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Taxes and Corporate Financing Decisions – Evidence from the Belgian ACE Reform

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Nils aus dem Moore[1]

Taxes and Corporate Financing Decisions – Evidence from the Belgian ACE Reform

Abstract

We contribute to the empirical literature on the debt bias of corporate income taxation through a micro-econometric evaluation of the so-called ACE corporate tax reform in Belgium based on firm-level accounting data. We interpret the tax reform that came into effect in January 2006 as an economic quasi experiment. We identify its causal impact on the leverage ratio of Belgian corporations by means of a difference-in-differences (DiD) approach, using corporations from the UK as comparison group. Our results document that the ACE reform led to a systematic pattern of heterogeneous effects on the capital structure of Belgian corporations, as the estimated reduction of the leverage ratio is most pronounced for big firms. Estimation of quantile treatment effects further reveals that reform effects get monotonically larger across the distribution of firm leverage. Finally, we provide evidence of sectoral heterogeneity with significant effects observed for capital-intensive but not for labor-intensive sectors.

JEL Classification: H25, H32, H22, G32, G38

Keywords: Corporate income taxation; financial structure; debt bias; allowance for corporate equity; difference-in-differences

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1 Introduction

Most systems of corporate income taxation (CIT) that are in place today favor corporate debt over equity. This "debt bias" results from the common practice that interest payments are deductible for corporate income tax purposes, while equity returns are not. As a result, corporations are induced to have higher leverage ratios. Recent evidence shows that the size of the effect has grown over time due to intensified international corporate tax competition and the increasing availability of means, especially in the context of multinational enterprises or by using forms of hybrid finance (de Mooij, 2011b).

Public finance economists have criticized the non-neutrality of the CIT with respect to corporate financing decisions for decades. Several approaches for tax reforms that would overcome this distortionary effect of CIT have been proposed. Until recently, however, only a handful of countries decided in favor of the implementation of such a neutral system of CIT. However, the recent financial and economic crisis has renewed the interest of tax experts and policy-makers. It is widely recognized that excessive debt, especially, but not only in the financial sector, might have deepened the crisis (Slemrod 2009, IMF 2009, and de Mooij 2011a).

Against this backdrop, the present paper untertakes a microeconometric evaluation of the so-called ACE corporate tax reform in Belgium based on firm-level accounting data. We interpret the tax reform that came into effect in January 2006 as an economic quasi-experiment. We identify its causal impact on the leverage ratio of Belgian corporations by means of a difference-in-differences (DiD) approach. We use corporations from the United Kingdom as a comparison group. Following the approach by Princen (2012), the required properties of a valid counterfactual are ensured, firstly, by matching the two firm samples from Germany and the UK on the propensity score, and secondly by controlling for relevant covariates in the subsequent DiD estimation.

The main research question is if and to what extent the introduction of the allowance for corporate equity in the corporate income tax code led to a reduction of the leverage ratio in Belgian corporations. This question is of high interest for two reasons in the

post-crisis era, both from an academic as well as from a policy-making perspective: First, in hindsight, the result contributes to the empirical literature on the tax elasticity of corporate debt and, due to the research design, circumvents several endogeneity issues that have plagued many studies on the subject. Second, looking ahead, the Belgian experience is of high importance for other countries that are currently weighing the pros and cons of introducing an allowance for corporate equity in their respective system of corporate income taxation.

Our results document that the ACE corporate tax reform in Belgium had intricate effects on the capital structure choice of Belgian corporations. In contrast to the evaluation by Princen (2012), we do not find a significant reduction of financial leverage in response to the reform at the level of the full sample of Belgian firms. However, upon closer analysis, we show that this finding masks a systematic pattern of heterogeneous reform effects. In fact, stratification of the data by firm size shows that the expected reduction of the leverage ratio is primarily implemented by big firms. Estimation of quantile treatment effects further reveal that the reform effect becomes monotonically larger in absolute size across the distribution of firm leverage, including small significant reductions in financial leverage of -0.4 percent at the 25th percentile up to substantially larger reductions of -4.7 percent at the 95th percentile. Moreover, we provide evidence of consistent sectoral heterogeneity with significant reform effects observed for capital-intensive sectors from manufacturing and construction to wholesale and retail, but no significant effects for labor-intensive business services. Overall, our contribution thus offers a much more nuanced view of the causal quantitative effects from an ACE tax reform that is consistent with anecdotal descriptive evidence provided by experts from Belgian tax authorities.

The rest of the paper proceeds as follows: Section 2 gives an overview of the previous literature with a focus on recent empirical contributions, section 3 presents the institutional background of the ACE introduction in Belgium, section 4 describes our empirical methodology, section 5 discusses the results, and section 6 concludes.

2 Background Discussion and Previous Literature

Three different strands of literature are relevant for our study. We first give a concise overview of the legal basis and economic rationalizations for the bias toward debt in current CIT systems (2.1). Since, as Tirole pointedly notes, in this subject area "the intellectual challenge is by and large the empirical one" (Tirole 2006, 8), we then elaborate in greater detail on empirical contributions focused on estimating the tax elasticity of corporate debt (2.2). Finally, we review the experience in other countries that introduced an ACE system or similar elements into their CIT system and touch upon current reform proposals and policy initiatives at the national and international level (2.3).

2.1 Legal Basis and Economic Rationales

Almost all CIT systems contain a bias toward debt, since they generally allow a deduction of interest payments when determining taxable profits. In contrast, the return to equity, whether it is received in the form of dividends that are paid to shareholders or as capital gains on shares, cannot be deducted. Debt usually remains tax-favored, even if personal income taxes (PIT) and taxes on capital gains and dividends are simultaneously taken into account.[1] De Mooij (2011a, 5-6) presents comparative calculations of the cost of capital[2] in the year 2007 for investments financed by debt, retained earnings, and new equity in the U.S., Japan, and the EU-27. He derives three important messages: First, in all three regions, a sizeable debt bias exists, since the cost of equity-financed investment is higher than that of debt-financed investment. Second, the debt bias is generally smaller for investors that are subject to the personal income tax and not PIT-exempt. Third, in the EU and the U.S., debt is subsidized at the margin, i.e., to become just profitable,

[1] To assess the overall tax burden, it is not sufficient to consider only the CIT since tax burdens are ultimately not born by corporations but by individuals, most notably as shareholders but, depending on the extent and direction of burden shifting, also in various stakeholder roles, e.g. as employees or consumers. From a shareholder perspective, the overall tax burden depends on the tax treatment at the corporate level via the CIT as well as from the tax provisions that are relevant at the individual level.

[2] The cost of capital is the required pre-tax return on an investment that just breaks even after tax.

debt-financed investments require a lower pre-tax return than equity-financed projects.[3]

To distinguish debt from equity, tax laws around the world usually use the following three properties (cf. de Mooij 2011a, 9): First, debt holders have a legal right to receive a predetermined return while the return of equity holders depends on the economic performance of the firm. Second, debt holders have a prior claim to the firm's assets in case of bankruptcy, whereas suppliers of equity only hold residual claims. Third, debt holders have no control rights over the firm, in contrast to the suppliers of equity. However, these features leave some scope for interpretation, not least due to the presence of hybrid financial instruments that blend characteristics of both, debt and equity.[4]

The original rationale to allow a deduction only for debt is obviously of a purely legal nature, since it asserts that interest is a real cost of doing business whereas equity returns reflect business income. Of course, this perspective completely neglects opportunity costs and makes no sense from an economic point of view (de Mooij 2011a, 10). Economically, a discrimination between debt and equity for tax purposes could perhaps be justified on the grounds of market imperfections. However, neither signaling theories that see debt as an instrument to overcome informational imperfections (between managers, shareholders and creditors), nor theories of adverse selection and resulting constraints in credit markets provide a compelling reason for a systematic tax preference for debt (de Mooij 2011a, 10-12).

Overall, corporate finance models have not been very successful in explaining the capital structure choices of firms in a way that is consistent with empirical observations. A common feature of all approaches is that firms are faced with informational imperfections and choose their debt-equity ratio with the aim of striking the ideal balance between any benefits of debt finance, including its tax shield, against any non-tax cost of debt. Three generic approaches can be distinguished. The defining non-tax aspects are, respectively, (i) the risk of bankruptcy and related costs, (ii) agency costs, and (iii) signaling effects.

[3]One reason for this marginal subsidy are tax allowances for accelerated depreciation, enabling markdowns faster than economic depreciation. Another reason is that nominal and not real interest costs are deductible for purposes of the CIT, cf. de Mooij (2011a, 5-6).

[4]Examples of hybrid financial instruments are preference shares, convertible debt, junk bonds, subordinated debt, warrants and indexed securities, see de Mooij (2011a, 9).

The **static trade-off theory**, first developed by Kraus and Litzenberger (1973) and Scott Jr. (1976) is based on the straighforward notion that firms face a trade-off between the tax shield of debt and the cost in case of financial distress. Since higher debt makes firms more vulnerable to shocks, it increases their risk of bankruptcy and consequently incites (potential) creditors to demand a higher interest rate.

Theories of agency costs act on the assumption that, due to asymmetric information, there can be different conflicts of interest. Easterbrook (1984) and Jensen (1986) model a conflict of interest between shareholders and managers. The latter might use free cash flow for "empire building", i.e., for excessive spending on investment that includes wasteful projects and runs against shareholders' interests. Hence, the issuance of debt constrains the extent of free cash flow and thereby protects shareholders against such opportunistic behavior of managers. Another variant of the agency costs approach models a conflict of interest that might arise from asymmetric information between shareholders and debtholders. If shareholders succeed in convincing the management to take excessive levels of debt, they can thereby shift a substantial part of the bankruptcy risk to bondholders. Against the backdrop of the financial crisis and its origins in excessively leveraged financial institutions, the assumed reasoning of the shareholders seems not at all far-fetched: "In good times, shareholders incur the profit; in bad times they are only liable for the invested sum and bondholders share in the risk of default." (de Mooij 2011a, 11)

Signaling theories interpret debt issuance as a forward-looking mean of communication to outside investors. In this view, inefficiently high levels of debt result from the fact that firms use debt issuances to signal their confidence in their future ability to service their debts (Ross 1977). However, as argued by Myers (1984) with reference to the pecking order theory of corporate finance,[5] debt may also signal the very reverse if investors interpret a high ratio of external financing as a sign of bad economic health, e.g., liquidity problems. The empirical jury still is out on these rivaling approaches with respect to the signaling character of debt (de Mooij 2011a, 11).

[5]According to this theory, new investments are financed according to the following pecking order: (1) internal finance, (2) debt, (3) external equity (see e.g., Myers 1984, 581-582).

To sum up, corporate finance theories do at present neither offer clear guidance on whether the choosen debt levels of non-financial firms are too high or too low, nor do they provide clear insights into the precise mechanisms that determine the outcome of corporate financing decisions. In light of this ambiguity, it seems all the more problematic that most CIT systems exhibit a debt bias.

2.2 Empirical Evidence on the Tax Elasticity of Corporate Debt

For a long time, the corporate finance literature has struggled with the question how much taxes actually matter for corporate debt policy. Until the early 1990s, empirical studies produced only insignificant tax effects, suggesting either that taxation simply has no impacts or reflecting the inability to identify them (cf. de Mooij 2011b, 3). In his presidential address to the American Finance Association in 1984, Stewart Myers dealt with the "Capital Structure Puzzle" of how firms choose their financial set-up and stated inter alia: "*I know of no study clearly demonstrating that a firm's tax status has predictable, material effects on its debt policy. I think the wait for such a study will be protracted*" (Myers 1984, 588). In the late 1990s, the situation had barely changed.[6]

In the last decade, however, many econometric studies finally came to the conclusion that taxes matter and exert a significant impact on debt ratios. This literature is reviewed by Auerbach (2002), Graham (2003, 2008), Weichenrieder and Klautke (2008) and Gordon (2010). In his excellent meta analysis on this subject, de Mooij (2011b) clusters the empirical contributions on debt bias according to the respective strategy that they pursue to identify tax effects. For decades, a severe challenge derived from the lack of variation over time in statutory tax rates and the additional fact that, in most countries, all corporations are subject to the same CIT rate. The recent literature has come up with at least four approaches to better identify tax effects, namely (i) by exploiting variation in non-debt

[6]In 1998, Myers, co-author of the leading textbook on corporate finance, concluded: *"I donŠt think most corporations worry a great deal about their debt-equity ratio. Obviously, they worry if it gets too high and they worry if it gets too low. But there's a big middle range where it doesn't seem to matter very much. I think that's why we're having a hard time pinning down exactly what the debt equity ratio is or should be. It's a 'second order' thing compared to the choice of financial structure."*(Myers et al. 1998, 12)

tax shields (such as depreciation allowances and tax losses that are carried forward),[7] (ii) by computing firm-specific marginal tax rates and analyzing the issuance of incremental debt,[8] (iii) by taking advantage of the variation in marginal tax rates across firms within one country to explain their debt levels (i.e., debt ratios),[9] and (iv) by utilizing the variation in tax rates across countries.[10]

In his meta analysis, de Mooij (2011b) includes 19 studies that are made comparable by translating and expressing the respective results in terms of a common outcome variable, namely the tax elasticity of debt, $\partial\, ln\,(D/A)\,/\,\partial\,\tau$. It measures the percentage change in the debt-asset ratio D/A in response to a one percentage-point change in the tax rate τ. Overall, the meta sample comprises 267 tax elasticities. In the subsequent analyses, de Mooij differentiates between studies that rely on variation of tax rates across firms within one country, and studies that use cross-country variation in tax rates.

As a first step, a descriptive analysis reveals that within-country studies display an average elasticity of 0.78, a median of 0.69 and a standard deviation of 0.72. Three quarters of these estimates are significantly different from zero at the 5 percent level. The average tax elasticitiy of debt from cross-country studies is somewhat smaller at 0.58, with a median of 0.51 and a standard deviation of 0.43. Of these studies, 79 percent are significantly different from zero at the 5 percent level (de Mooij 2011b, 11-12).

