (1). This shows that – as already provided in chapter 2.4 – that TCRs are more widely introduced in the tax systems of European countries then is the case for ACE systems. Last explanatory variable MNE_{cti}, which tests whether firms are part of a multinational organization, has a mean (median) value of 0.3. This shows that 3 of the 10 entities in this study have international shareholders or international subsidiaries and are therefore part of a multinational organization. Other entities in the sample are individual entities or part of a domestic group.

Regarding the firm-level control variables, the mean (median) value of the operational revenue (or: sales) is 8.16 (8,27) measured in logarithmic values. This corresponds to average yearly revenue of 3.5 million euros for the firms in the sample. Further, an average sales growth can be observed with a mean (median) value of 0.07 (0.02). Which represents an average increase in the operational revenue of firms by 7 percent. The average measured cash flow rate is 0.16, with a median value of 0.08. Which shows that the average firm has a cash flow of 16% percent available, when compared to the lagged book value of fixed assets. Last, the measured profit

margin of firms has been measured with a mean (median) of 0.06 (0.05). Which can be explained as follows: the average firm holds earnings before interest and tax (EBIT) value of 6 percent in relation to the sales of that current year.

Concerning the country-level data, the statutory corporate tax rate (Tax_{ct}) has a mean (median) value of 0.26 (0.28). Which shows that the average corporate tax rate is 26 percent. The control variable measuring country's national GDP, presented in logarithmic values, holds a mean value of 7.03. This value corresponds to an average GDP of 1131 billion US Dollars (current prices). The average value of the measured growth ratio in national GDP is 0.02. The average GDP per capita is 10.41, or 33 thousand US Dollars. The average yearly inflation value is 0.04. The average population is 3.51 in logarithmic values, which corresponds to 33.5 million people. Last, the average unemployment rate, calculated as a ratio of the total labor force, is 0.12. So the average country has an unemployment rate of 0.12 of the total labor force.

Table 3: *descriptive statistics*

	N	MEAN	S.D.	MIN	P25	MEDIAN	P75	MAX
FA	1714652	8.59	1.29	6.98	7.62	8.27	9.23	13.05
ACE	1714652	0.23	0.42	0.00	0.00	0.00	0.00	1.00
TCR	1714652	0.85	0.36	0.00	1.00	1.00	1.00	1.00
TAX	1714652	0.26	0.05	0.09	0.23	0.28	0.30	0.35
MNE	1714652	0.30	0.46	0.00	0.00	0.00	1.00	1.00
SALES	1714652	8.16	2.21	2.89	6.53	8.27	9.74	13.31
SALES GROWTH	1501792	0.07	0.41	-0.79	-0.07	0.02	0.12	2.75
CASHFLOW	1501792	0.16	0.28	-0.41	0.02	0.08	0.20	1.67
PROFIT MARGIN	1714652	0.06	0.22	-0.53	0.00	0.05	0.15	0.52
GDP	1714652	7.03	0.98	2.42	6.13	7.43	7.69	8.29
GDP GROWTH	1501792	0.02	0.02	-0.07	0.01	0.03	0.04	0.27
GDP PER CAPITA	1714652	10.41	0.21	9.66	10.36	10.43	10.55	11.47
INFLATION	1714652	0.04	0.44	-0.14	-0.05	-0.01	0.00	6.02
UNEMPLOYMENT	1714652	0.12	0.06	0.03	0.08	0.10	0.13	0.27

This table describes the descriptive statistics for al variables used in the empirical analysis. For each variable, this table describes the values of respectively: the number of observations, the mean value, the standard definition, the minimum value of the full sample, the median value of the first quartile, the median value of the full sample, the median value of the top quartile and the maximum value of the full sample.

Table 4 describes the Pearson correlation table for dependent variable FA_{ict}, independent variables ACE_{ct}, TCR_{ct} and MNE_{cti}, and control variables TAX_{ct}, $Sales_{tci}$, $Sales\ Growth_{tci}$, $Cash\ Flow\ Rate_{tci}$, $Profit\ Margin_{tci}$, GDP_{tc}, $GDP\ PC\ Growth_{tc}$, $GDP\ Per\ Capita_{tc}$, $Inflation_{tc}$ and $Unemployment_{tc}$. This correlation table describes the linear relation between the different variables. An interesting observation is that both alternative tax regimes (ACE_{ct}, TCR_{ct}) are negatively correlated with fixed asset value (FA_{ict}). Which indicates that both an ACE and TCR regime are negatively related to investment behavior. Whether this indication is true will be further tested in the empirical analysis of chapter 5. Further, a negative correlation is found between fixed asset value and the statutory corporate tax rate in a country (TAX_{ct},). This shows the negative effect on investments, following an increase in corporate tax rate as presented in prior literature. A positive correlation is found between investment behavior and the dummy variable for entities part of a multinational organization (MNE_{cti},), indicating that entities part of a multinational organization have a higher level of investments. Control variables $Sales_{tci}$ and $Sales\ Growth_{tci}$ are positively related with fixed asset value, which confirms the assumption that fixed asset value is higher for more profitable firms. However, $Cash\ Flow\ Rate_{tci}$ is negatively correlated with fixed asset value. Which confirms the assumptions that the level of investments is higher for highly profitable firms with substantial cash flow available. Furthermore, country-level control variables GDP_{tc}, $GDP\ PC\ Growth_{tc}$, $GDP\ Per\ Capita_{tc}$ are positively correlated with fixed asset value – indicating a positive association with investments. This suggests that the level of investments is higher in larger markets (tested by national GDP) and more productive markets (tested by GDP per capita). Last, Inflation and unemployment are negatively correlated with investment invest behavior, confirming the expectation that investments are lower in countries suffering form high inflation and high unemployment.

Table 4: *Pearson correlations*

	FA	*ACE*	*TCR*	*MNE*	*TAX*	*SALES*	*SALES GROWTH*
FA	**1.000**						
ACE	**-0.043**	**1.000**					
TCR	**-0.091**	**0.155**	**1.000**				
MNE	**-0.090**	**0.204**	**0.130**	**1.000**			
TAX	**0.247**	**-0.105**	**-0.138**	**-0.030**	**1.000**		
SALES	**0.494**	**-0.077**	**-0.135**	**-0.112**	**0.339**	**1.000**	
SALES GROWTH	**0.026**	**-0.032**	**-0.025**	**-0.011**	**0.019**	**0.050**	**1.000**
CASHFLOW	**-0.035**	**-0.077**	**-0.137**	**-0.057**	**0.179**	**0.395**	**0.073**
PROFIT MARGIN	-0.001	**-0.025**	**-0.052**	**-0.007**	**-0.041**	**0.026**	**0.087**
GDP	**0.018**	**0.164**	**0.243**	**0.507**	**-0.084**	0.002	**-0.022**
GDP GROWTH	**0.069**	**-0.373**	**-0.337**	**-0.321**	**0.103**	**0.120**	**0.055**
GDP PER CAPITA	**0.116**	**0.074**	**-0.316**	**0.445**	**0.021**	**0.109**	**-0.006**
INFLATION	**-0.011**	**-0.064**	**0.072**	**-0.367**	**-0.013**	**0.012**	**0.000**
UNEMPLOYMENT	**-0.110**	**-0.063**	**0.285**	**0.347**	**-0.126**	**-0.235**	**-0.024**

	CASH FLOW	*PROFIT MARGIN*	*GDP*	*GDP GROWTH*	*GDP P.C.*	*INFLATION*	*UNEMPL.*
FA							
ACE							
TCR							
MNE							
TAX							
SALES							
SALES GROWTH							
CASHFLOW	**1.000**						
PROFIT MARGIN	**0.181**	**1.000**					
GDP	**-0.019**	**-0.011**	**1.000**				
GDP GROWTH	**0.115**	**0.038**	**-0.169**	**1.000**			
GDP PER CAPITA	**0.071**	**0.043**	**0.477**	**0.081**	**1.000**		
INFLATION	**0.011**	**-0.010**	**-0.234**	**0.103**	**-0.387**	**1.000**	
UNEMPLOYMENT	**-0.155**	**-0.024**	**0.077**	**-0.339**	**-0.199**	**-0.036**	**1.000**

This table presents the Pearson correlations between the individual variables in the dataset. This correlation table describes linear relationship between each individual variable. Correlation coefficients that are found significant at the one percent level (probability < 0.001) are presented as bold value.

