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DETERMINING THE IMPACT OF TAXATION ON CORPORATE FINANCIAL DECISION-MAKING

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Abstract

This PhD project contributes to the corporate finance literature by analyzing several issues related to the impact of taxation on the financial decision-making of companies. The main research question of this doctoral project is twofold. First, I measure how the tax discrimination between debt and equity affects the capital structure of a company (Chapter 1). Secondly, I analyze how the heterogeneity among national tax systems distorts the financial decisions of a multinational enterprise (Chapter 2 and Chapter 3).

In a first chapter, I use difference-in-differences regressions to measure how the debt tax shield affects the capital structure of a company. By comparing the financial leverage of treatment and control companies before and after the introduction of an equity tax shield, I infer the impact of the tax discrimination between debt and equity. Consistent with the theoretical prediction, the estimated results show that the introduction of an equity tax shield has a significant negative effect on the financial leverage of a company. This effect amounts to approximately 2-7%, meaning that a classical tax system encourages companies to use on average 2-7% more debt than when there is an equal tax treatment of debt and equity.

The two following chapters focus on the distortion related to the existence of as many tax codes as countries. A second chapter investigates the consequences of a series of alternative international tax designs on the strategy of a multinational enterprise regarding the cross border distribution of its investment and the choice of its financing behavior. We start with a world where no international tax rules are at work. Then we successively introduce (i) the rules provided by the OECD Model Tax Convention, (ii) the EU Parent-Subsidiary Directive of July 23, 1990; and (iii) a combination of Allowance for Corporate Equity (ACE) and Com-

prehensive Business Income Tax (CBIT). Finally, we leave systems based on Separate Accounting (SA) aside and turn to Consolidation and Formulary Apportionment (C&FA) adopted either by all the jurisdictions at work in the model, or by a sole subset of them within the framework of an Enhanced Cooperation Agreement (ECA).

In a third and last chapter, I investigate how international tax consolidation (ITC) can tackle the distortion related to heterogeneous national tax systems. In this chapter, I aim at identifying the impact of international tax consolidation on the use of tax-motivated profit-shifting, by exploiting a tax reform in Italy. Based on financial data of subsidiary companies subject to an international tax consolidation regime, I analyze how the profit-shifting behavior of MNEs is affected by the tax reform using a difference-in-differences estimation strategy. Contrary to the theory that consolidation reduces tax distortions, I cannot find evidence that an international tax consolidation system, as implemented in Italy, has a significant impact on the use of tax-motivated profit-shifting by MNEs' subsidiaries.

Contents

Introduction **1**

1 Taxes Do Affect Corporate Financing Decisions **9**
1.1 Introduction 9
1.2 Institutional Background 13
1.3 Theoretical Framework 15
1.4 Empirical Methodology 18
1.5 Data 20
1.5.1 Summary Statistics 22
1.5.2 Matching Treatment and Control Observations . . 25
1.6 Results 30
1.6.1 Impact of Taxation on a Company's Capital Structure 30
1.6.2 Robustness 35
1.6.3 Impact on Small and Medium Enterprises versus Large Companies 38
1.6.4 Policy implications 42
1.7 Conclusion and further research tracks 43

2 Investment and Financing under Alternative Tax Designs **47**
2.1 Introduction and Motivation 47
2.2 The Model 51
2.2.1 Framework 51

2.2.2 Absence of International Tax Rules 53
2.3 EU Taxation under Separate Accounting 60
2.3.1 OECD Model Tax Convention 60
2.3.2 EU Direct Tax Directives 64
2.4 EU Tax Environment under Consolidation 71
2.4.1 Unanimity 72
2.4.2 Enhanced Cooperation 74
2.5 Policy Implications 76
2.6 Conclusions and further research tracks 78

3 International Tax Consolidation To Reduce Tax-Motivated Profit-Shifting ? 81
3.1 Introduction 81
3.2 Institutional Background 85
3.3 Theoretical Model 88
3.4 Empirical Methodology 91
3.5 Data 94
3.5.1 Summary Statistics 96
3.5.2 Matching Treatment and Control Observations . . 101
3.6 Results 104
3.6.1 Existence of Profit-Shifting Behavior 104
3.6.2 Impact of International Tax Consolidation on a Subsidiary's Pretax Profits 107
3.7 Policy Options and Challenges 112
3.8 Conclusions and further research tracks 113

Conclusions 115

Bibliography 123

Introduction

Aiming at maximizing firm value, financial managers both of small and medium enterprises (SME) as of multinational enterprises (MNE) try to optimize their company's tax liabilities. Tax considerations regarding location, organizational form, type and timing of transactions enhance the risk that financial decisions are guided by tax purposes rather than management objectives. This is especially true for multinational companies. Although value maximization is the leading principle of financial management, the use of tax planning strategies has a distorting impact on a company's financing and investment decisions. Several types of distortion can be identified in this respect. Two of them will be studied here.

One distortion is related to the different taxation of debt and equity, impacting the capital structure of companies. Most national tax systems favor the use of debt over equity, attributing a different tax treatment to the cost related to each of those financing sources. On the one hand, interest paid, i.e. the return to creditors, is a tax deductible expense, lowering the taxable base of the company. On the other hand, retained earnings or dividends paid, i.e. the return to shareholders, are not tax deductible. As a result, companies could trade-off between sources of financing, based on their tax differential. The question how the tax benefits of debt influence financial decision-making is after decades still highly debated. Modigliani and Miller (1958) theoretically showed that corporate financial decisions do not affect a company's value in a perfect world,

i.e. a world without taxation, without transaction costs, with symmetric information, complete contracting, and complete markets. Stiglitz (1973) and King (1974) formalized the tax system for corporate finance purposes and analyzed the impact of taxation on the cost of capital. They showed that corporate taxation affects the firm value and in particular the trade-off between debt and equity. Early research work tried in vain to find empirical support for this theoretical finding (a.o. Bradley et al. (1984), Long and Malitz (1985), Titman and Wessels (1988)). Other studies found empirical evidence that the tax benefits of debt influence a company's capital structure (a.o. MacKie-Mason (1990), Graham (2000)) and consequently, distort corporate financing decisions. The tax differential between financing sources would encourage companies to engage in tax-motivated strategies, affecting their economic activity. One strategy is to issue hybrid financial instruments, remunerating shareholders but structuring their return as tax deductible interest. The unequal tax treatment of debt and equity would also encourage companies to borrow and to increase their financial constraints. As a result, it would create disincentives to establish a strong financial position and would increase the probability of financial distress.

The financial crisis of 2008 revealed the rapid growth of debt usage among banking institutions these last decades. Excessive leverage undermined the sector's stability and caused the default of several banks. The excess use of debt was, however, not proper to the banking sector and many other companies got caught by financial distress. The unequal tax treatment of debt and equity for corporate tax purposes has been pinpoint as one of the issues weakening the financial position of companies, as they are encouraged to finance investment through debt rather than through equity. Based on the comparison of new equity and full debt investments in terms of effective marginal tax rates (EMTR), cross-country research (European Commission (2010)) showed that in almost all EU Members States the use of new equity is taxed and the use of debt is

subsidized. In the wake of the financial crisis, tax policy makers analyze the possibilities to protect the current economic system and to give it the necessary tools to counter such severe recessions. Economic theory offers two potential solutions to this issue, i.e. an Allowance for Corporate Equity (ACE) and a Comprehensive Business Income Tax (CBIT). The former grants a tax deduction for the return on equity. The latter disallows the tax deduction of interest payments on debt. Both measures result in an equal tax treatment of the two financing sources. Only a limited number of countries introduced this kind of mechanism. Italy, Brazil, Austria, and Croatia implemented a type of ACE system but empirical evaluation of those implementations was inconclusive (Staderini (2001), Klemm (2007)). The introduction of an ACE system in Belgium in 2006 offered the opportunity to analyze the system's effectiveness and to contribute to the academic debate regarding the impact of taxation on a company's debt policy (Chapter I). The implications of this kind of research are considerable, since the capital structure distortion affects almost all companies, whether they are involved in purely domestic activities or are dealing with cross-border transactions.

Another distortion is proper to international activities and relates to the existence of as many corporate tax codes as countries. Divergences across national tax codes add a high degree of complexity to the financial management of an international group and trigger considerable tax-related burdens. Compliance cost is one of them, since a company needs to comply with the tax rules of every country in which it is active, irrespective of the type or the amount of income generated. Being subject to different compliance rules and tax procedures puts a heavy administrative burden on companies engaged in cross-border activities, especially as tax changes are frequent. Both the European Tax Survey (European Commission (2004)) and the PWC Total Tax Contribution Survey provide evidence that the cost of complying with corporate income taxes for multinationals amounts to approximately 2% of taxes paid. In ad-

dition to compliance costs, the diversity of tax rules also gives rise to double taxation. Although an important network of double tax treaties exists, double tax situations remain common, especially with respect to the computation of transfer pricing and the restructuring of international groups. Goods sold by one group entity to another need to be priced according to the 'arm's length' principle. This principle requires related companies to act as if they were independent parties and to use market prices for their intra-group transfers. As this transfer pricing determines the distribution of the tax base of the MNE among the countries involved, it is subject to considerable control by the national tax authorities. Price adjustments following those controls, however, can not be offset by corresponding price adjustments in other tax jurisdictions with the result of taxing certain intra-group transactions twice. Issues related to cross-border reorganizations and in particular the transfer of assets resulting in capital gains also risk to trigger double taxation, as the right to tax is not uniformly settled. Moreover, the absence of cross-border loss compensation gives rise to over-taxation, as the losses of one group entity may most often not be offset against the profits of a foreign group entity. Hence, the international group with both loss-making and profit-making entities is not taxed as an economic unit but as legally independent entities.

Even if multinational enterprises (MNEs) suffer from the diversity of tax rules across countries, it is also at the root of many tax planning strategies and behaviors. Numerous inconsistencies occur between national tax codes. These inconsistencies allow multinational companies to engage in cross-border tax arbitrage and to organize their economic activities in order to benefit from the most lucrative tax rules. The question whether the existence of a multitude of different tax systems impacts economic decisions has also been the subject of an important strand of the corporate finance literature. From a theoretical point of view, international tax differences have been identified as distorting factors. Empirical research

testing this theory provides evidence that strategies regarding the location, timing, and type of transactions are tax-motivated. Hines (1996a) and Devereux and Griffith (1998) show the importance of taxation in the location decision. Weichenrieder (1996) finds that taxation influences the level of foreign direct investment. Moreover, further to the US Tax Reform Act of 1986, authors like Gordon and MacKie-Mason (1997) and Scholes et al. (2002) show how taxation affects organizational form choices.

Besides location and organizational decisions, discrepancies between tax codes influence the financial decisions of companies. For tax planning purposes, MNEs tend to shift profits from high-tax to low-tax countries. Grubert and Mutti (1991) empirically provide evidence that this is the case for US MNEs. Huizinga and Laeven (2008) find evidence that EU multinationals' profit shifting depends on international tax rate differences. This profit-shifting behavior can take several forms, one of which is to create strategic debt between a group entity in a low-tax country and a group entity in a high-tax country in order to benefit in an optimal way from the tax deductibility of interest expenses. The debt is issued by the low-taxed entity and conferred to a high-taxed entity. Hence, the interest cost reduces the tax bill of the highly-taxed entity and the interest revenue is taxed at the low tax rate of the debt-emitting company. The literature shows that this type of profit-shifting by MNEs was extensively studied. Several authors found support for the hypothesis that capital structure and intra-group interest patterns are tax-motivated. Altshuler and Grubert (2003), as well as Desai et al. (2004) provide evidence for U.S. MNEs that the level of internal debt in a foreign subsidiary increases with the foreign tax rate. In a European setting, Huizinga et al. (2008) and Buettner et al. (2009) show that a foreign subsidiary's capital structure reflects local tax rates and tax rate differences. Another profit-shifting strategy is to relocate expenses through the use of management fees or research costs. By charging general service costs to the

high-taxed entities instead of allocating them proportionally to all group members, the tax liability of the high-taxed entities is lowered and profit is transfered to the low-taxed entities. Clausing (2001) provides substantial evidence of the relationship between taxes and intra firm trade flows. A third type of profit-shifting is to take advantage of transfer pricing and to increase the price of goods sold to low-taxed group entities. Hines and Rice (1994) study the profitability of US affiliates and provide indirect evidence of tax-motivated transfer pricing. Clausing (2003) shows that taxation influences intra firm trade prices. The abundant literature regarding international profit-shifting shows the extent of corporate tax distortions and the interest of academic scholars in this kind of tax issues.

Containing these tax distortions is an important objective for governments and their tax policies try to react to the ever evolving market imperfections. As a way to reduce tax-motivated profit-shifting, Summers (1988), Bucks and Mazerov (1993), Mintz and Smart (2004) and others suggest to introduce an international tax consolidation system (ITC). As for financial consolidation, tax consolidation aims at taxing the economic reality rather than the legal entities of a company. Group entities are therefore required to compute their tax base without taking into account the intra-group payments of dividends, interests, royalties, and other intra-group income flows. The taxable revenues of all group companies are then consolidated regardless of whether these companies are residents or non-residents of the parent company's country. Once consolidated, the income is distributed amongst the countries in which the MNE is active and which can tax their tax base portion. This system is called 'Consolidation and Formulary Apportionment'(C&FA), as the consolidated tax base is allocated to participating jurisdictions according to a formula. This system, which is used in the US for state taxation purposes, requires to set aside the current system of 'Separate Accounting'(SA), where each national entity is taxed separately in accordance

with OECD principles and model tax conventions.

The European Commission, hosting an important number of multinational companies and aiming at the achievement of the Single Market, suggested (EU Commission, 2001) to move to a system of C&FA. For the purposes of taxing the income of companies active in different Member States, a consolidated tax base would be computed, which would then be apportioned amongst the Member States according to a formula including factors such as employment, assets, and sales. The use of a Common Consolidated Corporate Tax Base (CCCTB) would harmonize the rules to compute the individual tax base and would determine the way in which those tax bases can be consolidated at group level. All intra-group transactions would thus be eliminated for corporate tax purposes and profit-shifting would no longer have a reason for being. The decision regarding the corporate tax rate would remain at the EU Member State level. Consequently, a system of common corporate tax rules, applying to the multinational group as a whole instead of the legal entities separately, would replace the existing national tax systems for those companies. A CCCTB would have the advantage of lowering compliance costs for companies, dealing with one tax administration rather than 27 different ones, and of offering several tax benefits, like the offset of losses, the tax-free payment of dividends and the tax-free transfer of assets between group entities. A proposal for a CCCTB Directive was issued in 2011 (European Commission (2011)), transforming the working principles in legal rules. In this proposal, companies of all sizes are offered the possibility to opt for CCCTB, which would harmonize tax rules without modifying accounting rules. This Directive proposal is hoped to be welcomed by the Council, despite the fact that the Member States enjoy autonomy with respect to their income tax system. Introducing a single consolidated tax base for EU-wide corporate activities would therefore request Member States to give up part of their tax sovereignty. EU Directives and Community rules already exist regarding tax competition,

anti-discrimination and state aids.

Moving from a system of filing separate tax forms for every entity to a C&FA system, inevitably affects the investment and financing decisions of companies. Based on the US experience in this respect, several studies were published on the impact of such an international system of group taxation (a.o. McLure (1980), Weiner (1994), Mintz (2000)). Empirically measure the extent of these changes in an EU setting is not yet feasible. From a theoretical point of view, however, an evaluation of the impact of this move can be made. Modeling the characteristics of the intermediary stages, allows to get a feeling of how investment and financing decisions will be altered (Chapter 2).

In the meantime, some countries introduced an international tax consolidation system, consolidating the taxable incomes of all group companies. Instead of formulary apportionment, they use an alternative way to tax the international consolidated tax base. In those international tax consolidation systems, the right to tax the consolidated income is given to the parent's country, which then grants tax relief for the corporate tax paid abroad. This type of international tax consolidation already exists for some decades in Denmark (1960, amended in 2004 - "international joint taxation") as well as in France (1966, but only applied to a very limited number of companies) and was recently introduced in Italy (2004 - "worldwide consolidation") and Austria (2005). Austria implemented an international consolidation system according to which an Austrian parent company can choose which subsidiaries to include in the consolidation area. Italy opted for a consolidation system in which an Italian parent company needs to include all the subsidiaries, verifying the consolidation criteria. Because the latter of the two implementations is expected to reduce profit-shifting best, it offers the possibility to measure the impact of an international tax consolidation system on the profit-shifting behavior of companies (Chapter 3).

CHAPTER 1

Taxes Do Affect Corporate Financing Decisions

1.1 Introduction

Twenty years ago MacKie-Mason (1990) raised the question whether taxes affect corporate financing decisions. After decades of research strong evidence answering this question was still not found. Based on Modigliani and Miller (1958, 1963)'s work, Stiglitz (1973) and King (1974) focused on the tax discrimination between debt and equity and theoretically showed that the cost of capital is dependent on the mode of financing, if tax differentials exist between those modes. Their work triggered an important number of studies, empirically testing the finding and measuring the impact of the unequal tax treatment of financing modes on a firm's financial decisions. Early research work tried in vain to find empirical support for this theoretical result (a.o. Marsh (1982), Bradley et al. (1984), Long and Malitz (1985), Titman and Wessels (1988)). It was suggested that the use of debt was influenced more by its other non-tax functions, such as a signal of firm quality, an antitakeover device or a means of restricting managerial discretion, than by its related tax advantage (see Harris and Raviv (1990) for a literature review). Those studies

which found evidence that the tax benefits of debt influence a company's capital structure (a.o. MacKie-Mason (1990), Graham (2000), Gordon and Lee (2001)), needed to assume restrictive conditions to measure the impact of the tax benefits of debt in an accurate way. MacKie-Mason (1990), for instance, limited his sample to less profitable companies to find evidence that taxation impacts a company's debt policy. He found that a one-standard-deviation increase in a non-debt tax shield, e.g. depreciation and investment tax credits, reduces the percentage of debt issues by about 10 percentage points. Graham (2000) uses simulation methods for the period 1980-1994 to show that the tax benefit of debt amounts to about 9-10% of firm value. Moreover, a large strand of this literature uses differences in marginal tax rates to measure the impact of tax shields, in order to cope with the limited variation in accessible tax variables.

By using a different approach for studying the impact of taxation on capital structure, this paper provides significant evidence of how tax benefits influence corporate financial decision-making. The paper goes back to the experimental ideal for evaluating the impact of taxes on corporate debt policy, i.e. analyzing a tax system which attributes a similar tax deductibility to the return on equity as the generally implemented deductibility for interest expenses on debt. As such, tax neutrality between the two sources of finance is ensured and corporate taxation no longer favors debt over equity. Such a tax system is based on the theoretical concept of a neutral "pure profits" tax as developed by Boadway and Bruce (1984). They advocate to tax only the returns on investment above the costs of capital, which requires to tax the sources of finance equally. Devereux and Freeman (1991) suggested to put this idea into practice by providing companies with an 'Allowance for Corporate Equity'(ACE), i.e. an equity tax relief. Empirical testing of this theoretical system, however, was until now not possible due to a lack of faithful implementation of all aspects of this tax feature or due to a lack of pertinent

data. The introduction of the tax deductibility of equity costs in Belgium in 2006, offers the experimental ideal for testing how tax benefits affect the capital structure of a company. Unlike other implementations, this equity tax reform includes most of the basic and powerful features of the theoretical taxation system as developed by Devereux and Freeman (1991) and therefore, approaches tax neutrality very closely. As a result the studied tax shield is labeled 'full' system versus 'partial' systems. Since all of the latter systems are guided by different rules, studies related to those systems did not allow to draw a general conclusion about the system's impact (o.a. Staderini (2001), Klemm (2007))[1]. In addition to a different approach of the topic, this paper offers the benefit of analyzing a large dataset, as the tax reform automatically applies to all companies filing a corporate tax return in the country. Moreover, as the equity tax shield studied in this paper was only introduced in 2006, some theoretical studies (Gerard (2006a), Gerard (2006c)) but few empirical analyses studying its capital structure implications are available so far.

I develop a simple model to show what changes the introduction of an eq-

[1]Other countries in and outside the EU (Croatia (1994), Brazil (1996), Italy (1997) and Austria (2000)) chose to introduce an Allowance for Corporate Equity, although they implemented the system differently. Croatia included most of the features of the theoretical tax as developed by Devereux and Freeman (1991). Brazil limited the application of the system to dividends paid out to shareholders instead of applying it to the total amount of equity as suggested by the theoretical model. Italy and Austria lowered the tax rate on equity returns but did not exempt them from taxation. The empirical studies evaluating those ACE systems are not unanimously convincing. Keen and King (2002) analyze the Croatian implementation of ACE, but do not have the necessary data to study the impact of the Croatian system on the leverage of companies. Klemm (2007) studied Brazilian data and noted no significant change of the capital structure of Brazilian companies. Staderini (2001) analyzed the impact of the Italian system and found, however, that the leverage of companies decreased following the introduction of the system. Based on these results, it is hard to conclude on the system's efficiency. An explanation, however, could be that altering basic and powerful characteristics of the theoretical proposition and hence the implementation of a partial ACE system, was not an efficient choice. Three countries, Croatia, Italy and Austria, decided to abolish the system few years after its introduction. In Croatia and Austria, the desire to cut the overall corporate tax rate most probably explains the decision to eliminate the system.

uity tax shield is expected to produce. The model predicts that further to equalizing the tax treatment of debt and equity, a company lowers its debt ratio. To quantitatively test this prediction and in order to measure the impact of taxation on corporate financing decisions, I use in this paper a difference-in-differences identification strategy, comparing the capital structure of treatment and control companies before and after the tax reform. Belgian firms are considered the treatment companies; French firms play the role of control companies. The data related to the period 2001-2005 are the pre-treatment data; those related to the period 2006-2007 the post-treatment data. The sample includes individual company information of 3,332 treatment companies and 17,100 control companies. In order to ascertain the comparability of both groups of companies, capital structure trends are analyzed and a propensity score method is applied to match treatment and control firms. Consistent with the theoretical prediction set out in the model, the empirical results provide considerable evidence of a significant negative effect of the equity tax shield on the leverage of a company. This means that the debt tax shield, proper to a traditional tax system, affects a company's capital structure. The main results are robust to several robustness tests. By generating the same analysis for a different control group (26,241 German companies), I assess whether the results are not country-specific. For both control groups, I find that the estimated impact is highly significant and that it amounts economically to a leverage ratio decrease of approximately 2-7%. Further extension of the analysis reveals that, consistent with the financial constraint theory, the capital structure of large companies is more affected by the introduction of an equal tax treatment of debt and equity than the capital structure of small and medium enterprises.

The paper proceeds as follows. Section 1 presents the institutional background and the principal characteristics of the tax reform. Section 2 discusses the theoretical framework. Section 3 presents the empirical

methodology and shows how it applies to the introduction of an equity tax shield. Section 4 describes the data set and presents the construction of an adequate control group. Section 5 discusses the main results, produces some robustness checks and considers some further extensions of the analysis. Section 6 concludes.

1.2 Institutional Background

Belgian corporate tax rules can be considered as a traditional tax system (Graham (2003)). Companies are taxed on their profits, i.e. the business income less the costs to generate that income. Those business related costs include the interest paid as return to the creditors. Since these interest expenses reduce taxable income, they are said to be tax deductible. The return to shareholders or dividends, however, are included in the taxable base and are taxed. From January 1, 2006 on, Belgian companies or foreign companies permanently established in Belgium can deduct from their taxable income what is called a "Risk Capital Deduction", which is an amount computed as the fictious interest cost of the adjusted equity of a company. Hence, not the actual equity cost, i.e. the return to shareholders, but an estimated equity cost is tax deductible. From that moment on, however, debt and equity can be considered receiving the same tax treatment. As both means of financing reduce the taxable income of a company, they can be seen as providing a corporate tax shield.