As the second step, de Mooij (2011b, 17-20) runs a series of meta regressions to analyze the influence of various characteristics of the underlying studies, including different debt indicators (i.e., leverage-asset ratio, debt-asset ratio, internal/external debt, long-

[7]Studies in this category are DeAngelo and Masulis (1980), Bradley, Jarrell and Kim (1984), Titman and Wessels (1988), MacKie-Mason (1990), Dhaliwal, Trezevant and Wang (1992), Shum (1996), Cloyd, Limberg and Robinson (1997) and Ayers, Cloyd and Robinson (2001).

[8]Studies in this category are Givoly, Hayn, Ofer and Sarig (1992), Graham (1996), Alworth and Arachi (2001), and Gropp (2002).

[9]Studies in this category are Graham, Lemmon and Schallheim (1998), Graham (1999), Booth, Aivazian, Demirguc-Kunt and Maksimovic (2001), Gordon and Lee (2001), Jog and Tang (2001), Bartholdy (2005), Gordon and Lee (2007) and Dwenger and Steiner (2014).

[10]Studies in this category are Rajan and Zingales (1995), Booth, Aivazian, Demirguc-Kunt and Maksimovic (2001), Altshuler and Grubert (2003), Desai, Foley and Hines Jr. (2004), Mills and Newberry (2004), Moore and Ruane (2005), Ramb and Weichenrieder (2005), Buettner, Overesch, Schreiber and Wamser (2006), Overesch and Wamser (2006), Huizinga, Laeven and Nicodème (2008), Buettner, Overesch, Schreiber and Wamser (2009), Mintz and Weichenrieder (2010), and Buettner and Wamser (2013).

term/short-term debt), alternative tax variables (e.g., statutory tax rate, average tax rate, with/without controls for PIT, with/without controls for non-debt-tax-shields) the regional focus and the publication status of the respective study. Concerning the respective impact on the corporate tax elasticity of debt, ten quite robust findings stand out:

1. Estimates that derive from within-country variation in tax rates are larger than those based on cross-country variation.

2. The responsiveness of the debt structure to taxes is gradually rising over time, since the average sample year of the primary data has a significant positive impact on the size of the tax elasticity.

3. The elasticity for long-term debt is systematically smaller than for other types of debt, the elasticity of short-term debt is generally insignificant.

4. The widely-spread belief that the responsiveness of intracompany debt (i.e., debt within multinational enterprises or international holding structures) is systematically larger than that of "normal", i.e., external debt, is not supported.

5. Studies that use the average tax rate computed from firm-level data instead of the statutory rate find systematically larger tax elasticities.

6. Studies that control for the evolution of relevant personal income tax (PIT) rates yield significantly larger elasticities for the CIT elasticity.

7. Estimations that control for non-debt tax shields yield smaller elasticities than those without such controls.

8. Corporate debt bias seems to be a non-linear phenomenon since the tax rate at wich the elasticitiy is measured exerts a positive effect on the size of the elasticity.

9. The size of the debt bias varies systematically between countries. For instance, studies based on data for either the U.S. or Germany yield elasticities that are slightly larger than studies where the location of residence of the firm (or, in case of

multinationals, of the headquarters/parent company) varies across many different countries.

10. The publication status does not matter systematically.[11]

Finally, in step three of his analysis, de Mooij (2011b, 21-22) uses the results of the meta regressions to simulate typical elasticities which best reflect the most salient findings from primary studies, thereby summarizing the extant evidence in a kind of "consensus estimate". In doing so, he obtains simulated tax elasticities that illustrate four main lessons that are contained in the state of empirically verified knowledge: (1) the sizeable difference in simulated tax elasticities between the values of 0.5 for total leverage and of 0.7 for total debt implies that the narrower category of debt liabilities is more responsive to tax than the broader category of liabilities;[12] (2) the simulated elasticities for both intracompany debt and third-party debt are similar to that for total leverage, but smaller than those for total debt; (3) the simulated elasticity for short-term debt is larger than the elasticity for long-term debt; and (4) the responsiveness of debt to CIT has risen over time: Data for 1992 lead to a simulated elasticity of 0.19, whereas data for 2011 translate to a simulated elasticity of 0.3.

By computing the marginal impacts of the CIT rate on the debt-asset ratio, de Mooij (2011b, 21) obtains an impact of the CIT rate on the debt-asset ratio of 0.17 for narrow and 0.28 for broad measures of financial leverage. In the related policy-paper, he provides a plain illustration of the economic relevance of this result (de Mooij 2011a, 8): "A coefficient of 0.28 would mean that a 10 percent-point lower CIT rate, e.g., from 40 to 30 percent, reduces the debt-asset ratio by 2.8 percent, e.g., from 50 to 47.2 percent. A country with a CIT rate of 36 percent (like the U.S., addition by the author) that would fully eliminate the corporate tax advantage of debt would see the average corporate debt-asset ratio fall by 10 percent, e.g., from 50 to 40 percent."

[11] However, a higher publication rank (based on the journal classification of the Tinbergen Institute) is correlated with a smaller standard error (de Mooij 2011b, 20).

[12] Total debt consists only of short-term and long-term debt, whereas a broad notion of financial leverage also includes accounts payable to creditors, reserves, insurance, deferred taxes and other non-debt liabilities (de Mooij 2011b, 13 and de Mooij 2011a, 8, footnote 10, for details see Rajan and Zingales (1995)).

2.3 ACEs in Practice: Experiences and Prospects

The theoretical concept of a neutral "pure profits" tax that would subject only those returns on investment to corporate tax that are above the costs of capital was developed by Boadway and Bruce (1984).[13] The idea was further pushed towards implementation by Devereux and Freeman (1991) in the context of the Capital Taxes Committee of the Institute for Fiscal Studies in London (IFS 1991). They advocated to ensure equal taxation of all sources of finance by providing companies with an 'Allowance for Corporate Equity'. Since the equity tax relief is guaranteed, they later proposed the risk-free nominal interest rate, i.e., at that time, the rate on government bonds, as the appropriate notional return for the calculation of the ACE (Devereux, Griffith and Klemm 2002). In practice, the base of such an ACE would be equal to the book value of equity minus equity stakes in other firms.

Besides being neutral with respect to the scale and financing mode of investment, an ACE tax offers the additional benefit that it offsets investment distortions that result from differences between economic depreciation and official depreciation schedules for tax purposes: The present value of the sum of the depreciation allowance and the ACE allowance is independent of the rate at which firms write down their assets in the tax accounts (de Mooij 2011a, 16).

The first European countries that experimented with variants of an ACE in practice were Croatia (1994), Italy (1997), and Austria (2000).[14] The subsequent abolition was not a result of technical or administrative difficulties, but followed the dominant tax reform logic of the time, i.e., to reduce statutory rates at all costs in the context of 'rate cut cum base broadening' strategies (Keen and King 2002).

Early evaluations suggested that these ACE reforms, notwithstanding their sometimes only partly implementation and short-lived existence, were associated with reduced debt-

[13] In the strict sense, it would be more correct to state that the publication of Boadway and Bruce (1984) accomplished the breakthrough of the ACE concept in the international public finance community, since the basic idea was put forward already by Wenger (1983), unfortunately only in German language.

[14] Brazil introduced a variant of the ACE tax in 1996, but limited the notional interest deduction to distributed profit, excluding retained earnings (see Klemm 2007 for details).

equity ratios (Staderini 2001, Keen and King 2002, Klemm 2007). However, these empirical studies suffered from various problems that resulted from major identification challenges due to the simultaneity with other relevant policy measures, especially in the context of Croatia in the midst of its transition from a centrally planned to a market economy, and the lack of adequate data.

In contrast to these early ACE implementations, the introduction in Belgium at the beginning of the year 2006 offers a comparatively "clean" scenario and the first opportunity to evaluate a full-scale ACE corporate tax system with a rigorous identification strategy. Yet to the best of our knowledge, Princen (2012) is the only microeconometric evaluation study so far. In her working paper, she pursues a DiD approach and uses French corporations as the comparison group whose comparability is ensured via a prior matching on the propensity score. She detects a highly significant impact of the ACE introduction that implies a decrease in the leverage ratio of firms in the Belgian industrial sector of 2 to 7 percent. In accordance with the financial constraint theory (see e.g., Erickson and Whited 2000, Almeida and Campello 2007), she furthermore finds that the leverage ratio of large companies is more responsive than those of small and medium entreprises who are obviously more restrained with respect to size and speed of financial structure adjustments. Princen (2012) also inspects whether the ACE introduction had a positive impact on corporate investment, but finds no significant effect.

In the aftermath of the global financial crisis that spread from the U.S. after the collapse of Lehman Brothers in September 2008, a renewed interest in the ACE tax can be observed. As early as June 2009, the Fiscal Affairs Department of the IMF issued a policy paper that contained possible implications of the crisis for future tax design. It accentuated the fact that the debt bias of corporate income taxation has likely encouraged excessive leverage and thereby contributed to the build-up of the crisis.[15] Concerning the basic

[15]Bullet point no. 1 of the Executive Summary addresses the debt bias of corporate income taxation head-on (IMF 2009, 1): "Corporate-level tax biases favoring debt finance, including in the financial sector, are pervasive, often large - and hard to justify given the potential impact on financial stability. There is a strong case for dealing more decisively with this bias; for example, by also allowing a deduction of an imputed equity cost (which for regulated financial institutions would be akin to an allowance for Tier 1 capital)."

alternative to eliminate the debt bias, either by the limitation of interest deductibility [16] or by the introduction of an allowance for the notional cost of equity finance, the IMF clearly favors the latter, i.e., the implementation of ACE tax reforms (IMF 2009, 14-16).

Similar recommendations were adopted by an expert group of the European Commission (European Commission 2008), by a tax committee of the Dutch government (Ministry of Finance of the Netherlands 2010), by the Mirrlees Review for the UK (Mirrlees et al. 2011), and by the German Council of Economic Experts (German Council of Economic Experts 2012, 220-247).[17]

These calls for ACE tax reforms did not go unheard: In 2010, Latvia introduced a notional interest deduction on retained earnings. The applicable rate is calculated as the annual weighted average rate of interest on loans to non-financial businesses (de Mooij 2011a). In December 2011, the Italian Government of Mr. Monti presented a reform under the title "Aiuto alla Crescita Economica" (Aid to Economic Growth), abbreviated ACE, that shares both, the acronym and the main characteristics with the original IFS proposal.[18]

Overall, the idea to eliminate the debt bias of corporate income tax systems by means of an allowance for corporate equity, established and discussed in academia for almost three decades, but implemented only in very few countries, might now be on the cusp of a broader implementation. Thus, a rigorous examination of the Belgian experience is surely warranted.

[16] Through thin capitalization rules, a comprehensive business income tax or 'cash flow' forms of corporate income taxation, see IMF (2009, 13)

[17] This enumeration is by no means exhaustive and focuses on the most prominent protagonists of the debate. With respect to individual countries, comparable recommendations were voiced by, e.g., Fehr and Wiegard (2003), HSK and RWI (2006), Keuschnigg and Dietz (2007), and Zöller (2011).

[18] The ACE tax reform bill was passed into law on 22 December 2011 and further detailed in a decree by the Ministry of Economy and Finance dated 14 March 2012. See Panteghini, Parisi and Pighetti (2012, 4-7) for details.

3 The ACE Corporate Tax Reform in Belgium

The ACE Tax reform was passed into law by the Belgian Parliament in June 2005.[19] It introduced the so-called "Deduction for Risk Capital" by inserting the new Articles 205bis to 205novies in the Belgian Income Tax Code. The law is applicable as from tax year 2007, i.e., for financial years ending as of December 31, 2006.

In an explanatory memorandum[20] the tax reform is motivated by four objectives: (i) to reduce the tax discrimination between equity and debt financing; (ii) to reinforce the attractiveness of capital intensive investments and financing; (iii) to provide an attractive environment especially for finance companies; and (iv) to introduce a viable alternative to Belgian Coordination Centers (BCCs).

However, as the detailed analysis of Valenduc (2009) elaborates, the prime reason for the Belgian Government to engage in the ACE tax reform was undoubtedly the coming abolishment of the preferential tax regime that existed since 1982 under the designation of "Centres de Coordination". The BCCs allowed Belgium to attract many headquarters from multinational enterprises or specialized entities that served as internal bank for international holding structures: In the early 1990's more than 250 multinational groups had established a coordination centre in Belgium (Peeters and Hermie 2011, 5).

But from the second half of the 1990's, the debate on preferential tax regimes and harmful practices of international tax competition gained momentum, both in the OECD and the European Union.[21] The ECOFIN Council agreed on the so-called "fiscal package" on December 1, 1997 which stipulated the abolition of harmful tax regimes in the European Union until January 1, 2003. In November 1998, the European Commission made clear that it regards the BCC regime as a harmful tax practice that has to be brought to a termination. After the failure to construct a de jure "Europe-proof" loophole that would have left the substance of the BCC regime de facto untouched and some legalistic

[19] The Law of 22 June 2005, introducing the deduction for risk capital (*State Gazette*, 30 June 2005), as implemented by the Royal Decree of 17 September 2005 (*State Gazette*, 30 September 2005).

[20] Preparatory Works, Parl. Doc. Kamer 2004-2005, No. 51-1778/001.

[21] See Valenduc (2009, 30-38) for details.

rearguard action that led at least to an extension of the transition period for established BCCs, the Belgian Government finally gave in. Searching for a way that preserved a favorable tax situation for the remaining BCCs[22], it decided finally to implement the ACE tax reform.

Concerning the implementation, three fundamental rules were defined with respect to the equity base, the applicable interest rate, and the body of affected enterprises: (i) The equity to be taken into account for the calculation of the notional interest deduction is the company's slightly corrected equity, i.e., the stock of share capital and retained earnings, at the end of the previous book year, as documented in the annual accounts.[23] (ii) The applicable interest rate is determined by the government on the basis of the annual average rate of the monthly published interest rate on 10-year Belgian Government bonds. (iii) For small and medium sized entreprises, the notional rate is increased by 50 basis points.[24]

Regarding reach and impact of the reform, statistics from the Belgian Ministry of Finance reveal that 434,275 companies were affected in the fiscal year 2009 who received in total a notional interest deduction of 17.3 billion Euro. The largest 20 companies accounted for a third of this amount (5.6 Billion Euro) and the largest 500 companies for slightly more than half (9 billion Euro). On the other hand, 110,100 small and medium enterprises received only 5.3 percent (925 million Euro) of the granted deductions (Adams 2012, 15).