4.6 Research Design

To identify the relation between the introduction of TCR and ACE regimes and the level of investments, and find an answer for the first and second hypothesis, an ordinary least square (OLS) regression is performed on firms' fixed asset value, as a proxy for investments. The regression is estimated using the following specification:

$$FA_{ict} = \beta_0 + \beta_1 ACE_{ct} + \beta_2 TCR_{ct} + \beta_3 Tax_{ct} + \beta_4 X_{ict} + \beta_5 Z_{ct} + \alpha_i + \lambda_t + \varepsilon_{ict} \quad (11)$$

In this regression, $FA_{ict}$is the dependent variable, which represents the unconsolidated current-year book value of fixed assets of firm i, headquartered in a country c in the year t. Explanatory variables TCR_{ct} and ACE_{ct} are dummy variables that take the value 1 in all the years t a country c has implemented respectively an interest deductibility limitation ($TCR_{ct} = 1$) or an allowance for corporate equity ($ACE_{ct} = 1$), and 0 otherwise. Tax_{ct}, represents the statutory corporate tax rate in country c in the year t. The variable is implemented to control for the expected declining response of the level of investments on a higher tax rate. Further, X_{ict} represent firm-level control variables $Sales_{cti}$, $Salesgrowth_{tci}$, $Cashflow_{cti}$ and $Profitmargin_{cti}$ to control for their assumed impact on a firm's investment behavior. Next, control variables Z_{ct} represent country-level variables ($national\ GDP_{ct}$ $GDP\ per\ capital_{ct}$ $GDP\ growth_{ct}$ $Inflation_{ct}$ $Unemployment_{ct}$), which are added to control for time-varying, country-specific effects such as local market efficiency and other market conditions. Firm fixed effects (α_i) are added to control for unobserved time-invariant differences in firm-level characteristics. Time-dummies are included (λ_t) to control for year-specific effects that have an impact on the sample as a whole. At last, ε_{ict} represents the error term.

Next, it is to be expected that the effect of the introduction of alternative tax regimes on investments is more pronounced for entities part of a multinational organization due to the opportunity to shift investment across the border. To identify the impact of TCR and ACE regimes on the level of investments for multinational entities, and therefore to form an answer on the third hypothesis, the regression specification can be formulated as follows:

$$FA_{ict} = \beta_0 + \beta_1 ACE_{ct} + \beta_2 TCR_{ct} + \beta_3 ACE_{ct} * MNE_{cti} + \beta_4 TCR_{ct} * MNE_{cti} + \beta_5 Tax_{ct} + \beta_6 MNE_{cti} + \beta_7 X_{ct} + \beta_8 Z_{ct} + \alpha_i + \lambda_t + \varepsilon_{ict} \quad (12)$$

In this regression, a dummy is introduced for entities that are part of a multinational organization. Dependent variable FA_{ict} and explanatory variables ACE_{ct} and TCR_{ct} are implemented equally as described in formula (12). The dummy takes the value of 1 if the entity i is part of a multinational organization (MNE_{cti}=1) and takes the value of 0 otherwise ($MNE_{cti} = 0$). The key variables of interest in this regression specification are the interaction terms between the multinational-dummy and respectively: countries in which a TCR system was introduced ($TCR_{ct} * MNE_{cti}$) and countries that implemented an ACE regime ($ACE_{ct} * MNE_{cti}$). The relation between the explanatory variables and their interaction term can be described as follows. When assuming a firm is part of a multinational organization (MNE_{cti}=1) in a country that introduces a thin cap rule during the sample period, the interaction term represents the additional effect on investments following the TCR introduction, given the firm is part of a multinational organization. Hence, β_4 represents the partial effect on investments of a TCR system for multinational organizations. Following this same rhetoric, $\beta_3$presents the partial effect of an ACE system for multinational organizations. Assuming the effect on investments resulting from the introduction of a TCR or ACE is more severe for multinationals, the coefficients of the interaction variables are expected to follow the coefficient of their stand-alone explanatory variable: the interaction term between ACE and multinationals ($ACE_{ct} * MNE_{cti}$) is expected to be positive, and the interaction term between TCR and multinationals ($TCR_{ct} * MNE_{cti}$) is expected to be negative. Further, control variables regarding corporate tax rate, firm-level characteristics and country-level characteristics are implemented equally as described in formula (13). Firm-fixed effects and year-fixed effect are implemented likewise.

4.7 Conclusion

This chapter has described the available panel dataset, the creation of the regression variables, the descriptive statistics of the created variables and the research design for further analysis. It can be concluded that the sample data withholds representable date for the empirical analysis. The only found flaw in the data is the large presence of companies located in Spain or Italy. This will be taken into account in the empirical analysis to be performed in chapter 5.

5. Empirical Analysis

5.1 Introduction

This chapter describes the empirical analysis that is performed to empirically test the hypotheses created in chapter 3. For this empirical analysis various regressions are performed as described in the methodology of chapter 4.

5.2 Regression results

The results of the main regressions are provided in Table 5. First, to form a sort of starting point for the resulting part of the empirical analysis, a regression is performed including only basic firm-level and country-level control variables - including the statutory corporate tax rate. Regression specification (1) shows the results of this regression. The control variable of the tax rate shows a negative effect[35] of company fixed asset value by reporting a coefficient of -0.349. To be more precise, a one percentage point increase of the tax rate is estimated to result in a 0.349 percent lower fixed asset value. This finding is inconsistent with the found elasticity in the empirical overview of de Mooij & Ederveen (2003). However, when comparing to prior studies applying a similar research method, such as the recent studies of Buettner & Wamser (2018) or Wamser (2011), the observed coefficient is more in line with prior literature.[36] A firm's operational revenue (sales) is positively associated with fixed asset value. A percentage point increase is followed by a 0.131 percent increase in fixed asset value. Which confirms the expectation that firms that increase their operational revenue increase their investment for example by investing in more production facilities. The found coefficient might also be related to a possible effect of firm-size, in which a larger firm (with a larger amount of sales) holds larger investments compared to a smaller firm (with less sales). Contrary to the expectations, variables controlling for sales growth, cash flow and profit margin show negative coefficient – indicating that these variables are negatively related with firms' investment behavior. Which

[35] All reported effects are significant at the one percent ($p. < 0.01$) level, unless mentioned otherwise.

[36] De study of Buettner & Wamser (2018) finds a tax coefficient of -0.83, the study of Wamser (2011) finds an effect of -0.574. Both studies were performed on firm-level data of foreign subsidiaries owned by German multinationals. As the data used in this research uses a broader sample, and not only focuses on multinationals, the found coefficient of -0.349 in specification (1) is in accordance with prior literature.

suggests that, given this starting point regression, increasing liquidity and profitability for a firm are not positively associated with investment behavior, but in fact have a negative effect on investment level. Further, national GDP is positively related to fixed asset value, showing that investments increase when the host country market increases. GDP per capita reports an opposite relation to fixed asset value, indicating that firms lower their investments when productivity increases. Although this might seem irrational, it could be explained as multinational organizations might shift away production facilities (fixed assets) when labor costs (GDP per capita) increase. The study of Buettner & Wamser (2018) finds similar conflicting coefficients between national GDP and GDP per capita. Last, a country's unemployment rate is negatively associated with fixed asset value. This indicates that the level of investments in a country decreases when the level of unemployment increases, which is equal to the made expectations.

When continuing to regression specification (2), the explanatory variables for ACE and TCR regimes are added to the regression. Both coefficients for both regimes are found negative. More precise, the ACE variable reports a coefficient of -0.020, which indicates that the introduction of an ACE regime in a country is associated with 2.0 percent decrease in fixed asset value. This is a peculiar finding, as this is not in line with the assumptions of the first hypothesis. Theoretically, the introduction of an ACE system results in a lower cost of capital for the applicable firms, which would be followed by an increase in investments (and therefore fixed asset value). However, as emphasized before, it is possible that the ACE regime is not solely implemented, but actually as a part of an array of new tax rules. Hence, it could be that firms lower their fixed asset value following the introduction of the array of tax rules. Another reason could be that firms in the sample are not able to benefit from the ACE system. The introduction of thin-cap rules in a country is as well negatively associated with fixed asset value, the introduction of a TCR regime is estimated to decrease a firm's fixed asset value with 2.7 percent. This finding is consistent with the assumptions made in the second hypothesis: thin-cap rules limit the interest deductibility and therefore increase the cost of capital for the investing firm, this results in a lower level of investments.

As described earlier, the investment reaction on both ACE and TCR could be attributable to mobility effects in which capital-intensive activities are substituted for labor-intensive activities, or substitution effects in which investment activities are shifted to other countries. Of which the latter is only available to multinational organizations. To test whether firms part of a multinational organization increasingly react to the introduction of a ACE or TCR system, regression specification (3) includes the multinational dummy variable and (more importantly) the interaction variables between the alternative tax regimes and the multinational dummy. Regression specification (3) is the main regression of this analysis. The multinational dummy is not shown in the regression results of (3), because the dummy is omitted because of collinearity. This can be explained, as the regression model controls for all firm-level fixed effects, including the fact whether a firm is part of a multinational organization (as in the formed database, this firm characteristic does not change over time). When turning to explanatory variables ACE and TCR, both variables (continue to) report a negative coefficient. This indicates a negative association between both ACE and TCR systems and fixed asset value. However, the variables of interest in specification (3) are the interaction variables.