The main goal of the measure is to promote equity funded activities and to encourage companies to strengthen their capital structure and to have a stronger financial position through an increased equity level. Even if the first goal of the measure is not to increase investments, it seeks to maintain earnings in the country, which could later on be used to finance new investments. With this measure, policymakers also tend to reduce the tax discrimination between debt and equity, but also to offer an alternative to the abolished special tax regime for coordination

centers. The latter regime granted attractive tax advantages [2] to MNEs' subsidiaries [3] that offered financial and business services to other companies in the group. The regime was gradually withdrawn since it was qualified as 'unfair tax competition' by the European Code of Conduct and considered breaking European State Aid legislation in 2003. From January 1, 2011 on, coordination centres could no longer benefit from this favourable tax regime.

The equity taken into account to determine the equity tax shield is the shareholder's equity, i.e. the equity hold by external shareholders and adjusted by subtracting certain items to avoid abuse and double deductions. Starting point of the computation is the equity mentioned in the opening balance sheet for the taxable period. This equity is adjusted for the net tax value of own shares, of non-portfolio participations, and of shares issued by investment companies producing taxable revenues. Moreover, the remaining equity is reduced by the net equity assigned to foreign permanent establishments or real estate property or rights, by the net book value of tangible fixed assets, which costs do unreasonably exceed professional needs or which are considered as an investment not acquired in order to produce a regular income and by tax-free revaluation gains and capital subsidies. Worthwhile noting is that the adjusted equity consists of both existing and new equity.

The fictious interest rate is determined annually and is equal to the average return of the 10-year linear state bond of the year two years prior

[2] Instead of being taxed on its business profits, coordination centres were taxed on 4% to 10% of their business expenses, which excluded salary and financial costs. Moreover, no withholding taxes were levied on dividends, interests and royalties distributed to group companies. Finally, coordination centres were exempted from property tax and from registration duties on subscriptions and on increases of capital.

[3] The status of coordination centre was subject to conditions of size. It was granted only to an entity that is part of a multinational group with subsidiaries in at least 4 different countries. Furthermore, the multinational group needed to have a total consolidated equity of at least 1 billion Belgian francs and a total consolidated turnover of at least 10 billion Belgian francs. Moreover, the entity was required to have at least 10 employees by the second year of operations.

to the tax year concerned. As a result, a company's equity will, for corporate tax purposes, be treated as debt with the same annual interest rate as a 10-year state bond. Moreover, this equity tax shield includes several features to facilitate and encourage its use. First, the deduction automatically applies to all companies filing a Belgian corporate tax return. Furthermore, it can be carried forward to the next seven years, no thin capitalization rules apply to the adjusted equity and no withholding tax is levied on the fictious interest deduction. Finally, no investment in tangible or intangible assets is required. Except for the latter feature, this equity tax shield or Allowance for Corporate Equity represents the features of the theoretical tax as developed by Devereux and Freeman (1991). The new tax law does not require an equity increase to correspond to the acquisition of a new asset so that the deductible amount can remain stable from one year to another. The theoretical taxation system, however, supposes the existence of fixed assets depreciated over several years and assumes therefore a decreasing deductible amount.

The control companies used in the subsequent empirical analysis are firms incorporated in France. In order to assess the robustness of the results, a second control group is constructed, containing German companies. Like Belgium, both France and Germany have a traditional tax system, providing for the tax deductibility of interest expenses but not of the capital cost of equity.

1.3 Theoretical Framework

To clarify the impact of the tax neutrality between debt and equity, I develop a simple one period model showing how the introduction of an equity tax shield affects the capital structure of a company. Assuming a world without risk, inflation, and taxation, a firm investing in an asset of value I seeks to maximize its present value (PV). Suppose the assets of the firm are financed for a fraction b by debt and a fraction $(1-b)$ by equity, where $b \geq 0$. It was under these assumptions that Modigliani and

Miller (1958) developed their major prediction, i.e. that the financing mode is irrelevant with respect to the value of the firm.

Taking into account a traditional corporate tax system, the trade-off theory of capital structure (Kraus and Litzenberger (1973), Scott (1976), Bradley et al. (1984), but also Jensen and Meckling (1976), Myers (1977)) shows that a firm's leverage is determined by the trade-off between the tax benefits of debt and the costs of additional financial constraints and bankruptcy triggered by an increased leverage. Leaving bankruptcy costs aside, the subsequent model focuses on the impact of the financing mode on the value of the firm. It assumes a tax system in which a firm is taxed on its end-of-period wealth after deduction of interest expenses and which is based on a constant marginal tax rate (τ_c). Investors are subject to a constant withholding tax on dividends (τ_d) and on interests (τ_i), where $\tau_d \geq 0$, $\tau_i \geq 0$ and $\tau_d \neq \tau_i$. Considering that the time period tends to infinity, the company's objective function can be modeled as follows:

$$\max_b \; PV = \frac{(1-\tau_c)y(I)}{r} + (1-b)\frac{\tau_i - \tau_d}{1-\tau_d}I + b\tau_c I \tag{1.1}$$

where $y(I)$ is an increasing and concave function of investment and stands for the end-of-period earnings before interest and taxes, and r is the real interest rate and discount rate. In this equation, the first term represents the present value of the taxable base before interest and depreciation, and the following terms the tax advantage respectively related to equity financing and debt financing. The tax advantage of equity is derived from the arbitrage made by the investor between debt and equity returns. An investor will acquire shares only if the dividends D he receives are at least as high as the return he could obtain from an equally risky loan, i.e. $(1-\tau_d)D \geq (1-\tau_i)\frac{r}{r}I$. As such the tax advantage of equity can be expressed as $(1-b)\frac{\tau_i-\tau_d}{1-\tau_d}I$. The tax advantage of debt is derived from the value of debt and expressed as $b\tau_c I$. When maximiz-

ing the objective function with respect to debt, the first order condition becomes:

$$\frac{dPV}{db} = -\frac{\tau_i - \tau_d}{1 - \tau_d} I + \tau_c I \tag{1.2}$$

It follows from equation (1.2) that the optimal debt usage is undefined. Assuming then that equation (1.2) is strictly positive, a company will maximize its debt usage to optimize its present value. Accordingly, the financing mode affects the value of the firm, since debt is favored for corporate tax purposes.

When an equity tax shield is introduced into the traditional tax system, the market value of equity is affected. As for debt, the firm now also enjoys a tax benefit for equity amounting to the return of an equally risky loan. Therefore, an additional tax advantage related to equity $(1-b)\frac{\tau_c(1-\tau_i)}{1-\tau_d} I$ increases the firm's present value. The present value of the firm becomes:

$$PV = \frac{(1-\tau_c)y(I)}{r} + (1-b)\frac{(\tau_i - \tau_d) + \tau_c(1-\tau_i)}{1-\tau_d} I + b\tau_c I \tag{1.3}$$

Defining leverage as the ratio of total debt to the present value, $L = \frac{b}{PV}$, the impact of an equity tax shield can be measured by optimizing leverage with respect to this tax shield, yielding:

$$\frac{dL}{d[\tau_c(1-\tau_i)]} = \frac{-b\frac{1-b}{1-\tau_d} I}{PV^2} \tag{1.4}$$

As total debt and the withholding tax rates are positive, equation (1.4) is strictly negative. As a result, the introduction of an equity tax shield encourages companies to lower their debt usage. In order to measure the extent to which the tax benefits of debt influence corporate financing decisions, this paper is based on the following implication. Further to equations (1.2) and (1.4), when an equity tax shield is introduced,

the tax-favored treatment of debt is offset and the capital structure rebalanced, i.e. the debt usage lowered. Hence, the new capital structure reflects the optimal mix of debt and equity for the company and is freed of tax interference. The empirically testable prediction can then be stated as follows:

Prediction: *Further to equalizing the tax treatment of debt and equity, a company lowers its debt ratio.*

Consequently, it is expected to observe a significant negative effect of the tax reform on the leverage of treated companies. I test this prediction empirically in the following sections.

1.4 Empirical Methodology

Ideally, the impact of a tax reform is assessed by using a random experiment. Random assignment of firms to a policy change, would allow controlling for all relevant (observable and unobservable) covariates, affecting the outcome of interest. Moreover, in such a random setting no outcomes are favored over others and selection bias is inexistent. To approach this experimental ideal, a natural experiment needs to be found to mimic random assignment. Considering the tax reform as an exogenous event, I can, by determining a treatment and control group, assume the existence of a natural experiment to test the effect of equalizing the tax treatment of debt and equity. Accordingly, the fact of being subject to the tax reform is the treatment, the treatment group comprising the companies established in the experimental country, the control group including the companies established in a non-experimental country. Because pre- and post-reform data are available, I can use a difference-in-differences identification strategy. This panel data technique consists in comparing the years before and after the adoption of the tax reform for both treated and control groups. Estimating the impact of the tax reform through such a difference-in-differences strategy, however, is only possible

if two key assumptions hold. The first assumption requires that capital structure trends before the introduction of the tax reform are similar in both groups. Hence, treatment and control groups should present the same trend over time in the absence of treatment. Therefore, country and time fixed effects have to be controlled for. The second assumption requires treatment and control groups to have exactly the same pre-treatment characteristics. As a result, the only relevant difference between the two groups would be their access to the equity tax shield. Their difference in outcome would then be entirely attributable to the tax reform. Thus, the validity of the difference-in-differences methodology depends on whether the experience of the control group accurately represents how the treatment group would have done in the absence of the tax reform. Before applying this difference-in-differences approach, I need to control whether the two basic assumptions are verified.

I investigate the equal pre-treatment trend assumption by analyzing graphically how the capital structure of companies evolves over time in the treatment and the control group. To make sure that the assumption of equal pre-treatment characteristics holds, I use a propensity score method to match the treatment and control groups. By stratifying each covariate and pairing a treatment firm and a control firm when they fall in the same category for each covariate, matching balances the observed covariates between treatment and control groups. As a result, a selection of the control group (counterfactual) is made which is similar to the treated group in all pre-treatment features and the second assumption is thus verified. To ease matching when the number of covariates is large, Rosenbaum and Rubin (1983) suggested to use a propensity score $p(X)$, summarizing all the observable firm characteristics into a single index. This propensity score or conditional probability that firm i with observable characteristics X_i is subject to the equity tax shield ACE_i is

a scalar function of covariates expressed as:

$$p(X) \equiv E[ACE_i|X_i] = Prob[ACE_i = 1|X_i] \tag{1.5}$$

Consequently, this evaluation technique commonly used in policy analysis, makes it sufficient to compare firms with similar propensity scores instead of comparing firms with identical observable characteristics X_i. Once a satisfying control group is selected, a difference-in-differences model can be set up. Let C_c (or Country) be a fixed country effect dummy (equal to one if an experimental country, equal to zero if a non-experimental country), T_t (or Time) be a fixed year effect dummy (equal to one if after the tax reform, equal to zero if before the tax reform) and X_{ict} be the individual controls. The leverage of a company i in country c at time t can be estimated by using an Ordinary Least Squares (OLS) regression analysis, which takes the following specification for a difference-in-differences estimation:

$$Y_{ict} = \alpha + \gamma\, C_c + \lambda\, T_t + \delta\, X_{ict} + \rho\, C_c \cdot T_t + \epsilon_{ict} \tag{1.6}$$

where γ are time-invariant country effects, λ are country-invariant time effects and ρ is the causal effect of interest. The coefficient ρ captures the variation in the outcome of interest in the experimental country (relative to the non-experimental country) in the years after the tax reform (relative to the years before the tax reform). Hence, it measures the marginal difference between the pre and post period with respect to the introduction of an equity tax shield and determines the economic importance of this difference.

1.5 Data

The AMADEUS database (Bureau van Dijk) comprises balance sheet and income statement information on public and private companies in 41 European countries. The database version used contains data for

15 million companies from the year 2001 on. These companies are non-financial firms and the effects on the financial sector will therefore not be treated in the subsequent analysis. The standard format used to register the information, allows to compare cross-border financial data easily. Analyzing a 2006 tax reform in Belgium, I select a sample of Belgian and French companies active during at least one year in the time period 2001-2007, as such constructing an unbalanced panel of company data. In this sample, Belgian firms are considered the treatment companies; French firms the control companies. The data related to the period 2001-2005 are the pre-treatment data; those related to the period 2006-2007 the post-treatment data. Data for one particular company in one particular year constitute the observational unit. As in previous capital structure literature, the sample is limited to companies which are active in the industrial sector (SIC code 2000-5999), excluding the real estate industry, financial services, the public and primary sector. Outliers are controlled for by deleting observations if the book value of fixed assets or of total debt is more than 100% or less than 0% of total assets, leaving me with a sample of 18,322 Belgian and 91,814 French company-year observations. For robustness purposes, I construct a sample of Belgian and German companies, in the same way as I did for the sample containing Belgian and French data. The second sample includes, in addition to the 18,322 Belgian company-year observations, 32,931 German ones. It appears, however, that this sample contains only part of the German companies. This is due to the compliance rate of filing national accounts at the national bank, which is almost 100% in Belgium, 65% in France, and only 3% in Germany. Those highly differing compliance rates are due to the different type of data providers: private rating agencies in Germany and public institutions in Belgium and France.

The data collected are used to construct the capital structure measure and the control variables needed for the empirical analysis. Working with unconsolidated financial account information of both listed and non-

listed companies, I use book values to construct the variables. This is also the case for the dependent variable, for which I use two different definitions. First, I define leverage as is done commonly in the capital structure literature (Rajan and Zingales (1995), Graham and Harvey (2001), Ortiz-Molina (2007)). What is called 'book leverage' is measured as the ratio of total non-equity liabilities to total assets. Total non-equity liabilities or total debt is the sum of long-term debt and current liabilities. As the purpose of this paper is related to the tax advantage of debt, I use in a second set of regressions financial leverage as dependent variable, given that only interest related to financial debt is tax deductible. Financial leverage is defined as the ratio of financial debt, i.e. long term debt and loans, to total assets (Rajan and Zingales (1995)). According to the capital structure literature (a.o. Bradley et al. (1984), Long and Malitz (1985), Titman and Wessels (1988), Harris and Raviv (1991)), the main covariates of the model include tangibility, firm size, and profitability. Tangibility is defined as the book value of tangible fixed assets over the book value of total assets. Firm size is measured by the natural logarithm of total assets. Profitability is measured as the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) to the book value of total assets. The industry dummy variables are based on two-digit SIC codes. Inflation is the annual percentage of inflation in consumer prices as measured by the World Bank. GDP Growth is the annual percentage of GDP per capita growth as measured by this same institution.

1.5.1 Summary Statistics

Descriptive statistics of the sample are reported in Table 1.1. The table provides means and standard deviations for the main variables used in the analysis, as well as for some additional firm characteristics. These statistics are given for the full sample, the treatment and the control group.

As mentioned above, the use of a difference-in-differences methodology is

Table 1.1: Descriptive Statistics and Means Differences

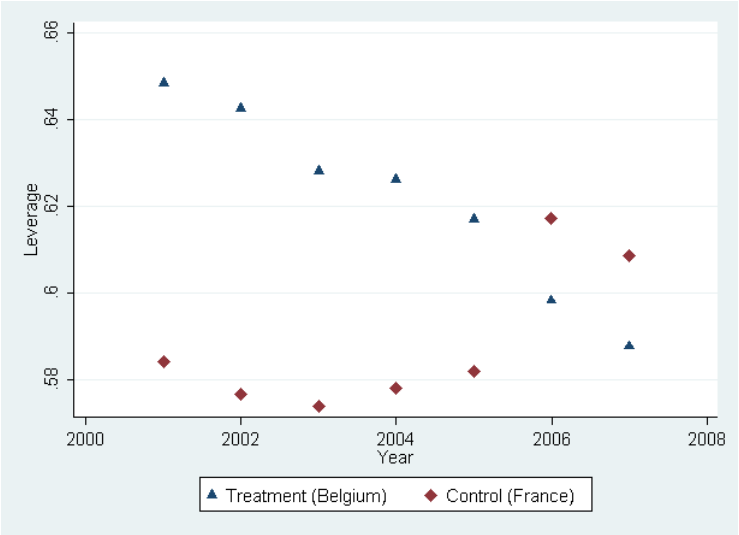
The table provides means and standard deviations for the main variables used in the paper, as well as for some additional firm characteristics. Pre-treatment (2004) data for the treatment and control groups are used. Employees is the number of employees. Total Assets are total assets (in millions of EUR). The current ratio is the ratio of current assets over current liabilities. The liquidity ratio is the ratio of current assets, other than inventories, over current liabilities. The solvency ratio is the ratio of shareholder funds over total assets. Leverage is the book leverage, i.e. total debt (long term debt plus current liabilities) over total assets. Investment (in millions of EUR) is the change in fixed assets (tangible and intangible fixed assets) over total assets. Tangibility is the ratio of tangible fixed assets over total assets. Profitability is the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) over total assets. Return on equity is the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) over shareholder funds. Profit margin is the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) over sales. Net Operating Loss is a dummy variable that takes one if the company is loss-making, zero otherwise. Inventories Turnover is the ratio of sales over inventories. Sales are the sales (in millions of EUR). $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level.

	Full Sample		Treated		Control		
Variable	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Means Diff
Profile							
Employees	241	(1144)	193	(445)	252	(1245)	59**
Balance Sheet							
Total Assets (millions)	50.028	(418.754)	45.923	(125.612)	50.796	(453.004)	4.872
Current Ratio	3.695	(237.333)	12.999	(596.190)	1.954	(18.713)	-11.045**
Liquidity Ratio	3.324	(237.336)	12.642	(596.197)	1.581	(18.719)	-11.061**
Solvency Ratio	0.338	(0.200)	0.338	(0.212)	0.337	(0.198)	-0.001
Leverage	0.585	(0.204)	0.626	(0.214)	0.578	(0.201)	-0.048***
Investment (millions)	21.700	(302.000)	23.400	(93.400)	21.400	(326.000)	-2.000
Tangibility	0.180	(0.164)	0.243	(0.200)	0.168	(0.154)	-0.075***
P&L Account							
Profitability	0.113	(0.117)	0.134	(0.118)	0.109	(0.116)	-0.025***
Return on Equity	0.734	(26.386)	0.763	(7.567)	0.728	(28.562)	-0.035
Profit Margin	0.063	(1.015)	0.089	(0.169)	0.059	(1.098)	-0.031
Net Operating Loss	0.186	(0.389)	0.193	(0.394)	0.185	(0.388)	-0.008
Inventories Turnover	102.339	(1298.701)	98.705	(799.352)	102.943	(1364.186)	4.238
Sales (millions)	76.230	(708.698)	65.013	(145.425)	78.183	(765.490)	13.200
N	17,200		2,711		14,489		

conditioned by two assumptions. The first condition states that during the pre-reform period, the debt ratio of the treatment and the control group follow a common trend. In order to determine whether the equal pre-treatment trend assumption is verified, graphical analysis is used to study the annual evolution of leverage. In Figure 1.1, I plot the average leverage of both groups for the time period 2001-2007. The figure shows that disregarding the 2005 treatment data, which could be affected by an announcement effect, the average leverage of the treatment and control groups before the 2006 tax reform follow a similar trend. From 2005 on, the leverage of Belgian companies decreases, whereas the leverage of control companies increases. This relative decline in the treatment group provides significant evidence that the introduction of an equity tax shield in Belgium has affected the capital structure trend.

Figure 1.1: Evolution of the Leverage Trend over Time

The figure plots the annual mean leverage of both the treatment and the control group before matching for the time period 2001-2007. The use of a difference-in-differences strategy requires the treatment and control group to follow a common trend during the pre-treatment period. Hence, treatment and control groups should present the same trend over time in the absence of treatment.



The second assumption on which the difference-in-differences identification strategy is based, is that treatment and control groups have the same characteristics in the absence of the treatment, i.e. the equity tax shield. In order to verify this assumption, Table 1.1 compares the characteristics of the treatment and control companies for the pre-treatment year 2004, reporting the differences in means of both groups for balance sheet and profit and loss items. Table 1.1 describes the statistics for the Belgian and French data. Those summary statistics show that the comparison group differs significantly from the treatment group with respect to several characteristics. Regarding their profile, companies in the control group tend to have significantly more employees (252 versus 193). As to the balance sheet structure of the companies, Table 1.1 shows that there are highly significant differences between treatment and control companies. Firms in the treatment country have a smaller amount of total assets (46 million versus 51 million), which is not surprising as France is a larger economic player than Belgium. Likewise, the leverage of treatment companies (63%) is systematically larger than the leverage of control companies (58%) and hence the latter have a more balanced capital structure than the former. As regards the profit and loss account, I observe that treatment companies tend to generate less sales (65 million versus 78 million) than control companies. All those highly significant differences justify the use of a matching method to adjust the imbalance of covariates between groups and to correctly implement a difference-in-differences strategy.

1.5.2 Matching Treatment and Control Observations

Because treatment and control companies need to have identical characteristics in the absence of treatment, a reorganization of the control group is made in an attempt to make the control observations similar to the treatment observations, except for the treatment. This reorganization is called 'matching'. To this end, the covariates are balanced between the two groups of observations based on pre-treatment sample

data. 2004 observations were preferred to 2005 data as basis to perform this balance in that the latter could be affected by the tax reform announcement. Three steps are used to adequately adjust the control group and to make it comparable to the treatment group.

First, I construct a tool to compare the two groups, i.e. the propensity score or the estimated probability of being subject to the treatment, given observable characteristics. The propensity score is estimated, using a probit model which limits the predicted probabilities to the [0,1] interval and which is based on variables that potentially determine leverage. Hence, the control variables include tangibility, firm size, profitability, and industry, as well as dummies reflecting whether the company is publicly listed and whether it is loss-making. For each of the observations, the propensity score thus summarizes all the information of the control variables into a single index. Estimation results are presented in Table 1.2.

Table 1.2: Probit for the Probability of Treatment

The table presents the probit estimation results of the propensity to be subject to the equity tax shield. Firm characteristics, influencing the capital structure of companies, are used to estimate the model. The dependent variable takes value one if the company is subject to the tax reform, zero otherwise. The estimation is based on pre-treatment data, i.e. 2004 observations. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level.

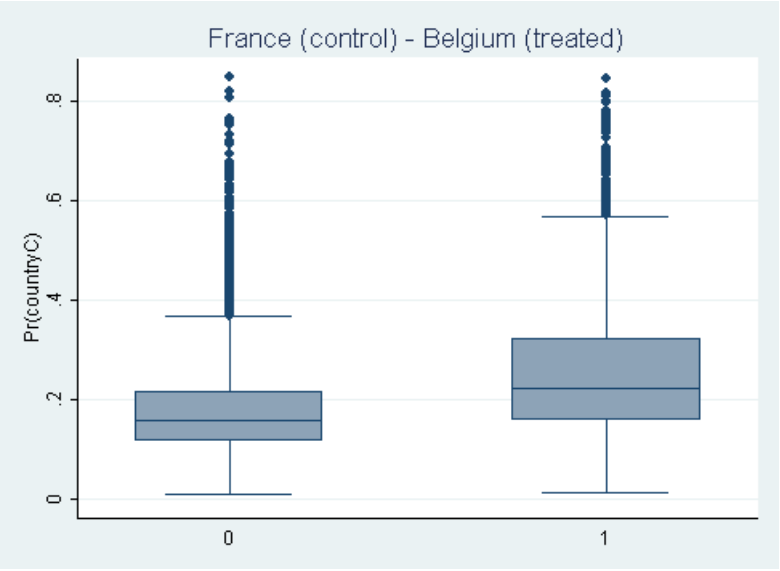
Variable	Coefficient	(Std. Err.)
Tangibility	1.521***	(0.076)
Profitability	1.112***	(0.121)
Log(Size)	0.026***	(0.008)
Listed	-0.284	(0.409)
Net Operating Loss	0.109***	(0.035)
Industry dummies	Yes	
N	17,196	
Log-likelihood	-6,937.113	
Pseudo R^2	0.0742	

A second step consists in assessing the overlap of the two groups in

terms of propensity score, which is done visually by checking the region of common support (Figure 1.2). The boxplots in Figure 1.2 represent the propensity score distributions of the treatment and control groups and provide a comparability check of those groups. Although it cannot be ascertained that a control observation can be found for every treatment observation, the overlap of the boxplots (i.e. the area between the whiskers) seems important enough to match the treatment and the control observations.