Early descriptive analyses come to the conclusion that the reform achieved the four above-mentioned aims of the Belgian Government.[25] Subsequent to the elimination of the tax discrimination between equity and debt financing, a substantial rise in equity capital was observed. The net total rose from 13 billion Euro in 2005, the last pre-reform year, to 102 billion Euro in 2006 and to 141 billion Euro in 2007.[26]

[22]During the controversy between Belgium and the European Union and due to the resulting uncertainty with respect to the future corporate tax regime, only 121 coordination centers remained in Belgium when the ACE tax came into effect (Peeters and Hermie 2011, 5).

[23]See Peeters and Hermie (2011, 7) for an overview of the necessary adjustments to the equity base.

[24]In practice, however, the government reacted in December 2011 to the perturbations from the global financial and economic crisis and the agreements of the so-called European "Six Pack" by capping the ACE rate to 3 percent for the years 2012 to 2014 (3.5 percent for SME's), whereas the normal rate for 2012, according to the law, would have been 4.2 percent (Adams 2012, 7).

[25]The following information is taken from Burggraeve, Jeanfils, Van Cauter and Van Meensel (2008).

[26]See "Tableau 1: Variations Nettes Du Capital Social" in Burggraeve et al. (2008, 15).

The evolution of foreign direct investment suggests that the ACE reform indeed reinforced the attractiveness of capital intensive investments (+41 billion Euros from 2005 to 2006). The new tax environment also attracted newly created finance companies, 5,350 alone for the years 2005 and 2006, mainly owned by foreign parent companies.

Finally, the number of BCCs continued to decline after the ACE tax came into effect, but in contrast to the last couple of pre-reform years, the parallel decline in capital of the remaining BCCs came to a stop. Obviously, these coordination centers came to the conclusion that the notional interest deduction provided them an equally advantageous tax situation like the original prefential treatment that was replaced by the ACE reform (Burggraeve et al. 2008, 21-23).

4 Research Design

4.1 Econometric Model

To approximate the ideal of a random experiment as close as possible in the non-experimental setting of the Belgian ACE tax reform, we employ the counterfactual research design of the Difference-in-Differences approach (henceforth: DiD).[27] Hence, we interpret the ACE introduction in Belgium as an exogenous treatment and evaluate its effect on the leverage ratio as the outcome variable. The Belgium corporations that are subject to the tax reform from accounting year 2006 onwards constitute the treatment group.

A critical challenge in the implementation of the DiD approach is to find a suitable control group so that two key assumptions can be asserted to hold (Imbens 2004, 7-9). The first assumption can be conceived as the DiD equivalent to the standard exogeneity assumption.[28] It states in terms of the notation advocated by Rubin (1974, 1978) that the potential outcomes are independent from the treatment assignment once all relevant characteristics of the respective units of observations in treatment and control groups are taken into account. We therefore follow the terminology of Lechner (1999, 2002) and refer to this assumption as *conditional independence* (henceforth: CIA).[29]

The second assumption, commonly referred to as *overlap*, concerns the joint distribution of treatments and covariates. It requires that the covariate patterns of observations from treatment and control groups are very similar for a sizeable share of the unmatched sample. Put differently, the overlap assumption states that unbiased estimates of treatment effects are only possible if treatment and control group have in large part the same pre-treatment characteristics. A critical lack of overlap occurs if for a sizeable proportion of units with a

[27] See Bauer, Schmidt and Fertig (2009, 358-362) for a short introduction to policy analysis by DiD estimation and Morgan and Winship (2007, 31-166) for an excellent exposition of the principles and methods that are the foundation for the counterfactual model of causal inference.

[28] In the literature, this assumption is alternatively referred to as "ignorable treatment assignment", "conditional independence assumption", "unconfoundedness" or "selection on observables", see the survey by Imbens (2004).

[29] In experiments, this property is achieved by random sampling. In a non-experimental context, CIA can be fulfilled if all characteristics that matter systematically for the propensity of the units of observation to be part of the treatment group are observed.

given covariate pattern in the treatment group, no corresponding control units exist that exhibit a very similar covariate pattern (Imbens 2004, 7-9, and Abadie, Drukker, Herr and Imbens 2004, 291-292).

Translated to our context, CIA implies that treatment and control group display a similar trend with respect to the outcome variable in the absence of treatment. Therefore, the trend in the capital structure of control group companies should be similar to the one that is observed in affected Belgian firms for at least a couple of years prior to the ACE tax reform. Minor differences in national trends are no exclusion criterion, since the DiD implementation in a regression framework allows to control for country and time fixed effects as well as for macroeconomic influences resulting from differences in, e.g., GDP growth or inflation rates.

More concretely, the stratified sampling of the counterfactual group corporations ensures that the firms in the treatment and control groups have the same pre-treatment characteristics. Thus, the only remaining difference of relevance would be the fact that treatment companies in Belgium benefit from the equity tax shield from accounting year 2006 onwards whereas the tax discrimination between debt and equity financing persists for the firms in the control group. Hence, a difference in the outcome of interest, i.e., the leverage ratio, could be interpreted entirely as the causal effect of the Belgian ACE tax reform.

Matching of treatment and control groups via the propensity score as proposed by Rosenbaum and Rubin (1983) summarizes all relevant firm characteristics X in a single index, $p(X)$. Hence, the conditional probability that firm i with observable charasteristics X_i will be part of the treatment group that is affected by the ACE tax reform can be expressed in the following way:

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

As a result of equation 1, it is sufficient to use the scalar $p(X)$ to compare and match firms from treatment and control groups instead of having to deal with the whole vector of characteristics, X. After the identification of a suitable control group, a DiD regression

model can be set up to evaluate the effect of the Belgian ACE tax reform as follows:

$$LR_{i,j,t} = \alpha + \beta X_{i,j,t} + \gamma C_j + \lambda T_t + \delta ACE_{j,t} + \epsilon_{i,j,t} \quad (2)$$

In equation 2, the individual leverage ratio $LR_{i,j,t}$ of firm i in country j at time t is explained by the firm characteristics $X_{i,j,t}$, time-invariant country effects C_j, country-invariant time effects T_t, and the tax reform treatment effect $ACE_{j,t}$. The latter is itself defined as an interaction term ($ACE_{j,t} = C_j \times P_t$) of an indicator for the treatment sample (i.e. $C_j = 1$ in the case of Belgian firms, $C_j = 0$ for firms of the comparison group) and an indicator for the post-reform time period (i.e. $P_t = 1$ for the years 2006 et seq., $P_t = 0$ for years until 2005).

4.2 Selection of Comparison Group

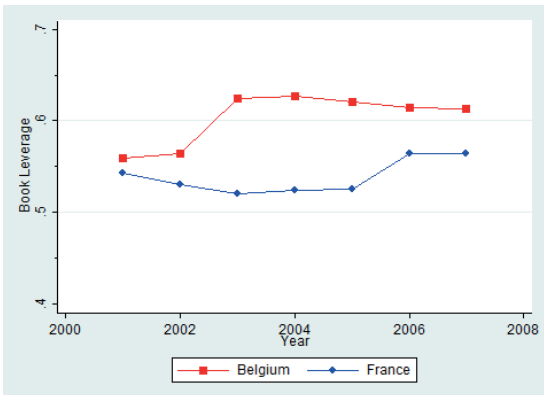
The identification of a suitable comparison country that provides the necessary reservoir for calculating counterfactual observations can be based on a variety of characteristics (e.g., institutional comparability, similarity with respect to economic structure and business law, cultural and geographical proximity and so forth). The most decisive criterion in light of the common trend assumption is that the units of observation in treatment and control group display a common trend with respect to the outcome variable of interest in the years before the treatment.

In the context of the ACE tax reform in Belgium, this demands that the evolution of the leverage ratio of selected control group companies should be as similar as possible to the one of affected Belgian firms in the years before the notional interest deduction came into effect. In her evaluation of the ACE reform in Belgium, Princen (2012) first selects France as the source country for comparison group firms and then performs a propensity score estimation to match the two samples as described above. At first sight, this seems to be an obvious choice, given the similarities between both countries, the fact that the considerably bigger firm population in France allows to draw good comparison companies for every unit of observation in Belgium and, not least, that the data quality for France

is among the best in the utilized Amadeus accounting database.

Hence, we started our investigation of possible comparison countries also with France by calculating the averages of two alternative outcome variables that measure the financial structure of companies, i.e., book leverage and financial leverage.[30] However, the requirements of the common trend assumption are quite obviously not fullfilled by French manufacturing firms in the relevant time span, as documented in figure 1 and figure 2.

Figure 1: Book Leverage (Mean), Belgium and France, Manufacturing, 2001-2007



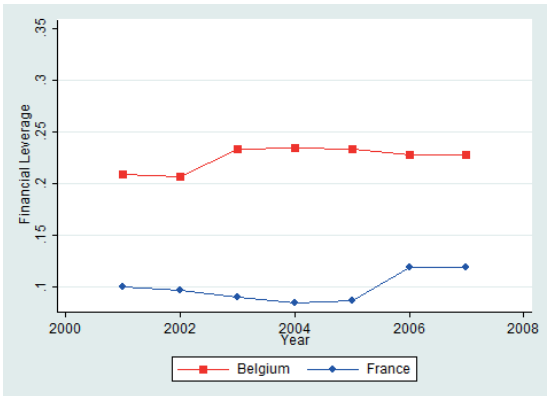
Source: Own calculation, based on accounting information from the Amadeus database (BvD), updates #124 and #202.

Figure 1 shows the evolution of the respective mean for book leverage in manufacturing firms from Belgium and France in the time period from 2001 to 2007. At first glance, two conspicuous features catches one's eyes: First, in the pre-reform period, the manufacturing firms from Belgium and France are not displaying the same evolution. Whereas the path of the book leverage ratio in Belgium jumps from the year 2002 to 2003 and starts a smooth decline afterwards, the trend in France is slightly falling in the years from 2001

[30] Book leverage and financial leverage are both standard measures for the financial structure of firms. They differ with respect to the types of debt that are taken into account. The broader defined book leverage ratio calculates the sum of all types of leverage in the balance sheet (including, e.g., vendor financing) and relates it to total assets, whereas the narrower defined financial leverage ratio focuses on classical debt items of financial nature only. We follow Dwenger and Steiner (2014) who argue that the financial leverage ratio is thus the more appropriate outcome variable subject to optimization for tax purposes by firms.

to 2005. Second, even more striking is the fact that in the post-reform period that starts with the year 2006, no noticeable shift is observed for the Belgian firms, but a significant rise in the leverage ratio of the French companies stands out.

Figure 2: Financial Leverage (Mean), Belgium and France, Manufacturing, 2001-2007



Source: Own calculation, based on accounting information from the Amadeus database (BvD), updates #124 and #202.

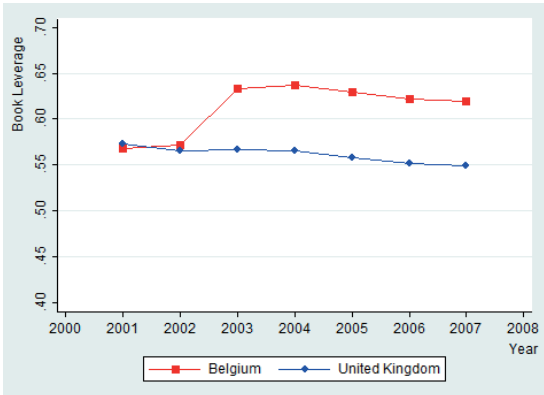
The described pattern holds also for financial leverage as the alternative outcome variable to measure the financial structure. The respective mean trends for Belgian and French manufacturing firms are displayed in figure 2. One could suspect that composition effects arising from the entry and exit of firms in the two unbalanced firm samples might be responsible for the observed peculiarities. But the overall picture does not change at all if one calculates and plots the trend evolution of the more robust median values over time, as documented by figure 7 and figure 8 in the appendix.

Finally, we checked whether the problematic jumps in the trends are due to the size composition that is dominated by small and medium-sized firms. We therefore calculated the respective mean and median values for book and financial leverage separately for small, medium and big firms.[31] The resulting plots (see figure 9 in the appendix) document negligible differences of quantitative nature, but the overall qualitative impression

[31]We followed the definition of the European Commission for the classification of companies as small, medium or big (see European Commission 2003) and excluded micro enterprises for whom the Belgian ACE tax reform did not apply.

is confirmed. Hence, a firm sample from France is obviously no suitable choice as the comparison group.[32]

Figure 3: Book Leverage (Mean), Belgium and UK, Manufacturing, 2001-2007



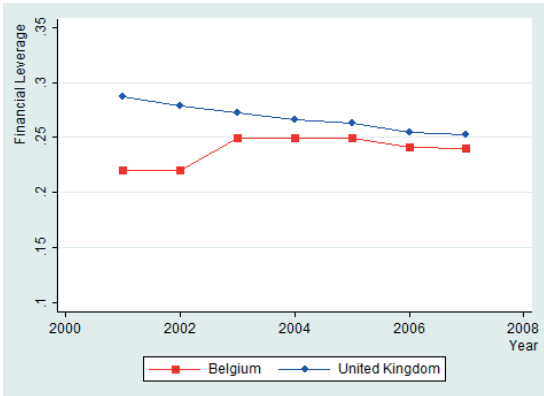
Source: Own calculation, based on accounting information from the Amadeus database (BvD), updates #124 and #202.