As described in chapter 4, the coefficients of the interaction terms represent the partial effect of the introduction of an ACE/TCR regime on fixed asset value - for firms that are part of a multinational organization. When first turning to the interaction effect between ACE and multinationals, the variable reports a coefficient of 0.042. This means that under the condition that entities are part of a multinational organization, the introduction of an ACE regime increases the fixed asset value with 4.2 percent. This indicates a positive relation between ACE regimes and the investment reaction for multinational organizations. This is an interesting finding when compared to specification (2), as for the full sample the introduction of an ACE system is followed by a negative effect on fixed asset value. So contrary to the results of the full sample, but in line with the predictions made in the hypothesis, the interaction effect between ACE systems and multinationals is positive. Which confirms the predictions that entities that are part of a multinational organization are increasingly able to react to the introduction of an ACE system due to the ability intra-group investment shifting. Hence, the mobility effect for these entities following the introduction of an ACE system appears to be substantial.

When continuing to the interaction between multinational organizations and TCR systems, the results of the basic regression provided in specification (2) states that thin cap rules are negatively associated with investments. This finding was consistent with the hypothesis as thin cap rules increase the investing firm's cost of capital. In specification (3) the interaction term between TCR and multinational organizations shows a negative variable as well, by reporting a coefficient of -0.016, significant at the 5 percent level. This shows that following the introduction of thin cap rules; the partial effect for companies that are part of a multinational organization is 1.7 percent. This finding is in line with the third hypotheses. As multinationals are able to shift investments over the border to avoid TCR regulations it is to be expected that fixed asset value decreases more following a TCR introduction for entities part of a multinational organization, the regression results of (3) confirm this expectation. Thus, the regression results for both interaction variables confirm the made expectations that companies that are part of a multinational shift investments into the hosting country when the cost of capital decreases (introduction ACE) and shift investments away when costs of capital increases (introduction TCR).

The contradicting coefficients between the ACE variable and the interaction variable between ACE and multinationals suggests that multinational firms react differently to tax regulations (or at least to an ACE system) compared to their domestic counterparts. Therefore, the positive investment reaction following an ACE for multinationals might be absorbed by the negative reaction of the full sample (i.e. the domestic firms). To test this divergent reaction, the regression is performed on separate samples of domestic firms (4) and multinational firms (5), which is shown in table 6. For the sample of domestic firms, Specification (4) shows similar results as for the full sample presented in specification (2); both ACE and TCR are negatively associated with fixed asset value. However, for the sample of multinational firms, the regression results do not follow the full sample, as is shown in regression specification (5). Moreover, the coefficient of explanatory variable ACE in Specification (5) shows a positive value of 0.016, which indicates that multinationals increase investments in firms located in a country that allows an ACE system with 1.6 percent. This finding further confirms the statement made earlier that multinational organizations have the ability to react on tax regulation by shifting

investments between related entities in various jurisdictions. As the number of domestic firm-year observations (1,052,693) is around twice as large as the amount of observations for multinationals (449,099) in the sample, it is likely that the positive effect on investments reported by multinational firms is absorbed in the full sample because of the negative investment reaction for the domestic firms.

Further it is interesting to observe that the investment reaction on an increase of the statutory tax rate is substantially larger for multinational firms. A 1 percent increase in tax rate for firms' part of a multinational organization is followed by a 0.486 percent decrease in fixed asset value, compared to 0.097 percent decrease for purely domestic firms. This finding further confirms that the investment reaction of multinational entities following changes in tax regulation is substantially larger than that of domestic firms.

Table 5: *alternative tax regimes and investments*

	(1)	(2)	(3)
	FIXED ASSETS	*FIXED ASSETS*	*FIXED ASSETS*
ACE		**-0.020*** **	**-0.029 *** **
		(0.002)	(0.002)
TCR		**-0.027*** **	**-0.020*** **
		(0.003)	(0.004)
*ACE*MNE*			**0.042 *** **
			(0.004)
*TCR*MNE*			**-0.017 ** **
			(0.007)
TAX	**-0.349*** **	**-0.252*** **	**-0.268*** **
	(0.039)	(0.039)	(0.039)
SALES	**0.131*** **	**0.131*** **	**0.130*** **
	(0.001)	(0.002)	(0.002)
SALES GROWTH	**-0.027*** **	**-0.027*** **	**-0.027*** **
	(0.001)	(0.001)	(0.001)
CASHFLOW	**-0.216*** **	**-0.216*** **	**-0.216*** **
	(0.004)	(0.004)	(0.004)
PROFIT MARGIN	**-0.007** **	**-0.007*** **	**-0.007** **
	(0.003)	(0.003)	(0.003)
GDP	**0.304*** **	**0.476*** **	**0.424*** **
	(0.060)	(0.062)	(0.063)
GDP GROWTH	**-0.515*** **	**-0.556*** **	**-0.577*** **
	(0.030)	(0.030)	(0.030)
GDP PER CAPITA	**-0.004*** **	**-0.245*** **	**-0.217** **
	(0.066)	(0.070)	(0.070)
INFLATION	0.008	**0.010*** **	**0.009** **
	(0.002)	(0.002)	(0.002)
UNEMPLOYMENT	**-0.144*** **	**-0.196*** **	**-0.220*** **
	(0.047)	(0.048)	(0.048)
Intercept	5.584	6.889	6.974
R-squared	0.145	0.086	0.101
Observations	1,501,792	1,501,792	1,501,792

This table provides the results of the regression performed on dependent variable fixed asset value (FA) in natural logs. ACE and TCR included in specifications (4) and (5) are dummy variables indicating whether an ACE or TCR is in place. Interaction terms are included in the specification (5) to test the interaction effect of tax rate and ACE/TCR systems on the dependent variable. The regressions include firm-level control variables and country-level control variables (including the statutory corporate tax rate in the hosting country). All regressions further include fixed effects on the year-level and entity-level. Robust standard errors clustered on the entity-level are provided in the parentheses. The level of significance is signified at ten (p. < 0.1 = *), five (p. < 0.05 = **) and one (p. < 0.01 = ***) percent, respectively.

Table 6: *additional analysis on the effect of multinational organizations*

	(4)	(5)
	FIXED ASSETS	*FIXED ASSETS*
ACE	**-0.024*** **	**0.016*** **
	(0.002)	(0.004)
TCR	**-0.011** **	**-0.050*** **
	(0.004)	(0.006)
TAX	**-0.097** **	**-0.468 *** **
	(0.043)	(0.078)
SALES	**0.116*** **	**0.162 *** **
	(0.002)	(0.004)
SALES GROWTH	**-0.026*** **	**-0.026 *** **
	(0.001)	(0.002)
CASH FLOW	**-0.197*** **	**-0.236*** **
	(0.005)	(0.006)
PROFIT MARGIN	**-0.005** **	**-0.012* **
	(0.003)	(0.007)
GDP	**0.338*** **	**0.475*** **
	(0.072)	(0.115)
GDP GROWTH	**-0.545*** **	**-0.411*** **
	(0.036)	(0.052)
GDP PER CAPITA	**-0.069** **	**-0.464*** **
	(0.084)	(0.124)
INFLATION	**0.010*** **	0.004
	(0.001)	(0.004)
UNEMPLOYMENT	**-0.203*** **	**-0.354*** **
	(0.056)	(0.091)
INTERCEPT	5.921	9.387
R-squared	0.087	0.122
Obs.	1,052,693	449,099

This table provides the results of the regression performed on dependent variable fixed asset value (FA) in natural logs. The regression is separately performed on a sample of firms not part of a multinational organizations (4) and a sample of firms that are part of a multinational organization (5). ACE and TCR are dummy variables indicating whether an ACE or TCR is in place. The regressions include firm-level control variables and country-level control variables (including the statutory corporate tax rate in the hosting country). All regressions further include fixed effects on the year-level and entity-level. Robust standard errors clustered on the entity-level are provided in the parentheses. The level of significance is signified at ten (p. < 0.1 = *), five (p. < 0.05 = **) and one (p. < 0.01 = ***) percent, respectively.

5.3 Robustness analysis

To tests the robustness of the main regression results found in the previous chapter, various additional tests are performed. The regression results of this additional analysis can be found in table 7.

First, as described in chapter 2.4.4, among the thin cap rules that have been implemented by European countries different forms can be identified. As a result, the negative relation between thin cap rules and fixed asset value might be attributable to one specific thin cap rule instead of thin cap rules in general. To test for this, a separation has been made between two forms of thin cap rules: the "regular" safe haven (debt-to-equity) ratio and the earnings stripping approach. The safe have ratio allows interest to be deducted as long as a certain debt-to-equity ratio is met, hence this method relates the allowable interest to be deducted directly to the firm's leverage. As long as a company's leverage ratio is in "the save haven", the company is not affected by the TCR. Earnings stripping method most often relate to operating profit, and therefore cap interest deductibility on a percentage of EBITDA. Hence, whether a company is affected by an earnings-stripping TCR depends on its own yearly performance (EBITDA). By basing the TCR on company's performance instead of its leverage makes the question whether a firm is affected by a TCR also more unpredictable. Therefore more firms might be reacting on this form of a TCR. Earnings stripping TCRs are increasingly implemented, and most often replace the more "traditional" safe haven ratio. As can be observed in the footnotes of chapter 2.4.4, the countries Portugal, the Netherlands, Germany and Finland have replaced their safe-haven rule for an earnings-stripping rule. To test whether earnings stripping rules are of any effect on the relation between thin cap rules in general and investment behavior, dummy variable $TCR2_{ct}$ and interaction variable $TCR * TCR2_{ct}$ are created; taking the value 1 if the implemented thin cap rule applies the earnings stripping method and value 0 otherwise. Regression specification (6) implements the interaction variable. The general thin cap variable remains negative, which indicates that earnings stripping TCRs do not specifically drive the reported effect on investment behavior. The coefficient of the created interaction variable is found negative as well, which indicates an additional negative effect on investments. More specifically: the restructuring of a safe haven thin cap rule into an earnings stripping rule

decreases company fixed assets value with 1.1 percent. Hence, this robustness tests shows that although the negative reaction between TCRs and fixed asset value is not purely driven by earnings stripping rules, the negative reaction is more severe following the introduction of an earnings stripping rule than following the introduction of a “general” safe haven rule.