Figure 1.2: Boxplots of the Estimated Propensity Score

The figure shows boxplots of the propensity score distributions of the treatment and control groups after balancing the covariates. For each distribution, the lower and upper quartiles (25th and 75th percentiles) form the bottom and top of the box. The horizontal line within the box indicates the median (50th percentile) and the ends of the whiskers represent the maximum and minimum of the sub-sample. The observations lying outside the whiskers are considered outliers. The boxplots provide a comparability check for the treatment and control group in terms of observable characteristics. The overlap in the distributions (area between the whiskers) indicates how well a matching strategy can be implemented. The wider the overlap, the better treatment observations and control observations can be matched.



In a third and last step, treatment and control companies are paired up

according to their propensity score. Because the probability of finding a control and treatment company with an identical propensity score is very small, an algorithm is used to find the best fitting match. Here, a nearest neighbor algorithm is selected, matching each treatment observation with the closest control observation as regards propensity score. This algorithm allows to match one control observation with several treatment observations. Because the control group is larger than the treatment group, the control observations which are not matched with a treatment observation are dropped. As shown by Table 1.3, matching allows to largely reduce the differences between the treatment and the control group and consequently, to make the groups more comparable. The first three columns of Table 1.3 present the means and means differences between the treatment and the control group before matching; the last three columns of Table 1.3 show the means and mean differences after matching. The mean differences between the groups, which are statistically different from zero in the unmatched sample become statistically equal to zero in the matched sample, indicating that the adjusted control group now closely resembles the treatment group.

The control group adjusted, an average treatment effect can be estimated. Having both pre- and post-treatment data and given a treatment and control group with similar pre-treatment trend and characteristics, a difference-in-differences strategy can be setup, allowing to control for country and time effects. The latter are measured by the variables Country and Time. Country is a dummy variable that takes one if the company is located in an experimental country, zero otherwise. This variable captures the country-specificities of leverage. Time is a dummy variable that takes one if the company observation is done after the tax reform, zero otherwise. This variable captures the time-specificities of leverage. Both variables are proper to the implementation of a difference-in-differences estimation. The variation in leverage due to the tax reform is captured through the dummy variable ACE, that

Table 1.3: Mean Differences Before and After Matching

The table provides mean and standard deviation for the main variables used in the paper, as well as for some additional firm characteristics. Pre-treatment (2004) data for the treatment and control group are used. Total Assets are total assets (in millions of EUR). The current ratio is the ratio of current assets over current liabilities. The liquidity ratio is the ratio of current assets, other than inventories, over current liabilities. The solvency ratio is the ratio of shareholder funds over total assets. Leverage is the book leverage, i.e. total debt (long term debt plus current liabilities) over total assets. Investment (in millions of EUR) is the change in fixed assets (tangible and intangible fixed assets) over total assets. Tangibility is the ratio of tangible fixed assets over total assets. Profitability is the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) over total assets. Return on equity is the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) over shareholder funds. Profit margin is the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) over sales. Net Operating Loss is a dummy variable that takes one if the company is loss-making, zero otherwise. Inventories Turnover is the ratio of sales over inventories. Sales are the sales (in millions of EUR). $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level.

	Unmatched Sample			Matched Sample		
Variable	Treated	Control	Difference	Treated	Control	Difference
Profile						
Employees	193	252	59**	226	261	35
Balance Sheet						
Total Assets (millions)	45.923	50.796	4.872	45.190	50.053	4.863
Current Ratio	12.999	1.954	-11.045**	18.032	1.609	-16.423
Liquidity Ratio	12.642	1.581	-11.061**	17.671	1.240	-16.431
Solvency Ratio	0.338	0.337	-0.001	0.333	0.333	0.000
Leverage	0.626	0.578	-0.048***	0.632	0.580	-0.052
Investment (millions)	23.400	21.400	-2.000	23.301	20.886	-0.415
Tangibility	0.243	0.168	-0.075***	0.178	0.180	0.002
P&L Account						
Profitability	0.134	0.109	-0.025***	0.105	0.111	0.006
Return on Equity	0.763	0.728	-0.035	0.653	0.410	-0.243
Profit Margin	0.089	0.059	-0.031	0.071	0.067	-0.004
Net Operating Loss	0.193	0.185	-0.008	0.191	0.186	-0.005
Inventories Turnover	98.705	102.943	4.238	97.019	91.480	-5.539
Sales	65.013	78.183	13.200	67.213	88.100	20.887
N	2,711	14,489	(17,200)	2,703	2,129	(574)

takes one if the company is located in an experimental country and if the observation is done after the tax reform, zero otherwise.

1.6 Results

A first subsection reports the basic regressions testing the impact of an equity tax shield on the capital structure of companies. Then, the robustness of these results is checked by using raw unmatched data and by using an additional control group. Third, the consistency of the results with the financial constraint theory, the same analysis is made after splitting the sample into small and medium enterprises (SME) and large companies.

1.6.1 Impact of Taxation on a Company's Capital Structure

Table 1.4 reports the basic regression estimations, using a difference-in-differences strategy after having matched treatment and control companies. Both coefficients and standard errors are reported. Standard errors are robust for firm specific clustering. As mentioned above, two measures of leverage are used, i.e. book leverage and financial leverage. Book leverage is measured as the ratio of the book value of total debt to the book value of total assets. Financial leverage is defined as the ratio of financial debt, i.e. long term debt and loans, to total assets.
Regressions (1) to (4) of Table 1.4 use book leverage as dependent variable. Regression (1) regresses the outcome variable on a country-specific dummy, a time-specific dummy, a dummy reflecting the existence of the tax reform, tangibility, profitability, firm size, and industry. In this basic regression, the variable of interest ACE has an estimated negative coefficient of -0.071 and is significant at the 1% level. This result is consistent with the theoretical prediction that taxation has an effect on the capital structure of companies, given that introducing an equity tax shield lowers the debt usage. It suggests that adopting the same tax favourable treatment for equity as for debt, reduces the debt ratio of companies with more than 7%. The coefficient on Country, returning one if the

observation is related to a company located in the treatment country, is positive (0.076) and highly significant (1% level). This suggests that in the absence of the tax reform, there are substantial country-specific effects determining the book leverage of a company. The same is true with respect to time effects. The positive and significant coefficient (0.034) on Time, returning one if the observation is post-reform, indicates that the time period is an important factor explaining the leverage of a company. However, with respect to the control variables, only the impact of profitability is consistent with the theoretical predictions. Previous capital structure research (Rajan and Zingales (1995)) finds that leverage decreases with profitability, since financing with retained earnings is prefered over debt financing for profitability purposes. Contrary to what theory predicts, tangibility and firm size have a negative effect on leverage. The negative impact of firm size would mean that size reflects the information of outside investors who prefer equity over debt (Rajan and Zingales (1995)). A possible explanation for the negative impact of tangibility comes from the fact that leverage may be influenced more by tax purposes than by finance purposes as debt and fixed assets both offer tax deductible expenses (DeAngelo and Masulis (1980), Huizinga et al. (2008)). Further to the R^2 statistic, this set of variables explains 9.9% of the variation in book leverage. Moreover, that both firm size and tangibility present a negative relationship instead of an expected positive one, suggests a missing variable bias.

Therefore, regression (2) uses the same specification as regression (1) but adds a non-debt tax shield variable, i.e. Net Operating Loss (NOL) to the control variables. Net Operating Loss is a dummy variable that takes one if the company is loss-making, zero otherwise. Hence, it proxies the presence of tax losses carry forward, which offer the possibility to offset taxable profits. The coefficient of the NOL variable (0.059) is significant at the 1% level. The R^2 statistic (0.1087), however, did not increase much and the coefficients of firm size and tangibility remain negative.

Table 1.4: Impact of Taxation on a Company's Capital Structure

The table reports the leverage regression estimations, using a difference-in-differences strategy for Belgian and French data. The regressions are estimated by Ordinary Least Squares (OLS). Two dependent variables are used. Book leverage is measured as the ratio of total debt to the book value of total assets. Financial leverage is the ratio of financial debt to the book value of total assets. Country is a dummy variable that takes one if the company is located in an experimental country, zero otherwise. Time is a dummy variable that takes one if the company observation is done after the tax reform, zero otherwise. ACE is a dummy variable that takes one if the company is located in an experimental country and if the observation is done after the tax reform, zero otherwise. Tangibility is defined as the book value of tangible fixed assets over the book value of total assets. Profitability is measured as the ratio of earnings before interest, taxes, depreciation, and amortization to the book value of total assets. Firm size is measured by the natural logarithm of total assets. Net Operating Loss is a dummy variable that takes one if the company is loss-making, zero otherwise. Non-Debt Tax Shield is defined as the ratio of depreciation costs over total assets. Inflation is the annual percentage of inflation in consumer prices as measured by the World Bank. GDP Growth is the annual percentage of GDP per capita growth as measured by the World Bank. The industry dummy variables are based on two-digit SIC codes. Both coefficients and standard errors are reported. Standard errors are robust for firm specific clustering. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level.

Dependent Variable	Book Leverage				Financial Leverage		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Country	0.076^{***}	0.074^{***}	0.035^{***}	0.037^{***}	0.105^{***}	0.098^{***}	0.100^{***}
	(0.004)	(0.004)	(0.006)	(0.006)	(0.003)	(0.005)	(0.005)
Time	0.034^{***}	0.036^{***}	0.033^{***}	0.031^{***}	0.025^{***}	0.025^{***}	0.027^{***}
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)

ACE (-)	-0.071***	-0.069***	-0.062***	-0.062***	-0.047***	-0.046***	-0.043***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Tangibility (+)	-0.075***	-0.093***	-0.121***	-0.121***	0.199***	0.194***	0.194***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.010)	(0.010)	(0.010)
Profitability (-)	-0.209***	-0.122***	-0.271***	-0.270***	-0.163***	-0.173***	-0.173***
	(0.024)	(0.021)	(0.031)	(0.031)	(0.018)	(0.020)	(0.020)
Firm Size (+)	-0.009***	-0.009***	-0.013***	-0.013***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Net Operating Loss (NOL)	-	0.059***	-	-	-	-	-
		(0.004)					
Non-Debt Tax Shield (NDTS)	-	-	0.599***	0.597***	-	0.103*	0.098*
			(0.066)	(0.066)		(0.0053)	(0.053)
Inflation (-)	-	-	-	-0.007***	-	-	-0.004**
				(0.002)			(0.002)
GDP Growth (+)	-	-	-	0.000	-	-	-0.005***
				(0.001)			(0.001)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	86,931	86,931	86,135	86,135	86,931	86,135	86,135
R^2	0.0986	0.1087	0.1157	0.1158	0.1124	0.1125	0.1127

Regression (3) uses the same specification as regression (1) but adds the variable Non-Debt Tax Shield (NDTS), defined as the ratio of depreciation costs over total assets. This additional variable could indicate whether the negative coefficient of tangibility might be explained by the tax shield related to depreciation. Although the coefficient of NDTS (0.599) is significant at the 1% level, it does not change the direction in which tangibility affects book leverage. The economic significance of the variable of interest ACE is slightly altered, as introducing an equity tax shield now lowers a company's leverage on average with 6% instead of 7%. Adding the NDTS variable, however, improved the goodness of fit of the model. The R^2 statistic indicates that the model now explains 11.6% of the leverage variation.

This same estimation of 6% is found when some macroeconomic variables, which allow to control for major economic differences between the treatment and the control group, are introduced (regression (4)). As suggested by Huizinga et al. (2008), inflation may lead to higher risk premiums and nominal interest rates, which discourages the use of debt. Hence, Inflation is expected to be negatively related to leverage. GDP Growth proxies the growth opportunities of a company. As a company with high hopes for future growth will need to invest, GDP Growth is expected to be positively related to leverage (Frank and Goyal (2009)). In regression (4) Inflation has a statistically significant impact (1% level) of -0.007 on the debt ratio, GDP Growth has no effect.

Regressions (5) to (7) use financial leverage as endogenous variable. Regression (5) shows that the estimated ACE coefficient is lower using this leverage measure compared with using the book leverage as dependent variable (-0.047 versus -0.071). The coefficient of the ACE variable remains highly significant (1% level). This indicates that, following the introduction of the equity tax shield, companies also decreased their trade debt and not only their financial debt which generate tax deductible interests. Moreover, the impacts of tangibility and firm size are now con-

sistent with the theoretical predictions. As in previous capital structure research (Rajan and Zingales (1995)) leverage increases with tangibility, since fixed assets serve as debt collateral, and with firm size, since large firms can more easily contract for credits. As book leverage, financial leverage decreases with profitability. All three estimated coefficients are significant at the 1% level. The R^2 statistic shows that 11.2% of the financial leverage variation is explained by this set of variables.
Regression (6) of Table 1.4 again includes the Non-Debt Tax Shield variable. Once more the estimated ACE coefficient is significant, both from a statistical (1% level) as from an economic point of view (-0.046).
Regression (7) adds the macroeconomic variables Inflation and GDP Growth. Both variables have a negative impact on the financial leverage of a company. This impact is statistically significant (5% and 1% respectively). The estimated coefficient of the variable of interest is in line with what was found for regression (6).
Whether for book leverage or for financial leverage, all specifications report a quite unanimous evaluation of the tax reform with respect to capital structure. The introduction of an equity tax shield significantly lowers the use of debt, which economically amounts to a decrease of leverage of 4-7%. These results provide strong evidence that taxes do affect corporate financing decisions.

1.6.2 Robustness

In order to verify the robustness of the results, two additional sets of regressions are generated. First, I produce the results for unmatched data, in view of excluding the hypothesis that matching may have altered the regression outcomes. Second, I generate the results for an additional control group, to assess whether the results are not country-specific. German companies constitute the additional control group. Table 1.5 reports the results of the robustness tests.

Table 1.5: Robustness

The table reports the leverage regression estimations, using a difference-in-differences strategy to test the robustness of the results. The regressions are estimated by Ordinary Least Squares (OLS). The dependent variable, Book leverage, is measured as the ratio of total debt to the book value of total assets. Total debt is the sum of the book value of long-term debt and of current liabilities. Regressions (1) to (3) are based on unmatched data; regressions (4) to (6) are based on Belgian-German data. Country is a dummy variable that takes 1 if the company is located in an experimental country, zero otherwise. Time is a dummy variable that takes one if the company observation is done after the tax reform, zero otherwise. ACE is a dummy variable that takes one if the company is located in an experimental country and if the observation is done after the tax reform, zero otherwise. Tangibility is defined as the book value of tangible fixed assets over the book value of total assets. Profitability is measured as the ratio of earnings before interest, taxes, depreciation, and amortization to the book value of total assets. Firm size is measured by the natural logarithm of total assets. Non-Debt Tax Shield is defined as the ratio of depreciation costs over total assets. Inflation is the annual percentage of inflation in consumer prices as measured by the World Bank. GDP Growth is the annual percentage of GDP per capita growth as measured by the World Bank. The industry dummy variables are based on two-digit SIC codes. Both coefficients and standard errors are reported. Standard errors are robust for firm specific clustering. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level.

Dependent Variable	Book Leverage					
	Unmatched Data			Belgian-German Data		
	(1)	(2)	(3)	(4)	(5)	(6)
Country	0.073^{***}	0.029^{***}	0.031^{***}	0.081^{***}	0.080^{***}	0.089^{***}
	(0.004)	(0.006)	(0.006)	(0.005)	(0.007)	(0.007)

Time	0.036***	0.033***	0.029***	-0.018***	-0.018***	-0.001
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.005)
ACE (-)	-0.074***	-0.061***	-0.061***	-0.018***	-0.018***	-0.026***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Tangibility (+)	-0.116***	-0.160***	-0.160***	0.055***	0.057***	0.058***
	(0.009)	(0.009)	(0.009)	(0.013)	(0.014)	(0.014)
Profitability (-)	-0.197***	-0.280***	-0.280***	-0.006	-0.006	-0.006
	(0.019)	(0.026)	(0.026)	(0.004)	(0.004)	(0.004)
Firm Size (+)	-0.005***	-0.015***	-0.015***	-0.009***	-0.009***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Non-Debt Tax Shield (NDTS)	-	0.680***	0.677***	-	-0.013	-0.019
		(0.065)	(0.065)		(0.0065)	(0.065)
Inflation (-)	-	-	-0.011***	-	-	-0.003
			(0.002)			(0.002)
GDP Growth (+)	-	-	0.000	-	-	-0.007***
			(0.001)			(0.001)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	106,685	104,603	104,603	54,273	53,307	53,307
R^2	0.0972	0.1267	0.1268	0.1042	0.1025	0.1028

Regressions (1) to (6) of Table 1.5 use book leverage as endogenous variable. In order to control whether matching may have altered the estimations, regressions (1) to (3) use unmatched data. I find very similar, almost identical, results compared to the basic results of regression (1) of Table 1.4, both for the coefficients of the dependent variable as for the coefficients of the control variables. This same analysis can be made with respect to regressions (2) and (3). Regression (2) adds the Non-Debt Tax Shield variable. Regression (3) completes with the macroeconomic variables Inflation and GDP Growth. As with regression (1), I obtain almost identical results without matching as with matching, which suggests the robustness of the results.

Using German companies as control units and book leverage as dependent variable, I find ACE coefficients which are weaker than those for the French control group. Regressions (4) to (6) show ACE coefficients of approximately -0.020, whereas identical specifications for the French control group provide ACE coefficients of approximately 0.060. All the results are still highly significant (1% level). Regarding the coefficients of the explanatory variables, I observe that, consistent with the theoretical predictions, tangibility has a positive effect on leverage and profitability a negative one. Firm size, on the contrary, influences leverage negatively. As mentioned above, size would in this case reflect the information of outside investors who prefer equity over debt (Rajan and Zingales (1995)). Overall, the robustness tests are conclusive, as neither the matching of treated and control companies, nor the use of a different control group, statistically alters the baseline results. From an economic point of view, though, it might be considered that the impact of the introduction of an equity tax shield amounts to approximately 2-7% rather than 4-7%.

1.6.3 Impact on Small and Medium Enterprises versus Large Companies

To determine which type of companies experience the highest impact from the introduction of an Allowance for Corporate Equity, the sample

is split into two subsamples: small and medium enterprises (SME) and large companies. This split-up is done based on the SME definition of the European Commission. Small and medium sized enterprises are defined as those having less than 250 employees and total assets which do not exceed EUR 43 million. Large companies are defined as those exceeding one of those thresholds. The results of Table 1.6 show how the equity tax shield differently affects SMEs and large firms with respect to financial leverage.

Regressions (1) to (3) of Table 1.6 use the SME subsample; regressions (4) to (6) of Table 1.6 use the large company subsample. Comparing the ACE coefficients of the former with those of the latter, I observe that the impact of the tax reform on large companies has been slightly more substantial than the impact on SMEs. SMEs reduced their debt ratio with approximately 4.6%, whereas large companies lowered their leverage with approximately 4.9%. Furthermore, all results are statistically significant at the 1% level. These results are consistent with the financial constraint theory (a.o. Erickson and Whited (2000), Almeida and Campello (2007)), predicting that small firms are more financially constrained than large comapnies. Small firms are often younger and face more important credit constraints than large firms. Hence, they cannot be as reactive to equity incentives as larger firms. According to this theory it is therefore not surprising to observe a higher leverage decrease for large firms than for small and medium firms following the introduction of an equity tax shield. The R^2 statistic of the specifications indicates that the model better fits the large company data than the SME data.

Table 1.6: Small and Medium Enterprises versus Large Companies

The table reports leverage regression estimations, using a difference-in-differences strategy, to compare the impact on small and medium enterprises versus large companies. The regressions are estimated by Ordinary Least Squares (OLS). The dependent variable, Financial Leverage, is the ratio of financial debt to the book value of total assets. Country is a dummy variable that takes one if the company is located in an experimental country, zero otherwise. Time is a dummy variable that takes one if the company observation is done after the tax reform, zero otherwise. ACE is a dummy variable that takes one if the company is located in an experimental country and if the observation is done after the tax reform, zero otherwise. Tangibility is defined as the book value of tangible fixed assets over the book value of total assets. Profitability is measured as the ratio of earnings before interest, taxes, depreciation, and amortization to the book value of total assets. Firm size is measured by the natural logarithm of total assets. Non-Debt Tax Shield is defined as the ratio of depreciation costs over total assets. Inflation is the annual percentage of inflation in consumer prices as measured by the World Bank. GDP Growth is the annual percentage of GDP per capita growth as measured by the World Bank. The industry dummy variables are based on two-digit SIC codes. Both coefficients and standard errors are reported. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level.

Dependent Variable	Financial Leverage					
	Small and Medium Enterprises			Large Companies		
	(1)	(2)	(3)	(4)	(5)	(6)
Country	0.092***	0.082***	0.083***	0.149***	0.148***	0.150***
	(0.003)	(0.005)	(0.005)	(0.010)	(0.008)	(0.014)
Time	0.029***	0.029***	0.031***	0.017***	0.016***	0.017***

	(0.002)	(0.002)	(0.002)	(0.004)	(0.008)	(0.004)
ACE (-)	-0.048***	-0.047***	-0.044***	-0.051***	-0.050***	-0.046***
	(0.003)	(0.003)	(0.004)	(0.009)	(0.008)	(0.009)
Tangibility (+)	0.248***	0.240***	0.241***	0.088***	0.087***	0.087***
	(0.010)	(0.010)	(0.010)	(0.026)	(0.008)	(0.025)
Profitability (-)	-0.143***	-0.156***	-0.156***	-0.263***	-0.265***	-0.264***
	(0.018)	(0.021)	(0.021)	(0.029)	(0.008)	(0.028)
Firm Size (+)	-0.001	-0.001	-0.001	0.017***	0.017***	0.017***
	(0.002)	(0.002)	(0.002)	(0.005)	(0.008)	(0.005)
Non-Debt Tax Shield (NDTS)	-	0.150***	0.145***	-	0.011	0.004
		(0.053)	(0.053)		(0.186)	(0.187)
Inflation (-)	-	-	-0.003	-	-	-0.009
			(0.002)			(0.006)
GDP Growth (+)	-	-	-0.005***	-	-	-0.006**
			(0.001)			(0.003)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	70,871	70,170	70,170	16,072	15,970	15,975
R^2	0.1096	0.1104	0.1107	0.1696	0.1689	0.1695

1.6.4 Policy implications

As aforementioned, the introduction of an Allowance for Corporate Equity in Belgium actually served two goals. The official goal was to make capital structure decisions more tax-neutral. The results obtained according to the above estimations clearly show that companies adjusted their debt policy and balanced their capital structure further to the ACE introduction. I found that the ACE system encouraged companies to decrease their leverage by approximately 2 to 7%. Based on these results, it can be ascertained that the measure had the requested effect. The unofficial goal of the ACE system was to offer an alternative to the abolished special tax regime for coordination centers. Hence, it was intended to hold back multinational companies which established a coordination center in Belgium by offering them an equivalent tax advantage. The results found show that the tax reform has a more substantial impact on large companies than on small and medium enterprises. This provides some evidence that the Belgian government continues to favor MNEs.

The tax favor granted of MNEs is one of the reasons why the ACE measure has been criticised. From a theoretical point of view, similar results could probably be obtained by using a Comprehensive Business Income Tax (CBIT), disallowing the tax deduction of interest payments on debt. For a small economy, however, the latter system is not feasible as long as surrounding countries do not introduce a similar measure. The introduction of a CBIT system in a single country would potentially drain companies away. This argument leads to the idea of a combined ACE-CBIT system, which would grant partial but equal tax deductibility for the costs of both financing modes.