After screening different candidate countries, we choose firms from the United Kingdom as the comparison group for our analysis of the ACE introduction in Belgium. During the relevant time span, the corporate tax system of the UK features no relevant reforms. Figure 3 and figure 4 demonstrate that the respective mean trends of book leverage and financial leverage satisfy the common trends assumption almost perfectly in the time span from 2003 to 2007, providing an opportunitiy for a clean identification with three years of observations in the pre-reform period and two years after the ACE tax came into effect.[33]

[32]Nevertheless, we replicated the results of Princen (2012) by means of a DiD estimation on matched samples from Belgium and France. Throughout, we obtain very similar results as Princen. However, we refrain from interpreting these results as a causal effect of the ACE tax reform since the common trend assumption is apparently violated not only for French manufacturing firms, but across all sectors.

[33]This holds also for the corresponding median trends and across all size groups (see figures 10, 11 and 12 in the appendix).

Figure 4: Financial Leverage (Mean), Belgium and UK, Manufacturing, 2001-2007



Source: Own calculation, based on accounting information from the Amadeus database (BvD), updates #124 and #202.

4.3 Data and Variables

The dataset for our empirical analysis is mainly based on the pan-European database AMADEUS compiled by the Bureau van Dijk (BvD). It contains detailed accounting information on more than 10 million companies from 41 countries, including the EU countries and Eastern Europe. A standard company report includes 24 balance sheet items, 26 ratios, 25 profit and loss items and descriptive information including trade descriptions and activity codes.

More precisely, the accounting data used in the present analysis stem from the BvD Amadeus updates #124 (January 2005) and #202 (January 2011). Since every update spans about ten years backwards, there is a considerable overlap of the two sources. Given that, for every update, quality inspections and data revisions by BvD usually focus on the most recent three to five years, we do not construct our final dataset by simply assembling the two updates at a single date. Instead, we use a merging procedure that exploits the existing overlap to fill gaps in the newer update with information from the older one wherever this enhancement of overall data quality is feasible.

To avoid a limitation on manufacturing in face of a tax reform that applied uniformly

to corporations in all industries, we constructed a composite dataset that encompasses five broad economic sectors: "Manufacturing" (Nace Rev.2 Code: C), "Construction" (F), "Trade and Retail" (G), "Accomodation and Food Services" (I) and "Business Services" (M).[34]

We restrict the time span of our dataset to the years from 2003 to 2007 for two reasons: Prior to that period, precisely from 2002 to 2003, the average leverage ratio of Belgian corporations displays a significant increase.[35] Afterwards, the accounting year 2008 witnessed the collapse of Lehman Brothers on September 15^{th} and the resulting escalation of the U.S. financial crisis to the second global economic depression.

Several additional steps of data selection and preparation are undertaken: First, since we evaluate a corporate tax reform, we restrict the sample to companies of the corporate sector. Second, to identify the reform effect without confounding influences from (multi- or international) group or holding structures, we only keep companies for which unconsolidated accounting data are available. Third, we exclude all companies that are defined as "micro" by the European Commission (2003), since they were also excluded from the benefits of the ACE equity tax shield. Fourth, observations with clear data errors were dropped,[36] likewise observations with book values for fixed assets or total debt higher than 100 percent or lower than 0 percent of total assets, and observations that appeared in the first or one hundredth percentile of the respective distribution with respect to at least one of the main variables.[37]

As covariates that control for country specific influences on a macroeconomic level, the respective GDP growth rates and the inflation rates for Belgium and the UK were added. This information is taken from the database *OECDStat*. Finally, a group of category variables is defined to allow for split-sample analyses along several differentiating characteristics like firm size or industry affiliation. Within the five broad economic sectors, we

[34] We investigated separately by sectors for Belgium and the UK whether the common trend assumption is likewise fulfilled beyond the manufacturing sector. The throughout positive results are documented by figures 13, 14, 15, and 16 in the appendix.

[35] See figures 3 and 4.

[36] For example, we dropped observations with negative values for fixed assets or turnover.

[37] The three central variables that were included in this data cleaning of extreme values are the respective ratios of book leverage and financial leverage to total assets, as well as the ratio of total fixed assets to total assets, labeled "Tangibility".

include industry dummy variables that differentiate between groups of economic activities on the two-digit level of NACE Rev. 2. Table 2 summarizes the descriptive statistics of the dataset that served as the point of departure for the propensity score matching that is described in the following subsection.

The variables used in our estimations are defined and constructed as follows: **Financial leverage** is the ratio of financial debt to total assets. **Book leverage** is the ratio of total debt (i.e., the sum of long term debt and current liabilities) to total assets. **Tangibility** is measured as the ratio of the book value of tangible fixed assets to the book value of total assets. **Profitability** is calculated as the rate of earnings before interest, taxes, depreciation and amortization (EBITDA) to the book value of total assets. **Size** is defined as the natural logarithm of total assets.

The dummy variable **Net operating loss** takes the value of one if the firm is making an operative loss in the respective year and zero otherwise. The variable **Non-debt tax shield** is calculated as the ratio of depreciation costs over total assets. It serves as a proxy for tax reliefs which are not due to debt and arise most likely through (accelerated) depreciation allowances.

The macro variables **Inflation** and **GDP growth rate** are the annual percentage rates of change of the harmonized consumer price index and of national GDP growth, respectively, as defined by the OECD. The **Sectoral dummys** are defined in accordance to NACE Rev.2, the **Size dummys** follow the approach of the European Commission (2003).

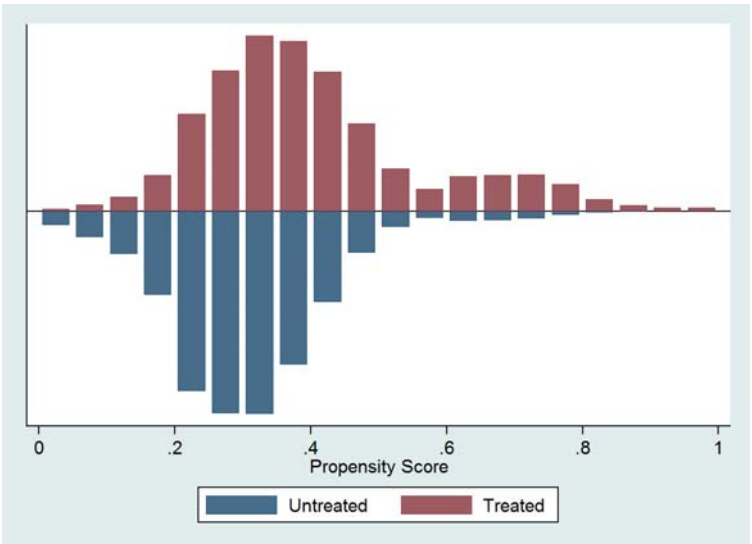
4.4 Matching and Descriptive Evidence

The propensity score estimations to match the sectoral samples of treated and untreated observations with respect to all relevant and observable characteristics is carried out on the basis of data for the year 2004. In so doing, we insulate the estimates from conceivable anticipation effects by Belgian firms who possibly started to adjust their leverage ratio before the law came into effect.[38]

[38]However, such a precipitate adjustment of the financial structure is unlikely, since a declining debt tax-shield would inevitably lead to higher tax liabilitities for the accounting year 2005.

As the first step of the matching procedure, the propensity score is estimated by means of a probit model based on the variables that potentially determine the leverage ratio. Thus, the set of independent variables consists of the two accounting ratios tangibility and profitability, firm size, a dummy for loss-making firms, as well as industry dummies at the two-digit level. We use a very flexible functional form that includes squared and cubic terms as well as some interactions. As a result of this estimation, the relevant information contained in these variables is compressed into a single index, the propensity score.[39]

Figure 5: Common Support for Belgium and the UK



In step two, we used the propensity scores obtained in step one as a tool to match treatment observations from Belgium with similar control observations from the UK. Given that the sample size for the UK is bigger than for Belgium and we later employ estimation techniques on the basis of the matched sample that cannot deal with frequency weights, we applied a nearest neighbor matching with only one match per treatment observation and no replacement.

[39]Since we are not interested in these estimation results per se, but only in the use of the resulting propensity score as a matching tool, we do not discuss the preparatoy probit regression in detail. The output is documented in table 14 in the appendix.

To obtain an ideal evaluation dataset, we followed the advice of Leuven and Sianesi (2011) and forced the matching routine to drop all treatment observations from Belgium that were off the common support, i.e., whose propensity score was higher than the maximum or less than the minimum propensity score of the control observations from the UK. The result of the matching procedure is illustrated by figure 5. It shows that the common support reaches across a wide range of propensity score values, and that a suitable match from the UK control group was found for a very large majority of observations in the Belgian treatment group.[40]

Table 1: Belgium and UK - Results of Propensity Score Matching

Variable		Treated	Control	% Diff.	% Diff. Reduction	t	p>|t|
Tangibility	Unmatched	0.24574	0.26744	-8.9		-14.83	0.000
	Matched	0.24574	0.24470	0.4	95.2	0.65	0.513
Profitability	Unmatched	0.10112	0.09356	7.1		11.81	0.000
	Matched	0.10112	0.10104	0.1	99.0	0.11	0.910
Size	Unmatched	8.45360	8.85220	-32.9		-55.14	0.000
	Matched	8.45360	8.46540	-1.0	97.0	-1.51	0.131
Net Operating Loss (NOL)	Unmatched	0.21242	0.20197	2.6		4.36	0.000
	Matched	0.21242	0.20401	2.1	19.5	3.03	0.002

A detailed account of the matching quality is documented in table 1. The aim of stratifying a sample in which treated and control observations are virtually identical with respect to the decisive covariates is achieved to a great extent: For Tangibility, Profitability and Size, the matched sample displays no significant differences in the means of treated and control observations. The only exception is the dummy variable that indicates whether a firm recorded an operating loss in the previous accounting year: 21.2 percent of the Belgian companies booked an operative loss for the year 2003, whereas this was the case for "only" 20.4 percent of their counterparts from the UK. However, the significant difference of 80 basis point between the two means is clearly irrelevant in economic terms.[41] Overall,

[40] To be precise, the matching procedure resulted in a loss of 17,487 observations with respect to the original firm sample that included 83,320 observations for Belgium, i.e., a loss of 20,1 percent of the original sample size.

[41] In addition, our preferred DiD regression specification will not use this simple dummy, but rely on

we are confident that the matched sample provides a good basis for the evaluation of the Belgian ACE tax reform.

The summary statistics are provided in table 2. The first two data columns contain the mean values for Belgium and the UK for the pre-reform period from 2003 to 2005, and the fourth and fifth data columns display the respective values for the two years of the post-reform period, i.e., 2006 and 2007. The respective differences "Belgium UK" in columns four and seven, omitted for the sets of industry and size dummy variables, are estimated by two-sample t tests making use of Welch's approximation, i.e., without imposing the assumption of equal variances in the different subgroups. By substracting the two differences in columns four and seven for financial leverage and book leverage, an unconditional DiD estimator, i.e. the pure difference in differences across groups and time periods, can be calculated for the respective leverage ratio.[42] For financial leverage, the unconditional reform effect amounts to an increase of 0.007 percentage points; for the alternative outcome variable of book leverage, the difference between the two differences is null.

the continuous variable "Non-Debt Tax Shield" (NDTS). We nevertheless decide in favor of NOL for the matching procedure since its data coverage is slightly better than that of $NDTS$.

[42] See Wooldridge 2006, 467-470 for a brief exposition of this elementary DiD approach.

Table 2: Descriptive Statistics, Matched Sample, 2003-2007

	Pre-period (2003-2005)			Post-period (2006-2007)		
Variable	Belgium	UK	Diff.	Belgium	UK	Diff.
Financial leverage	0.260	0.275	-0.015***	0.251	0.260	-0.008***
	(0.199)	(0.214)	(0.002)	(0.195)	(0.209)	(0.002)
Book leverage	0.652	0.604	0.047***	0.632	0.585	0.047***
	(0.218)	(0.219)	(0.002)	(0.218)	(0.219)	(0.002)
Tangibility	0.248	0.246	0.002	0.241	0.229	0.012***
	(0.243)	(0.245)	(0.002)	(0.237)	(0.243)	(0.002)
Profitability	0.100	0.091	0.009***	0.103	0.089	0.014***
	(0.100)	(0.109)	(0.001)	(0.097)	(0.109)	(0.001)
Size	8.535	8.915	-0.380***	8.772	9.136	-0.364***
	(1.182)	(1.192)	(0.008)	(1.174)	(1.261)	(0.010)
Net operating loss (Dummy)	0.203	0.200	0.003	0.172	0.183	-0.011***
	(0.402)	(0.400)	(0.003)	(0.377)	(0.387)	(0.003)
Non-Debt Tax Shield	0.045	0.032	0.013***	0.042	0.029	0.012***
	(0.045)	(0.039)	(0.000)	(0.042)	(0.074)	(0.001)
Inflation	1.962	1.569	0.393***	2.082	2.325	-0.243***
	(0.422)	(0.324)	(0.003)	(0.260)	(0.005)	(0.002)
GDP Growth Rate	1.957	2.891	-0.934***	2.780	3.041	-0.262***
	(0.989)	(0.588)	(0.006)	(0.060)	(0.430)	(0.002)
Industry dummies:						
Manufacturing (C)	0.262	0.318		0.265	0.319	
	(0.440)	(0.466)		(0.442)	(0.466)	
Construction (F)	0.141	0.175		0.141	0.172	
	(0.348)	(0.380)		(0.348)	(0.377)	
Wholesale & retail trade (G)	0.436	0.402		0.442	0.406	
	(0.496)	(0.490)		(0.497)	(0.491)	
Accomodation & food svc. (I)	0.021	0.035		0.020	0.035	
	(0.144)	(0.184)		(0.141)	(0.184)	
Professional activities (M)	0.139	0.069		0.132	0.069	
	(0.346)	(0.254)		(0.338)	(0.253)	
Size dummies:						
Small	0.788	0.754		0.791	0.749	
	(0.408)	(0.431)		(0.406)	(0.434)	
Medium	0.154	0.177		0.152	0.181	
	(0.361)	(0.382)		(0.359)	(0.385)	
Big	0.058	0.068		0.056	0.069	
	(0.234)	(0.253)		(0.231)	(0.254)	
Number of observations	40,008	55,950		25,735	34,753	

Notes: (i) Data from Amadeus (BvD), updates #124 and #202. (ii) Differences (BE-UK) are estimated by two-sample t tests making use of Welch's approximation. (iii) Standard errors are reported in parentheses. (iv) * Significant at 10%, ** at 5%, *** at 1%.