As described before, regression estimates can be highly influenced by extreme outliers. To control for this all variables are either scaled, or presented as a natural logarithm. Further all non-dummy variables are winsorized at the top and bottom 1 percent. Nonetheless, when analyzing the sample data, the firm-year observations of the current year fixed assets still suffer from large variation because of a few very large outliers. When plotting the data a right skewed distribution is observed. The fixed asset value of the top 1 percent of the companies in the sample of 466 million euro is considerably larger than the mean value of 5.4 million, after winsorizing. To test whether these extreme observations significantly affect the regression results, in specification (7) the fixed asset value is winsorized at the 5 percent level. As a result the top percent reports a fixed asset value of around 75 million. However, the found relations in the main regression remain present and are therefore robust when controlling for large outliers present in the sample.

Next, as the sample period of this research is set on the years 2009 up and till 2016, firm-level and country-level information is obtained for all the years in this sample period. However, as different control variables (sales growth, cash flow rate, and GDP growth) are calculated using lagged values; effectively only data for the years 2010 till 2016 is used in the performed regression estimations. To test whether the found results in the main regression are robust for the 2009 data, all control variables using lagged variables are excluded from the regression to form specification (8). As can be observed, the effects found in the main regression are robust against the 2009 data.

To correctly perform an OLS regression, independently distributed standard errors are assumed. But, in contrast to this assumption, standard errors might be correlated among each other, which would result in incorrect standard errors. To control for any correlation in the error terms, in the main regressions the standard errors are clustered on the company level.

However, it might be the case that some firm-year observations are not affected independently by changes (for example changes in tax regulation), but uniformly on a country-level. Thus, the observations might be clustered on a country level. Therefore, in regression specification (9) the main regression is re-performed, however this time the (robust) standard errors are clustered on the country-level to further correct for correlated error terms. The negative association between ACE and fixed asset value – and the contrary effect of multinationals – holds under this additional analysis. However, the association between thin cap rules and fixed asset value, and the interaction effect of multinationals, loses its significance when clustering on the country-level.

As described in the descriptive statistics, around 50 percent of the companies in the sample are headquartered in either Spain or Italy. To test whether the results in the main regression are not largely affected by the specific tax regime of Spain or Italy, the regression is re-performed, in which weights are applied to every observations. To allow all 28 countries to have an equal effect on the regression results, every firm-year observation is given a $\frac{1}{N_c}$ weight, in which N_c presents the amount of firms in a country. As a result, firm-year observations for companies based in Italy (509,560 companies) have a smaller weight than companies headquartered in Germany (57,048 companies). Specification (10) provides the results. By allowing every country (and its tax system) to equally affect the regression estimation, the full sample effect on fixed asset value for both ACE and TCR system remains negative, be it at a 10 percent level of significance. Which indicates that the measured effect of the explanatory variables ACE and TCR is not (only) attributable to the tax systems of Italy and Spain. Regarding the effect of multinational organizations, both interaction variables lose their significance. Which suggests that the mobility effect of multinationals shifting investments in and out of the country when new tax regulations are introduced does not hold in all countries. However, also this regression specification has its limitation. As for some countries only a handful of companies are included in the sample – for Cyprus 4 companies are incorporated – the firm-year observations of these firms are weighted heavily in the regression. The regression results of this robustness tests might therefore suffer from company-specific characteristics from companies in the smaller, less present countries.

By using (the logarithmic value of) the current year book value of fixed assets as a proxy for investments, this study uses the same dependent variable as applied by Buettner & Wamser (2018). However, by using the overall fixed asset value, Buettner & Wamser (2018) does control for changes in fixed asset value not attributable to investments, such as depreciation and amortization costs. By not doing so, an observed decrease in fixed assets for an entity in a given year might be observed - indicating negative investments - while in reality this is only the result of annual amortization costs. Hence, no alteration in investment has taken place. To control for this and therefore to test the robustness of the results, an additional measurement of the level of a firm's investments is applied in regression specification (11). Following de Mooij & Liu (2018), the level of investments of a firm in this additional measurement is presented as the yearly investment spending divided by the lagged amount of fixed assets. Where yearly investment spending is calculated as the difference between current and lagged fixed asset value, corrected for depreciation and amortization costs. Hence, dependent variable $Investment\ ratio_{ict}$ represents the investment ratio of an entity i, headquartered in a country c in the year t on an unconsolidated level. More formally, the calculation of a company's investment-ratio can be computed as:

$$Investmen\ ratio_{cti} = \frac{Fixed\ Assets_{cti} + Fixed\ Assets_{ci(t-1)} + depreciations_{cti}}{Fixed\ Assets_{ci(t-1)}} \quad (13)$$

The regression results of specification (11) find contradicting outcomes compared to those of the main regression. First, for almost all control variables, the estimation coefficient changes sign. As a result, the control variable for corporate tax rate, which was observed to be negative in both the main and in the additional analyses, shows a significant positive coefficient. This suggests that an increase in the corporate tax rate is followed by an increase in firms' investments – which is quite an irrational observation. A similar effect on investments is observed for thin cap rules, as the coefficient of the explanatory variable TCR presents a positive coefficient as well. An explanation for this peculiar finding might be included in the calculation of the investment ratio variable. As the formula of (13) shows, investment spending (the numerator) is scaled by lagged fixed asset value (the denominator). If an increase in the investment ratio is observed, we assume this to be the result of an increase in de numerator

(investment spending). However, an increase in the ratio could also be the result of a decrease in the denominator (lagged fixed asset value). Regarding changes in tax regulation such as thin cap rules or tax rate changes, this could very well be the case because these kinds of reforms are often announced by the government multiple years before implementation. Therefore firms can adjust their investment behavior multiple years before implementation as well. Thus, it could be that ahead of the implementation of a thin cap rule in year t, a company already decreases its fixed asset value in year $t-1$, in which case the investment ratio measured in year t would inflate (holding the investment spending in year t constant).

A last observation of interest in specification (11) is that the contradicting effects distinguished between the full sample and the multinational sample hold for the ACE system. This might indicate that the given argumentation in the paragraph above does not hold for ACE systems, especially not for multinational organizations. The observed positive coefficient for the interaction variable between ACE and multinationals suggests that multinational firms increase the level of investments – in the year of the ACE introduction. This might suggest that firms' part of a multinational organization are more responsive to an ACE in the year of its introduction. The finding that multinational organizations are more responsive to the implementation of an ACE regarding their investment behavior is in line with the mobility effects arguments only available to multinationals. Multinational organizations are able to shift investments into the country in the year of the ACE introduction, to benefit from the tax benefit. An activity that is not available for domestic companies. As domestic firms theoretically only have the possibility to react to an ACE by substituting labor intensive production for capital intensive production. This allows multinational firms to react more – and perhaps more responsive – to changes in tax regulation. However, as this "responsiveness" is not the focus of this study this is only a made suggestion which cannot be truly confirmed by the applied regressions. Hence, a further analysis in the timing of the responsiveness between multinational firms and domestic firms is reserved for further research.