Another common criticism of the ACE system is related to its considerable cost for the Belgian public finances. Since the foregone tax revenues do not seem to boost the economy or serve any employment objective, the credibility of the measure is somewhat undermined in the eyes of the public. A simple analysis of the impact of the equity tax shield on

investment does not provide significant results. Table 1.7 reports the results of regressing the investment ratio (i.e. investment over capital stock as defined in Eisner and Strotz (1963)) on sales growth, the debt ratio and the cash flow ratio. As none of the ACE coefficients are statistically significant, no clear-cut impact of ACE on investment can be determined. This is not surprising given that both new and old equity are used to compute the tax advantage. Hence, a company does not need to generate new investments to benefit from the tax reform. From a policy point of view this could be a painful aspect, especially in the aftermath of the crisis guided by fiscal consolidation.

1.7 Conclusion and further research tracks

The debate on how taxes affect corporate financing decisions was after decades of research still not settled. This paper closes this debate by providing strong evidence on the impact of taxation on corporate debt policy. It proposes a new approach to the issue by taking advantage of a 2006 tax reform in Belgium introducing an equity tax shield. Such an equity tax shield or Allowance for Corporate Equity attributes a similar tax deductibility to the return on equity as to interest expenses. Hence, it sets an end to the tax discrimination between debt and equity. Examining the extent to which the removal of this tax discrimination impacts a company's capital structure, goes back to the core of the corporate tax distortion debate and offers therefore a unique opportunity to settle the issue.

To clarify the impact of the tax neutrality between debt and equity, I developed a simple model showing how the introduction of an equity tax shield affects the capital structure of a company. The model predicts that following the introduction of an equal tax treatment of debt and equity, companies lower their debt ratio. This prediction is evaluated quantitatively through the use of a difference-in-differences identification strategy comparing the capital structure of treatment and control

Table 1.7: Impact of an Equity Tax Shield on Investment

The table reports investment regression estimations, using a difference-in-differences strategy. The regressions are estimated by ordinary least squares. The dependent variable is the ratio of investment over capital stock. Country is a dummy variable that takes one if the company is located in an experimental country, zero otherwise. Time is a dummy variable that takes one if the company observation is done after the tax reform, zero otherwise. ACE is a dummy variable that takes one if the company is located in an experimental country and if the observation is done after the tax reform, zero otherwise. Sales Growth t-1 is the ratio of the change in sales over shareholder funds for the previous year. Cash flow ratio t is the ratio of cash flow over shareholder funds. Debt ratio t-1 is the ratio of total debt over shareholder funds for the previous year. Both coefficients and standard errors are reported. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level.

Dependent Variable	Investment Ratio		
	Full Sample	SME	Large Companies
Country	0.751	-0.224	1.634
	(0.692)	(0.189)	(2.282)
Time	-0.364	-0.047	-1.693**
	(0.454)	(0.085)	(1.007)
ACE	0.610	1.094	-0.772
	(1.104)	(3.430)	(2.113)
Sales Growth t-1	0.000	0.000	0.000*
	(0.000)	(0.000)	(0.000)
Cash Flow Ratio t	-0.268***	-0.358**	0.057
	(0.006)	(0.165)	(0.063)
Debt Ratio t-1	-0.008***	0.103*	0.051***
	(0.001)	(0.061)	(0.013)
Industry dummies	Yes	Yes	Yes
N	32,451	25,837	6,614
R^2	0.1894	0.2511	0.3019

companies before and after the tax reform. Hence, the sample consists of pre-treatment (2001-2005) and post-treatment (2006-2007) data for Belgian (treatment) and French (control) companies. In order to ascertain that the control group is adequate, capital structure trends are analyzed and a propensity score method is used to match treatment and control firms.

Consistent with the theoretical prediction, the empirical results report a significant negative impact of the reform on the leverage of companies subject to the equity tax shield. I found that the estimated impact is highly significant and that it amounts economically to a leverage decrease of approximately 2-7%, meaning that a traditional tax system encourages companies to use on average 2-7% more debt than when there is an equal tax treatment of debt and equity. Further extension of the analysis reveals that large companies experience a higher effect from the equity tax shield than small and medium companies.

Having established a strong relation between taxation and debt policy, it would be interesting to study the channels through which the ACE system affects a company's leverage. To explore these channels, additional data related to dividends and retained earnings should be collected, as they are not available in the current database. Moreover, in order to control for the potential effect of the former coordination center regime, it would be useful to identify those companies in the sample which benefitted from the regime during the period 2001-2007. A relevant research track would also be to expand the analysis to the impact of the tax reform on the debt level of a company. This would allow to measure the effect of the treatment in absolute terms rather than in relative terms. Furthermore, in the wake of the financial crisis, it would be interesting to study the impact of the tax discrimination between debt and equity for the banking sector and to determine how more tax neutrality has affected the financial stability within this sector.

CHAPTER 2

Investment and Financing Strategy of a Multinational Enterprise under Alternative Tax Designs

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Joint work with Marcel GERARD

2.1 Introduction and Motivation

As shown by the corporate finance literature, corporate taxation distorts a company's financial decision making in a twofold way. First, the unequal tax treatment of debt and equity, applied by most tax systems, influences a company's capital structure. Based on Modigliani and Miller (1958,1963)'s work, Stiglitz (1973) and King (1974) formalized the incidence of the tax discrimination between debt and equity on the cost of capital and the value of a single firm. Their work triggered an important number of empirical studies quantifying the impact of the distortions due to this tax discrimination (a.o. Kaplan (1989),

Fama and French (1998), Desai et al. (2004)). Second, the corporate tax differences between countries impact the functioning of multinational enterprises (MNEs). A company active in a multinational setting faces a wide range of tax regulations, characterized by diversity in the definition of the tax base and in tax rates. The existence of as many tax codes as countries, therefore, is at the root of many strategic behaviors of MNEs. International tax divergences enhance cross-border tax arbitrage and as a result impact the level of foreign direct investment (a.o. Hartman (1985), Weichenrieder (1996)), the choice of legal form (a.o. De Mooij and Nicodeme (2008)) and the location decision (a.o. Hines (1996a), Devereux and Griffith (1998)) of companies regarding real investment as well as taxable income. A MNE, however, is also confronted with a lot of barriers impeding the development of cross-border activities. One considerable hurdle hampering international business is the administrative burden related to the diversity of national tax codes. Another major obstacle is double (or even multiple) taxation, i.e. the double (or multiple) taxation of the same multinational regarding the same revenue during the same time period.

In order to tackle these distortions, several institutional bodies, aiming at the development of international trade, tend to eliminate barriers to cross-border activities by providing a set of rules, guidelines and suggestions. For MNEs taxed in the European Union, two institutional bodies have played a major role in shaping international rules for tax purposes. A first institutional body, is the Organisation for Economic Cooperation and Development (OECD), regrouping the governments of around thirty countries. It suggested in 1958 a "Model Tax Convention" as framework for the negotiation of international tax treaties. Those tax treaties, concluded between two countries, aim at avoiding double taxation of income or capital by providing a tax relief system. A second institutional body is the European Commission, aiming at the achievement of the Single Market. In the past it issued two direct tax Directives, abolishing with-

holding taxes on dividend, interest and royalty payments between associated companies of different Member States (Parent-Subsidiary Directive (90/435/EEC) and Interests and Royalties Directive (2003/49/EC)). In order to take hold of the administrative burden related to international taxation, the European Commission introduced in 2011 a Directive proposal to adopt a Common Consolidated Corporate Tax Base (CCCTB), taxing a MNE on its consolidated tax base instead of taxing each entity separately (EU Commission (2011)).

The topic of profit-shifting and the strategic behavior of MNEs was addressed in several studies (Allingham and Sandmo (1972), Grubert and Mutti (1991), Hines and Rice (1994), Mintz and Smart (2004)). Moreover, various authors theoretically studied how the tax environment determines the behavior of the firm. In particular, the shift from separate taxation to consolidated taxation has been analyzed extensively (a.o. McLure (1980), Weiner (1994), Mintz (2000)). Gerard (2007) and Gerard and Traversa (2010) showed how the use of anti-abuse measures can counter the adverse results obtained if only a subgroup of countries shift to consolidated taxation.

Three features differentiate this paper from previous research. First, we simultaneously investigate a real variable, i.e. the international distribution of investment, and a financial variable, i.e. the amount of internal debt. We determine how each tax design alters the investment and financing decisions of a MNE and especially focus on how it creates incentives to use internal debt. This is the main originality of this paper. Another feature that differentiates this study from the previous ones is that we follow the development of MNE taxation from the issuing of the OECD Model Tax Convention (1958) to the EU Directive proposal regarding a Common Consolidated Corporate Tax Base (2011). Hence, we focus on those tax designs related to the evolution of MNE taxation in the European Union. Finally, we analyze alternative tracks for MNE taxation and determine how they would alter a MNE's tax strategies. As

such, we contribute to the evaluation of the existing tax environments, by comparing them with alternative tax environments serving the same objectives. At a moment where a proposal for a European common tax approach was issued, this study is markedly relevant, in particular as it would not be surprising to see the proposal rejected by some EU Member States.

Our analysis leads to several results. First, the differences between the initial and optimal levels of investment and internal debt, illustrate the large set of profit-shifting opportunities, which various tax environments offer to MNEs. Second, we found that the use of a credit method as tax relief for cross-border dividends leads to a financially efficient solution and the elimination of profit-shifting incentives. Third, although not entirely eliminating the incentive to use a lucrative detour, we found that a combined ACE-CBIT system may offer a valuable alternative to the introduction of a common consolidated tax base.

In section 2, we present the framework of our study and we model a world where no international tax rules are at work. We consider both the case where the profits are reported in the country in which they are generated and the case where a lucrative detour is used. In section 3, we analyze a MNE's profit-shifting behavior under separate taxation. We start with the rules provided by the OECD Model Tax Convention and we then successively introduce the rules provided by the EU direct tax Directives related to MNE taxation. In section 4, we leave systems based on separate taxation aside and turn to MNE taxation based on a consolidated tax base. We analyze the setting where this type of taxation is adopted by all EU Member States, as well as the setting where it is adopted by a sole subset of them (Enhanced Cooperation Agreement). Section 5 sets out the policy implications of the analysis. Section 6 concludes.

2.2 The Model

In order to analyze the impact of the tax environment on a MNE's profit-shifting behavior, a theoretical model is developed. In that model, we progressively incorporate the international tax rules proper to each of the tax environments. First, we present the framework against which the theoretical model is developed. Then, we model the tax situation of a MNE in an institutional environment, free of any international tax rules and subject to double (or multiple) taxation of the same income.

2.2.1 Framework

In the model, we consider a MNE which is present in three countries p, i and j. Countries p and i have the resources to host a production activity and they have the consumers to host an economic market on which the products of the MNE can be distributed; country j does not. Country p hosts the parent company of the MNE (which is a production and commercial company), country i a fully-owned commercial subsidiary and country j a service subsidiary.

Additionally, we suppose that the size of the country is expressed according to the size of the economic market. As we assume that the fraction of sales of the MNE in country p, denoted by q, exceeds that in country i, denoted by $(1-q)$ (i.e. $q > 1-q$), country p is larger than country i, which in turn is larger than country j. We assume that this relation also holds for the fraction of real investment, i.e. real investment in country p (α) exceeds that in country i $(1-\alpha)$ (i.e. $\alpha > 1-\alpha$). Total sales and total investment amount each to unity. Moreover, we consider that the distribution of investment α is controlled by the MNE, but that the distribution of sales q is given. In other words, capital is mobile but final demand is not. Focusing on those variables we deliberately seem to leave aside other important aspects like transfer pricing. Transfer pricing is, however, as much as the internal debt, an illustration of profit-shifting activities and paper profit generation. Finally, we require that both q

and α are between 0 and 1.

For the purposes of the model, we assume that p^r is the retail price (discounted on an infinite horizon), which is exogenously determined by the final market and obtained by selling the product on that market. Moreover, p^w is the wholesale price, also exogenously determined by the wholesale market and paid by one entity of the MNE to another entity for acquiring its production. Such intra-MNE trade occurs because we assume sales to be performed by the local entity, either the subsidiary located in i or the parent company located in p.

Regarding the funding of the MNE, suppose the subsidiary in country j is entirely financed through shares. The subsidiary in country i is funded partially through a loan granted by the parent company and partially through shares. Hence, an amount x represents the present value of interest payments (discounted over an infinite horizon)[1] made by the subsidiary to its parent company and corresponds to the value of the internal debt. Interest payments are a deductible expense for the paying entity but a taxable item for the receiving one.

Two types of taxes are at work in the model, the corporate income tax (τ) and withholding taxes (w). Regarding the first type of taxes, i.e. the corporate income tax, we assume that the profits generated by a subsidiary are subject to the corporate tax of its host country i or j, and possibly to the corporate tax of the parent's country (MNE's home country). The second type of taxes, withholding taxes, are levied at source on interest and dividend payments. Since we assume that each subsidiary distributes its entire after-tax profits as dividend to its parent, the host country of the subsidiary levies a withholding tax w on this dividend. In our model, we designate those withholding taxes as w_i^d and w_j^d, where the superscripts refer to the type of income (interest i or dividend d) and the subscripts to the countries (i or j). Furthermore, if

[1] In this model, nothing opposes x to be negative; that corresponds to a situation where the entity makes a loan to its parent for profit-shifting purposes.

one of the entities needs to pay interest to another entity, the country of the paying entity levies a withholding tax w_i^i or w_j^i on the interest paid. We do not explicitly investigate the determination of the tax rates by the respective countries at stake. The relative values of the tax rates stem from the assumptions that we issue regarding the relative size of the countries. Consistent with the theory that large countries are less subject to tax competition than small countries, we assume that corporate tax rates τ are given and that they increase with the size of the country $(0 \leq \tau_j < \tau_i < \tau_p < 1)$[2]. Finally, we suppose that the corporate tax rates τ are considerably higher than the withholding tax rates w, an assumption in line with most frequent observations.

2.2.2 Absence of International Tax Rules

In a first stage, we consider the taxation of a MNE in an institutional environment without any international tax rule. As such, the MNE is subject to the tax rules of all countries in which it has economic activities. Hence, both the host country of the subsidiary and the home country of the MNE claim the right to tax the profits generated by the subsidiary and paid out to the parent company as dividend. Consequently, we assume maximal taxation and suppose that each cross-border income is taxed three times: τ_{host}, w_{host} and τ_{home}. We first consider a case without a lucrative detour, then we introduce the profit-shifting strategy of making a lucrative detour through country j.

2.2.2.1 Without lucrative detour

Suppose that the MNE is not engaged in profit-shifting activities and reports the profits where they are generated. Hence, only countries p and i collect taxes from the MNE, as we assumed that country j does not have the resources to host an economic activity.

Assume that B_p is the pre-tax profit of the MNE generated in country

[2]This is in line with the literature on tax competition and might be shown with a simple model. That result has been established a.o. by Kanbur and Keen (1993) for commodity taxation and extensively used since then.

p. It consists of the revenues of selling q to consumers in country p, the revenues of selling production $(\alpha - q)$ to the group entity in country i, and the amount of interest x received from the entity in country i.

$$B_p = p^r q + p^w(\alpha - q) + x \tag{2.1}$$

Similarly, assume that B_i is the pre-tax profit of the MNE generated in country i. It consists of the sales $(1 - q)$ to consumers in country i from which the cost of acquiring a fraction of the parent's production, as well as the interest payments x are subtracted.

$$B_i = p^r(1 - q) - p^w(\alpha - q) - x \tag{2.2}$$

As no international tax relief rules exist, we assume that cross-border income is subject to triple taxation. First, the host country i levies corporate income tax (τ_i) on the subsidiary's profits. Then, as the subsidiary in country i pays out interests to its parent company, withholding tax w_i^i is levied by country i on those interest payments x. The subsidiary in country i distributing its entire after-tax profit as dividend to its parent, a second tax applies, i.e. a withholding tax w_i^d levied by country i on this dividend. From his side, the home country of the MNE claims the right to tax the profit generated by the subsidiary and levies corporate income tax τ_p on both benefits, B_i and B_p. Hence, B_i is taxed for a third time.

Moreover, adjusting its investment and internal debt levels triggers some additional costs for the MNE. According to the existing literature, we assume a quadratic cost function. Let $\frac{c}{2}(x - x_0)^2$ be the cost of adjusting the amount of interest from its initial amount x_0 to optimal amount x and $\frac{\gamma}{2}(\alpha - \alpha_0)^2$ the cost of modifying investment from its initial distribution α_0 to optimal distribution α. We request $0 \leq \alpha \leq 1$.

Assume the present value $V(\alpha, x)$ of the MNE is computed as its after-tax profits. Since the MNE seeks to maximize its present value $V(\alpha, x)$ with

respect to investment α and interest payments x, its objective function becomes

$$\begin{aligned}\max_{\alpha,x} V(\alpha,x) &= (1-\tau_p)B_p + (1-w_i^d)[(1-\tau_i)B_i - xw_i^i] \\ &\quad -\tau_p B_i - \frac{\gamma}{2}(\alpha-\alpha_0)^2 - \frac{c}{2}(x-x_0)^2 \end{aligned} \tag{2.3}$$

where the first term is the after-tax profits of the parent company, the second term the profit of the subsidiary after being taxed by its host country, the third term the tax levied by the home country and the last two terms the adjusting costs of moving to optimal values of α and x.

When maximizing the MNE's objective function with respect to the fraction of real investment α and to interest payments x, we obtain the following first order conditions:

$$\frac{dV(\alpha,x)}{d\alpha} = \left[1-(1-w_i^d)(1-\tau_i)\right]p^w - \gamma(\alpha-\alpha_0) = 0 \tag{2.4}$$

$$\frac{dV(\alpha,x)}{dx} = 1-(1-w_i^d)(-\tau_i+w_i^i) - c(x-x_0) = 0 \tag{2.5}$$

and second order conditions:

$$\frac{d^2V(\alpha,x)}{d\alpha^2} = -\gamma < 0 \tag{2.6}$$

$$\frac{d^2V(\alpha,x)}{dx^2} = -c < 0 \tag{2.7}$$

Based on the first order conditions, the equilibrium values of α and x in country p can be expressed as

$$\alpha^{NIR} = \alpha_0 + \frac{\tau_i - (1-\tau_i)w_i^d}{\gamma}p^w \tag{2.8}$$

$$= \alpha_0 + \frac{ETR^d_{i,NIR}}{\gamma} p^w \tag{2.9}$$

$$x^{NIR} = x_0 + \frac{\tau_i + (1-\tau_i)w^d_i - (1-w^d_i)w^i_i}{c} \tag{2.10}$$

$$= x_0 + \frac{ETR^d_{i,NIR} - ETR^i_{i,NIR}}{c} \tag{2.11}$$

In the equations above $ETR^d_{i,NIR}$ stands for the effective tax rate on dividends paid out in country i in an environment without international tax rules and without lucrative detour. Similarly, $ETR^i_{i,NIR}$ stands for the effective tax rate on interests paid in country i.

Given a tax environment without lucrative detour, it turns out that the optimal level of real investment α^{NIR} increases when the effective tax rate on dividends paid by the subsidiary increases. Hence, the investment in country p increases with taxation of dividends in country i. As total investment amounts to unity, investment in country i is discouraged when the effective tax rate on dividends raises. Note that the corporate tax rate in country p does not influence the effective tax rate on dividends. Indeed profits are taxed similarly in country p wherever they have been generated.

Regarding the optimal amount of internal debt, it increases with the effective tax rate differential between dividends and interests. In particular, if the effective tax rate on dividends exceeds that on interests, the MNE has an incentive to circulate the profits as interest payments rather than as dividends, and vice versa. Also for interests, the corporate tax rate in country p does not influence the effective tax rate. In addition, when $ETR^d_i = ETR^i_i$, $x = x_0$ and financial neutrality or the famous "irrelevance of corporate finance" is at work.

2.2.2.2 With lucrative detour

We now consider the case where the MNE, in order to optimize its after-tax profit, will try to locate part of its profits in the country with the lowest tax rate. Country j corresponds to this criterion. However, country j only hosts a service subsidiary of the MNE, since it offers no opportunity for production or consumption. Hence, the MNE will not make real investments in country j. One option for the MNE to benefit from country j's favorable tax rate, is to make a detour through country j to invest indirectly in country i. Instead of the parent company directly granting a loan to the subsidiary in country i, it now makes a lucrative detour through the entity in country j, which then grants a loan to the subsidiary in country i.

As a result, the pre-tax profit B_p consists of the revenues of selling q in country p and of the revenues of selling $(\alpha - q)$ to the group entity in country i.

$$B_p = p^r q + p^w(\alpha - q) \tag{2.12}$$

Pre-tax profit B_i consists of the revenues of selling $(1 - q)$ in country i from which the interest payments x, as well as the cost of acquiring a fraction of p's production is subtracted.

$$B_i = p^r(1 - q) - p^w(\alpha - q) - x \tag{2.13}$$

Hosting a service subsidiary granting loans to other group members, the pre-tax profit B_j consists of the interests paid by the subsidiary in country i.

$$B_j = x \tag{2.14}$$

As no tax relief rules exist, cross-border dividends and interests are subject to triple taxation. First, the profits B_i and B_j are subject to their

host country's corporate tax (τ_i and τ_j respectively). Second, since both subsidiaries distribute their entire after-tax income as dividend to their parent and since the subsidiary in country i pays out interests to the subsidiary in country j, these outgoing dividends and interest are subject to a withholding tax (w_i^d, w_j^d and w_i^i respectively). Finally, the profits of all group entities are subject to the home country's corporate income tax τ_p. This leads to expressing the MNE's objective function as

$$\begin{aligned} \max_{\alpha,x} V(\alpha,x) &= (1-\tau_p)B_p + (1-w_i^d)[(1-\tau_i)B_i - xw_i^i] \\ &\quad +(1-w_j^d)(1-\tau_j)B_j - \tau_p(B_i+B_j) \\ &\quad -\frac{\gamma}{2}(\alpha-\alpha_0)^2 - \frac{c}{2}(x-x_0)^2 \end{aligned} \tag{2.15}$$

where the first term is the after-tax profits of the parent company, the two following terms the profits of the subsidiary after being taxed by its host country, the fourth term the tax levied by the home country and the last two terms the adjusting costs of moving to optimal values of α and x.

When maximizing the MNE's objective function with respect to the fraction of real investment α and to the amount of interest payments x, we obtain the following first order conditions:

$$\frac{dV(\alpha,x)}{d\alpha} = [1-(1-w_i^d)(1-\tau_i)]p^w - \gamma(\alpha-\alpha_0) = 0 \tag{2.16}$$

$$\frac{dV(\alpha,x)}{dx} = -(1-w_i^d)(1-\tau_i+w_i^i)+(1-w_j^d)(1-\tau_j)-c(x-x_0) = 0 \tag{2.17}$$

and the same second order conditions as under section 2.2.2.1. The equilibrium values of α and x in country p can be expressed as

$$\alpha^{NIRD} = \alpha_0 + \frac{\tau_i + (1-\tau_i)\, w_i^d}{\gamma} p^w$$

$$\begin{aligned} &= \alpha_0 + \frac{ETR^d_{i,NIRD}}{\gamma} p^w \\ &= \alpha^{NIR} \end{aligned} \tag{2.18}$$

$$\begin{aligned} x^{NIRD} &= x_0 + \frac{[\tau_i + (1-\tau_i)w^d_i] - [(1-w^d_i)w^i_i] - [\tau_j + w^d_j(1-\tau_j)]}{c} \\ &= x_0 + \frac{ETR^d_{i,NIRD} - ETR^i_{i,NIRD} - ETR^d_{j,NIRD}}{c} \\ &= x^{NIR} - \frac{ETR^d_{j,NIRD}}{c} \end{aligned} \tag{2.19}$$

where the effective tax rate on dividends and interests in country i are unchanged.

When comparing these equilibrium values with those related to an environment without lucrative detour, we observe that a detour through country j does not alter the optimal investment level. The optimal amount of internal debt, however, is smaller when shifting income using a lucrative detour, what might seem surprising. Since country p taxes x in any case, making a detour through j instead of going directly from i to p simply introduces an extra tax burden.