5 Results

5.1 Benchmark Results

The results of our DiD estimation for book leverage and financial leverage according to equation 2 are displayed by table 3 and table 4, respectively. There is no difference between the underlying econometric models, except for the change of the outcome variable that measures the financial structure. All variants are estimated by pooled OLS with standard errors clustered at the level of the individual firm.[43] The tables contain coefficients and corresponding standard errors in parentheses of four different specifications in columns (1) to (4).

In column (1), the leverage ratio is explained only by those factors that capital structure research has identified unambiguously as being of importance: profitability, tangibility, and size (see, e.g., Bradley et al. 1984; Long and Malitz 1985; Titman and Wessels 1988; Harris and Raviv 1991). Comparing column (1) for the alternative outcomes, one observes that the regression results for financial leverage appear to be more trustworthy, since the coefficients for the three central regressors are correctly signed and of plausible size:

The financial leverage ratio (i) declines with higher profits that increase the self-financing capacity and reduce the need for external funding; (ii) rises with a higher tangibility that provides more collateral and enables a higher debt ratio; and (iii) increases with firm size, which reflects the fact that bigger companies usually have easy access to outside financing, whereas small and medium-sized firms are often subject to borrowing. In contrast, the coefficient for tangibility is highly significant with the "wrong" sign and the one for size is insignificant in column (1) of the equivalent estimation for the book leverage ratio.

Turning to the three variables that define the DiD framework, the country dummy signals that the book leverage ratio is on average 4.8 percent higher in Belgium than in the UK, whereas no significant difference is documented with respect to financial leverage.

[43] Since we use nearest neighbour matching with unique matches and without replacement, no special adjustments to the OLS estimation routine in Stata, like the explicit consideration of frequency weights or the like, were necessary.

Table 3: Effect on Book Leverage, 4 Specifications, All Sectors, Matched Sample

Dependent Variable: Book Leverage	(1)	(2)	(3)	(4)
Country *(Dummy)*	0.04776***	0.04620***	0.03903***	0.02958***
	(0.00263)	(0.00262)	(0.00282)	(0.00387)
Period *(Dummy)*	-0.02631***	-0.01506***	-0.02541***	-0.04057***
	(0.00180)	(0.00168)	(0.00179)	(0.00436)
ACE	-0.00222	-0.00167	-0.00132	0.01193***
	(0.00210)	(0.00210)	(0.00210)	(0.00382)
Profitability	-0.24928***	-0.14177***	-0.33248***	-0.33255***
	(0.01055)	(0.01174)	(0.01279)	(0.01279)
Tangibility	-0.07349***	-0.08507***	-0.11247***	-0.11244***
	(0.00583)	(0.00580)	(0.00721)	(0.00721)
Size	-0.00044	0.00018	0.00089	0.00089
	(0.00115)	(0.00113)	(0.00115)	(0.00115)
Net Operating Loss (NOL) *(Dummy)*		0.05902***		
		(0.00245)		
Non-Debt Tax Shield (NDTS)			0.69874***	0.69887***
			(0.07251)	(0.07253)
GDP Growth Rate				-0.00258**
				(0.00107)
Inflation				0.01857***
				(0.00514)
R^2	0.059	0.067	0.070	0.070
Observations	106,762	106,731	106,762	106,76

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

Regarding the two time segments before and after the ACE reform, the period dummy indicates a significant decline on average in the latter period for both leverage ratios in both countries (-2.6 percent for book leverage, -2.0 percent for financial leverage). Finally, the interaction term ACE is insignificant in the case of book leverage. For financial leverage, the coefficient signals a significant reform effect, but in the "wrong" direction and in any case of negligible size in economic terms (+0.5 percent).

The columns (2), (3) and (4) of tables 3 and 4 document the step by step refinement of the regression model: In column (2), we add a dummy that reports whether the company booked an operative loss in the respective accounting year. *NOL* thereby proxies the likely existence of a tax-reducing loss carryforward. It is replaced in column (3) by

Table 4: Effect on Financial Leverage, 4 Specifications, All Sectors, Matched Sample

Dependent Variable: Financial Leverage	(1)	(2)	(3)	(4)
Country *(Dummy)*	-0.00326	-0.00465**	-0.00485**	-0.00893**
	(0.00238)	(0.00237)	(0.00243)	(0.00352)
Period *(Dummy)*	-0.02037***	-0.01978***	-0.02021***	-0.02687***
	(0.00178)	(0.00177)	(0.00178)	(0.00418)
ACE	0.00468**	0.00525***	0.00485**	0.01063***
	(0.00199)	(0.00198)	(0.00199)	(0.00371)
Profitability	-0.34458***	-0.24936***	-0.35979***	-0.35982***
	(0.00874)	(0.00951)	(0.00895)	(0.00895)
Tangibility	0.21726***	0.20708***	0.21015***	0.21016***
	(0.00545)	(0.00543)	(0.00583)	(0.00583)
Size	0.02377***	0.02433***	0.02401***	0.02402***
	(0.00113)	(0.00112)	(0.00113)	(0.00113)
Net Operating Loss (NOL) *(Dummy)*		0.05219***		
		(0.00230)		
Non-Debt Tax Shield (NDTS)			0.12729***	0.12736***
			(0.02912)	(0.02912)
GDP Growth Rate				-0.00105
				(0.00102)
Inflation				0.00819*
				(0.00494)
R^2	0.116	0.124	0.117	0.117
Observations	106,350	106,320	106,350	106,350

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

the continuous, and hence more informative variable $NDTS$ which signals non-debt tax shields that result from depreciation allowances. Finally, we include the macroeconomic and country-specific covariates GDP growth and Inflation in column (4).

Examining first the results for the stepwise added or modified variables, we note that $NDTS$ is highly significant in column (3) of both tables. Given its larger coefficient compared to NOL, we keep $NDTS$ in the estimations reported in column (4). Not surprisingly, the macroeconomic covariates GDP and inflation are of minor importance in our firm-level regressions that contain fixed effects for countries, industries and years.

Regarding the central explanatory variables, the result pattern from estimation (1) barely

changed in estimations (2) to (4): Only profitability is highly significant and correctly signed in both tables, 3 and 4. In the book leverage estimations, the "wrong" sign of tangibility and the insignificance persist throughout in columns (2) to (4). In contrast, these explanatory variables are correctly signed and highly significant, as before in column (1), in the estimations (2) to (4) of financial leverage.

Finally, the inspection of the variables that define the DiD setup reveals no differences with respect to the earlier results for specification (1): Consistent with the line plots in figures 3 and 4, the country dummy signals that Belgian firms have an average book leverage ratio that is between 3.0 percent (column 4) and 4.6 percent (column 2) higher than the average for their counterparts from the UK, whereas the average for financial leverage over the whole time span is marginally smaller in Belgium than in the UK, reaching a maximum of 0.9 percent in column (4). Concerning the difference in average leverage ratios across both countries between the pre- and post-reform years, the period dummy signals a decline for book leverage (with a maximum value of -4.1 percent in column 4) as well as for financial leverage (with a maximum value of -2.7 percent in column 4). The largest absolute values for the ACE term in columns (2) to (4) would imply a statistically significant rise of both leverage ratios, by 1.2 percent for book leverage and by 1.1 percent for financial leverage. This result stands in clear contrast to the theoretically well-founded prediction that the introduction of an equity tax shield shoud lead to a decline of leverage ratios, since the elimination of the tax advantage for debt makes equity financing relatively more attractive.

Since we have no reason to suspect any flaws in the implementation of the DiD approach or a lack of data quality as the fundamental reason for the results, we conjecture that the estimations above might not be able to reveal the true effects of the ACE introduction. [44]

However, descriptive statistics report a noticeable increase of net capital investments

[44] To ensure that the above results are not driven by our choice to run DiD regressions with additional covariates on the basis of matched data, we conducted two series of supplementary analyses: Firstly "Unmatched DiD" estimations that were carried out on the basis of unmatched data for Belgium and the UK, and, secondly, "Pure DiD" estimations on the basis of the matched sample but either without the inclusion of any covariates or only a very small subset of the original covariates. The respective results for both outcome variables, book leverage and financial leverage, are documented in tables 15, 16, 17 and 18.

in Belgium after the reform came into effect (Adams 2012 and Burggraeve, Jeanfils, Van Cauter and Van Meensel 2008). To a large degree, it was concentrated on the rather small share of (very) big firms in the Belgian corporate sector. Naturally, one might conjecture that a large degree of effect heterogeneity between different Belgian firms might be the reason for the unsatisfactory pattern of the benchmark results. We explore this hypothesis in the following subsection.

5.2 Effect Heterogeneity

Our conjecture that effect heterogeneity likely plays an important role in the context of the ACE introduction in Belgium rests on two descriptive facts: First, an early analysis of the Belgian central bank revealed a considerable increase in the aggregated equity base of Belgian corporations immediately after the ACE reform came into effect. As documented by table 5, it was mainly driven by big firms and financing companies. Second, the distribution of notional interest deductions received is strongly right-skewed with respect to firm size, as illustrated by figure 6 for the fiscal year 2009.

Table 5: Equity Base of Belgian Companies, in Billion Euro (2004-2006)

Equity	2004	2005	2006	$\Delta 2004-2005$	$\Delta 2005-2006$
Non-financial corporations	230	255	286	25	31
- Big firms	173	193	215	20	22
- SME	58	63	72	5	9
Financing companies	207	225	292	18	67
Banks and insurance companies	44	43	49	-1	7
Total	**481**	**523**	**628**	**42**	**105**

Source: Burggraeve et al. (2008)

Table 5 displays for Belgian companies an increase in the aggregate equity base of 105 billion Euro from year 2005 to 2006, the first accounting year to be booked under the tax rules of the ACE reform. This value is considerably larger than the difference between the last two pre-reform years that amounts to 42 billion euro. The disaggregation into

the main categories of (i) Non-financial corporations (further differentiated into big firms versus small and medium enterprises, SME), (ii) Financing companies[45] and (iii) Banks and insurance companies, reveals that big firms and especially financing companies are responsible for the aggregate broadening of the equity base. In contrast, the aggregate contribution of 9 billion Euro by all SME's amounts to less than 10 percent of the capital increase from 2005 to 2006.

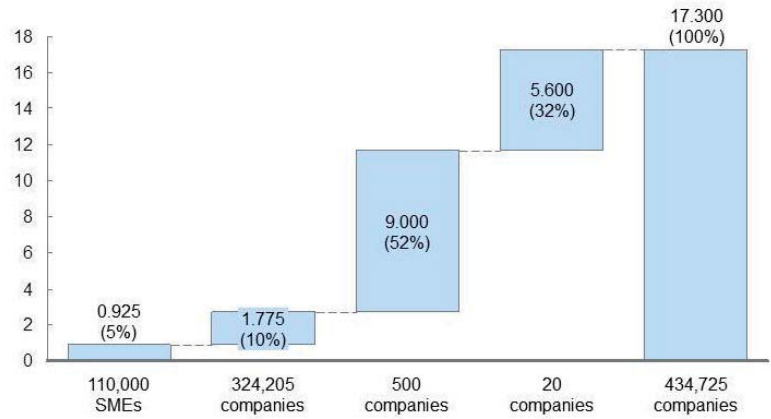
Figure 6 illustrates the uneven distribution of notional interest deductions that Belgian companies received in the fiscal year 2009. Overall, the Belgian tax and revenue office made out allowances of 17.3 billion euro. Of this total, 32 percent (5.6 billion euro) were granted to a small group of only 20 companies. Reading the figure from right to left, the next group comprises 500 companies that account together for a good half of the total (52 percent, 9 billion euro). In contrast, the big rest of 434,205 companies that represent 99.9 percent of the total firm population claimed only 15 percent of the ACE tax benefits. Therein, the large group of 110,000 small and medium-sized companies (SMEs) is responsible for only 5 percent of the granted deductions.

The complementary information from table 5 and figure 6 suggests that an in-depth analysis of potential effect heterogeneity is highly warranted. To adequately account for the likely existence of heterogeneous effects, we continued our evalution of the ACE tax reform with the following two steps: First, we ran split-sample analyses for three different size groups, using specification (4) from above to estimate financial leverage as the outcome variable.[46] Second, we evaluated the effect of the ACE reform on the financing decisions of Belgian corporations through estimation of quantile treatment effects as proposed by Fröhlich and Melly (2010). Quantile regressions were performed for the whole sample, as well as separately for five different sectors. Thereby, we intend to capture the

[45]Financing companies are special entities whose purpose is capital procurement and provision of financing means for closely related firms. Unlike banks, they do not supply services to facilitate payment transactions (Dautzenberg, Breuer and Breuer 2013).

[46]The choice of financial leverage as the outcome variable is motivated by the facts that, first, in the preceding subsection, the estimations for financial leverage seemed to be more trustworthy, and second, the potential for short-term adjustments of the leverage ratio on the part of firms is higher for the more narrowly defined financial leverage than for the broader and more persistent book leverage. Model (4) was chosen because it is the most comprehensive specification.

Figure 6: Interest deduction received by Belgian companies, in billion Euro, 2009



Source: Adams (2012) for the data, own illustration.

likely relevance of different sectoral backgrounds as a second dimension of possible effect heterogeneity.

Table 6 reproduces the benchmark result for financial leverage, specification (4), from table 4 for all companies in column (1). The subsequent columns report the results of our split-sample analyses separately for small, medium and big firms.[47]

Focusing our attention directly on the coefficient values of the ACE indicator, we see that the conjecture of effect heterogeneity by firm size is confirmed: For small firms in column (2), a highly significant *positive* effect is obtained that implies a rise of the financial leverage ratio by 1.5 percent. For medium-sized companies, column (3) reports no significant effect. For the group of big firms, though, the results in column (5) indicate a highly significant and sizeable *negative* effect that implies a reduction in the financial leverage ratio of -3.4 percent.