Table 7: *robustness analysis*

	(6)	(7)	(8)	(9)	(10)	(11)
	FA	*FA*	*FA*	*FA*	*FA*	*INV. RATE*
ACE	**-0.030*** **	**-0.025*** **	**-0.029*** **	**-0.029*** **	**-0.144***	**-0.002** **
	(0.002)	(0.002)	(0.002)	(0.008)	(0.080)	(0.001)
TCR	**-0.017*** **	**-0.018*** **	**-0.014*** **	-0.020	**-0.043***	**0.017*** **
	(0.004)	(0.004)	(0.004)	(0.019)	(0.023)	(0.002)
*ACE*MNE*	**0.041*** **	**0.037*** **	**0.049*** **	**0.042*** **	0.134	**0.012*** **
	(0.004)	(0.003)	(0.004)	(0.013)	(0.084)	(0.002)
*TCR*MNE*	**-0.016** **	**-0.015** **	**-0.022*** **	-0.017	-0.004	0.003
	(0.007)	(0.006)	(0.007)	(0.027)	(0.026)	(0.004)
*TCR*TCR2*	**-0.011*** **					
	(0.034)					
TAX	**-0.300*** **	**-0.263*** **	**-0.247*** **	-0.268	0.005	**0.334*** **
	(0.040)	(0.037)	(0.040)	(0.380)	(0.040)	(0.021)
SALES	**0.130*** **	**0.121*** **	**0.121*** **	**0.130*** **	**0.143*** **	**-0.009 *** **
	(0.002)	(0.001)	(0.001)	(0.016)	(0.014)	(0.001)
SALES	**-0.027*** **	**-0.026*** **		**-0.027*** **	**-0.039*** **	**0.034*** **
GROWTH	(0.001)	(0.001)		(0.002)	(0.007)	(0.001)
CASH	**-0.216*** **	**-0.205*** **		**-0.216*** **	**-0.194*** **	**0.301*** **
FLOW	(0.004)	(0.003)		(0.011)	(0.035)	(0.003)
PROFIT MARGIN	**-0.007** **	**-0.006** **	**-0.079*** **	-0.007	0.093	**-0.084*** **
	(0.003)	(0.003)	(0.003)	(0.013)	(0.056)	(0.002)
GDP	**0.378*** **	**0.278*** **	**1.057*** **	0.424	1.041	**-0.301*** **
	(0.063)	(0.058)	(0.055)	(0.429)	(0.775)	(0.033)
GDP GROWTH	**-0.595*** **	**-0.521*** **		**-0.577*** **	**-0.412** **	**0.232*** **
	(0.030)	(0.028)		(0.191)	(0.149)	(0.020)
GDP PER CAPITA	**-0.181** **	0.089	**-0.847*** **	-0.217	-0.631	**0.200*** **
	(0.070)	(0.065)	(0.061)	(0.370)	(0.763)	(0.038)
INFLATION	**0.009*** **	**0.009*** **	**0.017*** **	**0.009** **	0.008	-0.002
	(0.002)	(0.002)	(0.002)	(0.004)	(0.008)	(0.001)
UNEMPLOYMENT	**-0.213*** **	**-0.193*** **	**-0.225*** **	-0.220	-0.329	**-0.348*** **
	(0.048)	(0.045)	(0.046)	(0.246)	(0.684)	(0.029)
INTERCEPT	6.922	6.690	9.106	6.974	8.502	0.122
R-squared	0.116	0.147	0.018	0.101	0.027	0.017
Obs.	1,501,792	1,501,792	1,714,652	1,501,792	1,501,792	1,501,792

This table provides the results of the regression performed on dependent variable fixed asset value (FA) in natural logs, in addition the regression is performed on dependent variable investment rate (11, 12). ACE and TCR are dummy variables indicating whether an ACE or TCR is in place. Dummy variable MNE describes whether the firm is part of a multinational. Interaction terms are included to test the interaction between entities part of a multinational organization and ACE/TCR systems. The interaction between general TCRs and earnings stripping rules is tested in (6). To control for outliers fixed assets are winsorized on a 5 percent level in (7). Lagged variables are excluded in (8). Observations are weighted based on the number of companies in a country in (10). All regressions include firm-level control variables and country-level control variables. All regressions further include fixed effects on the year-level and entity-level. Robust standard errors clustered on the entity-level are provided in the parentheses. Specification (9) clusters robust standard errors on country-level. The level of significance is signified at ten (p. < 0.1 = *), five (p. < 0.05 = **) and one (p. < 0.01 = ***) percent, respectively.

5.4 Conclusion

Overall, the regression results find significant effects on the book value of fixed assets - and therefore on the level of investments - following the implementation of an ACE or TCR regime. Regarding thin cap rules, a negative effect is observed, which is in line with the predictions that the thin cap rules increase the cost of capital of the investing firm and therefore decrease the level of investments. Further, the interaction effect with the multinational dummy variable shows that the negative effect of a TCR is more severe for entities that are part of a multinational organization. Which suggests that these firms are better able to react on the thin cap rules by shifting investments (i.e. production) across boarder to related firms in the organization. However this finding does not hold under all robustness tests.

For the countries that have implemented some form of an ACE system, a negative relation is found as well between the introduction of the ACE and firm's fixed asset value. This is a rather contradicting finding not in line with the made hypotheses, as economic theory suggests that an ACE system has a positive effect on the investment behavior of firms through lowering the cost of capital. However, implementing an interaction effect between ACE and the multinational dummy shows that multinational firms report an opposing positive investment reaction on ACE systems. Separate analysis on multinationals confirmed that multinationals react positively by increasing the fixed asset value after an ACE introduction. This suggests that the positive investment reaction of multinationals is absorbed by the negative reaction of the domestic firms in the full sample. Although the interaction effect has not been found robust when equally giving weights to every hosting country in the sample (although, as described in the prior paragraph, also this robustness test has its limitations).

In the end it is interesting to find that following the introduction of an ACE, a divergent reaction can be observed between companies' part of a multinational and domestic companies. This confirms the existence of shifting activities (or mobility effects) as presented in the third chapter. Further, the findings of this empirical research show that the investment stimulating aspect of an ACE – the reason why it's often preferred above a TCR in economic theory – only "works" for multinationals. As for the full sample (domestic and multinational firms) the investment reaction is negative. This finding holds under all robustness tests.

6. Conclusion

The aim of this thesis has been to study the effect of the introduction of alternative tax regimes on the level of investments in the hosting country. More specifically, the empirical analysis of this study has considered whether the introduction of alternative tax regimes to address the distortive debt bias present in western tax systems, results in adverse effects on firms' investment behavior.

Using the Modigliani Miller irrelevance proposition as a starting point, an investing firm is ought to be irrelevant between financing investments with debt or equity. But, given the deductibility of debt payments (not backed by an equal deductibility of equity payments) in most tax systems, the irrelevance proposition is foregone and a bias towards debt financing is created. The country-level effects of favoring debt are clear: an increase in firms' leverage, consequently resulting in an increase in costs of financial distress, an increase in debt-shifting activities and a decrease in overall country welfare. Overall, no rationale can be found in the academic literature for the discriminating between debt and equity.

Policy makers in most European countries have begun taking measurements against the debt bias. Applied alternatives to the tax deductibility of interest have one of two forms: (1) a thin cap rule (TCR) that limits excessive debt payments to be deductible form taxable income or (2) an allowance for corporate equity ACE) which allows a proportion of equity to be deductible similar to debt payments. Although both systems effectively assess the debt bias regarding the financing decision, ACE and TCR regimes withhold different propositions; which are assumed to result in a divergent effect on firms' level of investments. Intuitively, as the adoption of a TCR will limit the benefit of deducting debt payments from taxable income, the cost of debt financing will increase and therefore the overall cost of capital for a company will increase. Because of the higher costs of capital for companies after the implementation of the TCR, a subsequent reduction is to be expected in the level investments. Oppositely, an ACE system allows a notional return on equity to be deducted from corporate income, which decreases the costs of equity and therefore decreases the overall costs of capital will decrease. Hence, the lower cost of capital is expected to increase the level of investments in the country

implementing the ACE. Thus, based on this economical reasoning, an ACE would be preferred above a TCR when addressing the debt bias using alternative tax regulation, as an ACE system encourages investments where a TCR discourages investment behavior.

An empirical analysis is performed on a panel data set containing 1.5 million firm-year observations in 28 hosting countries between 2009 and 2016, with (the logarithmic value of) firm's current year book value of fixed assets as a measurement of firm's investment behavior. The regression results find a significant impact on the level of investments in the hosting country for both the TCR and ACE system. More precisely, the introduction of thin cap rules is associated with a reduction in fixed asset value of 2.0 percent; indicating a negative investment reaction. This finding confirms the predictions made in the first hypotheses. The negative investment reaction strengthens for firms that are part of a multinational organization. For these companies the introduction of a TCR is followed by an additional decrease in fixed asset value of 1.7 percent. Although this finding has not been found robust when testing on an additional dependent variable to measure investments, it does give an indication of the made assumption that multinationals increasingly react to tax regulation due to shifting possibilities not available for domestic companies.

Contrary to economic beliefs, a negative investment reaction is observed following the introduction of an ACE for the full sample. The introduction of an ACE system is associated with a 2.0 percent decrease in fixed asset value in the same year. The negative investment reaction for the full sample has been found robust under all additional analyses. Concluding from these results, the second hypotheses must be rejected. Different explanation for this conclusion can be given, one of which is that an ACE system (just as any tax rule) is most often introduced as a array of tax rules. Hence, the total array of tax rules might actually increase the cost of capital in the hosting country for a firm - resulting in lower investments.

However, when differing in the investment reaction of firms' part of a multinational organization and firms not part of a multinational (domestic firms), a contrasting investment reaction is observed. Multinational firms increase their fixed asset value with an average of 1.6 percent following an ACE introduction, contrary to their domestic counterparties. The observed

contrary investment reaction between multinational and domestic firms, (further) confirms the existence of mobility effects. Multinational organizations with a company located in country A that introduces an ACE, will replace capital investments (such as production) from entities located in other countries to the company in country A to benefit from the ACE regime. The investment reaction of multinational firms on both ACE systems and TCRs confirms the third hypothesis; multinational firms are able to react more pronounced in their investment reaction following the introduction of an alternative tax regime.