Finally, in order to determine whether using a detour is really lucrative, we need to compute the additional value of the MNE when moving through country j. Substituting for the variables α and x their equilibrium values in equations (2.3) and (2.15), enables to generate the value of the MNE under both environments.

So far, we have considered a world without international tax rules. Therefore, companies are entirely free to organize their transactions according to their economic needs. As shown by the model, some of their profit is, however, subject to multiple taxation. When relaxing the assumption that no international tax rules exist, the model changes considerably. Starting from the last tax environment (section 2.2.2.2), several tax environments are compared. For each of them, we compute the optimal investment level and interest level, and we compare them with the results

found before.

2.3 EU Taxation under Separate Accounting

In this section, we analyze the tax situation of a MNE active in the current European Union (EU) setting. Several tax relief systems are available, both preventing double corporate taxation and withholding taxes. We first extend the model to an environment comprising the rules provided by the OECD Model Tax Convention. Then, we suppose the EU Parent-Subsidiary Directive (90/435/EEC) and Interests and Royalties Directive (2003/49/EC) at work. Finally, we model in that framework the introduction of a combined ACE-CBIT system.

2.3.1 OECD Model Tax Convention

A first institutional body, which has shaped international double tax relief rules, is the Organisation for Economic Cooperation (OECD). This organization, regrouping the governments of around thirty countries, suggested in 1958 a "Model Tax Convention" as framework for the negotiation of international tax treaties. Those tax treaties, concluded between two countries, aim at avoiding double taxation of income or capital by providing a tax relief system. When entering into a double tax treaty according to the OECD Model Tax Convention, countries need to choose between two methods of double tax relief, the credit method and the exemption system. Under a credit method, the country of the beneficiary may tax cross-border income provided that the taxes paid abroad are deductible at home. Under an exemption system, the country of the beneficiary may tax at most a fraction δ of cross-border income.

In the model below, we assume again that the MNE organizes its financial structure in order to benefit from the lowest tax rate, which country j offers to corporate profits. Hence, a lucrative detour through country j is used and the profits are defined as under section 2.2.2.2.

2.3.1.1 Credit method for dividends

One method to avoid the double taxation of dividends is to request from the taxing country to credit foreign withholding tax. Under a credit method as defined by the OECD Model Tax Convention (also called 'direct credit'), the country of the beneficiary may only tax cross-border income provided that withholding taxes paid abroad are deductible at home up to the amount of taxes owed to the country of the beneficiary. This means that the host country, on top of corporate income tax, will levy a withholding tax on cross-border dividends and that the home country p credits this tax on its corporate income tax (up to the amount that country p would have collected). Hence, the cross-border dividends will be taxed at the highest of following tax rates: the corporate income tax levied by country p and the withholding tax levied by country i.
Note that this definition of the credit method differs from the one given by the EU Parent-Subsidiary Directive (90/435/EEC), which will be modeled in the following subsection. For interests, we assume that the country of the company paying the interests (country i) levies a withholding tax on that amount. Knowing that pretax profits are defined as under section 2.2.2.2, the MNE will define its objective function as follows,

$$\begin{aligned}\max_{\alpha,x} V(\alpha,x) &= (1-\tau_p)B_p + (1-\max\left\{\tau_p, w_i^d\right\})[(1-\tau_i)B_i - xw_i^i] \\ &\quad +(1-\max\left\{\tau_p, w_j^d\right\})(1-\tau_j)B_j \\ &\quad -\frac{\gamma}{2}(\alpha-\alpha_0)^2 - \frac{c}{2}(x-x_0)^2 \qquad (2.20)\end{aligned}$$

where the first term is the after-tax profits of the parent company, the two following terms the profits of the subsidiary after being taxed by its host country, and the last two terms the adjusting costs of moving to optimal values of α and x. Since we assumed that corporate tax rates are higher than withholding tax rates, the home country will only levy that fraction of its corporate income tax which exceeds the withholding

tax levied by the host country. Hence, $\max(\tau_p, w_i^d) = \max(\tau_p, w_j^d) = \tau_p$. When maximizing the value of the firm with respect to the fraction of real investment α and to the amount of interest x, we obtain the following first order conditions,

$$\frac{dV(\alpha,x)}{d\alpha} = [(1-\tau_p) - (1-\tau_p)(1-\tau_i)]p^w - \gamma(\alpha - \alpha_0) = 0 \quad (2.21)$$

$$\frac{dV(\alpha,x)}{dx} = -(1-\tau_p)(1-\tau_i+w_i^i)+(1-\tau_p)(1-\tau_j+w_i^i)-c(x-x_0) = 0 \quad (2.22)$$

and the same second order conditions as under section 2.2.2.1. It turns out that the equilibrium values of α and x in country p are,

$$\begin{aligned} \alpha^{OCRE} &= \alpha_0 + \frac{\tau_i(1-\tau_p)}{\gamma}p^w \\ &= \alpha_0 + \frac{ETR^d_{i,OCRE}}{\gamma}p^w \end{aligned} \quad (2.23)$$

and

$$\begin{aligned} x^{OCRE} &= x_0 + \frac{\tau_i(1-\tau_p) - w_i^i(1-\tau_p) - \tau_j(1-\tau_p)}{c} \\ &= x_0 + \frac{ETR^d_{i,OCRE} - ETR^i_{i,OCRE} - ETR^d_{j,OCRE}}{c} \end{aligned} \quad (2.24)$$

We observe that the effective tax rates on dividends and interests are now influenced by the corporate tax rate in country p. Moreover, comparing these optimal values with the values found in the previous section reveals that investment in country p increases when double taxation is eliminated. The optimal amount of internal debt depends of the corporate tax rate of the three countries involved, as well as on the withholding tax rate of country i. The higher the effective tax rate of dividends with respect to interests, the higher the incentive to shift income by using

internal debt.

2.3.1.2 Exemption method for dividends

Another method to avoid the double taxation of dividends is to exempt the cross-border dividend from corporate taxation in the country of the beneficiary. The OECD Model Tax Convention stipulates that the country of the beneficiary may tax at most a fraction δ of the cross-border dividends.

Hence, the host countries will levy corporate tax and withholding tax on the dividends distributed by the subsidiaries to the parent company. Only a fraction δ of those dividends is subject to the corporate tax of country p. For cross-border interests, we assume that only the country of the paying company may levy a withholding tax on that amount. Hence, the interests paid out by the subsidiary in country i to the subsidiary in country j is subject to a withholding tax w_i^i. As a result, the MNE's objective function becomes

$$\begin{aligned}\max_{\alpha,x} V(\alpha,x) &= (1-\tau_p)B_p + (1-\delta\tau_p)(1-w_i^d)[(1-\tau_i)B_i - xw_i^i] \\ &\quad +(1-\delta\tau_p)(1-w_j^d)(1-\tau_j)B_j \\ &\quad -\frac{\gamma}{2}(\alpha-\alpha_0)^2 - \frac{c}{2}(x-x_0)^2 \qquad (2.25)\end{aligned}$$

where the pretax profits are defined as under section 2.2.2.2 and where the first term is the after-tax profits of the parent company, the two following terms the profits of the subsidiary after being taxed by its respective host country, and the last two terms the adjusting costs of moving to optimal values of α and x.

When maximizing the MNE's objective function with respect to α and x, we obtain the following first order conditions:

$$\frac{dV(\alpha,x)}{d\alpha} = [(1-\tau_p)-(1-\delta\tau_p)(1-w_i^d)(1-\tau_i)]p^w - \gamma(\alpha-\alpha_0) = 0 \quad (2.26)$$

$$\begin{aligned}\frac{dV(\alpha,x)}{dx} &= -(1-\delta\tau_p)(1-w_i^d)(1-\tau_i+w_i^i) \\ &\quad +(1-\delta\tau_p)(1-w_j^d)(1-\tau_j)-c(x-x_0)=0 \quad (2.27)\end{aligned}$$

and the same second order conditions as under section 2.2.2.1. The equilibrium values of α and x in country p are given by

$$\begin{aligned}\alpha^{OEXE} &= \alpha_0+\frac{(1-\tau_p)-(1-\delta\tau_p)(1-w_i^d)(1-\tau_i)}{\gamma}p^w \quad (2.28)\\ &= \alpha_0+\frac{ETR^d_{i,OEXE}-\tau_p}{\gamma}p^w\end{aligned}$$

and

$$\begin{aligned}x^{OEXE} &= x_0+\frac{(1-\delta\tau_p)[(1-w_i^d)(1-\tau_i)-(1-w_i^d)w_i^i-(1-w_j^d)(1-\tau_j)]}{c}\\ &= x_0+\frac{-ETR^d_{i,OEXE}-ETR^i_{i,OEXE}+ETR^d_{j,OEXE}}{c} \quad (2.29)\end{aligned}$$

Once more, we observe that real investment in country p increases with the effective tax rate on dividends paid in country i. The tax relief system provided by the OECD Model Tax Convention, therefore, encourages foreign investment. Moreover, as under the credit method, the corporate tax rate of country p influences the fraction of investment, as well as the amount of interest x^{OEXE} shifted. The higher the corporate tax rate of country p, the lower the optimal amount of interest shifted to country j. Hence, the OECD tax relief system discourages interest shifting.

2.3.2 EU Direct Tax Directives

In a second setting, the rules of the OECD Model Tax Convention are supplemented by the EU treaties, regulations, and directives. They set out the principles and rules for the creation of the Single Market, ensuring the free movement of goods, services, capital, and labor among the 27 EU Member States. Although tax sovereignty still applies in the EU, Member States can unanimously decide to give up part of their na-

tional sovereignty to enhance the development of common tax measures. With respect to direct taxation, two Directives are of major importance, i.e. the Parent-Subsidiary Directive (90/435/EEC) and the Interests and Royalties Directive (2003/49/EC), eliminating withholding taxes on dividend, interest and royalty payments between related companies. In order for those Directives to apply, companies need to be subject to corporate tax in the EU, be tax resident in an EU Member State, and be of a type listed in the Directives. We assume that the three countries of our model are Member States of the European Union and that the companies in those countries may apply the mentioned Directives.
Furthermore, in order to benefit from the withholding tax exemption for dividends, the EU parent company should hold at least 10% of the shares in its foreign EU subsidiary. In our model, we assume that those conditions are verified for all companies, including the entity in country j. Consequently, withholding taxes will no longer appear in our model.

2.3.2.1 Credit method for dividends

As the OECD Model Tax Convention, the EU Parent-Subsidiary Directive provides for two methods to avoid the double taxation of dividends. One of those is the credit method (full credit method), which slightly differs, however, from the one used in the OECD Model Tax Convention (direct credit method). Under full crediting, the country of the beneficiary may only tax cross-border income provided that all taxes paid abroad are deductible at home up to the amount of taxes owed to the country of the beneficiary. This means that the host country will levy corporate tax and that the home country credits this tax on its corporate tax up to the amount that it would have collected. As the EU direct tax Directives apply, all withholding taxes are eliminated and the cross-border dividends will be taxed at the highest of both corporate tax rates. This leads the MNE to define its objective function as follows,

$$\max_{\alpha,x} \; V(\alpha,x) \;\; = \;\; (1-\tau_p)B_p + (1-max\left\{\tau_p,\tau_i\right\})B_i$$

$$+(1 - max\{\tau_p, \tau_j\})B_j$$
$$-\frac{\gamma}{2}(\alpha - \alpha_0)^2 - \frac{c}{2}(x - x_0)^2 \quad (2.30)$$

As we assumed that $\tau_j < \tau_i < \tau_p$, this objective function can be rewritten as:

$$\max_{\alpha,x} V(\alpha, x) = (1 - \tau_p)B_p + (1 - \tau_p)B_i + (1 - \tau_p)B_j$$
$$-\frac{\gamma}{2}(\alpha - \alpha_0)^2 - \frac{c}{2}(x - x_0)^2 \quad (2.31)$$

where the profits are defined as under section 2.2.2.2 and where the first term is the after-tax profits of the parent company, the two following terms the profits of the subsidiary after being taxed by its respective host country, and the last two terms the adjusting costs of moving to optimal values of α and x.

When maximizing the value of the firm with respect to α and x, we obtain the following first order conditions:

$$\frac{dV(\alpha, x)}{d\alpha} = -\gamma(\alpha - \alpha_0) = 0 \quad (2.32)$$

$$\frac{dV(\alpha, x)}{dx} = -c(x - x_0) = 0 \quad (2.33)$$

and the same second order conditions as under section 2.2.2.1. The equilibrium values of α and x in country p can be written

$$\alpha^{ECRE} = \alpha_0 \quad (2.34)$$

$$x^{ECRE} = x_0 \quad (2.35)$$

We observe that the optimal values are independent of tax parameters,

meaning that the tax environment is neutral with respect to both the investment and finance decision of the MNE. The credit method under the EU Parent-Subsidiary Directive can, therefore, be considered as an economically efficient tax environment. Gerard and Traversa (2010) suggest to move to the credit system. A move to crediting, though, should imply - see section 2.3.2.1 above - that dividends from country j be taxed in a similar way as profits from countries p and i, thus in a similar way as profits not subject to a lucrative detour. Such a move, however, seems to be in contradiction with the trend among countries. Indeed, a country like the UK which was for long characterized by crediting has moved to exemption. The main reason, presumably, is that the credit method may create discrimination among domestic and other European resident shareholders, since credits hardly cross the national borders. Moreover, moving to a credit system does not prevent lucrative detours when the profit remains in the country of the subsidiary and is from there used to finance further investments of the MNE.

2.3.2.2 Exemption method for dividends

A second tax relief method provided for by the EU Parent-Subsidiary Directive, is to apply an exemption method. As under the OECD Model Tax Convention, the exemption method consists of exempting all but a fraction δ of the cross-border dividends from corporate taxation in the country of the beneficiary. Hence, after being subject to the corporate tax of their host country, a fraction δ of the dividends paid out by the subsidiaries is taxed according to the home country's corporate tax rate (τ_p). As the EU tax Directives apply, withholding taxes are eliminated both on dividends as on interests. This leads to the following objective function:

$$\begin{aligned} \max_{\alpha,x} \; V(\alpha, x) \quad &= \quad (1-\tau_p)B_p + (1-\delta\tau_p)(1-\tau_i)B_i \\ &\quad +(1-\delta\tau_p)(1-\tau_j)B_j \end{aligned}$$

$$-\frac{\gamma}{2}(\alpha-\alpha_0)^2-\frac{c}{2}(x-x_0)^2 \tag{2.36}$$

where the benefits are defined as under section 2.2.2.2 and where the first term is the after-tax profits of the parent company, the two following terms the profits of the subsidiary after being taxed by its respective host country, and the last two terms the adjusting costs of moving to optimal values of α and x.

When maximizing the MNE's objective function with respect to α and x, we obtain the following first order conditions:

$$\frac{dV(\alpha,x)}{d\alpha}=[(1-\tau_p)-(1-\delta\tau_p)(1-\tau_i)]p^w-\gamma(\alpha-\alpha_0)=0 \tag{2.37}$$

$$\frac{dV(\alpha,x)}{dx}=-(1-\delta\tau_p)(1-\tau_i)+(1-\delta\tau_p)(1-\tau_j)-c(x-x_0)=0 \tag{2.38}$$

and the same second order conditions as under section 2.2.2.1. The equilibrium values of α and x in country p become

$$\alpha^{EEXE}=\alpha_0+\frac{(1-\tau_p)-(1-\delta\tau_p)(1-\tau_i)}{\gamma}p^w \tag{2.39}$$

and

$$x^{EEXE}=x_0+\frac{(\tau_i-\tau_j)(1-\delta\tau_p)}{c} \tag{2.40}$$

Notice that in many countries, $\delta=0$. In that latter case,

$$\alpha^{EEXE}=\alpha_0+\frac{\tau_i-\tau_p}{\gamma}p^w \tag{2.41}$$

and

$$x^{EEXE}=x_0+\frac{\tau_i-\tau_j}{c} \tag{2.42}$$

We observe that neutrality of the tax system with respect to the investment and finance decision of the MNE further requires the equality among corporate tax rates.

2.3.2.3 Combination of ACE and CBIT

A suggestion to reduce the corporate tax distortion between sources of financing is the introduction of a system combining an Allowance for Corporate Equity (ACE) and a Comprehensive Business Income Tax (CBIT). Such proposition tackles the unequal tax treatment of debt and equity (and also retained earnings), by giving partial, but equal tax relief to both financing modes. Hence, the deductibility of interests is partially abolished and the deductibility of dividends is partially established. Suppose therefore that a fraction θ of the interests can no longer be deducted by the paying company, but that a tax shield is granted for a fraction $1-\theta$ of the dividend payments.

The ACE-CBIT system leaves the benefits before tax unchanged and the pretax profits B_p, B_i and B_j, therefore, have their usual definition. The tax base of the subsidiary in country i, however, is altered since a fraction θ of interests is no longer tax deductible. Consequently, for corporate tax purposes, the fraction θx is added to the pretax profits of the subsidiary in country i.

Moreover, since a tax shield is granted for a fraction $1-\theta$ of dividend payments, both subsidiaries can benefit from a tax advantage amounting to $\tau_{host}(1-\theta)$ of their dividends. As we assumed that the subsidiaries distribute their entire after-tax income as dividend to their parent company, the amount of dividends equals the subsidiary's after-tax profits. Assuming an exemption system for the taxation of dividends in line with the EU Parent-Subsidiary Directive, the company's objective function now is,

$$\begin{aligned}\max_{\alpha,x} V(\alpha,x) &= (1-\tau_p)B_p \\ &\quad +(1-\delta\tau_p)[B_i-\tau_i(B_i+\theta x)+\tau_i(1-\theta)(B_i+\theta x)]\end{aligned}$$

$$+(1-\delta\tau_p)[(B_j-\tau_j B_j+\tau_j(1-\theta)B_j] \\ -\frac{\gamma}{2}(\alpha-\alpha_0)^2-\frac{c}{2}(x-x_0)^2 \quad (2.43)$$

where the first term is the after-tax profits of the parent company, the two following terms the profits of the subsidiary after being taxed by its respective host country, and the last two terms the adjusting costs of moving to optimal values of α and x.

When maximizing the MNE's objective function with respect to α and x, we obtain the following first order conditions:

$$\frac{dV(\alpha,x)}{d\alpha}=[(1-\tau_p)-(1-\delta\tau_p)]p^w(1-\theta\tau_i)-\gamma(\alpha-\alpha_0)=0 \quad (2.44)$$

$$\frac{dV(\alpha,x)}{dx}=(1-\delta\tau_p)\theta\tau_i(1-\theta)-(1-\delta\tau_p)\theta\tau_j c-c(x-x_0)=0 \quad (2.45)$$

and the same second order conditions as under section 2.2.2.1. The equilibrium values of α and x in country p can be expressed as,

$$\alpha^{ACBIT}=\alpha_0+\frac{(1-\tau_p)-(1-\delta\tau_p)(1-\theta\tau_i)}{\gamma}p^w \quad (2.46)$$

$$x^{ACBIT}=x_0+\frac{(1-\delta\tau_p)\theta\tau_i(1-\theta)-(1-\delta\tau_p)\theta\tau_j}{c} \quad (2.47)$$

Especially if $\delta=0$ and $\theta=1/2$,

$$\alpha^{ACBIT}=\alpha_0+\frac{\frac{\tau_i}{2}-\tau_p}{\gamma}p^w \quad (2.48)$$

$$x^{ACBIT}=x_0+\frac{\tau_i-2\tau_j}{4c} \quad (2.49)$$

We observe that the ACE-CBIT system has lowered the impact of the corporate tax rate in country i in the distribution of investment compared to the exemption system (section 2.3.2.2). Moreover, it sharply decreased the optimal amount of internal debt and thus the importance of a profit-shifting strategy. Hence, the ACE-CBIT system provides for an interesting alternative, as it brings the amount of interest close to its efficient level.

2.4 EU Tax Environment under Consolidation

The analysis of an ACE-CBIT system shows that tax efficiency can be approached by other tax environments than the credit method. This system, however, does not entirely eliminate profit-shifting and does not tackle the compliance cost issue. This is mainly due to the fact that each entity is taxed separately, based on its individual accounts, without considering the group as a whole (Separate Accounting (SA) approach). In order to address this issue, countries like the United States and Canada decided, for state taxation purposes, to move to a system of consolidated taxation (called Consolidation and Formulary Apportionment (C&FA)). In this system, one consolidated tax base is computed, which is distributed amongst the affected countries according to a given apportionment formula. Also the European Union considers to move to such a system, suggesting a Common Consolidated Corporate Tax Base (CCCTB).

Because the unanimity principle for tax issues makes multinational decision-making difficult in the EU, the mechanism of an Enhanced Cooperation Agreement (ECA) may well be used for this purpose. This alternative decision-making method, adopted in the Treaty of Nice (2002), allows a minimum of eight EU Member States to integrate more or faster than other Member States. It was introduced as a means of tackling the problem of the growing diversity in the European Union and allowing the further integration and development of the European project.

In this section, we consider two situations. In the first one, all EU Member States unanimously decide to introduce the CCCTB taxation system; under the second one, only the countries p and i adopt the reform (under an Enhanced Cooperation Agreement) and country j stays out of the consolidation area.

2.4.1 Unanimity

Under a Common Consolidated Corporate Tax Base (CCCTB), one consolidated tax base is computed in which the intra-group payments of dividends, interests, and royalties are ignored. The pretax profits of all group companies are consolidated regardless of whether these companies are residents or non-residents of the MNE's home country. The consolidated tax base is then distributed amongst the countries using a formula. We assume that this formula is a weighted linear combination of real investment (with weight λ) and final sales (with weight $1-\lambda$). Each country taxes its tax base fraction according to its own tax rate.

Given that all intra-group income is ignored when consolidating, the consolidated tax base B consists solely of the revenues of selling to consumers. Since total sales amount to unity, B is expressed as:

$$B = p^r \tag{2.50}$$

The fraction of the consolidated profits B_p^{FA}, attributed to country p, consists of a fraction of B, proportional to investment and sales. As a result, the apportioned profits for country p and country i are:

$$B_p^{FA} = [\lambda\alpha + (1-\lambda)q]B \tag{2.51}$$

$$B_i^{FA} = [\lambda(1-\alpha) + (1-\lambda)(1-q)]B \tag{2.52}$$

Hence, the objective function of the MNE becomes:

$$\max_{\alpha,x} V(\alpha,x) = (1-\tau_p)B_p^{FA}+(1-\tau_i)B_i^{FA}-\frac{\gamma}{2}(\alpha-\alpha_0)^2-\frac{c}{2}(x-x_0)^2 \quad (2.53)$$

where the first term is the profit attributed to country p after being taxed by the home country, the second term the profits attributed to country i after being taxed by the host country and the last two terms the adjusting costs of moving to optimal values of α and x.

There is no longer room for interest-shifting under this tax environment, since intra-MNE movements vanish. Accordingly no tax base is allocated to country j. We then maximize the MNE's objective function with respect to the sole fraction of real investment α, keeping x possibly equal to x_0 in order to avoid the extra cost to set x equal to any other value. We obtain the first order condition

$$\frac{dV(\alpha,x)}{d\alpha} = (1-\tau_p)\lambda p^r - (1-\tau_i)\lambda p^r - \gamma(\alpha-\alpha_0) = 0 \quad (2.54)$$

and the equilibrium values of α and x are,

$$\alpha^{FA} = \alpha_0 + \frac{\tau_i - \tau_p}{\gamma}\lambda p^r \quad (2.55)$$

$$x^{FA} = x_0 \quad (2.56)$$

Two observations deserve attention at this point. First, as the irrelevance of the determination of x shows, there is no longer room for profit-shifting strategies with respect to the source of finance, the transfer price or any other instrument. Second, the move from separate accounting to consolidation might reduce tax competition and allow corporate tax rates to go up when determined as the outcome of a non-cooperative game

between countries. The condition therefore is that

$$\lambda p^r < p^w \tag{2.57}$$

Since we know that $p^r > p^w$ - the retail price exceeds the wholesale price - the condition requires that the weight of the formula be rather on the distribution of sales, the variable not or less under control of the MNE, or on the variable with respect to which the MNE is less elastic, than on the distribution of investment. That property has been demonstrated by Riedl and Runkel (2007) as well as by Gerard (2007).