Note that in regression (4) for big companies, the macroeconomic covariates GDP growth and inflation are also significant and display the expected sign. Higher GDP rates signal

[47] The respective number of observations is documented in the penultimate row of table 6.

Table 6: Effect on Financial Leverage, All Sectors, by Size

Dependent Variable: Financial Leverage	(1)	(2)	(3)	(4)
Subsample by size	ALL	SMALL	MEDIUM	BIG
Country *(Dummy)*	-0.00893**	-0.00475	-0.03191***	-0.03276**
	(0.00352)	(0.00398)	(0.00860)	(0.01547)
Period *(Dummy)*	-0.02687***	-0.02886***	-0.01198***	-0.03511***
	(0.00418)	(0.00479)	(0.00438)	(0.00701)
ACE	0.01063***	0.01450***	0.00204	-0.03438**
	(0.00371)	(0.00425)	(0.00918)	(0.01578)
Profitability	-0.35982***	-0.33338***	-0.40837***	-0.44779***
	(0.00895)	(0.01001)	(0.02156)	(0.04373)
Tangibility	0.21016***	0.23390***	0.15248***	0.07959***
	(0.00583)	(0.00644)	(0.01566)	(0.02973)
Size	0.02402***	0.01410***	0.02331***	0.02576***
	(0.00113)	(0.00220)	(0.00503)	(0.00464)
Non-Debt Tax Shield (NDTS)	0.12736***	0.16395***	-0.07683	-0.27895
	(0.02912)	(0.03391)	(0.08494)	(0.17221)
GDP Growth Rate	-0.00105	-0.00233**	0.00207	0.01177***
	(0.00102)	(0.00115)	(0.00256)	(0.00449)
Inflation	0.00819*	0.01326**	-0.00264	-0.05490***
	(0.00494)	(0.00564)	(0.01242)	(0.02064)
Observations	130,317	91,718	26,662	11,937
R^2	0.117	0.128	0.100	0.105

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

better growth opportunities of companies. As firms often have to resort to debt finance to realize such opportunities by means of additional investment projects, the GDP growth rate is expected to be positively related to the financial leverage ratio (Frank and Goyal 2009). In contrast, higher inflation is associated with higher risk premiums and rising nominal interest rates. These factors discourage the use of debt and thereby lead to a lower leverage ratio (Huizinga, Laeven and Nicodème 2008).[48]

Given the information from table 5 and figure 6 on the strongly right-skewed pattern of

[48]The phenomenon that a small number of (very) big companies might reflect quite faithfully the overall macroeconomic condition of an entire economy is discussed in the recent macroeconomic literature under the heading of *granularity*, see Gabaix (2011) and a first application for Germany by Wagner (2011). The significance of the macroeconomic covariates in the estimations for big firms suggests that Belgium might also qualify as a granular economy.

claims for notional interest deductions across the firm size distribution, we doubt that the rise in the leverage ratio of small firms is somehow related to the ACE introduction. In contrast, we are quite confident that the 3.4 percent drop in the leverage ratio of big firms is a first trustworthy estimate for the causal effect of the ACE tax reform on the financial structure of Belgian corporations.

The results from the second step of our heterogeneity analysis are displayed in table 7. We estimated specification (4) with the classical quantile regression estimator of Koenker and Bassett Jr. (1978) in the extended version with heteroskedasticity consistent standard errors as provided by Fröhlich and Melly (2010). We used the same data as above, i.e., the matched sample with paired observations from Belgium and the UK. Column (1) reports the results for the full sample, the adjacent columns display the quantile treatment effects for five different sectors.

Regarding the results for the full sample in column (1), a consistent pattern emerges: the effect size rises continuously in absolute size along the distribution of financial leverage. The first significant value of -0.4 percent is observed at the 25^{th} percentile and the largest effect of -4.7 percent at the 95^{th} percentile. Except for the first effect that is significant at the 5 percent level, all quantile effects are significant at the 1 percent level.

Columns (2) to (6) establish a sizeable degree of sectoral heterogeneity: whereas "Manufacturing" displays significantly negative effects for all evaluated percentiles, reaching a maximum value of -6.7 percent for the 95^{th} percentile, not a single significant effect is observed for the sector of "Business Services" in column (6). The three remaining sectors are intermediate cases. In "Construction", an effect of 6.2 percent is registered at the 95^{th} percentile (i.e., close to the respective value for "Manufacturing"), but the lower half of the quantile range, median included, displays no significant effects. "Wholesale & Retail" and "Accomodation" reach very similar maximum values of, respectively, -4.4 percent and -4.6 percent at the 95^{th} percentile, but differ substantially at lower evaluation points. Most notably, the median effect in column (5) is already significantly negative with a coefficient size of -3.8 precent, whereas the first significant effect is registered not before the 75^{th} in column (4).

Table 7: Effect on Financial Leverage, Quantile Treatment Estimations, by Sector

Dependent Variable: Financial Leverage	(1) All	(2) Manufacturing	(3) Construction	(4) Wholesale & Retail	(5) Accomodation & Food Services	(6) Business Services
10th percentile	-0.00136	-0.00497***	0.00562**	0.00013	-0.00260	-0.00404
	(0.00084)	(0.00163)	(0.00248)	(0.00138)	(0.01344)	(0.00319)
25th percentile	-0.00411**	-0.00881***	0.00974***	-0.00306	-0.01015	-0.00549
	(0.00161)	(0.00298)	(0.00369)	(0.00252)	(0.01790)	(0.00434)
50th percentile (median)	-0.00754***	-0.01258***	0.00561	-0.00426	-0.03810**	-0.00802
	(0.00225)	(0.00399)	(0.00569)	(0.00340)	(0.01693)	(0.00798)
75th percentile	-0.02509***	-0.03120***	-0.03309***	-0.01473***	-0.03151**	0.00093
	(0.00260)	(0.00441)	(0.00720)	(0.00370)	(0.01600)	(0.01160)
90th percentile	-0.04192***	-0.05861***	-0.06383***	-0.03269***	-0.04074**	0.01327
	(0.00366)	(0.00559)	(0.01160)	(0.00514)	(0.01773)	(0.01497)
95th percentile	-0.04712***	-0.06716***	-0.06219***	-0.04369***	-0.04622**	0.01167
	(0.00457)	(0.00703)	(0.01416)	(0.00620)	(0.02030)	(0.01376)

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

At this point, we do not attempt to explain the sectoral differences in greater detail. At first sight, sectoral differences in capital intensity and the related disparities with respect to financing needs are likely to be of importance for the observed contrasts. For the purpose of our research question, it is sufficient to note that the results displayed in table 7 clearly demonstrate a high degree of sectoral heterogeneity in the effect of the ACE introduction on the financial leverage ratio of Belgian firms.

5.3 Robustness

Our results seem to be quite robust for a number of reasons. Firstly, as already discussed in sections 4.1 and 4.2, all our evidence suggests that the key assumptions required for the implementation of a DiD estimation are satisfied in our setup. Secondly, the estimation results hardly differ in case of minor changes of the specification or the estimation method. For instance, the inclusion of the year 2008 in the sample leads to very similar estimates for the ACE effect, only with slightly reduced absolute values and levels of significance.[49]

To assess the robustness of our central results, we carried out three different analyses for both steps of our precedent heterogeneity analysis, i.e., (i) for the estimation across size groups using the matched composite sample that includes all sectors, and (ii), for the sector-specific estimation of quantile treatment effects.

Firstly, we ran both estimations as a "pure" unconditional DiD implementation, i.e., using the matched sample but without further covariates. Secondly, we used the original specification from the preceding subsection but employed the unmatched dataset. Taken together, these estimations allow us to appraise whether or to what degree the above results might be driven by either (i) the use of covariates that are determined simultaneously to the outcome variable and might therefore suffer from endogeneity issues or by (ii) the balancing of the data through the prior propensity score matching. Ultimately, we carried out a placebo DiD test that allows us to assess at least indirectly the plausibility of the common trends or CIA assumption.

[49] These estimation results are available upon request from the author.

Table 8: Unconditional DiD, Financial Leverage, All Sectors, by Size

Dependent Variable: Financial Leverage	(1)	(2)	(3)	(4)
Subsample by size	ALL	SMALL	MEDIUM	BIG
Country *(Dummy)*	-0.01348***	0.00216	-0.04481***	-0.08105***
	(0.00240)	(0.00264)	(0.00607)	(0.01136)
Period *(Dummy)*	-0.01390***	-0.01903***	-0.00977**	-0.01998***
	(0.00161)	(0.00198)	(0.00383)	(0.00534)
ACE	0.00647***	0.00801***	0.00754	0.00696
	(0.00201)	(0.00224)	(0.00514)	(0.00902)
Observations	111,160	83,738	19,409	8,013
R^2	0.029	0.032	0.047	0.055

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

Table 9: Unconditional DiD, Financial Leverage, Quantile Treatment Effects, by Sector

Dependent Variable: Financial Leverage	(1) All	(2) Manufacturing	(3) Construction	(4) Wholesale & Retail	(5) Accomodation & Food Services	(6) Business Services
10th percentile	-0.00136	-0.00497***	0.00562**	0.00013	-0.00260	-0.00404
	(0.00084)	(0.00163)	(0.00248)	(0.00138)	(0.01344)	-0.00319
25th percentile	-0.00411**	-0.00881***	0.00974***	-0.00306	-0.01015	-0.00549
	(0.00161)	(0.00298)	(0.00369)	(0.00252)	(0.01790)	-0.00434
50th percentile	-0.00754***	-0.01258***	0.00561	-0.00426	-0.03810**	-0.00802
(median)	(0.00225)	(0.00399)	(0.00569)	(0.00340)	(0.01693)	-0.00798
75th percentile	-0.02509***	-0.03120***	-0.03309***	-0.01473***	-0.03151**	0.00093
	(0.00260)	(0.00441)	(0.00720)	(0.00370)	(0.01600)	-0.0116
90th percentile	-0.04192***	-0.05861***	-0.06383***	-0.03269***	-0.04074**	0.01327
	(0.00366)	(0.00559)	(0.01160)	(0.00514)	(0.01773)	-0.01497
95th percentile	-0.04712***	-0.06716***	-0.06219***	-0.04369***	-0.04622**	0.01167
	(0.00457)	(0.00703)	(0.01416)	(0.00620)	(0.02030)	-0.01376

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

The respective results of the unconditional DiD estimations are documented in tables 8 and 9. Comparing table 8 to the original table 6 of the estimation across all sectors by different size groups, it is obvious that the most important effect, namely the significantly negative effect for big companies, has vanished. Results for the other size categories remain qualitatively unchanged: In columns (1) and (2), the significantly positive effects of economically irrelevant size are now even smaller but remain significant, whereas the effect for medium-sized companies in column (3) is still insignificant. In light of table 2,[50] we interpret table 8 as a confirmation of our original approach: At least for estimations within broadly defined size categories, it seems necessary to go beyond matching (conducted on the basis of data from one single year) and to control for relevant covariates in a regression implementation.

In contrast, the unconditional estimation of quantile treatment effects that is documented in table 9 displays almost exactly the same results as the original estimation with covariates, represented in table 7. This might be explained by the setup of the quantile treatment effect estimations: They focus on six points along the distribution of the outcome variable and are carried out separately for five different sectors. In so doing, they inherently ensure a substantially higher degree of comparability between treated and untreated observations. Consequently, the inclusion of covariates is not necessary.

The results of the robustness estimations on the basis of the unmatched sample are documented in tables 10 and 11. Comparing table 10 to the original result table 6, one notes that the only original effect that was at the same time of an economically relevant size and statistically significant in table 6, namely the treatment effect for big companies, is qualitatively identical in both tables but of a somewhat smaller magnitude in the robustness estimation on the basis of the unmatched sample. Turning to the quantile treatment effect estimations by sector, the comparison between tables 7 and 11 reveals a qualitatively very similar pattern of results, with somewhat bigger reductions of the financial leverage ratio in the sector "Accomodation & Food Services" and some rather obscure rises of the leverage ratio in the sector of "Business Services".

[50] Table 2 documents that for relevant explanatory variables of the leverage ratios, significant differences remain between the two sub-samples from Belgium and the UK even after propensity score matching.