As indicated in the additional analysis of chapter 5.4, the total of firms present in the sample is (very) unevenly distributed among the 28 countries. This brings me to the first limitation of this study. Two countries (Spain and Italy) host around 50 percent of all companies in the sample. Possible explanations for this distribution are present. Firm-level information regarding fixed asset value might be more widely available in these countries. Or the tax systems in both countries might make it beneficial for organizations to own a large number of smaller local entities compared to one large entity. Nonetheless, the unequal distribution makes the regression results dependable of the specific characteristics present in these countries, and less dependable of others. In an attempt to control for this, several actions have been performed. One of which is performing the regression when equally giving weight to every country in the sample. However, also this measure has its limitations. As after the weighing, the regression results might be affected by the company characteristics of firms located in a hosting country with a very small presence in the sample.

A second limitation rests in the availability of ACE systems. Though the sample includes 28 countries, only the companies in 4 countries were affected by an ACE regime: two countries (Portugal and Italy) introduced an ACE during the sample period, one country had an ACE system already implemented during the period (Belgium) and one country abandoned an ACE system during the sample period (Latvia). Therefore the effect on investments can only be tested on a small variation of ACE systems, which is not desirable, moreover because chapter 2.4.4 confirmed that every ACE has its own specific characteristics. Hence, the empirical results that are found in the regression are (very) dependable of the characteristics of the specific ACE system and the few countries that implemented them.

A third limitation is found in the chosen dependent variable, forming a proxy to measure firms' investment behavior. Following the study of Buettner & Wamser (2018), the book value of current year fixed assets is used. However, this method does not control for the depreciation and amortization costs. By not doing so a decrease in investments for an entity in a given year might be observed, while in reality this is only formed by the annual amortization costs as investments have remained constant. To control for this, as a robustness test, the regression is performed on additional dependent variable: the investment ratio. However, to my belief, it must be concluded that both created variables are not able to measure the investment reaction following the introduction of an ACE or TCR in total. This primarily lies in the fact that tax regulations are announced multiple years before actual implementation. As a result, firms might also adjust their fixed asset value multiple years before the implementation. As both created variables only measure the "investment reaction" as the increase in fixed asset value in the year of implementation, the part of the investment reaction that took place in the years direct after the announcement are not taken into account. Hence, to test whether the years after announcement are of any effect, it might be interesting to measure in firms' fixed asset value from the moment of announcement up to the moment of implementation. This would be a suggestion for further research.

A fourth and last limitation of this study lies in the manner firms are affected by thin cap rules. As described in chapter 2.4.4, thin cap rules are applied as "safe haven" (debt-to-equity) ratio or as earnings stripping ratio. For the debt-to-equity approach applies that as long as a company's leverage is within the safe haven ratio, the firm is not affected by the thin cap rule and interest remains deductible. This also applies for the earnings stripping approach, as firms with no excessive interest payments (related to their EBITDA), are not affected by the thin cap rule. To only test (the investment reaction of) firms that are affected by the TCR, it might be of more interest to solely focus on firms that are on the margin to be affected by the TCR. Thus, only firms with a debt-to-equity ratio of around 3:1 if the TCR to be implemented withholds a 3:1 ratio. It is likely that this section of companies will show a more pronounced investment reaction. Also this is a matter that might be interesting to study if further research is performed.

When returning to the research question of this study, the first part of the question can be affirmatively answered. Yes, the empirical analyses of this study provide evidence for the association between interest deductibility regulations and firms' investments. But, the performed analyses showed that the answer on the second part of the question is less clear. Yes, a divergent investment reaction is observed between the introduction of a TCR or an ACE, however this divergence only holds for firms that are part of a multinational organization, as for domestic firms the investment reactions for both systems is negative. Overall, this study further clarifies that the effect on investments is a factor to consider for policy makers when implementing either a TCR or ACE system. It further shows that an ACE is not a stimulation of investments at the country-level in the year of implementation – contrary to economic beliefs. This study is therefore of relevance for both policymakers as academics studying the effects interest deductibility regulations. Giving respect to the limitations of this study, this study adds to prior literature in several ways. First, regarding both ACE and TCR related literature; the study performs the first "truly" cross-sectional analysis on investments. Regarding ACE regimes, a similar study has only been performed on a sample of German multinationals (Hebous & Ruf 2017), and concerning TCRs a comparable study focused on the foreign subsidiaries of German multinationals (Buettner & Wamser; 2018). Thereby this study adds to the research of Hebous & Ruff (2017) a measured effect on active investments, where the authors only found an effect on passive investments. Second, where prior literature primarily focuses on multinational companies, this study differs between domestic and multinational companies. By doing so, the results show that both forms of companies react differently to changes in tax regulation.

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Appendix A

Financing decision making theories

a. Modigliani Miller theorem

In its essence, a company has two options to raise capital for an investment – when assuming no retained earnings are available. The firm can generate capital by either the issuance of debt or by the issuance of equity in the form of shares. On debt, interest payments have to be made to the party supplying the capital. On equity, compensation in the form of dividends can (but there is no obligation to) be supplied to the shareholders. Theoretically, the corporation should be indifferent between the options of financing by issuing debt or financing by issuing equity, as this decision does not affect the company value. This is stated by the Modigliani-Miller theorem, which is largely accepted as a cornerstone in corporate finance literature and a starting point of the capital structure theories. The crux of the theorem is described by Modigliani (1980, p. xiii) as:

"With neutral taxes, well-functioning markets and rational investors, wo can 'undo' the corporate financial structure by holding positive or negative amounts of debt, the market value of the firm – debt plus equity – depends only on the income stream generated by its assets. It follows, in particular, that the value of the firm should not be affected by the share of debt in its financial structure or by what will be done with the returns – paid out as dividends or reinvested (profitably)."

As Modigliani describes, certain market conditions are assumed. The theorem only holds in case of rational investors, neutral taxes[37] and "well-functioning markets" (or perfect markets), of which the latter assumes the absence of capital-market frictions[38], no information asymmetry and equal access to credit markets.

What nowadays is known as the 'Modigliani-Miller theorem' actually consists of four distinct propositions published over a series of papers (1958, 1961 and 1963). The first proposition

[37] Some say the theorem holds the assumption of "no taxes", however this assumption is rejected by Miller (1977) through the existence of personal income taxes. This will be discussed at the end of the paragraph.
[38] e.g.: transaction costs, bankruptcy costs or trade restrictions.

states that, when the before mentioned assumptions hold, a firm's debt-to-equity ratio has no effect on its market value. The proposition is also known as an irrelevance proposition; if certain conditions hold, financial decisions will be irrelevant when determining the company's value. Under the theorem, the value of an unleveraged firm (V_U) will be equal to that of a leveraged firm (V_L), which is equal to the sum of debt (D) plus equity (E). This can be formulated as follows:

$$V = V_L = V_U = D + E \quad \text{(a)}$$

Hence, when the liability side of the balance for a firm has no effect on the value of the firm, the company value is created from the cash flow generating abilities of the assets of the firm. The value of the cash flows on those assets can then be calculated by discounting the expected cash flows (CF_t) on its specific rate of return for that specific group of assets (r_A).

This specific expected rate of return can be formed under the assumption of perfect (so: complete) markets, as the expected rate of return can be generated for every specific risk class of assets. This same assumption of perfect markets also results in the equilibrium where the expected rate of return on a group of assets is equal to the total costs of capital. Therefore, we could expand equation (a) into:

$$V_L = V_U = D + E = \sum_{t=1}^{\infty} CF_t / r_A \quad \text{(b)}$$

So, as the liability side of the firm has no effect on firm value and value is only generated by (cash flows generating abilities of) the asset side, the firm value can only be increased by either increasing the cash flows or decreasing the expected rates of return.

As the debt-to-equity ratio has no effect on the value of a firm, each firm's cost of capital is a constant according to Modigliani & Miller (1958). The cost of capital - or weighted average cost of capital (WACC) - is a standard tool in practical finance that consists of the cost of debt (r_D) and the cost of equity (r_E). In which the costs of debt and equity are formulated as the expected rates of return demanded by a firm's equity and debt holders. The WACC of a firm then depends on the costs of debt and equity in relation to the total value of the firm, which can be formulated as:

$$WACC = r_A = \frac{r_D D}{V} + \frac{r_E E}{V} \quad \text{(c)}$$

So, the WACC of the company's assets r_A is the expected return on the portfolio of the company's outstanding debt and equity.[39] According to the first proposition of Modigliani & Miller the WACC or r_A is a constant. With the use of this constant term, we can solve the equation of the WACC for the cost of equity:

$$r_E = r_A + \frac{(r_A - r_D)D}{E} \quad \text{(d)}$$

So the cost of equity – in the form of the expected return of equity holders (shareholders) – increases when the debt-to-equity ratio D/E increases. Where the rate of the decrease is dependent of the spread between the overall cost of capital r_A and the cost of debt r_D (in the form of the expected return of debt holders). This equation is the second proposition of Modigliani & Miller, and it shows why an increase in a company's debt-to-equity ratio does not increases the company value. When the D/E increases the expected return of equity holders (r_E) will rise due to increased risk, as well as the expected return of debt holders (r_D). The expected return of equity and debt holders increases, because a higher amount of debt increases the possibility of a bankruptcy for the firm. Subsequently, in the case of a bankruptcy the equity holders are less assured to receive back their equity investment as funds are distributed first to the debt holders. Therefore the equity holders expect to be compensated for this risk in the form of a higher return on equity. The same holds for debt holders, in the way that also debt holders will increase expected return in order to be compensated for the increased (bankruptcy) risk. Thus, thus the idea that "expansive" equity can be substituted for "cheap" debt does not hold, as the substitution makes the remaining portion of debt and equity more expensive. As a result, the reduction and the increase of the overall cost of capital balance out, so the cost of capital remains constant under the Modigliani & Miller theorem.