Although that system exhibits interesting properties, it does not guarantee that every participating country will gain tax revenues. The case of j above is emblematic, since country j no longer has revenues to tax. It may therefore be difficult to convince all EU Member States to join the reform, and justifies that the adoption of the reform by a sole subset of Member States, through an Enhanced Cooperation Agreement, is investigated.

2.4.2 Enhanced Cooperation

The mechanism of an Enhanced Cooperation Agreement (ECA) allows a number of EU Member States to integrate more or faster than other Member States. Applied to the C&FA issue, this alternative decision-making method would cluster the EU Member States in two groups. One group of Member States would maintain their current separate accounting system in order for them to further attract corporations through their competitive tax system. The other group of Member States would implement the CCCTB, allowing them to lower corporate transaction costs.

Consider that only the active countries p and i adopt a common consolidated tax base and that country j decides to stay out of the consolidation area, maintaining its current environment. Hence, the use of profit-shifting strategies is relevant again and interests x will be shifted

from the consolidation area tot the service subsidiary outside of the area in country j.

The common tax base includes the tax bases of the active countries from which the flow of interest x shifted to country j is subtracted.

$$B = p^r - x \tag{2.58}$$

A separate tax base of the entity in country j coexists:

$$B_j = x \tag{2.59}$$

The objective function of the MNE remains:

$$\begin{aligned} \max_{\alpha,x} \; V(\alpha, x) &= (1-\tau_p)B_p^{FA} + (1-\tau_i)B_i^{FA} + (1-\tau_j)B_j \\ &\quad -\frac{\gamma}{2}(\alpha-\alpha_0)^2 - \frac{c}{2}(x-x_0)^2 \end{aligned} \tag{2.60}$$

The apportioned tax bases are defined as in the former section 2.4.1.

When maximizing the MNE's objective function with respect to α and x, we obtain the following first order conditions:

$$\frac{dV(\alpha,x)}{d\alpha} = (1-\tau_p)\lambda(p^r-x) - (1-\tau_i)\lambda(p^r-x) - \gamma(\alpha-\alpha_0) = 0 \tag{2.61}$$

$$\begin{aligned} \frac{dV(\alpha,x)}{dx} &= -(1-\tau_p)[q(1-\lambda)+\lambda\alpha] \\ &\quad -(1-\tau_i)[(1-q)(1-\lambda)+\lambda(1-\alpha)] \\ &\quad +(1-\tau_j) - c(x-x_0) = 0 \end{aligned} \tag{2.62}$$

The equilibrium values of α and x in country p can be expressed as:

$$\alpha^{ECA} = \frac{c\gamma\alpha_0 - c\lambda(\tau_i-\tau_p)(x_0-p^r) - (\tau_i-\tau_j) + (\tau_i-\tau_p)^2\lambda q(1-\lambda)}{-(\tau_i-\tau_p)^2\lambda^2 + c\gamma}$$

$$x^{ECA} = x_0 + \frac{(\tau_p - \tau_i)[q(1-\lambda) + \lambda\alpha^{ECA}] + (\tau_i - \tau_j)}{c}$$

Comparing those equilibrium values with the ones obtained under a unanimous introduction of the C&FA reform, we observe that optimal investment in the parent company is reduced and the optimal debt fraction is increased under enhanced cooperation. Hence, a detour through a non-consolidating country is still profitable. Not the cooperating countries, but the country staying out of the consolidation area benefits from the enhanced cooperation agreement, as an important number of tax planning strategies persist. We can therefore reasonably consider that the consolidating countries will attempt to counter this.

2.5 Policy Implications

Given the tax competition between Member States, it may be expected that some of them may not be willing to introduce a common consolidated tax base. Remote countries with attractive tax regimes like Ireland and Estonia may not be eager to give up their favorable tax features without having the guarantee of at least maintaining their current tax revenues. This is also the case for Member States which offer special depreciation schemes, R&D tax credits or other non-debt tax shields (like the Allowance for Corporate Equity in Belgium). As a result, it is highly probable that the introduction of a common consolidated tax base in the EU will only be possible through the use of an Enhanced Cooperation Agreement. The analysis above, however, has shown that the introduction of such a tax base by a limited number of Member States does not lead to efficient taxation and leaves room for income-shifting strategies. In line with the existing theoretical literature (a.o. Gerard and Traversa (2010)), we find that the use of a credit method as tax relief for cross-border dividends leads to a financially efficient solution and the elimination of profit-shifting incentives. Nonetheless, as noticed earlier, the

Table 2.1: Summary

	Optimal Investment	Optimal Debt Level
1.No international tax rules		
-Without profit-shifting	$\alpha_0 + \frac{\tau_i+(1-\tau_i)w_i^d}{\gamma}p^w$	$x_0 + \frac{\tau_i+(1-\tau_i)w_i^d-(1-w_i^d)w_i^i}{c}$
-With profit-shifting	$\alpha_0 + \frac{\tau_i+(1-\tau_i)w_i^d}{\gamma}p^w$	$x_0 + \frac{[\tau_i+(1-\tau_i)w_i^d]-[(1-w_i^d)w_i^i]-[\tau_j+w_j^d(1-\tau_j)]}{c}$
2.Separate Accounting		
2.1 OECD Tax Convention		
-Credit Method	$\alpha_0 + \frac{\tau_i(1-\tau_p)}{\gamma}p^w$	$x_0 + \frac{(\tau_i-w_i^i-\tau_j)(1-\tau_p)}{c}$
-Exemption	$\alpha_0 + \frac{(1-\tau_p)-(1-\delta\tau_p)(1-\tau_i)(1-w_i^d)}{\gamma}p^w$	$x_0 + \frac{(1-\delta\tau_p)[(1-w_i^d)(1-\tau_i)-(1-w_i^d)w_i^i-(1-w_j^d)(1-\tau_j)]}{c}$
2.2 EU Direct Tax Directives		
-Credit Method	α_0	x_0
-Exemption	$\alpha_0 + \frac{(1-\tau_p)-(1-\delta\tau_p)(1-\tau_i)}{\gamma}p^w$	$x_0 + \frac{(1-\delta\tau_p)[(1-\tau_j)-(1-\tau_i)]}{c}$
-ACE-CBIT	$\alpha_0 + \frac{(1-\tau_p)-(1-\delta\tau_p)(1-\tau_i\theta)}{\gamma}p^w$	$x_0 + \frac{(1-\delta\tau_p)[\theta\tau_j-\theta^2\tau_i-\theta\tau_j]}{c}$
3.Consolidation		
3.1 Unanimity	$\alpha_0 + \frac{\tau_i-\tau_p}{\gamma}\lambda p^r$	x_0
3.2 Enhanced Cooperation	$\frac{c\lambda(\tau_i-\tau_p)(x_0-p^r)+(\tau_i-\tau_j)-(\tau_i-\tau_p)^2\lambda q(1-\lambda)-c\gamma\alpha_0}{(\tau_i-\tau_p)^2\lambda^2-c\gamma}$	$x_0 + \frac{(\tau_p-\tau_i)[q(1-\lambda)+\lambda\alpha^{ECA}]+(\tau_i-\tau_j)}{c}$

political trend is to move away from crediting since it may create discrimination among domestic and other European shareholders. Therefore, Gerard and Traversa (2010) consider a second option to reduce profit-shifting strategies, the use of anti-abuse measures. Those rules aim at safeguarding the tax base of countries by making potentially lucrative detours no longer beneficial, even if profits are not repatriated. Those measures are known as Controlled Foreign Companies (CFC) rules. Such measures are familiar to US tax designers, but raise issues in the European Union, especially since, for some analysts, they are not compatible with EU law, in particular with the right of free establishment.

Although not entirely eliminating the incentive to use a lucrative detour, the above analysis finds that a combined ACE-CBIT system may offer a valuable alternative to the introduction of a common consolidated tax base. Giving partial but equal tax relief to both interest and dividend payments, it is the studied tax environment which reduces profit-shifting strategies at best. This environment has the advantage of not having to move to tax consolidation and to preserve national tax sovereignty to a larger extent.

2.6 Conclusions and further research tracks

In this paper we have investigated the impact of tax environments on the behavior of a multinational enterprise. We focused on two key decisions of MNEs, i.e. the distribution of investment among countries and the use of internal debt. Investigating a real and a financial decision simultaneously is the main originality of this paper. It especially deserves interest at a moment when empirical literature reveals that the impact of corporate taxation is probably stronger on financial decisions than on real decisions - see a.o. Princen (2010). Our analysis leads to several results. First, the optimal investment and debt levels illustrate the large set of profit-shifting opportunities, which various tax environments offer to MNEs. Second, we find that alternative environments,

like a combined ACE-CBIT system, provide relevant results to reduce profit-shifting strategies.

In this paper we have assumed and modeled a three country world and a single multinational firm. The real-world situation, however, is more complex and requires to take into account non-tax factors influencing a company's financial decision-making (a.o. industry, strategy, cash position). Moreover, subsidiaries are most often not restrained to sell goods in their host country, as it is assumed in the above model. Many variables are also considered to be exogenous even if this does not correspond to what is observed most commonly. Hence, several extensions of the model are possible for a more comprehensive study of the impact of tax environments on an MNE's behavior. Meanwhile, the obtained results give a first idea of the direction in which the analysis will go.

CHAPTER 3

International Tax Consolidation To Reduce Tax-Motivated Profit-Shifting ?

3.1 Introduction

Divergences across national tax codes add a high degree of complexity to the financial management of international companies engaged in cross-border activities. In addition to compliance costs, the diversity of tax rules gives rise to other burden, like double taxation. Although an important network of double tax treaties exists, double tax situations remain common, especially with respect to the computation of transfer pricing and the restructuring of international groups. Moreover, the losses of one group entity may most often not be offset against the profits of a foreign group entity. Hence, the international group with both loss-making and profit-making entities is not taxed as an economic unit but as a group of legally independent entities. Taking into account these tax distortions, multinational enterprises (MNEs) are a priori expected to suffer from the diversity of tax rules across countries. Numerous inconsistencies between national tax codes, however, give rise to a considerable

number of tax planning strategies. These cross-country inconsistencies allow multinational companies to engage in international tax arbitrage and to organize their economic activities in order to benefit from the most lucrative tax rules. The development of important tax-motivated strategies, however, distorts the financing decisions of companies and alters their income-generating activities.

For tax planning purposes, companies are expected to shift profits from high-tax to low-tax countries. The transfer of profits from one jurisdiction to another can take several forms. One strategy is to relocate expenses from low-tax to high-tax countries through the payment of management fees or royalties. Accordingly, profits are increased in the low-tax entity. Another strategy is to increase transfer prices paid to low-taxed entities. Several authors find evidence of tax-motivated transfer prices (a.o. Clausing (2003)). A third strategy is to transfer debt liabilities to a group entity in a high-tax country in order to benefit in an optimal way from the tax deductibility of interest expenses. Empirical work (a.o. Desai et al. (2004), Huizinga et al. (2008)) examines international debt shifting and finds evidence that international tax rate differences affect the capital structure of foreign affiliates. Several studies offer a general analysis, including all of these forms (o.a. Huizinga and Laeven (2008), Weichenrieder (2009)) and find evidence of tax-motivated profit-shifting.

As suggested by some authors (a.o. Summers (1988), Bucks and Mazerov (1993), Mintz and Smart (2004)), a way to reduce this tax-motivated profit-shifting, would be to introduce international tax consolidation. As for financial consolidation, tax consolidation aims at taxing the economic reality rather than the legal entities of a company. Group entities are therefore required to compute their tax base without taking into account the intra-group payments of dividends, interests, and royalties. The taxable revenues of all group companies are then consolidated regardless of whether these companies are residents or non-residents of the par-

ent company's country. Once consolidated, the income is distributed amongst the countries in which the MNE is active and which can tax their tax base portion according to their tax rate. This system is used by the U.S. for state taxation purposes (called 'Formulary Apportionment') and suggested by the European Commission to tax MNEs located in the EU. An alternative is to tax the consolidated income according to the tax rate of the parent's country and to grant tax relief for the corporate tax paid abroad. This system is used by those countries which introduced international tax consolidation as group taxation regime and will be referred to as international tax consolidation (ITC) in the remainder of the paper. Its taxation part is similar to the foreign tax-credit system, which is used by the U.S. for international tax purposes. Whatever alternative is chosen, an international tax consolidation system taxes the global group income, instead of taxing the income of each group member separately.

The theoretical literature regarding international tax consolidation mainly focuses on consolidation and formulary apportionment. McLure (1980), for instance, proofs that formulary apportionment leads to the taxation of the factors included in the formula. Nielsen et al. (2003) demonstrate that under oligopolistic competition, a transition to formulary apportionment may increase profit shifting activities. The U.S. harmonization process regarding consolidation and formulary apportionment, generated several empirical studies discussing different modes of C&FA and their efficiency (o.a. Shackelford and Slemrod (1998)). Using Canadian data, Mintz and Smart (2004) find that in the absence of tax consolidation, profit-shifting has substantial negative effects on the corporate tax base. Although international tax consolidation (ITC) pursues the same objectives as C&FA, its working and impact have received little or no attention in the finance literature. This makes the issue of international tax consolidation a deserving research area.

This paper aims at filling the gap by determining the effect of inter-

national tax consolidation on a company's profit-shifting behavior. A simple theoretical model is developed showing how the introduction of an international tax consolidation system can affect the profit-shifting behavior of a MNE. This model predicts that there will be less profits shifted after the introduction of an international tax consolidation (ITC) system. In order to empirically test this theoretical prediction, I focus on Italy, which introduced an international tax consolidation system ("worldwide consolidation") in its tax legislation in 2004. Policy variation allows to compare the profit-shifting behavior of companies subject to the consolidation system, with the behavior of not-affected companies. Access to pre and post-reform data allow me to use a difference-in-differences strategy, which creates a clean way to explore the use of tax-motivated profit-shifting. Such a natural experiment is a unique opportunity to measure the extent to which separate accounting encourages companies to engage in profit-shifting strategies. The empirical results show that profit-shifting is tax-motivated but they do not allow to infer any impact of international tax consolidation on the profit-shifting behavior of companies.

The remainder of the paper is organized as follows. Section 2 describes the institutional background and the principal characteristics of the international tax consolidation system in Italy. Section 3 presents the underlying analytical model and theoretically predicts how an international tax consolidation system impacts a company's profit-shifting behavior. Section 4 discusses the estimation strategy. Section 5 introduces the data set and the sample selection. Section 6 presents the empirical results and analyzes the impact of an ITC system with respect to profit-shifting. Section 7 sets out the policy implications of the analysis. Section 8 concludes.

3.2 Institutional Background

Before 2004, tax consolidation was inexistent in Italy. The domestic tax law did not distinguish between an isolated company and a company that is part of a national or international corporate group. Taxable income was determined for each legal entity separately and each entity was taxed in its home country as if it was an independent company. A separate accounting basis was used for corporate income tax (IRPEG, Imposta sul Reddito delle Persone Giuridiche) purposes. Hence, an Italian parent company with several subsidiaries at home or abroad was on the one hand, deprived from cross-border loss-offset for tax purposes. On the other hand, however, it could benefit from tax mitigating strategies, including those related to the shifting of income. The profitability of these strategies was mainly related to the double tax relief system provided by the parent country, preventing the double taxation of interest, dividend and royalty income. Moreover, group companies in the European Union could benefit from the EU Parent-Subsidiary Directive (90/435/EEC), abolishing withholding taxes on dividend payments between associated companies of different Member States, and from the Interests and Royalties Directive (2003/49/EC), eliminating withholding taxes on interest and royalty payments of related companies.

To illustrate, consider an Irish subsidiary fully owned by an Italian parent company. The statutory corporate tax rate in Italy in 2003 equaled 38.25%, whereas the statutory corporate tax rate in Ireland amounted to only 12.5%. Suppose the Italian parent company has generated profit which in principle is taxed as business profit under Italian tax law. In order to optimize its tax situation, the parent company shifts some of its income to a group entity, which is less taxed. One way to do so, is by paying interest to a group member as compensation for an amount of debt issued by this group member. Hence, if the Italian parent pays interest to its Irish subsidiary, the payments will be deductible for tax purposes and will give rise to a tax gain for the parent company. The

interest income will be taxed in Ireland at a lower tax rate than in Italy (12.5% instead of 38.25%). Assuming that the EU Interests and Royalties Directive applies, no withholding tax is levied by the source country. Hence, in the above presented international tax system, income-shifting is gainful.

As part of a broad reform of its corporate income tax code, Italy introduced an international tax consolidation system, effective from January 1, 2004 on. All Italian qualifying companies can from that moment on opt for one of two tax consolidation regimes, domestic tax consolidation or worldwide tax consolidation. Under the latter system, the consolidated income is taxed according to the tax rate of the parent country and the double taxation of this income is eliminated by granting tax relief for the foreign taxes paid. Once a MNE has made the choice to elect for worldwide tax consolidation, it can no longer apply for domestic tax consolidation and its choice is binding for five years. Moreover, the 'all-in all-out' principle holds, meaning that all applying non-resident subsidiaries are bound by the parent company's tax choice. Participation to the regime cannot be elected by subsidiaries for optimization purposes.

In order for the parent company to consolidate its taxable income with that of its foreign subsidiaries, several qualifying conditions apply. First, the applying company needs to be an Italian resident company, having legal personality. Second, the parent company needs to be listed or have as majority shareholder the Italian Treasury, a public body or an Italian resident individual, who does not control other companies either in Italy or abroad. Finally, the Italian company must be the ultimate parent company, meaning that it holds directly or indirectly at least 50% of the ownership in the subsidiary companies.

Once the Italian parent company has opted for worldwide tax consolidation, the taxable income of the foreign subsidiaries, for which the shareholder criteria are met, is allocated to the parent's tax base. This

allocation is made according to the percentage of shareholding of the parent in the subsidiary. Thus, if the parent company holds 75% of shares in the foreign subsidiary, 75% of the profits or losses of the subsidiary are taken into account for tax consolidation purposes. Hence, Italian tax authorities can tax the Italian parent company on a group tax base according to the Italian tax rate and rules. This, however, does not prevent foreign tax authorities to levy their own income tax on their resident subsidiaries which are part of the Italian tax group. The MNE can therefore be subject to a double taxation of income generated by a foreign subsidiary of the tax group. To avoid double taxation of this income, Italian tax authorities grant tax credit relief to the parent company for the foreign taxes paid by the non-resident group members. The tax relief is limited to the amount of the Italian tax incurred on the income.

To illustrate, consider again an Irish subsidiary fully owned by an Italian parent company and assume that all qualifying conditions for the international tax consolidation system hold. If the Italian parent pays interest to its Irish subsidiary, this intra-group transaction will be ignored to compute the corporate tax base. The interest expense of the Italian parent company will be offset by the interest income of the Irish subsidiary and the entire group income will be taxed according to the Italian corporate tax rate. Hence, the MNE will no longer use income-shifting strategies to benefit from the lower tax rate of one of its group members.

By introducing an international tax consolidation system, Italy followed the example of Denmark which uses a similar 'international joint taxation' system since 1960 and preceded Austria which established a comparable system in 2005. France introduced a resembling regime in 1966, which due to its strict conditions, is only applied by about ten large multinational groups. Other countries like Germany, Spain, the Netherlands, and Poland limit their consolidation system to domestic sub-

sidiaries, leaving foreign entities aside. Few countries, like Belgium and Greece, do not provide for a group taxation regime at all (Princen and Gerard (2008)).

The European Commission, hosting an important number of multinational companies and aiming at the achievement of the Single Market, issued a proposal for a Common Consolidated Corporate Tax Base (CCCTB) Directive in 2011 (EU Commission, 2011), to move to a system of consolidation and formulary apportionment. In this proposal, companies of all sizes located in the EU are offered the possibility to opt for CCCTB, which would harmonize tax rules without modifying accounting rules. Because the European project provides for formulary apportionment and not for a system of taxation by the MNE parent company (ITC), the results of this study can as such not be used to predict the impact of CCCTB. They could, however, provide gainful insights and advice regarding its implementation and therefore be useful for European policy makers.

3.3 Theoretical Model

To clarify the impact of international tax consolidation, a simple one period model is developed showing how a tax consolidation system affects the profit-shifting behavior of a MNE. Let the MNE consist of a parent company p and a foreign subsidiary i. Assume a standard tax system in which a firm is taxed on its end-of-period earnings after deduction of interest expenses and which is based on a constant marginal tax rate τ_p in country p and τ_i in country i. Suppose x is the fraction of profit shifted from the high-tax country to the low-tax country. As discussed above, this profit can take the form of expenses, transfer prices or interest. Shifting profit also triggers costs, which I model according to previous literature as a quadratic function of the fraction of profit shifted.

Under divergent national tax codes, the optimal fraction x of income shifted will depend on the relative size of the tax rates. Two scenarios

can be distinguished. Consider a first scenario where $\tau_p > \tau_i$. Hence, it is the parent company who will shift part of its profit to its foreign subsidiary in order for this part of the income to be taxed at a lower tax rate. Considering that the time period tends to infinity, a MNE seeks to maximize its value V, which is the sum of the values of its entities. Hence, the value of the parent company consist of its after-tax and after-shifting profits. The value of the subsidiary consists of its after-tax profits including the part of the parent's profit shifted. Assuming that B_p and B_i correspond to the pretax profits of the MNE in country p and i respectively, the MNE's objective function in a tax system without tax consolidation can be modeled as follows:

$$\begin{aligned} \max_x \ V^{MNE} &= (1-\tau_p)(1-x)B_p \\ &\quad +(1-\tau_i)(B_i + xB_p) - \frac{\gamma}{2}x^2 \end{aligned} \tag{3.1}$$

When maximizing equation (3.1) with respect to the fraction of profit shifted, the first order condition becomes:

$$\frac{dV^{MNE}}{dx} = (\tau_p - \tau_i)B_p - \gamma x = 0 \tag{3.2}$$

It follows from equation (3.2) that the optimal fraction of profit shifted is equal to:

$$x = \frac{(\tau_p - \tau_i)B_p}{\gamma} > 0 \tag{3.3}$$

and, as $\tau_p > \tau_i$ equation (3.3) is strictly positive.
Conversely, when considering a second scenario where $\tau_i > \tau_p$, the foreign subsidiary will shift part of its profit to its parent company. The MNE's objective function can then be modeled as follows:

$$\begin{aligned} \max_x \ V^{MNE} &= (1-\tau_p)(B_p + xB_i) \\ &\quad +(1-\tau_i)(1-x)B_i - \frac{\gamma}{2}x^2 \end{aligned} \tag{3.4}$$

When maximizing this objective function with respect to the fraction of profit shifted, the first order condition becomes:

$$\frac{dV^{MNE}}{dx} = (\tau_i - \tau_p)B_i - \gamma x = 0 \tag{3.5}$$

Consequently, the optimal fraction of profit shifted is equal to:

$$x = \frac{(\tau_i - \tau_p)B_i}{\gamma} > 0 \tag{3.6}$$

and, as $\tau_i > \tau_p$ equation (3.6) is strictly positive.