Table 10: Financial Leverage, All Sectors, by Size, Unmatched Sample

Dependent Variable: Financial Leverage	(1)	(2)	(3)	(4)
Subsample by size	ALL	SMALL	MEDIUM	BIG
Country *(Dummy)*	-0.01379***	-0.00926**	-0.04262***	-0.03778***
	(0.00337)	(0.00389)	(0.00795)	(0.01458)
Period *(Dummy)*	-0.01474***	-0.01379***	-0.00794*	0.00714
	(0.00417)	(0.00489)	(0.00430)	(0.01809)
ACE	0.00556	0.00786*	0.00317	-0.02971*
	(0.00367)	(0.00431)	(0.00874)	(0.01564)
Profitability	-0.36566***	-0.32972***	-0.41917***	-0.47294***
	(0.00809)	(0.00932)	(0.01805)	(0.03307)
Tangibility	0.18948***	0.21779***	0.13007***	0.10097***
	(0.00514)	(0.00590)	(0.01232)	(0.01964)
Size	0.02299***	0.01174***	0.02178***	0.02361***
	(0.00097)	(0.00207)	(0.00440)	(0.00372)
Non-Debt Tax Shield (NDTS)	0.16535***	0.19188***	0.01881	-0.18068
	(0.02880)	(0.03419)	(0.07394)	(0.13277)
GDP Growth Rate	-0.00179*	-0.00305***	0.00043	0.00867**
	(0.00099)	(0.00114)	(0.00241)	(0.00429)
Inflation	0.00720	0.01084*	0.00161	-0.04008**
	(0.00485)	(0.00570)	(0.01170)	(0.02030)
Observations	130,317	91,718	26,662	11,937
R^2	0.122	0.124	0.111	0.108

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

Table 11: Financial Leverage, Quantile Treatment Effects, by Sector, Unmatched Sample

Dependent Variable: Financial Leverage	(1) All	(2) Manufacturing	(3) Construction	(4) Wholesale & Retail	(5) Accomodation & Food Services	(6) Business Services
10th percentile	-0.00198**	-0.00430***	0.00216	0.00011	0.00976	-0.00086
	(0.00078)	(0.00151)	(0.00223)	(0.00133)	(0.01217)	(0.00294)
25th percentile	-0.00639***	-0.00569**	-0.00771**	-0.00206	0.01696	0.00286
	(0.00155)	(0.00288)	(0.00362)	(0.00245)	(0.01708)	(0.00411)
50th percentile	-0.01771***	-0.00885**	-0.05357***	-0.00261	-0.01337	0.01293*
(median)	(0.00217)	(0.00386)	(0.00562)	(0.00332)	(0.01650)	(0.00752)
75th percentile	-0.05108***	-0.03423***	-0.13938***	-0.01586***	-0.02064	0.03498***
	(0.00258)	(0.00431)	(0.00701)	(0.00367)	(0.01496)	(0.01072)
90th percentile	-0.07896***	-0.06626***	-0.14881***	-0.03274***	-0.03649**	0.04154***
	(0.00360)	(0.00577)	(0.01200)	(0.00515)	(0.01668)	(0.01337)
95th percentile	-0.08142***	-0.07316***	-0.09685***	-0.04991***	-0.03938**	0.05179***
	(0.00470)	(0.00690)	(0.01312)	(0.00600)	(0.01567)	(0.01218)

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

Taken together, the qualitative results from the unconditional DiD implementations and the analyses on the basis of the unmatched sample corroborate our previous findings. Finally, to assess the plausibility of the common trends or CIA assumption, we employ a placebo approach as recommended by Imbens (2004) that was proposed already by Rosenbaum (1987) and Heckman and Hotz (1989). The basic idea is to estimate a DiD effect of a non-existing treatment, i.e. an effect that should equal zero. If the estimate for this setup is then significantly different from zero, the CIA assumption likely does not hold. As argued by Imbens (2004, 22), the most interesting case is to consider the treatment effect on a lagged outcome that is known to be unaffected by the treatment because its value is determined prior to the treatment itself.

In our application, we can implement this placebo approach by using the second lag of financial leverage as the outcome variable in an otherwise unchanged evaluation setup. Notably, the dummy and interaction terms that define the DiD setup remain unaltered. The use of the second lag of the outcome variable in the overall time span from 2003 to 2007 is sufficient to generate a placebo evaluation framework in which all values of the outcome variable are determined prior to the treatment, due to the lag structure: In the first post-reform year 2006, the outcome variable takes on the value of the year 2004; in the second post-reform year, the respective outcome value comes from the last pre-reform year 2005.

We performed this placebo exercise for both steps of our precedent heterogeneity analysis, i.e. (i) for the estimation across size groups using the matched composite sample that includes all sectors, and (ii), for the sector-specific estimation of quantile treatment effects. The respective results are documented in tables 12 and 13.

Table 12: Placebo DiD, Financial Leverage, All Sectors, by Size

Dependent Variable: Financial Leverage *(Second Lag)*	(1)	(2)	(3)	(4)
Subsample by size	ALL	SMALL	MEDIUM	BIG
Country *(Dummy)*	-0.00830**	-0.00773*	-0.03062***	-0.05368***
	(0.00383)	(0.00434)	(0.00954)	(0.01696)
Period *(Dummy)*	0.00562	-0.01797***	-0.02405***	-0.02375***
	(0.00460)	(0.00247)	(0.00513)	(0.00884)
ACE	0.01191***	0.01259***	0.00428	0.00462
	(0.00428)	(0.00486)	(0.01050)	(0.01916)
Profitability	-0.14577***	-0.11481***	-0.18353***	-0.26891***
	(0.00975)	(0.01060)	(0.02514)	(0.04746)
Tangibility	0.18050***	0.19886***	0.13674***	0.08012***
	(0.00583)	(0.00635)	(0.01623)	(0.03034)
Size	0.02241***	0.00104	0.00368	0.02099***
	(0.00114)	(0.00229)	(0.00527)	(0.00453)
Non-Debt Tax Shield (NDTS)	0.05091*	0.05123*	-0.08818	-0.18340
	(0.02891)	(0.03023)	(0.09274)	(0.18180)
GDP Growth Rate	0.00792***	0.00667***	0.01483***	0.00912
	(0.00140)	(0.00155)	(0.00366)	(0.00654)
Inflation	-0.00543	-0.00281	-0.02851**	-0.02562
	(0.00550)	(0.00624)	(0.01378)	(0.02444)
Observations	85,978	64,153	15,474	6,351
R^2	0.0814	0.0856	0.0688	0.0711

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

Table 13: Placebo DiD, Financial Leverage, Quantile Treatment Effects, by Sector

Dependent Variable: Financial Leverage *(Second Lag)*	(1) All	(2) Manufacturing	(3) Construction	(4) Wholesale & Retail	(5) Accomodation & Food Services	(6) Business Services
10th percentile	0.00129	0.00093	0.00779***	0.00062	0.02920*	0.0014
	(0.00100)	(0.00198)	-0.00262	-0.00158	-0.01769	-0.00381
25th percentile	0.00604***	0.00496	0.01876***	0.00467*	0.00803	0.00524
	(0.00176)	(0.00345)	-0.00391	-0.00258	-0.0159	-0.00546
50th percentile	0.00745***	0.00087	0.03400***	0.00914***	-0.01168	0.01520*
(median)	(0.00222)	(0.00398)	-0.00542	-0.00333	-0.01733	-0.00858
75th percentile	-0.00983***	-0.01861***	-0.00138	-0.00285	-0.01495	0.01523
	(0.00263)	(0.00429)	-0.00728	-0.00381	-0.01806	-0.01116
90th percentile	-0.02743***	-0.04620***	-0.02880***	-0.01991***	-0.01288	0.01608
	(0.00359)	(0.00543)	-0.01069	-0.00494	-0.01729	-0.01401
95th percentile	-0.02658***	-0.05625***	-0.01215	-0.02753***	-0.01247	0.02798*
	(0.00463)	(0.00781)	-0.0141	-0.00654	-0.01831	-0.01494

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

A comparison of the results documented in table 12 with the equivalent results from the true evaluation setting in table 6 reveals that the most important feature of the original table, namely the existence of a significantly negative effect of sizeable magnitude for the size category of big companies, has now vanished. (In contrast, the tiny positive effects for small and, by virtue of their share in the total sample, all companies, are still present.) The upshot of this placebo experiment is that the original effect on big companies is really about the ACE tax reform and not some artefact of the DiD implementation.

The result from our placebo excercise with respect to the estimation of quantile treatment effects, documented in table 13 is less clear-cut. A detailed comparison of the relevant columns (2) to (5) reveals that the respective sizes of the significantly negativ effects, which are present in table 13, are throughout smaller than in the original result table 7. Hence, this placebo experiment casts some doubts on the plausibilty of the unconfoundedness assumption. But it does not entirely invalidate our prior results.

6 Conclusion

The debt bias of most corporate tax systems and its consequences for the affected corporations and the economy at large are issues of great relevance, not only for the academic discipline of empirical public finance research, but also from an economic policy perspective: In the wake of the financial crisis that originated in the U.S. and spread globally after the collapse of Lehman Brothers, the questions how excessive debt levels came about and how economic and tax policy can provide incentives to reduce and stabilize them at sustainable levels are matters of major public interest. Our study furthers the understanding if and how an introduction of the allowance for corporate equity in the corporate income tax code can contribute to these objectives by providing a rigorous empirical evaluation of the ACE tax reform in Belgium.

Our findings suggest that the Belgian ACE tax reform did cause companies to reduce their financial leverage ratio, but in a less uniform and more subtle way than previously discussed in the literature. The result pattern from our detailed analyses along the two heterogeneity dimensions of firm size and sectoral affiliation suggests the following nuanced interpretation:

The financial leverage ratio of a firm is jointly determined by the extent of financing needs and the ease of access to debt instruments. The former obviously depends on the capital intensity of the respective economic sector and the latter on the creditworthiness of the individual firm that is usually approximated by its economic size, i.e., the balance sheet total.

Hence, the tax-motivated adjustment of the leverage ratio should be of high importance for big firms that are active in a rather capital-intensive sector. Since big firms do not suffer from the financing restrictions that apply to the better part of small and medium-sized firms, they are able to adjust their financial structure in a discretionary way.

It is precisely the group of big companies in rather capital-intensive sectors for which we find highly significant effects that rise in absolute coefficient size along the distribution of the outcome variable. This finding from the quantile treatment estimations suggests that

these firms had previously optimized with respect to tax purposes by choosing a very high leverage ratio as long as the tax discrimination against equity financing lingered on in the pre-reform period. However, once the Belgian ACE reform came into effect, they quickly adjusted their financial structure to the new tax environment by means of a significant reduction in their financial leverage ratio.

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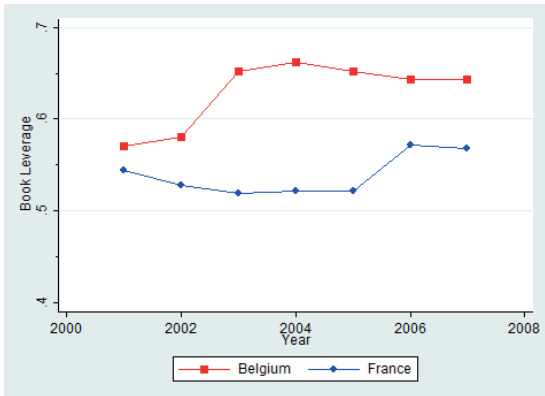
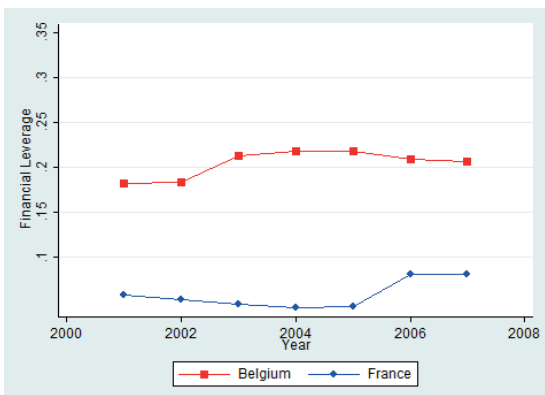
Appendix

Figure 7: Book Leverage (Median), Belgium and France, Manufacturing (2001-2007)



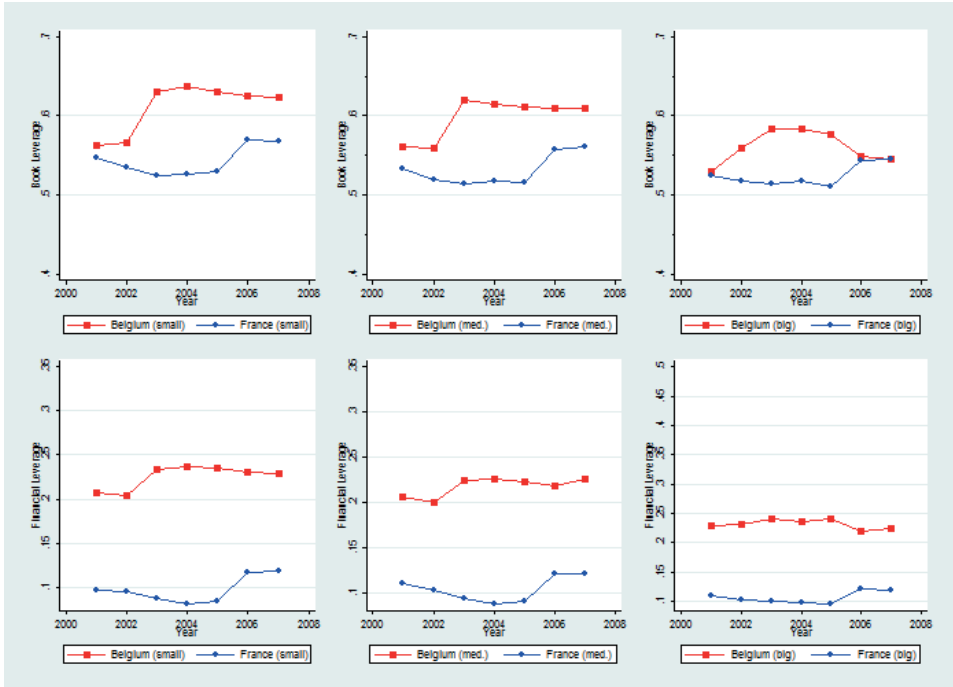
Source: Own calculation, based on accounting information from the Amadeus database (BvD).

Figure 8: Financial Leverage (Median), Belgium and France, Manufacturing (2001-2007)



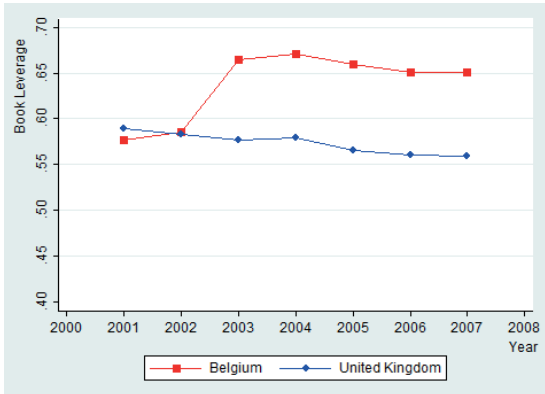
Source: Own calculation, based on accounting information from the Amadeus database (BvD).

Figure 9: Book Leverage -top- and Financial Leverage -bottom-
Belgium and France, Manufacturing, Mean by Firm Size, 2001-2007



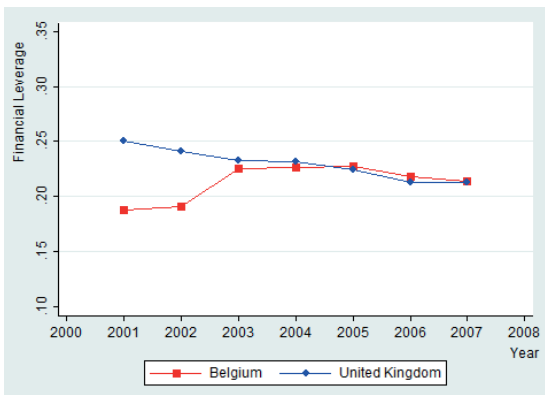
Source: Own calculation, based on accounting information from the Amadeus database (BvD).