From propositions II and I follows that the capital structure of a company does not affect its total value. The first proposition shows that the liability side of the balance sheet has no effect

[39] When ignoring taxes.

on the company value, where the second proposition shows that the return on the asset side of the balance sheet is constant and therefore irrelevant of the capital structure on the liability side. Together they show that "there is no magic in financial leverage", or as described by Myers (2001): *the value of a pizza does not depend how it's sliced*.

The third and fourth propositions of the Modigliani & Miller Theorem respectively establish that a company's market value is independent of its dividend policy and that equity-holders are indifferent about a company's financial policy. Because these propositions follow directly from the first and second proposition, they will not be discussed in more detail.

Although the indifference proposition of the Modigliani & Miller Theorem might be theoretically and intuitively correct, it is often criticized, as its state of indifference does not hold in the "real world". Different explanations can be identified of which the primary ones are the non-existence of perfect markets[40] and the role of taxation – I will focus on the latter. In most corporate tax systems, financing with debt is favored above financing with equity, because of the tax deductibility of interest payments from corporate taxable income, which is not equally backed by a matching tax deductibility for dividends. When interest payments are deductible, financing with debt instead of equity results in a higher after-tax return to debt and equity holders and therefore in a higher company value. When this is taken into account the proposed indifference will no longer hold, as the value of leveraged firms will be higher than that of the unleveraged firms. This difference between leveraged and unleveraged firm value is augmented by the tax shield value of debt, which is calculated as the corporate tax rate (t) times the amount of corporate debt (D). This can be formulated into equation (a) as:

$$V = D + E = V_L = V_U + tD \qquad \text{(e)}$$

As a result, the indifference in the investment decision of a firm also ceases to exist. As interest payments can be deducted from the taxable profit and dividend payments cannot, firms are stimulated to finance investments with debt instead of equity. This is the case as long as the

[40] Due to the existence of agency costs, transactions costs, information asymmetry and the inability of both individuals and companies to borrow at the same interest rate.

providers of debt or equity financing are taxed the same. If the return on investments after taxes is equal for both debt and equity financing, then the required return on investments before taxes will be higher for equity financing than for debt financing (van Strien, 2006). This way the tax authorities create a bias towards debt financing.

Based on equation (e), this stimulates a company to finance its investments exclusively with debt, as by substituting all equity for debt the company value will be equal to that of an unleveraged firm (V_U) plus the tax shield (tD). This way the firm maximizes its company value by minimizing its tax payments to the government. This surplus can subsequently can be passed on to shareholders in the form of higher dividends. In prior literature regarding the tax bias this has raised the question: do the company that issue equity instead of debt negatively affect shareholder value due to unnecessary corporate tax payments (Villamil, 2008): Or more relating to the Modigliani Miller theorem: does including taxes into the Theorem's equation have the effect of financing activities with full debt?

In an additional publication regarding the tax-assumption of the Theorem, Miller (1977) counters the full-debt statement, by pointing out that our tax system acts in other ways to reduce the gains from debt financing and introduces the aspect of personal income taxes. When a company relies heavily on debt in its capital structure, it commits to pay out a substantial proportion of its income in the form of interest payments, which are taxable in the personal income tax of the receiver. A debt free company, on the other hand, does not have this commitment and can (re)invest all of its income in the business. As a result Miller (1977) shows that a company can generate a higher after tax corporate income by substituting equity for debt, this will result in a higher payout to shareholders, but the value of the firm will not increase. The crux of the argument lies in the fact that as a result of the rise in the debt-asset ratio the proportion of interest payments over debt increases relative to dividends and equity gains. If taxes on interest payments are higher than taxes on dividends this will reduce or eliminate the advantage of debt financing. With this theory, Miller (1977) relocates to the original Modigliani & Miller theorem of (e), even with taxes.

Therefore, as described in the beginning of this chapter, the assumption of "no taxes" is not an assumption that has to be made for the Modigliani Miller theorem. Although this is often stated in other literature. Instead of "no taxes", a system of "neutral taxes" has to be implemented in order to eliminate the tax bias towards debt financing. However, when observing the Dutch tax system for example this assumption of "neutral taxes" does not hold, as the statutory tax rate on personal taxes is substantially below the rate on corporate income[41]. Therefore the bias towards debt financing remains. The Modigliani Miller theorem shows that in the essence, a indifference has to exist between financing investments with debt or equity, however when introducing the deductibility of interest payments, and when assuming that personal taxes are non-material in relation to the corporate tax rate, the theorem – even with the addition of Miller (1977) – results in the conclusion that companies have to finance their investments fully (or at least for a very substantial amount) with debt. Although this theory might not hold in practice when loosening all made assumptions, the Modigliani Miller theorem makes clear the bias towards debt financing that is created when interest payments are deductible from corporate income.

b. Tradeoff theory

From the Modigliani & Miller follows that, in a world with taxes, the tax shield created by the deductibility of interest payments results in a bias towards debt financing which stimulates companies to finance their investments almost fully with debt. However, no extensive empirical evidence is needed to observe that companies in the "real world" do not finance all of their activities exclusively with debt. An explanation for this observation can be found in the existence of other – non-economic – costs related to debt financing. In his publication *"the capital structure puzzle"*, Myers (1962) tries to explain the optimal debt ratio of a company using a framework: the tradeoff framework[42].

[41] Until 2017 in the Netherlands the effective tax rate on (minority-interest) dividends was 1,2%, compared to a statutory tax rate for the corporate income tax of 25%.

[42] The tradeoff theory is not originated by Myers (at least not with this publication), as the theory is also found in earlier publications of (Kraus and Litzenberger (1973) and Robicheck & Myers (1965).

The tradeoff theory explains the determination of the optimal debt-to-equity ratio as a tradeoff between the costs and benefits of issuing debt – when holding firm's assets and investment plans constant (Myers, 1984). For this tradeoff theory we can consider a balance between the benefits of debt - the benefits debt payments to be deducted from taxable income when financing with debt - and the costs of debt. In such a case the optimal level of debt is set to the point where the marginal benefit of an extra unit of debt equals the marginal costs of an extra unit of debt. In this point of optimal debt distribution the firm value will be maximized. The costs of supplying more debt can be divided into two categories: costs of financial distress and the costs related to agency problems.

Costs of financial distress

When firms attract more debt and increase their debt-equity ratio - as a result of the bias toward debt financing created by the tax authorities – this will also increase the obligated interest payments the firm has to make. If a firm is unable to make these payments and cannot (longer) meet debt holders' obligations it can experience financial distress. When the situation of financial distress lasts and the firm continues to be unable to meet debt obligations, the firm eventually can become insolvent and go bankrupt. In this case the firm will consequently incur the direct[43] and indirect[44] costs of financial distress. These costs of financial distress, which are a function of the probability a firm goes bankrupt (PV) and the costs that come with such a bankruptcy (B), can be added to formula (e) as follows:

$$V = D + E = V_L = V_U + tD - PV(B) \quad \text{(f)}$$

The increasing costs of financial distress ($PV(B)$) reduce the benefit of the tax shield (tD) that results from increasing the debt-to-equity ratio. As a result optimal debt-ratio will decrease.

Although theoretically the existence of the risk and costs of bankruptcy are commonly accepted, the magnitude of empirical studies that find bankruptcy costs is very small. In his

[43] E.g.: Lawyers' and accounts' fees, value of (managerial) time spent in administering the bankruptcy and negotiating with debt and equity holders (Warner, 1977)

[44] Lost sales, lost profits, staff leaving, firm's inability to obtain external financing, foregone investments opportunities.

study Miller (1977) confirms the existence of bankruptcy (and agency) costs, however he argues that, "*it is just that these costs, by any sensible reckoning, seem disproportionately small relative to the tax savings they are supposedly balancing*". Miller (1977) points out that the risk and the additional costs of bankruptcy refer mainly to the bankruptcies of individuals and some small businesses. A study that found evidence on bankruptcy costs was that of Warner (1977). For a sample of 11 railroad companies that were already in bankruptcy proceedings between 1933 and 1955, he found that the direct costs of bankruptcy are on average about one percent of the market value of the firm prior to bankruptcy. However, Warner (1977) admits that this study focusses only on measurable, direct costs. Some of the omitted indirect costs may be substantial.