When an international tax consolidation (ITC) system is introduced, only one taxable base for the entire group is computed. Because international tax consolidation eliminates all intra-group transactions, profit-shifting no longer yields a tax advantage and is no longer considered profitable. This is irrespective of the size of the parent country's tax rate relative to the subsidiary's country tax rate. Since under Italian ITC the consolidated tax base is taxed according to the Italian tax rate, the MNE's objective function becomes:

$$\max_x \; V^{MNE} \;=\; (1 - \tau_p)B_p + (1 - \max\{\tau_i, \tau_p\})B_i - \frac{\gamma}{2}x^2 \tag{3.7}$$

and when maximizing this objective function with respect to the fraction of profit shifted, the first order condition becomes:

$$\frac{dV^{MNE}}{dx} = -\gamma x = 0 \tag{3.8}$$

Consequently, the optimal fraction of profit shifted is equal to:

$$x = 0 \tag{3.9}$$

Hence, a MNE stops its profit-shifting activities after the introduction of an ITC. This theoretical result implies that a MNE will no longer shift profits from high-taxed to low-taxed entities once subject to an inter-

national tax consolidation system. Consequently, an entity in a low-tax country, to which formerly profit was shifted, will no longer receive these profits after the introduction of an ITC. Hence, the following prediction can be formulated regarding the profits of MNE subsidiaries.

Prediction: *A foreign affiliate of a multinational enterprise, which is located in a low-tax country, presents lower profits after the introduction of an international tax consolidation than before.*

In the following sections, I test this theoretical prediction empirically, taking advantage of the recent introduction of an ITC system in Italy.

3.4 Empirical Methodology

The introduction of an international tax consolidation system in Italy can be considered as a natural experiment, changing the legal and economic situation of some Italian MNEs, without altering the environment of others. Independently of their action, one group of MNEs is given the opportunity to benefit from international tax consolidation and another group not. Accordingly, the ITC reform acts as if it randomly assigns certain companies to a treatment. This has the advantage of addressing the problem of unobserved omitted variables, as both observable and unobservable factors are taken into account and hence of reducing estimation bias.

The existence of a natural experiment allows me to set up an estimation strategy, comparing treated and non-treated companies before and after the treatment. In the study at hand, the treatment is the international tax consolidation system, the treatment group contains the MNEs which qualify for ITC, and the non-treatment or control group includes the MNEs which do not qualify for ITC. This difference-in-differences strategy can be used if two conditions hold. First, the treatment and the control group should have a common pre-treatment trend, i.e. they should evolve in the same way over multiple periods before the intro-

duction of the treatment. I control whether this condition is verified by using a graphical analysis, plotting how the pretax profits of treatment and control companies evolve over time. I expect those pretax profits to evolve similarly before the tax reform and the pretax profits of the treatment companies to deviate from the trend once the ITC system is introduced.

The second assumption, conditioning the use of a difference-in-differences methodology, is that treatment and control groups should have the same pre-reform characteristics. In order to investigate this assumption, I compare the differences in means of several characteristics for the treatment and control sample. I expect these differences to be statistically equal to zero and hence to indicate that both groups of companies are similar before the introduction of the tax reform. If this is not the case, I need to build a suitable control group and to select control companies which have features comparable to those of the treatment companies. To adjust the control group, I need to pair each treatment observation with a control observation according to their closeness in terms of covariates. When the number of covariates is limited, each covariate is ordered and classified. A treatment observation is matched with a control observation if they are in the same category for each covariate. When the number of covariates is considerable, however, stratification becomes cumbersome and Rosenbaum and Rubin (1983) suggest to compute a propensity score for each observation, based on which treatment and control observations can be matched. This propensity score $p(X)$ summarizes all the observable covariates into a single index and is computed based on a logit or probit model. It is defined as the conditional probability that company i with observable characteristics X_i is subject to the tax reform ITC_i and is expressed as:

$$p(X) \equiv E[ITC_i|X_i] = Prob[ITC_i = 1|X_i] \tag{3.10}$$

Matching observations according to their propensity score allows to se-

lect a comparable control group by focusing on one factor instead of comparing all the observable covariates.

Controlling for these two assumptions ascertains that the control group represents the behavior of the treatment group in the absence of treatment and hence that both groups are comparable after the treatment. Comparable groups allow me to assume that the only relevant difference between both groups in the post-reform period is the international tax consolidation system and that the difference in outcome between affected and unaffected companies is attributable to the tax reform.

In order to assess the impact of the ITC system, outcomes of treatment and control groups are compared before and after the tax law change. MNEs which verify the ITC qualifying conditions are considered being affected by the policy change ('treatment group'); MNEs which do not verify the ITC qualifying conditions are considered being unaffected by the tax reform ('control group'). Hence, I compare the change in pretax profits of affected companies to the change in pretax profits of unaffected companies over the pre-to-post 2004 period. The difference-in-differences methodology consists in isolating the impact of the tax reform from group and time-specific effects. Let G_c (or Group) be a fixed group effect dummy (equal to one if the observation belongs to an experimental group, equal to zero if the observation belongs to a non-experimental group), T_t (or Time) be a fixed year effect dummy (equal to one if the observation is made after the tax reform, equal to zero if the observation is made before the tax reform) and X_{ict} be the individual controls. The pretax profits of a company i in country c at time t (Y_{ict}) can then be estimated by using the following Ordinary Least Squares (OLS) regression:

$$Y_{ict} = \alpha + \gamma\, G_c + \lambda\, T_t + \rho\, G_c \cdot T_t + \delta\, X_{ict} + \epsilon_{ict} \tag{3.11}$$

where γ are time-invariant group effects, λ are group-invariant time effects and ρ is the causal effect of interest. The coefficient of ρ expresses

the variation of pretax profits in the experimental group (relative to the non-experimental group) in the years after the tax reform (relative to the years before the tax reform). In the regressions, the interaction between the group and time variables is expressed by the variable ITC Reform, measuring the impact of the ITC reform on the pretax profits of the company.

As developed in the theoretical model above, I want to test whether being subject to an international tax consolidation system impacts the profit-shifting behavior of a multinational company.

3.5 Data

The empirical analysis is based on financial data, as well as ownership information of private companies collected by the Bureau van Dijk (AMADEUS database). This database contains individual company information providing from the financial accounts of more than 15 million non-financial entities located in 41 European countries. The standard format used to register the information allows to compare cross-border financial data easily. Moreover, based on the ownership data it is possible to link parent companies with their national and international first-tier subsidiaries. This gives me the opportunity to collect profit-related data for a large number of foreign subsidiaries of Italian parent companies. Gathering this type of information for several years, I define the data for one particular subsidiary in one particular year as the observational unit. These panel data related to foreign subsidiaries of Italian MNEs, allow me to assess the impact of the Italian international tax consolidation system on the profit-shifting behavior of multinational groups. A multinational enterprise is defined as a parent company holding at least one foreign subsidiary ('global ultimate owner'). The sample consists of European (non-Italian) first-tier subsidiaries, providing from 34 different countries. Those subsidiaries are split into two subsamples. The first subsample consists of those subsidiaries whose parent company

verify the legal ownership, legal status, and group interdependence criteria as defined by the Italian tax code to qualify for international tax consolidation; the second subsample consists of the subsidiaries whose parent company does not satisfy one of these criteria and therefore does not qualify for international tax consolidation. Hence, the first group consists of non-Italian subsidiaries held for at least 50% by their Italian parent company. The second group contains the foreign subsidiaries held for less than 50% by their Italian parent company.

Because the international tax consolidation system was introduced in Italy in 2004, financial data is collected for the time period 2002-2008. This setup allows to have 2 years of pre-reform data (2002-2003) and 5 years of post-reform data (2004-2008). In line with former profit-shifting papers, the study is based on industrial firms (SIC code 2000-5999) excluding real estate industry, financial services, and the public and primary sector.

For each of the subsidiary-year observations, I collect profit-related data. These data provide from unconsolidated financial account information and are used to construct the main variables of the regression analysis. I use two dependent variables. Log(Pretax Profits) is defined as the natural logarithm of pretax profits. Log(Pretax Earnings) is defined as the natural logarithm of earnings before interest and taxes (EBIT). As in former empirical work (Huizinga et al. (2008), Dharmapala and Riedel (2011)), I limit the sample to those observations with positive pretax profits, having the highest probability of engaging in profit-shifting strategies. Further to previous profit-shifting literature (Huizinga and Laeven (2008), Weichenrieder (2009)), the control variables contain measures of labor, capital and leverage. As a measure of labor, I use the natural logarithm of the costs of employees. Capital is measured as the natural logarithm of fixed assets. The coefficients of Labor and Capital are expected to be positive, since employees and assets contribute to the profitability of the company. Leverage is defined as the ratio of

total debt to total assets. The debt ratio is expected to have a negative impact on pretax profits, since the highly leveraged companies have to pay more interest costs, which lower pretax profits. As a measure of economic development, the control variables also include Per Capita Income, which is defined as the logarithm of GDP per capita as measured by the World Bank. Previous literature (Huizinga et al. (2008)) does not determine the impact of this variable on pretax profits in a clearcut way. If Per Capita Income is interpreted as a measure of productivity, a positive impact on pretax profits is expected. If Per Capita Income, however, is a measure of expected returns, higher expected returns can be related to countries with less effective property rights and therefore a negative impact on pretax profits is expected. The impact of the industry is captured by dummy variables, which are based on two-digit SIC codes. In order to measure the impact of the corporate tax rate differential, I collect tax related information for the countries of each of the sample subsidiaries. These official tax data provide from the International Bureau of Fiscal Documentation (IBFD)'s Tax Research Platform and the OECD Tax Database. Based on these, the variable Tax Rate Differential is computed for each subsidiary located in a low-tax country relative to the tax rate of the parent's country. Tax Rate Differential is defined as the difference between the statutory tax rate of the parent company and the statutory tax rate of the subsidiary.
This data collection leads to a sample of 9,230 treatment and 5,399 control subsidiary-year observations.

3.5.1 Summary Statistics

Descriptive statistics of the sample are reported in Table 3.1. It provides means and standard deviations for the main firm characteristics and for variables used in the empirical analysis. The full sample is used, including both pre-reform and post-reform years. As mentioned above, two conditions should hold before applying a difference-in-differences estimation strategy.

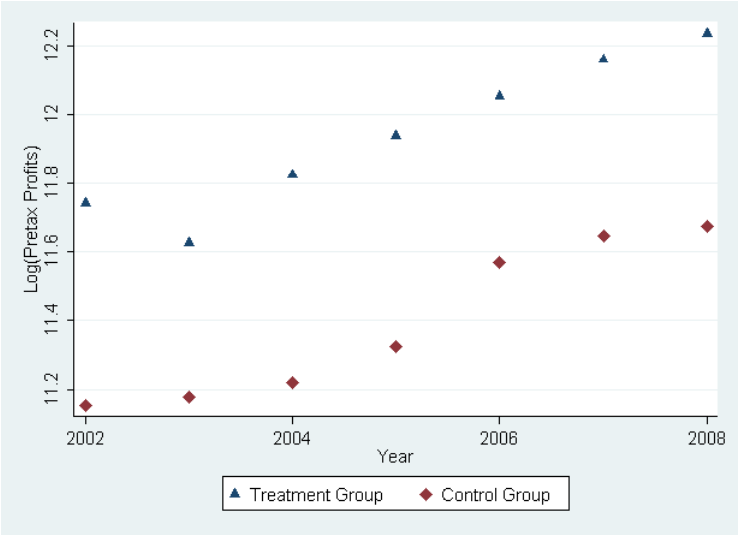
Table 3.1: Descriptive Statistics and Means Differences

The table provides means and standard deviations for the main variables used in the paper, as well as for some additional firm characteristics. Per Capita Income is the logarithm of GDP per capita as measured by the World Bank. Employees is the number of employees. Total Assets are total assets (in millions of EUR). Capital is the logarithm of fixed assets. The current ratio is the ratio of current assets over current liabilities. The liquidity ratio is the ratio of current assets, other than stocks, over current liabilities. The solvency ratio is the ratio of shareholder funds over total assets. Leverage is the ratio of total debt over total assets. Tangibility is the ratio of tangible fixed assets over total assets. Log(Pre-Tax Profits) is the logarithm of the pretax profits. Net Operating Loss is a dummy variable that takes one if the company is loss-making, zero otherwise. Stock Turnover is the ratio of sales over stocks. Sales are the sales (in millions of EUR). Labor is the logarithm of the costs of employees.

	Full Sample		Treated		Control	
Variable	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Profile						
Per Capita Income	9.513	(0.999)	9.579	(0.996)	9.402	(0.994)
Employees	128,353	(722,330)	153,541	(870,345)	85,293	(340,400)
Balance Sheet						
Total Assets (millions)	54.700	(1,090.000)	75.200	(1,370.000)	19.700	(179.000)
Capital	12.671	(2.754)	12.849	(2.839)	12.366	(2.576)
Current Ratio	6.401	(263.128)	6.848	(275.300)	5.663	(241.079)
Liquidity Ratio	4.540	(165.801)	4.907	(178.465)	3.918	(141.823)
Solvency Ratio	0.279	(5.114)	0.267	(6.353)	0.299	(1.406)
Leverage	0.666	(5.305)	0.677	(6.615)	0.649	(1.493)
Tangibility	0.249	(0.260)	0.247	(0.262)	0.252	(0.257)
P&L Account						
Log(Pretax Profits)	11.756	(2.467)	11.957	(2.552)	11.413	(2.273)
Net Operating Loss	0.032	(0.177)	0.033	(0.180)	0.031	(0.174)
Stock Turnover	139.526	(3,785.916)	198.511	(4,836.861)	47.306	(391.369)
Sales (millions)	67.200	(2,120.000)	91.600	(2,690.000)	28.000	(321.000)
Labor	12.546	(2.474)	12.715	(2.580)	12.267	(2.260)
N	14,629		9,230		5,399	

Figure 3.1: Evolution of the Profit Trend over Time

The figure plots the annual mean of Log(Pretax Profits) for both the treatment and the control group before matching for the time period 2002-2008. The use of a difference-in-differences strategy requires the treatment and control group to follow a common trend during the pre-treatment period, i.e. during the period 2002-2003. Hence, treatment and control groups should present the same trend over time in the absence of treatment.



The equal pre-treatment trend condition requires treatment and control groups to evolve in a similar way with respect to pretax profits before the introduction of the ITC system. I analyze graphically whether this condition holds, by plotting the annual means of Log(Pretax Profits) for the time period 2002-2008. Figure 3.1 shows that pretax profits are higher in treatment subsidiaries (approximately 11.7 before the 2004 tax reform) than in control subsidiaries (approximately 11.2 before the 2004 tax reform). For both groups, these profits grow over the post-reform period but seem to grow slightly faster for impacted subsidiaries than for those unaffected by the ITC reform. This would provide evidence that international tax consolidation has altered the profit-shifting behavior of the affected subsidiaries relative to the unaffected ones.

In order to verify whether the condition regarding the pre-treatment characteristics holds, Table 3.2 compares the means of the main firm characteristics for the treatment group and the control group before the introduction of the international tax consolidation system. It uses data of the pre-treatment year 2002 and shows the means differences between the two groups to determine whether they are statistically equal to zero. The descriptive statistics of Table 3.2 indicate that the means differences of most control variables used in the regression analysis, are statistically different from zero at the 1% level. Subsidiaries affected by the ITC reform are located in countries with a higher per capita income than subsidiaries not affected by the tax reform (logarithm of 9.013 versus 8.770). Subsidiaries in the treatment group tend to have a statistically higher capital than subsidiaries in the control group (12.556 versus 12.017). Moreover, the labor costs of treatment companies are higher than those of control companies (12.461 versus 11.995). As a result, there is a statistical difference at the 1% level between the treatment group and the control group fo all control variables, but Leverage. The treatment and control subsidiaries are also significantly different with respect to the dependent variable. The average Log(Pretax Profits) amounts to 11.742

Table 3.2: Mean Differences Before and After Matching

The table provides the means of the main variables used in the paper, as well as the means of some additional firm characteristics. Pre-treatment (2002) data for the treatment and control group are used. Per Capita Income is the logarithm of GDP per capita as measured by the World Bank. Employees is the number of employees. Total Assets are total assets (in millions of EUR). Capital is the logarithm of fixed assets. The current ratio is the ratio of current assets over current liabilities. The liquidity ratio is the ratio of current assets, other than stocks, over current liabilities. The solvency ratio is the ratio of shareholder funds over total assets. Leverage is the ratio of total debt over total assets. Tangibility is the ratio of tangible fixed assets over total assets. Log(Pretax Profits) is the logarithm of pretax profits. Net Operating Loss is a dummy variable that takes one if the company is loss-making, zero otherwise. Stock Turnover is the ratio of sales over stocks. Sales are the sales (in millions of EUR). Labor is the logarithm of costs of employees. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level.

	Unmatched Sample			Matched Sample		
Variable	Treated	Control	Difference	Treated	Control	Difference
Profile						
Per Capita Income	9.013	8.770	-0.243***	9.164	9.061	-0.103
Employees	154,529	89,522	-65,005	165,632	105,633	-59.999
Balance Sheet						
Total Assets (millions)	76.100	15.700	-60.400	98.658	18.756	-79.901
Capital	12.556	12.017	-0.540***	12.604	12.371	-0.233
Current Ratio	5.617	1.797	-3.820	6.426	1.523	-4.902
Liquidity Ratio	4.634	1.406	-3.228	5.306	1.186	-4.120
Solvency Ratio	0.305	0.156	-0.149	0.308	0.308	0.000
Leverage	0.641	0.799	0.158	0.632	0.630	-0.003
Tangibility	0.246	0.254	0.008	0.254	0.271	0.017
P&L Account						
Log(Pretax Profits)	11.742	11.155	-0.588***	11.849	11.593	-0.257
Net Operating Loss	0.044	0.037	-0.007	0.046	0.038	-0.009
Stock Turnover	55.065	39.764	-15.301	53.728	50.115	-3.612
Sales (millions)	58.000	22.700	-35.400	66.206	22.699	-43.507
Labor	12.461	11.995	-0.466***	12.496	12.320	-0.175
N	1,273	756		840	230	

for affected and to 11.155 for unaffected subsidiaries. These statistically significant differences between treatment and control groups during the pre-treatment period, indicate that the use of a matching method is needed before applying a difference-in-differences approach.

3.5.2 Matching Treatment and Control Observations

Like the summary statistics of Table 3.2 indicate, the pretreatment characteristics of treatment and control subsidiaries are significantly different. The second difference-in-differences condition is thus not verified. In order for this condition to hold, I need to alter the selection of control subsidiaries. To ascertain that the adjusted control group includes a suitable control company for each treatment company, I use a matching method. This method pairs each treatment company with a closely resembling control company. To obtain a sample which verifies the pretreatment characteristics condition, I use pre-reform data to match the observations. Because the number of covariates is considerable, I match observations based on their propensity score, summarizing all covariates within a single index. Matching using a propensity score is done in three steps.

The first step consists in estimating the propensity score. Estimating the probability of being subject to the treatment, is done by using a probit model. The dependent variable takes value one if the company is subject to the tax reform, zero otherwise. The probit model includes as control variables those covariates which are expected to influence the pretax profits of subsidiaries, i.e. capital, labor, per capita income, leverage, and the tax rate differential between the subsidiary and its parent company. Estimation results are presented in Table 3.3.

A second step consists of controlling whether there is sufficient overlap of the two groups in terms of propensity score. This can most easily be done by using boxplots, which graphically summarize the distribution of the propensity score for the treatment and control groups. Well fitted matches are possible in the region where boxplots overlap, i.e. the area

Table 3.3: Probit for the Probability of Treatment

The table presents the probit estimation results of the propensity to be subject to international tax consolidation. Firm characteristics, influencing the pretax profits of companies, are used to estimate the model. The dependent variable takes value one if the company is subject to the tax reform, zero otherwise. The estimation is based on pre-treatment data, i.e. 2002 observations.

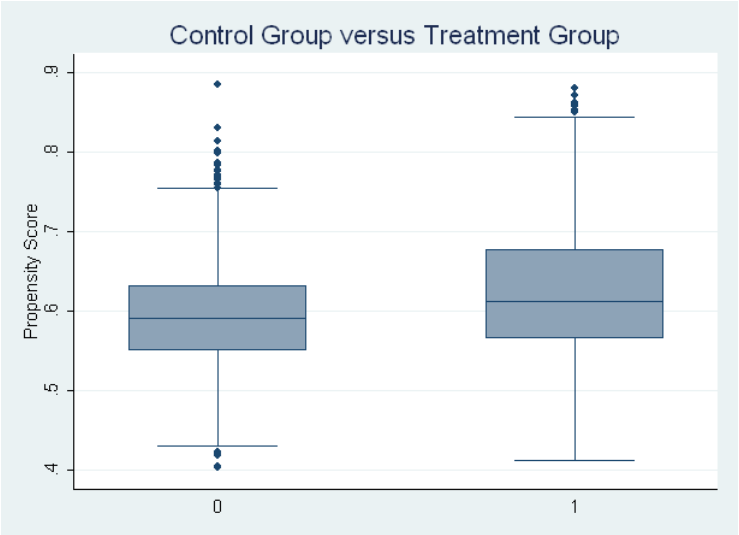
Variable	Coefficient	(Std. Err.)
Capital	0.028	(0.022)
Labor	0.000	(0.030)
Per Capita Income	0.087	(0.079)
Leverage	0.053	(0.118)
Tax Rate Differential	0.011	(0.014)
Industry dummies	Yes	
N	1,559	
Log-likelihood	-1,016.904	
Pseudo R^2	0.0221	

between the whiskers which is common to both groups. Figure 3.2 shows that a considerable region of common support exists for the treatment group and the adjusted control group.

In a third step, treatment and control observations are matched based on their estimated propensity score. Because the number of observations is large and the probability of finding identical propensity scores low, observations are matched using an algorithm. I use a nearest neighbor algorithm, which matches each treatment observation with the closest control observation in terms of propensity score. This means that a control observation can be selected as the best fitting match for several treatment observations. Treatment and control observations for which no match could be found are dropped. Table 3.2 shows how the sample was adjusted after matching and presents the means of the main company characteristics for the treatment and control groups. Comparing the means differences of the matched sample with those of the unmatched sample, I observe that the means differences between the treatment group and the control group are no longer statistically signif-

Figure 3.2: Boxplots of the Estimated Propensity Score

The figure shows boxplots of the propensity score distributions of the treatment and control groups after balancing the covariates. For each distribution, the lower and upper quartiles (25th and 75th percentiles) form the bottom and top of the box. The horizontal line within the box indicates the median (50th percentile) and the ends of the whiskers represent the maximum and minimum of the sub-sample. The observations lying outside the whiskers are considered outliers. The boxplots provide a comparability check for the treatment and control group in terms of observable characteristics. The overlap in the distributions (area between the whiskers) indicates how well a matching strategy can be implemented. The wider the overlap, the better treatment observations and control observations can be matched.



icant. Consequently, matching has adjusted the groups and made them comparable.

The observations being matched, I can now consider the two conditions for difference-in-differences estimation to be verified. Comparing pre-reform and post-reform data for both treatment and control subsidiaries, allows me to analyze the impact of an international tax consolidation system on a subsidiary's pretax profits. To control for time effects, I use the binary variable Time, which is equal to one for post-reform observations and equal to zero for pre-reform observations. Group effects are captured by the binary variable Group, which is equal to one for affected subsidiaries and equal to zero for unaffected subsidiaries. The effect of the ITC reform on pretax profits is measured by the binary variable ITC Reform, which takes one if the subsidiary is part of the treated group and the observation takes place during the post-reform period and which takes zero otherwise.

3.6 Results

This section analyzes how a company's pretax profits and hence its profit-shifting behavior is affected by the introduction of an international tax consolidation system. A first subsection presents the results regarding the existence of profit-shifting behavior. A second subsection presents the results determining the impact of ITC on a subsidiary's pretax profits.

3.6.1 Existence of Profit-Shifting Behavior

Table 3.4 shows the results for the profitability estimations assessing the existence of profit-shifting behavior. Both coefficients and standard errors are reported. Standard errors are robust for firm specific clustering. All regressions include group-specific and time-specific fixed effects, as well as industry dummies. The full sample of subsidiaries with positive pretax profits is used. In order to analyze whether the profitability of subsidiaries is tax-dependent, we use two different tax variables, Tax

Rate Subsidiary and Tax Rate Differential.