Figure 10: Book Leverage (Median): Belgium and UK, Manufacturing (2001-2007)



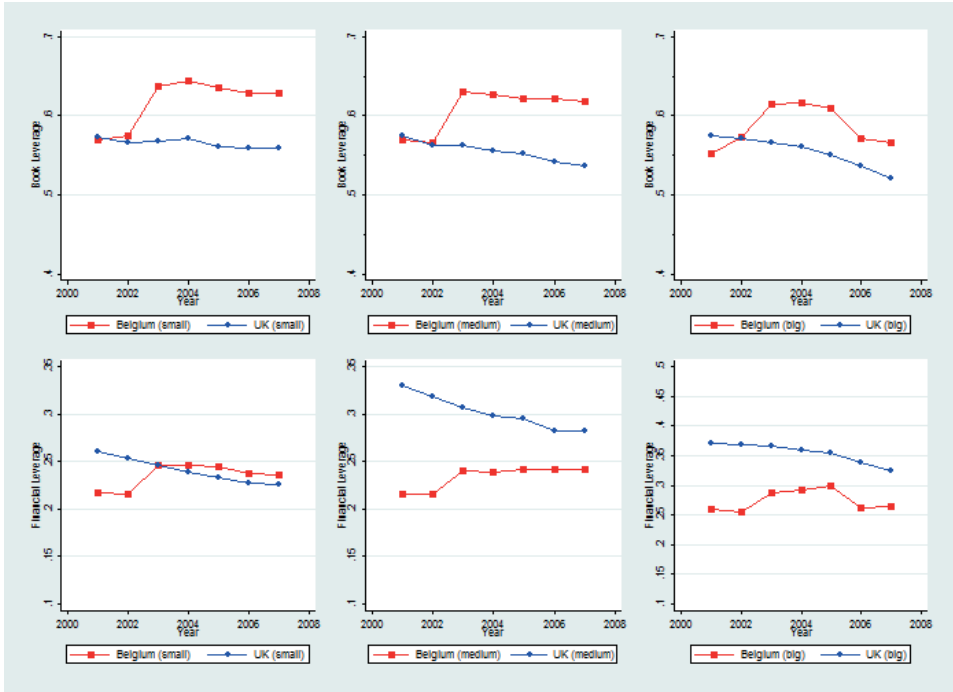
Source: Own calculation, based on accounting information from the Amadeus database (BvD).

Figure 11: Financial Leverage (Median): Belgium and UK, Manufacturing (2001-2007)



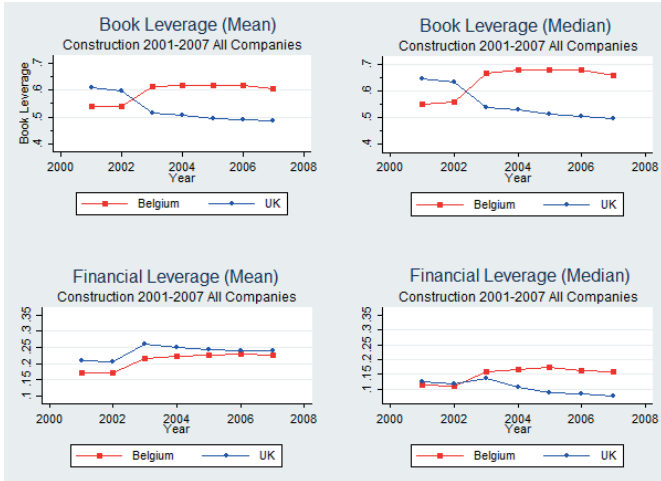
Source: Own calculation, based on accounting information from the Amadeus database (BvD).

Figure 12: Book leverage -top- and Financial leverage -bottom-
Belgium and UK, Manufacturing, Mean by Firm Size, 2001-2007



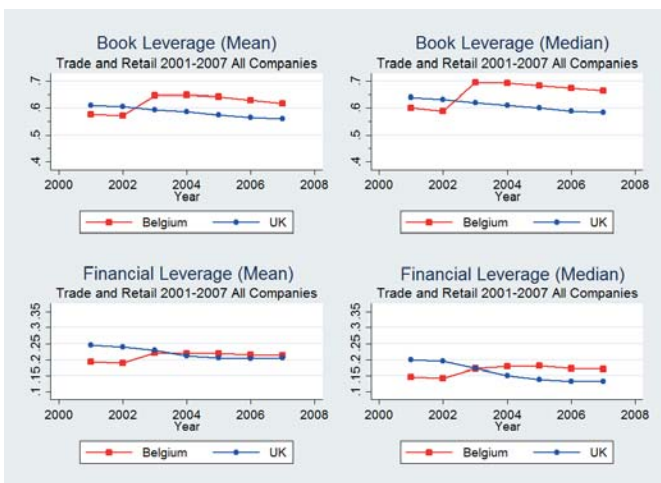
Source: Own calculation, based on accounting information from the Amadeus database (BvD).

Figure 13: Leverage Ratios: Construction
Belgium and UK, Means and Medians, 2001-2007



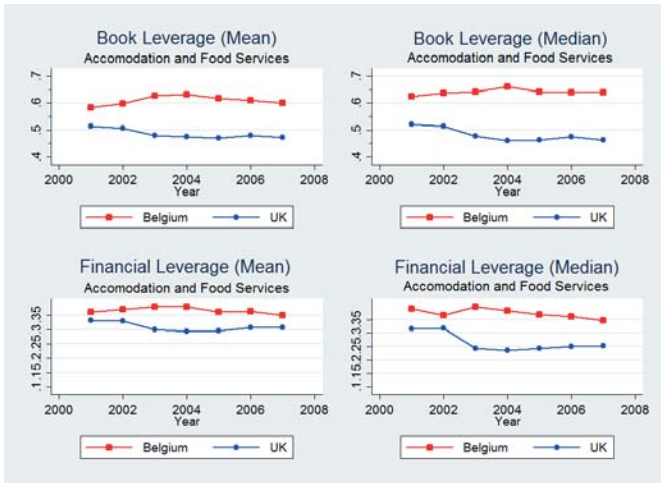
Source: Own calculation, based on accounting information from the Amadeus database (BvD).

Figure 14: Leverage Ratios: Trade and Retail
Belgium and UK, Means and Medians, 2001-2007



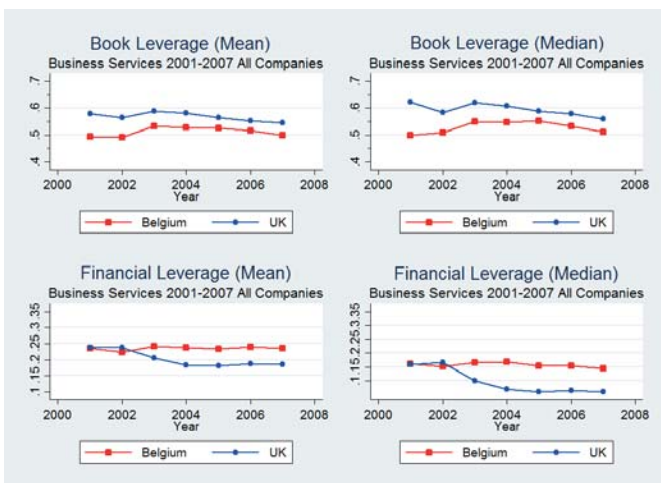
Source: Own calculation, based on accounting information from the Amadeus database (BvD).

Figure 15: Leverage Ratios: Accomodation and Food
Belgium and UK, Means and Medians, 2001-2007



Source: Own calculation, based on accounting information from the Amadeus database (BvD).

Figure 16: Leverage Ratios: Business Services
Belgium and UK, Means and Medians, 2001-2007



Source: Own calculation, based on accounting information from the Amadeus database (BvD).

Table 14: PS Matching - Probit Regression, All Sectors

Dependent Variable: Treatment = 1	Probit
Tangibility	4.0671***
	(0.1701)
Tangibility^2	-2.8254***
	(0.3081)
Tangibility^3	1.9630***
	(0.2331)
Profitability	3.3417***
	(0.2824)
Profitability^2	-7.6108***
	(0.3358)
Profitability^3	7.8358***
	(0.7758)
Size	-1.5769***
	(0.1338)
Size^2	0.1220***
	(0.0135)
Size^3	-0.0029***
	(0.0004)
Size x Tangibility	-0.3649***
	(0.0148)
Size x Profitability	-0.1815***
	(0.0321)
Net Operating Loss (NOL)	0.1923***
	(0.0108)
Pseudo R^2	0.0766
Observations	126,655

Notes: (i) Industry dummies and a constant term are included. (ii) Standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

Table 15: Book Leverage, All Sectors, Unmatched Sample

Dependent Variable: Book Leverage	(1)	(2)	(3)	(4)
Country *(Dummy)*	0.04751***	0.04574***	0.03825***	0.02937***
	(0.00251)	(0.00251)	(0.00267)	(0.00366)
Period *(Dummy)*	-0.00346**	-0.00683***	-0.00346**	-0.00810***
	(0.00138)	(0.00154)	(0.00138)	(0.00194)
ACE	-0.00666***	-0.00599***	-0.00579***	0.00641*
	(0.00204)	(0.00204)	(0.00204)	(0.00374)
Profitability	-0.21459***	-0.09916***	-0.29402***	-0.29406***
	(0.00921)	(0.01028)	(0.01091)	(0.01091)
Tangibility	-0.08244***	-0.09361***	-0.11800***	-0.11797***
	(0.00502)	(0.00499)	(0.00600)	(0.00600)
Size	-0.00291***	-0.00229**	-0.00159	-0.00159
	(0.00097)	(0.00096)	(0.00098)	(0.00098)
Net Operating Loss (NOL) *(Dummy)*		0.06374***		
		(0.00222)		
Non-Debt Tax Shield (NDTS)			0.70932***	0.70940***
			(0.06253)	(0.06253)
GDP Growth Rate				-0.00279***
				(0.00103)
Inflation				0.01651***
				(0.00499)
R^2	0.055	0.065	0.066	0.066
Observations	131,008	130,832	131,008	131,008

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

Table 16: Financial Leverage, All Sectors, Unmatched Sample

Dependent Variable: Financial Leverage	(1)	(2)	(3)	(4)
Country *(Dummy)*	-0.00721***	-0.00913***	-0.00936***	-0.01379***
	(0.00228)	(0.00227)	(0.00233)	(0.00337)
Period *(Dummy)*	-0.00888***	-0.00551***	-0.00863***	-0.01474***
	(0.00167)	(0.00155)	(0.00167)	(0.00417)
ACE	-0.00037	0.00053	-0.00016	0.00556
	(0.00194)	(0.00193)	(0.00194)	(0.00367)
Profitability	-0.34708***	-0.24078***	-0.36567***	-0.36566***
	(0.00786)	(0.00862)	(0.00809)	(0.00809)
Tangibility	0.19776***	0.18732***	0.18946***	0.18948***
	(0.00482)	(0.00480)	(0.00514)	(0.00514)
Size	0.02269***	0.02325***	0.02299***	0.02299***
	(0.00097)	(0.00096)	(0.00097)	(0.00097)
Net Operating Loss (NOL) *(Dummy)*		0.05874***		
		(0.00212)		
Non-Debt Tax Shield (NDTS)			0.16536***	0.16535***
			(0.02880)	(0.02880)
GDP Growth Rate				-0.00179*
				(0.00099)
Inflation				0.00720
				(0.00485)
R^2	0.122	0.131	0.122	0.122
Observations	130,317	130,145	130,317	130,317

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

Table 17: Book Leverage, All Sectors, Matched Sample, pure DiD

Dependent Variable: Book Leverage	(1)	(2)	(3)	(4)
Country *Dummy*	0.04852***	0.05071***	0.04702***	0.04641***
	(0.00257)	(0.00261)	(0.00263)	(0.00267)
Period *Dummy*	-0.01688***	-0.01789***	-0.01900***	-0.02158***
	(0.00161)	(0.00162)	(0.00166)	(0.00163)
ACE	-0.00117	-0.00101	-0.00201	-0.00067
	(0.00206)	(0.00206)	(0.00210)	(0.00207)
Size		0.00495***	0.00435***	0.00565***
		(0.00112)	(0.00112)	(0.00113)
Net Operating Loss (NOL) *(Dummy)*			0.07013***	
			(0.00221)	
Non-Debt Tax Shield (NDTS)				0.20355***
				(0.02980)
R^2	0.041	0.042	0.056	0.043
Observations	111,597	111,597	107,675	109,800

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.

Table 18: Financial Leverage, All Sectors, Matched Sample, pure DiD

Dependent Variable: Financial Leverage	(1)	(2)	(3)	(4)
Country *(Dummy)*	-0.01348***	-0.00421*	-0.01071***	-0.00934***
	(0.00240)	(0.00242)	(0.00244)	(0.00249)
Period *(Dummy)*	-0.01390***	-0.01893***	-0.02114***	-0.01388***
	(0.00161)	(0.00162)	(0.00179)	(0.00147)
ACE	0.00647***	0.00717***	0.00733***	0.00924***
	(0.00201)	(0.00199)	(0.00202)	(0.00201)
Size		0.02095***	0.01925***	0.02161***
		(0.00112)	(0.00111)	(0.00114)
Net Operating Loss (NOL) *(Dummy)*			0.09070***	
			(0.00214)	
Non-Debt Tax Shield (NDTS)				0.24164***
				(0.03516)
R^2	0.029	0.043	0.071	0.045
Observations	111,160	111,160	107,250	109,383

Notes: (i) Year and industry dummies and a constant term are included in all estimates. (ii) Robust standard errors are reported in parentheses. (iii) * Significant at 10%, ** at 5%, *** at 1%.