A study that did focus on the costs of financial distress in terms of both direct and indirect costs is the study of Altman (1978). Here, Indirect costs are calculated in two different ways: first the indirect costs are essentially calculated as unexpected losses, in addition the indirect costs are calculated by comparing expected earnings to actual earnings based on security analysts' predictions. A sample of 19 industrial firms is used in this study that went bankrupt over the period 1970-1978, and a second sample was used of seven recent large bankrupt companies. On average, Altman (1978) finds that bankruptcy costs ranged from 11% to 17% of firm value up to three years prior to the bankruptcy. In many cases the bankruptcy costs exceeded 20% of the firm value measured prior to the bankruptcy. Although the measurement of all costs that come with a bankruptcy is difficult (especially indirect cost), from this study it can be concluded that the total of costs of a potential bankruptcy – direct and indirect – are substantial and are not to be overlooked. When relating this result to the tradeoff theory of Myers (1984) the (present value of) expected bankruptcy costs is found larger and therefore might exceed the (present value of) the tax benefits from debt-financing when controlling for both direct and indirect costs. This implies that that costs of financial distress – contrary to the studies of Miller (1977) and Warner (1977) – are an important factor in the discussion of the optimal capital structure.

Agency costs

Agency costs reflect the conflict of interest between different stakeholders in a firm. Originally when relating to the economic theory of a firm's activity in the market, the firm is observed as a "black box" that operates to maximize profits, or: to maximize the present value. However, this theory gives no value to the potential conflicts of interests for the individual participants in the firm. All of these participants will try to maximize their own utility based on their own property rights,[45] which might subsequently result in an equilibrium in which the firm does not fully maximizes its present value. A study that does give right to these conflicting interests of different participants is that of Jensen & Meckling (1976). The core of the theory is an agency relationship that can be described as a contract between two persons under which one person (the principal) engages the other (the agent) to perform a certain service on their behalf in which a certain amount of authority is delegated to the agent. As both persons will try to maximize utility and the interest of the agent might not fully align with those of the principal, the agent will not always act in the best interest of the principal. As a result the principal will have to incur monitoring and bonding costs in order to set the right incentives and to minimize the self-interest seeking behavior, in order to minimize the divergence between the agent's decisions and the decisions that would maximize the principal's utility. Jensen & Meckling (1976) define total agency costs as the sum of (i) the monitoring of expenditures by the principle, (ii) the bonding expenditures by the agent and (iii) the residual loss remaining by the divergence of interests between the principal and the agent.

Two types of conflicts can be differentiated between individuals that result in agency costs. First the conflict of interest between shareholders and the management – also referred to as the agency costs of outside equity. Second the conflict of interest between shareholders and debt holders – also referred to as the agency costs of debt.

Agency costs of outside equity

[45] Property rights are individual rights that determine how costs and rewards are allocated among the participants of a company.

In the situation of a wholly owned firm that is operated by its owner the owner will make operational decisions that maximize firms present value – ass this aligns with maximizing the owners' individual utility. The benefits that are generated from these decisions will have the form of pecuniary benefits (or monetary benefits) but also non-pecuniary (non-monetary) benefits.[46] However, as the study of Jensen & Mecklin (1976) shows, when the manager-owner does fully own the firm (because of "outside equity"), he will only bear a fraction of the costs of a non-pecuniary benefit and he will only for a fraction benefit from new projects that are undertaken. As a result the manager-owner has an incentive to increasingly spend on non-pecuniary rewards – as he does fully benefit from these - and a disincentive to extensively devote his own time in order to find new projects for the firm. In line with this situation is that with respect of the management, assuming that management does not fully own the (inside) equity of a firm, a conflict of interest is introduced, as the personal interest of the management does not fully align with the maximization of the present value of the firm. Owners can discipline the management by implementing pay-offs that are related to the sales or value of the firm, to align mutual interest. However, as long as management does not wholly own the company, so in case of the existence of outside equity, managements personal interest does not fully align with the best interest of the company and therefore agency costs exist.

As a result of the agency costs of outside debt one might wonder why holders of outside equity (i.e. shareholders) do not sell-out their part of equity to create an organization with sole equity-ownership for the manager to avoid agency costs of outside debt. The manager could finance the repurchase of the outside equity with personal capital or the issuance of limited liability debt claims. The result will be an organization with sole-ownership for the manager-owner, with a small fraction of the capital supplied by the owner in return for 100% of the equity and the rest of the company financed with debt. Jensen & Mecklin (1976) recall three reasons, which are all aspects of the agency costs related to the existence of debt claims on the company.

Agency costs of debt

[46] Non-monetary benefits such as: physical appointments at the office, charitable contributions, a company jet etc.

First, organizations will not be fully financed with debt because of the incentive effects on the manager-owner's behavior of a financial structure based entirely on debt financing. In case of a deb-based financial structure the manager-owner will have the incentive to engage in activities that promise high pay-off, even if the probability of success is low. This because the manager – as an equity holder - does benefit (fully) of the gains in case of success but does not bear the costs in case things turn out badly because the creditors bear most of the costs (Jensen & Mecklin, 1976). As a result potential creditors will be reluctant in supplying debt to an organization financed with a very low portion of (inside) equity compared to debt. The higher the leverage of a firm, the higher the incentive will be for the manager and therefore the higher the agency costs will be for the debt-holders. In other words, the debt-financing incentive on mangers can be seen as a form of moral hazard, as management does not fully bear the risk of their decisions they make for the company.

To limit the debt-incentive for managers and therefore to limit related agency costs of debt, debt holders can implement various covenants in the bond contract before accepting to issue a bond to a company. For example, provisions can be made that constrain the management's ability to pay out dividends or attract future debt issues (Black-Scholes, 1973), or to ascertain the preservation of working capital (Black, Miller & Posner, 1974). Provisions are therefore very common in bond issues. The costs that are made in writing these provisions, enforcing these provisions upon the management, and the (potential) lower profit of the firm because of these provisions are altogether referred to as the bonding costs. Together with the costs of monitoring to observe if the management complies with the covenants, these are the costs that are undertaken to limit the agency costs of debt. Jensen & Mecklin (1976) propose that the bond holders will have incentive in the writing of such covenants and the actions of the management up to the point that the marginal costs of writing the covenants (the bonding and monitoring costs) are equal to the marginal benefits of applying the covenants (limiting the agency costs of debt).

The third element of the agency costs of debt is the existence of bankruptcy costs and the costs of reorganization. These costs – as already stated before in chapter 2.2.1 – explain why organizations are not fully financed with debt. Although the magnitude varies in empirical

studies as shown in the prior chapter, it can be ascertained that bankruptcies come with costs and therefore the probability of these costs affects the market value of the firm.

Overall, the agency costs that are associated with debt can be divided into three aspects: (i) the loss in company value due to debt incentivized decisions by management, (ii) the bonding and monitoring costs by bondholders and the company itself to limit these decisions, and (iii) bankruptcy and reorganization costs. The agency costs are another aspect affecting the optimal tradeoff between debt and equity to calculate the optimal debt-to-equity ratio for a firm's investment.

To conclude, the first part of this chapter has created a basis of basic financing literature to better understand the situation that is created by allowing debt payments to be deductible from corporate tax income, which is tolerated in most country's corporate income tax systems. The Modigliani Miller theorem demonstrates that essentially firms ought to be irrelevant between financing investments with either debt or equity. However, deductibility of debt payments stimulates firms to substitute equity for debt, up to the point the marginal benefit of investing one more unit of debt (i.e. the tax shield) is equal to its marginal costs (bankruptcy and agency costs). This is made clear by the tradeoff theory. As this chapter describes that the potential agency and bankruptcy costs can be substantial for a firm, and therefore for the economy, one could question what the benefits are of allowing interest deductibility and hence increase the leverage of company. Or in other words: is there a rationale for discriminating between (the deductibility of) debt and equity payments? This question will be addressed in the next paragraph of this chapter.

Appendix B

Firm-country distribution in the sample

	FREQUENTION	PERCENT	CUMULATION
Austria	2,464	0.14	0.14
Belgium	52,160	3.04	3.19
Bulgaria	22,119	1.29	4.48
Croatia	18,536	1.08	5.56
Cyprus	4	0.00	5.56
Czech Republic	43,408	2.53	8.09
Denmark	11,939	0.70	8.78
Estonia	8,424	0.49	9.28
Finland	31,240	1.82	11.10
France	175,350	10.23	21.32
Germany	57,048	3.33	24.65
Greece	18,200	1.06	25.71
Hungary	35,609	2.08	27.79
Ireland	7,291	0.43	28.22
Italy	509,560	29.72	57.93
Latvia	248	0.01	57.95
Luxembourg	1,928	0.11	58.06
Malta	32	0.00	58.06
Netherlands	552	0.03	58.09
Poland	49,827	2.91	61.00
Portugal	59,544	3.47	64.47
Romania	43,192	2.52	66.99
Slovak Republic	26,712	1.56	68.55
Slovenia	11,110	0.65	69.20
Spain	349,286	20.37	89.57
Sweden	83,105	4.85	94.41
Switzerland	1,328	0.08	94.49
United Kingdom	94,436	5.51	100.00
Total	**1,714,652**	**100.00**	

This table lists the 28 hosting countries that are present in the sample, and the number of companies located in these countries, for the estimation sample with sample period between 2008 and 2014.