Regressions (1) and (2) of Table 3.4 use Log(Pretax Profits) as dependent variable. Regressions (3) and (4) use Log(Pretax Earnings) as dependent variable. Regression (1) regresses the dependent variable on the group-specific dummy, the time-specific dummy, the statutory tax rate of the subsidiary, labor, capital, and leverage. The variable, Tax Rate Subsidiary, is the statutory corporate tax rate of the subsidiary. Its estimated coefficient is negative (-0.009) and statistically significant (5% level). This suggests that the higher the tax rate in the host country of the subsidiary, the lower its pretax profits. This result is consistent with the profit-shifting theory that MNEs shift profits from high-tax to low-tax countries. The control variables Labor, Capital, and Leverage are significant at the 1% level. Consistent with previous literature, Labor and Capital are positively and Leverage is negatively related with the dependent variable Log(Pretax Profits).

Regression (2) has the same specification as regression (1) but uses the variable Tax Rate Differential instead of Tax Rate Subsidiary to assess whether pretax profits are tax-dependent. Tax Rate Differential is the difference between the statutory tax rate of the parent company and the statutory tax rate of the subsidiary if the latter is smaller than the former; it equals zero otherwise. Tax Rate Differential has an estimated coefficient of 0.013, that is significant at the 1% level. This suggests that the lower the statutory tax rate of the subsidiary with respect to the statutory tax rate of the parent company, the higher the profits reported by the subsidiary. This result provides evidence that the profitability of the subsidiaries is tax-dependent.

The regressions (3) and (4) of Table 3.4, using Log(Pretax Earnings) as dependent variable, have the same specification as regressions (1) and (2). With respect to the tax-dependency of pretax earnings, the same analyses can be made as for regressions (1) and (2).

Both sets of results provide evidence that the statutory tax rate of the

Table 3.4: Existence of Profit-Shifting Behavior

The table reports the regression estimations, using Log(Pretax Profits) and Log(Pretax Earnings) as dependent variables. Log(Pretax Profits) is measured as the natural logarithm of pretax profits. Log(Pretax Earnings) is measured as the natural logarithm of earnings before interest and taxes (EBIT). Group is a dummy variable that takes one if the subsidiary has a parent company which verifies the ITC criteria, zero otherwise. Time is a dummy variable that takes one if the observation is done after the tax reform, zero otherwise. Tax Rate Subsidiary is the statutory corporate tax rate of the subsidiary. Tax Rate Differential is the difference between the statutory tax rate of the parent company and the statutory tax rate of the subsidiary if the latter is smaller than the former, zero otherwise. Labor is the natural logarithm of the costs of employees. Capital is the natural logarithm of fixed assets. Leverage is the ratio of total debt over total assets. The industry dummy variables are based on two-digit SIC codes. Both coefficients and standard errors are reported. Standard errors are robust for firm specific clustering. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level.

Dependent Variable	Log(Pretax Profits)		Log(Pretax Earnings)	
	(1)	(2)	(3)	(4)
Group	0.085***	0.090***	0.059***	0.078***
	(0.033)	(0.033)	(0.030)	(0.030)
Time	0.018	0.033	-0.035	-0.022
	(0.033)	(0.032)	(0.029)	(0.029)
Tax Rate Subsidiary (-)	-0.009**	-	-0.006*	-
	(0.004)		(0.003)	
Tax Rate Differential (-)	-	0.013***	-	0.011***
		(0.004)		(0.004)
Capital (+)	0.303***	0.300***	0.338***	0.334***
	(0.009)	(0.009)	(0.008)	(0.008)
Labor (+)	0.456***	0.465***	0.434***	0.442***
	(0.011)	(0.011)	(0.010)	(0.010)
Leverage (-)	-0.823***	-0.758***	-0.508***	-0.479***
	(0.046)	(0.044)	(0.041)	(0.039)
Industry dummies	Yes	Yes	Yes	Yes
N	10,049	10,061	10,049	10,061
R^2	0.6653	0.6654	0.7145	0.7142

subsidiary's country impacts the amount of pretax profits and earnings of that subsidiary. Moreover, the results are in line with the tax-motivated profit-shifting literature.

3.6.2 Impact of International Tax Consolidation on a Subsidiary's Pretax Profits

Table 3.5 shows the results for the profitability estimations using a difference-in-differences strategy. Both coefficients and standard errors are reported. Standard errors are robust for firm specific clustering. All regressions include group-specific and time-specific fixed effects, proper to the difference-in-differences estimation strategy. In order to test the theoretical prediction regarding the introduction of an international tax consolidation system, I focus in the below specifications on those subsidiaries which are located in low-tax countries. For the purpose of this analysis, low-tax countries are those which have a lower tax rate than Italy, the country of the parent company.

Table 3.5: Impact of ITC on Pretax Profits

The table reports both coefficients and standard errors of the regression estimations, using Log(Pretax Profits) and Log(Pretax Earnings) as dependent variables. Log(Pretax Profits) is measured as the logarithm of pretax profits. Log(Pretax Earnings) is measured as the logarithm of earnings before interest and taxes (EBIT). Group is a dummy variable that takes one if the subsidiary has a parent company which verifies the ITC criteria, zero otherwise. Time is a dummy variable that takes one if the observation is done after the tax reform, zero otherwise. ITC is a dummy variable that takes one if the subsidiary has a parent company which verifies the ITC criteria and if the observation is done after the tax reform, zero otherwise. Capital is the logarithm of fixed assets. Labor is the logarithm of the costs of employees. Leverage is the ratio of total debt over total assets. Per Capita Income is the logarithm of GDP per capita as measured by the World Bank. The industry dummy variables are based on two-digit SIC codes. Standard errors are robust for firm specific clustering. $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level.

Dependent Variable	Log(Pretax Profits)				Log(Pretax Earnings)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Group	0.363***	0.169**	0.111	0.105	0.317***	0.118*	0.062	0.057
	(0.134)	(0.079)	(0.076)	(0.076)	(0.130)	(0.071)	(0.068)	(0.068)
Time	0.760***	0.070	-0.018	-0.057	0.666***	-0.030	-0.112	-0.143**
	(0.136)	(0.081)	(0.077)	(0.079)	(0.132)	(0.072)	(0.069)	(0.070)
ITC Reform (-)	-0.0611	-0.050	-0.012	-0.009	-0.029	-0.009	0.026	0.029
	(0.156)	(0.092)	(0.088)	(0.088)	(0.152)	(0.082)	(0.077)	(0.079)

Capital (+)	-	0.352***	0.317***	0.319***	-	0.387***	0.0355***	0.356***
		(0.010)	(0.010)	(0.010)		(0.009)	(0.009)	(0.009)
Labor (+)	-	0.434***	0.436***	0.416***	-	0.412***	0.416***	0.400***
		(0.010)	(0.011)	(0.013)		(0.009)	(0.009)	(0.011)
Leverage (-)	-	-0.734***	-0.852***	-0.863***	-	-0.415***	-0.527***	-0.536***
		(0.057)	(0.055)	(0.056)		(0.051)	(0.049)	(0.050)
Per Capita Income (-)	-	-	-	0.072***	-	-	-	0.057**
		-	-	(0.032)				(0.023)
Industry dummies	No	No	Yes	Yes	No	No	Yes	Yes
N	7,289	7,289	7,289	7,289	7,289	7,289	7,289	7,289
R^2	0.0179	0.6600	0.6906	0.6909	0.0156	0.7107	0.7382	0.7385

Regressions (1) to (4), use Log(Pretax Profits) as dependent variable. Because pretax profits include both operating and financial profit, it captures transfer pricing distortions as well as internal debt distortions (Dharmapala and Riedel (2011)). Regression (1) of Table 3.5 regresses the dependent variable on the group-specific dummy, the time-specific dummy and the tax reform dummy, without any additional control variables. In this first regression, the variable of interest ITC Reform has an estimated negative but not statistically significant coefficient. Therefore, little can be said about the impact of the international tax consolidation system. The coefficients of the group-specific variable and time-specific variable are statistically significant at the 1% level. The positive coefficient of the group-specific variable suggests that subsidiaries, which are located in a low-tax country and whose parent company verify the conditions to apply for ITC, tend to have higher pretax profits than subsidiaries which do not verify the ITC criteria, whether before or after the introduction of an international tax consolidation system. Moreover, the positive coefficient of the time-specific variable suggests that subsidiaries tend to have higher pretax profits after the introduction of the ITC system than before, irrespective of the group to which they belong.

Regression (2) starts from the specification in regression (1) and adds the control variables Labor, Capital, and Leverage. The estimated coefficient (-0.050) of the variable of interest is consistent with the theoretical prediction. It is, however, not statistically significant. With respect to the explanatory variables, the results show a positive and statistically significant impact of Labor and Capital, and a negative significant impact of Leverage. These results are consistent with former empirical literature on profit-shifting. The R^2 statistic shows that 66% of the variation in profitability is explained by this set of variables versus 1.8% for the specification of regression (1).

Regression (3) starts from the specification of regression (2) and adds industry dummies. The variable of interest ITC Reform has a negative

coefficient (-0.013) but remains statistically insignificant, whereas the control variables are all significant at the 1% level. The introduction of the industry dummies slightly increased the goodness of fit of the model with respect to specification (2), since the R^2 statistic increased from 66% to 69%.

Regression (4) uses the same specification as regression (3) and adds the variable Per Capita Income, measuring the economic development of the subsidiary's host country. The coefficient of ITC Reform remains negative and insignificant and the coefficients of all control variables, Per Capita Income included, are statistically significant. Per Capita Income has a positive coefficient of 0.072, suggesting that this variable is a measure of productivity.

Regression (5) to (8) of Table 3.5 use as endogenous variable, Log(Pretax Earnings), which is measured as the natural logarithm of earnings before interest and taxes (EBIT). As in previous literature (a.o. Dharmapala and Riedel (2011)), the dependent variable is altered in order to identify the dominant type of profit-shifting used. Pretax Earnings include only operating profit, whereas Pretax Profits include both operating and financial profit. Running the same specifications as those for regressions (1) to (4), allows to compare the results for both dependent variables. The coefficients of the variable of interest are negative in regressions (5) and (6) and positive in regressions (7) and (8). None of them, however, is statistically significant, whereas control variables remain highly significant at the 1% level. Accordingly, it cannot be inferred whether further to the introduction of an international tax consolidation system, the type of profit-shifting used (transfer pricing or interest expenses) has changed.

The above results do not allow to determine the impact of international tax consolidation (ITC) on the profit-shifting behavior of companies. A possible explanation could be that companies anticipated the ITC tax reform or took time to adopt it. In that case, a difference-in-differences

estimation focusing on the introduction year 2004, would not capture the ITC effect. In order to test this possible explanation, I set up one set of regressions using 2003 as tax reform year and another using 2005 as tax reform year. Running the regressions shows that nor the anticipated effects, nor the reported effects are significant.

3.7 Policy Options and Challenges

In the light of a possible introduction of an EU common consolidated tax base, some challenges can be identified based on the above analysis. First, the Italian experience shows the technical difficulties of implementing international tax consolidation. The Italian policymaker opted to include both first-tier and second-tier subsidiaries. This is in line with theoretical tax consolidation, which requests to take into account all subsidiaries, whether they are fist-tier or second-tier. Extending the system to second-tier subsidiaries, however, highly increases the complexity of implementing such a system. It can indeed be difficult to determine whether a subsidiary is part of the consolidation area or not, since foreign shareholders cannot always be identified. Second and as mentioned in the former chapter, policymakers willing to implement such a system will need to keep in mind that on a stand-alone basis, the introduction of international tax consolidation is not necessarily revenue-enhancing. Although the country of the parent company taxes the consolidated income, it also needs to provide tax relief for foreign taxes paid.

Even if it is true that taxing the MNE as an economic unit rather than as a group of legally independent entities can only be achieved through tax consolidation, other policy options exist to eliminate tax-motivated profit-shifting. The former chapter studied several tax environments and showed that the combination of an ACE-CBIT system might be a valuable candidate to sharply reduce profit-shifting without implementing a consolidation system.

3.8 Conclusions and further research tracks

The purpose of this paper was to identify the impact of international tax consolidation on a MNE's profit-shifting behavior. A simple analytical model was developed showing how a tax consolidation system affects the pretax profits of a subsidiary. The model predicts that a foreign affiliate, located in a low-tax country, reports lower profits after the introduction of an ITC system. In order to empirically test this theoretical prediction, the study focused on Italy, which introduced an international tax consolidation system ("worldwide consolidation") in its tax legislation in 2004. Policy variation among Italian MNEs allowed to compare the pretax profits of two subsamples of foreign subsidiaries of Italian parent companies: a first subsample of subsidiaries, having a parent company which qualifies for the Italian ITC; a second subsample of subsidiaries, having a parent company which does not qualify for the Italian ITC. This difference-in-differences strategy created as such a clean way to explore the use of tax-motivated profit-shifting and the impact of an international tax consolidation system.

The empirical results show that profit-shifting is tax-motivated but the results do not allow to infer any impact of an international tax consolidation system, as implemented in Italy, on a MNE's profit-shifting behavior. This may be explained by certain limits of the study. First, given the optional character of the system, the data do not allow to distinguish those Italian parent companies which actually opted for ITC from those which qualified but did not adopt the system. Although the system reduces compliance cost and double taxation, remaining out of the ITC system may be beneficial for other tax planning purposes. Consequently, the treatment group includes companies which were not treated, i.e. companies whose profit-shifting behavior was not affected by the introduction of international tax consolidation. Second, aiming at contributing to the existing profit-shifting literature, this study focused on subsidiaries with positive pretax profits. One of the main advantages

of international tax consolidation, however, is loss-offset, meaning that the losses of one group entity can be offset against the profits of a foreign group entity.

Conclusions

Determining the impact of taxation on corporate financial decision-making, was the core issue of this doctoral project. Starting from Modigliani and Miller (1958)'s irrelevance theory, which shows that financial decisions do not affect a company's value in a world without taxation and transaction costs, this PhD project analyzed two types of tax distortions. Focusing on recent and potential corporate tax reforms in the European Union, it aimed at giving some guidelines for financial managers and policy makers with respect to these reforms. The first tax distortion is related to the unequal tax treatment of debt and equity and was studied in the first chapter of this dissertation. The second tax distortion is related to the existence of as many corporate tax codes as countries and was treated in the two following chapters.

The first tax distortion relates to the different taxation of debt and equity, impacting the capital structure of companies. As the tax deductibility of interest expenses is proper to almost all corporate taxation systems, measuring the impact of this unequal tax treatment is particularly relevant to understand how the capital structure of a company is determined. The debate on how taxes affect corporate financing decisions was after decades of research still not settled. The first chapter closed this debate by providing strong evidence on the impact of taxation on corporate debt policy. It proposed a new approach to the issue by taking advantage of a 2006 tax reform in Belgium introducing an equity tax shield. Such an equity tax shield or Allowance for Corporate Equity

(ACE) attributes a similar tax deductibility to the return on equity as to interest expenses. Hence, it sets an end to the tax discrimination between debt and equity. Examining the extent to which the removal of this tax discrimination impacts a company's capital structure, goes back to the core of the corporate tax distortion debate and offers therefore a unique opportunity to settle the issue. To clarify the question, I developed a simple model showing how the introduction of an equity tax shield affects the capital structure of a company. The model predicted that following the introduction of an equal tax treatment of debt and equity, companies lower their debt ratio. This prediction was evaluated quantitatively through the use of a difference-in-differences identification strategy comparing the capital structure of treatment and control companies before and after the tax reform. Hence, the sample consisted of pre-treatment (2001-2005) and post-treatment (2006-2007) data for Belgian (treatment) and French (control) companies. In order to ascertain that the control group is adequate, capital structure trends were analyzed and a propensity score method was used to match treatment and control firms. Accordingly, the impact of the tax discrimination between debt and equity could be inferred. Consistent with the theoretical prediction, the empirical results reported a significant negative impact of the reform on the leverage of companies subject to the equity tax shield. I found that the estimated impact is highly significant and that it amounts economically to a leverage decrease of approximately 2-7%, meaning that a traditional tax system encourages companies to use on average 2-7% more debt than when there is an equal tax treatment of debt and equity. Further extension of the analysis revealed that large companies experience a higher effect from the equity tax shield than small and medium companies.

The study of the Belgian ACE highlighted some features of the system, which are key to policy makers who would be interested in introducing such a system. First, the introduction of an ACE in Belgium reached

its goal of making capital structure decisions more tax-neutral. The results obtained clearly showed that companies adjusted their debt policy and balanced their capital structure further to the ACE introduction. From a theoretical point of view, similar results could be obtained by using a Comprehensive Business Income Tax (CBIT), disallowing the tax deduction of interest payments on debt. For a small economy, however, the latter system is not feasible as long as surrounding countries do not introduce a similar measure. This leads to a second feature of the Belgian ACE, i.e. its considerable cost. As the tax reform also served the goal of holding multinational enterprises back in Belgium, the tax advantage was granted to both new and old equity. This made the reform particularly cumbersome from a budgetary point of view. A third feature of the Belgian ACE system is that it has no clear-cut impact on investment. This is not surprising given that both new and old equity are used to compute the tax advantage. Hence, a company does not need to generate new investments to benefit from the tax reform. From a policy point of view this could be a painful aspect, especially in the aftermath of the crisis guided by fiscal consolidation.

Several relevant extensions of this debt bias study are possible. Having established a strong relation between taxation and debt policy, it would be interesting to study the channels through which the ACE system affects a company's leverage. To explore these channels, additional data related to dividends and retained earnings should be collected, as they are not available in the current database. Moreover, in order to control for the potential effect of the former coordination center regime, it would be useful to identify those companies in the sample which benefited from the regime during the period 2001-2007. A relevant research track would also be to expand the analysis to the impact of the tax reform on the debt level of a company. This would allow to measure the effect of the treatment in absolute terms rather than in relative terms. Furthermore, in the wake of the financial crisis, it would be interesting to study the

impact of the tax discrimination between debt and equity for the banking sector and to determine how more tax neutrality has affected the financial stability within this sector.

The second tax distortion studied in this doctoral project relates to the existence of as many corporate tax codes as countries and was analyzed in the second and third chapters. In the second chapter, jointly written with Professor Marcel Gérard, we investigated the impact of tax environments on the behavior of a multinational enterprise. We focused on two key decisions of MNEs, i.e. the distribution of investment among countries and the use of internal debt. Three features differentiate this paper from previous research. First, we simultaneously investigate a real variable, i.e. the international distribution of investment, and a financial variable, i.e. the amount of internal debt. We determine how each tax design alters the investment and financing decisions of a MNE and especially focus on how it creates incentives to use internal debt. Another feature that differentiates this study is that we follow the development of MNE taxation from the issuing of the OECD Model Tax Convention (1958) to the EU Directive proposal regarding a Common Consolidated Corporate Tax Base (2011). Hence, we focus on those tax designs related to the evolution of MNE taxation in the European Union. Finally, we analyze alternative tracks for MNE taxation and determine how they would alter a MNE's tax strategies. As such, we contribute to the evaluation of the existing tax environments, by comparing them with alternative tax environments serving the same objectives. We started with a world where no international tax rules are at work. Then we successively introduced the rules provided by the OECD Model Tax Convention, the EU Parent-Subsidiary Directive and a combination of ACE and CBIT. Finally, we left systems based on Separate Accounting (SA) aside and turned to Consolidation and Formulary Apportionment (C&FA) adopted either by all the jurisdictions at work in the model, or by a sole subset of them within the framework of an Enhanced Cooperation Agreement

(ECA). Our analysis led to several results. First, the optimal investment and debt levels illustrated the large set of profit-shifting opportunities, which various tax environments offer to MNEs. Second, we found that the use of a credit method as tax relief for cross-border dividends leads to a financially efficient solution and the elimination of profit-shifting incentives. Third, although not entirely eliminating the incentive to use a lucrative detour, we found that a combined ACE-CBIT system may offer a valuable alternative to the introduction of a common consolidated tax base. This third result is particularly relevant as it may be expected that some remote Member States with attractive tax regimes may not be willing to introduce a common consolidated tax base, given the tax competition between them. This is also the case for Member States which offer special depreciation schemes, R&D tax credits or other non-debt tax shields. As a result, it is highly probable that the introduction of a common consolidated tax base in the EU will only be possible through the use of an Enhanced Cooperation Agreement.

There are several paths for further research on this topic. In the second chapter we assumed and modeled a three country world and a single multinational firm. The real-world situation, however, is more complex and requires to take into account non-tax factors influencing a company's financial decision-making (a.o. industry, strategy, cash position). Moreover, subsidiaries are most often not restrained to sell goods in their host country, as we assumed in our model. Many variables are also considered to be exogenous even if this does not correspond to what is observed most commonly. Hence, several extensions of the model are possible for a more comprehensive study of the impact of tax environments on an MNE's behavior.

A third and last chapter focused on the impact of international tax consolidation (ITC) on a MNE's profit-shifting behavior. A simple analytical model was developed showing how a tax consolidation system affects the pretax profits of a subsidiary. The model predicted that a

foreign affiliate, located in a low-tax country, reports lower profits after the introduction of an ITC system. In order to empirically test this theoretical prediction, the study focused on Italy, which introduced an international tax consolidation system ("worldwide consolidation") in its tax legislation in 2004. Policy variation among Italian MNEs allowed to compare the pretax profits of two subsamples of foreign subsidiaries of Italian parent companies: a first subsample of subsidiaries, having a parent company which qualifies for the Italian ITC; a second subsample of subsidiaries, having a parent company which does not qualify for the Italian ITC. Applying a difference-in-differences strategy offered a clean way to explore the use of tax-motivated profit-shifting and the impact of an international tax consolidation system. The empirical results showed that profit-shifting is tax-motivated. The results do not allow to infer an impact of the ITC system, as implemented in Italy, on a MNE's profit-shifting behavior. This may be explained by certain limits of the study, which are also tracks for further research. First, given the optional character of the system, the data do not allow to distinguish those Italian parent companies which actually opted for ITC from those which qualified but did not adopt the system. Consequently, the treatment group includes companies which were not treated, i.e. companies whose profit-shifting behavior was not affected by the introduction of international tax consolidation. Second, aiming at contributing to the existing profit-shifting literature, this study focused on subsidiaries with positive pretax profits. One of the main advantages of international tax consolidation, however, is loss-offset, meaning that the losses of one group entity can be offset against the profits of a foreign group entity.

In the light of a possible introduction of an EU common consolidated tax base, the study allows to identify some policy challenges. First, the Italian experience showed the technical difficulties of implementing international tax consolidation. The Italian policy maker opted to include both first-tier and second-tier subsidiaries. This is in line with

theoretical tax consolidation, which requests to take into account all subsidiaries, whether they are fist-tier or second-tier. Extending the system to second-tier subsidiaries, however, highly increases the complexity of implementing such a system. It can indeed be difficult to determine whether a subsidiary is part of the consolidation area or not, since foreign shareholders cannot always be identified. Second and as mentioned in chapter two, policy makers willing to implement such a system will need to keep in mind that on a stand-alone basis, the introduction of international tax consolidation is not necessarily revenue-enhancing. Although the country of the parent company taxes the consolidated income, it also needs to provide tax relief for foreign taxes paid. Even if it is true that taxing the MNE as an economic unit rather than as a group of legally independent entities can only be achieved through tax consolidation, other policy options exist to eliminate tax-motivated profit-shifting. The second chapter studied several tax environments and showed that the combination of an ACE-CBIT system might be a valuable candidate to sharply reduce profit-shifting without implementing a consolidation system.

This PhD project offers a lot of policy insights but it is foremost valuable for financial managers. It highlighted the fact that tax policy makers analyze the possibilities to reduce tax distortions. This is particularly true for tax distortions, like the unequal tax treatment of debt and equity, which was pinpointed as one of the issues weakening the financial position of companies and leading to the financial crisis. Tax distortions, however, contributed to the understanding of modern financial management and abolishing them will therefore disrupt the framework against which the financial decisions are taken. Companies and in particular multinational enterprises, may therefore expect to be required to adjust their tax-motivated strategies. This does not mean that tax planning will no longer be possible; it means that tax planning opportunities will be altered.

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